HOMER CITY
REDEVELOPMENT

February 20, 2026

Justin C. Dickey, P.E.
Environmental Program Manager
Pennsylvania Department of Environmental Protection
Clean Water Program
Northwest Regional Office
230 Chestnut Street
Meadville, PA 16335

Major NPDES Permit Amendment Application
NPDES Permit No. PA0005037
Homer City Generating Station
Outfall 027 Modification
Black Lick and Center Townships, Indiana County, Pennsylvania

Dear Mr. Dickey:

Homer City Generation LP ("Homer City") owns the Homer City Generating Station, located in Black Lick and Center Townships, Indiana County, Pennsylvania. Industrial wastewater and stormwater discharges from Homer City are authorized under National Pollutant Discharge Elimination System (NPDES) Permit No. PA0005037 ("NPDES Permit").

As part of the ongoing redevelopment of the Homer City Generating Station, Homer City plans to modify the industrial wastewater discharge from NPDES Permit Outfall 027 to Blacklick Creek. The discharge from this outfall is currently permitted as Unit #3 Flue Gas Desulfurization (FGD) scrubber blowdown; however, this waste stream has been removed as Homer City has decommissioned its coal-powered generating units and associated FGD systems. Outfall 027 will be modified to discharge Cooling Tower Blowdown from the proposed natural gas generating units to be installed during redevelopment. The Cooling Tower Blowdown, which was previously conveyed to Outfall 001, will be conveyed by a modified pipeline directed south of the main Power Block through an improved Outfall 027 structure.

Homer City is submitting a Major NPDES Permit Amendment Application to authorize the change in wastestream to Outfall 027, and associated revisions to the effluent limitations at Outfall 027.

Enclosed please find the following items to support the Major NPDES Permit Amendment Application:

- Executive Summary
- General Information Form;
- NPDES Application for Permit Amendment and Checklist;
- Acts 14, 67, 68, and 127 Notifications and proof of receipts;
- Newspaper Notification and Proof of Publication
- Individual NPDES Application Sections
- Supporting Information

The $7,500 Application Fee will be mailed to the Department's Northwest Regional Office following application submission.

Please do not hesitate to contact me at 724-479-6109 or via e-mail at ssimmers@homercityredevelopment.com with any questions or comments.

Sincerely,



Shawn Simmers, PE

Director of Environmental Compliance

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National Pollutant Discharge Elimination System Major Permit Amendment Application

Homer City Generation LP
National Pollutant Discharge Elimination System
Permit No. PA0005037
Homer City Generating Station
Indiana County, Pennsylvania

GAI Project Number: C180881.17

February 2026

Prepared by: GAI Consultants, Inc.
Pittsburgh Office
385 East Waterfront Drive
Homestead, Pennsylvania 15120-5005

Prepared for: Homer City Generation LP
1750 Power Plant Road
Homer City, Pennsylvania 15748

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Homer City Generating Station
NPDES Permit No. PA0005037 Amendment Application

Executive Summary

Background

Homer City Generation LP ("Homer City") owns the Homer City Generating Station, located in Black Lick and Center Townships, Indiana County, Pennsylvania (PA). Industrial wastewater and stormwater discharges from Homer City are authorized under National Pollutant Discharge Elimination System (NPDES) Permit No. PA0005037 ("NPDES Permit").

Under the current NPDES Permit, Homer City is authorized to discharge 'Cooling tower blowdown from cooling towers #1, #2, and #3' via Outfall 001 to Two Lick Creek. As part of the ongoing redevelopment of the Homer City Generating Station, the coal-fired generating units and Cooling Towers #1-3 will be modified to include seven (7) natural gas generating units and associated closed cycle mechanical cooling towers. The proposed system will continue to operate as a closed-cycle recirculating system, with the cooling tower blowdown discharging primarily to Blacklick Creek via Outfall 027 or, alternatively, to Two Lick Creek via Outfall 001.

As part of the plans for redevelopment, Homer City plans to modify the industrial wastewater discharge from NPDES Permit Outfall 027 to Blacklick Creek. The discharge from this outfall is currently permitted as Unit #3 Flue Gas Desulfurization (FGD) scrubber blowdown; however, this waste stream has been removed as Homer City has decommissioned its coal-fired generating units and associated FGD systems. Outfall 027 will be modified to discharge cooling tower blowdown from the proposed natural gas generating units to be installed during redevelopment.

The cooling tower blowdown, which was previously conveyed exclusively to Outfall 001, will be conveyed by a modified pipeline directed south of the main Power Block through an improved Outfall 027 structure.

Homer City previously submitted documentation to the Pennsylvania Department of Environmental Protection ("the Department") requesting concurrence that a portion of the facility cooling tower blowdown could be discharged to Two Lick Creek via Outfall 001 as needed, such as during facility start-up, for required maintenance, or otherwise for compliance with NPDES Permit requirements, under the Station's existing NPDES Permit. The proposed discharge at Outfall 001 will continue to include treated water from the Ash Disposal Site and Coal Refuse Site through the Industrial Water Treatment (IWT) facility. Homer City received a letter from the Department on January 16, 2026 concurring that an NPDES Permit amendment is not required to reflect the changes to the discharges of wastewater via Outfall 001.

This NPDES Permit Amendment application was prepared by Homer City to authorize the modification of the industrial discharge at Outfall 027 to Blacklick Creek from FGD scrubber blowdown to cooling tower blowdown. Attachments 1-6 contain standard application forms: Application Checklist, General Information Form, NPDES Application for Permit Amendment, Act 14 Letters and Proof of Receipt, Newspaper Notification and Proof of Publication, and applicable sections from the NPDES Application for Individual Permit to Discharge Industrial Wastewater. Attachment 7 includes a Project Location Map, Site Plan, and Process Flow Diagram (PFD). The PFD provides an overview of the discharge to Outfall 027 under current permit conditions, as well as the proposed modifications including alternate cooling tower blowdown discharge to Outfall 001.

In addition to the NPDES Permit Amendment Application Forms listed above, the following additional information is provided for the Department's consideration in support of the amendment application.

Executive Summary

Outfall 027 Effluent Limitations and Monitoring Requirements

As a result of the retirement of the FGD scrubber blowdown wastewater source from Outfall 027, Homer City is requesting removal of the parameters and their associated monitoring requirements and effluent limitations through this NPDES Permit Amendment application. Parameters proposed to be removed include those associated with Technology-Based Effluent Limitations (TBELs) contained in the Federal Steam Electric Power Generating Effluent Guidelines (ELGs) at 40 CFR Part 423.13(g) for FGD wastewater, as well as parameters which were previously determined to be required for the protection of state water quality standards based on characteristics of the FGD scrubber blowdown wastewater discharge.

Technology-Based Effluent Limitations (TBELs)

The proposed cooling tower blowdown is also regulated under the Steam Electric Power Generating ELGs at 40 CFR Part 423.13(d)(1). In addition, low volume waste sources, which are also regulated under the Steam Electric Power Generating ELGs at 40 CFR Part 423.12(b)(3), will be directed to the recirculating water system for use as makeup water. As a result, various TBELs for the proposed cooling tower blowdown discharge are anticipated to be included at Outfall 027.

Water Quality Based Effluent Limitations (WQBELs)

Site-Specific Information

Additional site-specific information is provided in Attachment 8 to the NPDES Amendment application for the Department's consideration in development of water quality-based effluent limitations (WQBELs) and monitoring requirements for the proposed discharge to Outfall 027.

Site-Specific Mixing Information and Outfall Configuration

An evaluation was completed to identify the proposed outfall and diffuser configuration that would help achieve thermal mixing criteria at PA Code Chapters 93 and 96 of Title 25 and PA Department of Environmental Protection (PADEP) Document 386-2000-001 Guidelines. The results of this evaluation are included in the "Homer City Generating Station Redevelopment, Blacklick Creek Outfall 027 Reconfiguration Assessment Using CORMIX, ASA Analysis & Communications, Inc., February 2026" (CORMIX Report, Attachment 8-1).

The evaluation recommends a multi-port unidirectional diffuser with six (6) 8-inch discharge ports terminating in duckbill nozzles which can accomplish complete mixing with a Partial Mixing Factor (PMF) of 1 within 150 to 200 feet at low flow, or $Q_{7\text{-}10}$, conditions. The study used the United States (US) Environmental Protection Agency (EPA) CORMIX2 and the PADEP Thermal Limits Spreadsheet.

A separate outfall alternatives evaluation was completed and is included as an Appendix to Attachment 8-1. This evaluation found that a bank diffuser located under the abandoned railroad trestle, which is owned by Homer City Generation LP, and directed towards the confluence of Blacklick and Two Lick Creeks would minimize the overall disturbance, minimize maintenance efforts during operation, improve reliability, and necessitate the fewest rights of way challenges.

Executive Summary

Q_{7-10} Flow of Blacklick Creek

The low flow condition (Q_{7-10}) for Blacklick Creek at the Outfall 027 discharge location was evaluated to reflect changes in stream conditions on Two Lick Creek and to incorporate additional data from Blacklick Creek upstream of the Outfall 027 location following issuance of the existing NPDES Permit. The low flow condition for Blacklick Creek at Outfall 027 was determined to be 34 cubic feet per second (cfs) and is provided in the Q_{7-10} Report (Attachment 8-2).

Background Water Quality

The following stream-specific background water quality is provided:

Parameter	**Value**	**Reference**
pH	7.64 S.U.	Two Lick Creek Make-up Pump House Historic Data
Total Hardness	129.1 mg/L	Two Lick Creek Make-up Pump House Historic Data (2018-2021)

Kiskiminetas-Conemaugh River Watershed Total Maximum Daily Load (Kiski-Conemaugh TMDL)

The US EPA has developed Total Maximum Daily Loads (TMDLs) for streams impaired by acid mine drainage in the Kiskiminetas-Conemaugh River Watershed (Kiski-Conemaugh TMDL), including Blacklick Creek, to which the proposed cooling tower blowdown will discharge via Outfall 027. Waste Load Allocations (WLAs) have been determined for Outfall 027 as part of the Kiski-Conemaugh TMDL development and are included in the existing NPDES Permit as an annual loading limitation. Homer City is proposing to maintain the existing WLA annual loading limitations for the proposed discharge. Consistent with the existing NPDES Permit, Homer City is proposing to monitor and report the total mass loading on a monthly basis and comply with the total mass loading limitations on an annual basis. In addition, Homer City is proposing to maintain concentration limits for parameters associated with the TMDLs (i.e. Total Aluminum, Total Iron, Total Manganese) on an Average Monthly, Daily Maximum, and Instantaneous Maximum basis consistent with the existing NPDES Permit.

ATTACHMENT 1
NPDES Application Checklist for Permit Amendment

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Pennsylvania Department of Environmental Protection

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) APPLICATION CHECKLIST FOR PERMIT AMENDMENTS

APPLICANT'S ✓ CHECKLIST

Applicant Name	Homer City Generation LP

Check the following list to make sure you have included all the required information. Place a checkmark in the box provided for all items completed and/or provided. Failure to provide all of the requested information will delay processing.

ENCLOSE THIS CHECKLIST WITH YOUR COMPLETED PERMIT AMENDMENT FORM.

	MAJOR PERMIT AMENDMENTS	**✓ If Included**	**DEP Use Only**
1.	One signed original and two copies of the General Information Form (GIF) (4700-PM-CEE0001) (One copy if submitted electronically through the Public Upload tool).	☒	
2.	One signed original and two copies of the Application for Permit Amendment (3800-PM-BCW0027b) (One copy if submitted electronically through the Public Upload tool).	☒	
3.	Fee. Include the appropriate fee per the instructions. Check should be payable to "Commonwealth of Pennsylvania".	☒	
4.	Act 14 Notification to municipality and county with proof of receipt.	☒	
5.	Additional information (e.g., individual permit application components) if necessary.	☒	
	MINOR PERMIT AMENDMENTS	**✓ If Included**	**DEP Use Only**
1.	One signed original and two copies of the Application for Permit Amendment (3800-PM-BCW0027b) (One copy if submitted electronically through the Public Upload tool).	☐	
2.	Fee. Include the appropriate fee per the instructions. Check should be payable to "Commonwealth of Pennsylvania".	☐	
3.	Additional information (e.g., individual permit application components) if necessary.	☐	

ATTACHMENT 2
General Information Form

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pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
CENTER FOR ENVIRONMENTAL EXCELLENCE

GENERAL INFORMATION FORM – AUTHORIZATION APPLICATION

Before completing this General Information Form (GIF), read the step-by-step instructions provided in this application package. This form is used by the Department of Environmental Protection (DEP) to inform our programs regarding what other DEP permits or authorizations may be needed for the proposed project or activity. This version of the General Information Form (GIF) must be completed and returned with any program-specific application being submitted to the DEP.

Related ID#s (If Known)				DEP USE ONLY
Client ID#	298406	**APS ID#**		Date Received & General Notes
Site ID#	236714	**Auth ID#**		
Facility ID#				

CLIENT INFORMATION

DEP Client ID#	Client Type/Code	Dun & Bradstreet ID#
298406	PARTL	

Legal Organization Name or Registered Fictitious Name	Employer ID# (EIN)	Is the EIN a SSN?
Homer City Generation LP	80-0833693	☐ Yes ☒ No

State of Incorporation or Registration of Fictious Name	
Pennsylvania	☐ Corporation ☐ LLC ☐ Partnership ☐ LLP ☒ LP ☐ Sole Proprietorship ☐ Association/Organization ☐ Estate/Trust ☐ Other

Individual Last Name	First Name	MI	Suffix

Additional Individual Last Name	First Name	MI	Suffix

Mailing Address Line 1	Mailing Address Line 2
1750 Power Plant Road	

Address Last Line – City	State	ZIP+4	Country
Homer City	PA	15748-8009	USA

Client Contact Last Name	First Name	MI	Suffix
Simmers	Shawn		

Client Contact Title	Phone	Ext	Cell Phone
Director of Environmental Compliance	724-479-6109		

Email Address	FAX
ssimmers@homercityredevelopment.com	

SITE INFORMATION

DEP Site ID#	Site Name
236714	Homer City Generating Station

EPA ID# **Estimated Number of Employees to be Present at Site** Approx. 4-6

Description of Site

Fossil fuel electric generating station

Tax Parcel ID(s): 12-017.109.00

County Name(s)	Municipality(ies)	City	Boro	Twp	State
Indiana	Center	☐	☐	☒	PA
Indiana	Black Lick	☐	☐	☒	PA
		☐	☐	☐	

Site Location Line 1	Site Location Line 2
1750 Power Plant Road	

Site Location Last Line – City	State	ZIP+4
Homer City	PA	15748-8009

Detailed Written Directions to Site

Use directions from Route 22 East to 119 N, turn left at the light onto Cambells Mill Road, then right onto Blacklick Road, then right onto Coal Road. The site will be on your left just past Power Plant Road. To get to the Office location, turn right onto Power Plant Road and the office will be on your right just past the security gate.

Site Contact Last Name	First Name	MI	Suffix
Simmers	Shawn		

Site Contact Title	Site Contact Firm
Director of Environmental Compliance	Homer City Generation LP

Mailing Address Line 1	Mailing Address Line 2
1750 Power Plant Road	

Mailing Address Last Line – City	State	ZIP+4
Homer City	PA	15748-8009

Phone	Ext	FAX	Email Address
724-479-6109			ssimmers@homercityredevelopment.com

NAICS Codes (Two- & Three-Digit Codes – List All That Apply)	6-Digit Code (Optional)
221	221112

Client to Site Relationship

Owner/Operator

FACILITY INFORMATION

Modification of Existing Facility	Yes	No
1. Will this project modify an existing facility, system, or activity?	☒	☐
2. Will this project involve an addition to an existing facility, system, or activity?	☒	☐

If "Yes", check all relevant facility types and provide DEP facility identification numbers below.

	Facility Type	DEP Fac ID#		Facility Type	DEP Fac ID#
☐	Air Emission Plant		☐	Industrial Minerals Mining Operation	
☐	Beneficial Use (water)		☐	Laboratory Location	
☐	Blasting Operation		☐	Land Recycling Cleanup Location	
☐	Captive Hazardous Waste Operation		☐	Mine Drainage Treatment / Land Recycling Project Location	
☐	Coal Ash Beneficial Use Operation		☐	Municipal Waste Operation	
☐	Coal Mining Operation		☐	Oil & Gas Encroachment Location	
☐	Coal Pillar Location		☐	Oil & Gas Location	
☐	Commercial Hazardous Waste Operation		☐	Oil & Gas Water Poll Control Facility	
☐	Dam Location		☐	Public Water Supply System	
☐	Deep Mine Safety Operation -Anthracite		☐	Radiation Facility	
☐	Deep Mine Safety Operation -Bituminous		☐	Residual Waste Operation	
☐	Deep Mine Safety Operation -Ind Minerals		☐	Storage Tank Location	
☒	Encroachment Location (water, wetland)		☒	Water Pollution Control Facility	
☐	Erosion & Sediment Control Facility		☐	Water Resource	
☐	Explosive Storage Location		☒	Other:	PA0005037

Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
USGS Indiana Quadrangle Map	40	30	50	-79	11	50

Horizontal Accuracy Measure	Feet	*--or--*	Meters	
Horizontal Reference Datum Code	☐	North American Datum of 1927		
	☐	North American Datum of 1983		
	☒	World Geodetic System of 1984		
Horizontal Collection Method Code	EMAP			
Reference Point Code	N/A			
Altitude	Feet	1150	*--or--*	Meters
Altitude Datum Name	☒	The National Geodetic Vertical Datum of 1929		
	☐	The North American Vertical Datum of 1988 (NAVD88)		
Altitude (Vertical) Location Datum Collection Method Code	NTDEP			
Geometric Type Code	Point			
Data Collection Date	N/A			
Source Map Scale Number		Inch(es)	=	Feet
--or--		Centimeter(s)	=	Meters

PROJECT INFORMATION

Project Name

Major NPDES Permit Amendment – Outfall 027 Modification

Project Description

As part of the ongoing redevelopment of the Homer City Generating Station, Homer City Generation LP (Homer City) plans to modify the industrial wastewater discharge at Outfall 027 from Flue Gas Desulfurization (FGD) scrubber blowdown to Cooling Tower Blowdown. The FGD scrubber blowdown was produced by coal-fired generating Unit #3, which has been decommissioned. The source will be replaced by Cooling Tower Blowdown from natural gas generating units installed for the proposed facility. The Cooling Tower Blowdown will be conveyed by a new pipeline directed south of the main Power Block and will discharge to Blacklick Creek through an improved Outfall 027 structure.

Project Consultant Last Name	First Name	MI	Suffix
Gesk	Monica		

Project Consultant Title	Consulting Firm
Engineering Manager 2	GAI Consultants, Inc.

Mailing Address Line 1	Mailing Address Line 2
501 Technology Drive	Suite 1300

Address Last Line – City	State	ZIP+4
Canonsburg	PA	15317

Phone	Ext	FAX	Email Address
412-399-5576			m.gesk@gaiconsultants.com

Time Schedules	Project Milestone (Optional)

1. Is the project located in or within a 0.5-**mile radius of an Environmental Justice community as defined by DEP?** ☒ Yes ☐ No

To determine if the project is located in or within a 0.5-mile radius of an environmental justice community, please use the online PennEnviroScreen tool. To see specific EJ areas, select the appropriate year of your submittal from the themes box on the right.

2. Have you informed the surrounding community prior to submitting the application to the Department? ☒ Yes ☐ No

Method of notification: Letter, Newspaper Notice

3. **Have you addressed community concerns that were identified?** ☐ Yes ☐ No ☒ N/A

If no, please briefly describe the community concerns that have been expressed and not addressed.

4. **Is your project funded by state or federal grants?** ☐ Yes ☒ No

Note: If "Yes", specify what aspect of the project is related to the grant and provide the grant source, contact person and grant expiration date.

Aspect of Project Related to Grant

Grant Source: _____

Grant Contact Person: _____

Grant Expiration Date: _____

5. **Is this application for an authorization on Appendix A of the Land Use Policy? (For referenced list, see Appendix A of the Land Use Policy attached to GIF instructions)** ☐ Yes ☒ No

Note: If "No" to Question 5, the application is not subject to the Land Use Policy.

If "Yes" to Question 5, the application is subject to this policy and the Applicant should answer the additional questions in the **Land Use Information** section.

LAND USE INFORMATION

Note: Applicants should submit copies of local land use approvals or other evidence of compliance with local comprehensive plans and zoning ordinances.

1. **Is there an adopted county or multi-county comprehensive plan?** ☐ Yes ☐ No

2. **Is there a county stormwater management plan?** ☐ Yes ☐ No

3. **Is there an adopted municipal or multi-municipal comprehensive plan?** ☐ Yes ☐ No

4. **Is there an adopted county-wide zoning ordinance, municipal zoning ordinance or joint municipal zoning ordinance?** ☐ Yes ☐ No

Note: If the Applicant answers "No" to either Questions 1, 3 or 4, the provisions of the PA MPC are not applicable and the Applicant does not need to respond to questions 5 and 6 below.

If the Applicant answers "Yes" to questions 1, 3 and 4, the Applicant should respond to questions 5 and 6 below.

5. **Does the proposed project meet the provisions of the zoning ordinance or does the proposed project have zoning approval?** If zoning approval has been received, attach documentation. ☐ Yes ☐ No

6. **Have you attached Municipal and County Land Use Letters for the project?** ☐ Yes ☐ No

COORDINATION INFORMATION

Note: The PA Historical and Museum Commission must be notified of proposed projects in accordance with DEP Technical Guidance Document 012-0700-001 at PHMC's online portal, PA-SHARE.

If the activity will be a mining project (i.e., mining of coal or industrial minerals, coal refuse disposal and/or the operation of a coal or industrial minerals preparation/processing facility), respond to questions 1.0 through 2.5 below.

If the activity will not be a mining project, skip questions 1.0 through 2.5 and begin with question 3.0.

1.0	**Is this a coal mining project?** If "Yes", respond to 1.1-1.6. If "No", skip to Question 2.0.	☐	Yes	☒	No
1.1	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be equal to or greater than 200 tons/day?**	☐	Yes	☐	No
1.2	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be greater than 50,000 tons/year?**	☐	Yes	☐	No
1.3	**Will this coal mining project involve coal preparation/ processing activities in which thermal coal dryers or pneumatic coal cleaners will be used?**	☐	Yes	☐	No
1.4	**For this coal mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No
1.5	**Will this coal mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐	Yes	☐	No
1.6	**Will this coal mining project involve underground coal mining to be conducted within 500 feet of an oil or gas well?**	☐	Yes	☐	No
2.0	**Is this a non-coal (industrial minerals) mining project?** If "Yes", respond to 2.1-2.6. If "No", skip to Question 3.0.	☐	Yes	☒	No
2.1	**Will this non-coal (industrial minerals) mining project involve the crushing and screening of non-coal minerals other than sand and gravel?**	☐	Yes	☐	No
2.2	**Will this non-coal (industrial minerals) mining project involve the crushing and/or screening of sand and gravel with the exception of wet sand and gravel operations (screening only) and dry sand and gravel operations with a capacity of less than 150 tons/hour of unconsolidated materials?**	☐	Yes	☐	No
2.3	**Will this non-coal (industrial minerals) mining project involve the construction, operation and/or modification of a portable non-metallic (i.e., non-coal) minerals processing plant under the authority of the General Permit for Portable Non-metallic Mineral Processing Plants (i.e., BAQ-PGPA/GP-3)?**	☐	Yes	☐	No
2.4	**For this non-coal (industrial minerals) mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No

2.5	**Will this non-coal (industrial minerals) mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐ Yes	☐ No
3.0	**Will your project, activity, or authorization have anything to do with a well related to oil or gas production, have construction within 200 feet of, affect an oil or gas well, involve the waste from such a well, or string power lines above an oil or gas well?** If "Yes", respond to 3.1-3.3. If "No", skip to Question 4.0.	☐ Yes	☒ No
3.1	**Does the oil- or gas-related project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water (including wetlands)?**	☐ Yes	☐ No
3.2	**Will the oil- or gas-related project involve discharge of industrial wastewater or stormwater to a dry swale, surface water, ground water or an existing sanitary sewer system or storm water system?** If "Yes", discuss in *Project Description*.	☐ Yes	☐ No
3.3	**Will the oil- or gas-related project involve the construction and operation of industrial waste treatment facilities?**	☐ Yes	☐ No
4.0	**Will the project involve a construction activity that results in earth disturbance?** If "Yes", specify the total disturbed acreage.	☒ Yes	☐ No
	4.0.1 Total Disturbed Acreage Approx. 10 acres		
	4.0.2 Will the project discharge or drain to a special protection water (EV or HQ) or an EV wetland?	☐ Yes	☒ No
	4.0.3 Will the project involve a construction activity that results in earth disturbance in the area of the earth disturbance that are contaminated at levels exceeding residential or non-residential medium-specific concentrations (MSCs) in 25 Pa. Code Chapter 250 at residential or non-residential construction sites, respectively?	☐ Yes	☒ No
5.0	**Does the project involve any of the following: water obstruction and/or encroachment, wetland impacts, or floodplain project by the Commonwealth/political subdivision or public utility?** If "Yes", respond to 5.1-5.7. If "No", skip to Question 6.0.	☒ Yes	☐ No
5.1	**Water Obstruction and Encroachment Projects – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water?**	☒ Yes	☐ No
5.2	**Wetland Impacts – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a wetland?**	☒ Yes	☐ No

5.3	**Floodplain Projects by the Commonwealth, a Political Subdivision of the Commonwealth or a Public Utility – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a floodplain?**	☐	Yes	☒	No
5.4	**Is your project an interstate transmission natural gas pipeline?**	☐	Yes	☒	No
5.5	**Does your project consist of linear construction activities which result in earth disturbance in two or more DEP regions AND three or more counties?**	☐	Yes	☒	No
5.6	**Does your project utilize Floodplain Restoration as a best management practice for Post Construction Stormwater Management?**	☐	Yes	☒	No
5.7	**Does your project utilize Class V Gravity / Injection Wells as a best management practice for Post Construction Stormwater Management?**	☐	Yes	☒	No
6.0	**Will the project involve discharge of construction related stormwater to a dry swale, surface water, ground water or separate storm water system?**	☒	Yes	☐	No
6.1	**Will the project involve discharge of industrial waste stormwater or wastewater from an industrial activity or sewage to a dry swale, surface water, ground water or an existing sanitary sewer system or separate storm water system?**	☒	Yes	☐	No
7.0	**Will the project involve the construction and operation of industrial waste treatment facilities?**	☒	Yes	☐	No
8.0	**Will the project involve construction of sewage treatment facilities, sanitary sewers, or sewage pumping stations?** If "Yes", indicate estimated proposed flow (gal/day). Also, discuss the sanitary sewer pipe sizes and the number of pumping stations/treatment facilities/name of downstream sewage facilities in the *Project Description*, where applicable.	☐	Yes	☒	No
	8.0.1 Estimated Proposed Flow (gal/day)				
9.0	**Will the project involve the subdivision of land, or the generation of 800 gpd or more of sewage on an existing parcel of land or the generation of an additional 400 gpd of sewage on an already-developed parcel, or the generation of 800 gpd or more of industrial wastewater that would be discharged to an existing sanitary sewer system?**	☐	Yes	☒	No
	9.0.1 Was Act 537 sewage facilities planning submitted and approved by DEP? If "Yes" attach the approval letter. Approval required prior to 105/NPDES approval.	☐	Yes	☒	No
10.0	**Is this project for the beneficial use of biosolids for land application within Pennsylvania?** If "Yes" indicate how much (i.e. gallons or dry tons per year).	☐	Yes	☒	No
	10.0.1 Gallons Per Year (residential septage)				
	10.0.2 Dry Tons Per Year (biosolids)				

11.0	**Does the project involve construction, modification or removal of a dam?** If "Yes", identify the dam.	☐ Yes	☒ No
	11.0.1 Dam Name		
12.0	**Will the project interfere with the flow from, or otherwise impact, a dam?** If "Yes", identify the dam.	☐ Yes	☒ No
	12.0.1 Dam Name		
13.0	**Will the project involve operations (excluding during the construction period) that produce air emissions (i.e., NOX, VOC, etc.)?**	☐ Yes	☒ No
	13.0.1 If "Yes", is the operation subject to the agricultural exemption in 35 P.S. § 4004.1?	☐ Yes	☐ No
	13.0.2 If the answer to 13.0.1 is "No", identify each type of emission followed by the estimated amount of that emission.		
	Enter all types & amounts of emissions; separate each set with semicolons.		
14.0	**Does the project include the construction or modification of a drinking water supply to serve 15 or more connections or 25 or more people, at least 60 days out of the year?** If "Yes," check all proposed sub-facilities.	☐ Yes	☒ No
	14.0.1 Number of Persons Served		
	14.0.2 Number of Employee/Guests		
	14.0.3 Number of Connections		
	14.0.4 Sub-Fac: Distribution System	☐ Yes	☐ No
	14.0.5 Sub-Fac: Water Treatment Plant	☐ Yes	☐ No
	14.0.6 Sub-Fac: Source	☐ Yes	☐ No
	14.0.7 Sub-Fac: Pump Station	☐ Yes	☐ No
	14.0.8 Sub-Fac: Transmission Main	☐ Yes	☐ No
	14.0.9 Sub-Fac: Storage Facility	☐ Yes	☐ No
15.0	**Will your project include infiltration of storm water or waste water to ground water within one-half mile of a public water supply well, spring or infiltration gallery?**	☐ Yes	☒ No
16.0	**Is your project to be served by an existing public water supply?** If "Yes", indicate name of supplier and attach letter from supplier stating that it will serve the project.	☐ Yes	☒ No
	16.0.1 Supplier's Name		
	16.0.2 Letter of Approval from Supplier is Attached	☐ Yes	☐ No
17.0	**Will this project be served by on-lot drinking water wells?**	☐ Yes	☒ No
18.0	**Will this project involve a new or increased drinking water withdrawal from a river, stream, spring, lake, well or other water bod(ies)?** If "Yes," reference Safe Drinking Water Program.	☐ Yes	☒ No
	18.0.1 Source Name		

19.0	**Will the construction or operation of this project involve treatment, storage, reuse, or disposal of waste?** If "Yes," indicate what type (i.e., hazardous, municipal (including infectious & chemotherapeutic), residual) and the amount to be treated, stored, re-used or disposed. **19.0.1 Type & Amount**	☐	Yes	☒	No
20.0	**Will your project involve the removal of coal, minerals, contaminated media, or solid waste as part of any earth disturbance activities?**	☐	Yes	☒	No
21.0	**Does your project involve installation of a field constructed underground storage tank?** If "Yes," list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **21.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
22.0	**Does your project involve installation of an aboveground storage tank greater than 21,000 gallons capacity at an existing facility?** If "Yes," list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **22.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
23.0	**Does your project involve installation of a tank greater than 1,100 gallons which will contain a highly hazardous substance as defined in DEP's Regulated Substances List, 2570-BK-DEP2724?** If "Yes," list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **23.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
24.0	**Does your project involve installation of a storage tank at a new facility with a total AST capacity greater than 21,000 gallons?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **24.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
	NOTE: If the project includes the installation of a regulated storage tank system, including diesel emergency generator systems, the project may require the use of a Department Certified Tank Handler. For a full list of regulated storage tanks and substances, please go to www.dep.pa.gov search term storage tanks				
25.0	**Will the intended activity involve the use of a radiation source?**	☐	Yes	☒	No

CERTIFICATION

I certify that I have the authority to submit this application on behalf of the applicant named herein and that the information provided in this application is true and correct to the best of my knowledge and information.

For applicants supplying an EIN number: I am applying for a permit or authorization from the Pennsylvania Department of Environmental Protection (DEP). As part of this application, I will provide DEP with an accurate EIN number for the applicant entity. By filing this application with DEP, I hereby authorize DEP to confirm the accuracy of the EIN number provided with the Pennsylvania Department of Revenue. As applicant, I further consent to the Department of Revenue discussing the same with DEP prior to issuance of the Commonwealth permit or authorization.

Type or Print Name	By: HCG GP LLC, its general partner, By: Joel S. Heiser	
Signature	Title: General Counsel & Secretary	Date: 12/18/2025

ATTACHMENT 3
NPDES Application for Permit Amendment

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pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) APPLICATION FOR PERMIT AMENDMENT

Before completing this form, read the step-by-step instructions provided in this application package. This application may be used only by permittees holding an individual NPDES permit.

Type of Amendment Requested:

☐ Minor Amendment

☒ Major Amendment

DEP USE ONLY
Date Received & General Notes

Existing Permit Information:

NPDES Permit No. PA0005037

Effective Date: January 1, 2022

Expiration Date: December 31, 2026

Facility Name:

Homer City Generation LP

Municipality: Black Lick and Center Townships

County: Indiana County

Will the applicant accept the draft and final permit electronically? ☒ Yes ☐ No Email: ssimmers@homercityredevelopment.com

Facility Type / Fee Category:

☐ SRSTP/SFTF	☐ Major Sewage with CSO	☐ Municipal Stormwater (MS4)
☐ Minor Sewage < 0.05 MGD	☐ Minor IW without ELG	☐ IW Stormwater
☐ Minor Sewage ≥ 0.05 MGD and < 1 MGD	☐ Minor IW with ELG	☐ CAAP
☐ Major Sewage ≥ 1 MGD and < 5 MGD	☒ Major IW < 250 MGD	☐ CAFO
☐ Major Sewage > 5 MGD	☐ Major IW ≥ 250 MGD	☐ Pesticides

AMENDMENT INFORMATION

Detailed Explanation of Permit Amendment Request (see Instructions and attach additional sheets if necessary):

As part of the ongoing redevelopment of the Homer City Generating Station, Homer City Generation LP (Homer City) plans to modify the industrial wastewater discharge from NPDES Permit Outfall 027 to Blacklick Creek. The discharge from this outfall is currently permitted as Unit #3 Flue Gas Desulfurization (FGD) scrubber blowdown; however, this waste stream has been removed as Homer City has decommissioned its coal-fired generating units and associated FGD systems. Outfall 027 will be modified to discharge Cooling Tower Blowdown from the proposed natural gas generating units to be installed during redevelopment. The Cooling Tower Blowdown, which was previously conveyed to Outfall 001, will be conveyed by a modified pipeline directed south of the main Power Block through an improved Outfall 027 structure.

As a result of the retirement of the FGD scrubber blowdown wastewater source from Outfall 027, Homer City is requesting removal of the following parameters and their associated monitoring requirements and effluent limitations through an NPDES Permit amendment. Parameters to be removed include those associated with Technology-Based Effluent Limitations (TBELs) contained in the Federal Steam Electric Power Generating Effluent Guidelines (ELGs) at 40 CFR Part 423 for FGD Scrubber Blowdown, as well as parameters which were previously determined to be required for the protection of state water quality standards based on characteristics of the FGD scrubber blowdown wastewater discharge:

Carbonaceous Biochemical Oxygen Demand (CBOD5); Total Suspended Solids; Total Dissolved Solids; Total Osmotic Pressure; Oil and Grease; Nitrate-Nitrite as N; Total Arsenic; Total Beryllium; Total Boron; Free Cyanide; Total Lead; Total Mercury; Total Selenium; Bromide; MBAS.

The proposed Cooling Tower Blowdown is also regulated under the Steam Electric Power Generating ELGs at 40 CFR Part 423. In addition, low volume waste sources will be directed to the recirculating water system for use as makeup water. As a result, the following parameters associated with TBELs for the proposed Cooling Tower Blowdown discharge are anticipated to be included at Outfall 027:

- pH (40 CFR §423.12(b)(1));
- TSS (40 CFR §423.12(b)(3));
- Oil and Grease (40 CFR §423.12(b)(3));
- Free Available Chlorine (40 CFR §423.13(d)(1));
- Total Chromium (40 CFR §423.13(d)(1));
- Total Zinc (40 CFR §423.13(d)(1));
- Priority Pollutants (40 CFR §423.13(d)(1)).

Attachment 8 to the NPDES Permit Amendment Application includes site-specific data and information for the development of water quality-based effluent limitations and monitoring requirements.

Total Maximum Daily Loads (TMDLs) have been developed for streams impaired by acid mine drainage in the Kiskiminetas-Conemaugh River Watershed (Kiski-Conemaugh TMDL), including Blacklick Creek, to which the proposed Cooling Tower Blowdown will disharge via Outfall 027. The following Waste Load Allocations (WLAs) have been determined for Outfall 027 as part of the Kiski-Conemaugh TMDL development and are included in the NPDES Permit as an annual loading limitation. Homer City is proposing to maintain the existing WLA annual loading limitations for the proposed discharge. Consistent with the existing NPDES Permit, Homer City is proposing to monitor and report the total mass loading on a monthly basis, and comply with the following total mass loading limitations on an annual basis:

- Total Aluminum Load: 4,045 lbs/yr
- Total Iron Load: 8,091 lbs/yr
- Total Manganese Load: 5,395 lbs/yr

In addition, Homer City is proposing to maintain concentration limits for parameters associated with the TMDLs on an Average Monthly, Daily Maximum, and Instantaneous Maximum basis as follows:

- Total Aluminum: 0.75 mg/L (Average Monthly); 0.75 mg/L (Daily Maximum); 0.75 mg/L (Instantaneous Maximum);
- Total Iron: 1.5 mg/L (Average Monthly); 3.0 mg/L (Daily Maximum); 3.75 mg/L (Instantaneous Maximum);
- Total Manganese: 1.0 mg/L (Average Monthly); 2.0 mg/L (Daily Maximum); 2.5 mg/L (Instantaneous Maximum).

A Topographic Map, Flow Diagram, and Site Plan depicting the proposed modifications to Outfall 027 are included in Attachment 7.

CLIENT/OPERATOR INFORMATION

DEP Client ID#	Client Type/Code			
298406	PARTL			
Organization Name or Registered Fictitious Name		**Employer ID# (EIN)**		**Dun & Bradstreet ID#**
Homer City Generation LP		80-0833693		
Individual Last Name	**First Name**	**MI**	**Suffix**	**SSN**
Client Mailing Address Line 1	**Client Mailing Address Line 2**			
1750 Power Plant Road				
Client Mailing Address City	**State**	**ZIP+4**	**Country**	
Homer City	PA	15748-8009	USA	
Client Contact Last Name	**First Name**	**MI**	**Suffix**	
Simmers	Shawn			
Client Contact Title		**Phone**	**Ext**	
Manager, Environmental		724-479-6109		
E-mail Address			**FAX**	
ssimmers@homercityredevelopment.com				

COMPLIANCE HISTORY REVIEW

Is the facility owner or operator in violation of any DEP regulation, permit, order or schedule of compliance at this or any other facility? ☐ YES ☒ NO

If YES, list each permit, order, regulation or schedule that is in violation and provide compliance status of the permitted activity (use additional sheets to provide information on all permits).

Permit Program | Permit No.

Brief Description of Non-Compliance:

Steps Taken to Achieve Compliance	Date(s) Compliance Achieved

Current Compliance Status: ☒ In Compliance ☐ In Non-Compliance

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. See Pa. C.S. § 4904 (relating to unsworn falsification).

By: HCG GP LLC, its general partner

Shawn T. Simmers
Name (type or print legibly)

Director of Environmental Compliance
Official Title

Signature

2/20/26
Date

HOMER CITY GENERATING STATION
FORM HW-C COMPLIANCE HISTORY

Date	Location	Permit Number/ Program	Permittee	Issuing Agency	Type of Action	Nature of Violation	Disposition	Dollar Amount of Penalty
7/25/2013	Homer City	Water (NPDES PA0005037)	NRG Homer City Services	PADEP	NOV (issued 1/7/2014)	Spill of flue gas desulfurization scrubber water		No Penalty
1/1/2014	Homer City	Water (NPDES PA0005037)	NRG Homer City Services	PADEP	Reported event	Exceedance of effluent limitation for selenium at Outfall 027		No Penalty
3/14/2015	Homer City	Water (NPDES PA0005037)	NRG Homer City Services	PADEP	Reported event	Discharge of stormwater (overflow of coal yard containment structures		No Penalty
Various dates between 8/18/2015 and 9/10/2016	Homer City	Water (NPDES PA0005037)	NRG Homer City Services	PADEP	Consent Order	Exceedance of effluent limitations for aluminum, iron or manganese at stormwater Outfalls 013, 026 and 029 (44 exceedances)	Active	$34,562 plus stipulated penalties

HOMER CITY GENERATING STATION
FORM HW-C COMPLIANCE HISTORY

Date	Location	Permit Number/ Program	Permittee	Issuing Agency	Type of Action	Nature of Violation	Disposition	Dollar Amount of Penalty
Various dates between 9/11/2016 and 06/13/2021	Homer City	Water (NPDES PA0005037)	NRG Homer City Services	PADEP	Consent Order	Multiple exceedances of effluent limitations for aluminum, iron or manganese at stormwater Outfalls 013 and 029	Active	Stipulated penalties paid per consent order
1/6/2016	Homer City	Water (NPDES PA0005037)	NRG Homer City Services	PADEP	Reported event	Leak in blowdown line upstream of Outfall 001		No Penalty
11/25/2016	Homer City	Water (NPDES PA0005037)	NRG Homer City Services	PADEP	Reported event	Exceedance of effluent limits for iron and aluminum at Outfall 001		No Penalty
4/9/2017	Homer City	Water (NPDES PA0005037)	NRG Homer City Services	PADEP	Reported event	Exceedance of effluent limitation for manganese at Outfall 018		No Penalty
4/27/2017	Homer City	Water (NPDES PA0005037)	NRG Homer City Services	PADEP	Reported event	Exceedance of effluent limitation for manganese at Outfall 001		No Penalty
1/25/2018	Homer City	Water (NPDES PA0005037)	NRG Homer City Services	PADEP	Reported event	Unit 3 Cooling Tower basin overflow discharge to Stormwater outfall.		No Penalty

HOMER CITY GENERATING STATION
FORM HW-C COMPLIANCE HISTORY

Date	Location	Permit Number/ Program	Permittee	Issuing Agency	Type of Action	Nature of Violation	Disposition	Dollar Amount of Penalty
6/18/2018	Homer City	Water (NPDES PA0005037)	NRG Homer City Services	PADEP	Reported event	Leak in blowdown line upstream of Outfall 001		No Penalty
8/30/2018	Homer City	Water (NPDES PA0005037)	NRG Homer City Services	PADEP	Reported event	Exceedance of effluent limitation for aluminum at Outfall 001		No Penalty
9/3/2019	Dixon Run	NPDES PA0235555	Homer City Generation	PADEP	Reported event	Exceedance of daily maximum discharge limit for aluminum		
4/14/2021	Homer City	NPDES PA0005037	Homer City Generation	PADEP	Reported event	Unauthorized discharge of process cooling water at outfall 022 due to pipe rupture.		
7/28/2021	Homer City	NPDES PA0005037	Homer City Generation	PADEP	Reported event	Exceedance of daily maximum and monthly average discharge limits for selenium at outfall 027		

ATTACHMENT 4
Act 14, 67, 68, and 127 Notifications and Proof of Receipt

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HOMER CITY
REDEVELOPMENT

December 22, 2025

Black Lick Township Commissioners
132 Hill Road
Blairsville, PA 15717

Acts 14, 67, 68, and 127 Notification
Homer City Generating Station
NPDES Permit Amendment - Outfall 027 Modification
NPDES Permit No. PA0005037
Black Lick and Center Townships, Indiana County, Pennsylvania

Dear Black Lick Township Commissioners:

The purpose of this notice is to inform you of Homer City Generation LP's (Homer City) intent to submit a Major National Pollutant Discharge Elimination System (NPDES) Permit Amendment Application and a Water Quality Management (WQM) Permit Application to the Pennsylvania Department of Environmental Protection (DEP) for the following:

Project Name:	Homer City Generating Station – NPDES Permit No. PA0005037 Outfall 027 Modification
Project Description:	As part of the ongoing redevelopment of the Homer City Generating Station, Homer City plans to modify the industrial wastewater discharge at NPDES Permitted Outfall 027 from Flue Gas Desulfurization (FGD) scrubber blowdown to Cooling Tower Blowdown. The FGD scrubber blowdown was produced by coal-fired generating Unit #3, which has been decommissioned. The source will be replaced by Cooling Tower Blowdown from natural gas generating units installed for the proposed facility. The Cooling Tower Blowdown will be conveyed by a new pipeline directed south of the main Power Block and will discharge to Blacklick Creek through a new outfall structure which will replace the existing outfall structure.
Applicant Name:	Homer City Generation LP
Applicant Contact:	Shawn Simmers, ssimmers@homercityredevelopment.com
Site Location:	1750 Powerplant Road, Homer City, PA 15748
Municipality/County:	Black Lick and Center Townships, Indiana County

Section 1905-A of the Commonwealth Administrative Code, as amended by Act 14 (effective April 17, 1984), requires that each applicant for a DEP permit must give written notice to the municipality(ies) and county(ies) in which the permitted activity is located. The written notices shall be received by the municipality(ies) and county(ies) at least thirty (30) days before the Department may issue or deny the permit. This notice satisfies that requirement.

This project must also satisfy Acts 67, 68, and 127 which amended the Municipalities Planning Code (effective August 21, 2000) to support sound land use practices and planning efforts, direct state agencies to consider comprehensive plans and zoning ordinances when reviewing applications for permitting of facilities or infrastructure, and specify that state agencies may rely upon comprehensive plans and zoning ordinances under certain conditions as described in Act 67, Section 1105 and Act 68, Section 619.2 of the Municipalities Planning Code.

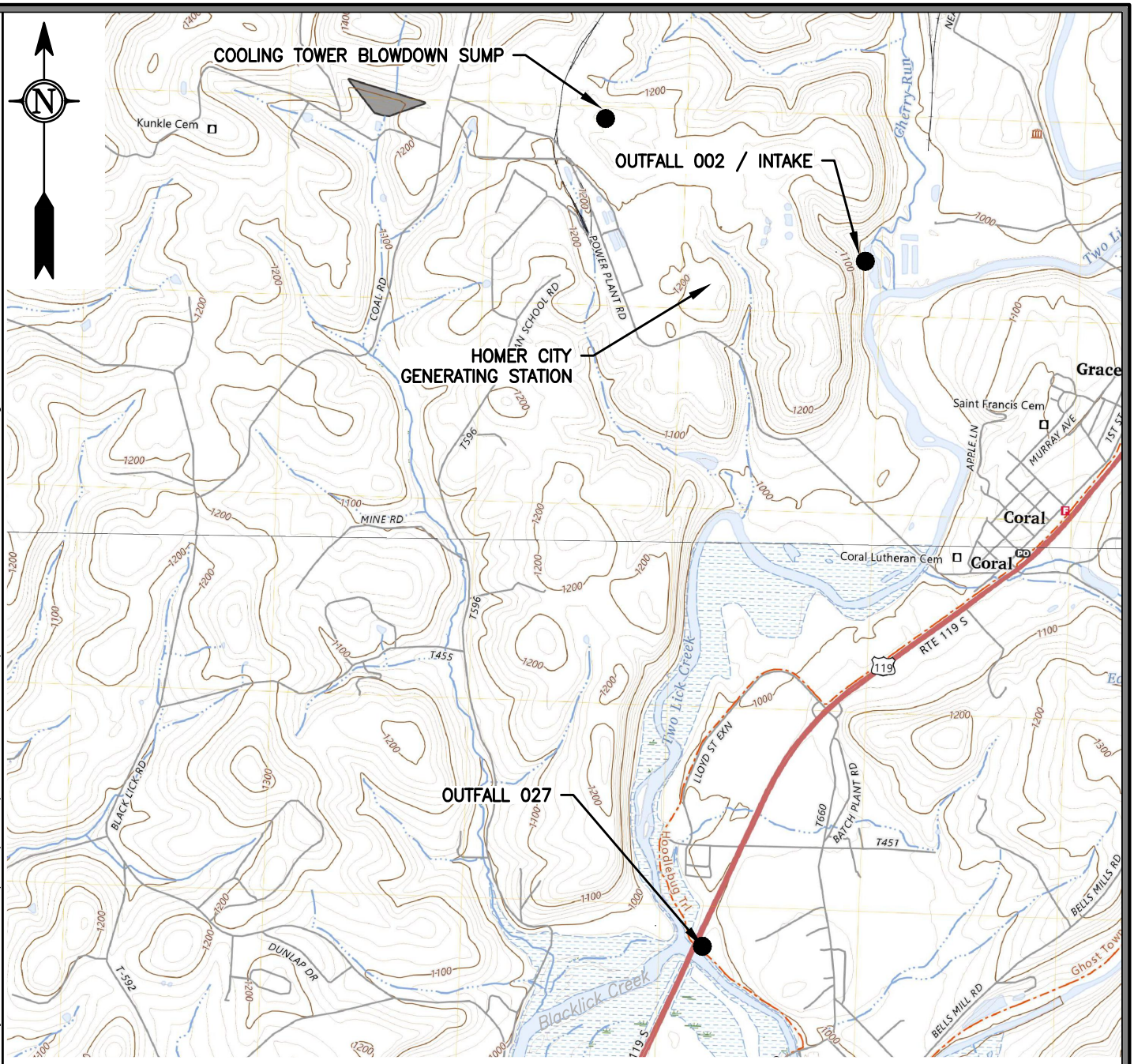
Enclosed is a General Information Form (GIF) we have completed for this project. DEP invites you to review the attached GIF and comment on the land use aspects of this project; please be specific to DEP when identifying any areas of conflict. If there are no land use comments received by the end of the comment period, DEP will assume that there are no substantive land use conflicts and proceed with the normal application review process.

Please submit any comments concerning this project within thirty (30) days from the date of receipt of this letter to the DEP Northwest Regional Office, 230 Chestnut Street, Meadville, PA 16335. For information about this land use review process, please visit www.dep.pa.gov (keyword: Land Use Reviews).

Enc.: Attachment A: Project Location Map, Attachment B: General Information Form (GIF)

ATTACHMENT A

PROJECT LOCATION MAP



MAPPING REFERENCE
U.S.G.S. 7.5 MINUTE QUADRANGLES:
INDIANA, BOLIVAR, PENNSYLVANIA 2023

SCALE: 1" = 2500'

2500 0 2500 5000

DRAWING TITLE

FIGURE 1 - SITE LOCATION MAP

PROJECT		DRAWN BY:	ISSUE DATE:
HOMER CITY GENERATING STATION NPDES AMENDMENT APPLICATION	gai consultants	**B.STEMPLE**	**12/05/2025**
		CHECKED BY:	SCALE:
		M.GESK	**1"=2500'**
CLIENT		APPROVED BY:	SHEET NO.:
HOMER CITY GENERATION, LP 1750 POWER PLANT ROAD		**M.GESK**	**1** OF **1**

GAI FILE NUMBER:	GAI DRAWING NUMBER:	© 2025 GAI Consultants
C180881-17-000-A2-002	**A2-002**	

This drawing was produced with computer aided drafting technology and is supported by electronic drawing files. Do not revise this drawing via manual drafting methods.

ISSUING OFFICE: Pittsburgh | 385 E. Waterfront Drive, Homestead, PA 15120

PLOTTED ON: 12/8/2025 10:55:50 AM PLOTTED BY: Lily N. Currie PLOT FILE: GAI.stb

GAI CAD FILE PATH: Z:\Energy\2018\C180881.17 - Homer City Industrial NPD\CAD\ACAD\Production DWGs\C180881-17-000-A2-002.dwg

ATTACHMENT B

GENERAL INFORMATION FORM

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
CENTER FOR ENVIRONMENTAL EXCELLENCE

GENERAL INFORMATION FORM – AUTHORIZATION APPLICATION

Before completing this General Information Form (GIF), read the step-by-step instructions provided in this application package. This form is used by the Department of Environmental Protection (DEP) to inform our programs regarding what other DEP permits or authorizations may be needed for the proposed project or activity. This version of the General Information Form (GIF) must be completed and returned with any program-specific application being submitted to the DEP.

Related ID#s (If Known)				DEP USE ONLY
Client ID#	298406	**APS ID#**		Date Received & General Notes
Site ID#	236714	**Auth ID#**		
Facility ID#				

CLIENT INFORMATION

DEP Client ID#	Client Type/Code	Dun & Bradstreet ID#
298406	PARTL	

Legal Organization Name or Registered Fictitious Name	Employer ID# (EIN)	Is the EIN a SSN?
Homer City Generation LP	80-0833693	☐ Yes ☒ No

State of Incorporation or Registration of Fictious Name	
Pennsylvania	☐ Corporation ☐ LLC ☐ Partnership ☐ LLP ☒ LP ☐ Sole Proprietorship ☐ Association/Organization ☐ Estate/Trust ☐ Other

Individual Last Name	First Name	MI	Suffix

Additional Individual Last Name	First Name	MI	Suffix

Mailing Address Line 1	Mailing Address Line 2
1750 Power Plant Road	

Address Last Line – City	State	ZIP+4	Country
Homer City	PA	15748-8009	USA

Client Contact Last Name	First Name	MI	Suffix
Simmers	Shawn		

Client Contact Title	Phone	Ext	Cell Phone
Director of Environmental Compliance	724-479-6109		

Email Address	FAX
ssimmers@homercityredevelopment.com	

SITE INFORMATION

DEP Site ID#	Site Name
236714	Homer City Generating Station

EPA ID# **Estimated Number of Employees to be Present at Site** Approx. 4-6

Description of Site

Fossil fuel electric generating station

Tax Parcel ID(s): 12-017.109.00

County Name(s)	Municipality(ies)	City	Boro	Twp	State
Indiana	Center	☐	☐	☒	PA
Indiana	Black Lick	☐	☐	☒	PA
		☐	☐	☐	

Site Location Line 1	Site Location Line 2
1750 Power Plant Road	

Site Location Last Line – City	State	ZIP+4
Homer City	PA	15748-8009

Detailed Written Directions to Site

Use directions from Route 22 East to 119 N, turn left at the light onto Cambells Mill Road, then right onto Blacklick Road, then right onto Coal Road. The site will be on your left just past Power Plant Road. To get to the Office location, turn right onto Power Plant Road and the office will be on your right just past the security gate.

Site Contact Last Name	First Name	MI	Suffix
Simmers	Shawn		

Site Contact Title	Site Contact Firm
Director of Environmental Compliance	Homer City Generation LP

Mailing Address Line 1	Mailing Address Line 2
1750 Power Plant Road	

Mailing Address Last Line – City	State	ZIP+4
Homer City	PA	15748-8009

Phone	Ext	FAX	Email Address
724-479-6109			ssimmers@homercityredevelopment.com

NAICS Codes (Two- & Three-Digit Codes – List All That Apply)	6-Digit Code (Optional)
221	221112

Client to Site Relationship

Owner/Operator

FACILITY INFORMATION

Modification of Existing Facility	Yes	No
1. Will this project modify an existing facility, system, or activity?	☒	☐
2. Will this project involve an addition to an existing facility, system, or activity?	☒	☐

If "Yes", check all relevant facility types and provide DEP facility identification numbers below.

	Facility Type	DEP Fac ID#		Facility Type	DEP Fac ID#
☐	Air Emission Plant		☐	Industrial Minerals Mining Operation	
☐	Beneficial Use (water)		☐	Laboratory Location	
☐	Blasting Operation		☐	Land Recycling Cleanup Location	
☐	Captive Hazardous Waste Operation		☐	Mine Drainage Treatment / Land Recycling Project Location	
☐	Coal Ash Beneficial Use Operation		☐	Municipal Waste Operation	
☐	Coal Mining Operation		☐	Oil & Gas Encroachment Location	
☐	Coal Pillar Location		☐	Oil & Gas Location	
☐	Commercial Hazardous Waste Operation		☐	Oil & Gas Water Poll Control Facility	
☐	Dam Location		☐	Public Water Supply System	
☐	Deep Mine Safety Operation -Anthracite		☐	Radiation Facility	
☐	Deep Mine Safety Operation -Bituminous		☐	Residual Waste Operation	
☐	Deep Mine Safety Operation -Ind Minerals		☐	Storage Tank Location	
☒	Encroachment Location (water, wetland)		☒	Water Pollution Control Facility	
☐	Erosion & Sediment Control Facility		☐	Water Resource	
☐	Explosive Storage Location		☒	Other:	PA0005037

Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
USGS Indiana Quadrangle Map	40	30	50	-79	11	50

Horizontal Accuracy Measure	Feet	*--or--*	Meters	
Horizontal Reference Datum Code	☐	North American Datum of 1927		
	☐	North American Datum of 1983		
	☒	World Geodetic System of 1984		
Horizontal Collection Method Code	EMAP			
Reference Point Code	N/A			
Altitude	Feet	1150	*--or--*	Meters
Altitude Datum Name	☒	The National Geodetic Vertical Datum of 1929		
	☐	The North American Vertical Datum of 1988 (NAVD88)		
Altitude (Vertical) Location Datum Collection Method Code	NTDEP			
Geometric Type Code	Point			
Data Collection Date	N/A			
Source Map Scale Number		Inch(es)	=	Feet
--or--		Centimeter(s)	=	Meters

PROJECT INFORMATION

Project Name

Major NPDES Permit Amendment – Outfall 027 Modification

Project Description

As part of the ongoing redevelopment of the Homer City Generating Station, Homer City Generation LP (Homer City) plans to modify the industrial wastewater discharge at Outfall 027 from Flue Gas Desulfurization (FGD) scrubber blowdown to Cooling Tower Blowdown. The FGD scrubber blowdown was produced by coal-fired generating Unit #3, which has been decommissioned. The source will be replaced by Cooling Tower Blowdown from natural gas generating units installed for the proposed facility. The Cooling Tower Blowdown will be conveyed by a new pipeline directed south of the main Power Block and will discharge to Blacklick Creek through an improved Outfall 027 structure.

Project Consultant Last Name	First Name	MI	Suffix
Gesk	Monica		

Project Consultant Title	Consulting Firm
Engineering Manager 2	GAI Consultants, Inc.

Mailing Address Line 1	Mailing Address Line 2
501 Technology Drive	Suite 1300

Address Last Line – City	State	ZIP+4
Canonsburg	PA	15317

Phone	Ext	FAX	Email Address
412-399-5576			m.gesk@gaiconsultants.com

Time Schedules	Project Milestone (Optional)

1. Is the project located in or within a 0.5-**mile radius of an Environmental Justice community as defined by DEP?** ☒ Yes ☐ No

To determine if the project is located in or within a 0.5-mile radius of an environmental justice community, please use the online PennEnviroScreen tool. To see specific EJ areas, select the appropriate year of your submittal from the themes box on the right.

2. Have you informed the surrounding community prior to submitting the application to the Department? ☒ Yes ☐ No

Method of notification: Letter, Newspaper Notice

3. **Have you addressed community concerns that were identified?** ☐ Yes ☐ No ☒ N/A

If no, please briefly describe the community concerns that have been expressed and not addressed.

4. **Is your project funded by state or federal grants?** ☐ Yes ☒ No

Note: If "Yes", specify what aspect of the project is related to the grant and provide the grant source, contact person and grant expiration date.

Aspect of Project Related to Grant

Grant Source: _____

Grant Contact Person: _____

Grant Expiration Date: _____

5. **Is this application for an authorization on Appendix A of the Land Use Policy? (For referenced list, see Appendix A of the Land Use Policy attached to GIF instructions)** ☐ Yes ☒ No

Note: If "No" to Question 5, the application is not subject to the Land Use Policy.

If "Yes" to Question 5, the application is subject to this policy and the Applicant should answer the additional questions in the **Land Use Information** section.

LAND USE INFORMATION

Note: Applicants should submit copies of local land use approvals or other evidence of compliance with local comprehensive plans and zoning ordinances.

1. **Is there an adopted county or multi-county comprehensive plan?** ☐ Yes ☐ No

2. **Is there a county stormwater management plan?** ☐ Yes ☐ No

3. **Is there an adopted municipal or multi-municipal comprehensive plan?** ☐ Yes ☐ No

4. **Is there an adopted county-wide zoning ordinance, municipal zoning ordinance or joint municipal zoning ordinance?** ☐ Yes ☐ No

Note: If the Applicant answers "No" to either Questions 1, 3 or 4, the provisions of the PA MPC are not applicable and the Applicant does not need to respond to questions 5 and 6 below.

If the Applicant answers "Yes" to questions 1, 3 and 4, the Applicant should respond to questions 5 and 6 below.

5. **Does the proposed project meet the provisions of the zoning ordinance or does the proposed project have zoning approval?** If zoning approval has been received, attach documentation. ☐ Yes ☐ No

6. **Have you attached Municipal and County Land Use Letters for the project?** ☐ Yes ☐ No

COORDINATION INFORMATION

Note: The PA Historical and Museum Commission must be notified of proposed projects in accordance with DEP Technical Guidance Document 012-0700-001 at PHMC's online portal, PA-SHARE.

If the activity will be a mining project (i.e., mining of coal or industrial minerals, coal refuse disposal and/or the operation of a coal or industrial minerals preparation/processing facility), respond to questions 1.0 through 2.5 below.

If the activity will not be a mining project, skip questions 1.0 through 2.5 and begin with question 3.0.

1.0	**Is this a coal mining project?** If "Yes", respond to 1.1-1.6. If "No", skip to Question 2.0.	☐	Yes	☒	No
1.1	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be equal to or greater than 200 tons/day?**	☐	Yes	☐	No
1.2	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be greater than 50,000 tons/year?**	☐	Yes	☐	No
1.3	**Will this coal mining project involve coal preparation/ processing activities in which thermal coal dryers or pneumatic coal cleaners will be used?**	☐	Yes	☐	No
1.4	**For this coal mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No
1.5	**Will this coal mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐	Yes	☐	No
1.6	**Will this coal mining project involve underground coal mining to be conducted within 500 feet of an oil or gas well?**	☐	Yes	☐	No
2.0	**Is this a non-coal (industrial minerals) mining project?** If "Yes", respond to 2.1-2.6. If "No", skip to Question 3.0.	☐	Yes	☒	No
2.1	**Will this non-coal (industrial minerals) mining project involve the crushing and screening of non-coal minerals other than sand and gravel?**	☐	Yes	☐	No
2.2	**Will this non-coal (industrial minerals) mining project involve the crushing and/or screening of sand and gravel with the exception of wet sand and gravel operations (screening only) and dry sand and gravel operations with a capacity of less than 150 tons/hour of unconsolidated materials?**	☐	Yes	☐	No
2.3	**Will this non-coal (industrial minerals) mining project involve the construction, operation and/or modification of a portable non-metallic (i.e., non-coal) minerals processing plant under the authority of the General Permit for Portable Non-metallic Mineral Processing Plants (i.e., BAQ-PGPA/GP-3)?**	☐	Yes	☐	No
2.4	**For this non-coal (industrial minerals) mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No

2.5	**Will this non-coal (industrial minerals) mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐ Yes	☐ No
3.0	**Will your project, activity, or authorization have anything to do with a well related to oil or gas production, have construction within 200 feet of, affect an oil or gas well, involve the waste from such a well, or string power lines above an oil or gas well?** If "Yes", respond to 3.1-3.3. If "No", skip to Question 4.0.	☐ Yes	☒ No
3.1	**Does the oil- or gas-related project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water (including wetlands)?**	☐ Yes	☐ No
3.2	**Will the oil- or gas-related project involve discharge of industrial wastewater or stormwater to a dry swale, surface water, ground water or an existing sanitary sewer system or storm water system?** If "Yes", discuss in *Project Description*.	☐ Yes	☐ No
3.3	**Will the oil- or gas-related project involve the construction and operation of industrial waste treatment facilities?**	☐ Yes	☐ No
4.0	**Will the project involve a construction activity that results in earth disturbance?** If "Yes", specify the total disturbed acreage.	☒ Yes	☐ No
	4.0.1 Total Disturbed Acreage Approx. 10 acres		
	4.0.2 Will the project discharge or drain to a special protection water (EV or HQ) or an EV wetland?	☐ Yes	☒ No
	4.0.3 Will the project involve a construction activity that results in earth disturbance in the area of the earth disturbance that are contaminated at levels exceeding residential or non-residential medium-specific concentrations (MSCs) in 25 Pa. Code Chapter 250 at residential or non-residential construction sites, respectively?	☐ Yes	☒ No
5.0	**Does the project involve any of the following: water obstruction and/or encroachment, wetland impacts, or floodplain project by the Commonwealth/political subdivision or public utility?** If "Yes", respond to 5.1-5.7. If "No", skip to Question 6.0.	☒ Yes	☐ No
5.1	**Water Obstruction and Encroachment Projects – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water?**	☒ Yes	☐ No
5.2	**Wetland Impacts – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a wetland?**	☒ Yes	☐ No

5.3	**Floodplain Projects by the Commonwealth, a Political Subdivision of the Commonwealth or a Public Utility – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a floodplain?**	☐	Yes	☒	No
5.4	**Is your project an interstate transmission natural gas pipeline?**	☐	Yes	☒	No
5.5	**Does your project consist of linear construction activities which result in earth disturbance in two or more DEP regions AND three or more counties?**	☐	Yes	☒	No
5.6	**Does your project utilize Floodplain Restoration as a best management practice for Post Construction Stormwater Management?**	☐	Yes	☒	No
5.7	**Does your project utilize Class V Gravity / Injection Wells as a best management practice for Post Construction Stormwater Management?**	☐	Yes	☒	No
6.0	**Will the project involve discharge of construction related stormwater to a dry swale, surface water, ground water or separate storm water system?**	☒	Yes	☐	No
6.1	**Will the project involve discharge of industrial waste stormwater or wastewater from an industrial activity or sewage to a dry swale, surface water, ground water or an existing sanitary sewer system or separate storm water system?**	☒	Yes	☐	No
7.0	**Will the project involve the construction and operation of industrial waste treatment facilities?**	☒	Yes	☐	No
8.0	**Will the project involve construction of sewage treatment facilities, sanitary sewers, or sewage pumping stations?** If "Yes", indicate estimated proposed flow (gal/day). Also, discuss the sanitary sewer pipe sizes and the number of pumping stations/treatment facilities/name of downstream sewage facilities in the *Project Description*, where applicable.	☐	Yes	☒	No
	8.0.1 Estimated Proposed Flow (gal/day)				
9.0	**Will the project involve the subdivision of land, or the generation of 800 gpd or more of sewage on an existing parcel of land or the generation of an additional 400 gpd of sewage on an already-developed parcel, or the generation of 800 gpd or more of industrial wastewater that would be discharged to an existing sanitary sewer system?**	☐	Yes	☒	No
	9.0.1 Was Act 537 sewage facilities planning submitted and approved by DEP? If "Yes" attach the approval letter. Approval required prior to 105/NPDES approval.	☐	Yes	☒	No
10.0	**Is this project for the beneficial use of biosolids for land application within Pennsylvania?** If "Yes" indicate how much (i.e. gallons or dry tons per year).	☐	Yes	☒	No
	10.0.1 Gallons Per Year (residential septage)				
	10.0.2 Dry Tons Per Year (biosolids)				

11.0	**Does the project involve construction, modification or removal of a dam?** If "Yes", identify the dam.	☐ Yes	☒ No
	11.0.1 Dam Name		
12.0	**Will the project interfere with the flow from, or otherwise impact, a dam?** If "Yes", identify the dam.	☐ Yes	☒ No
	12.0.1 Dam Name		
13.0	**Will the project involve operations (excluding during the construction period) that produce air emissions (i.e., NOX, VOC, etc.)?**	☐ Yes	☒ No
	13.0.1 If "Yes", is the operation subject to the agricultural exemption in 35 P.S. § 4004.1?	☐ Yes	☐ No
	13.0.2 If the answer to 13.0.1 is "No", identify each type of emission followed by the estimated amount of that emission.		
	Enter all types & amounts of emissions; separate each set with semicolons.		
14.0	**Does the project include the construction or modification of a drinking water supply to serve 15 or more connections or 25 or more people, at least 60 days out of the year?** If "Yes," check all proposed sub-facilities.	☐ Yes	☒ No
	14.0.1 Number of Persons Served		
	14.0.2 Number of Employee/Guests		
	14.0.3 Number of Connections		
	14.0.4 Sub-Fac: Distribution System	☐ Yes	☐ No
	14.0.5 Sub-Fac: Water Treatment Plant	☐ Yes	☐ No
	14.0.6 Sub-Fac: Source	☐ Yes	☐ No
	14.0.7 Sub-Fac: Pump Station	☐ Yes	☐ No
	14.0.8 Sub-Fac: Transmission Main	☐ Yes	☐ No
	14.0.9 Sub-Fac: Storage Facility	☐ Yes	☐ No
15.0	**Will your project include infiltration of storm water or waste water to ground water within one-half mile of a public water supply well, spring or infiltration gallery?**	☐ Yes	☒ No
16.0	**Is your project to be served by an existing public water supply?** If "Yes", indicate name of supplier and attach letter from supplier stating that it will serve the project.	☐ Yes	☒ No
	16.0.1 Supplier's Name		
	16.0.2 Letter of Approval from Supplier is Attached	☐ Yes	☐ No
17.0	**Will this project be served by on-lot drinking water wells?**	☐ Yes	☒ No
18.0	**Will this project involve a new or increased drinking water withdrawal from a river, stream, spring, lake, well or other water bod(ies)?** If "Yes," reference Safe Drinking Water Program.	☐ Yes	☒ No
	18.0.1 Source Name		

19.0	**Will the construction or operation of this project involve treatment, storage, reuse, or disposal of waste?** If "Yes," indicate what type (i.e., hazardous, municipal (including infectious & chemotherapeutic), residual) and the amount to be treated, stored, re-used or disposed. **19.0.1 Type & Amount**	☐	Yes	☒	No
20.0	**Will your project involve the removal of coal, minerals, contaminated media, or solid waste as part of any earth disturbance activities?**	☐	Yes	☒	No
21.0	**Does your project involve installation of a field constructed underground storage tank?** If "Yes," list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **21.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
22.0	**Does your project involve installation of an aboveground storage tank greater than 21,000 gallons capacity at an existing facility?** If "Yes," list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **22.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
23.0	**Does your project involve installation of a tank greater than 1,100 gallons which will contain a highly hazardous substance as defined in DEP's Regulated Substances List, 2570-BK-DEP2724?** If "Yes," list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **23.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
24.0	**Does your project involve installation of a storage tank at a new facility with a total AST capacity greater than 21,000 gallons?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **24.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
	NOTE: If the project includes the installation of a regulated storage tank system, including diesel emergency generator systems, the project may require the use of a Department Certified Tank Handler. For a full list of regulated storage tanks and substances, please go to www.dep.pa.gov search term storage tanks				
25.0	**Will the intended activity involve the use of a radiation source?**	☐	Yes	☒	No

CERTIFICATION

I certify that I have the authority to submit this application on behalf of the applicant named herein and that the information provided in this application is true and correct to the best of my knowledge and information.

For applicants supplying an EIN number: I am applying for a permit or authorization from the Pennsylvania Department of Environmental Protection (DEP). As part of this application, I will provide DEP with an accurate EIN number for the applicant entity. By filing this application with DEP, I hereby authorize DEP to confirm the accuracy of the EIN number provided with the Pennsylvania Department of Revenue. As applicant, I further consent to the Department of Revenue discussing the same with DEP prior to issuance of the Commonwealth permit or authorization.

Type or Print Name	By: HCG GP LLC, its general partner, By: Joel S. Heiser	
Signature	Title: General Counsel & Secretary	Date: 12/18/2025

December 30, 2025

Dear Customer,

The following is the proof-of-delivery for tracking number: 887333982568

Delivery Information:

Status:	Delivered	**Delivered To:**	
Signed for by:	TSTILES	**Delivery Location:**	132 HILL RD
Service type:	FedEx Ground		
Special Handling:	Adult Signature Required		Blairsville, PA, 15717
		Delivery date:	Dec 26, 2025 15:16

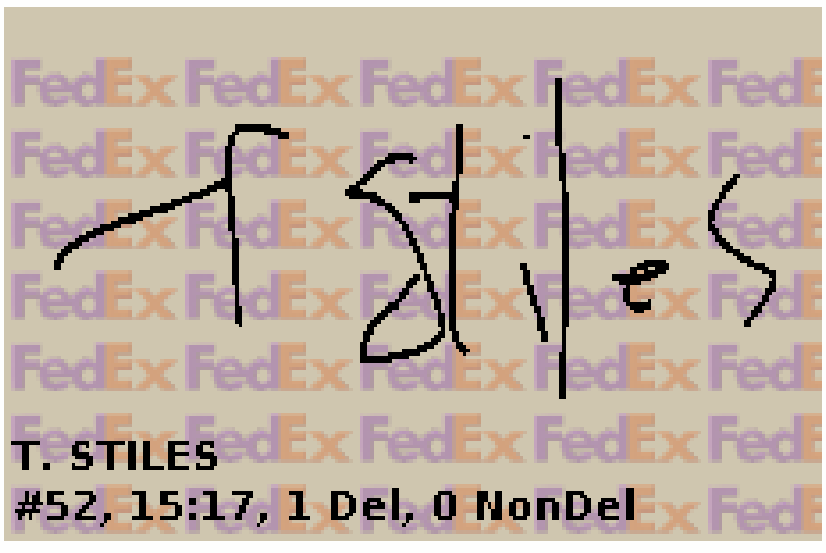
Shipping Information:

Tracking number:	887333982568	**Ship Date:**	Dec 22, 2025
		Weight:	0.2 LB/0.09 KG

Recipient:
Black Lick Twp Commissioners, Black Lick Twp Commissioners
132 HILL RD
BLAIRSVILLE, PA, US, 15717591732

Shipper:
Monica Gesk, GAI Consultants
385 East Waterfront Drive
Homestead, PA, US, 15120

Reference C180881.17.006.001



Thank you for choosing FedEx

HOMER CITY
REDEVELOPMENT

December 22, 2025

Center Township Commissioners
1212 Neal Road
Homer City, PA 15748

Acts 14, 67, 68, and 127 Notification
Homer City Generating Station
NPDES Permit Amendment - Outfall 027 Modification
NPDES Permit No. PA0005037
Black Lick and Center Townships, Indiana County, Pennsylvania

Dear Center Township Commissioners:

The purpose of this notice is to inform you of Homer City Generation LP's (Homer City) intent to submit a Major National Pollutant Discharge Elimination System (NPDES) Permit Amendment Application and a Water Quality Management (WQM) Permit Application to the Pennsylvania Department of Environmental Protection (DEP) for the following:

Project Name:	Homer City Generating Station – NPDES Permit No. PA0005037 Outfall 027 Modification
Project Description:	As part of the ongoing redevelopment of the Homer City Generating Station, Homer City plans to modify the industrial wastewater discharge at NPDES Permitted Outfall 027 from Flue Gas Desulfurization (FGD) scrubber blowdown to Cooling Tower Blowdown. The FGD scrubber blowdown was produced by coal-fired generating Unit #3, which has been decommissioned. The source will be replaced by Cooling Tower Blowdown from natural gas generating units installed for the proposed facility. The Cooling Tower Blowdown will be conveyed by a new pipeline directed south of the main Power Block and will discharge to Blacklick Creek through a new outfall structure which will replace the existing outfall structure.
Applicant Name:	Homer City Generation LP
Applicant Contact:	Shawn Simmers, ssimmers@homercityredevelopment.com
Site Location:	1750 Powerplant Road, Homer City, PA 15748
Municipality/County:	Black Lick and Center Townships, Indiana County

Section 1905-A of the Commonwealth Administrative Code, as amended by Act 14 (effective April 17, 1984), requires that each applicant for a DEP permit must give written notice to the municipality(ies) and county(ies) in which the permitted activity is located. The written notices shall be received by the municipality(ies) and county(ies) at least thirty (30) days before the Department may issue or deny the permit. This notice satisfies that requirement.

This project must also satisfy Acts 67, 68, and 127 which amended the Municipalities Planning Code (effective August 21, 2000) to support sound land use practices and planning efforts, direct state agencies to consider comprehensive plans and zoning ordinances when reviewing applications for permitting of facilities or infrastructure, and specify that state agencies may rely upon comprehensive plans and zoning ordinances under certain conditions as described in Act 67, Section 1105 and Act 68, Section 619.2 of the Municipalities Planning Code.

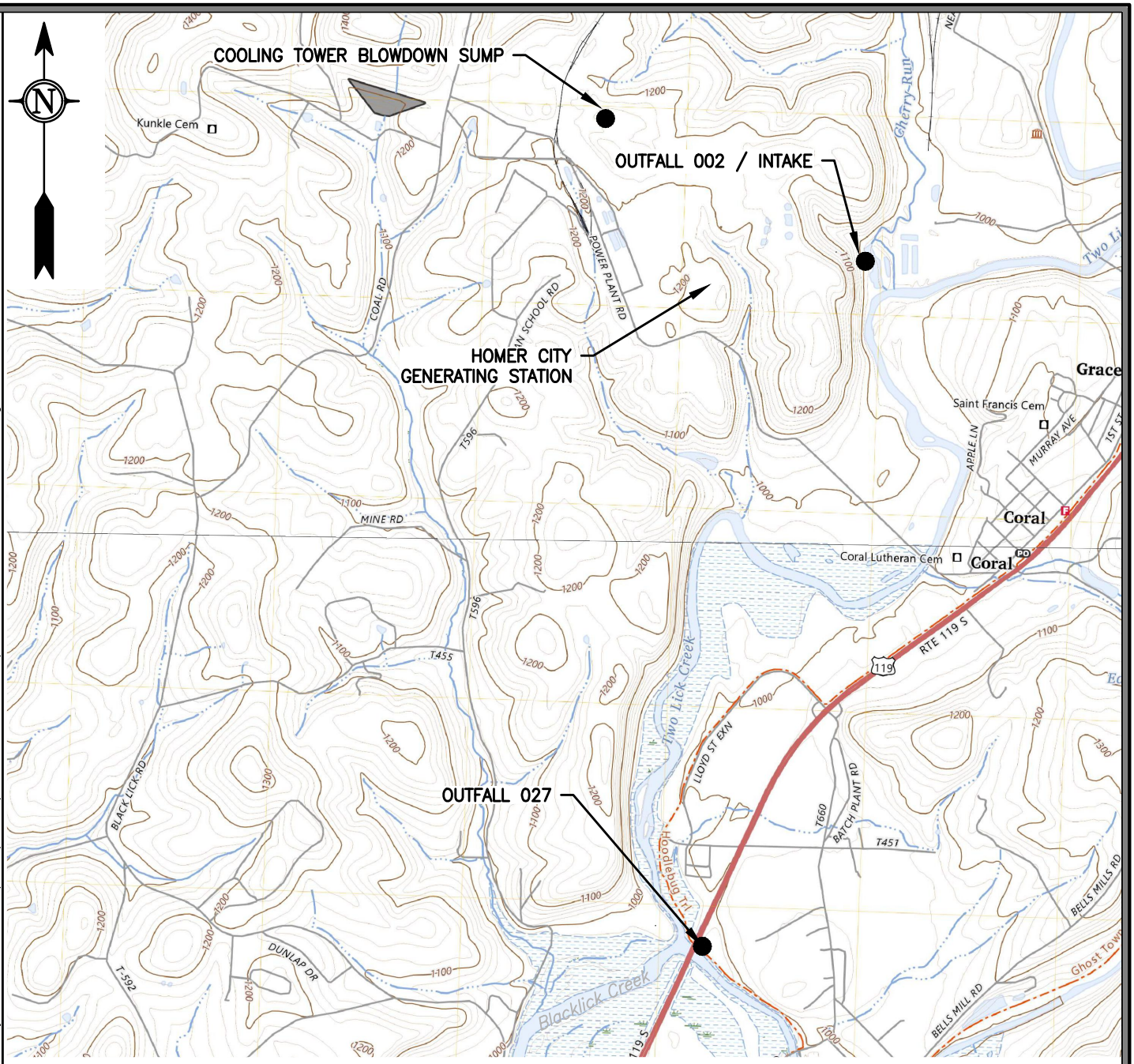
Enclosed is a General Information Form (GIF) we have completed for this project. DEP invites you to review the attached GIF and comment on the land use aspects of this project; please be specific to DEP when identifying any areas of conflict. If there are no land use comments received by the end of the comment period, DEP will assume that there are no substantive land use conflicts and proceed with the normal application review process.

Please submit any comments concerning this project within thirty (30) days from the date of receipt of this letter to the DEP Northwest Regional Office, 230 Chestnut Street, Meadville, PA 16335. For information about this land use review process, please visit www.dep.pa.gov (keyword: Land Use Reviews).

Enc.: Attachment A: Project Location Map, Attachment B: General Information Form (GIF)

ATTACHMENT A

PROJECT LOCATION MAP



MAPPING REFERENCE
U.S.G.S. 7.5 MINUTE QUADRANGLES:
INDIANA, BOLIVAR, PENNSYLVANIA 2023

SCALE: 1" = 2500'

2500 0 2500 5000

DRAWING TITLE

FIGURE 1 - SITE LOCATION MAP

PROJECT		DRAWN BY:	ISSUE DATE:
HOMER CITY GENERATING STATION NPDES AMENDMENT APPLICATION	gai consultants	**B.STEMPLE**	**12/05/2025**
		CHECKED BY:	SCALE:
		M.GESK	**1"=2500'**
CLIENT		APPROVED BY:	SHEET NO.:
HOMER CITY GENERATION, LP 1750 POWER PLANT ROAD		**M.GESK**	**1** OF **1**

GAI FILE NUMBER:	GAI DRAWING NUMBER:	© 2025 GAI Consultants
C180881-17-000-A2-002	**A2-002**	

This drawing was produced with computer aided drafting technology and is supported by electronic drawing files. Do not revise this drawing via manual drafting methods.

ISSUING OFFICE: Pittsburgh | 385 E. Waterfront Drive, Homestead, PA 15120

PLOTTED ON: 12/8/2025 10:55:50 AM PLOTTED BY: Lily N. Currie PLOT FILE: GAI.stb

GAI CAD FILE PATH: Z:\Energy\2018\C180881.17 - Homer City Industrial NPD\CAD\ACAD\Production DWGs\C180881-17-000-A2-002.dwg

ATTACHMENT B

GENERAL INFORMATION FORM

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
CENTER FOR ENVIRONMENTAL EXCELLENCE

GENERAL INFORMATION FORM – AUTHORIZATION APPLICATION

Before completing this General Information Form (GIF), read the step-by-step instructions provided in this application package. This form is used by the Department of Environmental Protection (DEP) to inform our programs regarding what other DEP permits or authorizations may be needed for the proposed project or activity. This version of the General Information Form (GIF) must be completed and returned with any program-specific application being submitted to the DEP.

Related ID#s (If Known)				DEP USE ONLY
Client ID#	298406	**APS ID#**		Date Received & General Notes
Site ID#	236714	**Auth ID#**		
Facility ID#				

CLIENT INFORMATION

DEP Client ID#	Client Type/Code	Dun & Bradstreet ID#
298406	PARTL	

Legal Organization Name or Registered Fictitious Name	Employer ID# (EIN)	Is the EIN a SSN?
Homer City Generation LP	80-0833693	☐ Yes ☒ No

State of Incorporation or Registration of Fictious Name	
Pennsylvania	☐ Corporation ☐ LLC ☐ Partnership ☐ LLP ☒ LP ☐ Sole Proprietorship ☐ Association/Organization ☐ Estate/Trust ☐ Other

Individual Last Name	First Name	MI	Suffix

Additional Individual Last Name	First Name	MI	Suffix

Mailing Address Line 1	Mailing Address Line 2
1750 Power Plant Road	

Address Last Line – City	State	ZIP+4	Country
Homer City	PA	15748-8009	USA

Client Contact Last Name	First Name	MI	Suffix
Simmers	Shawn		

Client Contact Title	Phone	Ext	Cell Phone
Director of Environmental Compliance	724-479-6109		

Email Address	FAX
ssimmers@homercityredevelopment.com	

SITE INFORMATION

DEP Site ID#	Site Name
236714	Homer City Generating Station

EPA ID# **Estimated Number of Employees to be Present at Site** Approx. 4-6

Description of Site

Fossil fuel electric generating station

Tax Parcel ID(s): 12-017.109.00

County Name(s)	Municipality(ies)	City	Boro	Twp	State
Indiana	Center	☐	☐	☒	PA
Indiana	Black Lick	☐	☐	☒	PA
		☐	☐	☐	

Site Location Line 1	Site Location Line 2
1750 Power Plant Road	

Site Location Last Line – City	State	ZIP+4
Homer City	PA	15748-8009

Detailed Written Directions to Site

Use directions from Route 22 East to 119 N, turn left at the light onto Cambells Mill Road, then right onto Blacklick Road, then right onto Coal Road. The site will be on your left just past Power Plant Road. To get to the Office location, turn right onto Power Plant Road and the office will be on your right just past the security gate.

Site Contact Last Name	First Name	MI	Suffix
Simmers	Shawn		

Site Contact Title	Site Contact Firm
Director of Environmental Compliance	Homer City Generation LP

Mailing Address Line 1	Mailing Address Line 2
1750 Power Plant Road	

Mailing Address Last Line – City	State	ZIP+4
Homer City	PA	15748-8009

Phone	Ext	FAX	Email Address
724-479-6109			ssimmers@homercityredevelopment.com

NAICS Codes (Two- & Three-Digit Codes – List All That Apply)	6-Digit Code (Optional)
221	221112

Client to Site Relationship

Owner/Operator

FACILITY INFORMATION

Modification of Existing Facility	Yes	No
1. Will this project modify an existing facility, system, or activity?	☒	☐
2. Will this project involve an addition to an existing facility, system, or activity?	☒	☐

If "Yes", check all relevant facility types and provide DEP facility identification numbers below.

	Facility Type	DEP Fac ID#		Facility Type	DEP Fac ID#
☐	Air Emission Plant		☐	Industrial Minerals Mining Operation	
☐	Beneficial Use (water)		☐	Laboratory Location	
☐	Blasting Operation		☐	Land Recycling Cleanup Location	
☐	Captive Hazardous Waste Operation		☐	Mine Drainage Treatment / Land Recycling Project Location	
☐	Coal Ash Beneficial Use Operation		☐	Municipal Waste Operation	
☐	Coal Mining Operation		☐	Oil & Gas Encroachment Location	
☐	Coal Pillar Location		☐	Oil & Gas Location	
☐	Commercial Hazardous Waste Operation		☐	Oil & Gas Water Poll Control Facility	
☐	Dam Location		☐	Public Water Supply System	
☐	Deep Mine Safety Operation -Anthracite		☐	Radiation Facility	
☐	Deep Mine Safety Operation -Bituminous		☐	Residual Waste Operation	
☐	Deep Mine Safety Operation -Ind Minerals		☐	Storage Tank Location	
☒	Encroachment Location (water, wetland)		☒	Water Pollution Control Facility	
☐	Erosion & Sediment Control Facility		☐	Water Resource	
☐	Explosive Storage Location		☒	Other:	PA0005037

Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
USGS Indiana Quadrangle Map	40	30	50	-79	11	50

Horizontal Accuracy Measure	Feet	*--or--*	Meters	
Horizontal Reference Datum Code	☐	North American Datum of 1927		
	☐	North American Datum of 1983		
	☒	World Geodetic System of 1984		
Horizontal Collection Method Code	EMAP			
Reference Point Code	N/A			
Altitude	Feet	1150	*--or--*	Meters
Altitude Datum Name	☒	The National Geodetic Vertical Datum of 1929		
	☐	The North American Vertical Datum of 1988 (NAVD88)		
Altitude (Vertical) Location Datum Collection Method Code	NTDEP			
Geometric Type Code	Point			
Data Collection Date	N/A			
Source Map Scale Number		Inch(es)	=	Feet
--or--		Centimeter(s)	=	Meters

PROJECT INFORMATION

Project Name

Major NPDES Permit Amendment – Outfall 027 Modification

Project Description

As part of the ongoing redevelopment of the Homer City Generating Station, Homer City Generation LP (Homer City) plans to modify the industrial wastewater discharge at Outfall 027 from Flue Gas Desulfurization (FGD) scrubber blowdown to Cooling Tower Blowdown. The FGD scrubber blowdown was produced by coal-fired generating Unit #3, which has been decommissioned. The source will be replaced by Cooling Tower Blowdown from natural gas generating units installed for the proposed facility. The Cooling Tower Blowdown will be conveyed by a new pipeline directed south of the main Power Block and will discharge to Blacklick Creek through an improved Outfall 027 structure.

Project Consultant Last Name	First Name	MI	Suffix
Gesk	Monica		

Project Consultant Title	Consulting Firm
Engineering Manager 2	GAI Consultants, Inc.

Mailing Address Line 1	Mailing Address Line 2
501 Technology Drive	Suite 1300

Address Last Line – City	State	ZIP+4
Canonsburg	PA	15317

Phone	Ext	FAX	Email Address
412-399-5576			m.gesk@gaiconsultants.com

Time Schedules	Project Milestone (Optional)

1. Is the project located in or within a 0.5-**mile radius of an Environmental Justice community as defined by DEP?** ☒ Yes ☐ No

To determine if the project is located in or within a 0.5-mile radius of an environmental justice community, please use the online PennEnviroScreen tool. To see specific EJ areas, select the appropriate year of your submittal from the themes box on the right.

2. Have you informed the surrounding community prior to submitting the application to the Department? ☒ Yes ☐ No

Method of notification: Letter, Newspaper Notice

3. **Have you addressed community concerns that were identified?** ☐ Yes ☐ No ☒ N/A

If no, please briefly describe the community concerns that have been expressed and not addressed.

4. **Is your project funded by state or federal grants?** ☐ Yes ☒ No

Note: If "Yes", specify what aspect of the project is related to the grant and provide the grant source, contact person and grant expiration date.

Aspect of Project Related to Grant

Grant Source: _____

Grant Contact Person: _____

Grant Expiration Date: _____

5. **Is this application for an authorization on Appendix A of the Land Use Policy? (For referenced list, see Appendix A of the Land Use Policy attached to GIF instructions)** ☐ Yes ☒ No

Note: If "No" to Question 5, the application is not subject to the Land Use Policy.

If "Yes" to Question 5, the application is subject to this policy and the Applicant should answer the additional questions in the **Land Use Information** section.

LAND USE INFORMATION

Note: Applicants should submit copies of local land use approvals or other evidence of compliance with local comprehensive plans and zoning ordinances.

1. **Is there an adopted county or multi-county comprehensive plan?** ☐ Yes ☐ No

2. **Is there a county stormwater management plan?** ☐ Yes ☐ No

3. **Is there an adopted municipal or multi-municipal comprehensive plan?** ☐ Yes ☐ No

4. **Is there an adopted county-wide zoning ordinance, municipal zoning ordinance or joint municipal zoning ordinance?** ☐ Yes ☐ No

Note: If the Applicant answers "No" to either Questions 1, 3 or 4, the provisions of the PA MPC are not applicable and the Applicant does not need to respond to questions 5 and 6 below.

If the Applicant answers "Yes" to questions 1, 3 and 4, the Applicant should respond to questions 5 and 6 below.

5. **Does the proposed project meet the provisions of the zoning ordinance or does the proposed project have zoning approval?** If zoning approval has been received, attach documentation. ☐ Yes ☐ No

6. **Have you attached Municipal and County Land Use Letters for the project?** ☐ Yes ☐ No

COORDINATION INFORMATION

Note: The PA Historical and Museum Commission must be notified of proposed projects in accordance with DEP Technical Guidance Document 012-0700-001 at PHMC's online portal, PA-SHARE.

If the activity will be a mining project (i.e., mining of coal or industrial minerals, coal refuse disposal and/or the operation of a coal or industrial minerals preparation/processing facility), respond to questions 1.0 through 2.5 below.

If the activity will not be a mining project, skip questions 1.0 through 2.5 and begin with question 3.0.

1.0	**Is this a coal mining project?** If "Yes", respond to 1.1-1.6. If "No", skip to Question 2.0.	☐	Yes	☒	No
1.1	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be equal to or greater than 200 tons/day?**	☐	Yes	☐	No
1.2	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be greater than 50,000 tons/year?**	☐	Yes	☐	No
1.3	**Will this coal mining project involve coal preparation/ processing activities in which thermal coal dryers or pneumatic coal cleaners will be used?**	☐	Yes	☐	No
1.4	**For this coal mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No
1.5	**Will this coal mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐	Yes	☐	No
1.6	**Will this coal mining project involve underground coal mining to be conducted within 500 feet of an oil or gas well?**	☐	Yes	☐	No
2.0	**Is this a non-coal (industrial minerals) mining project?** If "Yes", respond to 2.1-2.6. If "No", skip to Question 3.0.	☐	Yes	☒	No
2.1	**Will this non-coal (industrial minerals) mining project involve the crushing and screening of non-coal minerals other than sand and gravel?**	☐	Yes	☐	No
2.2	**Will this non-coal (industrial minerals) mining project involve the crushing and/or screening of sand and gravel with the exception of wet sand and gravel operations (screening only) and dry sand and gravel operations with a capacity of less than 150 tons/hour of unconsolidated materials?**	☐	Yes	☐	No
2.3	**Will this non-coal (industrial minerals) mining project involve the construction, operation and/or modification of a portable non-metallic (i.e., non-coal) minerals processing plant under the authority of the General Permit for Portable Non-metallic Mineral Processing Plants (i.e., BAQ-PGPA/GP-3)?**	☐	Yes	☐	No
2.4	**For this non-coal (industrial minerals) mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No

2.5	**Will this non-coal (industrial minerals) mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐ Yes	☐ No
3.0	**Will your project, activity, or authorization have anything to do with a well related to oil or gas production, have construction within 200 feet of, affect an oil or gas well, involve the waste from such a well, or string power lines above an oil or gas well?** If "Yes", respond to 3.1-3.3. If "No", skip to Question 4.0.	☐ Yes	☒ No
3.1	**Does the oil- or gas-related project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water (including wetlands)?**	☐ Yes	☐ No
3.2	**Will the oil- or gas-related project involve discharge of industrial wastewater or stormwater to a dry swale, surface water, ground water or an existing sanitary sewer system or storm water system?** If "Yes", discuss in *Project Description*.	☐ Yes	☐ No
3.3	**Will the oil- or gas-related project involve the construction and operation of industrial waste treatment facilities?**	☐ Yes	☐ No
4.0	**Will the project involve a construction activity that results in earth disturbance?** If "Yes", specify the total disturbed acreage.	☒ Yes	☐ No
	4.0.1 Total Disturbed Acreage Approx. 10 acres		
	4.0.2 Will the project discharge or drain to a special protection water (EV or HQ) or an EV wetland?	☐ Yes	☒ No
	4.0.3 Will the project involve a construction activity that results in earth disturbance in the area of the earth disturbance that are contaminated at levels exceeding residential or non-residential medium-specific concentrations (MSCs) in 25 Pa. Code Chapter 250 at residential or non-residential construction sites, respectively?	☐ Yes	☒ No
5.0	**Does the project involve any of the following: water obstruction and/or encroachment, wetland impacts, or floodplain project by the Commonwealth/political subdivision or public utility?** If "Yes", respond to 5.1-5.7. If "No", skip to Question 6.0.	☒ Yes	☐ No
5.1	**Water Obstruction and Encroachment Projects – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water?**	☒ Yes	☐ No
5.2	**Wetland Impacts – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a wetland?**	☒ Yes	☐ No

5.3	**Floodplain Projects by the Commonwealth, a Political Subdivision of the Commonwealth or a Public Utility – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a floodplain?**	☐	Yes	☒	No
5.4	**Is your project an interstate transmission natural gas pipeline?**	☐	Yes	☒	No
5.5	**Does your project consist of linear construction activities which result in earth disturbance in two or more DEP regions AND three or more counties?**	☐	Yes	☒	No
5.6	**Does your project utilize Floodplain Restoration as a best management practice for Post Construction Stormwater Management?**	☐	Yes	☒	No
5.7	**Does your project utilize Class V Gravity / Injection Wells as a best management practice for Post Construction Stormwater Management?**	☐	Yes	☒	No
6.0	**Will the project involve discharge of construction related stormwater to a dry swale, surface water, ground water or separate storm water system?**	☒	Yes	☐	No
6.1	**Will the project involve discharge of industrial waste stormwater or wastewater from an industrial activity or sewage to a dry swale, surface water, ground water or an existing sanitary sewer system or separate storm water system?**	☒	Yes	☐	No
7.0	**Will the project involve the construction and operation of industrial waste treatment facilities?**	☒	Yes	☐	No
8.0	**Will the project involve construction of sewage treatment facilities, sanitary sewers, or sewage pumping stations?** If "Yes", indicate estimated proposed flow (gal/day). Also, discuss the sanitary sewer pipe sizes and the number of pumping stations/treatment facilities/name of downstream sewage facilities in the *Project Description*, where applicable.	☐	Yes	☒	No
	8.0.1 Estimated Proposed Flow (gal/day)				
9.0	**Will the project involve the subdivision of land, or the generation of 800 gpd or more of sewage on an existing parcel of land or the generation of an additional 400 gpd of sewage on an already-developed parcel, or the generation of 800 gpd or more of industrial wastewater that would be discharged to an existing sanitary sewer system?**	☐	Yes	☒	No
	9.0.1 Was Act 537 sewage facilities planning submitted and approved by DEP? If "Yes" attach the approval letter. Approval required prior to 105/NPDES approval.	☐	Yes	☒	No
10.0	**Is this project for the beneficial use of biosolids for land application within Pennsylvania?** If "Yes" indicate how much (i.e. gallons or dry tons per year).	☐	Yes	☒	No
	10.0.1 Gallons Per Year (residential septage)				
	10.0.2 Dry Tons Per Year (biosolids)				

11.0	**Does the project involve construction, modification or removal of a dam?** If "Yes", identify the dam.	☐ Yes	☒ No
	11.0.1 Dam Name		
12.0	**Will the project interfere with the flow from, or otherwise impact, a dam?** If "Yes", identify the dam.	☐ Yes	☒ No
	12.0.1 Dam Name		
13.0	**Will the project involve operations (excluding during the construction period) that produce air emissions (i.e., NOX, VOC, etc.)?**	☐ Yes	☒ No
	13.0.1 If "Yes", is the operation subject to the agricultural exemption in 35 P.S. § 4004.1?	☐ Yes	☐ No
	13.0.2 If the answer to 13.0.1 is "No", identify each type of emission followed by the estimated amount of that emission.		
	Enter all types & amounts of emissions; separate each set with semicolons.		
14.0	**Does the project include the construction or modification of a drinking water supply to serve 15 or more connections or 25 or more people, at least 60 days out of the year?** If "Yes," check all proposed sub-facilities.	☐ Yes	☒ No
	14.0.1 Number of Persons Served		
	14.0.2 Number of Employee/Guests		
	14.0.3 Number of Connections		
	14.0.4 Sub-Fac: Distribution System	☐ Yes	☐ No
	14.0.5 Sub-Fac: Water Treatment Plant	☐ Yes	☐ No
	14.0.6 Sub-Fac: Source	☐ Yes	☐ No
	14.0.7 Sub-Fac: Pump Station	☐ Yes	☐ No
	14.0.8 Sub-Fac: Transmission Main	☐ Yes	☐ No
	14.0.9 Sub-Fac: Storage Facility	☐ Yes	☐ No
15.0	**Will your project include infiltration of storm water or waste water to ground water within one-half mile of a public water supply well, spring or infiltration gallery?**	☐ Yes	☒ No
16.0	**Is your project to be served by an existing public water supply?** If "Yes", indicate name of supplier and attach letter from supplier stating that it will serve the project.	☐ Yes	☒ No
	16.0.1 Supplier's Name		
	16.0.2 Letter of Approval from Supplier is Attached	☐ Yes	☐ No
17.0	**Will this project be served by on-lot drinking water wells?**	☐ Yes	☒ No
18.0	**Will this project involve a new or increased drinking water withdrawal from a river, stream, spring, lake, well or other water bod(ies)?** If "Yes," reference Safe Drinking Water Program.	☐ Yes	☒ No
	18.0.1 Source Name		

19.0	**Will the construction or operation of this project involve treatment, storage, reuse, or disposal of waste?** If "Yes," indicate what type (i.e., hazardous, municipal (including infectious & chemotherapeutic), residual) and the amount to be treated, stored, re-used or disposed. **19.0.1 Type & Amount**	☐	Yes	☒	No
20.0	**Will your project involve the removal of coal, minerals, contaminated media, or solid waste as part of any earth disturbance activities?**	☐	Yes	☒	No
21.0	**Does your project involve installation of a field constructed underground storage tank?** If "Yes," list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **21.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
22.0	**Does your project involve installation of an aboveground storage tank greater than 21,000 gallons capacity at an existing facility?** If "Yes," list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **22.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
23.0	**Does your project involve installation of a tank greater than 1,100 gallons which will contain a highly hazardous substance as defined in DEP's Regulated Substances List, 2570-BK-DEP2724?** If "Yes," list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **23.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
24.0	**Does your project involve installation of a storage tank at a new facility with a total AST capacity greater than 21,000 gallons?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **24.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
	NOTE: If the project includes the installation of a regulated storage tank system, including diesel emergency generator systems, the project may require the use of a Department Certified Tank Handler. For a full list of regulated storage tanks and substances, please go to www.dep.pa.gov search term storage tanks				
25.0	**Will the intended activity involve the use of a radiation source?**	☐	Yes	☒	No

CERTIFICATION

I certify that I have the authority to submit this application on behalf of the applicant named herein and that the information provided in this application is true and correct to the best of my knowledge and information.

For applicants supplying an EIN number: I am applying for a permit or authorization from the Pennsylvania Department of Environmental Protection (DEP). As part of this application, I will provide DEP with an accurate EIN number for the applicant entity. By filing this application with DEP, I hereby authorize DEP to confirm the accuracy of the EIN number provided with the Pennsylvania Department of Revenue. As applicant, I further consent to the Department of Revenue discussing the same with DEP prior to issuance of the Commonwealth permit or authorization.

Type or Print Name	By: HCG GP LLC, its general partner, By: Joel S. Heiser	
Signature	Title: General Counsel & Secretary	Date: 12/18/2025

December 30, 2025

Dear Customer,

The following is the proof-of-delivery for tracking number: 887334103686

Delivery Information:

Status:	Delivered	**Delivered To:**	
Signed for by:	SSMITH	**Delivery Location:**	1212 NEAL RD
Service type:	FedEx Ground		
Special Handling:	Adult Signature Required		Homer City, PA, 15748
		Delivery date:	Dec 29, 2025 10:22

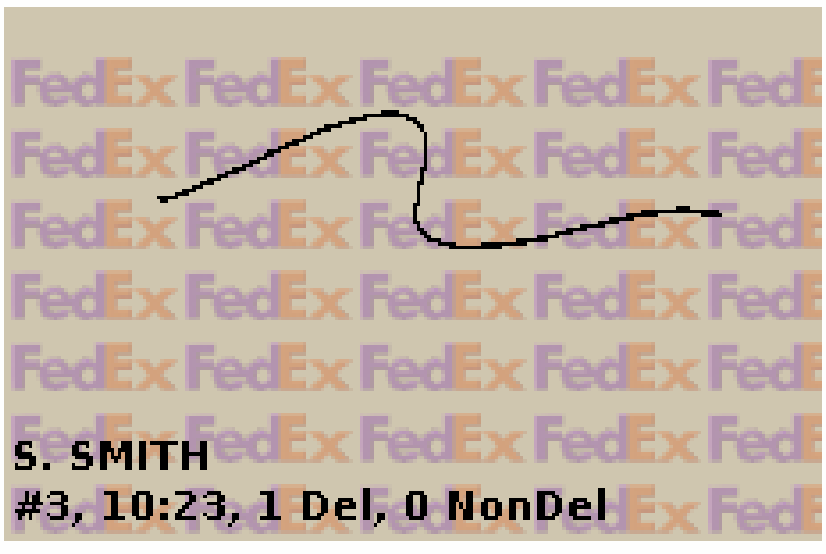
Shipping Information:

Tracking number:	887334103686	**Ship Date:**	Dec 22, 2025
		Weight:	0.2 LB/0.09 KG

Recipient:
Center Twp Commissioners, Center Twp Commissioners
1212 NEAL RD
HOMER CITY, PA, US, 15748721212

Shipper:
Monica Gesk, GAI Consultants
385 East Waterfront Drive
Homestead, PA, US, 15120

Reference C180881.17.006.001



Thank you for choosing FedEx

HOMER CITY
REDEVELOPMENT

December 22, 2025

Indiana County Commissioners
825 Philadelphia Street
Indiana, PA 15701

Acts 14, 67, 68, and 127 Notification
Homer City Generating Station
NPDES Permit Amendment - Outfall 027 Modification
NPDES Permit No. PA0005037
Black Lick and Center Townships, Indiana County, Pennsylvania

Dear Indiana County Commissioners:

The purpose of this notice is to inform you of Homer City Generation LP's (Homer City) intent to submit a Major National Pollutant Discharge Elimination System (NPDES) Permit Amendment Application and a Water Quality Management (WQM) Permit Application to the Pennsylvania Department of Environmental Protection (DEP) for the following:

Project Name:	Homer City Generating Station – NPDES Permit No. PA0005037 Outfall 027 Modification
Project Description:	As part of the ongoing redevelopment of the Homer City Generating Station, Homer City plans to modify the industrial wastewater discharge at NPDES Permitted Outfall 027 from Flue Gas Desulfurization (FGD) scrubber blowdown to Cooling Tower Blowdown. The FGD scrubber blowdown was produced by coal-fired generating Unit #3, which has been decommissioned. The source will be replaced by Cooling Tower Blowdown from natural gas generating units installed for the proposed facility. The Cooling Tower Blowdown will be conveyed by a new pipeline directed south of the main Power Block and will discharge to Blacklick Creek through a new outfall structure which will replace the existing outfall structure.
Applicant Name:	Homer City Generation LP
Applicant Contact:	Shawn Simmers, ssimmers@homercityredevelopment.com
Site Location:	1750 Powerplant Road, Homer City, PA 15748
Municipality/County:	Black Lick and Center Townships, Indiana County

Section 1905-A of the Commonwealth Administrative Code, as amended by Act 14 (effective April 17, 1984), requires that each applicant for a DEP permit must give written notice to the municipality(ies) and county(ies) in which the permitted activity is located. The written notices shall be received by the municipality(ies) and county(ies) at least thirty (30) days before the Department may issue or deny the permit. This notice satisfies that requirement.

This project must also satisfy Acts 67, 68, and 127 which amended the Municipalities Planning Code (effective August 21, 2000) to support sound land use practices and planning efforts, direct state agencies to consider comprehensive plans and zoning ordinances when reviewing applications for permitting of facilities or infrastructure, and specify that state agencies may rely upon comprehensive plans and zoning ordinances under certain conditions as described in Act 67, Section 1105 and Act 68, Section 619.2 of the Municipalities Planning Code.

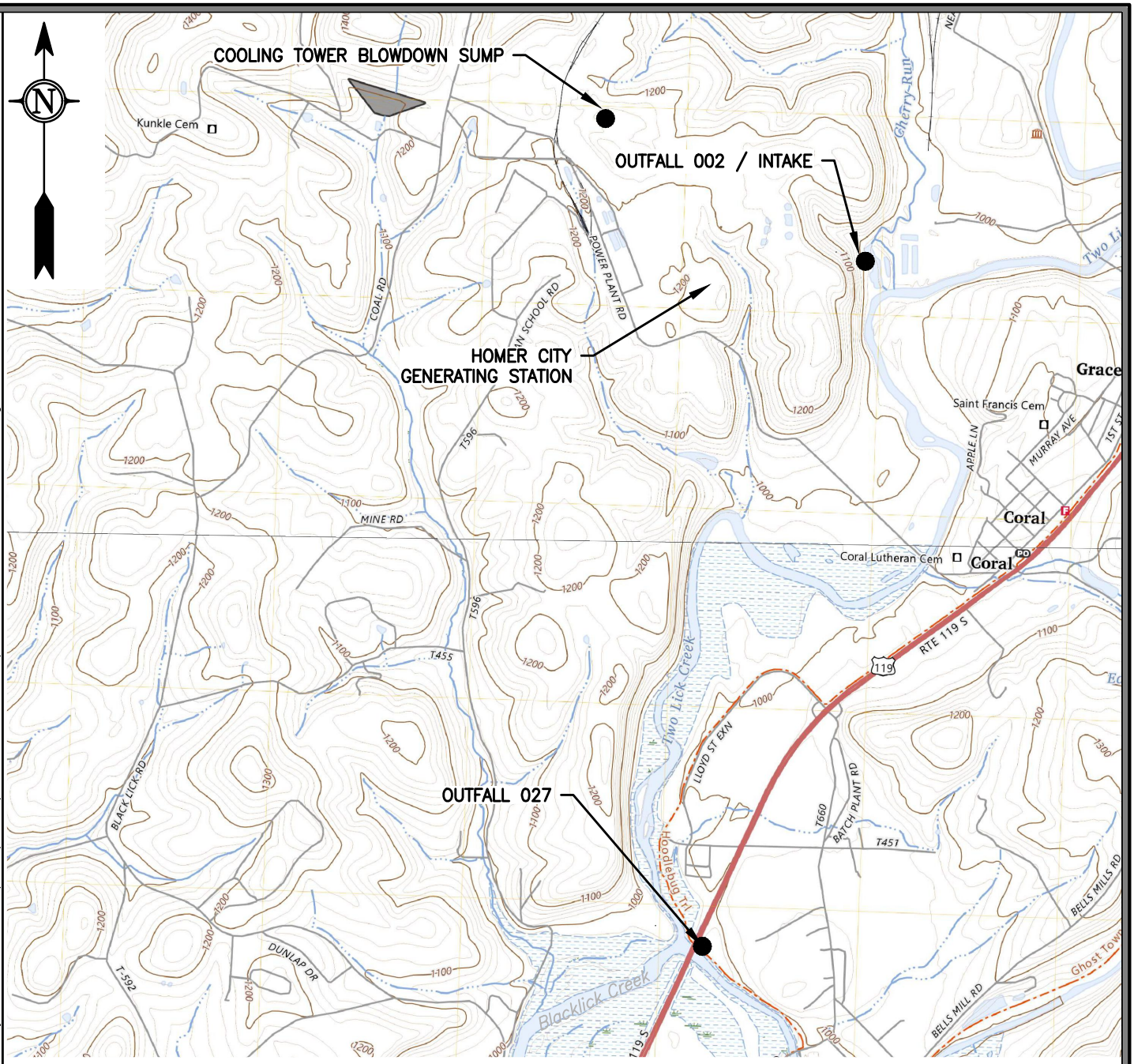
Enclosed is a General Information Form (GIF) we have completed for this project. DEP invites you to review the attached GIF and comment on the land use aspects of this project; please be specific to DEP when identifying any areas of conflict. If there are no land use comments received by the end of the comment period, DEP will assume that there are no substantive land use conflicts and proceed with the normal application review process.

Please submit any comments concerning this project within thirty (30) days from the date of receipt of this letter to the DEP Northwest Regional Office, 230 Chestnut Street, Meadville, PA 16335. For information about this land use review process, please visit www.dep.pa.gov (keyword: Land Use Reviews).

Enc.: Attachment A: Project Location Map, Attachment B: General Information Form (GIF)

ATTACHMENT A

PROJECT LOCATION MAP



MAPPING REFERENCE
U.S.G.S. 7.5 MINUTE QUADRANGLES:
INDIANA, BOLIVAR, PENNSYLVANIA 2023

SCALE: 1" = 2500'

2500 0 2500 5000

DRAWING TITLE

FIGURE 1 - SITE LOCATION MAP

PROJECT		DRAWN BY:	ISSUE DATE:
HOMER CITY GENERATING STATION NPDES AMENDMENT APPLICATION	gai consultants	**B.STEMPLE**	**12/05/2025**
		CHECKED BY:	SCALE:
		M.GESK	**1"=2500'**
CLIENT		APPROVED BY:	SHEET NO.:
HOMER CITY GENERATION, LP 1750 POWER PLANT ROAD		**M.GESK**	**1** OF **1**

GAI FILE NUMBER:	GAI DRAWING NUMBER:	© 2025 GAI Consultants
C180881-17-000-A2-002	**A2-002**	

This drawing was produced with computer aided drafting technology and is supported by electronic drawing files. Do not revise this drawing via manual drafting methods.

ISSUING OFFICE: Pittsburgh | 385 E. Waterfront Drive, Homestead, PA 15120

PLOTTED ON: 12/8/2025 10:55:50 AM PLOTTED BY: Lily N. Currie PLOT FILE: GAI.stb

GAI CAD FILE PATH: Z:\Energy\2018\C180881.17 - Homer City Industrial NPD\CAD\ACAD\Production DWGs\C180881-17-000-A2-002.dwg

ATTACHMENT B

GENERAL INFORMATION FORM

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
CENTER FOR ENVIRONMENTAL EXCELLENCE

GENERAL INFORMATION FORM – AUTHORIZATION APPLICATION

Before completing this General Information Form (GIF), read the step-by-step instructions provided in this application package. This form is used by the Department of Environmental Protection (DEP) to inform our programs regarding what other DEP permits or authorizations may be needed for the proposed project or activity. This version of the General Information Form (GIF) must be completed and returned with any program-specific application being submitted to the DEP.

Related ID#s (If Known)				DEP USE ONLY
Client ID#	298406	**APS ID#**		Date Received & General Notes
Site ID#	236714	**Auth ID#**		
Facility ID#				

CLIENT INFORMATION

DEP Client ID#	Client Type/Code	Dun & Bradstreet ID#
298406	PARTL	

Legal Organization Name or Registered Fictitious Name	Employer ID# (EIN)	Is the EIN a SSN?
Homer City Generation LP	80-0833693	☐ Yes ☒ No

State of Incorporation or Registration of Fictious Name	
Pennsylvania	☐ Corporation ☐ LLC ☐ Partnership ☐ LLP ☒ LP ☐ Sole Proprietorship ☐ Association/Organization ☐ Estate/Trust ☐ Other

Individual Last Name	First Name	MI	Suffix

Additional Individual Last Name	First Name	MI	Suffix

Mailing Address Line 1	Mailing Address Line 2
1750 Power Plant Road	

Address Last Line – City	State	ZIP+4	Country
Homer City	PA	15748-8009	USA

Client Contact Last Name	First Name	MI	Suffix
Simmers	Shawn		

Client Contact Title	Phone	Ext	Cell Phone
Director of Environmental Compliance	724-479-6109		

Email Address	FAX
ssimmers@homercityredevelopment.com	

SITE INFORMATION

DEP Site ID#	Site Name
236714	Homer City Generating Station

EPA ID# **Estimated Number of Employees to be Present at Site** Approx. 4-6

Description of Site

Fossil fuel electric generating station

Tax Parcel ID(s): 12-017.109.00

County Name(s)	Municipality(ies)	City	Boro	Twp	State
Indiana	Center	☐	☐	☒	PA
Indiana	Black Lick	☐	☐	☒	PA
		☐	☐	☐	

Site Location Line 1	Site Location Line 2
1750 Power Plant Road	

Site Location Last Line – City	State	ZIP+4
Homer City	PA	15748-8009

Detailed Written Directions to Site

Use directions from Route 22 East to 119 N, turn left at the light onto Cambells Mill Road, then right onto Blacklick Road, then right onto Coal Road. The site will be on your left just past Power Plant Road. To get to the Office location, turn right onto Power Plant Road and the office will be on your right just past the security gate.

Site Contact Last Name	First Name	MI	Suffix
Simmers	Shawn		

Site Contact Title	Site Contact Firm
Director of Environmental Compliance	Homer City Generation LP

Mailing Address Line 1	Mailing Address Line 2
1750 Power Plant Road	

Mailing Address Last Line – City	State	ZIP+4
Homer City	PA	15748-8009

Phone	Ext	FAX	Email Address
724-479-6109			ssimmers@homercityredevelopment.com

NAICS Codes (Two- & Three-Digit Codes – List All That Apply)	6-Digit Code (Optional)
221	221112

Client to Site Relationship

Owner/Operator

FACILITY INFORMATION

Modification of Existing Facility	Yes	No
1. Will this project modify an existing facility, system, or activity?	☒	☐
2. Will this project involve an addition to an existing facility, system, or activity?	☒	☐

If "Yes", check all relevant facility types and provide DEP facility identification numbers below.

	Facility Type	DEP Fac ID#		Facility Type	DEP Fac ID#
☐	Air Emission Plant		☐	Industrial Minerals Mining Operation	
☐	Beneficial Use (water)		☐	Laboratory Location	
☐	Blasting Operation		☐	Land Recycling Cleanup Location	
☐	Captive Hazardous Waste Operation		☐	Mine Drainage Treatment / Land Recycling Project Location	
☐	Coal Ash Beneficial Use Operation		☐	Municipal Waste Operation	
☐	Coal Mining Operation		☐	Oil & Gas Encroachment Location	
☐	Coal Pillar Location		☐	Oil & Gas Location	
☐	Commercial Hazardous Waste Operation		☐	Oil & Gas Water Poll Control Facility	
☐	Dam Location		☐	Public Water Supply System	
☐	Deep Mine Safety Operation -Anthracite		☐	Radiation Facility	
☐	Deep Mine Safety Operation -Bituminous		☐	Residual Waste Operation	
☐	Deep Mine Safety Operation -Ind Minerals		☐	Storage Tank Location	
☒	Encroachment Location (water, wetland)		☒	Water Pollution Control Facility	
☐	Erosion & Sediment Control Facility		☐	Water Resource	
☐	Explosive Storage Location		☒	Other:	PA0005037

Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
USGS Indiana Quadrangle Map	40	30	50	-79	11	50

Horizontal Accuracy Measure	Feet	*--or--*	Meters	
Horizontal Reference Datum Code	☐	North American Datum of 1927		
	☐	North American Datum of 1983		
	☒	World Geodetic System of 1984		
Horizontal Collection Method Code	EMAP			
Reference Point Code	N/A			
Altitude	Feet	1150	*--or--*	Meters
Altitude Datum Name	☒	The National Geodetic Vertical Datum of 1929		
	☐	The North American Vertical Datum of 1988 (NAVD88)		
Altitude (Vertical) Location Datum Collection Method Code	NTDEP			
Geometric Type Code	Point			
Data Collection Date	N/A			
Source Map Scale Number		Inch(es)	=	Feet
--or--		Centimeter(s)	=	Meters

PROJECT INFORMATION

Project Name

Major NPDES Permit Amendment – Outfall 027 Modification

Project Description

As part of the ongoing redevelopment of the Homer City Generating Station, Homer City Generation LP (Homer City) plans to modify the industrial wastewater discharge at Outfall 027 from Flue Gas Desulfurization (FGD) scrubber blowdown to Cooling Tower Blowdown. The FGD scrubber blowdown was produced by coal-fired generating Unit #3, which has been decommissioned. The source will be replaced by Cooling Tower Blowdown from natural gas generating units installed for the proposed facility. The Cooling Tower Blowdown will be conveyed by a new pipeline directed south of the main Power Block and will discharge to Blacklick Creek through an improved Outfall 027 structure.

Project Consultant Last Name	First Name	MI	Suffix
Gesk	Monica		

Project Consultant Title	Consulting Firm
Engineering Manager 2	GAI Consultants, Inc.

Mailing Address Line 1	Mailing Address Line 2
501 Technology Drive	Suite 1300

Address Last Line – City	State	ZIP+4
Canonsburg	PA	15317

Phone	Ext	FAX	Email Address
412-399-5576			m.gesk@gaiconsultants.com

Time Schedules	Project Milestone (Optional)

1. Is the project located in or within a 0.5-**mile radius of an Environmental Justice community as defined by DEP?** ☒ Yes ☐ No

To determine if the project is located in or within a 0.5-mile radius of an environmental justice community, please use the online PennEnviroScreen tool. To see specific EJ areas, select the appropriate year of your submittal from the themes box on the right.

2. Have you informed the surrounding community prior to submitting the application to the Department? ☒ Yes ☐ No

Method of notification: Letter, Newspaper Notice

3. **Have you addressed community concerns that were identified?** ☐ Yes ☐ No ☒ N/A

If no, please briefly describe the community concerns that have been expressed and not addressed.

4. **Is your project funded by state or federal grants?** ☐ Yes ☒ No

Note: If "Yes", specify what aspect of the project is related to the grant and provide the grant source, contact person and grant expiration date.

Aspect of Project Related to Grant

Grant Source: _____

Grant Contact Person: _____

Grant Expiration Date: _____

5. **Is this application for an authorization on Appendix A of the Land Use Policy? (For referenced list, see Appendix A of the Land Use Policy attached to GIF instructions)** ☐ Yes ☒ No

Note: If "No" to Question 5, the application is not subject to the Land Use Policy.

If "Yes" to Question 5, the application is subject to this policy and the Applicant should answer the additional questions in the **Land Use Information** section.

LAND USE INFORMATION

Note: Applicants should submit copies of local land use approvals or other evidence of compliance with local comprehensive plans and zoning ordinances.

1. **Is there an adopted county or multi-county comprehensive plan?** ☐ Yes ☐ No

2. **Is there a county stormwater management plan?** ☐ Yes ☐ No

3. **Is there an adopted municipal or multi-municipal comprehensive plan?** ☐ Yes ☐ No

4. **Is there an adopted county-wide zoning ordinance, municipal zoning ordinance or joint municipal zoning ordinance?** ☐ Yes ☐ No

Note: If the Applicant answers "No" to either Questions 1, 3 or 4, the provisions of the PA MPC are not applicable and the Applicant does not need to respond to questions 5 and 6 below.

If the Applicant answers "Yes" to questions 1, 3 and 4, the Applicant should respond to questions 5 and 6 below.

5. **Does the proposed project meet the provisions of the zoning ordinance or does the proposed project have zoning approval?** If zoning approval has been received, attach documentation. ☐ Yes ☐ No

6. **Have you attached Municipal and County Land Use Letters for the project?** ☐ Yes ☐ No

COORDINATION INFORMATION

Note: The PA Historical and Museum Commission must be notified of proposed projects in accordance with DEP Technical Guidance Document 012-0700-001 at PHMC's online portal, PA-SHARE.

If the activity will be a mining project (i.e., mining of coal or industrial minerals, coal refuse disposal and/or the operation of a coal or industrial minerals preparation/processing facility), respond to questions 1.0 through 2.5 below.

If the activity will not be a mining project, skip questions 1.0 through 2.5 and begin with question 3.0.

1.0	**Is this a coal mining project?** If "Yes", respond to 1.1-1.6. If "No", skip to Question 2.0.	☐	Yes	☒	No
1.1	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be equal to or greater than 200 tons/day?**	☐	Yes	☐	No
1.2	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be greater than 50,000 tons/year?**	☐	Yes	☐	No
1.3	**Will this coal mining project involve coal preparation/ processing activities in which thermal coal dryers or pneumatic coal cleaners will be used?**	☐	Yes	☐	No
1.4	**For this coal mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No
1.5	**Will this coal mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐	Yes	☐	No
1.6	**Will this coal mining project involve underground coal mining to be conducted within 500 feet of an oil or gas well?**	☐	Yes	☐	No
2.0	**Is this a non-coal (industrial minerals) mining project?** If "Yes", respond to 2.1-2.6. If "No", skip to Question 3.0.	☐	Yes	☒	No
2.1	**Will this non-coal (industrial minerals) mining project involve the crushing and screening of non-coal minerals other than sand and gravel?**	☐	Yes	☐	No
2.2	**Will this non-coal (industrial minerals) mining project involve the crushing and/or screening of sand and gravel with the exception of wet sand and gravel operations (screening only) and dry sand and gravel operations with a capacity of less than 150 tons/hour of unconsolidated materials?**	☐	Yes	☐	No
2.3	**Will this non-coal (industrial minerals) mining project involve the construction, operation and/or modification of a portable non-metallic (i.e., non-coal) minerals processing plant under the authority of the General Permit for Portable Non-metallic Mineral Processing Plants (i.e., BAQ-PGPA/GP-3)?**	☐	Yes	☐	No
2.4	**For this non-coal (industrial minerals) mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No

2.5	**Will this non-coal (industrial minerals) mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐ Yes	☐ No
3.0	**Will your project, activity, or authorization have anything to do with a well related to oil or gas production, have construction within 200 feet of, affect an oil or gas well, involve the waste from such a well, or string power lines above an oil or gas well?** If "Yes", respond to 3.1-3.3. If "No", skip to Question 4.0.	☐ Yes	☒ No
3.1	**Does the oil- or gas-related project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water (including wetlands)?**	☐ Yes	☐ No
3.2	**Will the oil- or gas-related project involve discharge of industrial wastewater or stormwater to a dry swale, surface water, ground water or an existing sanitary sewer system or storm water system?** If "Yes", discuss in *Project Description*.	☐ Yes	☐ No
3.3	**Will the oil- or gas-related project involve the construction and operation of industrial waste treatment facilities?**	☐ Yes	☐ No
4.0	**Will the project involve a construction activity that results in earth disturbance?** If "Yes", specify the total disturbed acreage.	☒ Yes	☐ No
	4.0.1 Total Disturbed Acreage Approx. 10 acres		
	4.0.2 Will the project discharge or drain to a special protection water (EV or HQ) or an EV wetland?	☐ Yes	☒ No
	4.0.3 Will the project involve a construction activity that results in earth disturbance in the area of the earth disturbance that are contaminated at levels exceeding residential or non-residential medium-specific concentrations (MSCs) in 25 Pa. Code Chapter 250 at residential or non-residential construction sites, respectively?	☐ Yes	☒ No
5.0	**Does the project involve any of the following: water obstruction and/or encroachment, wetland impacts, or floodplain project by the Commonwealth/political subdivision or public utility?** If "Yes", respond to 5.1-5.7. If "No", skip to Question 6.0.	☒ Yes	☐ No
5.1	**Water Obstruction and Encroachment Projects – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water?**	☒ Yes	☐ No
5.2	**Wetland Impacts – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a wetland?**	☒ Yes	☐ No

5.3	**Floodplain Projects by the Commonwealth, a Political Subdivision of the Commonwealth or a Public Utility – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a floodplain?**	☐	Yes	☒	No
5.4	**Is your project an interstate transmission natural gas pipeline?**	☐	Yes	☒	No
5.5	**Does your project consist of linear construction activities which result in earth disturbance in two or more DEP regions AND three or more counties?**	☐	Yes	☒	No
5.6	**Does your project utilize Floodplain Restoration as a best management practice for Post Construction Stormwater Management?**	☐	Yes	☒	No
5.7	**Does your project utilize Class V Gravity / Injection Wells as a best management practice for Post Construction Stormwater Management?**	☐	Yes	☒	No
6.0	**Will the project involve discharge of construction related stormwater to a dry swale, surface water, ground water or separate storm water system?**	☒	Yes	☐	No
6.1	**Will the project involve discharge of industrial waste stormwater or wastewater from an industrial activity or sewage to a dry swale, surface water, ground water or an existing sanitary sewer system or separate storm water system?**	☒	Yes	☐	No
7.0	**Will the project involve the construction and operation of industrial waste treatment facilities?**	☒	Yes	☐	No
8.0	**Will the project involve construction of sewage treatment facilities, sanitary sewers, or sewage pumping stations?** If "Yes", indicate estimated proposed flow (gal/day). Also, discuss the sanitary sewer pipe sizes and the number of pumping stations/treatment facilities/name of downstream sewage facilities in the *Project Description*, where applicable.	☐	Yes	☒	No
	8.0.1 Estimated Proposed Flow (gal/day)				
9.0	**Will the project involve the subdivision of land, or the generation of 800 gpd or more of sewage on an existing parcel of land or the generation of an additional 400 gpd of sewage on an already-developed parcel, or the generation of 800 gpd or more of industrial wastewater that would be discharged to an existing sanitary sewer system?**	☐	Yes	☒	No
	9.0.1 Was Act 537 sewage facilities planning submitted and approved by DEP? If "Yes" attach the approval letter. Approval required prior to 105/NPDES approval.	☐	Yes	☒	No
10.0	**Is this project for the beneficial use of biosolids for land application within Pennsylvania?** If "Yes" indicate how much (i.e. gallons or dry tons per year).	☐	Yes	☒	No
	10.0.1 Gallons Per Year (residential septage)				
	10.0.2 Dry Tons Per Year (biosolids)				

11.0	**Does the project involve construction, modification or removal of a dam?** If "Yes", identify the dam.	☐ Yes	☒ No
	11.0.1 Dam Name		
12.0	**Will the project interfere with the flow from, or otherwise impact, a dam?** If "Yes", identify the dam.	☐ Yes	☒ No
	12.0.1 Dam Name		
13.0	**Will the project involve operations (excluding during the construction period) that produce air emissions (i.e., NOX, VOC, etc.)?**	☐ Yes	☒ No
	13.0.1 If "Yes", is the operation subject to the agricultural exemption in 35 P.S. § 4004.1?	☐ Yes	☐ No
	13.0.2 If the answer to 13.0.1 is "No", identify each type of emission followed by the estimated amount of that emission.		
	Enter all types & amounts of emissions; separate each set with semicolons.		
14.0	**Does the project include the construction or modification of a drinking water supply to serve 15 or more connections or 25 or more people, at least 60 days out of the year?** If "Yes," check all proposed sub-facilities.	☐ Yes	☒ No
	14.0.1 Number of Persons Served		
	14.0.2 Number of Employee/Guests		
	14.0.3 Number of Connections		
	14.0.4 Sub-Fac: Distribution System	☐ Yes	☐ No
	14.0.5 Sub-Fac: Water Treatment Plant	☐ Yes	☐ No
	14.0.6 Sub-Fac: Source	☐ Yes	☐ No
	14.0.7 Sub-Fac: Pump Station	☐ Yes	☐ No
	14.0.8 Sub-Fac: Transmission Main	☐ Yes	☐ No
	14.0.9 Sub-Fac: Storage Facility	☐ Yes	☐ No
15.0	**Will your project include infiltration of storm water or waste water to ground water within one-half mile of a public water supply well, spring or infiltration gallery?**	☐ Yes	☒ No
16.0	**Is your project to be served by an existing public water supply?** If "Yes", indicate name of supplier and attach letter from supplier stating that it will serve the project.	☐ Yes	☒ No
	16.0.1 Supplier's Name		
	16.0.2 Letter of Approval from Supplier is Attached	☐ Yes	☐ No
17.0	**Will this project be served by on-lot drinking water wells?**	☐ Yes	☒ No
18.0	**Will this project involve a new or increased drinking water withdrawal from a river, stream, spring, lake, well or other water bod(ies)?** If "Yes," reference Safe Drinking Water Program.	☐ Yes	☒ No
	18.0.1 Source Name		

19.0	**Will the construction or operation of this project involve treatment, storage, reuse, or disposal of waste?** If "Yes," indicate what type (i.e., hazardous, municipal (including infectious & chemotherapeutic), residual) and the amount to be treated, stored, re-used or disposed. **19.0.1 Type & Amount**	☐	Yes	☒	No
20.0	**Will your project involve the removal of coal, minerals, contaminated media, or solid waste as part of any earth disturbance activities?**	☐	Yes	☒	No
21.0	**Does your project involve installation of a field constructed underground storage tank?** If "Yes," list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **21.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
22.0	**Does your project involve installation of an aboveground storage tank greater than 21,000 gallons capacity at an existing facility?** If "Yes," list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **22.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
23.0	**Does your project involve installation of a tank greater than 1,100 gallons which will contain a highly hazardous substance as defined in DEP's Regulated Substances List, 2570-BK-DEP2724?** If "Yes," list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **23.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
24.0	**Does your project involve installation of a storage tank at a new facility with a total AST capacity greater than 21,000 gallons?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **24.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☒	No
	NOTE: If the project includes the installation of a regulated storage tank system, including diesel emergency generator systems, the project may require the use of a Department Certified Tank Handler. For a full list of regulated storage tanks and substances, please go to www.dep.pa.gov search term storage tanks				
25.0	**Will the intended activity involve the use of a radiation source?**	☐	Yes	☒	No

CERTIFICATION

I certify that I have the authority to submit this application on behalf of the applicant named herein and that the information provided in this application is true and correct to the best of my knowledge and information.

For applicants supplying an EIN number: I am applying for a permit or authorization from the Pennsylvania Department of Environmental Protection (DEP). As part of this application, I will provide DEP with an accurate EIN number for the applicant entity. By filing this application with DEP, I hereby authorize DEP to confirm the accuracy of the EIN number provided with the Pennsylvania Department of Revenue. As applicant, I further consent to the Department of Revenue discussing the same with DEP prior to issuance of the Commonwealth permit or authorization.

Type or Print Name	By: HCG GP LLC, its general partner, By: Joel S. Heiser	
Signature	Title: General Counsel & Secretary	Date: 12/18/2025

January 09, 2026

Dear Customer,

The following is the proof-of-delivery for tracking number: 887697855402

Delivery Information:

Status:	Delivered	**Delivered To:**	
Signed for by:	MMILLER	**Delivery Location:**	825 PHILADELPHIA ST
Service type:	FedEx Ground		
Special Handling:	Adult Signature Required		Indiana, PA, 15701
		Delivery date:	Jan 9, 2026 10:37

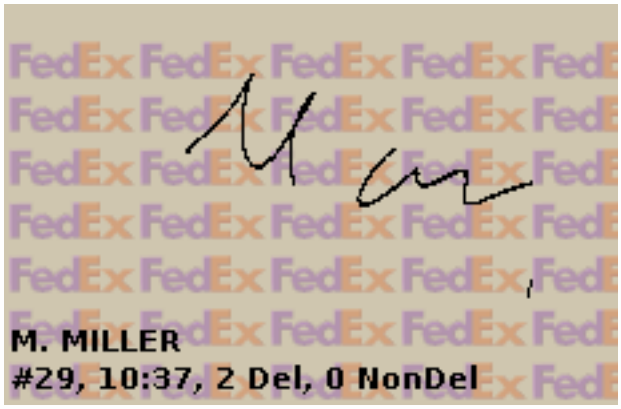
Shipping Information:

Tracking number:	887697855402	**Ship Date:**	Jan 7, 2026
		Weight:	0.1 LB/0.05 KG

Recipient:
Indiana County Commissioners, Indiana County Commissioners
825 PHILADELPHIA ST
INDIANA, PA, US, 15701395199

Shipper:
Taylor Boring, GAI Consultants
385 East Waterfront Drive
Homestead, PA, US, 15120

Reference C180881.17.006.001



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ATTACHMENT 5
Newspaper Notification and Proof of Publication

gai consultants
transforming ideas into reality®

NOTICE

Notice is hereby given that Homer City Generation, LP. (the "Company"), located at 1750 Power Plant Road, Homer City, PA 15748, Telephone: 724-479-6109, intends to make application to the Pennsylvania Department of Environmental Protection ("PaDEP") for a Water Quality Management Permit and an amendment of NPDES Permit No. PA0005037 for the discharge of industrial wastewater in a manner which meets PaDEP requirements from the Company's facility located in Center and Blacklick Townships, Indiana County. The proposed discharges are of a continuous nature and are associated with operation of proposed cooling towers. These discharges will continue to be conveyed to Blacklick Creek.

This application is made under the provisions of the Clean Streams Law, the Act of June 22, 1937, P.L. 1987, as amended. Persons desiring additional information, or who wish to provide comment concerning these permit applications should contact the Company as indicated above, or the PaDEP at the following address: Environmental Program Manager of Clean Water Program, Northwest Regional Office, 230 Chestnut Street, Meadville, PA 16335 or by Telephone: 814-332-6942.

12/3, 12/10, 12/17, 12/24

Proof of Publication

State of Pennsylvania
County of Indiana] SS

On this 30th day of December 2025 A.D.

before me, the subscriber, a Notary Public in and for said County and State, personally appeared:

Mary Novak

who being duly sworn according to laws, deposes and says, that (s)he is the Solicitor of the Indiana Gazette, that the said Indiana Gazette is a daily newspaper of general circulation, published in the borough of Indiana, in the County of Indiana, State of Pennsylvania, by the Indiana Gazette Inc., and was established in said Borough on the second day of July 1890, since which date, said daily newspaper has been regularly issued in said Borough and County, that annexed hereto is a true copy of a notice in the above matter exactly as the same was printed in the regular editions and issues of the said daily newspaper on the following dates, viz:

12/3, 12/10, 12/17, 12/24

Affiant further deposes and says that (s)he is an employee of the publisher of the said daily newspaper and has been authorized to verify the foregoing statement and the (s)he is not interested in the subject matter of the aforesaid notice or publication and that all allegations in the foregoing statement as to time, place, and character of publication are true.

By: Mary Novak

Sworn to and subscribed before me the day and year aforesaid.

Commonwealth of Pennsylvania - Notary Seal
DAWN HAYES - Notary Public
Indiana County
My Commission Expires August 31, 2029
Commission Number 1406600

Signature of notarial officer

Proof of Publication		$658.00
Proof of Intent	$	15.00
Total		$673.00

Indiana Gazette Inc., publishers of the Indiana Gazette, a daily newspaper, hearby acknowledges receipt of the aforesaid publication costs, and certifies the same have been fully paid.

Indiana Gazette Inc.
899 Water Street, Indiana, PA 15701

By _____

ATTACHMENT 6
Individual NPDES Application Sections

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transforming ideas into reality®

Pennsylvania Department of Environmental Protection

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) APPLICATION FOR INDIVIDUAL PERMIT TO DISCHARGE INDUSTRIAL WASTEWATER

Before completing this form, please read the instructions (3800-PM-BCW0008a). FAILURE TO FOLLOW THE INSTRUCTIONS MAY RESULT IN DENIAL OF THE APPLICATION.

Related ID#s (If Known)	DEP USE ONLY
Client ID# 298406 **APS ID#** _____	Date Received:
Site ID# 236714 **Facility ID#** _____	Permit No.:
	Auth ID: PDG?

GENERAL INFORMATION

Applicant/Operator Name	**Homer City Generation LP**	**25 Pa. Code § 92a.26 Fee Category** *(See instructions for fees)*

☐ New Permit (Anticipated Discharge Date: _____)
☐ Permit Renewal: NPDES No. PA 00005037 (Major Amendment)
Permit Expiration Date: December 31, 2026
Permit Renewal Application Due Date: July 4, 2026
WQM Permit No(s).: _____
WQM Permit Issuance Date(s): _____
Currently Using eDMR System? ☐ Yes ☐ No Start Date: _____

☐ Minor facility without ELG
☐ Minor facility with ELG
☒ Major facility < 250 MGD
☐ Major facility ≥ 250 MGD
☐ CAAP

Is applicant a "small business"?
☐ Yes ☒ No

Will the applicant accept the draft and final permit electronically? ☒ Yes ☐ No Email: ssimmers@homercityredevelopment.com

Is there on-site sewage treatment facility? ☐ Yes ☒ No
If Yes, is the facility operated by operator(s) certified in compliance with the Operators Certification Act? ☐ Yes ☐ No

Describe the nature of the business or operations resulting in discharge(s):

SIC Code	Primary?	Description	NAICS Code	Primary?	Description

OTHER ENVIRONMENTAL PERMITS

Type of Permit	Agency That Issued Permit	Date Issued

DISCHARGE INFORMATION

1. Attach a site plan, a line drawing with a water balance, and topographic map(s) that present the information requested in the instructions. Attached: ☒ Yes ☐ No

2. Total Hardness Upstream of Process Wastewater Outfall (mg/L): 129.1 Basis: Two Lick Creek Make-up Pump House Historical Data (2018-2021)

Applicant Name:

3. List all discharge points (outfalls) and internal monitoring points (IMPs). If numbers were previously assigned in a permit, use those numbers. Order sequentially and use additional pages as necessary.

Outfall / IMP No.	LATITUDE			LONGITUDE			RECEIVING WATERS			
	Deg	Min	Sec	Deg	Min	Sec	Name of Receiving Waters	Ch. 93 Class.	Impaired?	TMDL?
027	40	28	55	-79	11	35	Blacklick Creek	TSF	☒	☒
									☐	☐
									☐	☐
									☐	☐
									☐	☐
									☐	☐
									☐	☐
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									☐	☐

4. List all outfalls and IMPs in the same order as in question 2, above, and provide the requested information. Attach additional pages as necessary. See instructions.

Outfall / IMP No.	DISCHARGE CHARACTERIZATION							Design Flow (MGD)	Average Flow During Production / Operation (MGD)	Maximum Flow During Production / Operation (MGD)
	Process	Non-Process	Stormwater	Sewage	Groundwater	AAPF	Combined			
027	☒	☐	☐	☐	☐	☐	☐	6.84		
	☐	☐	☐	☐	☐	☐	☐			
	☐	☐	☐	☐	☐	☐	☐			
	☐	☐	☐	☐	☐	☐	☐			
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	☐	☐	☐	☐	☐	☐	☐			

Applicant Name:

5. List all outfalls and IMPs in the same order as in questions 2 and 3, above, and provide the requested information. Attach additional pages as necessary. See instructions.

Outfall / IMP No.	Wastewater or Stormwater Description	Discharge Type	Frequency		Batch Discharges		
			Hours / Day	Days / Week	No. Discharge Cycles/Day	Length of Discharge Cycle (Hrs)	Batch Discharge Rate (MGD)
027	Cooling Tower Blowdown, Low Volume Waste Sources	Continuous	24	7			

TREATMENT FACILITY INFORMATION

Complete this sheet for each existing and proposed industrial waste, sewage and/or stormwater treatment facility (one sheet per facility).

Treatment Facility Name: Outfall 027 Cooling Tower Blowdown Treatment Plant	Effluent Discharged To Outfall / IMP No.: 027

1. Provide a narrative description of the wastewater treatment process. Attach a line drawing or process flow diagram to the application.

Cooling tower blowdown is generated from the (7) cooling towers, equipped with a cooling tower to reject heat from the closed loop circulating water system (CWS). Cooling water will be recycled, to the extent that its quality is no longer suitable for use due to scaling potential from its high concentration of minerals and total dissolved solids (TDS) and discharged via Outfall 027.

Cooling water is sourced from raw water from Two Lick Creek, evaporation cooler blowdown, Heat Recovery Steam Generator (HRSG) blowdown, and various plant drains. These sources collect in the cooling tower basins where chemical additives are applied to improve function and longevity of equipment. Water from the cooling tower basin is routed to a condenser and then the cooling tower to reject heat and recycle water back to the generating units.

Once concentrations of TDS and minerals in the system warrant blowdown, the stream will be sent to a 43,400-gallon wastewater collection sump and treated to neutralize the chlorine from the previous treatment application. Two fully redundant submersible sump pumps will pump the blowdown water from the wastewater sump to Outfall 027. The maximum blowdown rate to Outfall 027 is approximately 4,750 gallons per minute (gpm), equivalent to approximately 6.84 million gallons per day (MGD).

A Process Flow Diagram is included in Attachment 7.

2. List each treatment unit at the facility in sequential order of treatment.

Treatment Unit Description	Method for Handling and Disposal of Solid or Liquid Residue Resulting from Treatment
Chemical Treatment	N/A

3. Describe any proposed upgrades to this treatment facility within the next five years.

The Outfall 027 Cooling Tower Blowdown Treatment facility will be constructed upon approval from PADEP. No additional treatment facility upgrades are proposed within the next five years.

4. Identify all chemicals that have been used for wastewater treatment over the past two years.

Chemical Name	Purpose	Max Usage Rate	Units	Acrylamide?
N/A				☐
				☐
				☐

5. List any additional proposed wastewater treatment chemicals anticipated in the next five years.

Chemical Name	Purpose	Max Usage Rate	Units	Acrylamide?
Sodium Bisulfite	Chlorine neutralization	1,400	lb/day	☐
Sulfuric Acid	pH adjustment	1,440	lb/day	☐

CHEMICAL ADDITIVES

1. Identify all chemical additives that have been introduced to any waste stream over the past two years.

Chemical Additive Name	Outfall / IMP No.	Purpose	Usage Frequency	Max Usage Rate	Units
N/A					

2. List all chemical additives that the applicant is requesting approval to use upon issuance of the permit by DEP. Identify the point of introduction on a line or process diagram.

Chemical Additive Name	Outfall / IMP No.	Purpose	Proposed Usage Frequency	Proposed Max Usage Rate	Units
Chemstream CWT-310	027	Scale inhibitor	Daily	98	lb/day
Chemstream CWT-311	027	Dispersant/scale inhibitor	Daily	448	lb/day
ChemChlor 160	027	Biocide	Daily	12,250	lb/day

3. List all chemical additives in the same order as question 2, above, and provide the requested information. For chemical additives that are not on DEP's Approved List, submit New Chemical Additive Request Form(s) to DEP's Central Office. For chemical additives that are on DEP's Approved List but a Chemical Additives Notification Form was not previously submitted, attach a Chemical Additives Notification Form to the application.

Chemical Additive Name	On Approved List?	Notification Form Attached?	Notification Form Previously Submitted?	Notification Form Submission Date	Analytical Method
Chemstream CWT-310	☒	☒	☐		
Chemstream CWT-311	☒	☒	☐		
ChemChlor 160	☒	☒	☐		
	☐	☐	☐		
	☐	☐	☐		
	☐	☐	☐		

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BUREAU OF CLEAN WATER

CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.dep.pa.gov/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Homer City Generation LP	**Facility Name:**	Homer City Generating Station
Permit No.:	PA0005037	**Municipality:**	Black Lick and Center Townships
Permit Effective Date:	January 1, 2022	**County:**	Indiana County
Permit Expiration Date:	December 31, 2026		

Trade Name of Chemical Additive:	CWT-310
Manufacturer Name:	Chemstream, Inc.
Intended Use(s):	Scale inhibitor
Location(s) of Use:	Cooling Tower Basin
Frequency of Use:	24/7, when cooling water introduced to basins
Method of Introduction:	Chemical feed pump (0.05 gallon/hour)
Treatment Following Introduction:	N/A
Discharge Point (Outfall No.):	Outfall 027
Design Flow of Discharge (MGD):	6.84
Receiving Water Body Name:	Blacklick Creek
Q_{7-10} Flow of Stream (cfs):	34 cfs
Calculated WQBEL (mg/L):	8.93
Maximum Usage Rate:	509 **Units:** lb/dy

Will Other Chemical Additives Be Introduced at the Same Time? ☒ YES ☐ NO If YES, Number: 2

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. See 18 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer

Shawn Simmers Dir of Env

Phone: 814 207 0538

Date: 2/20/26

Signature of Principal Executive Officer or Authorized Agent

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CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.dep.pa.gov/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Homer City Generation LP	**Facility Name:**	Homer City Generating Station
Permit No.:	PA0005037	**Municipality:**	Black Lick and Center Townships
Permit Effective Date:	January 1, 2022	**County:**	Indiana County
Permit Expiration Date:	December 31, 2026		

Trade Name of Chemical Additive:	CWT-311
Manufacturer Name:	Chemstream
Intended Use(s):	Dispersant/scale inhibitor
Location(s) of Use:	Cooling Tower Basin
Frequency of Use:	24/7, when cooling water introduced to basins
Method of Introduction:	Chemical feed pump (0.27 gallon/hour)
Treatment Following Introduction:	N/A
Discharge Point (Outfall No.):	Outfall 027
Design Flow of Discharge (MGD):	6.84
Receiving Water Body Name:	Blacklick Creek
Q_{7-10} Flow of Stream (cfs):	34 cfs
Calculated WQBEL (mg/L):	29.9
Maximum Usage Rate:	1,705 **Units:** lb/dy

Will Other Chemical Additives Be Introduced at the Same Time? ☒ YES ☐ NO If YES, Number: 2

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. See 18 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer: Sharon Simmers, Dir of Env

Phone: 814 209 0538

Date: 2/20/26

Signature of Principal Executive Officer or Authorized Agent

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CHEMICAL ADDITIVES NOTIFICATION FORM

Use this form to notify the DEP regional office that issued the NPDES permit of the new or increased use of chemical additives that were not reported in the NPDES permit application and are on DEP's Approved List (see www.dep.pa.gov/chemicaladditives). Use one form per chemical additive and discharge point.

Permittee Name:	Homer City Generation LP	**Facility Name:**	Homer City Generating Station
Permit No.:	PA0005037	**Municipality:**	Black Lick and Center Townships
Permit Effective Date:	January 1, 2022	**County:**	Indiana County
Permit Expiration Date:	December 31, 2026		

Trade Name of Chemical Additive:	ChemChlor 160
Manufacturer Name:	Chemstream
Intended Use(s):	Biocide
Location(s) of Use:	Cooling Tower Basin
Frequency of Use:	24/7, when cooling water introduced to basins
Method of Introduction:	Chemical feed pump (4.6 gallon/hour)
Treatment Following Introduction:	Sodium Bisulfite (Dechlorination)
Discharge Point (Outfall No.):	Outfall 027
Design Flow of Discharge (MGD):	6.84
Receiving Water Body Name:	Blacklick Creek
Q_{7-10} Flow of Stream (cfs):	34 cfs
Calculated WQBEL (mg/L):	0.011
Maximum Usage Rate:	12,250* **Units:** lb/dy (*See attached calculation)

Will Other Chemical Additives Be Introduced at the Same Time? ☒ YES ☐ NO If YES, Number: 2

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. See 18 Pa. C.S. § 4904 (relating to unsworn falsification).

Name/Title Principal Executive Officer: Shawn Simmers, Dir of Env.

Phone: 814 209 0538

Date: 2/20/22

Signature of Principal Executive Officer or Authorized Agent

Homer City Generation LP
Homer City Generating Station
ChemChlor 160 – Maximum Usage Rate Calculation

ChemChlor 160 will be added to the cooling tower basins at a dosage rate of up to 12,250 lb/day, with a target of 0.2 mg/L Free Available Chlorine in the cooling tower system to prevent biological growth.

ChemClor is composed of between 12.5% to 15.6% Sodium Hypochlorite (NaOCl) and 0.1% to 2.0% Sodium Hydroxide (NaOH), with the remaining volume being water. Once in solution, NaOCl is found as hypochlorous acid, HOCl, which serves as an oxidant to prevent biological growth in the cooling towers. NaOH will consume free hydrogen and bring the pH up by consuming these proton (i.e. H+ + OH- -> H2O).

Dechlorination will occur prior to discharge from Outfall 027. Sodium Bisulfite (NaHSO3) will be added to consume any free oxidant (NaHSO3 + HOCl + H2O -> NaHSO4 + HCl). Approximately 1.5-2.0 mg/L of Sodium Bisulfite must be added per free mg/L of Sodium Hypochlorite to complete this reaction. Sodium Bisulfite will target 2 times the free chlorine concentration to ensure all free oxidant is reduced. For example, based on the 0.2 mg/L Free Available Chlorine target of the Sodium Hypochlorite, Sodium Bisulfite would be dosed to 0.4 mg/L.

This reaction removes any remaining oxidant and therefore there will be no measurable ChemClor 160 concentration in the water discharged from Outfall 027.

Discharge Information

Instructions | Discharge | Stream

Facility: **Homer City Generation LP** NPDES Permit No.: **PA0005037** Outfall No.: **027**

Evaluation Type: **Custom / Additives** Wastewater Description: **Cooling Tower Blowdown**

Discharge Characteristics								
Design Flow (MGD)*	Hardness (mg/l)*	pH (SU)*	Partial Mix Factors (PMFs)				Complete Mix Times (min)	
			AFC	CFC	THH	CRL	Q_{7-10}	Q_h
6.84	1228	7						

				0 if left blank		*0.5 if left blank*		*0 if left blank*			*1 if left blank*	
Discharge Pollutant	Units	Max Discharge Conc		Trib Conc	Stream Conc	Daily CV	Hourly CV	Stream CV	Fate Coeff	FOS	Criteria Mod	Chem Transl
CWT-310 - Antiscalant/Scale Inhibitor	mg/L		2									
CWT-311 - Dispersant/Scale Inhibitor	mg/L		9									
ChemChlor 160 - Biocide	mg/L	<	0.02									

Stream / Surface Water Information

Homer City Generation LP, NPDES Permit No. PA0005037, Outfall 027

Instructions | Discharge | *Stream*

Receiving Surface Water Name: **Blacklick Creek**

No. Reaches to Model: **1**

- (●) Statewide Criteria
- ( ) Great Lakes Criteria
- ( ) ORSANCO Criteria

Location	Stream Code*	RMI*	Elevation (ft)*	DA (mi^2)*	Slope (ft/ft)	PWS Withdrawal (MGD)	Apply Fish Criteria*
Point of Discharge	043979	10.72	960	194			Yes
End of Reach 1	043979	10	950	418			Yes

Q $_{7\text{-}10}$

Location	RMI	LFY (cfs/mi^2)*	Flow (cfs)		W/D Ratio	Width (ft)	Depth (ft)	Velocity (fps)	Travel Time (days)	Tributary		Stream		Analysis	
			Stream	Tributary						Hardness	pH	Hardness*	pH*	Hardness	pH
Point of Discharge	10.72		34									129.1	7.64		
End of Reach 1	10		34									129.1	7.64		

Q $_{h}$

Location	RMI	LFY (cfs/mi^2)	Flow (cfs)		W/D Ratio	Width (ft)	Depth (ft)	Velocity (fps)	Travel Time (days)	Tributary		Stream		Analysis	
			Stream	Tributary						Hardness	pH	Hardness	pH	Hardness	pH
Point of Discharge	10.72														
End of Reach 1	10														

Model Results

Homer City Generation LP, NPDES Permit No. PA0005037, Outfall 027

Instructions | Results | RETURN TO INPUTS | SAVE AS PDF | PRINT | ○ All | ○ Inputs | ○ Results | ◉ Limits

☐ ***Hydrodynamics***

☐ ***Wasteload Allocations***

☑ ***Recommended WQBELs & Monitoring Requirements***

No. Samples/Month: 4

	Mass Limits		*Concentration Limits*						
Pollutants	AML (lbs/day)	MDL (lbs/day)	AML	MDL	IMAX	Units	Governing WQBEL	WQBEL Basis	Comments
CWT-311 - Dispersant/Scale Inhibitor	Report	Report	Report	Report	Report	mg/L	29.9	CFC	Discharge Conc > 25% WQBEL (no RP)
ChemChlor 160 - Biocide	0.62	0.97	0.011	0.017	0.027	mg/L	0.011	CFC	Discharge Conc ≥ 50% WQBEL (RP)

☑ ***Other Pollutants without Limits or Monitoring***

The following pollutants do not require effluent limits or monitoring based on water quality because reasonable potential to exceed water quality criteria was not determined and the discharge concentration was less than thresholds for monitoring, or the pollutant was not detected and a sufficiently sensitive analytical method was used (e.g., <= Target QL).

Pollutants	Governing WQBEL	Units	Comments
CWT-310 - Antiscalant/Scale Inhibitor	8.93	mg/L	Discharge Conc ≤ 25% WQBEL

PRODUCTION DATA FOR EFFLUENT LIMITATION GUIDELINES (ELGs)

Complete this section for each production line with an applicable ELG. See instructions and use additional sheets as necessary.

1. Production line and process description: **Cooling Tower Blowdown; Low Volume Waste Sources**
2. Applicable ELG: 40 CFR: **423** Subpart: 423.13(d)(1); 423.12(b)(3)
3. Is this production considered a new source? ☐ Yes ☒ No
4. Outfall / IMP No. receiving wastewater: **027**
5. Units of production measurement for ELG: **N/A**
6. Design production capacity: **N/A**
7. Complete the table below for the five last years of production. Report production data using the same units of measurement as reported in question 5.

Parameter	Production Years				
	20	20	20	20	20
Total Annual Production	N/A	N/A	N/A	N/A	N/A
Max Monthly Production	N/A	N/A	N/A	N/A	N/A
Month of Max Production	N/A	N/A	N/A	N/A	N/A
Avg Annual Production	N/A	N/A	N/A	N/A	N/A
Avg Production Hours/Day	N/A	N/A	N/A	N/A	N/A
Avg Production Days/Month	N/A	N/A	N/A	N/A	N/A
Avg Annual Water Usage (MGD)	N/A	N/A	N/A	N/A	N/A
Avg Annual Wastewater Flow (MGD)	N/A	N/A	N/A	N/A	N/A

8. Average annual production over the past five years: **N/A** Units: **N/A**
9. Anticipated average annual production for the next five years: **N/A** Units: **N/A**
10. Explain the basis for the anticipated average annual production for the next five years:

N/A

11. Attach any pertinent information from the applicable ELG in 40 CFR that would allow DEP to appropriately determine technology-based effluent limitations.

NPDES Permit No. PA0005037 currently authorizes the discharge of Flue Gas Desulfurization (FGD) scrubber blowdown from Outfall 027. Outfall 027 currently includes Technology Based Effluent Limitations (TBELs) for FGD scrubber blowdown wastewater under 40 CFR §423.13(g)(3)(i), including Total Dissolved Solids (TDS), Nitrate-Nitrite as N, Total Arsenic, Total Mercury, Total Selenium, and Bromide. As Unit #3 has been decommissioned, Homer City is requesting the removal of TBELs associated with FGD scrubber blowdown. Based on the proposed discharges from Outfall 027, these will be replaced with TBELs for Cooling Tower Blowdown under 40 CFR §423.13(d)(1) and low volume waste sources under 40 CFR §423.12(b)(3).

POLLUTANT IDENTIFICATION AND ANALYSIS

1. Summary of Required Analyses (see instructions):

Outfall / IMP No.	Pollutant Groups which must be sampled for and analyzed							Other Pollutants Analyzed
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	
027	☒	☒	☒	☒	☒	☐	☐	Free Available Chlorine
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	
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	☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	☐	

2. Is screening for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) required? ☐ Yes ☒ No

Method used:	Describe results:

3. Other Potentially Toxic Pollutants Known or Expected to be Present in the Discharge.

a. GC/MS "Five Peaks" Pollutants (see instructions).

Outfall / IMP No.	Group Number (3 - 6)	Chemical or Compound Name	Quantitation Limit (µg/L)	Avg Effluent Concentration (µg/L)	Max Effluent Concentration (µg/L)	No. Samples Positive / No. Analyzed
						/
						/
						/
						/
						/

b. Other Potential Pollutants.

Outfall / IMP No.	Chemical Substance or Compound Name	Reason/Suspected Reason for Presence in Discharge	Avg Concentration (µg/L)	Indicate if Presence is Known (K) or Suspected (S)

☐ If additional peaks were not available for one or more groups with the method used check here and attach an explanation of why the method was selected.

4. Additional Analysis Results Tables may be attached to provide any of the optional site-specific information discussed in Appendix A of the instructions.
Optional site-specific data is attached to this application? ☒ Yes ☐ No

ANAYLSIS RESULTS TABLE
POLLUTANT GROUP 1

APPLICANT NAME	Homer City Generation LP

■ **Outfall / IMP Number 027** (Show location of sampling point on Line Drawing)

☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)

☐ Intake Sampling Results (Specify Source: _____)

☐ Background (Upstream) Sampling Results (Specify Location: _____)

■ **New Discharge (Basis for Information: Design Engineer Projection)**

POLLUTANT GROUP 1 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
BOD_5 (mg/L)	3.4	194	N/A	N/A	1.8	76	N/A	N/A	N/A	N/A
COD (mg/L)	15.3	873	N/A	N/A	8.5	359	N/A	N/A	N/A	N/A
TOC (mg/L)	1.1	63	N/A	N/A	0.6	25	N/A	N/A	N/A	N/A
TSS (mg/L)	10.7	610	N/A	N/A	10.7	452	N/A	N/A	N/A	N/A
Ammonia-Nitrogen (mg/L)	<0.2	<11	N/A	N/A	<0.2	<8	N/A	N/A	N/A	N/A
Temperature (Winter) (°F)	85	XXX	N/A	XXX	75	XXX	N/A	XXX	XXX	N/A
Temperature (Summer) (°F)	85	XXX	N/A	XXX	75	XXX	N/A	XXX	XXX	N/A
pH – Minimum (S.U.)	8	XXX	XXX	XXX	8	XXX	N/A	XXX	XXX	N/A
pH – Maximum (S.U.)	8	XXX	XXX	XXX	8	XXX	N/A	XXX	XXX	N/A
Fecal Coliform (No./100 mL)	<1	XXX	N/A	XXX	<1	XXX	N/A	N/A	XXX	N/A
Oil and Grease (mg/L)	<5.2	<297	N/A	N/A	<5.2	<220	N/A	N/A	N/A	N/A
TRC (mg/L)	<0.02	XXX	N/A	XXX	<0.02	XXX	N/A	N/A	N/A	N/A
Total Phosphorus (mg/L)	4.6	262	N/A	N/A	0.5	21	N/A	N/A	N/A	N/A
TKN (mg/L)	4.6	262	N/A	N/A	3.3	140	N/A	N/A	N/A	N/A
Nitrite + Nitrate-Nitrogen (mg/L)	4.5	257	N/A	N/A	3.2	135	N/A	N/A	N/A	N/A
Total Dissolved Solids (mg/L)	2,800	159,728	N/A	N/A	1,257	53,151	N/A	N/A	N/A	N/A
Color (Pt-Co Units)	<30	XXX	N/A	XXX	<30	XXX	N/A	N/A	N/A	N/A
Bromide (mg/L)	<0.2	<11	N/A	N/A	<0.2	<8	N/A	N/A	N/A	N/A
Chloride (mg/L)	540.9	30,856	N/A	N/A	267	11,290	N/A	N/A	N/A	N/A
Sulfate (mg/L)	1,190	67,884	N/A	N/A	443.7	18,761	N/A	N/A	N/A	N/A
Sulfide (mg/L)	<1.0	<57	N/A	N/A	<1.0	<42	N/A	N/A	N/A	N/A
Surfactants (mg/L)	<0.2	<11	N/A	N/A	<0.2	<8	N/A	N/A	N/A	N/A
Fluoride (mg/L)	<2.5	<143	N/A	N/A	<2.5	<106	N/A	N/A	N/A	N/A
Total Hardness (mg/L)	1,228.8	70,098	N/A	N/A	656.9	27,776	N/A	N/A	N/A	N/A

ANAYLSIS RESULTS TABLE
POLLUTANT GROUP 1

APPLICANT NAME	Homer City Generation LP

■ **Outfall / IMP Number 027** (Show location of sampling point on Line Drawing)

☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)

☐ Intake Sampling Results (Specify Source: _____)

☐ Background (Upstream) Sampling Results (Specify Location: _____)

■ **New Discharge (Basis for Information: Design Engineer Projection)**

POLLUTANT GROUP 1 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Perfluorooctanoic acid (PFOA) (ng/L)	9.2	0.0005	N/A	N/A	8.1	0.0003	N/A	N/A	N/A	N/A
Perfluorooctanesulfonic acid (PFOS) (ng/L)	9.7	0.0006	N/A	N/A	6.9	0.0003	N/A	N/A	N/A	N/A
Perfluorobutanesulfonic acid (PFBS) (ng/L)	7.1	0.0004	N/A	N/A	5.9	0.0002	N/A	N/A	N/A	N/A
Hexafluoropropylene oxide dimer acid (HFPO-DA) (ng/L)	3.6	0.0002	N/A	N/A	3	0.0001	N/A	N/A	N/A	N/A

ANAYLSIS RESULTS TABLE
POLLUTANT GROUP 2

APPLICANT NAME	Homer City Generation LP

■ **Outfall / IMP Number 027** (Show location of sampling point on Line Drawing)

☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)

☐ Intake Sampling Results (Specify Source: _____)

☐ Background (Upstream) Sampling Results (Specify Location: _____)

■ **New Discharge (Basis for Information: Design Engineer Projection)**

POLLUTANT GROUP 2 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Aluminum, Total (µg/L)	508.8	29	N/A	N/A	508.8	22	N/A	N/A	N/A	N/A
Antimony, Total (µg/L)	45.8	3	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Arsenic, Total (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Barium, Total (µg/L)	508.8	29	N/A	N/A	231	10	N/A	N/A	N/A	N/A
Beryllium, Total (µg/L)	15.3	0.9	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Boron, Total (µg/L)	305.3	17	N/A	N/A	115	5	N/A	N/A	N/A	N/A
Cadmium, Total (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Chromium, Total (µg/L)	15.3	0.9	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Chromium, Hexavalent (µg/L)	<15.3	<0.9	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Cobalt, Total (µg/L)	25.4	1	N/A	N/A	10.8	0.5	N/A	N/A	N/A	N/A
Copper, Total (µg/L)	101.8	6	N/A	N/A	6.8	0.3	N/A	N/A	N/A	N/A
Cyanide, Free (µg/L)	< 1.0	<0.06	N/A	N/A	< 1.0	<0.04	N/A	N/A	N/A	N/A
Cyanide, Total (µg/L)	< 10.0	<0.6	N/A	N/A	< 10.0	<0.4	N/A	N/A	N/A	N/A
Iron, Total (µg/L)	254.4	15	N/A	N/A	254.4	11	N/A	N/A	N/A	N/A
Iron, Dissolved (µg/L)	<195	<11	N/A	N/A	<195	<8	N/A	N/A	N/A	N/A
Lead, Total (µg/L)	<1.0	<0.06	N/A	N/A	<1.0	<0.04	N/A	N/A	N/A	N/A
Manganese, Total (µg/L)	254.4	15	N/A	N/A	254.4	11	N/A	N/A	N/A	N/A
Mercury, Total (µg/L)	0.029	0.002	N/A	N/A	0.011	0.0005	N/A	N/A	N/A	N/A
Molybdenum, Total (µg/L)	20.4	1	N/A	N/A	<3.5	<0.1	N/A	N/A	N/A	N/A
Nickel, Total (µg/L)	50.9	3	N/A	N/A	26.3	1	N/A	N/A	N/A	N/A
Phenols, Total (µg/L)	<25.0	<1	N/A	N/A	<25.0	<1	N/A	N/A	N/A	N/A
Selenium, Total (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Silver, Total (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Thallium, Total (µg/L)	<1.0	<0.06	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Zinc, Total (µg/L)	457.9	26	N/A	N/A	64.3	3	N/A	N/A	N/A	N/A

ANAYLSIS RESULTS TABLE
POLLUTANT GROUP 3

APPLICANT NAME	Homer City Generation LP

■ **Outfall / IMP Number 027** (Show location of sampling point on Line Drawing)

☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)

☐ Intake Sampling Results (Specify Source: _____)

☐ Background (Upstream) Sampling Results (Specify Location: _____)

■ **New Discharge (Basis for Information: Design Engineer Projection)**

POLLUTANT GROUP 3 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Acrolein (µg/L)	<2.0	<0.1	N/A	N/A	<2.0	<0.08	N/A	N/A	N/A	N/A
Acrylonitrile (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Benzene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Bromoform (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Carbon Tetrachloride (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Chlorobenzene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Chlorodibromomethane (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Chloroethane (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
2-Chloroethylvinyl Ether (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Chloroform (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Dichlorobromomethane (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
1,1-Dichloroethane (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
1,2-Dichloroethane (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
1,1-Dichloroethylene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
1,2 Dichloropropane (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
1,3-Dichloropropylene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
1,4-Dioxane (µg/L)	<10.0	<0.6	N/A	N/A	<10.0	<0.4	N/A	N/A	N/A	N/A
Ethylbenzene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Methyl Bromide (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Methyl Chloride (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Methylene Chloride (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
1,1,2,2-Tetrachloroethane (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Tetrachloroethylene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Toluene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
1,2-Trans-Dichloroethylene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A

ANAYLSIS RESULTS TABLE
POLLUTANT GROUP 3

APPLICANT NAME	Homer City Generation LP

■ **Outfall / IMP Number 027** (Show location of sampling point on Line Drawing)

☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)

☐ Intake Sampling Results (Specify Source: _____)

☐ Background (Upstream) Sampling Results (Specify Location: _____)

■ **New Discharge (Basis for Information: Design Engineer Projection)**

POLLUTANT GROUP 3 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
1,1,1-Trichloroethane (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
1,1,2-Trichloroethane (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Trichloroethylene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Vinyl Chloride (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A

ANAYLSIS RESULTS TABLE
POLLUTANT GROUP 4

APPLICANT NAME	Homer City Generation LP

■ **Outfall / IMP Number 027** (Show location of sampling point on Line Drawing)

☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)

☐ Intake Sampling Results (Specify Source: _____)

☐ Background (Upstream) Sampling Results (Specify Location: _____)

■ **New Discharge (Basis for Information: Design Engineer Projection)**

POLLUTANT GROUP 4 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
2-Chlorophenol (µg/L)	<10	<0.6	N/A	N/A	<10	<0.4	N/A	N/A	N/A	N/A
2,4-Dichlorophenol (µg/L)	<10	<0.6	N/A	N/A	<10	<0.4	N/A	N/A	N/A	N/A
2,4-Dimethylphenol (µg/L)	<10	<0.6	N/A	N/A	<10	<0.4	N/A	N/A	N/A	N/A
4,6-Dinitro-o-Cresol (µg/L)	<10	<0.6	N/A	N/A	<10	<0.4	N/A	N/A	N/A	N/A
2,4-Dinitrophenol (µg/L)	<10	<0.6	N/A	N/A	<10	<0.4	N/A	N/A	N/A	N/A
2-Nitrophenol (µg/L)	<10	<0.6	N/A	N/A	<10	<0.4	N/A	N/A	N/A	N/A
4-Nitrophenol (µg/L)	<10	<0.6	N/A	N/A	<10	<0.4	N/A	N/A	N/A	N/A
P-Chloro-m-Cresol (µg/L)	<10	<0.6	N/A	N/A	<10	<0.4	N/A	N/A	N/A	N/A
Pentachlorophenol (µg/L)	<10	<0.6	N/A	N/A	<10	<0.4	N/A	N/A	N/A	N/A
Phenol (µg/L)	<10	<0.6	N/A	N/A	<10	<0.4	N/A	N/A	N/A	N/A
2,4,6-Trichloro-phenol (µg/L)	<10	<0.6	N/A	N/A	<10	<0.4	N/A	N/A	N/A	N/A

ANAYLSIS RESULTS TABLE
POLLUTANT GROUP 5

APPLICANT NAME	Homer City Generation LP

■ **Outfall / IMP Number 027** (Show location of sampling point on Line Drawing)

☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)

☐ Intake Sampling Results (Specify Source: _____)

☐ Background (Upstream) Sampling Results (Specify Location: _____)

■ **New Discharge (Basis for Information: Design Engineer Projection)**

POLLUTANT GROUP 5 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Acenaphthene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Acenaphthylene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Acrylamide (µg/L)	<5000	<285	N/A	N/A	<5000	<211	N/A	N/A	N/A	N/A
Anthracene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Benzidine (µg/L)	<50	<3	N/A	N/A	<50	<2	N/A	N/A	N/A	N/A
Benzo(a)Anthracene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Benzo(a)Pyrene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
3,4-Benzo-fluoranthene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Benzo(ghi)Perylene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Benzo(k)Fluoranthene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Bis(2-Chloroethoxy)Methane (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Bis(2-Chloroethyl)Ether (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Bis(2-Chloroisopropyl)Ether (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Bis(2-Ethylhexyl)Phthalate (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
4-Bromophenyl Phenyl Ether (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Butyl Benzyl Phthalate (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
2-Chloronaphthalene (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
4-Chlorophenyl Phenyl Ether (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Chrysene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Dibenzo(a,h)Anthracene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
1,2-Dichlorobenzene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
1,3- Dichlorobenzene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A

ANAYLSIS RESULTS TABLE
POLLUTANT GROUP 5

APPLICANT NAME	Homer City Generation LP

■ **Outfall / IMP Number 027** (Show location of sampling point on Line Drawing)

☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)

☐ Intake Sampling Results (Specify Source: _____)

☐ Background (Upstream) Sampling Results (Specify Location: _____)

■ **New Discharge (Basis for Information: Design Engineer Projection)**

POLLUTANT GROUP 5 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
1,4- Dichlorobenzene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
3,3'-Dichlorobenzidine (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Diethyl Phthalate (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Dimethyl Phthalate (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Di-n-Butyl Phthalate (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
2,4-Dinitrotoluene (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Di-n-Octyl Phthalate (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
1,2-Diphenylhydrazine (as Azobenzene) (µg/L)	<10	<0.6	N/A	N/A	<10	<0.4	N/A	N/A	N/A	N/A
Fluoranthene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Fluorene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Hexachlorobenzene (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Hexechlorobutadiene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Hexachlorocyclopentadiene (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Hexachloroethane (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Indeno(1,2,3-cd)Pyrene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Isophorone (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
Naphthalene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A
Nitrobenzene (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
N-Nitroso-di-methylamine (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
N-Nitroso-di-n-p-propylamine (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A
N-Nitroso-di-n-phenylamine (µg/L)	<5.0	<0.3	N/A	N/A	<5.0	<0.2	N/A	N/A	N/A	N/A

ANAYLSIS RESULTS TABLE
POLLUTANT GROUP 5

APPLICANT NAME	Homer City Generation LP

■ **Outfall / IMP Number 027** (Show location of sampling point on Line Drawing)

☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)

☐ Intake Sampling Results (Specify Source: _____)

☐ Background (Upstream) Sampling Results (Specify Location: _____)

■ **New Discharge (Basis for Information: Design Engineer Projection)**

POLLUTANT GROUP 5 PARAMETERS	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Phenanthrene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
Pyrene (µg/L)	<2.5	<0.1	N/A	N/A	<2.5	<0.1	N/A	N/A	N/A	N/A
1,2,4-Trichlorobenzene (µg/L)	<0.5	<0.03	N/A	N/A	<0.5	<0.02	N/A	N/A	N/A	N/A

ANAYLSIS RESULTS TABLE
POLLUTANT GROUP 7

APPLICANT NAME	Homer City Generation LP

■ **Outfall / IMP Number 027** (Show location of sampling point on Line Drawing)

☐ Treatment Facility Influent Sampling Results (Show location of sampling point on Line Drawing)

☐ Intake Sampling Results (Specify Source: _____)

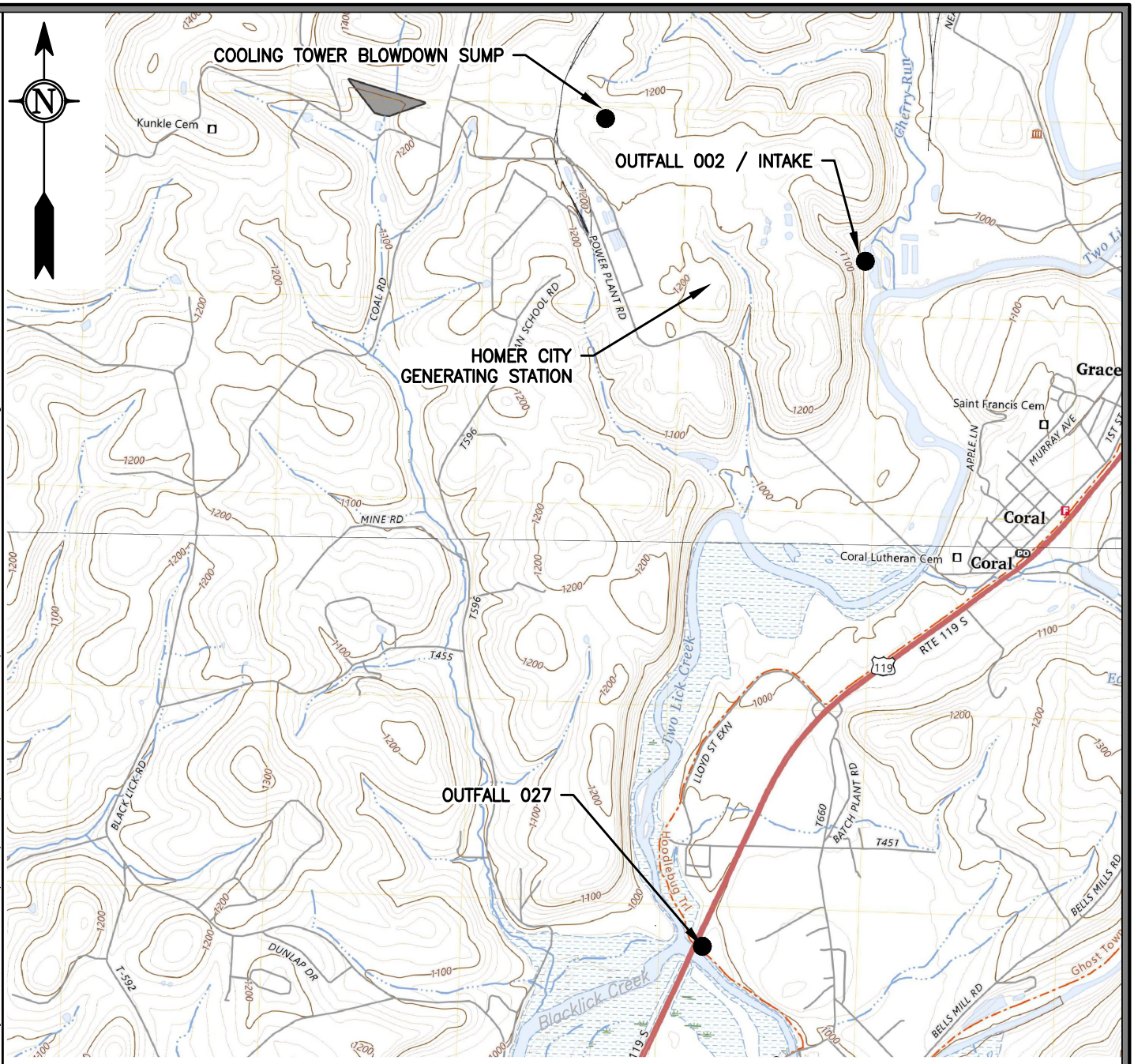
☐ Background (Upstream) Sampling Results (Specify Location: _____)

■ **New Discharge (Basis for Information: Design Engineer Projection)**

POLLUTANT GROUP 7 PARAMETERS Additional Parameters	CONCENTRATION / MASS PRESENT						No. Analyses	No. "Non-Detect" Results	QL Used	Method Used
	Min/Max Daily Value		Max Avg Monthly Value		Long-Term Avg Value					
	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)	Conc	Mass (lbs/day)				
Free Available Chlorine (mg/L)	<0.02	<1	N/A	N/A	<0.02	<0.8	N/A	N/A	N/A	N/A

ATTACHMENT 7
Figures

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MAPPING REFERENCE
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SCALE: 1" = 2500'

2500 0 2500 5000

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FIGURE 1 - SITE LOCATION MAP

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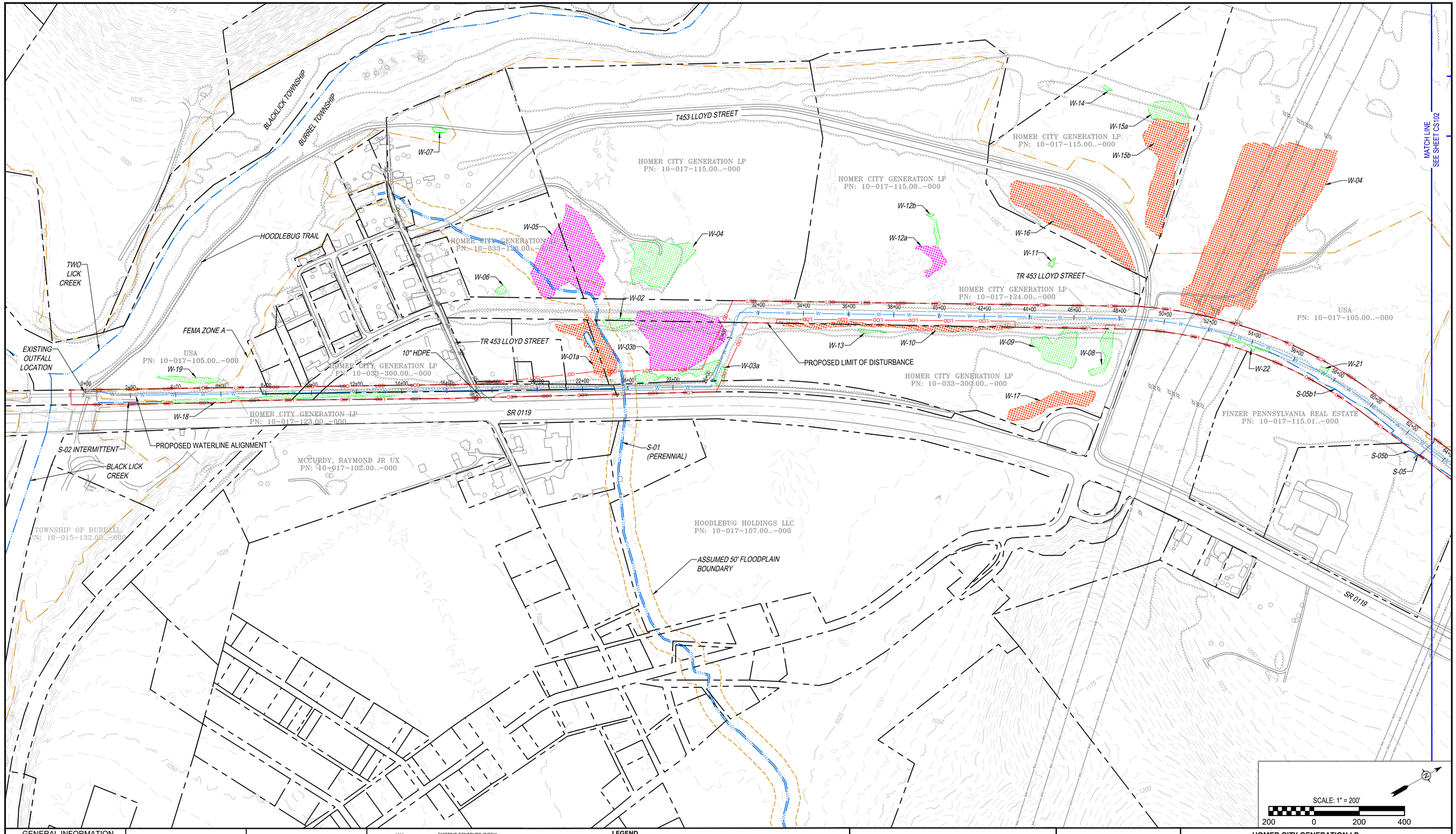
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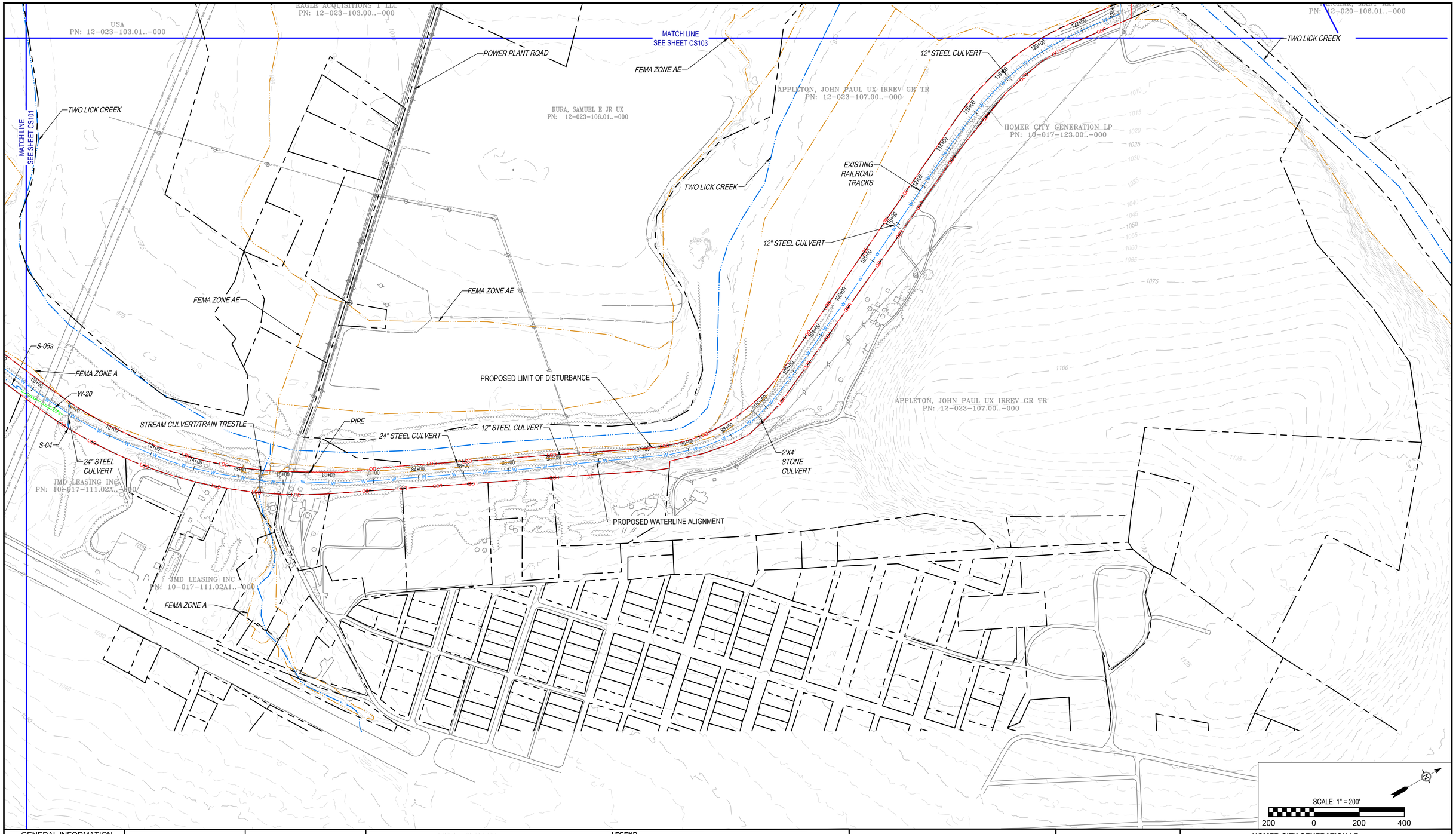
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OVERALL SITE PLAN

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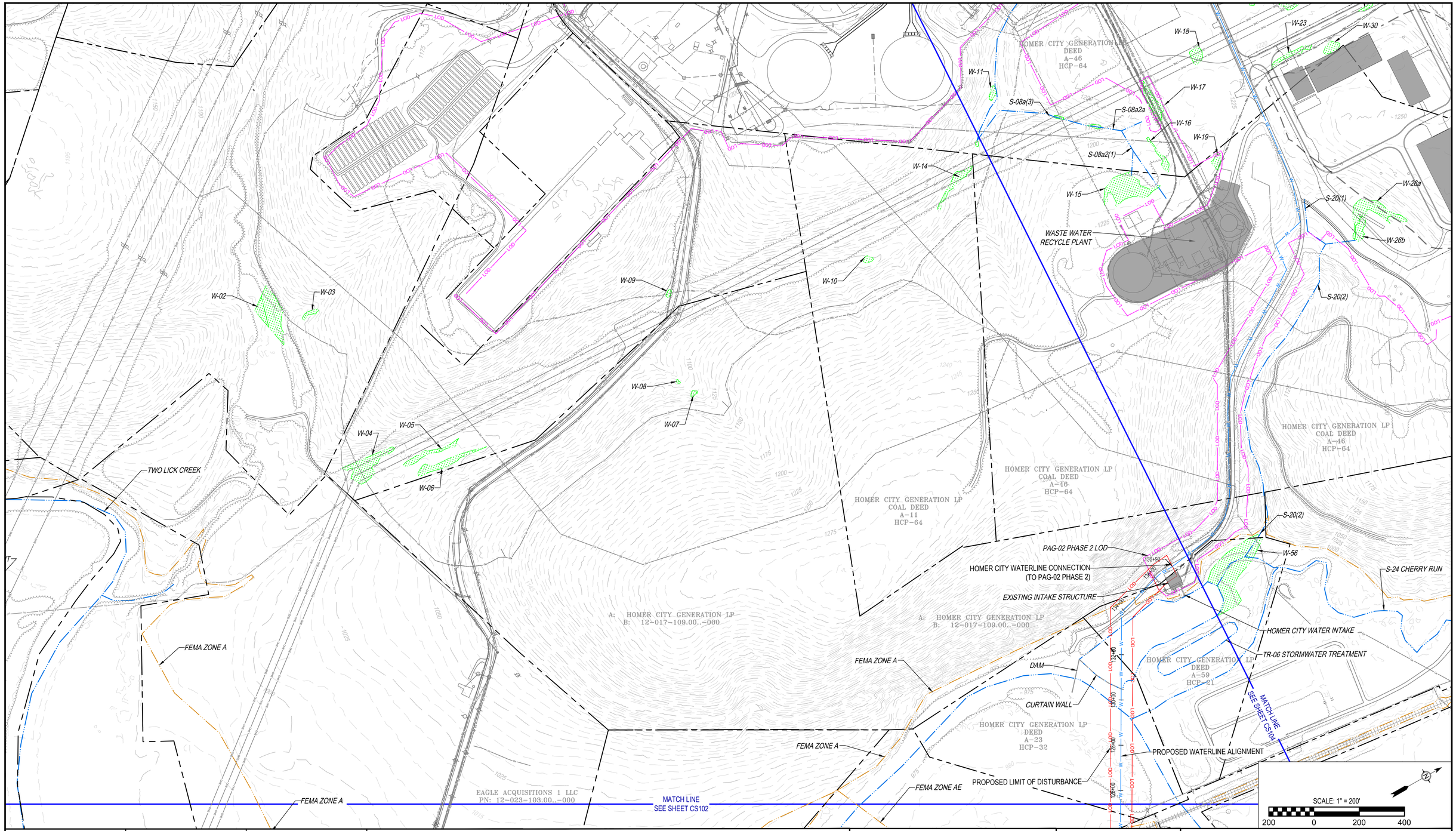
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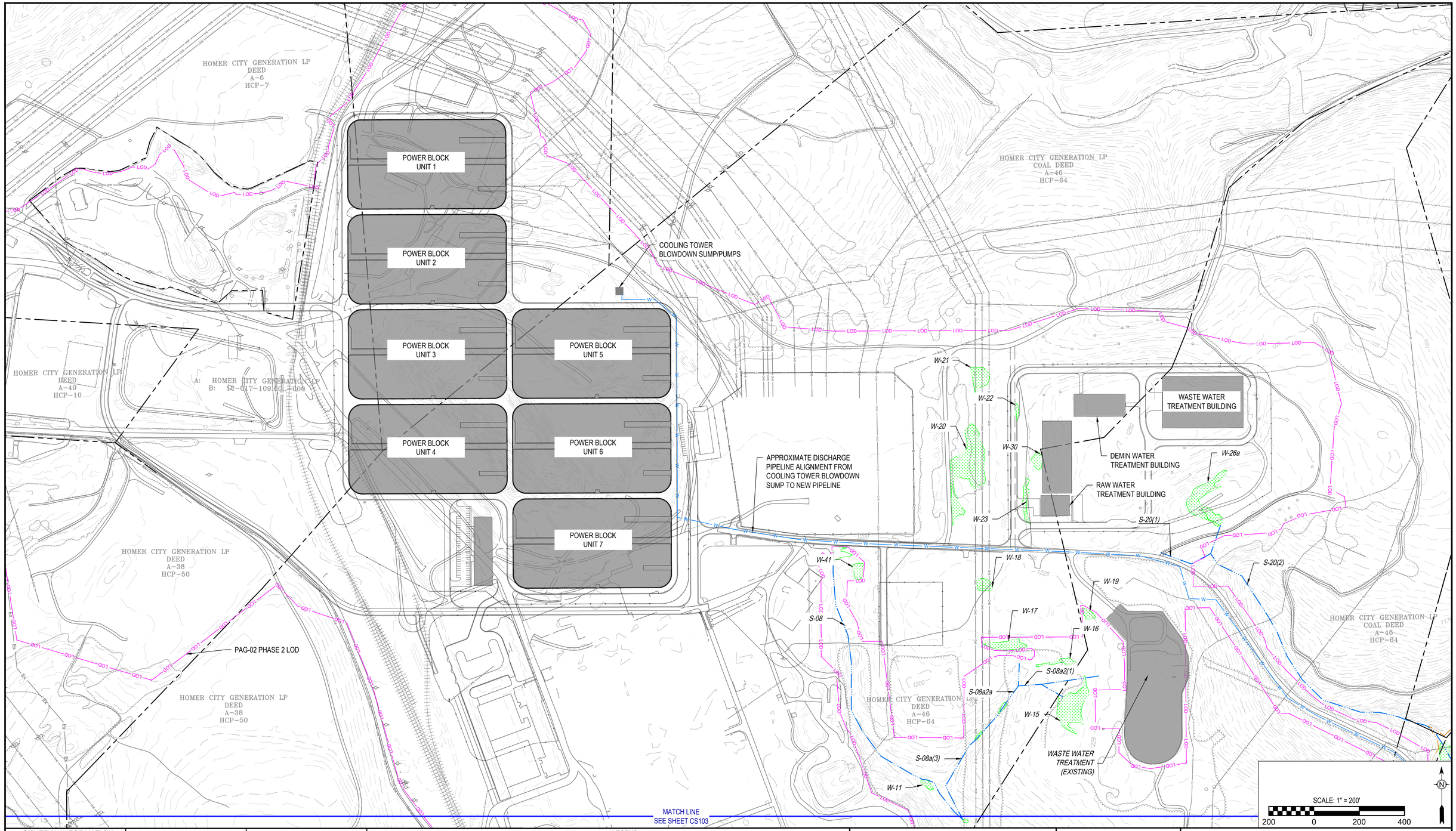
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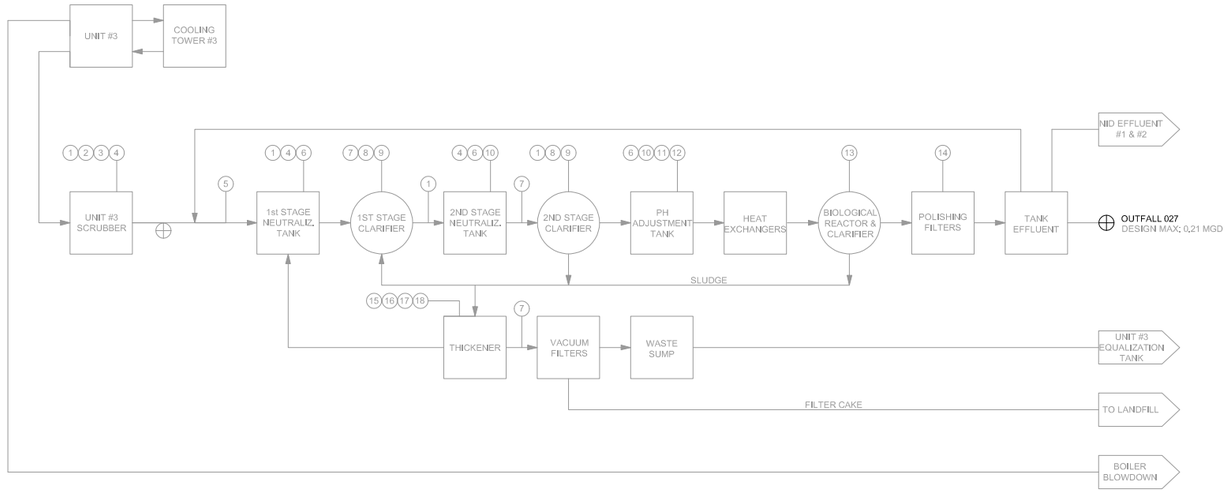
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EXISTING OUTFALL 027 PFD

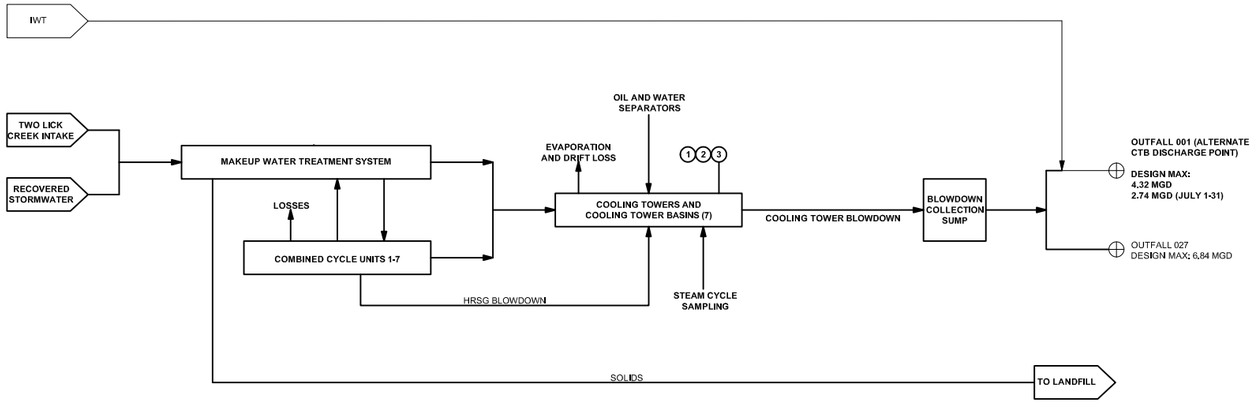


CHEMICALS	
1	FERRIC CHLORIDE
2	FORMIC ACID 95%
3	FOAMTROL AF 2290 ANTI-FOAM
4	GE METCLEAR MR 2405
5	NALCO 8100
6	HYDRATED LIME
7	NALCO 2706
8	KLARAID PC 1195 COAGULANT
9	POLYFLOC AE 1702 ANIONIC-POLYMER
10	HYDROCHLORIC ACID
11	PHOSPHORIC ACID
12	UREA (AMMONIUM NITRATE)
13	ANTI-FOAM AF-210
14	CITRIC ACID
15	WTSCT-304 POLYMER SOLUTION
16	WTSWW-541CE
17	KLARAID IC1172
18	KLARAID CB1430

LEGEND

- EXISTING
- PROPOSED FOR REMOVAL
- PROPOSED

PROPOSED OUTFALL 027 PFD



CHEMICAL ADDITIVES	
1	CHEMSTREAM CWT-311 DISPERSANT
2	CHEMSTREAM CWT-310 SCALE/CORROSION INHIBITOR
3	CHEMCHLOR 160 - SODIUM HYPOCHLORITE

REFERENCES

1. Kiewit Water Mass Balance Process Flow Diagram (20059040-WB-001)
2. Kiewit Piping and Instrumentation Diagram (20059040-PD)
3. Homer City NPDES Permit Water Balance Sampling Diagram (D-352-1801A/B)

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FIGURE 3 - PROCESS FLOW DIAGRAM

PROJECT

HOMER CITY GENERATING STATION
NPDES PERMIT
AMENDMENT APPLICATION

gai consultants

CLIENT

HOMER CITY GENERATION LP
1750 POWER PLANT ROAD
HOMER CITY, PENNSYLVANIA

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ATTACHMENT 8
Supporting Information

Attachment 8-1 - Blacklick Creek Outfall 027 Reconfiguration Assessment (Under Separate Cover)

Attachment 8-2 - Calculation of Q7,10 for Blacklick Creek at Outfall 027

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MEMO

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Date:	January 23, 2026
Project No.	C180881.18
To:	Homer City Generation LP
From:	GAI Consultants, Inc.
Subject:	**Calculation of $Q_{7\text{-}10}$ for Blacklick Creek at Outfall 027**

Overview

GAI Consultants, Inc. (GAI) has prepared this memo to document the data and method used to calculate the $Q_{7\text{-}10}$ (the 7-day minimum flow that occurs on average once every 10 years) for Blacklick Creek at Outfall 027 for the purpose of evaluating the need for Water Quality-Based Effluent Limitations (WQBELs) for this Outfall as included in Homer City Generating Station's (Station's) National Pollutant Discharge Elimination System (NPDES) Permit (Permit No. PA0005037). The $Q_{7\text{-}10}$ is being updated to reflect current stream conditions for consideration in development of the amended NPDES permit.

Outfall 027 is located directly downstream of the confluence of Two Lick Creek and Blacklick Creek; therefore, the $Q_{7\text{-}10}$ at Outfall 027 was calculated as the sum of the $Q_{7\text{-}10}$ from each of these waterways.

References

1. U. S. Geological Survey (USGS) Gage 03042000 (Blacklick Creek at Josephine, PA) (https://waterdata.usgs.gov/nwis/uv?site_no=03042000&legacy=1)
2. USGS Hydrologic Toolbox (2024, Version 1.1.0) (https://doi.org/10.5066/P13VDNAK)

Calculation Method

Two Lick Creek

Homer City is required by a Consent Order and Agreement to maintain a minimum flow of 11 cubic feet per second (cfs) at the Two Lick Dam, located downstream of the Station's intake on Two Lick Creek. There are no additional water users on Two Lick Creek between Two Lick Dam and the confluence of Two Lick Creek and Blacklick Creek.

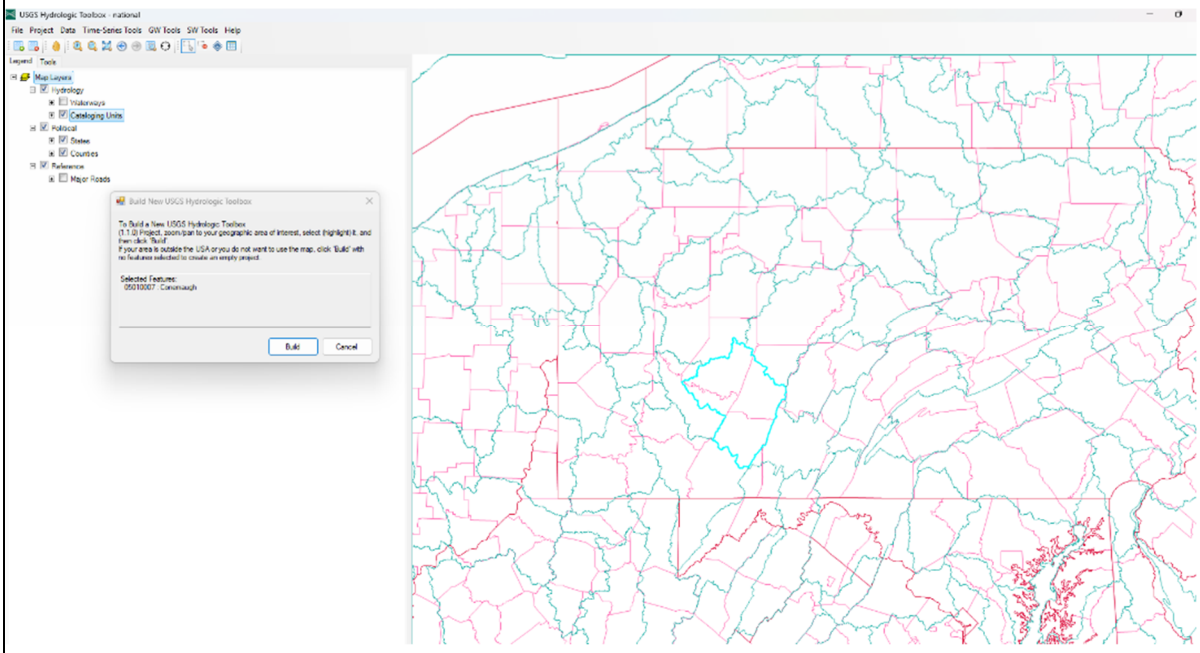
As a result, a low flow of 11 cfs is used to represent the $Q_{7\text{-}10}$ on Two Lick Creek just upstream of Blacklick Creek.

Blacklick Creek

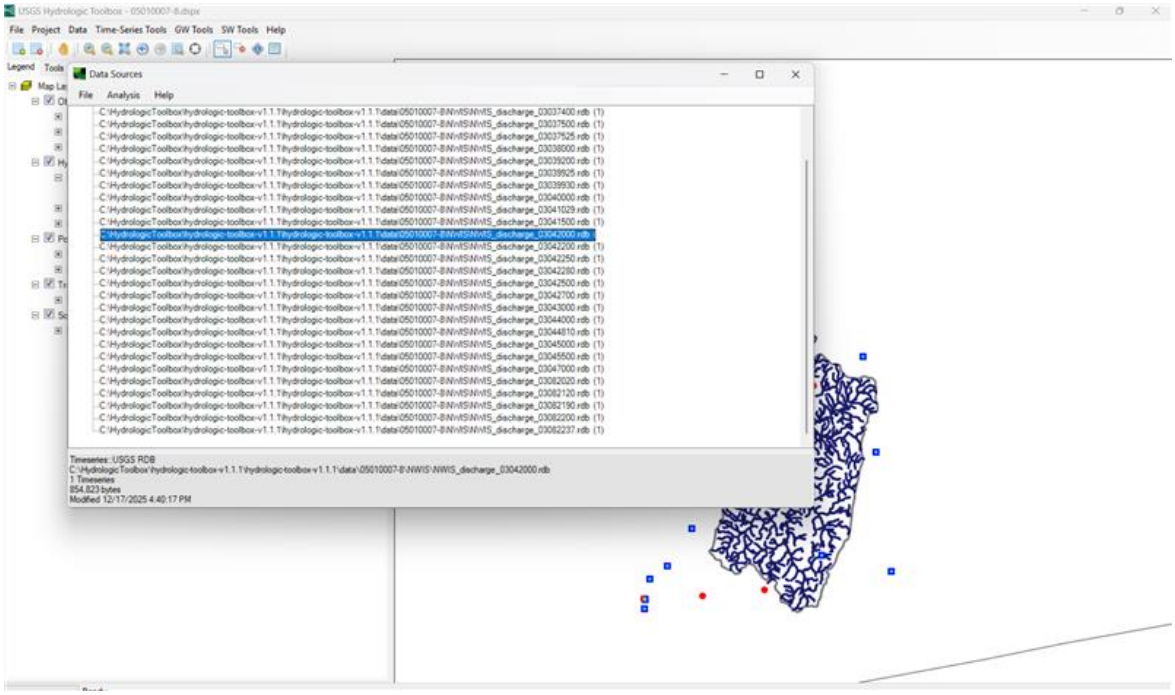
A USGS gage is located on the left bank of Blacklick Creek, on the downstream side of Josephine Bridge on Old Indiana Road, 0.5 miles upstream from Two Lick Creek at Josephine, Indiana County, PA. (Station ID No. 03042000; Latitude: 40°28'37", Longitude: -79°11'13"). Daily flow data from this gage is available from 2/1/1952 through present. The Q_{7-10} for Blacklick Creek was determined by utilizing the USGS Hydrologic Toolbox (Toolbox). The USGS Hydrologic Toolbox is a desktop software program developed by USGS to analyze hydrologic data including the computation of hydrologic-frequency statistics such as the 7-day minimum flow that occurs on average once every 10 years (Q_{7-10}).

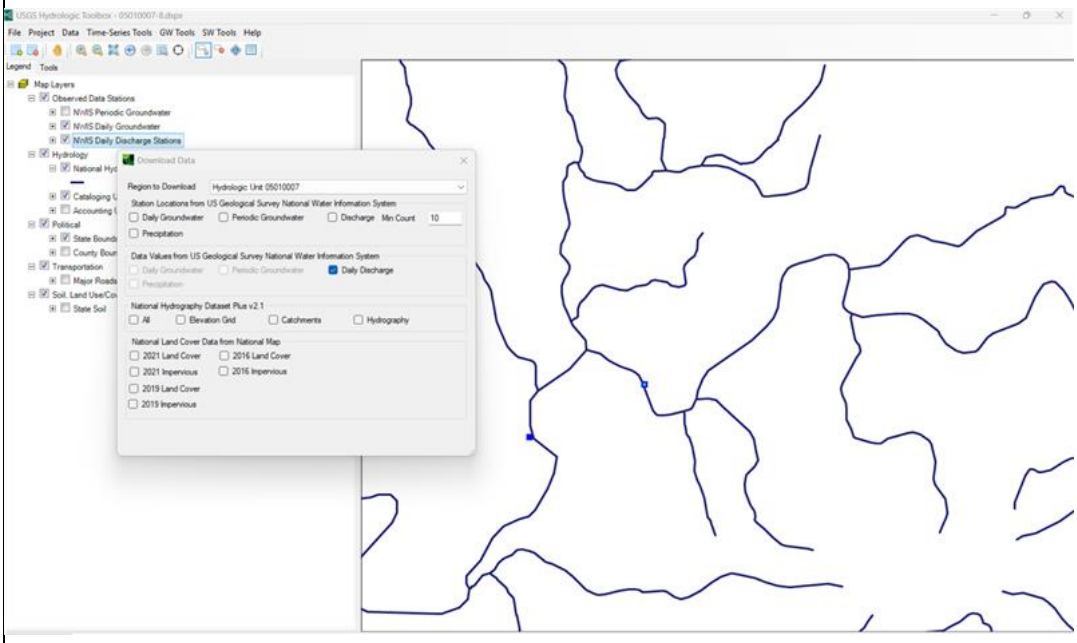
The following steps were taken to determine the Q_{7-10} for Blacklick Creek at Outfall 027 using USGS gage data:

1. In the Toolbox, the drainage basin that includes USGS gage 03042000 on Blacklick Creek at Josephine, PA was identified. Below is the drainage basin selected in the Toolbox.

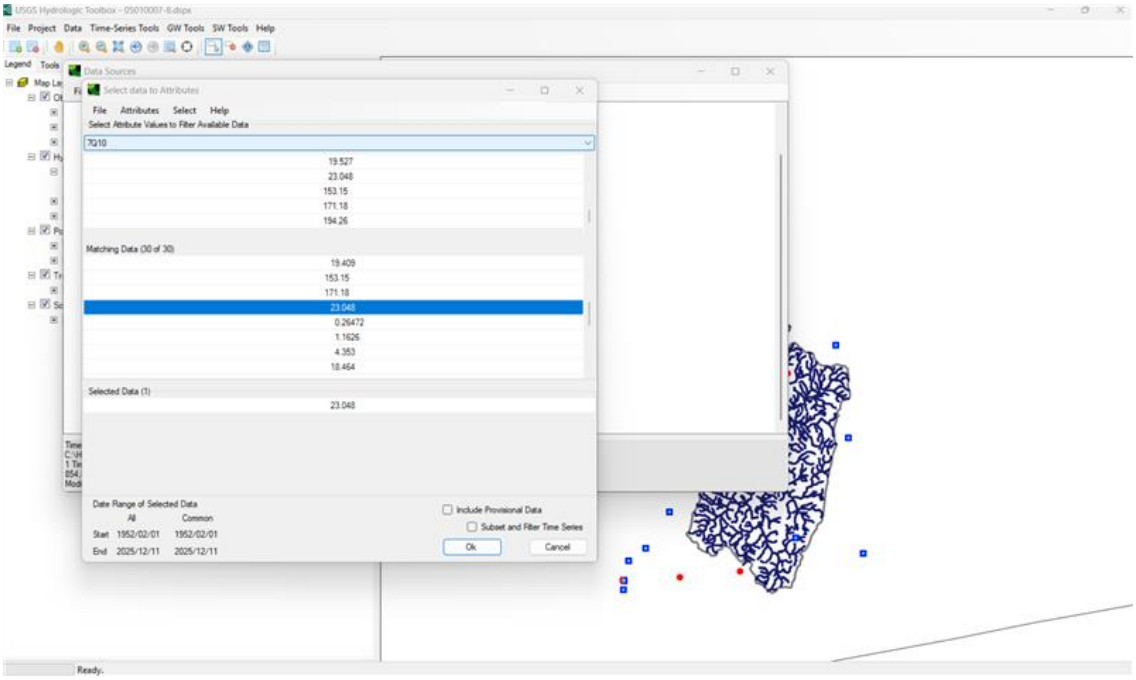


2. After selecting the drainage basin, the data layers associated with the selected basin were downloaded. Station ID No. 03042000 was selected and the daily discharge data from the period of record (2/1/1952 through 12/11/2025) was downloaded, shown below.





3. Under the data sources downloaded, the low flow condition was specified under the integrated design flow tab and the Q_{7-10} statistic with a data range of 2/1/1952 – 12/11/2025 was computed for this station. The result was 23 cfs, as shown below.



Results

With the Q_{7-10} from Blacklick Creek (23 cfs) and the minimum required flow from Two Lick Creek (11 cfs), a Q_{7-10} of 34 cfs was determined for the Blacklick Creek at Outfall 027 as follows:

23 cfs [Blacklick Creek upstream of Outfall 027] + 11 cfs [Two Lick Creek upstream of Outfall 027]

= 34 cfs [Blacklick Creek at Outfall 027]

ATTACHMENT 8-1

Blacklick Creek Outfall 027 Reconfiguration Assessment

HOMER CITY GENERATING STATION REDEVELOPMENT BLACKLICK CREEK OUTFALL 027 RECONFIGURATION ASSESSMENT USING CORMIX

Prepared for:
Homer City Generation LP

Prepared by:
ASA Analysis & Communication, Inc.
4052 Diane Way
Doylestown, PA 18902

February 2026

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EXECUTIVE SUMMARY

Homer City Generating LP is redeveloping the existing Homer City Generating Station (HCGS) to replace coal fired power generation with gas fired generation. This will necessitate discharging cooling tower blowdown to both the existing Outfall 001, which discharges to Two Lick Creek, and to Outfall 027, which discharges to Blacklick Creek. While there is an existing pipeline and outfall pipe to Blacklick Creek, Outfall 027 would be reconfigured and rebuilt to provide the necessary mixing. The purpose of this modeling exercise is to identify the outfall configuration that would help achieve thermal mixing criteria at Pennsylvania Code Chapters 93 and 96 of Title 25 and Pennsylvania Department of Environmental Protection (PADEP) Document 386-2000-001 Guidelines.

A separate outfall alternatives evaluation (Appendix D) found that a bank diffuser located under the abandoned railroad trestle, which is owned by Homer City Generation LP, and directed towards the confluence of Blacklick and Two Lick Creeks would minimize the overall disturbance, minimize operations-period maintenance effort, improve reliability, and necessitate the fewest rights of way challenges. Given the selected location, this modeling exercise was used to identify the configuration of the diffuser.

The evaluation found that June, July, November and December temperature criteria drive the mixing needs. During the winter, the excess temperature (the differential temperature between ambient and discharge) of approximately 27.4°F needs to be mixed to achieve no greater than a 5°F excess (in November and December). During the summer, the excess temperature of 5.8°F needs to be mixed to achieve no greater than 1°F excess (in June and July).

This evaluation found that a multiport unidirectional diffuser with six 8-inch discharge ports terminating in duckbill nozzles provides a good balance between efficient mixing, outfall size, etc. The discharge ports maybe spaced 2-ft center to center. The overall outfall assembly would be approximately 11 ft wide. The ports would be placed under river rock to minimize visual impact to the stream. The ports and nozzles would be positioned so they are submerged under $Q_{7\text{-}10}$ conditions and directed horizontally outward towards downstream. The creek bed immediately in the path of the discharge would be reinforced with river rock to prevent scouring.

Such an outfall is expected to achieve the target mixing criteria within 150-200 ft under $Q_{7\text{-}10}$ conditions (which are more stringent that the flow conditions used in the Pennsylvania Department of Environmental Protection (PADEP) Thermal Limits Spreadsheet (TLS). Use of duckbill nozzles with contraction ratio of 0.6 would achieve similar mixing in approximately half this distance. A multiport diffuser provides rapid and more complete mixing of the discharge, and suggest a Partial Mixing Factor (PMF) of approximately 1 in the TLS analysis. Given the potential challenges with ice, debris, bed load movement, the evaluation recommends the use of a 100 percent safety factor, and therefore a distance of up to 300 ft to achieve the necessary mixing. If ideal conditions were available, the 300 ft distance could allow up to 40 °F excess temperature.

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1. PURPOSE

The purpose of this modeling effort is to evaluate the ability of Homer City Generating Station's (HCGS) Outfall 027 discharge to meet thermal mixing criteria at Pennsylvania Code Chapters 93 and 96 of Title 25 and Pennsylvania Department of Environmental Protection (PADEP) Document 386-2000-001 Guidelines, and identify an appropriate outfall configuration to facilitate necessary mixing.

This effort would also evaluate the extent of mixing that would be afforded by the outfall and assist with identifying the appropriate partial mixing factor (PMF) that may be used for the other water quality parameter analyses.

2. BACKGROUND

This section provides background information regarding the HCGS Outfall 027 on Blacklick Creek.

2.1 OUTFALL LOCATION AND FLOW RATE

HCGS has historically discharged treated wet flue gas desulfurization (FGD) blowdown via a 8-inch pipe referred to as Outfall 027 under the National Pollutant Discharge Elimination System (NPDES) permit PA0005037 to Blacklick Creek. Following its modernization, HCGS intends to discharge cooling tower blowdown to Blacklick Creek using this outfall. The total discharge to Blacklick Creek would then be a maximum of 4,750 gpm; the existing pipe would be replaced with an approximately 20-inch inside-diameter high density polyethylene (HDPE) pipe. The outfall would consist of a shoreline diffuser with multiple duck-bill nozzles, seated immediately west of the railroad trestle, and orientated towards the confluence of Blacklick Creek and Two Lick Creek.

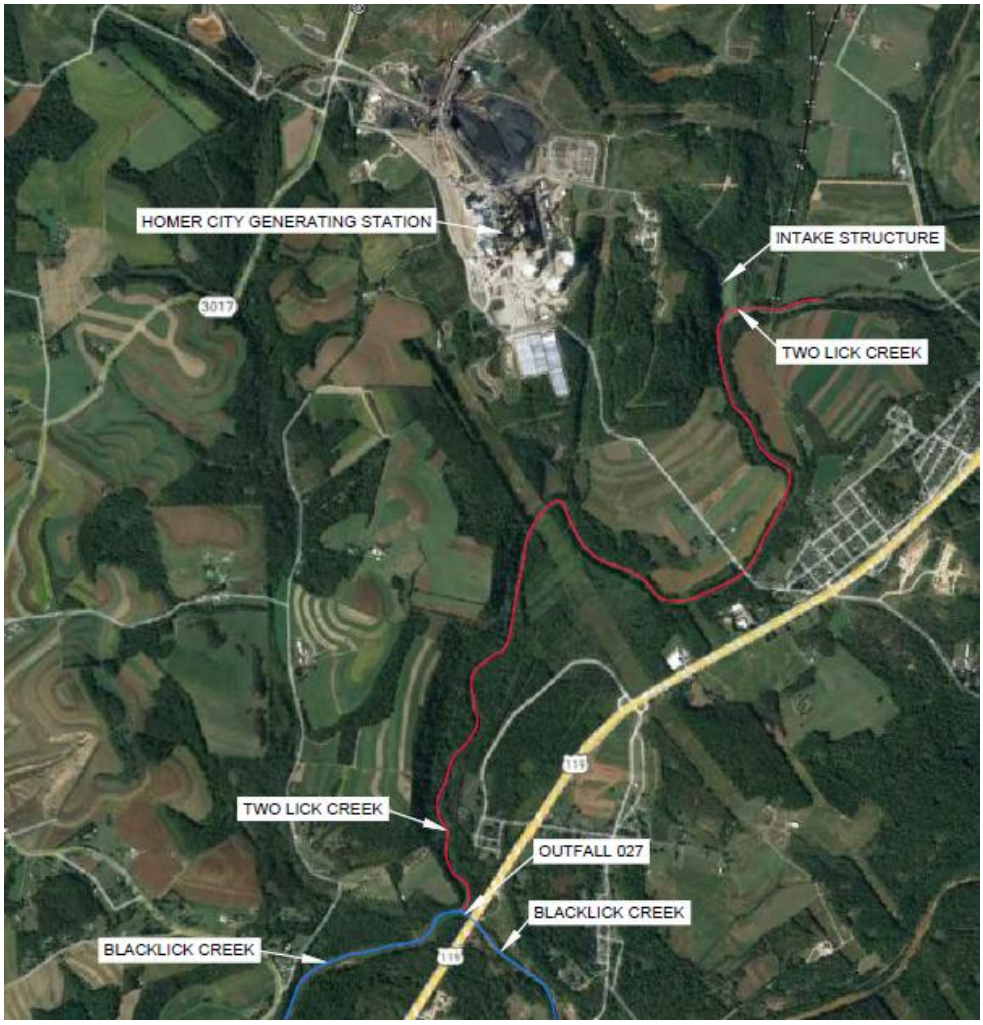


Figure 2-1. HCGS, Two Lick Creek and Blacklick Creek Layout
(Source: Google Maps 2025)

2.2 THE DISCHARGE

Outfall 027 is located near the confluence of Two Lick Creek and Blacklick Creek, immediately west of Route 119 (Figure 2-1). Outfall 027 discharge to Blacklick Creek is located on the north

bank about 75 ft upstream from the confluence with Two Lick Creek (Figure 2-2). All or a portion of the cooling water blowdown is intended to be discharged to Blacklick Creek, with a maximum design flow of 4,750 gpm. The anticipated temperature of the Cooling Tower Blowdown is expected to be approximately 63.6 °F in the winter and 79.7 °F in the summer. Per the Kiewit (2025) design, the blowdown temperature when ambient temperature is 90°F (Fired Guarantee) would be 84.4°F; and under the planned maximum high ambient temperature condition of 105°F, the blowdown temperature would be 85.6°F. Table 2-1.



Figure 2-2: HCGS Outfall 027
(Source: Google Maps 2025)

Table 2-1. Anticipated Cooling Tower Blowdown Temperature

Monthly	Condition	Cooling Tower Blowdown Temperature (F)
Jan	Average	63.6
Feb	Average	63.6
Mar	Average	63.6
Apr	Average	71.3
May	Average	71.3
Jun	Average	79.7
Jul	Average	79.7
Aug	Average	79.7
Sep	Average	79.7
Oct	Average	71.3
Nov	Average	71.3
Dec	Average	63.6
90°F	Fired Guarantee‡	84.4
105°F	Max hot day‡	85.6

Source: Kiewit 2025

‡: CORMIX modeling was not performed for this potential blowdown temperature. The modeling was performed for conservative conditions, including $Q_{7\text{-}10}$ stream flow and maximum blowdown. The compounding effect of these two conditions is already conservative. Further compounding with Fired Guarantee and Maximum Hot Day would make results unrealistically conservative.

2.3 OUTFALL CONFIGURATION

The new 20-inch HDPE pipe will terminate in a manifold with multiple diffuser pipes ending with duckbill nozzles. The goal of this modeling exercise is to determine the number and configuration of those nozzles. The diffuser pipes would be small enough to remain submerged under $Q_{7\text{-}10}$ conditions[1] but large enough to prevent clogging. The outfall assembly would be orientated to direct the discharge towards the confluence of Blacklick Creek with Two Lick Creek, and achieve rapid mixing. Figure 2-3.

[1] $Q_{7\text{-}10}$ is defined as the lowest 7-day average flow that occurs (on average) once every 10 years.

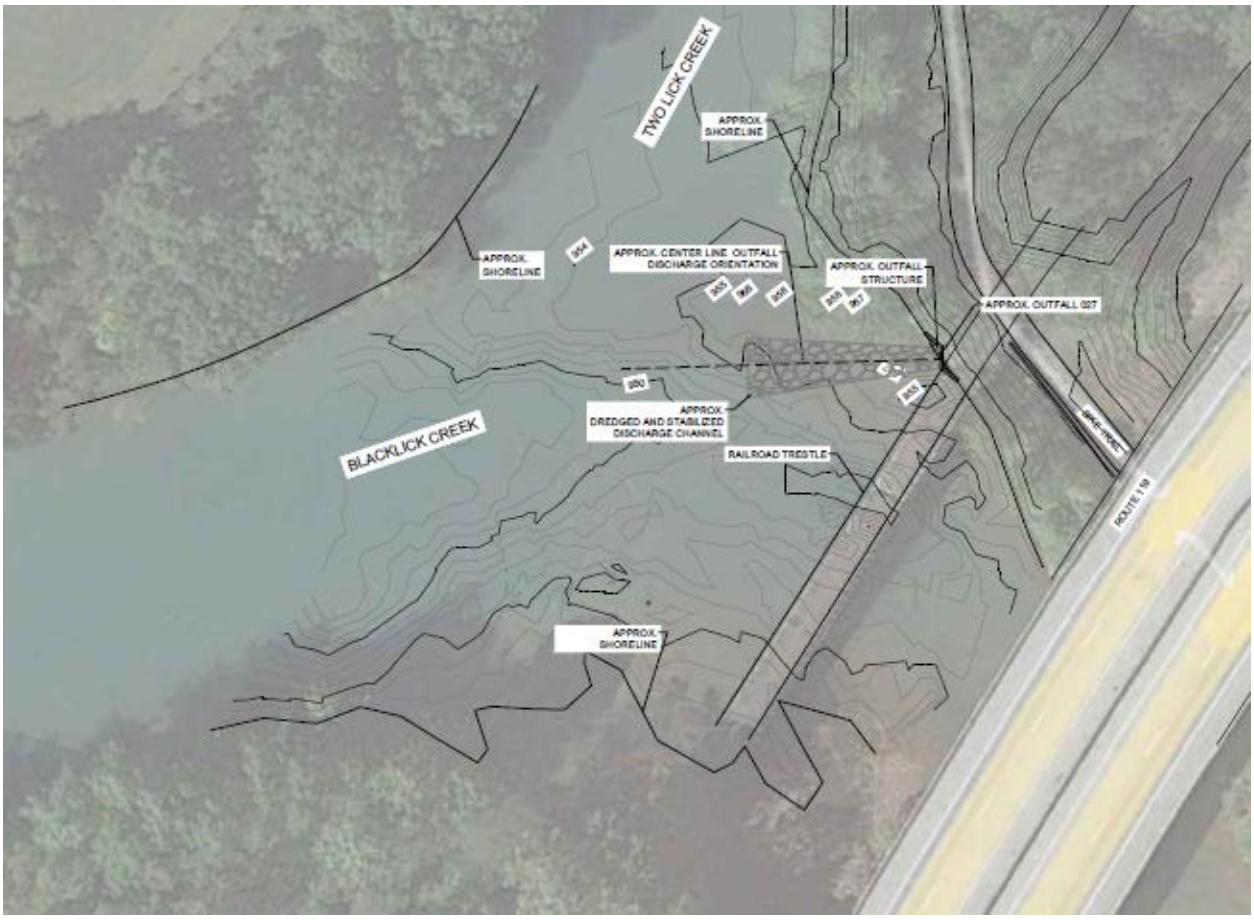


Figure 2-3: General Arrangement Outfall 027

2.4 BLACKLICK CREEK NEAR OUTFALL 027

Outfall 027 is located about 2.5 miles south of HCGS. Blacklick Creek immediately upstream of the confluence has a drainage area of 194 square miles. The land use in the area is primarily agriculture. An abandoned railroad bridge and Route 119 bridge are about 125 ft and 240 ft upstream of the confluence, respectively. The channel width upstream of the bridge is 94 ft wide; it widens to approximately 135 ft at Route 119 bridge and to approximately 207 ft downstream of the railroad bridge.

2.4.1 Flow Rate

Blacklick Creek discharge flow measured at USGS gauge 03042000, Josephine, PA (Lat 40`28'37", long -79`11'12") during the period of 1995-2025 had an annual average flow of 390 cfs (USGS, 2025).

Model runs were conducted with a $Q_{7\text{-}10}$ 34 cfs. This flow rate was provided by Homer City Generation LP based on evaluation of the USGS gage 03042000 (on Blacklick Creek) data indicating a $Q_{7\text{-}10}$ of 23 cfs and the conservation flow of 11 cfs required in Two Lick Creek at HCGS.

2.4.2 Bathymetry and Sediment

A bathymetric survey was conducted on September 23, 2025, in the area of Two Lick Creek and Blacklick Creek confluence. The bathymetry shows Blacklick Creek is shallow (approximately 3 ft to 3.5 ft) along the north bank near Outfall 027. A channel towards the centerline is deeper (approximately 7 ft), the deepest portion of the channel at the confluence of Blacklick Creek and Two Lick Creek (approximately 10.5 ft) (Figure 2-4). The channel bed near the confluence consists of cobble and fine sediment.

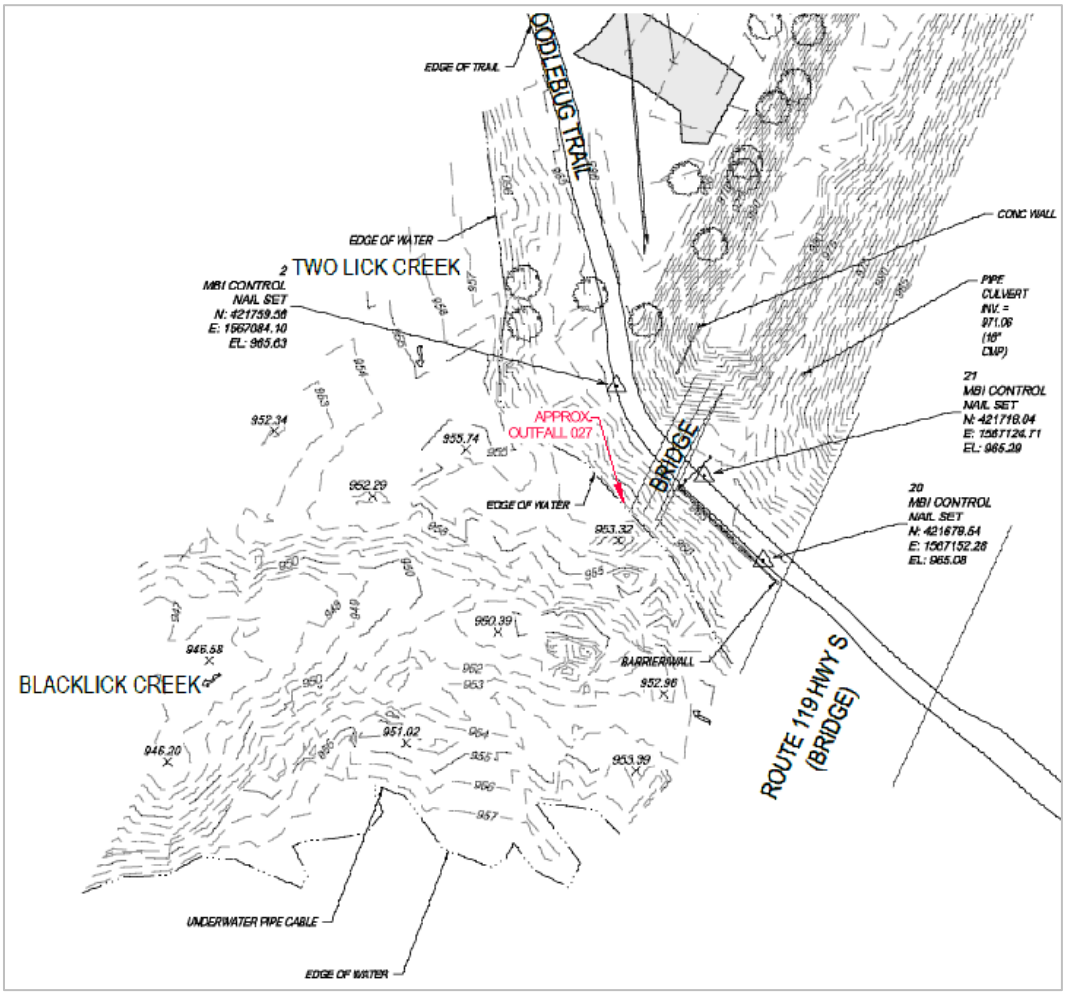


Figure 2-4. Blacklick Creek Bathymetry Near Outfall 027
Source: Michael Baker International 2025.

2.4.3 Water Quality

Water temperature in Black Lick Creek ranges from 34.7 °F in January to 74.7 °F in July, with a winter average of 36.2 °F and summer average of 73.9 °F from USGS gauge 03042000 at Josephine, PA (Lat 40`28'37", long -79`11'12") for the period from 2014-2015.

3. THERMAL COMPLIANCE CRITERIA

PADEP Document 386-2000-001 provides guidelines for water quality-based effluent limitations for thermal discharges to surface water.

Based on data available, Blacklick Creek temperatures appear to mimic the default temperatures in the PADEP Thermal Limits Spreadsheet (TLS), therefore, the default temperatures were used. The following key data were used in the TLS (Table 3-1).

Table 3-1. Key TLS Inputs

Data Requirement	Value Used in TLS	Measurement Units
Outfall	027	
Stream Q_{7-10}	34	cfs
Analysis Type	TSF	
External intake rate	36	MGD
Discharge rate from outfall	6.768, 6.84	MGD
Q_{7-10} Multipliers	Default values in TLS	
Partial Mix Factor	1	

Table 3-2 shows the default ambient water temperatures and target maximum stream temperatures applicable to Trout Stocking Fishes (TSF). Column 4 of Table 3-2 shows the allowable increase in water temperatures for TSF, for the specific ambient conditions. Per the guidance, the months of June and July are the most constraining in terms of the allowable rise in the receiving waterbody temperature (of 1°F). Per Table 3-2 (Column 6), January and February have the greatest excess temperature above the target receiving waterbody temperature. Therefore, the necessary mixing of the discharge from Outfall 027 in Blacklick Creek would be governed by January, February, June and July conditions. In the winter runs of CORMIX, the goal is to mix 63.6°F Outfall 027 discharge (a 28.6°F excess) rapidly to achieve 40°F after mixing (the target 5°F excess). In the summer runs of CORMIX, the goal is to mix 73.9°F Outfall 027 discharge (a 5.8°F excess) rapidly to achieve the target 1°F excess. The outfall design would aim to achieve complete mixing as rapidly as possible.

Table 3-2. Target Temperature in Excess of Ambient Temperature (Q_{7-10} 34 cfs)

Semi-Monthly Increment	Ambient Stream Temperature (F)	TSF Target Maximum Stream Temperature (F)	TSF Target Temperature Above Ambient (F	Blowdown Temperature (F)	Blowdown Temperature Excess Over Ambient (F)	Blowdown Temperature Excess Over Target (F)
Jan 1-31	35	40	5	63.6	28.6	23.6
Feb 1-29	35	40	5	63.6	28.6	23.6
Mar 1-31	40	46	6	63.6	23.6	17.6
April 1-15	47	52	5	71.3	24.3	19.3
April 16-30	53	58	5	71.3	18.3	13.3
May 1-15	58	64	6	71.3	13.3	7.3

Semi-Monthly Increment	Ambient Stream Temperature (F)	TSF Target Maximum Stream Temperature (F)	TSF Target Temperature Above Ambient (F	Blowdown Temperature (F)	Blowdown Temperature Excess Over Ambient (F)	Blowdown Temperature Excess Over Target (F)
May 16-31	62	68	6	71.3	9.3	3.3
Jun 1-15	67	70	3	79.7	12.7	9.7
Jun 16-30	71	72	1	79.7	8.7	7.7
Jul 1-31	75	76	1	79.7	4.7	3.7
Aug 1-15	74	80	6	79.7	5.7	-0.3
Aug 16-31	74	87	13	79.7	5.7	-7.3
Sep 1-15	71	84	13	79.7	8.7	-4.3
Sep 16-30	65	78	13	79.7	14.7	1.7
Oct 1-15	60	72	12	71.3	11.3	-0.7
Oct 16-31	54	66	12	71.3	17.3	5.3
Nov 1-15	48	58	10	71.3	23.3	13.3
Nov 16-30	42	50	8	71.3	29.3	21.3
Dec 1-31	37	42	5	63.6	26.6	21.6

The multi-port diffuser facilitates rapid and complete mixing, which translates to a partial mix factor (PMF) of 1 in TLS(Table 3-3). A lower PMFs assume less efficient mixing. PMF of 1 assumes complete mixing, which is applicable to a multi-port diffuser. During the months March through May and August through September, the Blacklick appears to have greater assimilative capacity and allows for the discharge temperature to be as high as 110°F even with reduced mixing. However, during June, July, November and December the allowable discharge temperature is more sensitive. During June and July, the default ambient stream temperature is nearly the same as the target temperature and therefore, there is limited assimilative capacity. It is more important to achieve complete mixing sooner during these months.

Table 3-3. Wasteload Allocations with Partial Mix Factor of 1s ($Q_{7\text{-}10}$ 34 cfs)

Semi-Monthly Increment	Ambient Stream Temperature (F)	TSF Target Maximum Stream Temperature (F)	Case 2 Daily WLA with PMF 1 (F)	Allowable Excess Temperature Over Ambient with PMF 1 (F)
Jan 1-31	35	40	91.4	56.4
Feb 1-29	35	40	96.2	61.2
Mar 1-31	40	46	110	70
April 1-15	47	52	110	63
April 16-30	53	58	110	57
May 1-15	58	64	110	52
May 16-31	62	68	110	48
Jun 1-15	67	70	98.9	31.9

Semi-Monthly Increment	Ambient Stream Temperature (F)	TSF Target Maximum Stream Temperature (F)	Case 2 Daily WLA with PMF 1 (F)	Allowable Excess Temperature Over Ambient with PMF 1 (F)
Jun 16-30	71	72	81.6	10.6
Jul 1-31	75	76	81.5	6.5
Aug 1-15	74	80	107	33
Aug 16-31	74	87	110	36
Sep 1-15	71	84	110	39
Sep 16-30	65	78	110	45
Oct 1-15	60	72	110	50
Oct 16-31	54	66	110	56
Nov 1-15	48	58	109.4	61.4
Nov 16-30	42	50	91.1	49.1
Dec 1-31	37	42	80.6	43.6

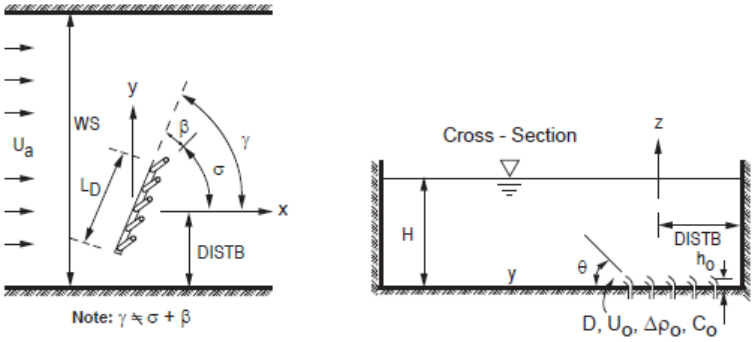
Table 3-3 shows the allowable discharge temperatures and the allowable excess temperature over ambient temperature during the different monthly and semi-monthly periods under various mixing conditions. The better the mixing (PMF=1), the greater the allowable discharge temperature.

4. CORMIX

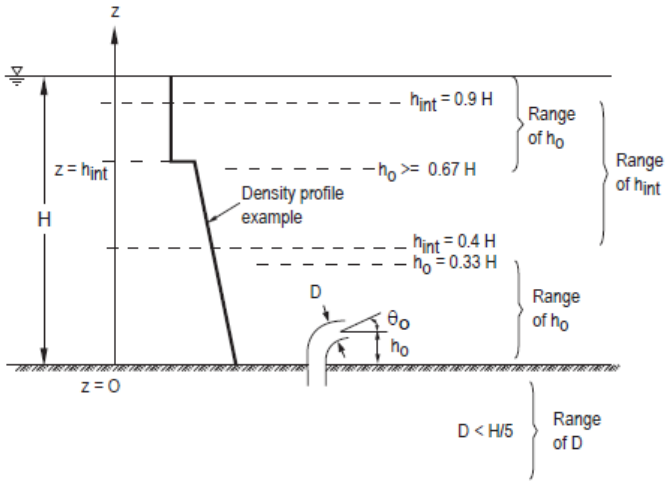
As described in the CORMIX user manual, CORMIX is a USEPA supported hydrodynamic simulation software that mimics turbulent buoyant jet mixing. CORMIX is a package model in that the model developers and authors have verified its predictions for typical outfall configurations, provided that the dimensions, angles, and parameters appropriately represent the outfall and its surroundings.

CORMIX can simulate three types of outfalls. CORMIX1 simulates mixing due to a single port discharge (a pipe). CORMIX2 simulates a multiport submerged diffuser. CORMIX3 simulates surface discharges that result when an effluent enters a larger waterbody laterally, through a canal, channel, or near-surface pipe. The HCGS Outfall 027 will be modeled using CORMIX2.

Key CORMIX2 parameters are shown in Figure 4-1 and defined in Table 4-1.



a) Definition Diagram CORMIX2



b) Limits of Applicability CORMIX 2

Figure 4-1. CORMIX2 Parameter Configuration

(Source: MixZon Inc 2020)

Table 4-1. CORMIX1 Parameter Definitions

Parameter Symbol	Parameter Definition	Range
H	Average waterbody depth	
D	Equivalent port diameter	
θ	Vertical angle of discharge between the port centerline and horizontal plan	$\Theta > 45°$, $D < H$ $\Theta < 45°$, $D < H/3$
σ	Horizontal angle of discharge, measured counterclockwise from the ambient current direction to the plan projection of the port centerline	0-360°
HD	Local water depth	
h_0	Port height	$h_0 < 1/3$ HD $h_0 > 2/3$ HD

5. MODEL INPUTS

This section presents information and data for the HCGS Outfall 027 CORMIX modeling, as well as the simplifications made to data to meet CORMIX2 configuration criteria. Inputs represent the actual system to the extent possible; adjustments made to meet CORMIX constraints generally are biased towards more conservative results.

5.1 SUMMARY OF INPUTS

Table 5-1 presents basic model inputs. Cells highlighted grey show the parameters modified for the various scenarios evaluated. Model runs used $Q_{7\text{-}10}$ of 34 cfs and a maximum discharge flow of 4,750 gpm.

Table 5-1. CORMIX Inputs

Data Field	Value Used in CORMIX	Units
Effluent Type	Heated	
Heat loss coefficient	78	W/m^2 °C
Discharge Temperature Excess	27.4	°F
Flow Rate (Average)	4,000	
(Maximum Allowed)	4750	gpm
(Minimum Allowed)	405	
Effluent Temperature	Fresh	
	66.6, 79.7	°F
Average Ambient Depth at 7Q10	2.46	ft
Depth at Discharge, H_D at 7Q10	2.17	ft
Wind Speed	10	miles per hour (mph)
Ambient flow characteristics	Steady	
Flow rate at 7Q10	34	cfs
Ambient density	Uniform	
Ambient water temperature	39.2, 73.9	°F
Waterbody Type	bounded	
Width of Waterbody	118.9	ft
Manning's n	0.025	(for dredged channel)
Discharge Type	CORMIX2 Multiport	
Discharge Located On	Left bank	
Distance to nearest bank	32	ft
Theta	0	degrees
Sigma	328	degrees
Beta	58	degrees
Discharge configuration	Multiport, single port per riser	

Data Field	Value Used in CORMIX	Units
Nozzle direct	Unidirectional, Same direction	
Diffuser length Distance to 2nd end point (LD2) Total number of openings Port diameter Contraction ratio	Variables	
Port height above channel bottom	0.67	ft
Mixing Zone	Non-Toxic Effluent	
Water Quality Standard (Excess)	Variable	°F
Mixing Zone	None specified	
Region of Interest	5,000	ft

5.2 CORMIX SIMPLIFICATION OF OUTFALL CHARACTERISTICS

CORMIX is a package model, in that, the outfall, receiving waterbody, and discharge need to meet certain model requirements. When the data do not meet those requirements, then the inputs need to be adjusted appropriately. This is typical of any modeling exercise. This evaluation incorporated two simplifications to data.

1. Ambient temperature adjustment. The minimum ambient temperature allowable in CORMIX is 39.2°F. The actual average wintertime temperature in Blacklick Creek is 36.2°F. The model runs therefore used 39.2 °F as the winter temperature. The excess temperature is what drives mixing. The actual excess temperature is 27.4 °F. The evaluation therefore held the modeling excess temperature consistent with the actual excess temperature, and adjusted up the wintertime discharge temperature from 63.6°F to 66.6 °F. Conclusions from modeling would be adjusted back to actual values.

2. The discharge contraction ratio. CORMIX allows contraction ratios between 0.85 and 1 (wide open). In reality, the duckbill nozzle can be constricted more to achieve smaller openings. The evaluation used 1 and 0.85. If a stiffer duckbill were used, the opening may be smaller resulting in higher jet velocities. The actual mixing distance could therefore be somewhat shorter than predicted here.

5.3 MODELING SCENARIOS

Modeling scenarios associated with $Q_{7\text{-}10}$ of 34 cfs and 4,750 gpm discharge are summarized in Table 5-3. Key variables are: season (ambient, effluent and excess temperatures), discharge rate from Outfall 027 (low, average, high), contraction ratio, and diffuser configuration (C1 through C6 defined in Table 5-2). Non-varying inputs are defined in Table 5-1.

Table 5-2 Diffuser Configurations

Diffuser Configuration	Diffuser length (ft)	LD2 (ft)	Port Diameter (ft)	Total Number of Openings
C1	16	48	0.50	11
C2	13	45	0.50	11
C3	11	43	0.67	6
C4	9	41	0.67	6
C5	8	40	0.83	4
C6	7	39	1.00	3

Table 5-3. Modeling Scenarios Summary (Q_{7-10} = 34.0 cfs)

Scenario Number	Ambient Temperature (F)	Effluent Temperature (F)	Excess Temperature (F)	Discharge rate (gpm)	Contraction Ratio	Diffuser Length (ft)	LD2 (ft)	Port Diameter (ft)	Total Number of Openings
C301	73.9	79.7	5.8	405	0.85	16	48	0.50	11
C302	73.9	79.7	5.8	405	0.85	13	45	0.50	11
C303	73.9	79.7	5.8	405	0.85	11	43	0.67	6
C304	73.9	79.7	5.8	405	0.85	9	41	0.67	6
C305	73.9	79.7	5.8	405	0.85	8	40	0.83	4
C306	73.9	79.7	5.8	405	0.85	7	39	1.00	3
C307	73.9	79.7	5.8	405	1.00	16	48	0.50	11
C308	73.9	79.7	5.8	405	1.00	13	45	0.50	11
C309	73.9	79.7	5.8	405	1.00	11	43	0.67	6
C310	73.9	79.7	5.8	405	1.00	9	41	0.67	6
C311	73.9	79.7	5.8	405	1.00	8	40	0.83	4
C312	73.9	79.7	5.8	405	1.00	7	39	1.00	3
C313	73.9	79.7	5.8	4000	0.85	16	48	0.50	11
C314	73.9	79.7	5.8	4000	0.85	13	45	0.50	11
C315	73.9	79.7	5.8	4000	0.85	11	43	0.67	6
C316	73.9	79.7	5.8	4000	0.85	9	41	0.67	6
C317	73.9	79.7	5.8	4000	0.85	8	40	0.83	4
C318	73.9	79.7	5.8	4000	0.85	7	39	1.00	3
C319	73.9	79.7	5.8	4000	1.00	16	48	0.50	11
C320	73.9	79.7	5.8	4000	1.00	13	45	0.50	11
C321	73.9	79.7	5.8	4000	1.00	11	43	0.67	6
C322	73.9	79.7	5.8	4000	1.00	9	41	0.67	6
C323	73.9	79.7	5.8	4000	1.00	8	40	0.83	4
C324	73.9	79.7	5.8	4000	1.00	7	39	1.00	3

Scenario Number	Ambient Temperature (F)	Effluent Temperature (F)	Excess Temperature (F)	Discharge rate (gpm)	Contraction Ratio	Diffuser Length (ft)	LD2 (ft)	Port Diameter (ft)	Total Number of Openings
C325	73.9	79.7	5.8	4750	0.85	16	48	0.50	11
C326	73.9	79.7	5.8	4750	0.85	13	45	0.50	11
C327	73.9	79.7	5.8	4750	0.85	11	43	0.67	6
C328	73.9	79.7	5.8	4750	0.85	9	41	0.67	6
C329	73.9	79.7	5.8	4750	0.85	8	40	0.83	4
C330	73.9	79.7	5.8	4750	0.85	7	39	1.00	3
C331	73.9	79.7	5.8	4750	1.00	16	48	0.50	11
C332	73.9	79.7	5.8	4750	1.00	13	45	0.50	11
C333	73.9	79.7	5.8	4750	1.00	11	43	0.67	6
C334	73.9	79.7	5.8	4750	1.00	9	41	0.67	6
C335	73.9	79.7	5.8	4750	1.00	8	40	0.83	4
C336	73.9	79.7	5.8	4750	1.00	7	39	1.00	3
C337	39.2	66.6	27.4	405	0.85	16	48	0.50	11
C338	39.2	66.6	27.4	405	0.85	13	45	0.50	11
C339	39.2	66.6	27.4	405	0.85	11	43	0.67	6
C340	39.2	66.6	27.4	405	0.85	9	41	0.67	6
C341	39.2	66.6	27.4	405	0.85	8	40	0.83	4
C342	39.2	66.6	27.4	405	0.85	7	39	1.00	3
C343	39.2	66.6	27.4	405	1.00	16	48	0.50	11
C344	39.2	66.6	27.4	405	1.00	13	45	0.50	11
C345	39.2	66.6	27.4	405	1.00	11	43	0.67	6
C346	39.2	66.6	27.4	405	1.00	9	41	0.67	6
C347	39.2	66.6	27.4	405	1.00	8	40	0.83	4
C348	39.2	66.6	27.4	405	1.00	7	39	1.00	3
C349	39.2	66.6	27.4	4000	0.85	16	48	0.50	11

Scenario Number	Ambient Temperature (F)	Effluent Temperature (F)	Excess Temperature (F)	Discharge rate (gpm)	Contraction Ratio	Diffuser Length (ft)	LD2 (ft)	Port Diameter (ft)	Total Number of Openings
C350	39.2	66.6	27.4	4000	0.85	13	45	0.50	11
C351	39.2	66.6	27.4	4000	0.85	11	43	0.67	6
C352	39.2	66.6	27.4	4000	0.85	9	41	0.67	6
C353	39.2	66.6	27.4	4000	0.85	8	40	0.83	4
C354	39.2	66.6	27.4	4000	0.85	7	39	1.00	3
C355	39.2	66.6	27.4	4000	1.00	16	48	0.50	11
C356	39.2	66.6	27.4	4000	1.00	13	45	0.50	11
C357	39.2	66.6	27.4	4000	1.00	11	43	0.67	6
C358	39.2	66.6	27.4	4000	1.00	9	41	0.67	6
C359	39.2	66.6	27.4	4000	1.00	8	40	0.83	4
C360	39.2	66.6	27.4	4000	1.00	7	39	1.00	3
C361	39.2	66.6	27.4	4750	0.85	16	48	0.50	11
C362	39.2	66.6	27.4	4750	0.85	13	45	0.50	11
C363	39.2	66.6	27.4	4750	0.85	11	43	0.67	6
C364	39.2	66.6	27.4	4750	0.85	9	41	0.67	6
C365	39.2	66.6	27.4	4750	0.85	8	40	0.83	4
C366	39.2	66.6	27.4	4750	0.85	7	39	1.00	3
C367	39.2	66.6	27.4	4750	1.00	16	48	0.50	11
C368	39.2	66.6	27.4	4750	1.00	13	45	0.50	11
C369	39.2	66.6	27.4	4750	1.00	11	43	0.67	6
C370	39.2	66.6	27.4	4750	1.00	9	41	0.67	6
C371	39.2	66.6	27.4	4750	1.00	8	40	0.83	4
C372	39.2	66.6	27.4	4750	1.00	7	39	1.00	3
C369-50F	39.2	90.0	50.8	4750	1.00	11	43	0.67	6
C369-40F	39.2	79.2	40.0	4750	1.00	11	43	0.67	6

6. MODEL OUTPUTS

Once the different data are input for each scenario, CORMIX provides five output files.

1. Session Report – provides a project summary including all inputs.

2. Processing Record – provides the FORTRAN execution of the code and will identify if any errors occurred.

3. Flow Class Description – in depth description of the assigned flow class.

4. Design Recommendations – recommendations for changes to the configuration to increase mixing or create a more stable flow. Utilized when using CORMIX to model new configurations.

5. Prediction File – provides simulation details such as the predicted geometry for the plume and the velocity along the centerline on the plume in excess of the ambient velocity.

Session and Prediction files for key scenarios are provided in Appendix A – CORMIX Files.

CORMIX outputs are in metric units.

CORMIX will run several modules and evaluate them for fit and present the best fit modules in the Prediction File. If the nature and dimensions of the mixing zone were provided with the input data, then CORMIX notes when mixing zone criteria have been met (or why mixing zone cannot be met).

Model outputs are summarized in Appendix B which pulls key values from the Prediction Files. Table 6-1 presents the modeling scenarios and dimensions of the Outfall 027 plume.

- Jet velocity (fps) is the velocity with which the discharge leaves the outfall/diffuser pipe

- X (ft) is the plume centerline distance, measured from the diffuser, it will travel in the direction of Blacklick Creek flow (downstream) before reaching the target temperature.

- Y (ft) is centerline lateral movement, that the plume will travel laterally before reaching the target temperature.

- Z (ft) is the centerline vertical movement before reaching the target temperature (upward is positive).

- Time (seconds) to achieve target temperature.

6.1 KEY OBSERVATIONS

The following are key observations from this modeling effort:

- During the months of July and July, the allowable excess temperature is 1°F. The low discharge rate of 405 cfs achieves the necessary mixing within approximately 50 ft, before the effluent even reaches the confluence. When HCGS discharges at average or maximum rates of 4,000 gpm and 4,750 gpm, the distance for the plume to achieve 1°F

above ambient is between 150-200 ft from the outfall. The distance to achieve 3°F above ambient, when discharging 4,000 gpm or 4,750 gpm, is less than 10 ft. The plume excess temperature achieves 5°F almost immediately under all discharge conditions.

- The winter excess temperature is 27.4 °F. The diffuser needs to provide rapid mixing during the winter to get to the target excess of 5°F. The low discharge rate of 405 cfs achieves the necessary mixing within 40-50 ft. When HCGS discharges at average or maximum rates of 4,000 gpm or 4,750 gpm, the distance for the plume to achieve 5°F above ambient is approximately 120-170 ft from the outfall.

- A lower contraction ratio (less open orifice) increases discharge velocity providing better mixing. While higher jet velocity can increase mixing, it could also necessitate higher discharge energy and result in greater headloss. This system has sufficient head (potential energy), therefore additional headloss is a non-issue. Higher jet velocity could also cause scouring of the creek bed. A 50 ft length of the creek bed in the path of the discharge would be stabilized with river rock to prevent scour. The discharge nozzles would be directed horizontally outward to avoid breaking the water surface during low creek flow conditions or scouring the creek bed. This study evaluated contraction ratios of 0.85 and 1. The above mixing estimates are based on these values. The study recommends a contraction ratio of 0.6 for the diffuser nozzles. CORMIX is incapable of modeling a contraction ratio of 0.6. Use of contraction ratio of 0.6 would halve the above-mentioned mixing lengths.

- Longer overall header length (small and more numerous nozzles) provides better mixing. However, a longer/larger header pipe would necessitate greater extent of disturbance. The study recommends a diffuser header length between 10-12 ft. Use of a header between 10-12 ft would result in the lower end of the mixing distances mentioned above (with a 0.85 contraction ratio).

- A diffuser/outfall that is out of obvious public attention is preferable. Small diffuser pipes would be easier to conceal under rock. However, smaller pipes can clog easily. Pipe size needs to be balanced to achieve these two competing goals. This study recommends six 8-inch diameter diffusers or eleven 6-inch diffusers.

- The greater the number of nozzles the better mixing. Modeling found that there was no significant benefit from increasing the separation between nozzles.

- Minimum design flow 405 gpm requires less distance to mix than design maximum flow of 4,750 gpm.

- The goal is to have the Outfall 027 discharge fully mixed at the confluence of Blacklick and Two Lick Creeks; that distance is between 150-200 ft from the outfall. Reducing the contraction ratio to 0.6 would likely achieve full mixing between 100-150 ft.

Key results for the second set of model runs are provided in Table 6-1.

Table 6-1: Summary of Prediction Results for the Secondary Modeled Scenarios (Q_{7-10} = 34 cfs)

Scenario Number[2]	Jet Velocity (fps)	X (ft)	Y (ft)	Z (ft)	Time (s)
C301	0.5	0.7	-0.4	0.7	3
C301	0.5	6.1	-3.8	19.0	36
C302	0.5	0.6	0.3	0.7	2
C302	0.5	23.2	-3.4	2.2	179
C303	0.5	0.5	-0.3	0.7	2
C303	0.5	30.1	-2.9	2.2	238
C304	0.5	0.4	-0.2	0.7	1
C304	0.5	0.8	-0.5	0.7	3
C304	0.5	44.5	-2.4	2.2	359
C305	0.5	0.3	-0.2	0.7	1
C305	0.5	0.7	-0.4	0.7	2
C305	0.5	51.2	-2.1	2.2	416
C306	4.5	0.3	-0.2	0.7	1
C306	4.5	0.6	-0.4	0.7	2
C306	4.5	65.5	-1.9	2.2	537
C307	4.2	0.7	-0.4	0.7	3
C307	4.2	6.8	-4.2	1.0	43
C308	4.2	0.6	-0.3	0.7	2
C308	4.2	23.4	-3.4	2.2	182
C309	4.3	0.5	-0.3	0.7	2
C309	4.3	30.3	-2.9	2.2	241

[2] Matching model scenarios numbers represent results for when mixing met 5, 3 and 1 degrees for summer conditions. For scenarios with only two results the first scenario number results represent when both 5 and 3 degree criteria were met.

Scenario Number[2]	Jet Velocity (fps)	X (ft)	Y (ft)	Z (ft)	Time (s)
C310	4.3	0.4	-0.2	0.7	1
C310	4.3	0.8	-0.5	0.7	2
C310	4.3	52.9	-2.4	2.2	431
C311	4.2	0.3	-0.2	0.7	1
C311	4.2	0.7	-0.4	0.7	3
C311	4.2	59.4	-2.1	2.2	487
C312	0.4	0.3	-0.2	0.7	1
C312	0.4	0.9	-0.6	0.7	4
C312	0.4	65.7	-1.9	2.2	540
C313	4.9	0.7	-0.4	0.7	0
C313	4.9	1.3	-0.9	0.7	1
C313	4.9	166.9	54.5	2.2	954
C314	4.9	0.6	-0.3	0.7	0
C314	4.9	1.6	-1.0	0.8	1
C314	4.9	166.0	57.2	2.2	922
C315	5.0	0.5	-0.3	0.7	0
C315	5.0	1.4	-0.9	0.7	1
C315	5.0	165.3	59.5	2.2	875
C316	5.0	0.4	-0.2	0.7	0
C316	5.0	1.9	-1.2	0.8	1
C316	5.0	164.8	61.4	2.2	847
C317	4.8	0.3	-0.2	0.7	0
C317	4.8	2.0	-1.3	0.8	1
C317	4.8	194.0	62.0	2.2	842
C318	4.4	0.3	-0.2	0.7	0
C318	4.4	2.4	-1.5	0.8	1

Scenario Number[2]	Jet Velocity (fps)	X (ft)	Y (ft)	Z (ft)	Time (s)
C318	4.4	217.9	76.6	2.2	1248
C319	4.1	0.7	-0.4	0.7	0
C319	4.1	2.0	-1.3	0.8	1
C319	4.1	166.9	50.9	2.2	1037
C320	4.1	0.6	-0.3	0.7	0
C320	4.1	1.6	-1.0	0.8	1
C320	4.1	166.0	53.8	2.2	992
C321	4.2	0.5	-0.3	0.7	0
C321	4.2	1.9	-1.2	0.8	1
C321	4.2	165.3	56.3	2.2	951
C322	4.2	0.4	-0.2	0.7	0
C322	4.2	2.3	-1.4	0.8	1
C322	4.2	218.4	72.7	2.2	1359
C323	4.1	0.3	-0.2	0.7	0
C323	4.1	2.7	-1.7	0.8	1
C323	4.1	218.2	73.2	2.2	1356
C324	3.8	0.3	-0.2	0.7	0
C324	3.8	47.1	18.2	2.2	175
C324	3.8	223.8	73.2	2.2	1448
C325	5.8	0.7	-0.4	0.7	0
C325	5.8	1.3	-0.9	0.7	1
C325	5.8	166.9	61.2	2.2	799
C326	5.7	0.6	-0.3	0.7	0
C326	5.8	1.6	-1.0	0.8	1
C326	5.8	166.0	63.6	2.2	766
C327	5.9	0.5	-0.3	0.7	0

Scenario Number[2]	Jet Velocity (fps)	X (ft)	Y (ft)	Z (ft)	Time (s)
C327	5.9	1.4	-0.9	0.7	1
C327	5.9	165.3	65.6	2.2	735
C328	5.9	0.4	-0.2	0.8	0
C328	5.9	1.9	-1.2	0.8	1
C328	5.9	164.8	67.3	2.2	711
C329	5.7	0.3	-0.2	0.7	0
C329	5.7	2.0	-1.3	0.8	1
C329	5.7	164.5	67.8	2.2	707
C330	5.3	0.3	-0.2	0.7	0
C330	5.3	2.7	-1.7	0.8	1
C330	5.3	217.9	85.5	2.2	1080
C331	4.9	0.7	-0.4	0.7	0
C331	4.9	2.0	-1.3	0.8	1
C331	4.9	166.9	58.2	2.2	869
C332	4.9	0.6	-0.3	0.7	0
C332	4.9	1.6	-1.0	0.8	1
C332	4.9	166.0	60.7	2.2	832
C333	5.0	0.5	-0.3	0.7	0
C333	5.0	1.9	-1.2	0.8	1
C333	5.0	218.9	80.0	2.2	1173
C334	5.0	0.4	-0.2	0.7	0
C334	5.0	2.3	-1.4	0.8	1
C334	5.0	218.4	82.1	2.2	1141
C335	4.9	0.3	-0.2	0.7	0
C335	4.9	2.7	-1.7	0.8	1
C335	4.9	218.2	82.6	2.2	1139

Scenario Number[2]	Jet Velocity (fps)	X (ft)	Y (ft)	Z (ft)	Time (s)
C336	4.5	0.3	-0.2	0.7	0
C336	4.5	56.7	23.7	2.2	186
C336	4.5	217.9	81.5	2.2	1172
C337	0.5	5.4	-3.4	0.9	31
C338	0.5	11.8	-3.4	2.2	84
C339	0.5	16.8	-2.9	2.2	126
C340	0.5	32.9	-2.4	2.2	262
C341	0.5	43.2	-2.1	2.2	350
C342	0.4	53.2	-1.9	2.2	434
C343	0.4	6.1	-3.8	1.0	38
C344	0.4	11.9	-3.4	2.2	86
C345	0.4	23.0	-2.9	2.2	179
C346	0.4	38.9	-2.4	2.2	313
C347	0.4	43.4	-2.1	2.2	352
C348	0.4	59.0	-1.9	2.2	484
C349	4.9	124.9	41.4	2.2	651
C350	4.9	128.0	45.2	2.2	646
C351	5.0	126.7	46.9	2.2	611
C352	5.0	128.7	49.4	2.2	604
C353	4.8	133.9	51.9	2.2	634
C354	4.4	160.3	60.2	2.2	835
C355	4.1	134.1	41.7	2.2	777
C356	4.1	141.8	46.9	2.2	804
C357	4.2	156.9	54.7	2.2	909
C358	4.2	165.6	58.5	2.2	926
C359	4.1	191.8	66.5	2.2	1132

Scenario Number[2]	Jet Velocity (fps)	X (ft)	Y (ft)	Z (ft)	Time (s)
C360	3.8	189.0	64.8	2.2	1141
C361	9.0	60.1	21.9	2.2	169
C362	5.8	166.0	63.6	2.2	766
C363	4.5	178.1	69.2	2.2	882
C364	5.9	164.8	67.3	2.2	711
C365	5.7	164.5	67.8	2.2	707
C366	5.3	151.5	62.8	2.2	648
C367	4.9	156.2	54.7	2.2	796
C368	4.9	159.3	58.5	2.2	787
C369	5.0	157.1	60.1	2.2	745
C370	5.0	159.1	62.7	2.2	736
C371	4.9	165.8	65.7	2.2	777
C372	4.5	178.1	69.2	2.2	882
C369-50F	5.0	540.3	-81.4	2.2	4198
C369-40F	5.0	352.4	115.2	2.2	2282

6.2 UNCERTAINTIES

All models have limitations and uncertainties. This section discusses key limitations.

1. Both Blacklick and Two Lick Creeks are small. Bedload movement following a major storm could impact the bathymetry of the receiving area and impact mixing potential. Accumulation of debris could also hinder and thereby impact the mixing potential. Maintaining the creek and bank surrounding the outfall in good order is important.

2. This exercise used historical ambient data. If the ambient water temperatures were to change, the mixing potential and the overall distance to achieve the target temperature could also change.

7. RECOMMENDATIONS FOR OUTFALL 027 CONFIGURATION

This study recommends the following configuration for Outfall 027.

- A shoreline diffuser with multiple duck-bill nozzles, seated immediately west of the railroad trestle, and orientated towards the confluence of Blacklick Creek and Two Lick Creek.
- Approximately 50 ft of the creek bed between the outfall and the confluence, measured from the outfall, stabilized with river rock.
- A header pipe between 10-12 ft in length.
- Either six 8-inch diameter diffusers or eleven 6-inch diameter diffusers terminating in duckbill nozzles.
- For the duckbill nozzles to be oriented horizontally and directed towards the confluence.
- Duckbill nozzles with contraction ratio of 0.6 (to achieve partial mixing factor near 1) or contraction ratio of 0.85 to achieve partial mixing factor of 0.9. Note that the model was not capable of evaluation contraction ratio of 0.6.
- The vertical placement of diffuser pipes and nozzles to be such that they would be submerged under $Q_{7\text{-}10}$ conditions in the creek. The header and much of the diffuser pipes to be protected under river rock, with the duckbill nozzles exposed to the creek and discharging directly into the creek.

8. REFERENCES

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HDR (2014), Homer City Station Clean Water Act §316(b) Strategic Planning Document, NRG Homer City Services LLC, *Homer City, Pennsylvania,* September 12, 2014.

Honor Engineering (2025), Water Availability Report Homer City Redevelopment, Honor Engineer Project #: 4087-25001, 4/22/2025.

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StreamStats (2025), USGS, PA20251013125531180000, 2025-10-13 08:55:52 -0400.

APPENDIX A – CORMIX FILES

Scenario 301

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S301U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S301U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--15:42:36
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 4.88 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 14.63 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.49 m
  Port/Nozzle diameter          D0      = 0.1405 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.031794 m
  Total area of openings        TA0     = 0.1706 m^2
  Discharge velocity            U0      = 0.15 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.005239 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000714 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.000785 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000039 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000042 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.03 m          Lm  = 0.63 m          LM  = 0.63 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 9.34
  Port/nozzle Froude number     FRD0    = 4.44
  Velocity ratio                R       = 4.23
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    12.19 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.9605 deg.F
  Dilution at edge of NFR              s = 6.0
  NFR Location:                        x = 2.07 m
    (centerline coordinates)           y = -1.29 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.94 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       40.4785 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 30.74 m downstream.
  Plume contacts second bank at 67.80 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 301

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                    HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S301U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S301U.prd
 Time stamp:        12/21/2025--15:42:36

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     12.19  YB1   =      9.75  YB2   =     14.63
 LD    =      4.88  NOPEN =   11       NRISER=   11       SPAC  =      0.49    NPPERR =    1
 D0    =     0.141 A0    =     0.016 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     0.850 B0    =0.3179E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.150 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.5239E-02         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.7136E-03   j0 =U0*GP0*B0 =0.3854E-04   (based on slot width B0)
 m0 =U0*q0   =0.7849E-03   j0 =q0*GP0    =0.4239E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.035 lM    =     0.63  lm    =      0.63
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.3480E-02  J0    =0.1879E-03
 Associated 3-d length scales (meters)
 LQ    =      0.12  LM    =      1.05  Lm    =      1.75  Lb    =      4.65
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      9.34  FRD0  =      4.44  R     =      4.23  PL    =    4.46
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     0.150 D0    =     0.141 A0    =     0.016 THETA =      0.00
 FR0   =      9.34  FRD0  =      4.44  R     =      4.23
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        12.19 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.03     2.44     0.120   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.03     2.44 .00000E+00
      0.21    -0.13    0.21     2.6 0.224E+01   0.07     2.31 .26164E+01
      0.41    -0.26    0.22     3.3 0.178E+01   0.13     2.21 .59853E+01
      0.62    -0.39    0.23     3.8 0.154E+01   0.20     2.14 .97178E+01
      0.83    -0.52    0.24     4.2 0.139E+01   0.26     2.08 .13696E+02
      1.03    -0.65    0.25     4.6 0.127E+01   0.33     2.03 .17860E+02
      1.24    -0.78    0.26     4.9 0.118E+01   0.40     1.99 .22172E+02
```

Scenario 302

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S302U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S302U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--15:46:31
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.96 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.72 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.40 m
  Port/Nozzle diameter          D0      = 0.1405 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.039131 m
  Total area of openings        TA0     = 0.1706 m^2
  Discharge velocity            U0      = 0.15 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.006448 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000878 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.000966 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000047 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000052 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.04 m          Lm  = 0.77 m          LM  = 0.67 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 8.42
  Port/nozzle Froude number     FRD0    = 4.44
  Velocity ratio                R       = 4.23
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.73 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 1.1303 deg.F
  Dilution at edge of NFR              s = 5.1
  NFR Location:                        x = 1.68 m
    (centerline coordinates)           y = -1.05 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.53 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       30.6564 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 28.69 m downstream.
  Plume contacts second bank at 71.02 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

```
      1.45    -0.90    0.27     5.2 0.111E+01   0.46     1.97 .26606E+02
      1.65    -1.03    0.28     5.5 0.105E+01   0.53     1.95 .31144E+02
      1.86    -1.16    0.29     5.8 0.100E+01   0.60     1.94 .35772E+02
      2.07    -1.29    0.30     6.0 0.960E+00   0.66     1.94 .40479E+02
 Cumulative travel time =          40.4785 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.66 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      2.07    -1.29    0.66     6.0 0.960E+00   0.66     3.21    0.66    0.00   .40479E+02
      4.94    -1.29    0.66     6.7 0.864E+00   0.50     4.70    0.66    0.16   .11932E+03
      7.80    -1.29    0.66     7.2 0.802E+00   0.42     5.98    0.66    0.24   .19816E+03
     10.67    -1.29    0.66     7.7 0.752E+00   0.38     7.13    0.66    0.28   .27699E+03
     13.54    -1.29    0.66     8.1 0.708E+00   0.35     8.19    0.66    0.31   .35583E+03
     16.40    -1.29    0.66     8.6 0.668E+00   0.33     9.18    0.66    0.33   .43467E+03
     19.27    -1.29    0.66     9.1 0.630E+00   0.32    10.12    0.66    0.35   .51351E+03
     22.14    -1.29    0.66     9.6 0.593E+00   0.31    11.01    0.66    0.35   .59235E+03
     25.01    -1.29    0.66    10.2 0.557E+00   0.30    11.87    0.66    0.36   .67119E+03
     27.87    -1.29    0.66    10.9 0.523E+00   0.30    12.69    0.66    0.36   .75003E+03
     30.74    -1.29    0.66    11.6 0.490E+00   0.30    13.48    0.66    0.36   .82887E+03
 Cumulative travel time =         828.8652 sec  (    0.23 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     30.74    12.19    0.66    11.6 0.490E+00   0.30    26.97    0.66    0.36   .82887E+03
     34.45    12.19    0.66    12.4 0.455E+00   0.31    27.97    0.66    0.35   .93076E+03
     38.15    12.19    0.66    13.3 0.423E+00   0.32    28.96    0.66    0.34   .10326E+04
     41.86    12.19    0.66    14.3 0.393E+00   0.34    29.92    0.66    0.33   .11345E+04
     45.57    12.19    0.66    15.4 0.365E+00   0.35    30.87    0.66    0.31   .12364E+04
     49.27    12.19    0.66    16.5 0.340E+00   0.36    31.80    0.66    0.30   .13383E+04
     52.98    12.19    0.66    17.6 0.316E+00   0.38    32.72    0.66    0.28   .14402E+04
     56.68    12.19    0.66    18.9 0.295E+00   0.39    33.62    0.66    0.27   .15421E+04
     60.39    12.19    0.66    20.2 0.275E+00   0.41    34.51    0.66    0.25   .16440E+04
     64.09    12.19    0.66    21.5 0.257E+00   0.43    35.38    0.66    0.23   .17459E+04
     67.80    12.19    0.66    23.0 0.240E+00   0.45    36.24    0.66    0.22   .18478E+04
 Cumulative travel time =        1847.7788 sec  (    0.51 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     67.80    12.19    0.66    23.0 0.240E+00   0.45    36.24    0.66    0.22   .18478E+04
    213.42    12.19    0.66    38.7 0.127E+00   0.75    36.24    0.66    0.00   .58515E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    359.04    12.19    0.66    38.7 0.114E+00   0.75    36.24    0.66    0.00   .98553E+04
    504.66    12.19    0.66    38.7 0.102E+00   0.75    36.24    0.66    0.00   .13859E+05
    650.28    12.19    0.66    38.7 0.908E-01   0.75    36.24    0.66    0.00   .17863E+05
    795.90    12.19    0.66    38.7 0.811E-01   0.75    36.24    0.66    0.00   .21867E+05
    941.52    12.19    0.66    38.7 0.724E-01   0.75    36.24    0.66    0.00   .25870E+05
   1087.14    12.19    0.66    38.7 0.647E-01   0.75    36.24    0.66    0.00   .29874E+05
   1232.76    12.19    0.66    38.7 0.578E-01   0.75    36.24    0.66    0.00   .33878E+05
   1378.38    12.19    0.66    38.7 0.516E-01   0.75    36.24    0.66    0.00   .37882E+05
   1524.00    12.19    0.66    38.7 0.461E-01   0.75    36.24    0.66    0.00   .41885E+05
 Cumulative travel time =       41885.3945 sec  (   11.63 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 302

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S302U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S302U.prd
 Time stamp:        12/21/2025--15:46:31

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.73  YB1   =      9.75  YB2   =     13.72
 LD    =      3.96  NOPEN =   11       NRISER=   11       SPAC  =      0.40    NPPERR =    1
 D0    =     0.141 A0    =     0.016 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     0.850 B0    =0.3913E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.150 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.6448E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.8782E-03   j0 =U0*GP0*B0 =0.4743E-04   (based on slot width B0)
 m0 =U0*q0   =0.9661E-03   j0 =q0*GP0    =0.5217E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.043 lM    =      0.67  lm    =      0.77
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.3480E-02  J0    =0.1879E-03
 Associated 3-d length scales (meters)
 LQ    =      0.12  LM    =      1.05  Lm    =      1.75  Lb    =      4.65
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      8.42  FRD0  =      4.44  R     =      4.23  PL    =    3.37
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.150 D0    =      0.141 A0    =      0.016 THETA =      0.00
 FR0   =      8.42  FRD0  =      4.44  R     =      4.23
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.73 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.03     1.98     0.120   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.03     1.98 .00000E+00
      0.17    -0.10    0.21     2.3 0.251E+01   0.07     1.87 .19736E+01
      0.34    -0.21    0.22     2.8 0.204E+01   0.13     1.78 .45007E+01
      0.50    -0.31    0.23     3.3 0.178E+01   0.20     1.71 .73066E+01
      0.67    -0.42    0.23     3.6 0.161E+01   0.26     1.66 .10306E+02
      0.84    -0.52    0.24     3.9 0.148E+01   0.33     1.62 .13453E+02
      1.01    -0.63    0.25     4.2 0.138E+01   0.40     1.58 .16719E+02
```

Scenario 303

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S303U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S303U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--15:49:29
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.35 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.11 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.67 m
  Port/Nozzle diameter          D0      = 0.1883 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.041519 m
  Total area of openings        TA0     = 0.1670 m^2
  Discharge velocity            U0      = 0.15 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.007621 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000971 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.001166 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000051 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000062 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.05 m          Lm  = 0.93 m          LM  = 0.70 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 8.35
  Port/nozzle Froude number     FRD0   = 3.92
  Velocity ratio                R      = 4.32
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.43 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 1.2782 deg.F
  Dilution at edge of NFR              s = 4.5
  NFR Location:                        x = 1.42 m
    (centerline coordinates)           y = -0.89 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.27 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       24.2469 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 27.33 m downstream.
  Plume contacts second bank at 73.12 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ***********************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

```
      1.18    -0.73    0.26     4.5 0.130E+01   0.46     1.56 .20086E+02
      1.34    -0.84    0.26     4.7 0.124E+01   0.53     1.55 .23537E+02
      1.51    -0.94    0.27     4.9 0.118E+01   0.60     1.54 .27064E+02
      1.68    -1.05    0.28     5.1 0.113E+01   0.66     1.53 .30656E+02
 Cumulative travel time =          30.6564 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.78 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      1.68    -1.05    0.66     5.1 0.113E+01   0.66     2.73    0.66    0.00   .30656E+02
      4.38    -1.05    0.66     5.8 0.100E+01   0.48     4.23    0.66    0.18   .10491E+03
      7.08    -1.05    0.66     6.2 0.928E+00   0.40     5.49    0.66    0.26   .17916E+03
      9.78    -1.05    0.66     6.6 0.869E+00   0.35     6.62    0.66    0.31   .25341E+03
     12.48    -1.05    0.66     7.0 0.819E+00   0.32     7.65    0.66    0.34   .32766E+03
     15.18    -1.05    0.66     7.4 0.772E+00   0.30     8.62    0.66    0.36   .40191E+03
     17.88    -1.05    0.66     7.9 0.728E+00   0.29     9.53    0.66    0.37   .47616E+03
     20.58    -1.05    0.66     8.3 0.686E+00   0.28    10.39    0.66    0.38   .55041E+03
     23.28    -1.05    0.66     8.8 0.645E+00   0.28    11.22    0.66    0.38   .62466E+03
     25.99    -1.05    0.66     9.4 0.606E+00   0.27    12.02    0.66    0.39   .69891E+03
     28.69    -1.05    0.66    10.0 0.568E+00   0.27    12.79    0.66    0.39   .77316E+03
 Cumulative travel time =         773.1610 sec  (    0.21 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     28.69    11.73    0.66    10.0 0.568E+00   0.27    25.57    0.66    0.39   .77316E+03
     32.92    11.73    0.66    10.9 0.520E+00   0.29    26.75    0.66    0.38   .88957E+03
     37.15    11.73    0.66    11.8 0.476E+00   0.30    27.89    0.66    0.36   .10060E+04
     41.39    11.73    0.66    12.9 0.436E+00   0.31    29.01    0.66    0.35   .11224E+04
     45.62    11.73    0.66    14.0 0.400E+00   0.33    30.10    0.66    0.33   .12388E+04
     49.86    11.73    0.66    15.2 0.367E+00   0.34    31.17    0.66    0.32   .13552E+04
     54.09    11.73    0.66    16.5 0.337E+00   0.36    32.22    0.66    0.30   .14716E+04
     58.32    11.73    0.66    17.9 0.310E+00   0.38    33.25    0.66    0.28   .15880E+04
     62.56    11.73    0.66    19.4 0.285E+00   0.40    34.27    0.66    0.26   .17044E+04
     66.79    11.73    0.66    20.9 0.263E+00   0.42    35.26    0.66    0.24   .18208E+04
     71.02    11.73    0.66    22.6 0.243E+00   0.44    36.24    0.66    0.22   .19373E+04
 Cumulative travel time =        1937.2533 sec  (    0.54 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     71.02    11.73    0.66    22.6 0.243E+00   0.44    36.24    0.66    0.22   .19373E+04
    216.32    11.73    0.66    38.7 0.127E+00   0.75    36.24    0.66    0.00   .59322E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    361.62    11.73    0.66    38.7 0.113E+00   0.75    36.24    0.66    0.00   .99270E+04
    506.92    11.73    0.66    38.7 0.101E+00   0.75    36.24    0.66    0.00   .13922E+05
    652.21    11.73    0.66    38.7 0.906E-01   0.75    36.24    0.66    0.00   .17917E+05
    797.51    11.73    0.66    38.7 0.810E-01   0.75    36.24    0.66    0.00   .21912E+05
    942.81    11.73    0.66    38.7 0.723E-01   0.75    36.24    0.66    0.00   .25907E+05
   1088.11    11.73    0.66    38.7 0.646E-01   0.75    36.24    0.66    0.00   .29902E+05
   1233.41    11.73    0.66    38.7 0.578E-01   0.75    36.24    0.66    0.00   .33896E+05
   1378.70    11.73    0.66    38.7 0.516E-01   0.75    36.24    0.66    0.00   .37891E+05
   1524.00    11.73    0.66    38.7 0.461E-01   0.75    36.24    0.66    0.00   .41886E+05
 Cumulative travel time =       41886.2344 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 303

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                    HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S303U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S303U.prd
 Time stamp:        12/21/2025--15:49:29

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.43  YB1   =      9.75  YB2   =     13.11
 LD    =      3.35  NOPEN =    6       NRISER=    6       SPAC  =      0.67    NPPERR =    1
 D0    =     0.188 A0    =     0.028 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     0.850 B0    =0.4152E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.153 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7621E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9714E-03   j0 =U0*GP0*B0 =0.5138E-04   (based on slot width B0)
 m0 =U0*q0   =0.1166E-02   j0 =q0*GP0    =0.6166E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.050 lM    =     0.70  lm    =      0.93
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.3257E-02  J0    =0.1723E-03
 Associated 3-d length scales (meters)
 LQ    =      0.17  LM    =      1.04  Lm    =      1.76  Lb    =      4.65
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      8.35  FRD0  =      3.92  R     =      4.32  PL    =    4.27
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     0.153 D0    =     0.188 A0    =     0.028 THETA =      0.00
 FR0   =      8.35  FRD0  =      3.92  R     =      4.32
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
       11.43 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.03     1.68     0.123   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.03     1.68 .00000E+00
     0.14    -0.09    0.21     2.1 0.274E+01   0.07     1.57 .15576E+01
     0.28    -0.18    0.22     2.6 0.225E+01   0.13     1.49 .35416E+01
     0.43    -0.27    0.22     2.9 0.197E+01   0.20     1.43 .57478E+01
     0.57    -0.36    0.23     3.2 0.179E+01   0.26     1.38 .81106E+01
     0.71    -0.44    0.24     3.5 0.166E+01   0.33     1.34 .10595E+02
     0.85    -0.53    0.24     3.7 0.155E+01   0.40     1.31 .13178E+02
```

Scenario 304

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S304U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S304U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--15:51:38
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.74 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.50 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.55 m
  Port/Nozzle diameter          D0      = 0.1883 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.050746 m
  Total area of openings        TA0     = 0.1670 m^2
  Discharge velocity            U0      = 0.15 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.009314 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.001187 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.001425 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000063 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000075 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 1.13 m          LM  = 0.75 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 7.55
  Port/nozzle Froude number     FRD0    = 3.92
  Velocity ratio                R       = 4.32
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.13 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 1.4848 deg.F
  Dilution at edge of NFR              s = 3.9
  NFR Location:                        x = 1.16 m
    (centerline coordinates)           y = -0.73 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.01 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       18.3888 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 25.97 m downstream.
  Plume contacts second bank at 75.27 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

```
      1.00    -0.62    0.25     4.0 0.146E+01   0.46     1.29 .15845E+02
      1.14    -0.71    0.26     4.2 0.139E+01   0.53     1.28 .18585E+02
      1.28    -0.80    0.26     4.4 0.133E+01   0.60     1.27 .21388E+02
      1.42    -0.89    0.27     4.5 0.128E+01   0.66     1.27 .24247E+02
 Cumulative travel time =          24.2469 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.90 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      1.42    -0.89    0.66     4.5 0.128E+01   0.66     2.41    0.66    0.00   .24247E+02
      4.01    -0.89    0.66     5.2 0.112E+01   0.46     3.92    0.66    0.20   .95468E+02
      6.60    -0.89    0.66     5.6 0.103E+01   0.38     5.17    0.66    0.28   .16669E+03
      9.19    -0.89    0.66     6.0 0.968E+00   0.33     6.28    0.66    0.33   .23791E+03
     11.78    -0.89    0.66     6.3 0.911E+00   0.30     7.30    0.66    0.36   .30913E+03
     14.37    -0.89    0.66     6.7 0.859E+00   0.28     8.25    0.66    0.38   .38035E+03
     16.96    -0.89    0.66     7.1 0.810E+00   0.27     9.14    0.66    0.39   .45157E+03
     19.55    -0.89    0.66     7.5 0.764E+00   0.26     9.99    0.66    0.40   .52279E+03
     22.14    -0.89    0.66     7.9 0.718E+00   0.26    10.80    0.66    0.40   .59401E+03
     24.73    -0.89    0.66     8.4 0.675E+00   0.26    11.57    0.66    0.41   .66523E+03
     27.33    -0.89    0.66     9.0 0.633E+00   0.26    12.32    0.66    0.41   .73646E+03
 Cumulative travel time =         736.4554 sec  (    0.20 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     27.33    11.43    0.66     9.0 0.633E+00   0.26    24.65    0.66    0.41   .73646E+03
     31.90    11.43    0.66     9.9 0.573E+00   0.27    25.94    0.66    0.39   .86237E+03
     36.48    11.43    0.66    10.9 0.519E+00   0.28    27.19    0.66    0.38   .98829E+03
     41.06    11.43    0.66    11.9 0.471E+00   0.30    28.41    0.66    0.37   .11142E+04
     45.64    11.43    0.66    13.1 0.427E+00   0.31    29.60    0.66    0.35   .12401E+04
     50.22    11.43    0.66    14.4 0.388E+00   0.33    30.77    0.66    0.33   .13660E+04
     54.80    11.43    0.66    15.8 0.353E+00   0.35    31.91    0.66    0.31   .14920E+04
     59.38    11.43    0.66    17.2 0.321E+00   0.37    33.02    0.66    0.29   .16179E+04
     63.96    11.43    0.66    18.8 0.293E+00   0.39    34.11    0.66    0.27   .17438E+04
     68.54    11.43    0.66    20.5 0.268E+00   0.41    35.19    0.66    0.25   .18697E+04
     73.12    11.43    0.66    22.3 0.246E+00   0.43    36.24    0.66    0.23   .19956E+04
 Cumulative travel time =        1995.6318 sec  (    0.55 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     73.12    11.43    0.66    22.3 0.246E+00   0.43    36.24    0.66    0.23   .19956E+04
    218.21    11.43    0.66    38.7 0.127E+00   0.75    36.24    0.66    0.00   .59848E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    363.30    11.43    0.66    38.7 0.113E+00   0.75    36.24    0.66    0.00   .99739E+04
    508.39    11.43    0.66    38.7 0.101E+00   0.75    36.24    0.66    0.00   .13963E+05
    653.47    11.43    0.66    38.7 0.905E-01   0.75    36.24    0.66    0.00   .17952E+05
    798.56    11.43    0.66    38.7 0.809E-01   0.75    36.24    0.66    0.00   .21941E+05
    943.65    11.43    0.66    38.7 0.723E-01   0.75    36.24    0.66    0.00   .25930E+05
   1088.74    11.43    0.66    38.7 0.646E-01   0.75    36.24    0.66    0.00   .29920E+05
   1233.82    11.43    0.66    38.7 0.577E-01   0.75    36.24    0.66    0.00   .33909E+05
   1378.91    11.43    0.66    38.7 0.516E-01   0.75    36.24    0.66    0.00   .37898E+05
   1524.00    11.43    0.66    38.7 0.461E-01   0.75    36.24    0.66    0.00   .41887E+05
 Cumulative travel time =       41886.9336 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 304

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S304U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S304U.prd
 Time stamp:        12/21/2025--15:51:38

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.13  YB1   =      9.75  YB2   =     12.50
 LD    =      2.74  NOPEN =    6       NRISER=    6       SPAC  =      0.55    NPPERR =    1
 D0    =     0.188 A0    =     0.028 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     0.850 B0    =0.5075E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.153 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.9314E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1187E-02    j0 =U0*GP0*B0 =0.6280E-04   (based on slot width B0)
 m0 =U0*q0   =0.1425E-02    j0 =q0*GP0    =0.7536E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.061 lM    =     0.75  lm    =      1.13
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.3257E-02  J0    =0.1723E-03
 Associated 3-d length scales (meters)
 LQ    =      0.17  LM    =      1.04  Lm    =      1.76  Lb    =      4.65
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      7.55  FRD0  =      3.92  R     =      4.32  PL    =    3.21
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     0.153 D0    =     0.188 A0    =     0.028 THETA =      0.00
 FR0   =      7.55  FRD0  =      3.92  R     =      4.32
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.13 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.04     1.37     0.123   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.04     1.37 .00000E+00
     0.12    -0.07    0.21     1.9 0.302E+01   0.07     1.28 .11913E+01
     0.23    -0.15    0.21     2.3 0.252E+01   0.13     1.21 .26909E+01
     0.35    -0.22    0.22     2.6 0.224E+01   0.20     1.15 .43567E+01
     0.47    -0.29    0.23     2.8 0.204E+01   0.26     1.11 .61419E+01
     0.58    -0.36    0.23     3.1 0.190E+01   0.33     1.08 .80211E+01
     0.70    -0.44    0.24     3.3 0.178E+01   0.40     1.05 .99779E+01
```

```
      0.81    -0.51    0.24     3.4 0.169E+01   0.46     1.03 .12001E+02
      0.93    -0.58    0.25     3.6 0.161E+01   0.53     1.02 .14081E+02
      1.05    -0.65    0.25     3.8 0.154E+01   0.60     1.01 .16212E+02
      1.16    -0.73    0.26     3.9 0.148E+01   0.66     1.01 .18389E+02
 Cumulative travel time =          18.3888 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  2.05 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y        Z        S        C        BV       BH       ZU       ZL       TT
      1.16    -0.73    0.66     3.9 0.148E+01   0.66     2.07     0.66     0.00   .18389E+02
      3.64    -0.73    0.66     4.5 0.128E+01   0.44     3.60     0.66     0.22   .86598E+02
      6.12    -0.73    0.66     4.9 0.118E+01   0.36     4.85     0.66     0.31   .15481E+03
      8.61    -0.73    0.66     5.2 0.110E+01   0.31     5.94     0.66     0.35   .22301E+03
     11.09    -0.73    0.66     5.6 0.103E+01   0.28     6.94     0.66     0.38   .29122E+03
     13.57    -0.73    0.66     5.9 0.975E+00   0.26     7.87     0.66     0.40   .35943E+03
     16.05    -0.73    0.66     6.2 0.920E+00   0.25     8.75     0.66     0.41   .42764E+03
     18.53    -0.73    0.66     6.6 0.866E+00   0.24     9.57     0.66     0.42   .49585E+03
     21.01    -0.73    0.66     7.0 0.815E+00   0.24    10.37     0.66     0.42   .56406E+03
     23.49    -0.73    0.66     7.5 0.765E+00   0.24    11.12     0.66     0.43   .63227E+03
     25.97    -0.73    0.66     7.9 0.717E+00   0.24    11.86     0.66     0.43   .70048E+03
 Cumulative travel time =         700.4760 sec  (    0.19 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH       ZU       ZL       TT
     25.97    11.13    0.66     7.9 0.717E+00   0.24    23.71     0.66     0.43   .70048E+03
     30.90    11.13    0.66     8.8 0.642E+00   0.25    25.12     0.66     0.41   .83602E+03
     35.83    11.13    0.66     9.8 0.574E+00   0.26    26.49     0.66     0.40   .97156E+03
     40.76    11.13    0.66    10.9 0.514E+00   0.28    27.81     0.66     0.38   .11071E+04
     45.69    11.13    0.66    12.2 0.461E+00   0.29    29.10     0.66     0.37   .12427E+04
     50.62    11.13    0.66    13.5 0.413E+00   0.31    30.36     0.66     0.35   .13782E+04
     55.55    11.13    0.66    15.0 0.372E+00   0.33    31.59     0.66     0.33   .15137E+04
     60.48    11.13    0.66    16.5 0.335E+00   0.35    32.79     0.66     0.31   .16493E+04
     65.41    11.13    0.66    18.2 0.303E+00   0.38    33.96     0.66     0.28   .17848E+04
     70.34    11.13    0.66    20.0 0.274E+00   0.40    35.11     0.66     0.26   .19204E+04
     75.27    11.13    0.66    22.0 0.249E+00   0.43    36.24     0.66     0.23   .20559E+04
 Cumulative travel time =        2055.9143 sec  (    0.57 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH       ZU       ZL       TT
     75.27    11.13    0.66    22.0 0.249E+00   0.43    36.24     0.66     0.23   .20559E+04
    220.14    11.13    0.66    38.7 0.127E+00   0.75    36.24     0.66     0.00   .60391E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    365.02    11.13    0.66    38.7 0.113E+00   0.75    36.24     0.66     0.00   .10022E+05
    509.89    11.13    0.66    38.7 0.101E+00   0.75    36.24     0.66     0.00   .14006E+05
    654.76    11.13    0.66    38.7 0.904E-01   0.75    36.24     0.66     0.00   .17989E+05
    799.63    11.13    0.66    38.7 0.808E-01   0.75    36.24     0.66     0.00   .21972E+05
    944.51    11.13    0.66    38.7 0.722E-01   0.75    36.24     0.66     0.00   .25955E+05
   1089.38    11.13    0.66    38.7 0.646E-01   0.75    36.24     0.66     0.00   .29938E+05
   1234.25    11.13    0.66    38.7 0.577E-01   0.75    36.24     0.66     0.00   .33922E+05
   1379.13    11.13    0.66    38.7 0.516E-01   0.75    36.24     0.66     0.00   .37905E+05
   1524.00    11.13    0.66    38.7 0.461E-01   0.75    36.24     0.66     0.00   .41888E+05
 Cumulative travel time =       41888.1797 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 305

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S305U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S305U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--15:53:40
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.44 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.19 m
  Number of openings            NOPEN   = 4
  Number of Risers              NRISER = 4
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.81 m
  Port/Nozzle diameter          D0      = 0.2332 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.052567 m
  Total area of openings        TA0     = 0.1709 m^2
  Discharge velocity            U0      = 0.15 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.010479 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.001175 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.001567 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000064 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000085 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 1.25 m          LM  = 0.74 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 7.25
  Port/nozzle Froude number     FRD0   = 3.44
  Velocity ratio                R      = 4.22
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.97 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 1.6286 deg.F
  Dilution at edge of NFR              s = 3.6
  NFR Location:                        x = 1.03 m
    (centerline coordinates)           y = -0.65 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 0.89 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       15.7495 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 25.32 m downstream.
  Plume contacts second bank at 76.37 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ***********************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 305

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------

CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S305U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S305U.prd
 Time stamp:        12/21/2025--15:53:40

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.97  YB1   =      9.75  YB2   =     12.19
 LD    =      2.44  NOPEN =    4       NRISER=    4       SPAC  =      0.81    NPPERR =    1
 D0    =     0.233 A0    =     0.043 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.253 CR0   =     0.850 B0    =0.5257E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.150 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1048E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1175E-02   j0 =U0*GP0*B0 =0.6359E-04   (based on slot width B0)
 m0 =U0*q0   =0.1567E-02   j0 =q0*GP0    =0.8478E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.070 lM    =     0.74  lm    =      1.25
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2865E-02  J0    =0.1550E-03
 Associated 3-d length scales (meters)
 LQ    =      0.21  LM    =      0.99  Lm    =      1.74  Lb    =      4.65
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      7.25  FRD0  =      3.44  R     =      4.22  PL    =    3.88
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     0.150 D0    =     0.233 A0    =     0.043 THETA =      0.00
 FR0   =      7.25  FRD0  =      3.44  R     =      4.22
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.97 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.04     1.22     0.119   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.04     1.22 .00000E+00
      0.10    -0.06    0.21     1.8 0.320E+01   0.07     1.13 .10329E+01
      0.21    -0.13    0.21     2.1 0.270E+01   0.13     1.07 .23197E+01
      0.31    -0.19    0.22     2.4 0.241E+01   0.20     1.02 .37456E+01
      0.41    -0.26    0.22     2.6 0.221E+01   0.26     0.98 .52724E+01
      0.52    -0.32    0.23     2.8 0.206E+01   0.33     0.95 .68792E+01
      0.62    -0.39    0.23     3.0 0.194E+01   0.40     0.93 .85524E+01
```

```
      0.72    -0.45    0.24     3.1 0.185E+01   0.46     0.91 .10282E+02
      0.83    -0.52    0.24     3.3 0.176E+01   0.53     0.90 .12062E+02
      0.93    -0.58    0.25     3.4 0.169E+01   0.60     0.89 .13886E+02
      1.03    -0.65    0.25     3.6 0.163E+01   0.66     0.89 .15750E+02
 Cumulative travel time =          15.7495 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  2.13 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
      1.03    -0.65    0.66     3.6 0.163E+01   0.66     1.89    0.66    0.00   .15750E+02
      3.46    -0.65    0.66     4.2 0.139E+01   0.42     3.44    0.66    0.24   .82515E+02
      5.89    -0.65    0.66     4.5 0.127E+01   0.34     4.68    0.66    0.32   .14928E+03
      8.32    -0.65    0.66     4.9 0.119E+01   0.30     5.77    0.66    0.37   .21604E+03
     10.75    -0.65    0.66     5.2 0.112E+01   0.27     6.76    0.66    0.39   .28281E+03
     13.18    -0.65    0.66     5.5 0.105E+01   0.25     7.68    0.66    0.41   .34958E+03
     15.60    -0.65    0.66     5.8 0.992E+00   0.24     8.55    0.66    0.42   .41634E+03
     18.03    -0.65    0.66     6.1 0.934E+00   0.23     9.37    0.66    0.43   .48311E+03
     20.46    -0.65    0.66     6.5 0.878E+00   0.23    10.15    0.66    0.44   .54987E+03
     22.89    -0.65    0.66     6.9 0.824E+00   0.22    10.90    0.66    0.44   .61664E+03
     25.32    -0.65    0.66     7.4 0.772E+00   0.22    11.62    0.66    0.44   .68340E+03
 Cumulative travel time =         683.4011 sec  (    0.19 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
     25.32    10.97    0.66     7.4 0.772E+00   0.22    23.24    0.66    0.44   .68340E+03
     30.42    10.97    0.66     8.3 0.685E+00   0.24    24.71    0.66    0.43   .82377E+03
     35.53    10.97    0.66     9.3 0.608E+00   0.25    26.14    0.66    0.41   .96414E+03
     40.63    10.97    0.66    10.4 0.541E+00   0.27    27.52    0.66    0.40   .11045E+04
     45.74    10.97    0.66    11.6 0.481E+00   0.28    28.85    0.66    0.38   .12449E+04
     50.84    10.97    0.66    13.0 0.429E+00   0.30    30.16    0.66    0.36   .13853E+04
     55.95    10.97    0.66    14.5 0.383E+00   0.32    31.43    0.66    0.34   .15256E+04
     61.05    10.97    0.66    16.1 0.343E+00   0.35    32.67    0.66    0.31   .16660E+04
     66.16    10.97    0.66    17.9 0.309E+00   0.37    33.88    0.66    0.29   .18064E+04
     71.27    10.97    0.66    19.8 0.278E+00   0.40    35.08    0.66    0.27   .19467E+04
     76.37    10.97    0.66    21.8 0.251E+00   0.42    36.24    0.66    0.24   .20871E+04
 Cumulative travel time =       2087.1160 sec  (    0.58 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
     76.37    10.97    0.66    21.8 0.251E+00   0.42    36.24    0.66    0.24   .20871E+04
    221.13    10.97    0.66    38.7 0.126E+00   0.75    36.24    0.66    0.00   .60673E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    365.90    10.97    0.66    38.7 0.113E+00   0.75    36.24    0.66    0.00   .10048E+05
    510.66    10.97    0.66    38.7 0.101E+00   0.75    36.24    0.66    0.00   .14028E+05
    655.42    10.97    0.66    38.7 0.903E-01   0.75    36.24    0.66    0.00   .18008E+05
    800.19    10.97    0.66    38.7 0.808E-01   0.75    36.24    0.66    0.00   .21988E+05
    944.95    10.97    0.66    38.7 0.722E-01   0.75    36.24    0.66    0.00   .25968E+05
   1089.71    10.97    0.66    38.7 0.645E-01   0.75    36.24    0.66    0.00   .29948E+05
   1234.47    10.97    0.66    38.7 0.577E-01   0.75    36.24    0.66    0.00   .33929E+05
   1379.24    10.97    0.66    38.7 0.516E-01   0.75    36.24    0.66    0.00   .37909E+05
   1524.00    10.97    0.66    38.7 0.461E-01   0.75    36.24    0.66    0.00   .41889E+05
 Cumulative travel time =      41889.0977 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 306

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S306U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S306U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--10:17:21
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.13 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 11.89 m
  Number of openings            NOPEN   = 3
  Number of Risers              NRISER = 3
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 1.07 m
  Port/Nozzle diameter          D0      = 0.2810 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.058137 m
  Total area of openings        TA0     = 0.1861 m^2
  Discharge velocity            U0      = 0.14 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.011976 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.001096 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.001645 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000065 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000097 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.09 m          Lm  = 1.31 m          LM  = 0.68 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 6.33
  Port/nozzle Froude number     FRD0   = 2.88
  Velocity ratio                R      = 3.88
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.82 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 1.8368 deg.F
  Dilution at edge of NFR              s = 3.2
  NFR Location:                        x = 0.90 m
    (centerline coordinates)           y = -0.57 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 0.77 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       13.5176 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 24.72 m downstream.
  Plume contacts second bank at 77.53 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ***********************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 306

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S306U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S306U.prd
 Time stamp:        12/21/2025--10:17:21

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.82  YB1   =      9.75  YB2   =     11.89
 LD    =      2.13  NOPEN =    3       NRISER=    3       SPAC  =      1.07    NPPERR =    1
 D0    =     0.281 A0    =     0.062 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.305 CR0   =     0.850 B0    =0.5814E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.137 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1198E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1096E-02   j0 =U0*GP0*B0 =0.6459E-04   (based on slot width B0)
 m0 =U0*q0   =0.1645E-02   j0 =q0*GP0    =0.9689E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.087 lM    =     0.68  lm    =      1.31
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2339E-02  J0    =0.1378E-03
 Associated 3-d length scales (meters)
 LQ    =      0.25  LM    =      0.91  Lm    =      1.67  Lb    =      4.65
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      6.33  FRD0  =      2.88  R     =      3.88  PL    =    4.26
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     0.137 D0    =     0.281 A0    =     0.062 THETA =      0.00
 FR0   =      6.33  FRD0  =      2.88  R     =      3.88
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.82 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.05     1.07     0.107   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.05     1.07 .00000E+00
      0.09    -0.06    0.21     1.7 0.345E+01   0.07     0.99 .91133E+00
      0.18    -0.11    0.21     2.0 0.295E+01   0.13     0.93 .20259E+01
      0.27    -0.17    0.22     2.2 0.266E+01   0.20     0.89 .32534E+01
      0.36    -0.23    0.22     2.4 0.245E+01   0.26     0.85 .45636E+01
      0.45    -0.28    0.22     2.5 0.230E+01   0.33     0.83 .59398E+01
      0.54    -0.34    0.23     2.7 0.217E+01   0.40     0.81 .73710E+01
```

```
      0.63    -0.40    0.23     2.8 0.207E+01   0.46     0.79 .88496E+01
      0.72    -0.45    0.24     2.9 0.198E+01   0.53     0.78 .10370E+02
      0.81    -0.51    0.24     3.0 0.190E+01   0.60     0.78 .11927E+02
      0.90    -0.57    0.25     3.2 0.184E+01   0.66     0.77 .13518E+02
 Cumulative travel time =          13.5176 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  2.17 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      0.90    -0.57    0.66     3.2 0.184E+01   0.66     1.68    0.66    0.00   .13518E+02
      3.29    -0.57    0.66     3.7 0.155E+01   0.40     3.25    0.66    0.26   .79006E+02
      5.67    -0.57    0.66     4.1 0.141E+01   0.32     4.50    0.66    0.34   .14449E+03
      8.05    -0.57    0.66     4.4 0.131E+01   0.28     5.59    0.66    0.39   .20998E+03
     10.43    -0.57    0.66     4.7 0.123E+01   0.25     6.58    0.66    0.41   .27547E+03
     12.81    -0.57    0.66     5.0 0.116E+01   0.23     7.49    0.66    0.43   .34096E+03
     15.20    -0.57    0.66     5.3 0.109E+01   0.22     8.35    0.66    0.44   .40645E+03
     17.58    -0.57    0.66     5.6 0.102E+01   0.21     9.16    0.66    0.45   .47194E+03
     19.96    -0.57    0.66     5.9 0.962E+00   0.21     9.93    0.66    0.45   .53742E+03
     22.34    -0.57    0.66     6.3 0.901E+00   0.21    10.68    0.66    0.45   .60291E+03
     24.72    -0.57    0.66     6.8 0.843E+00   0.21    11.39    0.66    0.45   .66840E+03
 Cumulative travel time =         668.4017 sec  (    0.19 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     24.72    10.82    0.66     6.8 0.843E+00   0.21    22.78    0.66    0.45   .66840E+03
     30.00    10.82    0.66     7.7 0.741E+00   0.22    24.32    0.66    0.44   .81358E+03
     35.28    10.82    0.66     8.7 0.652E+00   0.24    25.80    0.66    0.43   .95877E+03
     40.56    10.82    0.66     9.8 0.574E+00   0.25    27.23    0.66    0.41   .11039E+04
     45.84    10.82    0.66    11.1 0.507E+00   0.27    28.61    0.66    0.39   .12491E+04
     51.13    10.82    0.66    12.4 0.448E+00   0.29    29.96    0.66    0.37   .13943E+04
     56.41    10.82    0.66    14.0 0.398E+00   0.31    31.27    0.66    0.35   .15395E+04
     61.69    10.82    0.66    15.6 0.354E+00   0.34    32.56    0.66    0.32   .16847E+04
     66.97    10.82    0.66    17.4 0.316E+00   0.36    33.81    0.66    0.30   .18299E+04
     72.25    10.82    0.66    19.4 0.283E+00   0.39    35.04    0.66    0.27   .19750E+04
     77.53    10.82    0.66    21.5 0.254E+00   0.42    36.24    0.66    0.24   .21202E+04
 Cumulative travel time =        2120.2183 sec  (    0.59 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     77.53    10.82    0.66    21.5 0.254E+00   0.42    36.24    0.66    0.24   .21202E+04
    222.17    10.82    0.66    38.7 0.126E+00   0.75    36.24    0.66    0.00   .60972E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    366.82    10.82    0.66    38.7 0.113E+00   0.75    36.24    0.66    0.00   .10074E+05
    511.47    10.82    0.66    38.7 0.101E+00   0.75    36.24    0.66    0.00   .14051E+05
    656.12    10.82    0.66    38.7 0.903E-01   0.75    36.24    0.66    0.00   .18028E+05
    800.76    10.82    0.66    38.7 0.807E-01   0.75    36.24    0.66    0.00   .22005E+05
    945.41    10.82    0.66    38.7 0.722E-01   0.75    36.24    0.66    0.00   .25982E+05
   1090.06    10.82    0.66    38.7 0.645E-01   0.75    36.24    0.66    0.00   .29959E+05
   1234.71    10.82    0.66    38.7 0.577E-01   0.75    36.24    0.66    0.00   .33936E+05
   1379.35    10.82    0.66    38.7 0.516E-01   0.75    36.24    0.66    0.00   .37913E+05
   1524.00    10.82    0.66    38.7 0.461E-01   0.75    36.24    0.66    0.00   .41890E+05
 Cumulative travel time =       41890.4141 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 307

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S307U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S307U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:04:48
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 4.88 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 14.63 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.49 m
  Port/Nozzle diameter          D0      = 0.1524 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.037405 m
  Total area of openings        TA0     = 0.2007 m^2
  Discharge velocity            U0      = 0.13 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.005239 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000607 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.000667 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000039 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000042 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.04 m          Lm  = 0.53 m          LM  = 0.53 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 7.32
  Port/nozzle Froude number     FRD0    = 3.63
  Velocity ratio                R       = 3.59
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

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  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    12.19 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.9919 deg.F
  Dilution at edge of NFR              s = 5.8
  NFR Location:                        x = 2.07 m
    (centerline coordinates)           y = -1.29 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.98 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       42.6234 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 30.95 m downstream.
  Plume contacts second bank at 67.99 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS ************************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 307

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S307U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S307U.prd
 Time stamp:        12/21/2025--20:04:48

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     12.19  YB1   =      9.75  YB2   =     14.63
 LD    =      4.88  NOPEN =   11       NRISER=   11       SPAC  =      0.49    NPPERR =    1
 D0    =     0.152 A0    =     0.018 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     1.000 B0    =0.3740E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =      0.127 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.5239E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.6065E-03   j0 =U0*GP0*B0 =0.3854E-04   (based on slot width B0)
 m0 =U0*q0   =0.6672E-03   j0 =q0*GP0    =0.4239E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.041 lM    =      0.53  lm    =      0.53
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2958E-02  J0    =0.1879E-03
 Associated 3-d length scales (meters)
 LQ    =      0.14  LM    =      0.93  Lm    =      1.61  Lb    =      4.65
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      7.32  FRD0  =      3.63  R     =      3.59  PL    =    4.46
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.127 D0    =      0.152 A0    =      0.018 THETA =      0.00
 FR0   =      7.32  FRD0  =      3.63  R     =      3.59
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        12.19 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.03     2.44     0.097   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.03     2.44 .00000E+00
      0.21    -0.13    0.21     2.5 0.229E+01   0.08     2.32 .28451E+01
      0.41    -0.26    0.22     3.2 0.183E+01   0.13     2.23 .64483E+01
      0.62    -0.39    0.23     3.7 0.159E+01   0.20     2.16 .10410E+02
      0.83    -0.52    0.24     4.1 0.143E+01   0.26     2.10 .14612E+02
      1.03    -0.65    0.25     4.4 0.131E+01   0.33     2.06 .18993E+02
      1.24    -0.78    0.26     4.8 0.122E+01   0.40     2.03 .23517E+02
```

```
      1.45    -0.90    0.27     5.1 0.115E+01   0.46     2.00 .28158E+02
      1.65    -1.03    0.28     5.3 0.109E+01   0.53     1.99 .32898E+02
      1.86    -1.16    0.29     5.6 0.104E+01   0.60     1.98 .37723E+02
      2.07    -1.29    0.30     5.8 0.992E+00   0.66     1.98 .42623E+02
 Cumulative travel time =          42.6234 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.57 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      2.07    -1.29    0.66     5.8 0.992E+00   0.66     3.11    0.66    0.00   .42623E+02
      4.96    -1.29    0.66     6.5 0.889E+00   0.49     4.63    0.66    0.17   .12203E+03
      7.84    -1.29    0.66     7.0 0.823E+00   0.42     5.92    0.66    0.25   .20144E+03
     10.73    -1.29    0.66     7.5 0.771E+00   0.37     7.09    0.66    0.29   .28085E+03
     13.62    -1.29    0.66     7.9 0.726E+00   0.34     8.16    0.66    0.32   .36026E+03
     16.51    -1.29    0.66     8.4 0.684E+00   0.32     9.16    0.66    0.34   .43967E+03
     19.40    -1.29    0.66     8.9 0.644E+00   0.31    10.10    0.66    0.35   .51908E+03
     22.29    -1.29    0.66     9.4 0.605E+00   0.30    11.00    0.66    0.36   .59849E+03
     25.17    -1.29    0.66    10.0 0.568E+00   0.30    11.86    0.66    0.36   .67790E+03
     28.06    -1.29    0.66    10.7 0.532E+00   0.30    12.69    0.66    0.37   .75730E+03
     30.95    -1.29    0.66    11.4 0.498E+00   0.30    13.49    0.66    0.36   .83671E+03
 Cumulative travel time =         836.7134 sec  (    0.23 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     30.95    12.19    0.66    11.4 0.498E+00   0.30    26.98    0.66    0.36   .83671E+03
     34.65    12.19    0.66    12.2 0.462E+00   0.31    27.98    0.66    0.35   .93854E+03
     38.36    12.19    0.66    13.1 0.429E+00   0.32    28.97    0.66    0.34   .10404E+04
     42.06    12.19    0.66    14.1 0.398E+00   0.33    29.93    0.66    0.33   .11422E+04
     45.76    12.19    0.66    15.2 0.370E+00   0.34    30.88    0.66    0.32   .12440E+04
     49.47    12.19    0.66    16.3 0.344E+00   0.36    31.81    0.66    0.30   .13459E+04
     53.17    12.19    0.66    17.4 0.320E+00   0.37    32.72    0.66    0.29   .14477E+04
     56.88    12.19    0.66    18.7 0.298E+00   0.39    33.62    0.66    0.27   .15495E+04
     60.58    12.19    0.66    20.0 0.278E+00   0.41    34.51    0.66    0.25   .16514E+04
     64.28    12.19    0.66    21.3 0.259E+00   0.42    35.38    0.66    0.24   .17532E+04
     67.99    12.19    0.66    22.8 0.242E+00   0.44    36.24    0.66    0.22   .18550E+04
 Cumulative travel time =        1855.0276 sec  (    0.52 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     67.99    12.19    0.66    22.8 0.242E+00   0.44    36.24    0.66    0.22   .18550E+04
    213.59    12.19    0.66    38.7 0.127E+00   0.75    36.24    0.66    0.00   .58583E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    359.19    12.19    0.66    38.7 0.114E+00   0.75    36.24    0.66    0.00   .98615E+04
    504.79    12.19    0.66    38.7 0.102E+00   0.75    36.24    0.66    0.00   .13865E+05
    650.39    12.19    0.66    38.7 0.908E-01   0.75    36.24    0.66    0.00   .17868E+05
    795.99    12.19    0.66    38.7 0.811E-01   0.75    36.24    0.66    0.00   .21871E+05
    941.59    12.19    0.66    38.7 0.724E-01   0.75    36.24    0.66    0.00   .25875E+05
   1087.20    12.19    0.66    38.7 0.647E-01   0.75    36.24    0.66    0.00   .29878E+05
   1232.80    12.19    0.66    38.7 0.578E-01   0.75    36.24    0.66    0.00   .33881E+05
   1378.40    12.19    0.66    38.7 0.516E-01   0.75    36.24    0.66    0.00   .37884E+05
   1524.00    12.19    0.66    38.7 0.461E-01   0.75    36.24    0.66    0.00   .41888E+05
 Cumulative travel time =       41887.5391 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 308

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S308U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S308U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:06:02
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.96 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.72 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.40 m
  Port/Nozzle diameter          D0      = 0.1524 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.046036 m
  Total area of openings        TA0     = 0.2007 m^2
  Discharge velocity            U0      = 0.13 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.006448 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000747 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.000821 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000047 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000052 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.05 m          Lm  = 0.65 m          LM  = 0.57 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 6.60
  Port/nozzle Froude number     FRD0    = 3.63
  Velocity ratio                R       = 3.59
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

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  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.73 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 1.1711 deg.F
  Dilution at edge of NFR              s = 5.0
  NFR Location:                        x = 1.68 m
    (centerline coordinates)           y = -1.05 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.57 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       32.4033 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 28.87 m downstream.
  Plume contacts second bank at 71.21 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 308

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S308U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S308U.prd
 Time stamp:        12/21/2025--20:06:02

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.73  YB1   =      9.75  YB2   =     13.72
 LD    =      3.96  NOPEN =   11       NRISER=   11       SPAC  =      0.40    NPPERR =    1
 D0    =     0.152 A0    =     0.018 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     1.000 B0    =0.4604E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.127 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.6448E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.7465E-03   j0 =U0*GP0*B0 =0.4743E-04   (based on slot width B0)
 m0 =U0*q0   =0.8212E-03   j0 =q0*GP0    =0.5217E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.051 lM    =      0.57  lm    =      0.65
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2958E-02  J0    =0.1879E-03
 Associated 3-d length scales (meters)
 LQ    =      0.14  LM    =      0.93  Lm    =      1.61  Lb    =      4.65
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      6.60  FRD0  =      3.63  R     =      3.59  PL    =    3.37
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     0.127 D0    =     0.152 A0    =     0.018 THETA =      0.00
 FR0   =      6.60  FRD0  =      3.63  R     =      3.59
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.73 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.04     1.98     0.097   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.04     1.98 .00000E+00
      0.17    -0.10    0.21     2.2 0.258E+01   0.08     1.87 .21528E+01
      0.34    -0.21    0.22     2.8 0.210E+01   0.13     1.79 .48654E+01
      0.50    -0.31    0.23     3.2 0.183E+01   0.20     1.73 .78552E+01
      0.67    -0.42    0.23     3.5 0.166E+01   0.26     1.68 .11035E+02
      0.84    -0.52    0.24     3.8 0.153E+01   0.33     1.64 .14360E+02
      1.01    -0.63    0.25     4.1 0.143E+01   0.40     1.61 .17800E+02
```

```
      1.18    -0.73    0.26     4.3 0.135E+01   0.46     1.59 .21337E+02
      1.34    -0.84    0.26     4.5 0.128E+01   0.53     1.58 .24957E+02
      1.51    -0.94    0.27     4.7 0.122E+01   0.60     1.57 .28649E+02
      1.68    -1.05    0.28     5.0 0.117E+01   0.66     1.57 .32403E+02
 Cumulative travel time =          32.4033 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.68 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      1.68    -1.05    0.66     5.0 0.117E+01   0.66     2.63    0.66    0.00   .32403E+02
      4.40    -1.05    0.66     5.6 0.104E+01   0.47     4.16    0.66    0.19   .10715E+03
      7.12    -1.05    0.66     6.0 0.955E+00   0.39     5.44    0.66    0.27   .18189E+03
      9.84    -1.05    0.66     6.5 0.893E+00   0.34     6.58    0.66    0.32   .25664E+03
     12.55    -1.05    0.66     6.8 0.841E+00   0.32     7.62    0.66    0.35   .33138E+03
     15.27    -1.05    0.66     7.2 0.792E+00   0.30     8.59    0.66    0.37   .40613E+03
     17.99    -1.05    0.66     7.7 0.746E+00   0.28     9.51    0.66    0.38   .48087E+03
     20.71    -1.05    0.66     8.1 0.702E+00   0.28    10.38    0.66    0.39   .55562E+03
     23.43    -1.05    0.66     8.6 0.659E+00   0.27    11.22    0.66    0.39   .63036E+03
     26.15    -1.05    0.66     9.2 0.618E+00   0.27    12.02    0.66    0.39   .70511E+03
     28.87    -1.05    0.66     9.8 0.579E+00   0.27    12.79    0.66    0.39   .77985E+03
 Cumulative travel time =         779.8545 sec  (    0.22 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     28.87    11.73    0.66     9.8 0.579E+00   0.27    25.58    0.66    0.39   .77985E+03
     33.10    11.73    0.66    10.7 0.529E+00   0.28    26.75    0.66    0.38   .89627E+03
     37.33    11.73    0.66    11.7 0.484E+00   0.29    27.90    0.66    0.37   .10127E+04
     41.57    11.73    0.66    12.7 0.443E+00   0.31    29.02    0.66    0.35   .11291E+04
     45.80    11.73    0.66    13.8 0.406E+00   0.32    30.11    0.66    0.34   .12455E+04
     50.04    11.73    0.66    15.0 0.372E+00   0.34    31.18    0.66    0.32   .13619E+04
     54.27    11.73    0.66    16.3 0.341E+00   0.36    32.23    0.66    0.31   .14784E+04
     58.51    11.73    0.66    17.7 0.313E+00   0.37    33.26    0.66    0.29   .15948E+04
     62.74    11.73    0.66    19.2 0.288E+00   0.39    34.27    0.66    0.27   .17112E+04
     66.97    11.73    0.66    20.8 0.266E+00   0.41    35.27    0.66    0.25   .18276E+04
     71.21    11.73    0.66    22.4 0.245E+00   0.43    36.24    0.66    0.23   .19440E+04
 Cumulative travel time =        1944.0378 sec  (    0.54 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     71.21    11.73    0.66    22.4 0.245E+00   0.43    36.24    0.66    0.23   .19440E+04
    216.49    11.73    0.66    38.7 0.127E+00   0.75    36.24    0.66    0.00   .59384E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    361.77    11.73    0.66    38.7 0.113E+00   0.75    36.24    0.66    0.00   .99328E+04
    507.05    11.73    0.66    38.7 0.101E+00   0.75    36.24    0.66    0.00   .13927E+05
    652.32    11.73    0.66    38.7 0.906E-01   0.75    36.24    0.66    0.00   .17922E+05
    797.60    11.73    0.66    38.7 0.810E-01   0.75    36.24    0.66    0.00   .21916E+05
    942.88    11.73    0.66    38.7 0.723E-01   0.75    36.24    0.66    0.00   .25910E+05
   1088.16    11.73    0.66    38.7 0.646E-01   0.75    36.24    0.66    0.00   .29905E+05
   1233.44    11.73    0.66    38.7 0.578E-01   0.75    36.24    0.66    0.00   .33899E+05
   1378.72    11.73    0.66    38.7 0.516E-01   0.75    36.24    0.66    0.00   .37894E+05
   1524.00    11.73    0.66    38.7 0.461E-01   0.75    36.24    0.66    0.00   .41888E+05
 Cumulative travel time =       41887.9805 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 309

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S309U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S309U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:07:07
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.35 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.11 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.67 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.048846 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 0.13 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.007621 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000826 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.000991 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000051 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000062 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 0.79 m          LM  = 0.60 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 6.54
  Port/nozzle Froude number     FRD0    = 3.20
  Velocity ratio                R       = 3.67
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.43 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 1.3282 deg.F
  Dilution at edge of NFR              s = 4.4
  NFR Location:                        x = 1.42 m
    (centerline coordinates)           y = -0.89 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.29 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       25.7104 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 27.47 m downstream.
  Plume contacts second bank at 73.31 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 309

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S309U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S309U.prd
 Time stamp:        12/21/2025--20:07:07

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.43  YB1   =      9.75  YB2   =     13.11
 LD    =      3.35  NOPEN =    6       NRISER=    6       SPAC  =      0.67    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.4885E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =      0.130 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7621E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.8257E-03   j0 =U0*GP0*B0 =0.5138E-04   (based on slot width B0)
 m0 =U0*q0   =0.9908E-03   j0 =q0*GP0    =0.6166E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.059 lM    =      0.60  lm    =      0.79
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2768E-02  J0    =0.1723E-03
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =      0.92  Lm    =      1.63  Lb    =      4.65
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      6.54  FRD0  =      3.20  R     =      3.67  PL    =    4.27
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.130 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =      6.54  FRD0  =      3.20  R     =      3.67
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
       11.43 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.04     1.68     0.100   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.04     1.68 .00000E+00
     0.14    -0.09    0.21     2.1 0.281E+01   0.07     1.58 .17036E+01
     0.28    -0.18    0.22     2.5 0.231E+01   0.13     1.50 .38398E+01
     0.43    -0.27    0.22     2.8 0.204E+01   0.20     1.45 .61979E+01
     0.57    -0.36    0.23     3.1 0.185E+01   0.26     1.40 .87112E+01
     0.71    -0.44    0.24     3.4 0.172E+01   0.33     1.36 .11344E+02
     0.85    -0.53    0.24     3.6 0.161E+01   0.40     1.34 .14074E+02
```

```
      1.00    -0.62    0.25     3.8 0.152E+01   0.46     1.32 .16886E+02
      1.14    -0.71    0.26     4.0 0.145E+01   0.53     1.30 .19768E+02
      1.28    -0.80    0.26     4.2 0.138E+01   0.60     1.30 .22712E+02
      1.42    -0.89    0.27     4.4 0.133E+01   0.66     1.29 .25710E+02
 Cumulative travel time =          25.7104 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.79 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      1.42    -0.89    0.66     4.4 0.133E+01   0.66     2.32    0.66    0.00   .25710E+02
      4.03    -0.89    0.66     5.0 0.116E+01   0.45     3.86    0.66    0.21   .97336E+02
      6.63    -0.89    0.66     5.4 0.107E+01   0.37     5.12    0.66    0.29   .16896E+03
      9.24    -0.89    0.66     5.8 0.997E+00   0.33     6.25    0.66    0.34   .24059E+03
     11.84    -0.89    0.66     6.1 0.938E+00   0.30     7.27    0.66    0.36   .31221E+03
     14.45    -0.89    0.66     6.5 0.883E+00   0.28     8.23    0.66    0.38   .38384E+03
     17.05    -0.89    0.66     6.9 0.832E+00   0.27     9.12    0.66    0.40   .45546E+03
     19.66    -0.89    0.66     7.3 0.783E+00   0.26     9.98    0.66    0.40   .52709E+03
     22.26    -0.89    0.66     7.8 0.736E+00   0.25    10.79    0.66    0.41   .59871E+03
     24.87    -0.89    0.66     8.3 0.690E+00   0.25    11.57    0.66    0.41   .67034E+03
     27.47    -0.89    0.66     8.8 0.646E+00   0.25    12.32    0.66    0.41   .74197E+03
 Cumulative travel time =         741.9651 sec  (    0.21 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     27.47    11.43    0.66     8.8 0.646E+00   0.25    24.65    0.66    0.41   .74197E+03
     32.06    11.43    0.66     9.7 0.585E+00   0.26    25.94    0.66    0.40   .86799E+03
     36.64    11.43    0.66    10.7 0.529E+00   0.28    27.19    0.66    0.39   .99401E+03
     41.22    11.43    0.66    11.8 0.479E+00   0.29    28.41    0.66    0.37   .11200E+04
     45.81    11.43    0.66    12.9 0.434E+00   0.31    29.60    0.66    0.35   .12460E+04
     50.39    11.43    0.66    14.2 0.393E+00   0.32    30.77    0.66    0.34   .13721E+04
     54.97    11.43    0.66    15.6 0.357E+00   0.34    31.91    0.66    0.32   .14981E+04
     59.56    11.43    0.66    17.1 0.325E+00   0.36    33.02    0.66    0.30   .16241E+04
     64.14    11.43    0.66    18.6 0.296E+00   0.38    34.11    0.66    0.28   .17501E+04
     68.72    11.43    0.66    20.3 0.271E+00   0.41    35.19    0.66    0.26   .18762E+04
     73.31    11.43    0.66    22.1 0.248E+00   0.43    36.24    0.66    0.23   .20022E+04
 Cumulative travel time =        2002.1755 sec  (    0.56 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     73.31    11.43    0.66    22.1 0.248E+00   0.43    36.24    0.66    0.23   .20022E+04
    218.38    11.43    0.66    38.7 0.127E+00   0.75    36.24    0.66    0.00   .59908E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    363.45    11.43    0.66    38.7 0.113E+00   0.75    36.24    0.66    0.00   .99794E+04
    508.52    11.43    0.66    38.7 0.101E+00   0.75    36.24    0.66    0.00   .13968E+05
    653.58    11.43    0.66    38.7 0.905E-01   0.75    36.24    0.66    0.00   .17957E+05
    798.65    11.43    0.66    38.7 0.809E-01   0.75    36.24    0.66    0.00   .21945E+05
    943.72    11.43    0.66    38.7 0.723E-01   0.75    36.24    0.66    0.00   .25934E+05
   1088.79    11.43    0.66    38.7 0.646E-01   0.75    36.24    0.66    0.00   .29923E+05
   1233.86    11.43    0.66    38.7 0.577E-01   0.75    36.24    0.66    0.00   .33911E+05
   1378.93    11.43    0.66    38.7 0.516E-01   0.75    36.24    0.66    0.00   .37900E+05
   1524.00    11.43    0.66    38.7 0.461E-01   0.75    36.24    0.66    0.00   .41888E+05
 Cumulative travel time =       41888.3945 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 310

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S310U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S310U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:08:25
********************************************************************************
SUMMARY OF INPUT DATA:
--------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
--------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.74 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.50 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.55 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.059701 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 0.13 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
--------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.009314 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.001009 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.001211 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000063 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000075 m^3/s^3
--------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 0.96 m          LM  = 0.64 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
--------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 5.92
  Port/nozzle Froude number     FRD0   = 3.20
  Velocity ratio                R      = 3.67
--------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
********************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.13 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 1.5476 deg.F
  Dilution at edge of NFR              s = 3.7
  NFR Location:                        x = 1.16 m
    (centerline coordinates)           y = -0.73 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.03 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       19.5599 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 26.11 m downstream.
  Plume contacts second bank at 75.43 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 310

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S310U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S310U.prd
 Time stamp:        12/21/2025--20:08:25

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.13  YB1   =      9.75  YB2   =     12.50
 LD    =      2.74  NOPEN =    6       NRISER=    6       SPAC  =      0.55    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.5970E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =      0.130 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.9314E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1009E-02   j0 =U0*GP0*B0 =0.6280E-04   (based on slot width B0)
 m0 =U0*q0   =0.1211E-02   j0 =q0*GP0    =0.7536E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.072 lM    =      0.64  lm    =      0.96
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2768E-02  J0    =0.1723E-03
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =      0.92  Lm    =      1.63  Lb    =      4.65
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      5.92  FRD0  =      3.20  R     =      3.67  PL    =    3.21
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.130 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =      5.92  FRD0  =      3.20  R     =      3.67
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.13 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.05     1.37     0.100   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.05     1.37 .00000E+00
     0.12    -0.07    0.21     1.9 0.310E+01   0.08     1.28 .13063E+01
     0.23    -0.15    0.21     2.2 0.260E+01   0.13     1.22 .29256E+01
     0.35    -0.22    0.22     2.5 0.232E+01   0.20     1.17 .47116E+01
     0.47    -0.29    0.23     2.7 0.212E+01   0.26     1.13 .66165E+01
     0.58    -0.36    0.23     2.9 0.197E+01   0.33     1.10 .86145E+01
     0.70    -0.44    0.24     3.1 0.185E+01   0.40     1.07 .10689E+02
```

```
      0.81    -0.51    0.24     3.3 0.176E+01   0.46     1.05 .12828E+02
      0.93    -0.58    0.25     3.5 0.168E+01   0.53     1.04 .15024E+02
      1.05    -0.65    0.25     3.6 0.161E+01   0.60     1.04 .17270E+02
      1.16    -0.73    0.26     3.7 0.155E+01   0.66     1.03 .19560E+02
 Cumulative travel time =          19.5599 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.93 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      1.16    -0.73    0.66     3.7 0.155E+01   0.66     1.99    0.66    0.00   .19560E+02
      3.66    -0.73    0.66     4.4 0.133E+01   0.43     3.55    0.66    0.23   .88137E+02
      6.15    -0.73    0.66     4.7 0.122E+01   0.35     4.80    0.66    0.31   .15671E+03
      8.65    -0.73    0.66     5.1 0.114E+01   0.30     5.91    0.66    0.36   .22529E+03
     11.14    -0.73    0.66     5.4 0.107E+01   0.27     6.92    0.66    0.39   .29387E+03
     13.63    -0.73    0.66     5.7 0.100E+01   0.26     7.85    0.66    0.41   .36244E+03
     16.13    -0.73    0.66     6.1 0.946E+00   0.24     8.73    0.66    0.42   .43102E+03
     18.62    -0.73    0.66     6.4 0.890E+00   0.24     9.56    0.66    0.43   .49960E+03
     21.12    -0.73    0.66     6.8 0.836E+00   0.23    10.36    0.66    0.43   .56817E+03
     23.61    -0.73    0.66     7.3 0.784E+00   0.23    11.12    0.66    0.43   .63675E+03
     26.11    -0.73    0.66     7.8 0.734E+00   0.23    11.86    0.66    0.43   .70533E+03
 Cumulative travel time =         705.3267 sec  (    0.20 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     26.11    11.13    0.66     7.8 0.734E+00   0.23    23.71    0.66    0.43   .70533E+03
     31.04    11.13    0.66     8.7 0.655E+00   0.24    25.12    0.66    0.42   .84094E+03
     35.97    11.13    0.66     9.7 0.585E+00   0.26    26.49    0.66    0.41   .97655E+03
     40.90    11.13    0.66    10.8 0.523E+00   0.27    27.81    0.66    0.39   .11122E+04
     45.83    11.13    0.66    12.0 0.468E+00   0.29    29.10    0.66    0.37   .12478E+04
     50.77    11.13    0.66    13.3 0.419E+00   0.31    30.36    0.66    0.35   .13834E+04
     55.70    11.13    0.66    14.8 0.377E+00   0.33    31.59    0.66    0.33   .15190E+04
     60.63    11.13    0.66    16.3 0.339E+00   0.35    32.78    0.66    0.31   .16546E+04
     65.56    11.13    0.66    18.0 0.306E+00   0.37    33.96    0.66    0.29   .17902E+04
     70.49    11.13    0.66    19.9 0.277E+00   0.40    35.11    0.66    0.26   .19258E+04
     75.43    11.13    0.66    21.8 0.251E+00   0.42    36.24    0.66    0.24   .20614E+04
 Cumulative travel time =        2061.4192 sec  (    0.57 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     75.43    11.13    0.66    21.8 0.251E+00   0.42    36.24    0.66    0.24   .20614E+04
    220.28    11.13    0.66    38.7 0.127E+00   0.75    36.24    0.66    0.00   .60442E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    365.14    11.13    0.66    38.7 0.113E+00   0.75    36.24    0.66    0.00   .10027E+05
    510.00    11.13    0.66    38.7 0.101E+00   0.75    36.24    0.66    0.00   .14010E+05
    654.86    11.13    0.66    38.7 0.904E-01   0.75    36.24    0.66    0.00   .17993E+05
    799.71    11.13    0.66    38.7 0.808E-01   0.75    36.24    0.66    0.00   .21975E+05
    944.57    11.13    0.66    38.7 0.722E-01   0.75    36.24    0.66    0.00   .25958E+05
   1089.43    11.13    0.66    38.7 0.646E-01   0.75    36.24    0.66    0.00   .29941E+05
   1234.29    11.13    0.66    38.7 0.577E-01   0.75    36.24    0.66    0.00   .33924E+05
   1379.14    11.13    0.66    38.7 0.516E-01   0.75    36.24    0.66    0.00   .37907E+05
   1524.00    11.13    0.66    38.7 0.461E-01   0.75    36.24    0.66    0.00   .41889E+05
 Cumulative travel time =       41889.3477 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 311

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S311U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S311U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:10:06
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.44 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.19 m
  Number of openings            NOPEN   = 4
  Number of Risers              NRISER = 4
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.81 m
  Port/Nozzle diameter          D0      = 0.2530 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.061843 m
  Total area of openings        TA0     = 0.2011 m^2
  Discharge velocity            U0      = 0.13 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.010479 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000999 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.001332 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000064 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000085 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.08 m          Lm  = 1.06 m          LM  = 0.63 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 5.68
  Port/nozzle Froude number     FRD0   = 2.81
  Velocity ratio                R      = 3.59
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.97 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 1.7 deg.F
  Dilution at edge of NFR              s = 3.4
  NFR Location:                        x = 1.03 m
    (centerline coordinates)           y = -0.65 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 0.91 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       16.7755 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 25.44 m downstream.
  Plume contacts second bank at 76.53 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ***********************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 311

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S311U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S311U.prd
 Time stamp:        12/21/2025--20:10:06

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.97  YB1   =      9.75  YB2   =     12.19
 LD    =      2.44  NOPEN =    4       NRISER=    4       SPAC  =      0.81    NPPERR =    1
 D0    =     0.253 A0    =     0.050 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.253 CR0   =     1.000 B0    =0.6184E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =      0.127 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1048E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9987E-03   j0 =U0*GP0*B0 =0.6359E-04   (based on slot width B0)
 m0 =U0*q0   =0.1332E-02   j0 =q0*GP0    =0.8478E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.082 lM    =      0.63  lm    =      1.06
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2435E-02  J0    =0.1550E-03
 Associated 3-d length scales (meters)
 LQ    =      0.22  LM    =      0.88  Lm    =      1.61  Lb    =      4.65
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      5.68  FRD0  =      2.81  R     =      3.59  PL    =    3.88
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.127 D0    =      0.253 A0    =      0.050 THETA =      0.00
 FR0   =      5.68  FRD0  =      2.81  R     =      3.59
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.97 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

        X        Y        Z        S        C        BV       BH       Uc        TT
     0.00     0.00     0.20     1.0 0.580E+01   0.05     1.22     0.097   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y        Z        S        C        BV       BH        TT
     0.00    -0.00     0.20     1.0 0.580E+01   0.05     1.22 .00000E+00
     0.10    -0.06     0.21     1.8 0.329E+01   0.07     1.14 .11339E+01
     0.21    -0.13     0.21     2.1 0.279E+01   0.13     1.08 .25251E+01
     0.31    -0.19     0.22     2.3 0.250E+01   0.20     1.03 .40558E+01
     0.41    -0.26     0.22     2.5 0.230E+01   0.26     0.99 .56871E+01
     0.52    -0.32     0.23     2.7 0.214E+01   0.33     0.96 .73978E+01
     0.62    -0.39     0.23     2.9 0.202E+01   0.40     0.94 .91741E+01
```

```
      0.72    -0.45    0.24     3.0 0.192E+01   0.46     0.93 .11007E+02
      0.83    -0.52    0.24     3.2 0.184E+01   0.53     0.92 .12888E+02
      0.93    -0.58    0.25     3.3 0.176E+01   0.60     0.91 .14812E+02
      1.03    -0.65    0.25     3.4 0.170E+01   0.66     0.91 .16775E+02
 Cumulative travel time =          16.7755 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  2.00 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
      1.03    -0.65    0.66     3.4 0.170E+01   0.66     1.81    0.66    0.00   .16775E+02
      3.47    -0.65    0.66     4.0 0.144E+01   0.42     3.38    0.66    0.25   .83884E+02
      5.92    -0.65    0.66     4.4 0.132E+01   0.33     4.64    0.66    0.33   .15099E+03
      8.36    -0.65    0.66     4.7 0.123E+01   0.29     5.74    0.66    0.37   .21810E+03
     10.80    -0.65    0.66     5.0 0.115E+01   0.26     6.74    0.66    0.40   .28521E+03
     13.24    -0.65    0.66     5.3 0.109E+01   0.24     7.67    0.66    0.42   .35232E+03
     15.68    -0.65    0.66     5.6 0.102E+01   0.23     8.54    0.66    0.43   .41943E+03
     18.12    -0.65    0.66     6.0 0.960E+00   0.22     9.36    0.66    0.44   .48654E+03
     20.56    -0.65    0.66     6.3 0.902E+00   0.22    10.14    0.66    0.44   .55364E+03
     23.00    -0.65    0.66     6.8 0.845E+00   0.22    10.90    0.66    0.44   .62075E+03
     25.44    -0.65    0.66     7.2 0.790E+00   0.22    11.62    0.66    0.44   .68786E+03
 Cumulative travel time =         687.8619 sec  (    0.19 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
     25.44    10.97    0.66     7.2 0.790E+00   0.22    23.24    0.66    0.44   .68786E+03
     30.55    10.97    0.66     8.1 0.700E+00   0.23    24.72    0.66    0.43   .82832E+03
     35.66    10.97    0.66     9.1 0.620E+00   0.24    26.14    0.66    0.42   .96878E+03
     40.77    10.97    0.66    10.2 0.550E+00   0.26    27.52    0.66    0.40   .11092E+04
     45.88    10.97    0.66    11.5 0.488E+00   0.28    28.86    0.66    0.38   .12497E+04
     50.98    10.97    0.66    12.8 0.435E+00   0.30    30.16    0.66    0.36   .13902E+04
     56.09    10.97    0.66    14.3 0.388E+00   0.32    31.43    0.66    0.34   .15306E+04
     61.20    10.97    0.66    15.9 0.347E+00   0.34    32.67    0.66    0.32   .16711E+04
     66.31    10.97    0.66    17.7 0.312E+00   0.37    33.88    0.66    0.29   .18115E+04
     71.42    10.97    0.66    19.6 0.280E+00   0.39    35.07    0.66    0.27   .19520E+04
     76.53    10.97    0.66    21.6 0.253E+00   0.42    36.24    0.66    0.24   .20924E+04
 Cumulative travel time =        2092.4399 sec  (    0.58 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
     76.53    10.97    0.66    21.6 0.253E+00   0.42    36.24    0.66    0.24   .20924E+04
    221.27    10.97    0.66    38.7 0.126E+00   0.75    36.24    0.66    0.00   .60722E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    366.02    10.97    0.66    38.7 0.113E+00   0.75    36.24    0.66    0.00   .10052E+05
    510.77    10.97    0.66    38.7 0.101E+00   0.75    36.24    0.66    0.00   .14032E+05
    655.52    10.97    0.66    38.7 0.903E-01   0.75    36.24    0.66    0.00   .18012E+05
    800.26    10.97    0.66    38.7 0.807E-01   0.75    36.24    0.66    0.00   .21991E+05
    945.01    10.97    0.66    38.7 0.722E-01   0.75    36.24    0.66    0.00   .25971E+05
   1089.76    10.97    0.66    38.7 0.645E-01   0.75    36.24    0.66    0.00   .29951E+05
   1234.51    10.97    0.66    38.7 0.577E-01   0.75    36.24    0.66    0.00   .33931E+05
   1379.25    10.97    0.66    38.7 0.516E-01   0.75    36.24    0.66    0.00   .37910E+05
   1524.00    10.97    0.66    38.7 0.461E-01   0.75    36.24    0.66    0.00   .41890E+05
 Cumulative travel time =       41890.1211 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 312

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S312U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S312U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--10:24:38
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.13 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 11.89 m
  Number of openings            NOPEN   = 3
  Number of Risers              NRISER = 3
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 1.07 m
  Port/Nozzle diameter          D0      = 0.3048 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.068397 m
  Total area of openings        TA0     = 0.2189 m^2
  Discharge velocity            U0      = 0.12 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.011976 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000932 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.001398 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000065 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000097 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.10 m          Lm  = 1.11 m          LM  = 0.58 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 4.96
  Port/nozzle Froude number     FRD0   = 2.35
  Velocity ratio                R      = 3.29
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.82 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 1.9186 deg.F
  Dilution at edge of NFR              s = 3.0
  NFR Location:                        x = 0.90 m
    (centerline coordinates)           y = -0.57 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 0.79 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       14.4079 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 24.82 m downstream.
  Plume contacts second bank at 77.69 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 312

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S312U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S312U.prd
 Time stamp:        12/21/2025--10:24:38

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.82  YB1   =      9.75  YB2   =     11.89
 LD    =      2.13  NOPEN =    3       NRISER=    3       SPAC  =      1.07    NPPERR =    1
 D0    =     0.305 A0    =     0.073 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.305 CR0   =     1.000 B0    =0.6840E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.117 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1198E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9319E-03   j0 =U0*GP0*B0 =0.6459E-04   (based on slot width B0)
 m0 =U0*q0   =0.1398E-02   j0 =q0*GP0    =0.9689E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.103 lM    =      0.58  lm    =      1.11
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.1988E-02  J0    =0.1378E-03
 Associated 3-d length scales (meters)
 LQ    =      0.27  LM    =      0.80  Lm    =      1.54  Lb    =      4.65
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      4.96  FRD0  =      2.35  R     =      3.29  PL    =    4.26
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.117 D0    =      0.305 A0    =      0.073 THETA =      0.00
 FR0   =      4.96  FRD0  =      2.35  R     =      3.29
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.82 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.05     1.07     0.087   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.05     1.07 .00000E+00
      0.09    -0.06    0.21     1.6 0.354E+01   0.08     0.99 .10006E+01
      0.18    -0.11    0.21     1.9 0.305E+01   0.13     0.94 .22061E+01
      0.27    -0.17    0.22     2.1 0.275E+01   0.20     0.90 .35246E+01
      0.36    -0.23    0.22     2.3 0.254E+01   0.26     0.87 .49253E+01
      0.45    -0.28    0.22     2.4 0.239E+01   0.33     0.84 .63914E+01
      0.54    -0.34    0.23     2.6 0.226E+01   0.40     0.82 .79118E+01
```

```
      0.63    -0.40    0.23     2.7 0.215E+01   0.46     0.81 .94789E+01
      0.72    -0.45    0.24     2.8 0.206E+01   0.53     0.80 .11087E+02
      0.81    -0.51    0.24     2.9 0.199E+01   0.60     0.79 .12731E+02
      0.90    -0.57    0.25     3.0 0.192E+01   0.66     0.79 .14408E+02
 Cumulative travel time =          14.4079 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  2.03 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      0.90    -0.57    0.66     3.0 0.192E+01   0.66     1.61    0.66    0.00   .14408E+02
      3.30    -0.57    0.66     3.6 0.160E+01   0.40     3.21    0.66    0.27   .80153E+02
      5.69    -0.57    0.66     4.0 0.146E+01   0.31     4.47    0.66    0.35   .14590E+03
      8.08    -0.57    0.66     4.3 0.136E+01   0.27     5.56    0.66    0.39   .21164E+03
     10.47    -0.57    0.66     4.5 0.127E+01   0.24     6.56    0.66    0.42   .27739E+03
     12.86    -0.57    0.66     4.8 0.120E+01   0.23     7.47    0.66    0.44   .34313E+03
     15.25    -0.57    0.66     5.1 0.112E+01   0.22     8.34    0.66    0.45   .40888E+03
     17.64    -0.57    0.66     5.4 0.105E+01   0.21     9.15    0.66    0.45   .47462E+03
     20.03    -0.57    0.66     5.8 0.989E+00   0.20     9.93    0.66    0.46   .54037E+03
     22.43    -0.57    0.66     6.2 0.925E+00   0.20    10.67    0.66    0.46   .60611E+03
     24.82    -0.57    0.66     6.6 0.864E+00   0.20    11.39    0.66    0.46   .67186E+03
 Cumulative travel time =         671.8582 sec  (    0.19 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     24.82    10.82    0.66     6.6 0.864E+00   0.20    22.78    0.66    0.46   .67186E+03
     30.10    10.82    0.66     7.5 0.757E+00   0.22    24.31    0.66    0.45   .81722E+03
     35.39    10.82    0.66     8.5 0.665E+00   0.23    25.79    0.66    0.43   .96259E+03
     40.68    10.82    0.66     9.6 0.584E+00   0.25    27.22    0.66    0.41   .11080E+04
     45.97    10.82    0.66    10.9 0.514E+00   0.27    28.61    0.66    0.39   .12533E+04
     51.25    10.82    0.66    12.3 0.454E+00   0.29    29.96    0.66    0.37   .13987E+04
     56.54    10.82    0.66    13.8 0.402E+00   0.31    31.27    0.66    0.35   .15441E+04
     61.83    10.82    0.66    15.5 0.358E+00   0.33    32.55    0.66    0.33   .16894E+04
     67.11    10.82    0.66    17.3 0.319E+00   0.36    33.81    0.66    0.30   .18348E+04
     72.40    10.82    0.66    19.2 0.285E+00   0.39    35.04    0.66    0.28   .19802E+04
     77.69    10.82    0.66    21.4 0.256E+00   0.41    36.24    0.66    0.25   .21255E+04
 Cumulative travel time =       2125.5215 sec  (    0.59 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     77.69    10.82    0.66    21.4 0.256E+00   0.41    36.24    0.66    0.25   .21255E+04
    222.32    10.82    0.66    38.7 0.126E+00   0.75    36.24    0.66    0.00   .61021E+04
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    366.95    10.82    0.66    38.7 0.113E+00   0.75    36.24    0.66    0.00   .10079E+05
    511.58    10.82    0.66    38.7 0.101E+00   0.75    36.24    0.66    0.00   .14055E+05
    656.21    10.82    0.66    38.7 0.903E-01   0.75    36.24    0.66    0.00   .18032E+05
    800.84    10.82    0.66    38.7 0.807E-01   0.75    36.24    0.66    0.00   .22008E+05
    945.47    10.82    0.66    38.7 0.722E-01   0.75    36.24    0.66    0.00   .25985E+05
   1090.11    10.82    0.66    38.7 0.645E-01   0.75    36.24    0.66    0.00   .29962E+05
   1234.74    10.82    0.66    38.7 0.577E-01   0.75    36.24    0.66    0.00   .33938E+05
   1379.37    10.82    0.66    38.7 0.516E-01   0.75    36.24    0.66    0.00   .37915E+05
   1524.00    10.82    0.66    38.7 0.461E-01   0.75    36.24    0.66    0.00   .41891E+05
 Cumulative travel time =      41891.3047 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
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-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 313

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CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S313U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S313U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:16:16
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 4.88 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 14.63 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.49 m
  Port/Nozzle diameter          D0      = 0.1405 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.031794 m
  Total area of openings        TA0     = 0.1706 m^2
  Discharge velocity            U0      = 1.48 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.051747 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.069606 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.076566 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000381 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000419 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.03 m          Lm  = 60.99 m          LM  = 13.22 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 92.25
  Port/nozzle Froude number     FRD0    = 43.88
  Velocity ratio                R       = 41.76
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    12.19 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5396 deg.F
  Dilution at edge of NFR              s = 10.7
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 36.89 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.26 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4787.6494 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 10.75 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 313

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S313U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S313U.prd
 Time stamp:        12/21/2025--20:16:16

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     12.19  YB1   =      9.75  YB2   =     14.63
 LD    =      4.88  NOPEN =   11       NRISER=   11       SPAC  =      0.49    NPPERR =    1
 D0    =     0.141 A0    =     0.016 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     0.850 B0    =0.3179E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.480 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.5175E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.6961E-01   j0 =U0*GP0*B0 =0.3806E-03   (based on slot width B0)
 m0 =U0*q0   =0.7657E-01   j0 =q0*GP0    =0.4187E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.035 lM    =     13.22  lm    =     60.99
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.3395E+00  J0    =0.1856E-02
 Associated 3-d length scales (meters)
 LQ    =      0.12  LM    =     10.32  Lm    =     17.25  Lb    =     45.91
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     92.25  FRD0  =     43.88  R     =     41.76  PL    =    0.97
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     1.480 D0    =     0.141 A0    =     0.016 THETA =      0.00
 FR0   =     92.25  FRD0  =     43.88  R     =     41.76
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        12.19 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.03     2.44     1.450   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.03     2.44 .00000E+00
      0.21    -0.13    0.21     1.7 0.335E+01   0.07     2.15 .27383E+00
      0.41    -0.26    0.22     2.0 0.285E+01   0.13     1.93 .63896E+00
      0.62    -0.39    0.23     2.3 0.256E+01   0.20     1.76 .10623E+01
      0.83    -0.52    0.24     2.5 0.236E+01   0.26     1.62 .15319E+01
      1.03    -0.65    0.25     2.6 0.220E+01   0.33     1.52 .20411E+01
      1.24    -0.78    0.26     2.8 0.208E+01   0.40     1.44 .25853E+01
```

```
      1.45    -0.90    0.27     2.9 0.198E+01   0.46     1.38 .31610E+01
      1.65    -1.03    0.28     3.1 0.189E+01   0.53     1.34 .37657E+01
      1.86    -1.16    0.29     3.2 0.182E+01   0.60     1.32 .43973E+01
      2.07    -1.29    0.30     3.3 0.175E+01   0.66     1.31 .50540E+01
 Cumulative travel time =          5.0540 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     2.07    -1.29    0.66     3.3 0.175E+01   0.66     1.46 .50540E+01
    18.33     5.57    0.66     4.6 0.125E+01   0.66     2.78 .25429E+03
    34.60    11.47    0.66     5.6 0.103E+01   0.66     4.05 .57498E+03
    50.87    16.61    0.66     6.5 0.891E+00   0.66     5.28 .95371E+03
    67.13    21.09    0.66     7.3 0.798E+00   0.66     6.49 .13827E+04
    83.40    24.96    0.66     8.0 0.729E+00   0.66     7.67 .18565E+04
    99.67    28.30    0.66     8.6 0.676E+00   0.66     8.82 .23713E+04
   115.93    31.13    0.66     9.2 0.632E+00   0.66     9.96 .29241E+04
   132.20    33.48    0.66     9.7 0.596E+00   0.66    11.08 .35124E+04
   148.46    35.40    0.66    10.3 0.566E+00   0.66    12.18 .41341E+04
   164.73    36.89    0.66    10.7 0.540E+00   0.66    13.26 .47876E+04
 Cumulative travel time =        4787.6494 sec  (    1.33 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.46 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of    10.7 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     1.06

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.05    0.66     4.8 0.120E+01   0.66    36.24    0.66    0.00   .47876E+04
 Cumulative travel time =        4787.6494 sec  (    1.33 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 314

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S314U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S314U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:19:23
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.96 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.72 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.40 m
  Port/Nozzle diameter          D0      = 0.1405 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.039131 m
  Total area of openings        TA0     = 0.1706 m^2
  Discharge velocity            U0      = 1.48 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.063689 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.085669 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.094235 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000468 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000515 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.04 m          Lm  = 75.07 m          LM  = 14.17 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 83.16
  Port/nozzle Froude number     FRD0   = 43.88
  Velocity ratio                R      = 41.76
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.73 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5445 deg.F
  Dilution at edge of NFR              s = 10.7
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 38.46 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.06 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4704.4619 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 10.65 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 314

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S314U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S314U.prd
 Time stamp:        12/21/2025--20:19:23

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.73  YB1   =      9.75  YB2   =     13.72
 LD    =      3.96  NOPEN =   11       NRISER=   11       SPAC  =      0.40    NPPERR =    1
 D0    =     0.141 A0    =     0.016 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     0.850 B0    =0.3913E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.480 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.6369E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.8567E-01   j0 =U0*GP0*B0 =0.4684E-03   (based on slot width B0)
 m0 =U0*q0   =0.9424E-01   j0 =q0*GP0    =0.5153E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.043 lM    =     14.17  lm    =     75.07
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.3395E+00  J0    =0.1856E-02
 Associated 3-d length scales (meters)
 LQ    =      0.12  LM    =     10.32  Lm    =     17.25  Lb    =     45.91
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     83.16  FRD0  =     43.88  R     =     41.76  PL    =    0.73
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     1.480 D0    =     0.141 A0    =     0.016 THETA =      0.00
 FR0   =     83.16  FRD0  =     43.88  R     =     41.76
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
       11.73 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.03     1.98     1.450   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.03     1.98 .00000E+00
      0.17    -0.10    0.21     1.6 0.358E+01   0.07     1.74 .20887E+00
      0.34    -0.21    0.22     1.9 0.309E+01   0.13     1.56 .48113E+00
      0.50    -0.31    0.23     2.1 0.280E+01   0.20     1.42 .79391E+00
      0.67    -0.42    0.23     2.2 0.259E+01   0.26     1.31 .11391E+01
      0.84    -0.52    0.24     2.4 0.243E+01   0.33     1.23 .15118E+01
      1.01    -0.63    0.25     2.5 0.230E+01   0.40     1.16 .19091E+01
```

```
      1.18    -0.73    0.26     2.6 0.220E+01   0.46     1.11 .23285E+01
      1.34    -0.84    0.26     2.8 0.211E+01   0.53     1.08 .27683E+01
      1.51    -0.94    0.27     2.9 0.203E+01   0.60     1.06 .32269E+01
      1.68    -1.05    0.28     3.0 0.196E+01   0.66     1.06 .37033E+01
 Cumulative travel time =          3.7033 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      1.68    -1.05    0.66     3.0 0.196E+01   0.66     1.18 .37033E+01
     17.99     6.06    0.66     4.4 0.132E+01   0.66     2.51 .23592E+03
     34.29    12.16    0.66     5.5 0.106E+01   0.66     3.80 .54414E+03
     50.60    17.45    0.66     6.3 0.915E+00   0.66     5.04 .91279E+03
     66.90    22.06    0.66     7.1 0.815E+00   0.66     6.25 .13332E+04
     83.21    26.06    0.66     7.8 0.742E+00   0.66     7.44 .17997E+04
     99.51    29.51    0.66     8.5 0.686E+00   0.66     8.60 .23080E+04
    115.82    32.44    0.66     9.1 0.640E+00   0.66     9.74 .28550E+04
    132.12    34.89    0.66     9.6 0.603E+00   0.66    10.87 .34381E+04
    148.43    36.89    0.66    10.1 0.572E+00   0.66    11.97 .40552E+04
    164.73    38.46    0.66    10.7 0.545E+00   0.66    13.06 .47045E+04
 Cumulative travel time =        4704.4619 sec  (    1.31 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.48 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of    10.7 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     1.06

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.51    0.66     4.8 0.120E+01   0.66    36.24    0.66    0.00   .47045E+04
 Cumulative travel time =        4704.4619 sec  (    1.31 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 315

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S315U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S315U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:25:09
********************************************************************************
SUMMARY OF INPUT DATA:
--------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
--------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.35 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.11 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.67 m
  Port/Nozzle diameter          D0      = 0.1883 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.041519 m
  Total area of openings        TA0     = 0.1670 m^2
  Discharge velocity            U0      = 1.51 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
--------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.075269 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.094758 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.113709 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000507 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000609 m^3/s^3
--------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.05 m          Lm  = 90.58 m          LM  = 14.85 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
--------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 82.43
  Port/nozzle Froude number     FRD0   = 38.71
  Velocity ratio                R      = 42.64
--------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
********************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.43 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5422 deg.F
  Dilution at edge of NFR              s = 10.7
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 40.16 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 12.96 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4599.7144 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 10.70 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 315

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S315U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S315U.prd
 Time stamp:        12/21/2025--20:25:09

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.43  YB1   =      9.75  YB2   =     13.11
 LD    =      3.35  NOPEN =    6       NRISER=    6       SPAC  =      0.67    NPPERR =    1
 D0    =     0.188 A0    =     0.028 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     0.850 B0    =0.4152E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.511 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7527E-01         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9476E-01   j0 =U0*GP0*B0 =0.5075E-03   (based on slot width B0)
 m0 =U0*q0   =0.1137E+00   j0 =q0*GP0    =0.6090E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.050 lM    =     14.85  lm    =     90.58
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.3177E+00  J0    =0.1701E-02
 Associated 3-d length scales (meters)
 LQ    =      0.17  LM    =     10.26  Lm    =     17.43  Lb    =     45.91
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     82.43  FRD0  =     38.71  R     =     42.64  PL    =    0.93
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.511 D0    =      0.188 A0    =      0.028 THETA =      0.00
 FR0   =     82.43  FRD0  =     38.71  R     =     42.64
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
       11.43 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.03     1.68     1.481   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.03     1.68 .00000E+00
     0.14    -0.09    0.21     1.5 0.374E+01   0.07     1.47 .16588E+00
     0.28    -0.18    0.22     1.8 0.326E+01   0.13     1.32 .37854E+00
     0.43    -0.27    0.22     2.0 0.297E+01   0.20     1.20 .62115E+00
     0.57    -0.36    0.23     2.1 0.276E+01   0.26     1.11 .88773E+00
     0.71    -0.44    0.24     2.2 0.260E+01   0.33     1.03 .11748E+01
     0.85    -0.53    0.24     2.3 0.247E+01   0.40     0.98 .14801E+01
```

```
      1.00    -0.62    0.25     2.5 0.236E+01   0.46     0.94 .18018E+01
      1.14    -0.71    0.26     2.6 0.227E+01   0.53     0.91 .21387E+01
      1.28    -0.80    0.26     2.6 0.219E+01   0.60     0.90 .24896E+01
      1.42    -0.89    0.27     2.7 0.212E+01   0.66     0.89 .28537E+01
 Cumulative travel time =          2.8537 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      1.42    -0.89    0.66     2.7 0.212E+01   0.66     1.00 .28537E+01
     17.75     6.43    0.66     4.3 0.136E+01   0.66     2.34 .22071E+03
     34.08    12.70    0.66     5.4 0.108E+01   0.66     3.63 .51726E+03
     50.41    18.15    0.66     6.3 0.922E+00   0.66     4.88 .87530E+03
     66.75    22.91    0.66     7.1 0.818E+00   0.66     6.10 .12857E+04
     83.08    27.05    0.66     7.8 0.743E+00   0.66     7.30 .17424E+04
     99.41    30.64    0.66     8.5 0.685E+00   0.66     8.47 .22411E+04
    115.74    33.71    0.66     9.1 0.639E+00   0.66     9.62 .27786E+04
    132.07    36.31    0.66     9.6 0.601E+00   0.66    10.75 .33523E+04
    148.40    38.45    0.66    10.2 0.569E+00   0.66    11.86 .39599E+04
    164.73    40.16    0.66    10.7 0.542E+00   0.66    12.96 .45997E+04
 Cumulative travel time =        4599.7144 sec  (    1.28 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.52 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of    10.7 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     1.06

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.81    0.66     4.8 0.120E+01   0.66    36.24    0.66    0.00   .45997E+04
 Cumulative travel time =        4599.7144 sec  (    1.28 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 316

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S316U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S316U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:26:37
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.74 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.50 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.55 m
  Port/Nozzle diameter          D0      = 0.1883 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.050746 m
  Total area of openings        TA0     = 0.1670 m^2
  Discharge velocity            U0      = 1.51 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.091995 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.115815 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.138978 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000620 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000744 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 110.71 m          LM  = 15.88 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 74.56
  Port/nozzle Froude number     FRD0    = 38.71
  Velocity ratio                R       = 42.64
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.13 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5454 deg.F
  Dilution at edge of NFR              s = 10.6
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 41.22 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 12.83 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4543.4316 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 10.63 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 316

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S316U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S316U.prd
 Time stamp:        12/21/2025--20:26:37

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.13  YB1   =      9.75  YB2   =     12.50
 LD    =      2.74  NOPEN =    6       NRISER=    6       SPAC  =      0.55    NPPERR =    1
 D0    =     0.188 A0    =     0.028 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     0.850 B0    =0.5075E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.511 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.9200E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1158E+00   j0 =U0*GP0*B0 =0.6203E-03   (based on slot width B0)
 m0 =U0*q0   =0.1390E+00   j0 =q0*GP0    =0.7443E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.061 lM    =     15.88  lm    =    110.71
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.3177E+00  J0    =0.1701E-02
 Associated 3-d length scales (meters)
 LQ    =      0.17  LM    =     10.26  Lm    =     17.43  Lb    =     45.91
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     74.56  FRD0  =     38.71  R     =     42.64  PL    =    0.70
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.511 D0    =      0.188 A0    =      0.028 THETA =      0.00
 FR0   =     74.56  FRD0  =     38.71  R     =     42.64
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.13 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.04     1.37     1.481   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.04     1.37 .00000E+00
      0.12    -0.07    0.21     1.5 0.397E+01   0.07     1.20 .12834E+00
      0.23    -0.15    0.21     1.7 0.351E+01   0.13     1.08 .28904E+00
      0.35    -0.22    0.22     1.8 0.322E+01   0.20     0.98 .47051E+00
      0.47    -0.29    0.23     1.9 0.301E+01   0.26     0.90 .66862E+00
      0.58    -0.36    0.23     2.0 0.285E+01   0.33     0.84 .88100E+00
      0.70    -0.44    0.24     2.1 0.272E+01   0.40     0.80 .11060E+01
```

```
      0.81    -0.51    0.24     2.2 0.261E+01   0.46     0.76 .13426E+01
      0.93    -0.58    0.25     2.3 0.251E+01   0.53     0.74 .15896E+01
      1.05    -0.65    0.25     2.4 0.243E+01   0.60     0.73 .18465E+01
      1.16    -0.73    0.26     2.5 0.236E+01   0.66     0.72 .21127E+01
 Cumulative travel time =          2.1127 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.16    -0.73    0.66     2.5 0.236E+01   0.66     0.81 .21127E+01
    17.52     6.77    0.66     4.1 0.142E+01   0.66     2.17 .20748E+03
    33.88    13.17    0.66     5.2 0.111E+01   0.66     3.46 .49544E+03
    50.23    18.73    0.66     6.2 0.939E+00   0.66     4.72 .84670E+03
    66.59    23.58    0.66     7.0 0.830E+00   0.66     5.95 .12514E+04
    82.95    27.81    0.66     7.7 0.752E+00   0.66     7.15 .17032E+04
    99.30    31.47    0.66     8.4 0.692E+00   0.66     8.32 .21977E+04
   115.66    34.60    0.66     9.0 0.645E+00   0.66     9.48 .27314E+04
   132.02    37.26    0.66     9.6 0.606E+00   0.66    10.61 .33017E+04
   148.37    39.46    0.66    10.1 0.573E+00   0.66    11.73 .39063E+04
   164.73    41.22    0.66    10.6 0.545E+00   0.66    12.83 .45434E+04
 Cumulative travel time =        4543.4316 sec  (    1.26 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.54 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of    10.6 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     1.06

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.12    0.66     4.8 0.120E+01   0.66    36.24    0.66    0.00   .45434E+04
 Cumulative travel time =        4543.4316 sec  (    1.26 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 317

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S317U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S317U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:28:10
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.44 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.19 m
  Number of openings            NOPEN   = 4
  Number of Risers              NRISER = 4
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.81 m
  Port/Nozzle diameter          D0      = 0.2332 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.052567 m
  Total area of openings        TA0     = 0.1709 m^2
  Discharge velocity            U0      = 1.48 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.103494 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.114616 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.152821 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000628 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000837 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 121.74 m          LM  = 15.59 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 71.60
  Port/nozzle Froude number     FRD0    = 33.99
  Velocity ratio                R       = 41.68
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.97 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5533 deg.F
  Dilution at edge of NFR              s = 10.5
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 41.07 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 12.74 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4567.1265 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 10.48 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 317

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S317U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S317U.prd
 Time stamp:        12/21/2025--20:28:10

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.97  YB1   =      9.75  YB2   =     12.19
 LD    =      2.44  NOPEN =    4       NRISER=    4       SPAC  =      0.81    NPPERR =    1
 D0    =     0.233 A0    =     0.043 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.253 CR0   =     0.850 B0    =0.5257E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.477 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1035E+00         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1146E+00   j0 =U0*GP0*B0 =0.6280E-03   (based on slot width B0)
 m0 =U0*q0   =0.1528E+00   j0 =q0*GP0    =0.8373E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.070 lM    =     15.59  lm    =    121.74
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2795E+00  J0    =0.1531E-02
 Associated 3-d length scales (meters)
 LQ    =      0.21  LM    =      9.82  Lm    =     17.23  Lb    =     45.91
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     71.60  FRD0  =     33.99  R     =     41.68  PL    =    0.84
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     1.477 D0    =     0.233 A0    =     0.043 THETA =      0.00
 FR0   =     71.60  FRD0  =     33.99  R     =     41.68
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.97 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.04     1.22     1.447   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.04     1.22 .00000E+00
     0.10    -0.06    0.21     1.4 0.412E+01   0.07     1.07 .11241E+00
     0.21    -0.13    0.21     1.6 0.368E+01   0.13     0.96 .25080E+00
     0.31    -0.19    0.22     1.7 0.340E+01   0.20     0.87 .40588E+00
     0.41    -0.26    0.22     1.8 0.320E+01   0.26     0.80 .57437E+00
     0.52    -0.32    0.23     1.9 0.304E+01   0.33     0.75 .75434E+00
     0.62    -0.39    0.23     2.0 0.290E+01   0.40     0.71 .94451E+00
```

```
      0.72    -0.45    0.24     2.1 0.279E+01   0.46     0.68 .11439E+01
      0.83    -0.52    0.24     2.2 0.269E+01   0.53     0.66 .13519E+01
      0.93    -0.58    0.25     2.2 0.261E+01   0.60     0.65 .15678E+01
      1.03    -0.65    0.25     2.3 0.253E+01   0.66     0.64 .17911E+01
 Cumulative travel time =          1.7911 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      1.03    -0.65    0.66     2.3 0.253E+01   0.66     0.72 .17911E+01
     17.40     6.91    0.66     4.0 0.146E+01   0.66     2.08 .20298E+03
     33.77    13.34    0.66     5.1 0.113E+01   0.66     3.38 .48987E+03
     50.14    18.90    0.66     6.1 0.958E+00   0.66     4.64 .84174E+03
     66.51    23.73    0.66     6.9 0.845E+00   0.66     5.86 .12482E+04
     82.88    27.93    0.66     7.6 0.765E+00   0.66     7.06 .17028E+04
     99.25    31.55    0.66     8.2 0.703E+00   0.66     8.24 .22009E+04
    115.62    34.64    0.66     8.9 0.655E+00   0.66     9.39 .27388E+04
    131.99    37.24    0.66     9.4 0.615E+00   0.66    10.52 .33140E+04
    148.36    39.37    0.66    10.0 0.582E+00   0.66    11.64 .39241E+04
    164.73    41.07    0.66    10.5 0.553E+00   0.66    12.74 .45671E+04
 Cumulative travel time =        4567.1265 sec  (    1.27 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.51 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of    10.5 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     1.06

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.27    0.66     4.8 0.120E+01   0.66    36.24    0.66    0.00   .45671E+04
 Cumulative travel time =        4567.1265 sec  (    1.27 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 318

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S318U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S318U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:29:39
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.13 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 11.89 m
  Number of openings            NOPEN   = 3
  Number of Risers              NRISER = 3
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 1.07 m
  Port/Nozzle diameter          D0      = 0.2810 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.058137 m
  Total area of openings        TA0     = 0.1861 m^2
  Discharge velocity            U0      = 1.36 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.118279 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.106950 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.160425 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000638 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000957 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.09 m          Lm  = 127.80 m          LM  = 14.39 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 62.54
  Port/nozzle Froude number     FRD0    = 28.44
  Velocity ratio                R       = 38.28
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.82 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5789 deg.F
  Dilution at edge of NFR              s = 10.0
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 38.98 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 12.57 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4736.0278 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 10.02 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 318

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S318U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S318U.prd
 Time stamp:        12/21/2025--20:29:39

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.82  YB1   =      9.75  YB2   =     11.89
 LD    =      2.13  NOPEN =    3       NRISER=    3       SPAC  =      1.07    NPPERR =    1
 D0    =     0.281 A0    =     0.062 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.305 CR0   =     0.850 B0    =0.5814E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.356 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1183E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1069E+00   j0 =U0*GP0*B0 =0.6380E-03   (based on slot width B0)
 m0 =U0*q0   =0.1604E+00   j0 =q0*GP0    =0.9570E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.087 lM    =     14.39  lm    =    127.80
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2282E+00  J0    =0.1361E-02
 Associated 3-d length scales (meters)
 LQ    =      0.25  LM    =      8.95  Lm    =     16.51  Lb    =     45.91
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     62.54  FRD0  =     28.44  R     =     38.28  PL    =    0.93
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.356 D0    =      0.281 A0    =      0.062 THETA =      0.00
 FR0   =     62.54  FRD0  =     28.44  R     =     38.28
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.82 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.05     1.07     1.326   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.05     1.07 .00000E+00
     0.09    -0.06    0.21     1.3 0.436E+01   0.07     0.94 .10122E+00
     0.18    -0.11    0.21     1.5 0.395E+01   0.13     0.84 .22256E+00
     0.27    -0.17    0.22     1.6 0.368E+01   0.20     0.76 .35685E+00
     0.36    -0.23    0.22     1.7 0.349E+01   0.26     0.70 .50154E+00
     0.45    -0.28    0.22     1.7 0.333E+01   0.33     0.65 .65516E+00
     0.54    -0.34    0.23     1.8 0.320E+01   0.40     0.62 .81670E+00
```

```
      0.63    -0.40    0.23     1.9 0.309E+01   0.46     0.59 .98544E+00
      0.72    -0.45    0.24     1.9 0.299E+01   0.53     0.57 .11608E+01
      0.81    -0.51    0.24     2.0 0.291E+01   0.60     0.57 .13424E+01
      0.90    -0.57    0.25     2.0 0.283E+01   0.66     0.56 .15297E+01
 Cumulative travel time =          1.5297 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.90    -0.57    0.66     2.0 0.283E+01   0.66     0.63 .15297E+01
    17.29     6.98    0.66     3.7 0.156E+01   0.66     1.99 .20454E+03
    33.67    13.30    0.66     4.8 0.120E+01   0.66     3.28 .49936E+03
    50.05    18.72    0.66     5.7 0.101E+01   0.66     4.54 .86298E+03
    66.44    23.36    0.66     6.5 0.888E+00   0.66     5.76 .12842E+04
    82.82    27.34    0.66     7.2 0.802E+00   0.66     6.95 .17561E+04
    99.20    30.71    0.66     7.9 0.737E+00   0.66     8.11 .22735E+04
   115.58    33.52    0.66     8.5 0.686E+00   0.66     9.25 .28330E+04
   131.97    35.82    0.66     9.0 0.644E+00   0.66    10.38 .34314E+04
   148.35    37.63    0.66     9.5 0.609E+00   0.66    11.48 .40664E+04
   164.73    38.98    0.66    10.0 0.579E+00   0.66    12.57 .47360E+04
 Cumulative travel time =        4736.0278 sec  (    1.32 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.40 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of    10.0 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     1.06

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.42    0.66     4.8 0.120E+01   0.66    36.24    0.66    0.00   .47360E+04
 Cumulative travel time =        4736.0278 sec  (    1.32 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 319

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S319U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S319U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:31:31
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 4.88 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 14.63 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.49 m
  Port/Nozzle diameter          D0      = 0.1524 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.037405 m
  Total area of openings        TA0     = 0.2007 m^2
  Discharge velocity            U0      = 1.26 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.051747 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.059165 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.065081 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000381 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000419 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.04 m          Lm  = 51.84 m          LM  = 11.24 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 72.30
  Port/nozzle Froude number     FRD0    = 35.82
  Velocity ratio                R       = 35.50
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    12.19 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5847 deg.F
  Dilution at edge of NFR              s = 9.9
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 31.44 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.05 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       5198.9199 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 9.92 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 319

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S319U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S319U.prd
 Time stamp:        12/21/2025--20:31:31

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     12.19  YB1   =      9.75  YB2   =     14.63
 LD    =      4.88  NOPEN =   11       NRISER=   11       SPAC  =      0.49    NPPERR =    1
 D0    =     0.152 A0    =     0.018 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     1.000 B0    =0.3740E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.258 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.5175E-01         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.5916E-01   j0 =U0*GP0*B0 =0.3806E-03   (based on slot width B0)
 m0 =U0*q0   =0.6508E-01   j0 =q0*GP0    =0.4187E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.041 lM    =     11.24  lm    =     51.84
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2885E+00  J0    =0.1856E-02
 Associated 3-d length scales (meters)
 LQ    =      0.14  LM    =      9.14  Lm    =     15.90  Lb    =     45.91
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     72.30  FRD0  =     35.82  R     =     35.50  PL    =    0.97
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.258 D0    =      0.152 A0    =      0.018 THETA =      0.00
 FR0   =     72.30  FRD0  =     35.82  R     =     35.50
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        12.19 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.03     2.44     1.228   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.03     2.44 .00000E+00
      0.21    -0.13    0.21     1.7 0.351E+01   0.08     2.15 .30654E+00
      0.41    -0.26    0.22     1.9 0.301E+01   0.13     1.93 .70838E+00
      0.62    -0.39    0.23     2.1 0.272E+01   0.20     1.76 .11709E+01
      0.83    -0.52    0.24     2.3 0.251E+01   0.26     1.63 .16817E+01
      1.03    -0.65    0.25     2.5 0.235E+01   0.33     1.52 .22336E+01
      1.24    -0.78    0.26     2.6 0.223E+01   0.40     1.44 .28220E+01
```

```
      1.45    -0.90    0.27     2.7 0.212E+01   0.46     1.38 .34432E+01
      1.65    -1.03    0.28     2.9 0.203E+01   0.53     1.35 .40945E+01
      1.86    -1.16    0.29     3.0 0.196E+01   0.60     1.33 .47738E+01
      2.07    -1.29    0.30     3.1 0.189E+01   0.66     1.32 .54792E+01
 Cumulative travel time =          5.4792 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     2.07    -1.29    0.66     3.1 0.189E+01   0.66     1.47 .54792E+01
    18.33     5.27    0.66     4.3 0.135E+01   0.66     2.77 .27688E+03
    34.60    10.81    0.66     5.2 0.111E+01   0.66     4.02 .62553E+03
    50.87    15.51    0.66     6.0 0.965E+00   0.66     5.24 .10370E+04
    67.13    19.50    0.66     6.7 0.864E+00   0.66     6.42 .15029E+04
    83.40    22.83    0.66     7.3 0.790E+00   0.66     7.58 .20174E+04
    99.67    25.58    0.66     7.9 0.732E+00   0.66     8.71 .25763E+04
   115.93    27.78    0.66     8.5 0.685E+00   0.66     9.82 .31763E+04
   132.20    29.48    0.66     9.0 0.646E+00   0.66    10.92 .38149E+04
   148.46    30.69    0.66     9.5 0.613E+00   0.66    11.99 .44897E+04
   164.73    31.44    0.66     9.9 0.585E+00   0.66    13.05 .51989E+04
 Cumulative travel time =        5198.9199 sec  (    1.44 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.24 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of     9.9 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     1.06

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.05    0.66     4.8 0.120E+01   0.66    36.24    0.66    0.00   .51989E+04
 Cumulative travel time =        5198.9199 sec  (    1.44 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 320

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S320U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S320U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:33:03
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.96 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.72 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.40 m
  Port/Nozzle diameter          D0      = 0.1524 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.046036 m
  Total area of openings        TA0     = 0.2007 m^2
  Discharge velocity            U0      = 1.26 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.063689 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.072818 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.080100 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000468 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000515 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.05 m          Lm  = 63.81 m          LM  = 12.04 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 65.17
  Port/nozzle Froude number     FRD0   = 35.82
  Velocity ratio                R      = 35.50
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.73 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5901 deg.F
  Dilution at edge of NFR              s = 9.8
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 33.12 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 12.86 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       5107.1855 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 9.83 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 320

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S320U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S320U.prd
 Time stamp:        12/21/2025--20:33:03

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.73  YB1   =      9.75  YB2   =     13.72
 LD    =      3.96  NOPEN =   11       NRISER=   11       SPAC  =      0.40    NPPERR =    1
 D0    =     0.152 A0    =     0.018 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     1.000 B0    =0.4604E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.258 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.6369E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.7282E-01   j0 =U0*GP0*B0 =0.4684E-03   (based on slot width B0)
 m0 =U0*q0   =0.8010E-01   j0 =q0*GP0    =0.5153E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.051 lM    =     12.04  lm    =     63.81
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2885E+00  J0    =0.1856E-02
 Associated 3-d length scales (meters)
 LQ    =      0.14  LM    =      9.14  Lm    =     15.90  Lb    =     45.91
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     65.17  FRD0  =     35.82  R     =     35.50  PL    =    0.73
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.258 D0    =      0.152 A0    =      0.018 THETA =      0.00
 FR0   =     65.17  FRD0  =     35.82  R     =     35.50
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.73 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.04     1.98     1.228   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.04     1.98 .00000E+00
      0.17    -0.10    0.21     1.6 0.374E+01   0.08     1.74 .23427E+00
      0.34    -0.21    0.22     1.8 0.326E+01   0.13     1.56 .53427E+00
      0.50    -0.31    0.23     2.0 0.296E+01   0.20     1.43 .87626E+00
      0.67    -0.42    0.23     2.1 0.276E+01   0.26     1.32 .12518E+01
      0.84    -0.52    0.24     2.2 0.260E+01   0.33     1.23 .16559E+01
      1.01    -0.63    0.25     2.4 0.247E+01   0.40     1.16 .20853E+01
```

```
      1.18    -0.73    0.26     2.5 0.236E+01   0.46     1.12 .25377E+01
      1.34    -0.84    0.26     2.6 0.226E+01   0.53     1.09 .30111E+01
      1.51    -0.94    0.27     2.7 0.218E+01   0.60     1.07 .35040E+01
      1.68    -1.05    0.28     2.7 0.211E+01   0.66     1.06 .40152E+01
 Cumulative travel time =          4.0152 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      1.68    -1.05    0.66     2.7 0.211E+01   0.66     1.19 .40152E+01
     17.99     5.79    0.66     4.1 0.143E+01   0.66     2.51 .25672E+03
     34.29    11.53    0.66     5.0 0.115E+01   0.66     3.77 .59165E+03
     50.60    16.41    0.66     5.9 0.991E+00   0.66     4.99 .99202E+03
     66.90    20.54    0.66     6.6 0.883E+00   0.66     6.19 .14485E+04
     83.21    24.01    0.66     7.2 0.804E+00   0.66     7.35 .19548E+04
     99.51    26.88    0.66     7.8 0.743E+00   0.66     8.49 .25066E+04
    115.82    29.19    0.66     8.4 0.694E+00   0.66     9.61 .31002E+04
    132.12    30.98    0.66     8.9 0.653E+00   0.66    10.71 .37330E+04
    148.43    32.28    0.66     9.4 0.619E+00   0.66    11.79 .44026E+04
    164.73    33.12    0.66     9.8 0.590E+00   0.66    12.86 .51072E+04
 Cumulative travel time =        5107.1870 sec  (    1.42 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.26 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of     9.8 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     1.06

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.51    0.66     4.8 0.120E+01   0.66    36.24    0.66    0.00   .51072E+04
 Cumulative travel time =        5107.1855 sec  (    1.42 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 321

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S321U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S321U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:34:39
********************************************************************************
SUMMARY OF INPUT DATA:
--------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
--------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.35 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.11 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.67 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.048846 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 1.28 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
--------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.075269 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.080544 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.096653 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000507 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000609 m^3/s^3
--------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 76.99 m          LM  = 12.63 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
--------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 64.59
  Port/nozzle Froude number     FRD0   = 31.59
  Velocity ratio                R      = 36.24
--------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
********************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.43 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5876 deg.F
  Dilution at edge of NFR              s = 9.9
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 34.95 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 12.75 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       4992.5581 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 9.87 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 321

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                    HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S321U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S321U.prd
 Time stamp:        12/21/2025--20:34:39

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.43  YB1   =      9.75  YB2   =     13.11
 LD    =      3.35  NOPEN =    6       NRISER=    6       SPAC  =      0.67    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.4885E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.284 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7527E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.8054E-01   j0 =U0*GP0*B0 =0.5075E-03   (based on slot width B0)
 m0 =U0*q0   =0.9665E-01   j0 =q0*GP0    =0.6090E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.059 lM    =     12.63  lm    =     76.99
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2700E+00  J0    =0.1701E-02
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =      9.08  Lm    =     16.07  Lb    =     45.91
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     64.59  FRD0  =     31.59  R     =     36.24  PL    =    0.93
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.284 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =     64.59  FRD0  =     31.59  R     =     36.24
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.43 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.04     1.68     1.254   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.04     1.68 .00000E+00
      0.14    -0.09    0.21     1.5 0.390E+01   0.07     1.47 .18633E+00
      0.28    -0.18    0.22     1.7 0.344E+01   0.13     1.32 .42087E+00
      0.43    -0.27    0.22     1.8 0.315E+01   0.20     1.20 .68629E+00
      0.57    -0.36    0.23     2.0 0.294E+01   0.26     1.11 .97640E+00
      0.71    -0.44    0.24     2.1 0.278E+01   0.33     1.04 .12876E+01
      0.85    -0.53    0.24     2.2 0.265E+01   0.40     0.98 .16176E+01
```

```
      1.00    -0.62    0.25     2.3 0.254E+01   0.46     0.94 .19644E+01
      1.14    -0.71    0.26     2.4 0.244E+01   0.53     0.91 .23269E+01
      1.28    -0.80    0.26     2.5 0.236E+01   0.60     0.90 .27038E+01
      1.42    -0.89    0.27     2.5 0.229E+01   0.66     0.89 .30943E+01
 Cumulative travel time =          3.0943 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      1.42    -0.89    0.66     2.5 0.229E+01   0.66     1.00 .30943E+01
     17.75     6.17    0.66     3.9 0.147E+01   0.66     2.33 .24006E+03
     34.08    12.10    0.66     5.0 0.117E+01   0.66     3.61 .56219E+03
     50.41    17.15    0.66     5.8 0.999E+00   0.66     4.84 .95095E+03
     66.75    21.44    0.66     6.5 0.886E+00   0.66     6.04 .13964E+04
     83.08    25.07    0.66     7.2 0.805E+00   0.66     7.21 .18921E+04
     99.41    28.09    0.66     7.8 0.742E+00   0.66     8.36 .24333E+04
    115.74    30.56    0.66     8.4 0.693E+00   0.66     9.48 .30166E+04
    132.07    32.50    0.66     8.9 0.652E+00   0.66    10.59 .36391E+04
    148.40    33.96    0.66     9.4 0.617E+00   0.66    11.68 .42984E+04
    164.73    34.96    0.66     9.9 0.588E+00   0.66    12.75 .49926E+04
 Cumulative travel time =        4992.5586 sec  (    1.39 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.30 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of     9.9 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     1.06

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.81    0.66     4.8 0.120E+01   0.66    36.24    0.66    0.00   .49926E+04
 Cumulative travel time =        4992.5581 sec  (    1.39 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 322

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S322U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S322U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:36:07
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.74 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;     YB2 = 12.50 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.55 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.059701 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 1.28 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.091995 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.098443 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.118131 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000620 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000744 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 94.10 m          LM  = 13.50 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 58.43
  Port/nozzle Froude number     FRD0   = 31.59
  Velocity ratio                R      = 36.24
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.13 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5913 deg.F
  Dilution at edge of NFR              s = 9.8
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 36.09 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 12.62 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4930.6558 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 9.81 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 322

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S322U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S322U.prd
 Time stamp:        12/21/2025--20:36:07

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.13  YB1   =      9.75  YB2   =     12.50
 LD    =      2.74  NOPEN =    6       NRISER=    6       SPAC  =      0.55    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.5970E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.284 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.9200E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9844E-01   j0 =U0*GP0*B0 =0.6203E-03   (based on slot width B0)
 m0 =U0*q0   =0.1181E+00   j0 =q0*GP0    =0.7443E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.072 lM    =     13.50  lm    =     94.10
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2700E+00  J0    =0.1701E-02
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =      9.08  Lm    =     16.07  Lb    =     45.91
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     58.43  FRD0  =     31.59  R     =     36.24  PL    =    0.70
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.284 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =     58.43  FRD0  =     31.59  R     =     36.24
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.13 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.05     1.37     1.254   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.05     1.37 .00000E+00
      0.12    -0.07    0.21     1.4 0.413E+01   0.08     1.20 .14444E+00
      0.23    -0.15    0.21     1.6 0.369E+01   0.13     1.08 .32192E+00
      0.35    -0.22    0.22     1.7 0.341E+01   0.20     0.98 .52061E+00
      0.47    -0.29    0.23     1.8 0.321E+01   0.26     0.91 .73629E+00
      0.58    -0.36    0.23     1.9 0.304E+01   0.33     0.85 .96653E+00
      0.70    -0.44    0.24     2.0 0.291E+01   0.40     0.80 .12097E+01
```

```
      0.81    -0.51    0.24     2.1 0.280E+01   0.46     0.76 .14645E+01
      0.93    -0.58    0.25     2.1 0.270E+01   0.53     0.74 .17302E+01
      1.05    -0.65    0.25     2.2 0.262E+01   0.60     0.73 .20058E+01
      1.16    -0.73    0.26     2.3 0.254E+01   0.66     0.73 .22909E+01
 Cumulative travel time =          2.2909 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      1.16    -0.73    0.66     2.3 0.254E+01   0.66     0.81 .22909E+01
     17.52     6.53    0.66     3.8 0.153E+01   0.66     2.16 .22557E+03
     33.88    12.60    0.66     4.8 0.120E+01   0.66     3.44 .53826E+03
     50.23    17.76    0.66     5.7 0.102E+01   0.66     4.68 .91956E+03
     66.59    22.16    0.66     6.5 0.899E+00   0.66     5.89 .13588E+04
     82.95    25.87    0.66     7.1 0.814E+00   0.66     7.06 .18491E+04
     99.30    28.97    0.66     7.7 0.750E+00   0.66     8.22 .23857E+04
    115.66    31.51    0.66     8.3 0.699E+00   0.66     9.35 .29648E+04
    132.02    33.52    0.66     8.8 0.657E+00   0.66    10.46 .35835E+04
    148.37    35.04    0.66     9.3 0.621E+00   0.66    11.55 .42395E+04
    164.73    36.09    0.66     9.8 0.591E+00   0.66    12.62 .49307E+04
 Cumulative travel time =        4930.6558 sec  (    1.37 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.32 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of     9.8 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     1.06

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.12    0.66     4.8 0.120E+01   0.66    36.24    0.66    0.00   .49307E+04
 Cumulative travel time =        4930.6558 sec  (    1.37 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 323

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S323U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S323U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:37:39
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.44 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.19 m
  Number of openings            NOPEN   = 4
  Number of Risers              NRISER = 4
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.81 m
  Port/Nozzle diameter          D0      = 0.2530 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.061843 m
  Total area of openings        TA0     = 0.2011 m^2
  Discharge velocity            U0      = 1.26 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.103494 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.097424 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.129898 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000628 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000837 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.08 m          Lm  = 103.48 m          LM  = 13.25 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 56.11
  Port/nozzle Froude number     FRD0   = 27.74
  Velocity ratio                R      = 35.42
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.97 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5998 deg.F
  Dilution at edge of NFR              s = 9.7
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 35.91 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 12.53 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4956.0059 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 9.67 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 323

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S323U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S323U.prd
 Time stamp:        12/21/2025--20:37:39

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.97  YB1   =      9.75  YB2   =     12.19
 LD    =      2.44  NOPEN =    4       NRISER=    4       SPAC  =      0.81    NPPERR =    1
 D0    =     0.253 A0    =     0.050 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.253 CR0   =     1.000 B0    =0.6184E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.255 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1035E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9742E-01   j0 =U0*GP0*B0 =0.6280E-03   (based on slot width B0)
 m0 =U0*q0   =0.1299E+00   j0 =q0*GP0    =0.8373E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.082 lM    =     13.25  lm    =    103.48
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2376E+00  J0    =0.1531E-02
 Associated 3-d length scales (meters)
 LQ    =      0.22  LM    =      8.70  Lm    =     15.88  Lb    =     45.91
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     56.11  FRD0  =     27.74  R     =     35.42  PL    =    0.84
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.255 D0    =      0.253 A0    =      0.050 THETA =      0.00
 FR0   =     56.11  FRD0  =     27.74  R     =     35.42
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.97 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.05     1.22     1.225   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.05     1.22 .00000E+00
     0.10    -0.06    0.21     1.4 0.428E+01   0.07     1.07 .12667E+00
     0.21    -0.13    0.21     1.5 0.387E+01   0.13     0.96 .27966E+00
     0.31    -0.19    0.22     1.6 0.360E+01   0.20     0.87 .44956E+00
     0.41    -0.26    0.22     1.7 0.340E+01   0.26     0.80 .63304E+00
     0.52    -0.32    0.23     1.8 0.324E+01   0.33     0.75 .82814E+00
     0.62    -0.39    0.23     1.9 0.311E+01   0.40     0.71 .10336E+01
```

```
      0.72    -0.45    0.24     1.9 0.300E+01   0.46     0.68 .12484E+01
      0.83    -0.52    0.24     2.0 0.290E+01   0.53     0.66 .14718E+01
      0.93    -0.58    0.25     2.1 0.281E+01   0.60     0.65 .17033E+01
      1.03    -0.65    0.25     2.1 0.274E+01   0.66     0.65 .19422E+01
 Cumulative travel time =          1.9422 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      1.03    -0.65    0.66     2.1 0.274E+01   0.66     0.72 .19422E+01
     17.40     6.68    0.66     3.7 0.158E+01   0.66     2.07 .22063E+03
     33.77    12.78    0.66     4.7 0.123E+01   0.66     3.35 .53212E+03
     50.14    17.94    0.66     5.6 0.104E+01   0.66     4.59 .91404E+03
     66.51    22.31    0.66     6.3 0.916E+00   0.66     5.80 .13552E+04
     82.88    26.00    0.66     7.0 0.829E+00   0.66     6.98 .18484E+04
     99.25    29.06    0.66     7.6 0.762E+00   0.66     8.13 .23888E+04
    115.62    31.54    0.66     8.2 0.710E+00   0.66     9.26 .29725E+04
    131.99    33.49    0.66     8.7 0.667E+00   0.66    10.37 .35965E+04
    148.36    34.94    0.66     9.2 0.631E+00   0.66    11.46 .42584E+04
    164.73    35.91    0.66     9.7 0.600E+00   0.66    12.53 .49560E+04
 Cumulative travel time =        4956.0063 sec  (    1.38 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.29 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of     9.7 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     1.06

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.27    0.66     4.8 0.120E+01   0.66    36.24    0.66    0.00   .49560E+04
 Cumulative travel time =        4956.0059 sec  (    1.38 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 324

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S324U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S324U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:38:58
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.13 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 11.89 m
  Number of openings            NOPEN   = 3
  Number of Risers              NRISER = 3
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 1.07 m
  Port/Nozzle diameter          D0      = 0.3048 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.068397 m
  Total area of openings        TA0     = 0.2189 m^2
  Discharge velocity            U0      = 1.15 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.118279 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.090907 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.136361 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000638 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000957 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.10 m          Lm  = 108.63 m          LM  = 12.24 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 49.01
  Port/nozzle Froude number     FRD0   = 23.22
  Velocity ratio                R      = 32.54
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.82 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.6276 deg.F
  Dilution at edge of NFR              s = 9.2
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 33.64 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 21.17 m
                          thickness (bv) = 0.39 m
  Cumulative travel time:       5138.9854 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 9.24 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 324

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S324U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S324U.prd
 Time stamp:        12/21/2025--20:38:58

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.82  YB1   =      9.75  YB2   =     11.89
 LD    =      2.13  NOPEN =    3       NRISER=    3       SPAC  =      1.07    NPPERR =    1
 D0    =     0.305 A0    =     0.073 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.305 CR0   =     1.000 B0    =0.6840E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.153 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1183E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9091E-01   j0 =U0*GP0*B0 =0.6380E-03   (based on slot width B0)
 m0 =U0*q0   =0.1364E+00   j0 =q0*GP0    =0.9570E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.103 lM    =     12.24  lm    =    108.63
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.1940E+00  J0    =0.1361E-02
 Associated 3-d length scales (meters)
 LQ    =      0.27  LM    =      7.92  Lm    =     15.22  Lb    =     45.91
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     49.01  FRD0  =     23.22  R     =     32.54  PL    =    0.93
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     1.153 D0    =     0.305 A0    =     0.073 THETA =      0.00
 FR0   =     49.01  FRD0  =     23.22  R     =     32.54
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.82 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.05     1.07     1.123   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.05     1.07 .00000E+00
     0.09    -0.06    0.21     1.3 0.452E+01   0.08     0.94 .11428E+00
     0.18    -0.11    0.21     1.4 0.414E+01   0.13     0.84 .24862E+00
     0.27    -0.17    0.22     1.5 0.389E+01   0.20     0.76 .39587E+00
     0.36    -0.23    0.22     1.6 0.370E+01   0.26     0.70 .55350E+00
     0.45    -0.28    0.22     1.6 0.355E+01   0.33     0.66 .72002E+00
     0.54    -0.34    0.23     1.7 0.342E+01   0.40     0.62 .89446E+00
```

```
      0.63    -0.40    0.23     1.8 0.331E+01   0.46     0.59 .10761E+01
      0.72    -0.45    0.24     1.8 0.322E+01   0.53     0.58 .12643E+01
      0.81    -0.51    0.24     1.9 0.313E+01   0.60     0.57 .14587E+01
      0.90    -0.57    0.25     1.9 0.306E+01   0.66     0.56 .16588E+01
 Cumulative travel time =          1.6588 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.90    -0.57    0.66     1.9 0.306E+01   0.66     0.63 .16588E+01
     14.37     5.55    0.66     3.2 0.181E+01   0.66     1.74 .17455E+03
     27.83    10.72    0.66     4.1 0.140E+01   0.66     2.81 .41883E+03
     41.29    15.17    0.66     4.9 0.119E+01   0.66     3.84 .71756E+03
     54.75    19.01    0.66     5.5 0.105E+01   0.66     4.84 .10622E+04
     68.22    22.32    0.66     6.1 0.951E+00   0.66     5.82 .14472E+04
     81.68    25.13    0.66     6.6 0.875E+00   0.66     6.78 .18688E+04
     95.14    27.51    0.66     7.1 0.815E+00   0.66     7.72 .23240E+04
    108.60    29.46    0.66     7.6 0.766E+00   0.66     8.64 .28105E+04
    122.07    31.03    0.66     8.0 0.724E+00   0.66     9.56 .33264E+04
    135.53    32.23    0.66     8.4 0.689E+00   0.66    10.45 .38702E+04
 Cumulative travel time =        3870.1758 sec  (    1.08 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
    135.53    32.23    0.66     8.4 0.689E+00   0.66    10.45 .38702E+04
    138.45    32.44    0.66     8.5 0.682E+00   0.56    12.46 .39917E+04
    141.37    32.64    0.66     8.6 0.675E+00   0.52    13.74 .41144E+04
    144.29    32.82    0.66     8.7 0.669E+00   0.49    14.85 .42383E+04
    147.21    32.98    0.66     8.8 0.662E+00   0.47    15.87 .43634E+04
    150.13    33.13    0.66     8.8 0.656E+00   0.45    16.83 .44898E+04
    153.05    33.26    0.66     8.9 0.650E+00   0.43    17.75 .46173E+04
    155.97    33.38    0.66     9.0 0.644E+00   0.42    18.64 .47460E+04
    158.89    33.48    0.66     9.1 0.639E+00   0.41    19.50 .48758E+04
    161.81    33.57    0.66     9.2 0.633E+00   0.40    20.34 .50068E+04
    164.73    33.64    0.66     9.2 0.628E+00   0.39    21.17 .51390E+04
 Cumulative travel time =        5138.9849 sec  (    1.43 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.86 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of     9.2 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     1.06

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.42    0.66     4.8 0.120E+01   0.66    36.24    0.66    0.00   .51390E+04
 Cumulative travel time =        5138.9854 sec  (    1.43 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 325

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S325U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S325U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:49:57
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 4.88 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 14.63 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.49 m
  Port/Nozzle diameter          D0      = 0.1405 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.031794 m
  Total area of openings        TA0     = 0.1706 m^2
  Discharge velocity            U0      = 1.76 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.061450 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.098155 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.107970 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000452 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000497 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.03 m          Lm  = 86.01 m         LM  = 16.62 m
  lm' = 99999 m          Lb' = 99999 m         La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 109.55
  Port/nozzle Froude number     FRD0    = 52.11
  Velocity ratio                R       = 49.59
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
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  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    12.19 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5407 deg.F
  Dilution at edge of NFR              s = 10.7
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 47.03 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.68 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4023.1375 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 10.73 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 325

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S325U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S325U.prd
 Time stamp:        12/21/2025--20:49:57

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     12.19  YB1   =      9.75  YB2   =     14.63
 LD    =      4.88  NOPEN =   11       NRISER=   11       SPAC  =      0.49    NPPERR =    1
 D0    =     0.141 A0    =     0.016 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     0.850 B0    =0.3179E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.757 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.6145E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9815E-01   j0 =U0*GP0*B0 =0.4520E-03   (based on slot width B0)
 m0 =U0*q0   =0.1080E+00   j0 =q0*GP0    =0.4972E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.035 lM    =     16.62  lm    =     86.01
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.4787E+00  J0    =0.2204E-02
 Associated 3-d length scales (meters)
 LQ    =      0.12  LM    =     12.26  Lm    =     20.48  Lb    =     54.51
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =    109.55  FRD0  =     52.11  R     =     49.59  PL    =    0.86
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.757 D0    =      0.141 A0    =      0.016 THETA =      0.00
 FR0   =    109.55  FRD0  =     52.11  R     =     49.59
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        12.19 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.03     2.44     1.727   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.03     2.44 .00000E+00
      0.21    -0.13    0.21     1.7 0.338E+01   0.07     2.14 .23048E+00
      0.41    -0.26    0.22     2.0 0.288E+01   0.13     1.92 .53767E+00
      0.62    -0.39    0.23     2.2 0.258E+01   0.20     1.75 .89390E+00
      0.83    -0.52    0.24     2.4 0.238E+01   0.26     1.61 .12893E+01
      1.03    -0.65    0.25     2.6 0.223E+01   0.33     1.51 .17182E+01
      1.24    -0.78    0.26     2.8 0.210E+01   0.40     1.42 .21767E+01
```

```
      1.45    -0.90    0.27     2.9 0.200E+01   0.46     1.36 .26621E+01
      1.65    -1.03    0.28     3.0 0.191E+01   0.53     1.33 .31721E+01
      1.86    -1.16    0.29     3.2 0.184E+01   0.60     1.31 .37050E+01
      2.07    -1.29    0.30     3.3 0.177E+01   0.66     1.30 .42593E+01
 Cumulative travel time =          4.2593 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      2.07    -1.29    0.66     3.3 0.177E+01   0.66     1.45 .42593E+01
     18.33     6.11    0.66     4.6 0.126E+01   0.66     2.79 .21262E+03
     34.60    12.70    0.66     5.6 0.103E+01   0.66     4.10 .48151E+03
     50.87    18.65    0.66     6.5 0.895E+00   0.66     5.37 .79944E+03
     67.13    24.03    0.66     7.2 0.801E+00   0.66     6.61 .11598E+04
     83.40    28.91    0.66     7.9 0.731E+00   0.66     7.84 .15580E+04
     99.67    33.33    0.66     8.6 0.677E+00   0.66     9.04 .19908E+04
    115.93    37.33    0.66     9.2 0.634E+00   0.66    10.22 .24556E+04
    132.20    40.93    0.66     9.7 0.598E+00   0.66    11.39 .29504E+04
    148.46    44.16    0.66    10.2 0.567E+00   0.66    12.54 .34734E+04
    164.73    47.03    0.66    10.7 0.541E+00   0.66    13.68 .40231E+04
 Cumulative travel time =        4023.1377 sec  (    1.12 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.82 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of    10.7 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.99

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.05    0.66     4.2 0.138E+01   0.66    36.24    0.66    0.00   .40231E+04
 Cumulative travel time =        4023.1375 sec  (    1.12 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 326

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S326U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S326U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:56:34
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.96 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;     YB2 = 13.72 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.40 m
  Port/Nozzle diameter          D0      = 0.1405 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.039131 m
  Total area of openings        TA0     = 0.1706 m^2
  Discharge velocity            U0      = 1.76 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.075631 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.120806 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.132887 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000556 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000612 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.04 m          Lm  = 105.86 m          LM  = 17.81 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 98.75
  Port/nozzle Froude number     FRD0   = 52.11
  Velocity ratio                R      = 49.59
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.73 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5454 deg.F
  Dilution at edge of NFR              s = 10.6
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 48.40 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.47 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       3955.2312 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 10.63 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 326

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                    HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S326U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S326U.prd
 Time stamp:        12/21/2025--20:52:34

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.73  YB1   =      9.75  YB2   =     13.72
 LD    =      3.96  NOPEN =   11       NRISER=   11       SPAC  =      0.40    NPPERR =    1
 D0    =     0.141 A0    =     0.016 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     0.850 B0    =0.3913E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.757 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7563E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1208E+00   j0 =U0*GP0*B0 =0.5563E-03   (based on slot width B0)
 m0 =U0*q0   =0.1329E+00   j0 =q0*GP0    =0.6119E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.043 lM    =     17.81  lm    =    105.86
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.4787E+00  J0    =0.2204E-02
 Associated 3-d length scales (meters)
 LQ    =      0.12  LM    =     12.26  Lm    =     20.48  Lb    =     54.51
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     98.75  FRD0  =     52.11  R     =     49.59  PL    =    0.65
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.757 D0    =      0.141 A0    =      0.016 THETA =      0.00
 FR0   =     98.75  FRD0  =     52.11  R     =     49.59
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.73 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.03     1.98     1.727   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.03     1.98 .00000E+00
      0.17    -0.10    0.21     1.6 0.360E+01   0.07     1.74 .17590E+00
      0.34    -0.21    0.22     1.9 0.311E+01   0.13     1.56 .40505E+00
      0.50    -0.31    0.23     2.1 0.282E+01   0.20     1.42 .66833E+00
      0.67    -0.42    0.23     2.2 0.261E+01   0.26     1.31 .95893E+00
      0.84    -0.52    0.24     2.4 0.245E+01   0.33     1.22 .12729E+01
      1.01    -0.63    0.25     2.5 0.232E+01   0.40     1.15 .16076E+01
```

```
      1.18    -0.73    0.26     2.6 0.222E+01   0.46     1.10 .19611E+01
      1.34    -0.84    0.26     2.7 0.213E+01   0.53     1.07 .23319E+01
      1.51    -0.94    0.27     2.8 0.205E+01   0.60     1.05 .27187E+01
      1.68    -1.05    0.28     2.9 0.198E+01   0.66     1.05 .31206E+01
 Cumulative travel time =          3.1206 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.68    -1.05    0.66     2.9 0.198E+01   0.66     1.17 .31206E+01
    17.99     6.56    0.66     4.4 0.133E+01   0.66     2.53 .19748E+03
    34.29    13.32    0.66     5.4 0.107E+01   0.66     3.84 .45614E+03
    50.60    19.40    0.66     6.3 0.918E+00   0.66     5.12 .76584E+03
    66.90    24.90    0.66     7.1 0.817E+00   0.66     6.38 .11192E+04
    83.21    29.88    0.66     7.8 0.744E+00   0.66     7.61 .15114E+04
    99.51    34.40    0.66     8.4 0.687E+00   0.66     8.81 .19390E+04
   115.82    38.48    0.66     9.0 0.642E+00   0.66    10.00 .23991E+04
   132.12    42.16    0.66     9.6 0.604E+00   0.66    11.17 .28897E+04
   148.43    45.46    0.66    10.1 0.572E+00   0.66    12.33 .34089E+04
   164.73    48.40    0.66    10.6 0.545E+00   0.66    13.47 .39552E+04
 Cumulative travel time =        3955.2312 sec  (    1.10 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
   164.73    48.40    0.66    10.6 0.545E+00   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.545E+00   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.545E+00   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.545E+00   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.545E+00   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.545E+00   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.545E+00   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.545E+00   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.545E+00   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.545E+00   0.66    13.47 .39552E+04
 Cumulative travel time =        3955.2319 sec  (    1.10 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.85 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of    10.6 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.99

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
   164.73   -24.51    0.66     4.2 0.138E+01   0.66    36.24    0.66    0.00   .39552E+04
 Cumulative travel time =        3955.2312 sec  (    1.10 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 327

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S327U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S327U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:54:17
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.35 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.11 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.67 m
  Port/Nozzle diameter          D0      = 0.1883 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.041519 m
  Total area of openings        TA0     = 0.1670 m^2
  Discharge velocity            U0      = 1.79 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.089382 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.133623 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.160348 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000603 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000723 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.05 m          Lm  = 127.73 m          LM  = 18.67 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 97.88
  Port/nozzle Froude number     FRD0   = 45.96
  Velocity ratio                R      = 50.63
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.43 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5429 deg.F
  Dilution at edge of NFR              s = 10.7
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 49.86 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.36 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       3868.4712 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 10.68 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 327

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S327U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S327U.prd
 Time stamp:        12/21/2025--20:54:17

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.43  YB1   =      9.75  YB2   =     13.11
 LD    =      3.35  NOPEN =    6       NRISER=    6       SPAC  =      0.67    NPPERR =    1
 D0    =     0.188 A0    =     0.028 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     0.850 B0    =0.4152E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.794 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.8938E-01         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1336E+00   j0 =U0*GP0*B0 =0.6026E-03   (based on slot width B0)
 m0 =U0*q0   =0.1603E+00   j0 =q0*GP0    =0.7232E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.050 lM    =     18.67  lm    =    127.74
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.4480E+00  J0    =0.2021E-02
 Associated 3-d length scales (meters)
 LQ    =      0.17  LM    =     12.18  Lm    =     20.69  Lb    =     54.51
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     97.88  FRD0  =     45.96  R     =     50.63  PL    =    0.83
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.794 D0    =      0.188 A0    =      0.028 THETA =      0.00
 FR0   =     97.88  FRD0  =     45.96  R     =     50.63
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
       11.43 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.03     1.68     1.764   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.03     1.68 .00000E+00
     0.14    -0.09    0.21     1.5 0.376E+01   0.07     1.47 .13975E+00
     0.28    -0.18    0.22     1.8 0.329E+01   0.13     1.32 .31877E+00
     0.43    -0.27    0.22     1.9 0.299E+01   0.20     1.20 .52302E+00
     0.57    -0.36    0.23     2.1 0.279E+01   0.26     1.10 .74748E+00
     0.71    -0.44    0.24     2.2 0.262E+01   0.33     1.03 .98927E+00
     0.85    -0.53    0.24     2.3 0.249E+01   0.40     0.97 .12464E+01
```

```
      1.00    -0.62    0.25     2.4 0.239E+01   0.46     0.93 .15175E+01
      1.14    -0.71    0.26     2.5 0.229E+01   0.53     0.90 .18015E+01
      1.28    -0.80    0.26     2.6 0.221E+01   0.60     0.89 .20973E+01
      1.42    -0.89    0.27     2.7 0.214E+01   0.66     0.88 .24044E+01
 Cumulative travel time =          2.4044 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.42    -0.89    0.66     2.7 0.214E+01   0.66     0.99 .24044E+01
    17.75     6.89    0.66     4.2 0.137E+01   0.66     2.36 .18491E+03
    34.08    13.80    0.66     5.4 0.108E+01   0.66     3.68 .43394E+03
    50.41    20.01    0.66     6.3 0.924E+00   0.66     4.97 .73488E+03
    66.75    25.63    0.66     7.1 0.820E+00   0.66     6.23 .10800E+04
    83.08    30.74    0.66     7.8 0.744E+00   0.66     7.46 .14641E+04
    99.41    35.38    0.66     8.5 0.686E+00   0.66     8.68 .18837E+04
   115.74    39.58    0.66     9.1 0.640E+00   0.66     9.87 .23359E+04
   132.07    43.38    0.66     9.6 0.602E+00   0.66    11.05 .28186E+04
   148.40    46.80    0.66    10.2 0.570E+00   0.66    12.22 .33300E+04
   164.73    49.86    0.66    10.7 0.543E+00   0.66    13.36 .38685E+04
 Cumulative travel time =        3868.4712 sec  (    1.07 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.90 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of    10.7 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.99

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.81    0.66     4.2 0.138E+01   0.66    36.24    0.66    0.00   .38685E+04
 Cumulative travel time =        3868.4712 sec  (    1.07 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 328

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S328U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S328U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:57:41
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.74 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.50 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.55 m
  Port/Nozzle diameter          D0      = 0.1883 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.050746 m
  Total area of openings        TA0     = 0.1670 m^2
  Discharge velocity            U0      = 1.79 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.109244 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.163317 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.195981 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000737 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000884 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 156.12 m          LM  = 19.96 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 88.54
  Port/nozzle Froude number     FRD0    = 45.96
  Velocity ratio                R       = 50.63
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.13 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5461 deg.F
  Dilution at edge of NFR              s = 10.6
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 50.79 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.23 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       3822.3010 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 10.62 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 328

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S328U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S328U.prd
 Time stamp:        12/21/2025--20:57:41

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.13  YB1   =      9.75  YB2   =     12.50
 LD    =      2.74  NOPEN =    6       NRISER=    6       SPAC  =      0.55    NPPERR =    1
 D0    =     0.188 A0    =     0.028 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     0.850 B0    =0.5075E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.794 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1092E+00         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1633E+00   j0 =U0*GP0*B0 =0.7366E-03   (based on slot width B0)
 m0 =U0*q0   =0.1960E+00   j0 =q0*GP0    =0.8839E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.061 lM    =     19.96  lm    =    156.12
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.4480E+00  J0    =0.2021E-02
 Associated 3-d length scales (meters)
 LQ    =      0.17  LM    =     12.18  Lm    =     20.69  Lb    =     54.51
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     88.54  FRD0  =     45.96  R     =     50.63  PL    =    0.62
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.794 D0    =      0.188 A0    =      0.028 THETA =      0.00
 FR0   =     88.54  FRD0  =     45.96  R     =     50.63
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.13 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.04     1.37     1.764   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.04     1.37 .00000E+00
     0.12    -0.07    0.21     1.5 0.399E+01   0.07     1.20 .10817E+00
     0.23    -0.15    0.21     1.6 0.353E+01   0.13     1.07 .24349E+00
     0.35    -0.22    0.22     1.8 0.324E+01   0.20     0.98 .39629E+00
     0.47    -0.29    0.23     1.9 0.304E+01   0.26     0.90 .56312E+00
     0.58    -0.36    0.23     2.0 0.287E+01   0.33     0.84 .74199E+00
     0.70    -0.44    0.24     2.1 0.274E+01   0.40     0.79 .93154E+00
```

```
      0.81    -0.51    0.24     2.2 0.263E+01   0.46     0.76 .11308E+01
      0.93    -0.58    0.25     2.3 0.253E+01   0.53     0.73 .13390E+01
      1.05    -0.65    0.25     2.4 0.245E+01   0.60     0.72 .15555E+01
      1.16    -0.73    0.26     2.4 0.238E+01   0.66     0.72 .17799E+01
 Cumulative travel time =          1.7799 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.16    -0.73    0.66     2.4 0.238E+01   0.66     0.81 .17799E+01
    17.52     7.21    0.66     4.1 0.142E+01   0.66     2.18 .17397E+03
    33.88    14.22    0.66     5.2 0.111E+01   0.66     3.51 .41593E+03
    50.23    20.52    0.66     6.2 0.941E+00   0.66     4.81 .71130E+03
    66.59    26.23    0.66     7.0 0.831E+00   0.66     6.07 .10517E+04
    82.95    31.40    0.66     7.7 0.753E+00   0.66     7.31 .14319E+04
    99.30    36.10    0.66     8.4 0.693E+00   0.66     8.53 .18480E+04
   115.66    40.36    0.66     9.0 0.645E+00   0.66     9.73 .22972E+04
   132.02    44.21    0.66     9.6 0.607E+00   0.66    10.91 .27771E+04
   148.37    47.68    0.66    10.1 0.574E+00   0.66    12.08 .32860E+04
   164.73    50.79    0.66    10.6 0.546E+00   0.66    13.23 .38223E+04
 Cumulative travel time =        3822.3018 sec  (    1.06 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.91 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of    10.6 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.99

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.12    0.66     4.2 0.138E+01   0.66    36.24    0.66    0.00   .38223E+04
 Cumulative travel time =        3822.3010 sec  (    1.06 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 329

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S329U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S329U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:48:35
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.44 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.19 m
  Number of openings            NOPEN   = 4
  Number of Risers              NRISER = 4
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.81 m
  Port/Nozzle diameter          D0      = 0.2332 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.052567 m
  Total area of openings        TA0     = 0.1709 m^2
  Discharge velocity            U0      = 1.75 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.122900 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.161626 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.215502 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000746 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000994 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 171.67 m          LM  = 19.60 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 85.03
  Port/nozzle Froude number       FRD0   = 40.37
  Velocity ratio                R       = 49.49
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.97 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5539 deg.F
  Dilution at edge of NFR              s = 10.5
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 50.67 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.14 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       3842.7554 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 10.47 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 329

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S329U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S329U.prd
 Time stamp:        12/21/2025--20:48:35

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.97  YB1   =      9.75  YB2   =     12.19
 LD    =      2.44  NOPEN =    4       NRISER=    4       SPAC  =      0.81    NPPERR =    1
 D0    =     0.233 A0    =     0.043 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.253 CR0   =     0.850 B0    =0.5257E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.753 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1229E+00         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1616E+00   j0 =U0*GP0*B0 =0.7458E-03   (based on slot width B0)
 m0 =U0*q0   =0.2155E+00   j0 =q0*GP0    =0.9943E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.070 lM    =     19.60  lm    =    171.67
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.3941E+00  J0    =0.1818E-02
 Associated 3-d length scales (meters)
 LQ    =      0.21  LM    =     11.66  Lm    =     20.46  Lb    =     54.51
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     85.03  FRD0  =     40.37  R     =     49.49  PL    =    0.75
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     1.753 D0    =     0.233 A0    =     0.043 THETA =      0.00
 FR0   =     85.03  FRD0  =     40.37  R     =     49.49
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.97 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.04     1.22     1.723   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.04     1.22 .00000E+00
     0.10    -0.06    0.21     1.4 0.414E+01   0.07     1.07 .94762E-01
     0.21    -0.13    0.21     1.6 0.370E+01   0.13     0.95 .21132E+00
     0.31    -0.19    0.22     1.7 0.342E+01   0.20     0.87 .34193E+00
     0.41    -0.26    0.22     1.8 0.322E+01   0.26     0.80 .48382E+00
     0.52    -0.32    0.23     1.9 0.306E+01   0.33     0.74 .63539E+00
     0.62    -0.39    0.23     2.0 0.292E+01   0.40     0.70 .79557E+00
```

```
      0.72    -0.45    0.24     2.1 0.281E+01   0.46     0.67 .96357E+00
      0.83    -0.52    0.24     2.1 0.272E+01   0.53     0.65 .11388E+01
      0.93    -0.58    0.25     2.2 0.263E+01   0.60     0.64 .13207E+01
      1.03    -0.65    0.25     2.3 0.256E+01   0.66     0.64 .15089E+01
 Cumulative travel time =          1.5089 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      1.03    -0.65    0.66     2.3 0.256E+01   0.66     0.71 .15089E+01
     17.40     7.34    0.66     3.9 0.147E+01   0.66     2.10 .17027E+03
     33.77    14.37    0.66     5.1 0.114E+01   0.66     3.43 .41140E+03
     50.14    20.68    0.66     6.0 0.960E+00   0.66     4.72 .70734E+03
     66.51    26.37    0.66     6.9 0.846E+00   0.66     5.99 .10493E+04
     82.88    31.52    0.66     7.6 0.766E+00   0.66     7.23 .14319E+04
     99.25    36.19    0.66     8.2 0.704E+00   0.66     8.45 .18510E+04
    115.62    40.41    0.66     8.8 0.655E+00   0.66     9.65 .23038E+04
    131.99    44.21    0.66     9.4 0.616E+00   0.66    10.83 .27879E+04
    148.36    47.63    0.66    10.0 0.582E+00   0.66    11.99 .33014E+04
    164.73    50.67    0.66    10.5 0.554E+00   0.66    13.14 .38428E+04
 Cumulative travel time =        3842.7559 sec  (    1.07 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.88 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of    10.5 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.99

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.27    0.66     4.2 0.138E+01   0.66    36.24    0.66    0.00   .38428E+04
 Cumulative travel time =        3842.7554 sec  (    1.07 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 330

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S330U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S330U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--15:14:27
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.13 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 11.89 m
  Number of openings            NOPEN   = 3
  Number of Risers              NRISER = 3
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 1.07 m
  Port/Nozzle diameter          D0      = 0.2810 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.058137 m
  Total area of openings        TA0     = 0.1861 m^2
  Discharge velocity            U0      = 1.61 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.140457 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.150816 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.226224 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000758 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001136 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.09 m          Lm  = 180.21 m          LM  = 18.10 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 74.26
  Port/nozzle Froude number     FRD0   = 33.78
  Velocity ratio                R      = 45.46
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.82 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5795 deg.F
  Dilution at edge of NFR              s = 10.0
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 48.94 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 12.98 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       3985.3037 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 10.01 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 330

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S330U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S330U.prd
 Time stamp:        12/21/2025--15:14:27

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.82  YB1   =      9.75  YB2   =     11.89
 LD    =      2.13  NOPEN =    3       NRISER=    3       SPAC  =      1.07    NPPERR =    1
 D0    =     0.281 A0    =     0.062 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.305 CR0   =     0.850 B0    =0.5814E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.611 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1405E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1508E+00   j0 =U0*GP0*B0 =0.7576E-03   (based on slot width B0)
 m0 =U0*q0   =0.2262E+00   j0 =q0*GP0    =0.1136E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.087 lM    =     18.10  lm    =    180.21
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.3218E+00  J0    =0.1616E-02
 Associated 3-d length scales (meters)
 LQ    =      0.25  LM    =     10.63  Lm    =     19.61  Lb    =     54.51
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     74.26  FRD0  =     33.78  R     =     45.46  PL    =    0.83
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.611 D0    =      0.281 A0    =      0.062 THETA =      0.00
 FR0   =     74.26  FRD0  =     33.78  R     =     45.46
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.82 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.05     1.07     1.581   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.05     1.07 .00000E+00
      0.09    -0.06    0.21     1.3 0.437E+01   0.07     0.93 .85372E-01
      0.18    -0.11    0.21     1.5 0.397E+01   0.13     0.84 .18761E+00
      0.27    -0.17    0.22     1.6 0.370E+01   0.20     0.76 .30073E+00
      0.36    -0.23    0.22     1.7 0.351E+01   0.26     0.70 .42259E+00
      0.45    -0.28    0.22     1.7 0.335E+01   0.33     0.65 .55197E+00
      0.54    -0.34    0.23     1.8 0.322E+01   0.40     0.61 .68803E+00
```

```
      0.63    -0.40    0.23     1.9 0.311E+01   0.46     0.59 .83016E+00
      0.72    -0.45    0.24     1.9 0.302E+01   0.53     0.57 .97788E+00
      0.81    -0.51    0.24     2.0 0.293E+01   0.60     0.56 .11308E+01
      0.90    -0.57    0.25     2.0 0.285E+01   0.66     0.56 .12887E+01
 Cumulative travel time =          1.2887 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.90    -0.57    0.66     2.0 0.285E+01   0.66     0.62 .12887E+01
     17.29     7.41    0.66     3.7 0.156E+01   0.66     2.01 .17163E+03
     33.67    14.36    0.66     4.8 0.120E+01   0.66     3.33 .41949E+03
     50.05    20.54    0.66     5.7 0.101E+01   0.66     4.62 .72536E+03
     66.44    26.07    0.66     6.5 0.889E+00   0.66     5.88 .10798E+04
     82.82    31.04    0.66     7.2 0.803E+00   0.66     7.12 .14769E+04
     99.20    35.50    0.66     7.9 0.738E+00   0.66     8.33 .19124E+04
    115.58    39.49    0.66     8.4 0.687E+00   0.66     9.52 .23833E+04
    131.97    43.04    0.66     9.0 0.645E+00   0.66    10.69 .28870E+04
    148.35    46.18    0.66     9.5 0.609E+00   0.66    11.84 .34216E+04
    164.73    48.94    0.66    10.0 0.580E+00   0.66    12.98 .39853E+04
 Cumulative travel time =        3985.3037 sec  (    1.11 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.76 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of    10.0 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.99

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.42    0.66     4.2 0.138E+01   0.66    36.24    0.66    0.00   .39853E+04
 Cumulative travel time =        3985.3037 sec  (    1.11 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 331

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S331U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S331U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--20:59:18
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 4.88 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 14.63 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.49 m
  Port/Nozzle diameter          D0      = 0.1524 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.037405 m
  Total area of openings        TA0     = 0.2007 m^2
  Discharge velocity            U0      = 1.49 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.061450 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.083432 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.091775 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000452 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000497 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.04 m          Lm  = 73.11 m         LM  = 14.13 m
  lm' = 99999 m          Lb' = 99999 m         La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 85.85
  Port/nozzle Froude number     FRD0   = 42.53
  Velocity ratio                R      = 42.15
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    12.19 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5859 deg.F
  Dilution at edge of NFR              s = 9.9
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 42.46 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.49 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4367.8843 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.90 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 331

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                    HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S331U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S331U.prd
 Time stamp:        12/21/2025--20:59:18

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     12.19  YB1   =      9.75  YB2   =     14.63
 LD    =      4.88  NOPEN =   11       NRISER=   11       SPAC  =      0.49    NPPERR =    1
 D0    =     0.152 A0    =     0.018 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     1.000 B0    =0.3740E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.493 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.6145E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.8343E-01   j0 =U0*GP0*B0 =0.4520E-03   (based on slot width B0)
 m0 =U0*q0   =0.9177E-01   j0 =q0*GP0    =0.4972E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.041 lM    =     14.13  lm    =     73.11
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.4069E+00  J0    =0.2204E-02
 Associated 3-d length scales (meters)
 LQ    =      0.14  LM    =     10.85  Lm    =     18.88  Lb    =     54.51
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     85.85  FRD0  =     42.53  R     =     42.15  PL    =    0.86
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.493 D0    =      0.152 A0    =      0.018 THETA =      0.00
 FR0   =     85.85  FRD0  =     42.53  R     =     42.15
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        12.19 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.03     2.44     1.463   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.03     2.44 .00000E+00
      0.21    -0.13    0.21     1.6 0.353E+01   0.08     2.14 .25813E+00
      0.41    -0.26    0.22     1.9 0.304E+01   0.13     1.92 .59629E+00
      0.62    -0.39    0.23     2.1 0.274E+01   0.20     1.75 .98558E+00
      0.83    -0.52    0.24     2.3 0.254E+01   0.26     1.62 .14157E+01
      1.03    -0.65    0.25     2.4 0.238E+01   0.33     1.51 .18807E+01
      1.24    -0.78    0.26     2.6 0.225E+01   0.40     1.43 .23765E+01
```

```
      1.45    -0.90    0.27     2.7 0.215E+01   0.46     1.37 .29002E+01
      1.65    -1.03    0.28     2.8 0.206E+01   0.53     1.33 .34496E+01
      1.86    -1.16    0.29     2.9 0.198E+01   0.60     1.31 .40228E+01
      2.07    -1.29    0.30     3.0 0.191E+01   0.66     1.30 .46183E+01
 Cumulative travel time =          4.6183 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      2.07    -1.29    0.66     3.0 0.191E+01   0.66     1.46 .46183E+01
     18.33     5.86    0.66     4.3 0.136E+01   0.66     2.79 .23136E+03
     34.60    12.15    0.66     5.2 0.112E+01   0.66     4.08 .52358E+03
     50.87    17.73    0.66     6.0 0.969E+00   0.66     5.33 .86892E+03
     67.13    22.71    0.66     6.7 0.867E+00   0.66     6.56 .12602E+04
     83.40    27.13    0.66     7.3 0.792E+00   0.66     7.76 .16925E+04
     99.67    31.06    0.66     7.9 0.734E+00   0.66     8.94 .21623E+04
    115.93    34.53    0.66     8.4 0.687E+00   0.66    10.10 .26668E+04
    132.20    37.57    0.66     9.0 0.648E+00   0.66    11.25 .32038E+04
    148.46    40.21    0.66     9.4 0.614E+00   0.66    12.37 .37713E+04
    164.73    42.46    0.66     9.9 0.586E+00   0.66    13.49 .43679E+04
 Cumulative travel time =        4367.8843 sec  (    1.21 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.58 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.9 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.99

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.05    0.66     4.2 0.138E+01   0.66    36.24    0.66    0.00   .43679E+04
 Cumulative travel time =        4367.8843 sec  (    1.21 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 332

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S332U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S332U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--21:00:43
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.96 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.72 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.40 m
  Port/Nozzle diameter          D0      = 0.1524 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.046036 m
  Total area of openings        TA0     = 0.2007 m^2
  Discharge velocity            U0      = 1.49 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.075631 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.102685 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.112954 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000556 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000612 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.05 m          Lm  = 89.98 m          LM  = 15.14 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 77.39
  Port/nozzle Froude number     FRD0    = 42.53
  Velocity ratio                R       = 42.15
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.73 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5911 deg.F
  Dilution at edge of NFR              s = 9.8
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 43.92 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.29 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4293.1836 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.81 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 332

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S332U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S332U.prd
 Time stamp:        12/21/2025--21:00:43

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.73  YB1   =      9.75  YB2   =     13.72
 LD    =      3.96  NOPEN =   11       NRISER=   11       SPAC  =      0.40    NPPERR =    1
 D0    =     0.152 A0    =     0.018 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     1.000 B0    =0.4604E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.493 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7563E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1027E+00   j0 =U0*GP0*B0 =0.5563E-03   (based on slot width B0)
 m0 =U0*q0   =0.1130E+00   j0 =q0*GP0    =0.6119E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.051 lM    =     15.14  lm    =     89.98
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.4069E+00  J0    =0.2204E-02
 Associated 3-d length scales (meters)
 LQ    =      0.14  LM    =     10.85  Lm    =     18.88  Lb    =     54.51
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     77.39  FRD0  =     42.53  R     =     42.15  PL    =    0.65
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.493 D0    =      0.152 A0    =      0.018 THETA =      0.00
 FR0   =     77.39  FRD0  =     42.53  R     =     42.15
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.73 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.580E+01   0.04     1.98     1.463   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.580E+01   0.04     1.98 .00000E+00
      0.17    -0.10    0.21     1.5 0.376E+01   0.08     1.74 .19738E+00
      0.34    -0.21    0.22     1.8 0.328E+01   0.13     1.56 .44995E+00
      0.50    -0.31    0.23     1.9 0.299E+01   0.20     1.42 .73787E+00
      0.67    -0.42    0.23     2.1 0.278E+01   0.26     1.31 .10541E+01
      0.84    -0.52    0.24     2.2 0.262E+01   0.33     1.22 .13945E+01
      1.01    -0.63    0.25     2.3 0.249E+01   0.40     1.15 .17563E+01
```

```
      1.18    -0.73    0.26     2.4 0.238E+01   0.46     1.11 .21376E+01
      1.34    -0.84    0.26     2.5 0.229E+01   0.53     1.08 .25367E+01
      1.51    -0.94    0.27     2.6 0.221E+01   0.60     1.06 .29525E+01
      1.68    -1.05    0.28     2.7 0.214E+01   0.66     1.05 .33838E+01
 Cumulative travel time =          3.3838 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      1.68    -1.05    0.66     2.7 0.214E+01   0.66     1.18 .33838E+01
     17.99     6.33    0.66     4.0 0.144E+01   0.66     2.52 .21478E+03
     34.29    12.79    0.66     5.0 0.116E+01   0.66     3.82 .49577E+03
     50.60    18.52    0.66     5.8 0.994E+00   0.66     5.08 .83205E+03
     66.90    23.62    0.66     6.6 0.885E+00   0.66     6.32 .12157E+04
     83.21    28.16    0.66     7.2 0.806E+00   0.66     7.53 .16414E+04
     99.51    32.19    0.66     7.8 0.744E+00   0.66     8.72 .21053E+04
    115.82    35.75    0.66     8.3 0.695E+00   0.66     9.88 .26047E+04
    132.12    38.88    0.66     8.9 0.655E+00   0.66    11.03 .31370E+04
    148.43    41.59    0.66     9.3 0.620E+00   0.66    12.17 .37004E+04
    164.73    43.92    0.66     9.8 0.591E+00   0.66    13.29 .42932E+04
 Cumulative travel time =        4293.1836 sec  (    1.19 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.60 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.8 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.99

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.51    0.66     4.2 0.138E+01   0.66    36.24    0.66    0.00   .42932E+04
 Cumulative travel time =        4293.1836 sec  (    1.19 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 333

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S333U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S333U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--21:02:05
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.35 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.11 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.67 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.048846 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 1.52 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.089382 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.113580 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.136296 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000603 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000723 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 108.57 m          LM  = 15.88 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 76.71
  Port/nozzle Froude number     FRD0   = 37.51
  Velocity ratio                R      = 43.04
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.43 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.5885 deg.F
  Dilution at edge of NFR              s = 9.9
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 45.49 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.18 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4198.3726 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.86 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 333

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S333U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S333U.prd
 Time stamp:        12/21/2025--21:02:05

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.43  YB1   =      9.75  YB2   =     13.11
 LD    =      3.35  NOPEN =    6       NRISER=    6       SPAC  =      0.67    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.4885E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.525 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.8938E-01         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1136E+00   j0 =U0*GP0*B0 =0.6026E-03   (based on slot width B0)
 m0 =U0*q0   =0.1363E+00   j0 =q0*GP0    =0.7232E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.059 lM    =     15.88  lm    =    108.57
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.3808E+00  J0    =0.2021E-02
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =     10.78  Lm    =     19.08  Lb    =     54.51
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     76.71  FRD0  =     37.51  R     =     43.04  PL    =    0.83
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.525 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =     76.71  FRD0  =     37.51  R     =     43.04
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
       11.43 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.04     1.68     1.495   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.04     1.68 .00000E+00
     0.14    -0.09    0.21     1.5 0.393E+01   0.07     1.47 .15704E+00
     0.28    -0.18    0.22     1.7 0.346E+01   0.13     1.32 .35455E+00
     0.43    -0.27    0.22     1.8 0.317E+01   0.20     1.20 .57804E+00
     0.57    -0.36    0.23     2.0 0.297E+01   0.26     1.11 .82235E+00
     0.71    -0.44    0.24     2.1 0.281E+01   0.33     1.03 .10845E+01
     0.85    -0.53    0.24     2.2 0.267E+01   0.40     0.97 .13625E+01
```

```
      1.00    -0.62    0.25     2.3 0.256E+01   0.46     0.93 .16548E+01
      1.14    -0.71    0.26     2.4 0.247E+01   0.53     0.91 .19603E+01
      1.28    -0.80    0.26     2.4 0.238E+01   0.60     0.89 .22780E+01
      1.42    -0.89    0.27     2.5 0.231E+01   0.66     0.89 .26073E+01
 Cumulative travel time =          2.6073 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.42    -0.89    0.66     2.5 0.231E+01   0.66     0.99 .26073E+01
    17.75     6.68    0.66     3.9 0.148E+01   0.66     2.35 .20103E+03
    34.08    13.30    0.66     4.9 0.117E+01   0.66     3.66 .47147E+03
    50.41    19.17    0.66     5.8 0.100E+01   0.66     4.93 .79817E+03
    66.75    24.40    0.66     6.5 0.888E+00   0.66     6.17 .11727E+04
    83.08    29.08    0.66     7.2 0.807E+00   0.66     7.39 .15896E+04
    99.41    33.24    0.66     7.8 0.744E+00   0.66     8.58 .20449E+04
   115.74    36.93    0.66     8.4 0.694E+00   0.66     9.76 .25356E+04
   132.07    40.19    0.66     8.9 0.653E+00   0.66    10.91 .30594E+04
   148.40    43.03    0.66     9.4 0.618E+00   0.66    12.05 .36142E+04
   164.73    45.49    0.66     9.9 0.589E+00   0.66    13.18 .41984E+04
 Cumulative travel time =        4198.3726 sec  (    1.17 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.65 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.9 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.99

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.81    0.66     4.2 0.138E+01   0.66    36.24    0.66    0.00   .41984E+04
 Cumulative travel time =        4198.3726 sec  (    1.17 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 334

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S334U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S334U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--21:03:23
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.74 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.50 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.55 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.059701 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 1.52 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.109244 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.138820 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.166584 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000737 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000884 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 132.70 m          LM  = 16.97 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 69.38
  Port/nozzle Froude number     FRD0   = 37.51
  Velocity ratio                R      = 43.04
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.13 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.592 deg.F
  Dilution at edge of NFR              s = 9.8
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 46.47 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.05 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4147.6973 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.80 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 334

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S334U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S334U.prd
 Time stamp:        12/21/2025--21:03:23

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =      0.035 F     =      0.054 USTAR =0.2910E-02
 UW    =      4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.13  YB1   =      9.75  YB2   =     12.50
 LD    =      2.74  NOPEN =    6       NRISER=    6       SPAC  =      0.55    NPPERR =    1
 D0    =      0.204 A0    =      0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =      0.204 CR0   =      1.000 B0    =0.5970E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =      1.525 Q0    =      0.300 Q0A   =0.2997E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1092E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1388E+00   j0 =U0*GP0*B0 =0.7366E-03   (based on slot width B0)
 m0 =U0*q0   =0.1666E+00   j0 =q0*GP0    =0.8839E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.072 lM    =     16.97  lm    =    132.70
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.3808E+00  J0    =0.2021E-02
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =     10.78  Lm    =     19.08  Lb    =     54.51
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     69.38  FRD0  =     37.51  R     =     43.04  PL    =    0.62
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.525 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =     69.38  FRD0  =     37.51  R     =     43.04
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.13 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.05     1.37     1.495   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.05     1.37 .00000E+00
     0.12    -0.07    0.21     1.4 0.415E+01   0.08     1.20 .12179E+00
     0.23    -0.15    0.21     1.6 0.371E+01   0.13     1.08 .27129E+00
     0.35    -0.22    0.22     1.7 0.343E+01   0.20     0.98 .43863E+00
     0.47    -0.29    0.23     1.8 0.323E+01   0.26     0.90 .62028E+00
     0.58    -0.36    0.23     1.9 0.307E+01   0.33     0.84 .81420E+00
     0.70    -0.44    0.24     2.0 0.294E+01   0.40     0.79 .10190E+01
```

```
      0.81    -0.51    0.24     2.1 0.283E+01   0.46     0.76 .12337E+01
      0.93    -0.58    0.25     2.1 0.273E+01   0.53     0.74 .14576E+01
      1.05    -0.65    0.25     2.2 0.264E+01   0.60     0.73 .16899E+01
      1.16    -0.73    0.26     2.3 0.257E+01   0.66     0.72 .19302E+01
 Cumulative travel time =          1.9302 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.16    -0.73    0.66     2.3 0.257E+01   0.66     0.81 .19302E+01
    17.52     7.01    0.66     3.8 0.154E+01   0.66     2.18 .18907E+03
    33.88    13.75    0.66     4.8 0.120E+01   0.66     3.49 .45177E+03
    50.23    19.71    0.66     5.7 0.102E+01   0.66     4.77 .77235E+03
    66.59    25.03    0.66     6.4 0.901E+00   0.66     6.02 .11418E+04
    82.95    29.78    0.66     7.1 0.816E+00   0.66     7.24 .15543E+04
    99.30    34.01    0.66     7.7 0.751E+00   0.66     8.44 .20058E+04
   115.66    37.76    0.66     8.3 0.700E+00   0.66     9.61 .24931E+04
   132.02    41.08    0.66     8.8 0.658E+00   0.66    10.78 .30138E+04
   148.37    43.97    0.66     9.3 0.622E+00   0.66    11.92 .35659E+04
   164.73    46.47    0.66     9.8 0.592E+00   0.66    13.05 .41477E+04
 Cumulative travel time =        4147.6973 sec  (    1.15 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.66 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.8 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.99

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.12    0.66     4.2 0.138E+01   0.66    36.24    0.66    0.00   .41477E+04
 Cumulative travel time =        4147.6973 sec  (    1.15 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 335

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S335U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S335U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--21:04:47
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.44 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.19 m
  Number of openings            NOPEN   = 4
  Number of Risers              NRISER = 4
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.81 m
  Port/Nozzle diameter          D0      = 0.2530 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.061843 m
  Total area of openings        TA0     = 0.2011 m^2
  Discharge velocity            U0      = 1.49 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.122900 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.137382 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.183177 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000746 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000994 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.08 m          Lm  = 145.92 m          LM  = 16.66 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 66.63
  Port/nozzle Froude number     FRD0    = 32.94
  Velocity ratio                R       = 42.07
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.97 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.6005 deg.F
  Dilution at edge of NFR              s = 9.7
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 46.34 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 12.96 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4169.6392 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.66 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 335

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                    HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S335U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S335U.prd
 Time stamp:        12/21/2025--21:04:47

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.97  YB1   =      9.75  YB2   =     12.19
 LD    =      2.44  NOPEN =    4       NRISER=    4       SPAC  =      0.81    NPPERR =    1
 D0    =     0.253 A0    =     0.050 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.253 CR0   =     1.000 B0    =0.6184E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.490 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1229E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1374E+00   j0 =U0*GP0*B0 =0.7458E-03   (based on slot width B0)
 m0 =U0*q0   =0.1832E+00   j0 =q0*GP0    =0.9943E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.082 lM    =     16.66  lm    =    145.92
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.3350E+00  J0    =0.1818E-02
 Associated 3-d length scales (meters)
 LQ    =      0.22  LM    =     10.33  Lm    =     18.86  Lb    =     54.51
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     66.63  FRD0  =     32.94  R     =     42.07  PL    =    0.75
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     1.490 D0    =     0.253 A0    =     0.050 THETA =      0.00
 FR0   =     66.63  FRD0  =     32.94  R     =     42.07
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.97 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.05     1.22     1.460   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.05     1.22 .00000E+00
     0.10    -0.06    0.21     1.3 0.430E+01   0.07     1.07 .10684E+00
     0.21    -0.13    0.21     1.5 0.389E+01   0.13     0.96 .23574E+00
     0.31    -0.19    0.22     1.6 0.362E+01   0.20     0.87 .37886E+00
     0.41    -0.26    0.22     1.7 0.342E+01   0.26     0.80 .53339E+00
     0.52    -0.32    0.23     1.8 0.326E+01   0.33     0.75 .69772E+00
     0.62    -0.39    0.23     1.9 0.313E+01   0.40     0.70 .87075E+00
```

```
      0.72    -0.45    0.24     1.9 0.302E+01   0.46     0.67 .10517E+01
      0.83    -0.52    0.24     2.0 0.292E+01   0.53     0.65 .12399E+01
      0.93    -0.58    0.25     2.0 0.284E+01   0.60     0.64 .14349E+01
      1.03    -0.65    0.25     2.1 0.276E+01   0.66     0.64 .16363E+01
 Cumulative travel time =          1.6363 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      1.03    -0.65    0.66     2.1 0.276E+01   0.66     0.72 .16363E+01
     17.40     7.15    0.66     3.6 0.159E+01   0.66     2.09 .18501E+03
     33.77    13.91    0.66     4.7 0.123E+01   0.66     3.41 .44678E+03
     50.14    19.87    0.66     5.6 0.104E+01   0.66     4.68 .76795E+03
     66.51    25.18    0.66     6.3 0.918E+00   0.66     5.93 .11391E+04
     82.88    29.90    0.66     7.0 0.830E+00   0.66     7.15 .15541E+04
     99.25    34.09    0.66     7.6 0.763E+00   0.66     8.35 .20088E+04
    115.62    37.81    0.66     8.2 0.711E+00   0.66     9.53 .25001E+04
    131.99    41.07    0.66     8.7 0.667E+00   0.66    10.69 .30253E+04
    148.36    43.90    0.66     9.2 0.631E+00   0.66    11.83 .35824E+04
    164.73    46.34    0.66     9.7 0.601E+00   0.66    12.96 .41696E+04
 Cumulative travel time =        4169.6392 sec  (    1.16 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.63 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.7 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.99

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.27    0.66     4.2 0.138E+01   0.66    36.24    0.66    0.00   .41696E+04
 Cumulative travel time =        4169.6392 sec  (    1.16 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 336

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S336U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S336U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--21:06:18
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 23.28 degC
  Bottom temperature                    = 23.28 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 997.4731 kg/m^3
  Bottom density                RHOAB   = 997.4731 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.13 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 11.89 m
  Number of openings            NOPEN   = 3
  Number of Risers              NRISER = 3
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 1.07 m
  Port/Nozzle diameter          D0      = 0.3048 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.068397 m
  Total area of openings        TA0     = 0.2189 m^2
  Discharge velocity            U0      = 1.37 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.5 degC
  Corresponding density         RHO0    = 996.6501 kg/m^3
  Density difference            DRHO    = 0.8229 kg/m^3
  Buoyant acceleration          GP0     = 0.0081 m/s^2
  Discharge concentration       C0      = 5.8 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.140457 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.128193 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.192290 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000758 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001136 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.10 m          Lm  = 153.18 m          LM  = 15.38 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 58.20
  Port/nozzle Froude number     FRD0   = 27.57
  Velocity ratio                R      = 38.64
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.82 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 0.6283 deg.F
  Dilution at edge of NFR              s = 9.2
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 44.45 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 12.79 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       4324.0986 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.23 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 336

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S334U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S334U.prd
 Time stamp:        12/21/2025--21:03:23

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  997.4731

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.13  YB1   =      9.75  YB2   =     12.50
 LD    =      2.74  NOPEN =    6       NRISER=    6       SPAC  =      0.55    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.5970E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.525 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  996.6501  DRHO0 =0.8229E+00  GP0   =0.8091E-02
 C0    =0.5800E+01  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1092E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1388E+00   j0 =U0*GP0*B0 =0.7366E-03   (based on slot width B0)
 m0 =U0*q0   =0.1666E+00   j0 =q0*GP0    =0.8839E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.072 lM    =     16.97  lm    =    132.70
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.3808E+00  J0    =0.2021E-02
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =     10.78  Lm    =     19.08  Lb    =     54.51
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     69.38  FRD0  =     37.51  R     =     43.04  PL    =    0.62
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.525 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =     69.38  FRD0  =     37.51  R     =     43.04
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5800E+01  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.13 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.580E+01   0.05     1.37     1.495   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.580E+01   0.05     1.37 .00000E+00
     0.12    -0.07    0.21     1.4 0.415E+01   0.08     1.20 .12179E+00
     0.23    -0.15    0.21     1.6 0.371E+01   0.13     1.08 .27129E+00
     0.35    -0.22    0.22     1.7 0.343E+01   0.20     0.98 .43863E+00
     0.47    -0.29    0.23     1.8 0.323E+01   0.26     0.90 .62028E+00
     0.58    -0.36    0.23     1.9 0.307E+01   0.33     0.84 .81420E+00
     0.70    -0.44    0.24     2.0 0.294E+01   0.40     0.79 .10190E+01
```

```
      0.81    -0.51    0.24     2.1 0.283E+01   0.46     0.76 .12337E+01
      0.93    -0.58    0.25     2.1 0.273E+01   0.53     0.74 .14576E+01
      1.05    -0.65    0.25     2.2 0.264E+01   0.60     0.73 .16899E+01
      1.16    -0.73    0.26     2.3 0.257E+01   0.66     0.72 .19302E+01
 Cumulative travel time =          1.9302 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.16    -0.73    0.66     2.3 0.257E+01   0.66     0.81 .19302E+01
    17.52     7.01    0.66     3.8 0.154E+01   0.66     2.18 .18907E+03
    33.88    13.75    0.66     4.8 0.120E+01   0.66     3.49 .45177E+03
    50.23    19.71    0.66     5.7 0.102E+01   0.66     4.77 .77235E+03
    66.59    25.03    0.66     6.4 0.901E+00   0.66     6.02 .11418E+04
    82.95    29.78    0.66     7.1 0.816E+00   0.66     7.24 .15543E+04
    99.30    34.01    0.66     7.7 0.751E+00   0.66     8.44 .20058E+04
   115.66    37.76    0.66     8.3 0.700E+00   0.66     9.61 .24931E+04
   132.02    41.08    0.66     8.8 0.658E+00   0.66    10.78 .30138E+04
   148.37    43.97    0.66     9.3 0.622E+00   0.66    11.92 .35659E+04
   164.73    46.47    0.66     9.8 0.592E+00   0.66    13.05 .41477E+04
 Cumulative travel time =        4147.6973 sec  (    1.15 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.66 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.8 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.99

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.12    0.66     4.2 0.138E+01   0.66    36.24    0.66    0.00   .41477E+04
 Cumulative travel time =        4147.6973 sec  (    1.15 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 337

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S337U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S337U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--15:11:53
******************************************************************************
SUMMARY OF INPUT DATA:
------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 4.88 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 14.63 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.49 m
  Port/Nozzle diameter          D0      = 0.1405 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.031794 m
  Total area of openings        TA0     = 0.1706 m^2
  Discharge velocity            U0      = 0.15 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.005239 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000714 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.000785 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000075 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000083 m^3/s^3
------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.03 m          Lm  = 0.63 m          LM  = 0.40 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 6.68
  Port/nozzle Froude number     FRD0    = 3.18
  Velocity ratio                R       = 4.23
------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    12.19 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 4.5375 deg.F
  Dilution at edge of NFR              s = 6.0
  NFR Location:                        x = 2.07 m
    (centerline coordinates)           y = -1.29 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.94 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       40.4785 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 22.56 m downstream.
  Plume contacts second bank at 49.32 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************* FINAL DESIGN ADVICE AND COMMENTS ***********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 337

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S337U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S337U.prd
 Time stamp:        12/21/2025--15:11:53

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     12.19  YB1   =      9.75  YB2   =     14.63
 LD    =      4.88  NOPEN =   11       NRISER=   11       SPAC  =      0.49    NPPERR =    1
 D0    =     0.141 A0    =     0.016 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     0.850 B0    =0.3179E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.150 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.5239E-02         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.7136E-03   j0 =U0*GP0*B0 =0.7532E-04   (based on slot width B0)
 m0 =U0*q0   =0.7849E-03   j0 =q0*GP0    =0.8285E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.035 lM    =     0.40  lm    =      0.63
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.3480E-02  J0    =0.3673E-03
 Associated 3-d length scales (meters)
 LQ    =      0.12  LM    =      0.75  Lm    =      1.75  Lb    =      9.08
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      6.68  FRD0  =      3.18  R     =      4.23  PL    =    5.58
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     0.150 D0    =     0.141 A0    =     0.016 THETA =      0.00
 FR0   =      6.68  FRD0  =      3.18  R     =      4.23
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        12.19 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.03     2.44     0.120   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.03     2.44 .00000E+00
      0.21    -0.13    0.21     2.6 0.106E+02   0.07     2.31 .26164E+01
      0.41    -0.26    0.22     3.3 0.842E+01   0.13     2.21 .59853E+01
      0.62    -0.39    0.23     3.8 0.729E+01   0.20     2.14 .97178E+01
      0.83    -0.52    0.24     4.2 0.654E+01   0.26     2.08 .13696E+02
      1.03    -0.65    0.25     4.6 0.601E+01   0.33     2.03 .17860E+02
      1.24    -0.78    0.26     4.9 0.559E+01   0.40     1.99 .22172E+02
```

```
      1.45    -0.90    0.27     5.2 0.525E+01   0.46     1.97 .26606E+02
      1.65    -1.03    0.28     5.5 0.498E+01   0.53     1.95 .31144E+02
      1.86    -1.16    0.29     5.8 0.474E+01   0.60     1.94 .35772E+02
      2.07    -1.29    0.30     6.0 0.454E+01   0.66     1.94 .40479E+02
 Cumulative travel time =          40.4785 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.66 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      2.07    -1.29    0.66     6.0 0.454E+01   0.66     3.21    0.66    0.00   .40479E+02
      4.12    -1.29    0.66     6.7 0.411E+01   0.50     4.70    0.66    0.16   .96823E+02
      6.17    -1.29    0.66     7.1 0.384E+01   0.42     5.98    0.66    0.24   .15317E+03
      8.22    -1.29    0.66     7.5 0.365E+01   0.37     7.13    0.66    0.29   .20951E+03
     10.27    -1.29    0.66     7.8 0.349E+01   0.34     8.19    0.66    0.33   .26586E+03
     12.31    -1.29    0.66     8.1 0.335E+01   0.31     9.18    0.66    0.35   .32220E+03
     14.36    -1.29    0.66     8.4 0.322E+01   0.29    10.12    0.66    0.37   .37855E+03
     16.41    -1.29    0.66     8.7 0.310E+01   0.28    11.02    0.66    0.38   .43489E+03
     18.46    -1.29    0.66     9.1 0.299E+01   0.27    11.87    0.66    0.39   .49123E+03
     20.51    -1.29    0.66     9.4 0.288E+01   0.26    12.70    0.66    0.40   .54758E+03
     22.56    -1.29    0.66     9.7 0.277E+01   0.25    13.49    0.66    0.41   .60392E+03
 Cumulative travel time =         603.9235 sec  (    0.17 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     22.56    12.19    0.66     9.7 0.277E+01   0.25    26.98    0.66    0.41   .60392E+03
     25.24    12.19    0.66    10.1 0.267E+01   0.25    27.99    0.66    0.41   .67751E+03
     27.91    12.19    0.66    10.5 0.256E+01   0.25    28.98    0.66    0.41   .75109E+03
     30.59    12.19    0.66    10.9 0.246E+01   0.26    29.94    0.66    0.41   .82468E+03
     33.27    12.19    0.66    11.3 0.236E+01   0.26    30.89    0.66    0.40   .89826E+03
     35.94    12.19    0.66    11.8 0.227E+01   0.26    31.82    0.66    0.40   .97184E+03
     38.62    12.19    0.66    12.2 0.218E+01   0.26    32.74    0.66    0.40   .10454E+04
     41.30    12.19    0.66    12.7 0.209E+01   0.27    33.64    0.66    0.40   .11190E+04
     43.97    12.19    0.66    13.3 0.200E+01   0.27    34.52    0.66    0.39   .11926E+04
     46.65    12.19    0.66    13.8 0.192E+01   0.27    35.39    0.66    0.39   .12662E+04
     49.32    12.19    0.66    14.4 0.184E+01   0.28    36.24    0.66    0.38   .13398E+04
 Cumulative travel time =        1339.7664 sec  (    0.37 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     49.32    12.19    0.66    14.4 0.184E+01   0.28    36.24    0.66    0.38   .13398E+04
    196.79    12.19    0.66    19.9 0.119E+01   0.39    36.24    0.66    0.28   .53943E+04
    344.26    12.19    0.66    36.3 0.579E+00   0.70    36.24    0.66    0.00   .94489E+04
    491.73    12.19    0.66    38.7 0.485E+00   0.75    36.24    0.66    0.00   .13503E+05
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    639.19    12.19    0.66    38.7 0.432E+00   0.75    36.24    0.66    0.00   .17558E+05
    786.66    12.19    0.66    38.7 0.386E+00   0.75    36.24    0.66    0.00   .21613E+05
    934.13    12.19    0.66    38.7 0.344E+00   0.75    36.24    0.66    0.00   .25667E+05
   1081.60    12.19    0.66    38.7 0.307E+00   0.75    36.24    0.66    0.00   .29722E+05
   1229.06    12.19    0.66    38.7 0.274E+00   0.75    36.24    0.66    0.00   .33776E+05
   1376.53    12.19    0.66    38.7 0.244E+00   0.75    36.24    0.66    0.00   .37831E+05
   1524.00    12.19    0.66    38.7 0.218E+00   0.75    36.24    0.66    0.00   .41885E+05
 Cumulative travel time =       41885.3945 sec  (   11.63 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 338
Scenario 339

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S338U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S338U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--15:09:49
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.96 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.72 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.40 m
  Port/Nozzle diameter          D0      = 0.1405 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.039131 m
  Total area of openings        TA0     = 0.1706 m^2
  Discharge velocity            U0      = 0.15 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.006448 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000878 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.000966 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000093 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000102 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.04 m          Lm  = 0.77 m          LM  = 0.43 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 6.02
  Port/nozzle Froude number     FRD0    = 3.18
  Velocity ratio                R       = 4.23
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.73 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 5.3397 deg.F
  Dilution at edge of NFR              s = 5.1
  NFR Location:                        x = 1.68 m
    (centerline coordinates)           y = -1.05 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.53 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       30.6564 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 20.97 m downstream.
  Plume contacts second bank at 51.62 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 338

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S338U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S338U.prd
 Time stamp:        12/21/2025--15:09:49

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.73  YB1   =      9.75  YB2   =     13.72
 LD    =      3.96  NOPEN =   11       NRISER=   11       SPAC  =      0.40    NPPERR =    1
 D0    =     0.141 A0    =     0.016 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     0.850 B0    =0.3913E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.150 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.6448E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.8782E-03   j0 =U0*GP0*B0 =0.9270E-04   (based on slot width B0)
 m0 =U0*q0   =0.9661E-03   j0 =q0*GP0    =0.1020E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.043 lM    =      0.43  lm    =      0.77
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.3480E-02  J0    =0.3673E-03
 Associated 3-d length scales (meters)
 LQ    =      0.12  LM    =      0.75  Lm    =      1.75  Lb    =      9.08
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      6.02  FRD0  =      3.18  R     =      4.23  PL    =    4.22
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.150 D0    =      0.141 A0    =      0.016 THETA =      0.00
 FR0   =      6.02  FRD0  =      3.18  R     =      4.23
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.73 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.03     1.98     0.120   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.03     1.98 .00000E+00
      0.17    -0.10    0.21     2.3 0.119E+02   0.07     1.87 .19736E+01
      0.34    -0.21    0.22     2.8 0.962E+01   0.13     1.78 .45007E+01
      0.50    -0.31    0.23     3.3 0.840E+01   0.20     1.71 .73066E+01
      0.67    -0.42    0.23     3.6 0.758E+01   0.26     1.66 .10306E+02
      0.84    -0.52    0.24     3.9 0.699E+01   0.33     1.62 .13453E+02
      1.01    -0.63    0.25     4.2 0.652E+01   0.40     1.58 .16719E+02
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      1.18    -0.73    0.26     4.5 0.615E+01   0.46     1.56 .20086E+02
      1.34    -0.84    0.26     4.7 0.584E+01   0.53     1.55 .23537E+02
      1.51    -0.94    0.27     4.9 0.557E+01   0.60     1.54 .27064E+02
      1.68    -1.05    0.28     5.1 0.534E+01   0.66     1.53 .30656E+02
 Cumulative travel time =          30.6564 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.78 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      1.68    -1.05    0.66     5.1 0.534E+01   0.66     2.73    0.66    0.00   .30656E+02
      3.61    -1.05    0.66     5.7 0.477E+01   0.48     4.22    0.66    0.18   .83682E+02
      5.54    -1.05    0.66     6.2 0.444E+01   0.39     5.49    0.66    0.27   .13671E+03
      7.47    -1.05    0.66     6.5 0.420E+01   0.34     6.61    0.66    0.32   .18973E+03
      9.39    -1.05    0.66     6.8 0.401E+01   0.31     7.65    0.66    0.35   .24276E+03
     11.32    -1.05    0.66     7.1 0.385E+01   0.29     8.61    0.66    0.37   .29579E+03
     13.25    -1.05    0.66     7.3 0.370E+01   0.27     9.53    0.66    0.39   .34881E+03
     15.18    -1.05    0.66     7.6 0.357E+01   0.26    10.39    0.66    0.40   .40184E+03
     17.11    -1.05    0.66     7.9 0.344E+01   0.25    11.22    0.66    0.41   .45486E+03
     19.04    -1.05    0.66     8.2 0.331E+01   0.24    12.02    0.66    0.42   .50789E+03
     20.97    -1.05    0.66     8.5 0.319E+01   0.23    12.79    0.66    0.43   .56092E+03
 Cumulative travel time =         560.9167 sec  (    0.16 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     20.97    11.73    0.66     8.5 0.319E+01   0.23    25.57    0.66    0.43   .56092E+03
     24.03    11.73    0.66     8.8 0.305E+01   0.23    26.75    0.66    0.43   .64520E+03
     27.10    11.73    0.66     9.2 0.291E+01   0.23    27.90    0.66    0.43   .72949E+03
     30.16    11.73    0.66     9.7 0.277E+01   0.23    29.03    0.66    0.43   .81377E+03
     33.23    11.73    0.66    10.1 0.264E+01   0.24    30.12    0.66    0.42   .89806E+03
     36.29    11.73    0.66    10.6 0.251E+01   0.24    31.20    0.66    0.42   .98234E+03
     39.36    11.73    0.66    11.2 0.239E+01   0.24    32.25    0.66    0.42   .10666E+04
     42.42    11.73    0.66    11.7 0.227E+01   0.25    33.28    0.66    0.41   .11509E+04
     45.49    11.73    0.66    12.3 0.215E+01   0.25    34.29    0.66    0.41   .12352E+04
     48.56    11.73    0.66    12.9 0.205E+01   0.26    35.28    0.66    0.40   .13195E+04
     51.62    11.73    0.66    13.6 0.194E+01   0.26    36.24    0.66    0.40   .14038E+04
 Cumulative travel time =        1403.7721 sec  (    0.39 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     51.62    11.73    0.66    13.6 0.194E+01   0.26    36.24    0.66    0.40   .14038E+04
    198.86    11.73    0.66    18.5 0.127E+01   0.36    36.24    0.66    0.30   .54520E+04
    346.10    11.73    0.66    33.2 0.632E+00   0.64    36.24    0.66    0.02   .95003E+04
    493.33    11.73    0.66    38.7 0.484E+00   0.75    36.24    0.66    0.00   .13549E+05
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    640.57    11.73    0.66    38.7 0.432E+00   0.75    36.24    0.66    0.00   .17597E+05
    787.81    11.73    0.66    38.7 0.385E+00   0.75    36.24    0.66    0.00   .21645E+05
    935.05    11.73    0.66    38.7 0.344E+00   0.75    36.24    0.66    0.00   .25693E+05
   1082.29    11.73    0.66    38.7 0.307E+00   0.75    36.24    0.66    0.00   .29741E+05
   1229.52    11.73    0.66    38.7 0.274E+00   0.75    36.24    0.66    0.00   .33790E+05
   1376.76    11.73    0.66    38.7 0.244E+00   0.75    36.24    0.66    0.00   .37838E+05
   1524.00    11.73    0.66    38.7 0.218E+00   0.75    36.24    0.66    0.00   .41886E+05
 Cumulative travel time =       41886.2344 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 339

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S339U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S339U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--15:08:30
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.35 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.11 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.67 m
  Port/Nozzle diameter          D0      = 0.1883 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.041519 m
  Total area of openings        TA0     = 0.1670 m^2
  Discharge velocity            U0      = 0.15 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.007621 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000971 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.001166 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000100 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000121 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.05 m          Lm  = 0.93 m          LM  = 0.45 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 5.97
  Port/nozzle Froude number     FRD0   = 2.80
  Velocity ratio                R      = 4.32
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.43 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 6.0382 deg.F
  Dilution at edge of NFR              s = 4.5
  NFR Location:                        x = 1.42 m
    (centerline coordinates)           y = -0.89 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.27 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       24.2469 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 19.92 m downstream.
  Plume contacts second bank at 53.10 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 339

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                    HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S339U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S339U.prd
 Time stamp:        12/21/2025--15:08:30

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.43  YB1   =      9.75  YB2   =     13.11
 LD    =      3.35  NOPEN =    6       NRISER=    6       SPAC  =      0.67    NPPERR =    1
 D0    =     0.188 A0    =     0.028 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     0.850 B0    =0.4152E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.153 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7621E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9714E-03   j0 =U0*GP0*B0 =0.1004E-03   (based on slot width B0)
 m0 =U0*q0   =0.1166E-02   j0 =q0*GP0    =0.1205E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.050 lM    =      0.45  lm    =      0.93
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.3257E-02  J0    =0.3367E-03
 Associated 3-d length scales (meters)
 LQ    =      0.17  LM    =      0.74  Lm    =      1.76  Lb    =      9.08
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      5.97  FRD0  =      2.80  R     =      4.32  PL    =    5.34
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     0.153 D0    =     0.188 A0    =     0.028 THETA =      0.00
 FR0   =      5.97  FRD0  =      2.80  R     =      4.32
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.43 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.03     1.68     0.123   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.03     1.68 .00000E+00
     0.14    -0.09    0.21     2.1 0.129E+02   0.07     1.57 .15576E+01
     0.28    -0.18    0.22     2.6 0.106E+02   0.13     1.49 .35416E+01
     0.43    -0.27    0.22     2.9 0.933E+01   0.20     1.43 .57478E+01
     0.57    -0.36    0.23     3.2 0.846E+01   0.26     1.38 .81106E+01
     0.71    -0.44    0.24     3.5 0.783E+01   0.33     1.34 .10595E+02
     0.85    -0.53    0.24     3.7 0.733E+01   0.40     1.31 .13178E+02
```

```
      1.00    -0.62    0.25     4.0 0.692E+01   0.46     1.29 .15845E+02
      1.14    -0.71    0.26     4.2 0.658E+01   0.53     1.28 .18585E+02
      1.28    -0.80    0.26     4.4 0.629E+01   0.60     1.27 .21388E+02
      1.42    -0.89    0.27     4.5 0.604E+01   0.66     1.27 .24247E+02
 Cumulative travel time =          24.2469 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.90 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      1.42    -0.89    0.66     4.5 0.604E+01   0.66     2.41    0.66    0.00   .24247E+02
      3.27    -0.89    0.66     5.1 0.533E+01   0.46     3.92    0.66    0.20   .75095E+02
      5.12    -0.89    0.66     5.5 0.494E+01   0.38     5.17    0.66    0.29   .12594E+03
      6.97    -0.89    0.66     5.8 0.467E+01   0.33     6.28    0.66    0.33   .17679E+03
      8.82    -0.89    0.66     6.1 0.446E+01   0.29     7.30    0.66    0.37   .22764E+03
     10.67    -0.89    0.66     6.4 0.428E+01   0.27     8.24    0.66    0.39   .27849E+03
     12.52    -0.89    0.66     6.6 0.411E+01   0.25     9.14    0.66    0.41   .32934E+03
     14.37    -0.89    0.66     6.8 0.396E+01   0.24     9.98    0.66    0.42   .38019E+03
     16.22    -0.89    0.66     7.1 0.382E+01   0.23    10.79    0.66    0.43   .43103E+03
     18.07    -0.89    0.66     7.4 0.368E+01   0.22    11.57    0.66    0.44   .48188E+03
     19.92    -0.89    0.66     7.6 0.355E+01   0.22    12.32    0.66    0.44   .53273E+03
 Cumulative travel time =         532.7314 sec  (    0.15 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     19.92    11.43    0.66     7.6 0.355E+01   0.22    24.65    0.66    0.44   .53273E+03
     23.23    11.43    0.66     8.0 0.337E+01   0.22    25.95    0.66    0.44   .62398E+03
     26.55    11.43    0.66     8.4 0.319E+01   0.22    27.21    0.66    0.44   .71523E+03
     29.87    11.43    0.66     8.9 0.302E+01   0.22    28.43    0.66    0.44   .80647E+03
     33.19    11.43    0.66     9.4 0.286E+01   0.22    29.63    0.66    0.44   .89772E+03
     36.51    11.43    0.66     9.9 0.270E+01   0.23    30.79    0.66    0.44   .98897E+03
     39.83    11.43    0.66    10.4 0.255E+01   0.23    31.93    0.66    0.43   .10802E+04
     43.15    11.43    0.66    11.0 0.241E+01   0.23    33.04    0.66    0.43   .11715E+04
     46.47    11.43    0.66    11.6 0.227E+01   0.24    34.13    0.66    0.42   .12627E+04
     49.78    11.43    0.66    12.3 0.214E+01   0.25    35.20    0.66    0.42   .13540E+04
     53.10    11.43    0.66    13.0 0.202E+01   0.25    36.24    0.66    0.41   .14452E+04
 Cumulative travel time =        1445.2068 sec  (    0.40 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     53.10    11.43    0.66    13.0 0.202E+01   0.25    36.24    0.66    0.41   .14452E+04
    200.19    11.43    0.66    17.5 0.134E+01   0.34    36.24    0.66    0.32   .54894E+04
    347.28    11.43    0.66    31.2 0.672E+00   0.60    36.24    0.66    0.06   .95336E+04
    494.37    11.43    0.66    38.7 0.483E+00   0.75    36.24    0.66    0.00   .13578E+05
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    641.46    11.43    0.66    38.7 0.431E+00   0.75    36.24    0.66    0.00   .17622E+05
    788.55    11.43    0.66    38.7 0.385E+00   0.75    36.24    0.66    0.00   .21666E+05
    935.64    11.43    0.66    38.7 0.344E+00   0.75    36.24    0.66    0.00   .25710E+05
   1082.73    11.43    0.66    38.7 0.307E+00   0.75    36.24    0.66    0.00   .29754E+05
   1229.82    11.43    0.66    38.7 0.274E+00   0.75    36.24    0.66    0.00   .33799E+05
   1376.91    11.43    0.66    38.7 0.244E+00   0.75    36.24    0.66    0.00   .37843E+05
   1524.00    11.43    0.66    38.7 0.218E+00   0.75    36.24    0.66    0.00   .41887E+05
 Cumulative travel time =       41886.9336 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 340

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S340U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S340U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--15:06:06
********************************************************************************
SUMMARY OF INPUT DATA:
--------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
--------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.74 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.50 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.55 m
  Port/Nozzle diameter          D0      = 0.1883 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.050746 m
  Total area of openings        TA0     = 0.1670 m^2
  Discharge velocity            U0      = 0.15 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
--------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.009314 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.001187 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.001425 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000123 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000147 m^3/s^3
--------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 1.13 m          LM  = 0.48 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
--------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 5.40
  Port/nozzle Froude number     FRD0   = 2.80
  Velocity ratio                R      = 4.32
--------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
********************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.13 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 7.0145 deg.F
  Dilution at edge of NFR              s = 3.9
  NFR Location:                        x = 1.16 m
    (centerline coordinates)           y = -0.73 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.01 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       18.3888 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 18.87 m downstream.
  Plume contacts second bank at 54.63 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 340

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S340U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S340U.prd
 Time stamp:        12/21/2025--15:06:06

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.13  YB1   =      9.75  YB2   =     12.50
 LD    =      2.74  NOPEN =    6       NRISER=    6       SPAC  =      0.55    NPPERR =    1
 D0    =     0.188 A0    =     0.028 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     0.850 B0    =0.5075E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.153 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.9314E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1187E-02   j0 =U0*GP0*B0 =0.1227E-03   (based on slot width B0)
 m0 =U0*q0   =0.1425E-02   j0 =q0*GP0    =0.1473E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.061 lM    =     0.48  lm    =      1.13
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.3257E-02  J0    =0.3367E-03
 Associated 3-d length scales (meters)
 LQ    =      0.17  LM    =      0.74  Lm    =      1.76  Lb    =      9.08
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      5.40  FRD0  =      2.80  R     =      4.32  PL    =    4.02
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     0.153 D0    =     0.188 A0    =     0.028 THETA =      0.00
 FR0   =      5.40  FRD0  =      2.80  R     =      4.32
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.13 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.04     1.37     0.123   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.04     1.37 .00000E+00
     0.12    -0.07    0.21     1.9 0.143E+02   0.07     1.28 .11913E+01
     0.23    -0.15    0.21     2.3 0.119E+02   0.13     1.21 .26909E+01
     0.35    -0.22    0.22     2.6 0.106E+02   0.20     1.15 .43567E+01
     0.47    -0.29    0.23     2.8 0.965E+01   0.26     1.11 .61419E+01
     0.58    -0.36    0.23     3.1 0.897E+01   0.33     1.08 .80211E+01
     0.70    -0.44    0.24     3.3 0.843E+01   0.40     1.05 .99779E+01
```

```
      0.81    -0.51    0.24     3.4 0.798E+01   0.46     1.03 .12001E+02
      0.93    -0.58    0.25     3.6 0.761E+01   0.53     1.02 .14081E+02
      1.05    -0.65    0.25     3.8 0.729E+01   0.60     1.01 .16212E+02
      1.16    -0.73    0.26     3.9 0.701E+01   0.66     1.01 .18389E+02
 Cumulative travel time =          18.3888 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  2.05 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      1.16    -0.73    0.66     3.9 0.701E+01   0.66     2.07    0.66    0.00   .18389E+02
      2.93    -0.73    0.66     4.5 0.609E+01   0.44     3.60    0.66    0.22   .67076E+02
      4.70    -0.73    0.66     4.9 0.563E+01   0.35     4.84    0.66    0.31   .11576E+03
      6.48    -0.73    0.66     5.1 0.531E+01   0.30     5.94    0.66    0.36   .16445E+03
      8.25    -0.73    0.66     5.4 0.506E+01   0.27     6.94    0.66    0.39   .21314E+03
     10.02    -0.73    0.66     5.6 0.485E+01   0.25     7.87    0.66    0.41   .26183E+03
     11.79    -0.73    0.66     5.8 0.466E+01   0.23     8.74    0.66    0.43   .31051E+03
     13.56    -0.73    0.66     6.0 0.449E+01   0.22     9.57    0.66    0.44   .35920E+03
     15.33    -0.73    0.66     6.3 0.432E+01   0.21    10.36    0.66    0.45   .40789E+03
     17.10    -0.73    0.66     6.5 0.417E+01   0.21    11.12    0.66    0.46   .45658E+03
     18.87    -0.73    0.66     6.7 0.401E+01   0.20    11.85    0.66    0.46   .50526E+03
 Cumulative travel time =         505.2645 sec  (    0.14 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     18.87    11.13    0.66     6.7 0.401E+01   0.20    23.71    0.66    0.46   .50526E+03
     22.45    11.13    0.66     7.1 0.378E+01   0.20    25.13    0.66    0.46   .60359E+03
     26.02    11.13    0.66     7.6 0.356E+01   0.20    26.50    0.66    0.46   .70192E+03
     29.60    11.13    0.66     8.0 0.335E+01   0.20    27.83    0.66    0.46   .80025E+03
     33.18    11.13    0.66     8.5 0.314E+01   0.21    29.13    0.66    0.46   .89858E+03
     36.75    11.13    0.66     9.1 0.295E+01   0.21    30.38    0.66    0.45   .99691E+03
     40.33    11.13    0.66     9.6 0.276E+01   0.21    31.61    0.66    0.45   .10952E+04
     43.91    11.13    0.66    10.3 0.258E+01   0.22    32.81    0.66    0.44   .11936E+04
     47.48    11.13    0.66    10.9 0.242E+01   0.23    33.98    0.66    0.44   .12919E+04
     51.06    11.13    0.66    11.6 0.226E+01   0.23    35.12    0.66    0.43   .13902E+04
     54.63    11.13    0.66    12.4 0.212E+01   0.24    36.24    0.66    0.42   .14885E+04
 Cumulative travel time =        1488.5481 sec  (    0.41 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     54.63    11.13    0.66    12.4 0.212E+01   0.24    36.24    0.66    0.42   .14885E+04
    201.57    11.13    0.66    16.5 0.142E+01   0.32    36.24    0.66    0.34   .55285E+04
    348.51    11.13    0.66    29.0 0.722E+00   0.56    36.24    0.66    0.10   .95685E+04
    495.44    11.13    0.66    38.7 0.483E+00   0.75    36.24    0.66    0.00   .13608E+05
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    642.38    11.13    0.66    38.7 0.431E+00   0.75    36.24    0.66    0.00   .17648E+05
    789.32    11.13    0.66    38.7 0.385E+00   0.75    36.24    0.66    0.00   .21688E+05
    936.25    11.13    0.66    38.7 0.343E+00   0.75    36.24    0.66    0.00   .25728E+05
   1083.19    11.13    0.66    38.7 0.306E+00   0.75    36.24    0.66    0.00   .29768E+05
   1230.13    11.13    0.66    38.7 0.273E+00   0.75    36.24    0.66    0.00   .33808E+05
   1377.06    11.13    0.66    38.7 0.244E+00   0.75    36.24    0.66    0.00   .37848E+05
   1524.00    11.13    0.66    38.7 0.218E+00   0.75    36.24    0.66    0.00   .41888E+05
 Cumulative travel time =       41888.1797 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 341

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S341U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S341U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--15:02:25
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.44 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.19 m
  Number of openings            NOPEN   = 4
  Number of Risers              NRISER = 4
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.81 m
  Port/Nozzle diameter          D0      = 0.2332 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.052567 m
  Total area of openings        TA0     = 0.1709 m^2
  Discharge velocity            U0      = 0.15 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.010479 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.001175 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.001567 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000124 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000166 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 1.25 m          LM  = 0.47 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 5.19
  Port/nozzle Froude number     FRD0   = 2.46
  Velocity ratio                R      = 4.22
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

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  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.97 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 7.6939 deg.F
  Dilution at edge of NFR              s = 3.6
  NFR Location:                        x = 1.03 m
    (centerline coordinates)           y = -0.65 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 0.89 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       15.7495 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 18.37 m downstream.
  Plume contacts second bank at 55.44 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 341

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S341U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S341U.prd
 Time stamp:        12/21/2025--15:02:25

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.97  YB1   =      9.75  YB2   =     12.19
 LD    =      2.44  NOPEN =    4       NRISER=    4       SPAC  =      0.81    NPPERR =    1
 D0    =     0.233 A0    =     0.043 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.253 CR0   =     0.850 B0    =0.5257E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.150 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1048E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1175E-02   j0 =U0*GP0*B0 =0.1243E-03   (based on slot width B0)
 m0 =U0*q0   =0.1567E-02   j0 =q0*GP0    =0.1657E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.070 lM    =     0.47  lm    =      1.25
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2865E-02  J0    =0.3030E-03
 Associated 3-d length scales (meters)
 LQ    =      0.21  LM    =      0.71  Lm    =      1.74  Lb    =      9.08
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      5.19  FRD0  =      2.46  R     =      4.22  PL    =    4.84
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.150 D0    =      0.233 A0    =      0.043 THETA =      0.00
 FR0   =      5.19  FRD0  =      2.46  R     =      4.22
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.97 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.04     1.22     0.119   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.04     1.22 .00000E+00
     0.10    -0.06    0.21     1.8 0.151E+02   0.07     1.13 .10329E+01
     0.21    -0.13    0.21     2.1 0.128E+02   0.13     1.07 .23197E+01
     0.31    -0.19    0.22     2.4 0.114E+02   0.20     1.02 .37456E+01
     0.41    -0.26    0.22     2.6 0.105E+02   0.26     0.98 .52724E+01
     0.52    -0.32    0.23     2.8 0.975E+01   0.33     0.95 .68792E+01
     0.62    -0.39    0.23     3.0 0.918E+01   0.40     0.93 .85524E+01
```

```
      0.72    -0.45    0.24     3.1 0.872E+01   0.46     0.91 .10282E+02
      0.83    -0.52    0.24     3.3 0.833E+01   0.53     0.90 .12062E+02
      0.93    -0.58    0.25     3.4 0.799E+01   0.60     0.89 .13886E+02
      1.03    -0.65    0.25     3.6 0.769E+01   0.66     0.89 .15750E+02
 Cumulative travel time =          15.7495 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  2.13 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y        Z        S        C        BV       BH       ZU       ZL       TT
    1.03    -0.65     0.66     3.6 0.769E+01   0.66     1.89     0.66     0.00   .15750E+02
    2.77    -0.65     0.66     4.1 0.661E+01   0.42     3.43     0.66     0.24   .63428E+02
    4.50    -0.65     0.66     4.5 0.608E+01   0.34     4.68     0.66     0.32   .11111E+03
    6.24    -0.65     0.66     4.8 0.573E+01   0.29     5.77     0.66     0.37   .15878E+03
    7.97    -0.65     0.66     5.0 0.546E+01   0.26     6.76     0.66     0.40   .20646E+03
    9.70    -0.65     0.66     5.2 0.523E+01   0.24     7.68     0.66     0.42   .25414E+03
   11.44    -0.65     0.66     5.4 0.502E+01   0.22     8.55     0.66     0.44   .30182E+03
   13.17    -0.65     0.66     5.6 0.483E+01   0.21     9.37     0.66     0.45   .34950E+03
   14.91    -0.65     0.66     5.8 0.466E+01   0.20    10.15     0.66     0.46   .39717E+03
   16.64    -0.65     0.66     6.0 0.449E+01   0.19    10.90     0.66     0.47   .44485E+03
   18.37    -0.65     0.66     6.3 0.432E+01   0.19    11.62     0.66     0.47   .49253E+03
 Cumulative travel time =         492.5296 sec  (    0.14 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH       ZU       ZL       TT
   18.37    10.97     0.66     6.3 0.432E+01   0.19    23.24     0.66     0.47   .49253E+03
   22.08    10.97     0.66     6.6 0.405E+01   0.19    24.73     0.66     0.47   .59445E+03
   25.79    10.97     0.66     7.1 0.380E+01   0.19    26.16     0.66     0.47   .69636E+03
   29.50    10.97     0.66     7.5 0.355E+01   0.19    27.54     0.66     0.47   .79828E+03
   33.20    10.97     0.66     8.0 0.332E+01   0.20    28.89     0.66     0.47   .90020E+03
   36.91    10.97     0.66     8.6 0.310E+01   0.20    30.19     0.66     0.46   .10021E+04
   40.62    10.97     0.66     9.2 0.289E+01   0.21    31.46     0.66     0.46   .11040E+04
   44.32    10.97     0.66     9.8 0.270E+01   0.21    32.70     0.66     0.45   .12059E+04
   48.03    10.97     0.66    10.5 0.251E+01   0.22    33.90     0.66     0.44   .13079E+04
   51.74    10.97     0.66    11.3 0.234E+01   0.23    35.09     0.66     0.44   .14098E+04
   55.44    10.97     0.66    12.1 0.218E+01   0.23    36.24     0.66     0.43   .15117E+04
 Cumulative travel time =        1511.6943 sec  (    0.42 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH       ZU       ZL       TT
    55.44    10.97     0.66    12.1 0.218E+01   0.23    36.24     0.66     0.43   .15117E+04
   202.30    10.97     0.66    16.0 0.147E+01   0.31    36.24     0.66     0.35   .55494E+04
   349.15    10.97     0.66    27.8 0.752E+00   0.54    36.24     0.66     0.12   .95872E+04
   496.01    10.97     0.66    38.7 0.483E+00   0.75    36.24     0.66     0.00   .13625E+05
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
   642.87    10.97     0.66    38.7 0.431E+00   0.75    36.24     0.66     0.00   .17663E+05
   789.72    10.97     0.66    38.7 0.385E+00   0.75    36.24     0.66     0.00   .21700E+05
   936.58    10.97     0.66    38.7 0.343E+00   0.75    36.24     0.66     0.00   .25738E+05
  1083.43    10.97     0.66    38.7 0.306E+00   0.75    36.24     0.66     0.00   .29776E+05
  1230.29    10.97     0.66    38.7 0.273E+00   0.75    36.24     0.66     0.00   .33814E+05
  1377.14    10.97     0.66    38.7 0.244E+00   0.75    36.24     0.66     0.00   .37851E+05
  1524.00    10.97     0.66    38.7 0.218E+00   0.75    36.24     0.66     0.00   .41889E+05
 Cumulative travel time =       41889.0938 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 342

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S342U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S342U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:59:52
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.13 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 11.89 m
  Number of openings            NOPEN   = 3
  Number of Risers              NRISER = 3
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 1.07 m
  Port/Nozzle diameter          D0      = 0.2810 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.058137 m
  Total area of openings        TA0     = 0.1861 m^2
  Discharge velocity            U0      = 0.14 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.011976 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.001096 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.001645 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000126 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000189 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.09 m          Lm  = 1.31 m          LM  = 0.44 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 4.53
  Port/nozzle Froude number       FRD0   = 2.06
  Velocity ratio                R       = 3.88
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.82 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 8.677100 deg.F
  Dilution at edge of NFR              s = 3.2
  NFR Location:                        x = 0.90 m
    (centerline coordinates)           y = -0.57 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 0.77 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       13.5176 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 17.91 m downstream.
  Plume contacts second bank at 56.33 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ***********************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 342

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S342U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S342U.prd
 Time stamp:        12/21/2025--14:59:52

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.82  YB1   =      9.75  YB2   =     11.89
 LD    =      2.13  NOPEN =    3       NRISER=    3       SPAC  =      1.07    NPPERR =    1
 D0    =     0.281 A0    =     0.062 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.305 CR0   =     0.850 B0    =0.5814E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.137 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1198E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1096E-02   j0 =U0*GP0*B0 =0.1263E-03   (based on slot width B0)
 m0 =U0*q0   =0.1645E-02   j0 =q0*GP0    =0.1894E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.087 lM    =      0.44  lm    =      1.31
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2339E-02  J0    =0.2694E-03
 Associated 3-d length scales (meters)
 LQ    =      0.25  LM    =      0.65  Lm    =      1.67  Lb    =      9.08
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      4.53  FRD0  =      2.06  R     =      3.88  PL    =    5.33
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.137 D0    =      0.281 A0    =      0.062 THETA =      0.00
 FR0   =      4.53  FRD0  =      2.06  R     =      3.88
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.82 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.05     1.07     0.107   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.05     1.07 .00000E+00
      0.09    -0.06    0.21     1.7 0.163E+02   0.07     0.99 .91133E+00
      0.18    -0.11    0.21     2.0 0.139E+02   0.13     0.93 .20259E+01
      0.27    -0.17    0.22     2.2 0.126E+02   0.20     0.89 .32534E+01
      0.36    -0.23    0.22     2.4 0.116E+02   0.26     0.85 .45636E+01
      0.45    -0.28    0.22     2.5 0.108E+02   0.33     0.83 .59398E+01
      0.54    -0.34    0.23     2.7 0.103E+02   0.40     0.81 .73710E+01
```

```
      0.63    -0.40    0.23     2.8 0.977E+01   0.46     0.79 .88496E+01
      0.72    -0.45    0.24     2.9 0.935E+01   0.53     0.78 .10370E+02
      0.81    -0.51    0.24     3.0 0.899E+01   0.60     0.78 .11927E+02
      0.90    -0.57    0.25     3.2 0.868E+01   0.66     0.77 .13518E+02
 Cumulative travel time =          13.5176 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  2.17 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      0.90    -0.57    0.66     3.2 0.868E+01   0.66     1.68    0.66    0.00   .13518E+02
      2.61    -0.57    0.66     3.7 0.733E+01   0.40     3.25    0.66    0.26   .60270E+02
      4.31    -0.57    0.66     4.1 0.672E+01   0.32     4.50    0.66    0.34   .10702E+03
      6.01    -0.57    0.66     4.3 0.632E+01   0.27     5.59    0.66    0.39   .15377E+03
      7.71    -0.57    0.66     4.5 0.602E+01   0.24     6.57    0.66    0.42   .20053E+03
      9.41    -0.57    0.66     4.7 0.576E+01   0.22     7.49    0.66    0.44   .24728E+03
     11.11    -0.57    0.66     4.9 0.553E+01   0.21     8.35    0.66    0.45   .29403E+03
     12.81    -0.57    0.66     5.1 0.532E+01   0.20     9.16    0.66    0.47   .34078E+03
     14.51    -0.57    0.66     5.3 0.512E+01   0.19     9.93    0.66    0.47   .38754E+03
     16.21    -0.57    0.66     5.5 0.492E+01   0.18    10.68    0.66    0.48   .43429E+03
     17.91    -0.57    0.66     5.7 0.474E+01   0.18    11.39    0.66    0.49   .48104E+03
 Cumulative travel time =         481.0417 sec  (    0.13 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     17.91    10.82    0.66     5.7 0.474E+01   0.18    22.78    0.66    0.49   .48104E+03
     21.75    10.82    0.66     6.1 0.442E+01   0.18    24.33    0.66    0.49   .58668E+03
     25.59    10.82    0.66     6.5 0.412E+01   0.18    25.82    0.66    0.48   .69233E+03
     29.44    10.82    0.66     7.0 0.383E+01   0.18    27.26    0.66    0.48   .79797E+03
     33.28    10.82    0.66     7.5 0.356E+01   0.18    28.65    0.66    0.48   .90361E+03
     37.12    10.82    0.66     8.1 0.330E+01   0.19    30.00    0.66    0.47   .10093E+04
     40.96    10.82    0.66     8.7 0.306E+01   0.19    31.31    0.66    0.47   .11149E+04
     44.81    10.82    0.66     9.3 0.284E+01   0.20    32.59    0.66    0.46   .12205E+04
     48.65    10.82    0.66    10.0 0.263E+01   0.21    33.84    0.66    0.45   .13262E+04
     52.49    10.82    0.66    10.8 0.244E+01   0.22    35.05    0.66    0.44   .14318E+04
     56.33    10.82    0.66    11.6 0.226E+01   0.23    36.24    0.66    0.44   .15375E+04
 Cumulative travel time =        1537.4666 sec  (    0.43 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     56.33    10.82    0.66    11.6 0.226E+01   0.23    36.24    0.66    0.44   .15375E+04
    203.10    10.82    0.66    15.3 0.153E+01   0.30    36.24    0.66    0.37   .55728E+04
    349.87    10.82    0.66    26.4 0.791E+00   0.51    36.24    0.66    0.15   .96081E+04
    496.63    10.82    0.66    38.7 0.482E+00   0.75    36.24    0.66    0.00   .13643E+05
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    643.40    10.82    0.66    38.7 0.431E+00   0.75    36.24    0.66    0.00   .17679E+05
    790.17    10.82    0.66    38.7 0.384E+00   0.75    36.24    0.66    0.00   .21714E+05
    936.93    10.82    0.66    38.7 0.343E+00   0.75    36.24    0.66    0.00   .25749E+05
   1083.70    10.82    0.66    38.7 0.306E+00   0.75    36.24    0.66    0.00   .29785E+05
   1230.47    10.82    0.66    38.7 0.273E+00   0.75    36.24    0.66    0.00   .33820E+05
   1377.23    10.82    0.66    38.7 0.244E+00   0.75    36.24    0.66    0.00   .37855E+05
   1524.00    10.82    0.66    38.7 0.218E+00   0.75    36.24    0.66    0.00   .41890E+05
 Cumulative travel time =       41890.4141 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 343

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S343U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S343U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:58:33
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 4.88 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 14.63 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.49 m
  Port/Nozzle diameter          D0      = 0.1524 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.037405 m
  Total area of openings        TA0     = 0.2007 m^2
  Discharge velocity            U0      = 0.13 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.005239 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000607 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.000667 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000075 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000083 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.04 m          Lm  = 0.53 m          LM  = 0.34 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 5.24
  Port/nozzle Froude number     FRD0   = 2.59
  Velocity ratio                R      = 3.59
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

Type text here

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    12.19 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 4.6859 deg.F
  Dilution at edge of NFR              s = 5.8
  NFR Location:                        x = 2.07 m
    (centerline coordinates)           y = -1.29 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.98 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       42.6234 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 22.69 m downstream.
  Plume contacts second bank at 49.47 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 345
Scenario Type text here

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORMIX MIXING ZONE EXPERT SYSTEM
              Subsystem CORMIX2: Multiport Diffuser Discharges
                         CORMIX Version 12.0GT
                   HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S343U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S343U.prd
 Time stamp:        12/21/2025--14:58:33

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     12.19  YB1   =      9.75  YB2   =     14.63
 LD    =      4.88  NOPEN =   11       NRISER=   11       SPAC  =      0.49    NPPERR =    1
 D0    =     0.152 A0    =     0.018 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     1.000 B0    =0.3740E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =      0.127 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.5239E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.6065E-03   j0 =U0*GP0*B0 =0.7532E-04   (based on slot width B0)
 m0 =U0*q0   =0.6672E-03   j0 =q0*GP0    =0.8285E-04   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.041 lM    =      0.34  lm    =      0.53
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2958E-02  J0    =0.3673E-03
 Associated 3-d length scales (meters)
 LQ    =      0.14  LM    =      0.66  Lm    =      1.61  Lb    =      9.08
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      5.24  FRD0  =      2.59  R     =      3.59  PL    =    5.58
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.127 D0    =      0.152 A0    =      0.018 THETA =      0.00
 FR0   =      5.24  FRD0  =      2.59  R     =      3.59
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        12.19 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.03     2.44     0.097   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.03     2.44 .00000E+00
      0.21    -0.13    0.21     2.5 0.108E+02   0.08     2.32 .28451E+01
      0.41    -0.26    0.22     3.2 0.865E+01   0.13     2.23 .64483E+01
      0.62    -0.39    0.23     3.7 0.750E+01   0.20     2.16 .10410E+02
      0.83    -0.52    0.24     4.1 0.674E+01   0.26     2.10 .14612E+02
      1.03    -0.65    0.25     4.4 0.619E+01   0.33     2.06 .18993E+02
      1.24    -0.78    0.26     4.8 0.576E+01   0.40     2.03 .23517E+02
```

```
      1.45    -0.90    0.27     5.1 0.542E+01   0.46     2.00 .28158E+02
      1.65    -1.03    0.28     5.3 0.514E+01   0.53     1.99 .32898E+02
      1.86    -1.16    0.29     5.6 0.489E+01   0.60     1.98 .37723E+02
      2.07    -1.29    0.30     5.8 0.469E+01   0.66     1.98 .42623E+02
 Cumulative travel time =          42.6234 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.57 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y        Z        S        C        BV       BH       ZU       ZL       TT
      2.07    -1.29    0.66     5.8 0.469E+01   0.66     3.11     0.66     0.00   .42623E+02
      4.13    -1.29    0.66     6.5 0.422E+01   0.49     4.62     0.66     0.17   .99332E+02
      6.19    -1.29    0.66     6.9 0.394E+01   0.41     5.92     0.66     0.25   .15604E+03
      8.26    -1.29    0.66     7.3 0.374E+01   0.36     7.08     0.66     0.30   .21275E+03
     10.32    -1.29    0.66     7.6 0.357E+01   0.33     8.15     0.66     0.33   .26946E+03
     12.38    -1.29    0.66     7.9 0.343E+01   0.30     9.15     0.66     0.36   .32617E+03
     14.44    -1.29    0.66     8.2 0.330E+01   0.29    10.10     0.66     0.37   .38288E+03
     16.51    -1.29    0.66     8.5 0.317E+01   0.27    11.00     0.66     0.39   .43959E+03
     18.57    -1.29    0.66     8.9 0.305E+01   0.26    11.86     0.66     0.40   .49629E+03
     20.63    -1.29    0.66     9.2 0.294E+01   0.25    12.69     0.66     0.41   .55300E+03
     22.69    -1.29    0.66     9.5 0.283E+01   0.25    13.49     0.66     0.41   .60971E+03
 Cumulative travel time =         609.7121 sec  (    0.17 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH       ZU       ZL       TT
     22.69    12.19    0.66     9.5 0.283E+01   0.25    26.98     0.66     0.41   .60971E+03
     25.37    12.19    0.66     9.9 0.272E+01   0.25    27.99     0.66     0.41   .68333E+03
     28.05    12.19    0.66    10.3 0.261E+01   0.25    28.97     0.66     0.41   .75695E+03
     30.73    12.19    0.66    10.7 0.251E+01   0.25    29.94     0.66     0.41   .83057E+03
     33.40    12.19    0.66    11.1 0.241E+01   0.25    30.89     0.66     0.41   .90419E+03
     36.08    12.19    0.66    11.6 0.231E+01   0.26    31.82     0.66     0.41   .97781E+03
     38.76    12.19    0.66    12.0 0.222E+01   0.26    32.73     0.66     0.40   .10514E+04
     41.44    12.19    0.66    12.5 0.212E+01   0.26    33.63     0.66     0.40   .11250E+04
     44.11    12.19    0.66    13.0 0.203E+01   0.27    34.52     0.66     0.40   .11987E+04
     46.79    12.19    0.66    13.6 0.195E+01   0.27    35.39     0.66     0.39   .12723E+04
     49.47    12.19    0.66    14.2 0.187E+01   0.27    36.24     0.66     0.39   .13459E+04
 Cumulative travel time =        1345.9041 sec  (    0.37 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH       ZU       ZL       TT
     49.47    12.19    0.66    14.2 0.187E+01   0.27    36.24     0.66     0.39   .13459E+04
    196.92    12.19    0.66    19.5 0.121E+01   0.38    36.24     0.66     0.28   .54001E+04
    344.38    12.19    0.66    35.5 0.593E+00   0.69    36.24     0.66     0.00   .94542E+04
    491.83    12.19    0.66    38.7 0.485E+00   0.75    36.24     0.66     0.00   .13508E+05
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    639.28    12.19    0.66    38.7 0.432E+00   0.75    36.24     0.66     0.00   .17563E+05
    786.73    12.19    0.66    38.7 0.386E+00   0.75    36.24     0.66     0.00   .21617E+05
    934.19    12.19    0.66    38.7 0.344E+00   0.75    36.24     0.66     0.00   .25671E+05
   1081.64    12.19    0.66    38.7 0.307E+00   0.75    36.24     0.66     0.00   .29725E+05
   1229.09    12.19    0.66    38.7 0.274E+00   0.75    36.24     0.66     0.00   .33779E+05
   1376.55    12.19    0.66    38.7 0.244E+00   0.75    36.24     0.66     0.00   .37833E+05
   1524.00    12.19    0.66    38.7 0.218E+00   0.75    36.24     0.66     0.00   .41888E+05
 Cumulative travel time =       41887.5391 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 344

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S344U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S344U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:56:52
********************************************************************************
SUMMARY OF INPUT DATA:
--------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F       = 0.0540
    Calculated from Manning's n           = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
--------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.96 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.72 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC    = 0.40 m
  Port/Nozzle diameter          D0      = 0.1524 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.046036 m
  Total area of openings        TA0     = 0.2007 m^2
  Discharge velocity            U0      = 0.13 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC   = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
--------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.006448 m^2/s
  Momentum flux
      (based on slot width B0)    m0 =U0^2*B0   = 0.000747 m^3/s^2
      (based on volume flux q0)   m0 =U0*q0     = 0.000821 m^3/s^2
  Buoyancy flux
      (based on slot width B0)    j0 =U0*GP0*B0 = 0.000093 m^3/s^3
      (based on volume flux q0)   j0 =q0*GP0    = 0.000102 m^3/s^3
--------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.05 m          Lm  = 0.65 m          LM  = 0.36 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
--------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 4.72
  Port/nozzle Froude number       FRD0   = 2.59
  Velocity ratio                R       = 3.59
--------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
********************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

Type text here

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Scenario 34

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.73 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 5.5324 deg.F
  Dilution at edge of NFR              s = 5.0
  NFR Location:                        x = 1.68 m
    (centerline coordinates)           y = -1.05 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.57 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       32.4033 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 21.08 m downstream.
  Plume contacts second bank at 51.74 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************* FINAL DESIGN ADVICE AND COMMENTS ***********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 344

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S344U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S344U.prd
 Time stamp:        12/21/2025--14:56:52

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.73  YB1   =      9.75  YB2   =     13.72
 LD    =      3.96  NOPEN =   11       NRISER=   11       SPAC  =      0.40    NPPERR =    1
 D0    =     0.152 A0    =     0.018 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     1.000 B0    =0.4604E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =      0.127 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.6448E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.7465E-03   j0 =U0*GP0*B0 =0.9270E-04   (based on slot width B0)
 m0 =U0*q0   =0.8212E-03   j0 =q0*GP0    =0.1020E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.051 lM    =      0.36  lm    =      0.65
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2958E-02  J0    =0.3673E-03
 Associated 3-d length scales (meters)
 LQ    =      0.14  LM    =      0.66  Lm    =      1.61  Lb    =      9.08
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      4.72  FRD0  =      2.59  R     =      3.59  PL    =    4.22
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.127 D0    =      0.152 A0    =      0.018 THETA =      0.00
 FR0   =      4.72  FRD0  =      2.59  R     =      3.59
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.73 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.04     1.98     0.097   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.04     1.98 .00000E+00
      0.17    -0.10    0.21     2.2 0.122E+02   0.08     1.87 .21528E+01
      0.34    -0.21    0.22     2.8 0.990E+01   0.13     1.79 .48654E+01
      0.50    -0.31    0.23     3.2 0.866E+01   0.20     1.73 .78552E+01
      0.67    -0.42    0.23     3.5 0.783E+01   0.26     1.68 .11035E+02
      0.84    -0.52    0.24     3.8 0.722E+01   0.33     1.64 .14360E+02
      1.01    -0.63    0.25     4.1 0.675E+01   0.40     1.61 .17800E+02
```

```
      1.18    -0.73    0.26     4.3 0.636E+01   0.46     1.59 .21337E+02
      1.34    -0.84    0.26     4.5 0.604E+01   0.53     1.58 .24957E+02
      1.51    -0.94    0.27     4.7 0.577E+01   0.60     1.57 .28649E+02
      1.68    -1.05    0.28     5.0 0.553E+01   0.66     1.57 .32403E+02
 Cumulative travel time =          32.4033 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.68 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      1.68    -1.05    0.66     5.0 0.553E+01   0.66     2.63    0.66    0.00   .32403E+02
      3.62    -1.05    0.66     5.6 0.491E+01   0.47     4.16    0.66    0.19   .85752E+02
      5.56    -1.05    0.66     6.0 0.457E+01   0.39     5.43    0.66    0.27   .13910E+03
      7.50    -1.05    0.66     6.3 0.432E+01   0.34     6.57    0.66    0.32   .19245E+03
      9.44    -1.05    0.66     6.6 0.413E+01   0.30     7.62    0.66    0.36   .24580E+03
     11.38    -1.05    0.66     6.9 0.396E+01   0.28     8.59    0.66    0.38   .29915E+03
     13.32    -1.05    0.66     7.1 0.380E+01   0.26     9.51    0.66    0.40   .35250E+03
     15.26    -1.05    0.66     7.4 0.366E+01   0.25    10.38    0.66    0.41   .40585E+03
     17.20    -1.05    0.66     7.7 0.353E+01   0.24    11.21    0.66    0.42   .45920E+03
     19.14    -1.05    0.66     8.0 0.340E+01   0.23    12.01    0.66    0.43   .51255E+03
     21.08    -1.05    0.66     8.3 0.327E+01   0.23    12.79    0.66    0.43   .56589E+03
 Cumulative travel time =         565.8944 sec  (    0.16 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     21.08    11.73    0.66     8.3 0.327E+01   0.23    25.57    0.66    0.43   .56589E+03
     24.15    11.73    0.66     8.6 0.312E+01   0.23    26.75    0.66    0.43   .65018E+03
     27.21    11.73    0.66     9.0 0.297E+01   0.23    27.90    0.66    0.43   .73447E+03
     30.28    11.73    0.66     9.5 0.283E+01   0.23    29.03    0.66    0.43   .81876E+03
     33.35    11.73    0.66     9.9 0.269E+01   0.23    30.12    0.66    0.43   .90304E+03
     36.41    11.73    0.66    10.4 0.256E+01   0.23    31.19    0.66    0.43   .98733E+03
     39.48    11.73    0.66    10.9 0.243E+01   0.24    32.24    0.66    0.42   .10716E+04
     42.54    11.73    0.66    11.5 0.231E+01   0.24    33.27    0.66    0.42   .11559E+04
     45.61    11.73    0.66    12.1 0.219E+01   0.25    34.28    0.66    0.41   .12402E+04
     48.67    11.73    0.66    12.7 0.208E+01   0.25    35.27    0.66    0.41   .13245E+04
     51.74    11.73    0.66    13.4 0.197E+01   0.26    36.24    0.66    0.40   .14088E+04
 Cumulative travel time =        1408.7650 sec  (    0.39 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     51.74    11.73    0.66    13.4 0.197E+01   0.26    36.24    0.66    0.40   .14088E+04
    198.97    11.73    0.66    18.1 0.130E+01   0.35    36.24    0.66    0.31   .54567E+04
    346.19    11.73    0.66    32.4 0.647E+00   0.63    36.24    0.66    0.03   .95046E+04
    493.42    11.73    0.66    38.7 0.484E+00   0.75    36.24    0.66    0.00   .13553E+05
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    640.64    11.73    0.66    38.7 0.432E+00   0.75    36.24    0.66    0.00   .17600E+05
    787.87    11.73    0.66    38.7 0.385E+00   0.75    36.24    0.66    0.00   .21648E+05
    935.10    11.73    0.66    38.7 0.344E+00   0.75    36.24    0.66    0.00   .25696E+05
   1082.32    11.73    0.66    38.7 0.307E+00   0.75    36.24    0.66    0.00   .29744E+05
   1229.55    11.73    0.66    38.7 0.274E+00   0.75    36.24    0.66    0.00   .33792E+05
   1376.77    11.73    0.66    38.7 0.244E+00   0.75    36.24    0.66    0.00   .37840E+05
   1524.00    11.73    0.66    38.7 0.218E+00   0.75    36.24    0.66    0.00   .41888E+05
 Cumulative travel time =       41887.9805 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 345

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S345U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S345U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:55:18
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.35 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.11 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.67 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.048846 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 0.13 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.007621 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000826 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.000991 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000100 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000121 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 0.79 m          LM  = 0.38 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 4.68
  Port/nozzle Froude number     FRD0   = 2.29
  Velocity ratio                R      = 3.67
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.43 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 6.2744 deg.F
  Dilution at edge of NFR              s = 4.4
  NFR Location:                        x = 1.42 m
    (centerline coordinates)           y = -0.89 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.29 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       25.7104 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 20.02 m downstream.
  Plume contacts second bank at 53.24 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS ************************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 345

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
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CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S345U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S345U.prd
 Time stamp:        12/21/2025--14:55:18

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.43  YB1   =      9.75  YB2   =     13.11
 LD    =      3.35  NOPEN =    6       NRISER=    6       SPAC  =      0.67    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.4885E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.130 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7621E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.8257E-03   j0 =U0*GP0*B0 =0.1004E-03   (based on slot width B0)
 m0 =U0*q0   =0.9908E-03   j0 =q0*GP0    =0.1205E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.059 lM    =      0.38  lm    =      0.79
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2768E-02  J0    =0.3367E-03
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =      0.66  Lm    =      1.63  Lb    =      9.08
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      4.68  FRD0  =      2.29  R     =      3.67  PL    =    5.34
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.130 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =      4.68  FRD0  =      2.29  R     =      3.67
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
       11.43 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.04     1.68     0.100   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
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BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.04     1.68 .00000E+00
     0.14    -0.09    0.21     2.1 0.133E+02   0.07     1.58 .17036E+01
     0.28    -0.18    0.22     2.5 0.109E+02   0.13     1.50 .38398E+01
     0.43    -0.27    0.22     2.8 0.963E+01   0.20     1.45 .61979E+01
     0.57    -0.36    0.23     3.1 0.876E+01   0.26     1.40 .87112E+01
     0.71    -0.44    0.24     3.4 0.810E+01   0.33     1.36 .11344E+02
     0.85    -0.53    0.24     3.6 0.759E+01   0.40     1.34 .14074E+02
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      1.00    -0.62    0.25     3.8 0.718E+01   0.46     1.32 .16886E+02
      1.14    -0.71    0.26     4.0 0.683E+01   0.53     1.30 .19768E+02
      1.28    -0.80    0.26     4.2 0.653E+01   0.60     1.30 .22712E+02
      1.42    -0.89    0.27     4.4 0.627E+01   0.66     1.29 .25710E+02
 Cumulative travel time =          25.7104 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
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BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

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 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
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** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.79 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
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BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
      1.42    -0.89    0.66     4.4 0.627E+01   0.66     2.32    0.66    0.00   .25710E+02
      3.28    -0.89    0.66     5.0 0.551E+01   0.45     3.85    0.66    0.21   .76851E+02
      5.14    -0.89    0.66     5.4 0.510E+01   0.37     5.12    0.66    0.29   .12799E+03
      7.00    -0.89    0.66     5.7 0.482E+01   0.32     6.24    0.66    0.34   .17913E+03
      8.86    -0.89    0.66     5.9 0.459E+01   0.29     7.27    0.66    0.37   .23027E+03
     10.72    -0.89    0.66     6.2 0.440E+01   0.26     8.22    0.66    0.40   .28141E+03
     12.58    -0.89    0.66     6.4 0.423E+01   0.25     9.12    0.66    0.41   .33255E+03
     14.44    -0.89    0.66     6.7 0.407E+01   0.23     9.97    0.66    0.43   .38369E+03
     16.30    -0.89    0.66     6.9 0.392E+01   0.22    10.79    0.66    0.44   .43484E+03
     18.16    -0.89    0.66     7.2 0.378E+01   0.22    11.57    0.66    0.44   .48598E+03
     20.02    -0.89    0.66     7.4 0.364E+01   0.21    12.32    0.66    0.45   .53712E+03
 Cumulative travel time =         537.1169 sec  (    0.15 hrs)

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 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     20.02    11.43    0.66     7.4 0.364E+01   0.21    24.65    0.66    0.45   .53712E+03
     23.34    11.43    0.66     7.8 0.345E+01   0.21    25.95    0.66    0.45   .62844E+03
     26.67    11.43    0.66     8.2 0.327E+01   0.21    27.21    0.66    0.45   .71977E+03
     29.99    11.43    0.66     8.7 0.309E+01   0.21    28.43    0.66    0.45   .81110E+03
     33.31    11.43    0.66     9.2 0.292E+01   0.22    29.63    0.66    0.44   .90243E+03
     36.63    11.43    0.66     9.7 0.276E+01   0.22    30.79    0.66    0.44   .99375E+03
     39.95    11.43    0.66    10.2 0.260E+01   0.23    31.93    0.66    0.44   .10851E+04
     43.27    11.43    0.66    10.8 0.245E+01   0.23    33.04    0.66    0.43   .11764E+04
     46.60    11.43    0.66    11.4 0.231E+01   0.24    34.13    0.66    0.43   .12677E+04
     49.92    11.43    0.66    12.1 0.218E+01   0.24    35.20    0.66    0.42   .13591E+04
     53.24    11.43    0.66    12.8 0.205E+01   0.25    36.24    0.66    0.41   .14504E+04
 Cumulative travel time =        1450.3900 sec  (    0.40 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
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 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
     53.24    11.43    0.66    12.8 0.205E+01   0.25    36.24    0.66    0.41   .14504E+04
    200.31    11.43    0.66    17.2 0.136E+01   0.33    36.24    0.66    0.33   .54942E+04
    347.39    11.43    0.66    30.5 0.688E+00   0.59    36.24    0.66    0.07   .95380E+04
    494.47    11.43    0.66    38.7 0.484E+00   0.75    36.24    0.66    0.00   .13582E+05
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    641.54    11.43    0.66    38.7 0.431E+00   0.75    36.24    0.66    0.00   .17626E+05
    788.62    11.43    0.66    38.7 0.385E+00   0.75    36.24    0.66    0.00   .21669E+05
    935.70    11.43    0.66    38.7 0.344E+00   0.75    36.24    0.66    0.00   .25713E+05
   1082.77    11.43    0.66    38.7 0.307E+00   0.75    36.24    0.66    0.00   .29757E+05
   1229.85    11.43    0.66    38.7 0.274E+00   0.75    36.24    0.66    0.00   .33801E+05
   1376.92    11.43    0.66    38.7 0.244E+00   0.75    36.24    0.66    0.00   .37845E+05
   1524.00    11.43    0.66    38.7 0.218E+00   0.75    36.24    0.66    0.00   .41888E+05
 Cumulative travel time =       41888.3945 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
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CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 346

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CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S346U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S346U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:53:41
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.74 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.50 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.55 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.059701 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 0.13 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.009314 m^2/s
  Momentum flux
      (based on slot width B0)    m0 =U0^2*B0   = 0.001009 m^3/s^2
      (based on volume flux q0)   m0 =U0*q0     = 0.001211 m^3/s^2
  Buoyancy flux
      (based on slot width B0)    j0 =U0*GP0*B0 = 0.000123 m^3/s^3
      (based on volume flux q0)   j0 =q0*GP0    = 0.000147 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 0.96 m          LM  = 0.41 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 4.23
  Port/nozzle Froude number       FRD0   = 2.29
  Velocity ratio                R       = 3.67
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
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  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.13 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 7.3113 deg.F
  Dilution at edge of NFR              s = 3.7
  NFR Location:                        x = 1.16 m
    (centerline coordinates)           y = -0.73 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 1.03 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       19.5599 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 18.97 m downstream.
  Plume contacts second bank at 54.78 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 346

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S346U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S346U.prd
 Time stamp:        12/21/2025--14:53:41

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 Bounded section
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 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.13  YB1   =      9.75  YB2   =     12.50
 LD    =      2.74  NOPEN =    6       NRISER=    6       SPAC  =      0.55    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.5970E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =      0.130 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.9314E-02          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1009E-02    j0 =U0*GP0*B0 =0.1227E-03   (based on slot width B0)
 m0 =U0*q0   =0.1211E-02    j0 =q0*GP0    =0.1473E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.072 lM    =     0.41  lm    =      0.96
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2768E-02  J0    =0.3367E-03
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =      0.66  Lm    =      1.63  Lb    =      9.08
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      4.23  FRD0  =      2.29  R     =      3.67  PL    =    4.02
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.130 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =      4.23  FRD0  =      2.29  R     =      3.67
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.13 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.05     1.37     0.100   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.05     1.37 .00000E+00
      0.12    -0.07    0.21     1.9 0.147E+02   0.08     1.28 .13063E+01
      0.23    -0.15    0.21     2.2 0.123E+02   0.13     1.22 .29256E+01
      0.35    -0.22    0.22     2.5 0.109E+02   0.20     1.17 .47116E+01
      0.47    -0.29    0.23     2.7 0.100E+02   0.26     1.13 .66165E+01
      0.58    -0.36    0.23     2.9 0.931E+01   0.33     1.10 .86145E+01
      0.70    -0.44    0.24     3.1 0.876E+01   0.40     1.07 .10689E+02
```

```
      0.81    -0.51    0.24     3.3 0.831E+01   0.46     1.05 .12828E+02
      0.93    -0.58    0.25     3.5 0.792E+01   0.53     1.04 .15024E+02
      1.05    -0.65    0.25     3.6 0.760E+01   0.60     1.04 .17270E+02
      1.16    -0.73    0.26     3.7 0.731E+01   0.66     1.03 .19560E+02
 Cumulative travel time =          19.5599 sec  (    0.01 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.93 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
      1.16    -0.73    0.66     3.7 0.731E+01   0.66     1.99    0.66    0.00   .19560E+02
      2.94    -0.73    0.66     4.3 0.631E+01   0.43     3.54    0.66    0.23   .68523E+02
      4.72    -0.73    0.66     4.7 0.582E+01   0.34     4.80    0.66    0.32   .11749E+03
      6.51    -0.73    0.66     5.0 0.548E+01   0.30     5.91    0.66    0.37   .16645E+03
      8.29    -0.73    0.66     5.2 0.522E+01   0.27     6.91    0.66    0.40   .21541E+03
     10.07    -0.73    0.66     5.4 0.500E+01   0.24     7.85    0.66    0.42   .26438E+03
     11.85    -0.73    0.66     5.7 0.480E+01   0.23     8.73    0.66    0.43   .31334E+03
     13.63    -0.73    0.66     5.9 0.462E+01   0.22     9.56    0.66    0.45   .36230E+03
     15.41    -0.73    0.66     6.1 0.445E+01   0.21    10.36    0.66    0.45   .41127E+03
     17.19    -0.73    0.66     6.3 0.428E+01   0.20    11.12    0.66    0.46   .46023E+03
     18.97    -0.73    0.66     6.6 0.413E+01   0.19    11.86    0.66    0.47   .50919E+03
 Cumulative travel time =         509.1930 sec  (    0.14 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
     18.97    11.13    0.66     6.6 0.413E+01   0.19    23.71    0.66    0.47   .50919E+03
     22.55    11.13    0.66     6.9 0.388E+01   0.19    25.13    0.66    0.47   .60764E+03
     26.13    11.13    0.66     7.4 0.365E+01   0.20    26.51    0.66    0.47   .70609E+03
     29.71    11.13    0.66     7.8 0.343E+01   0.20    27.84    0.66    0.46   .80454E+03
     33.29    11.13    0.66     8.3 0.321E+01   0.20    29.13    0.66    0.46   .90298E+03
     36.87    11.13    0.66     8.9 0.301E+01   0.20    30.39    0.66    0.46   .10014E+04
     40.46    11.13    0.66     9.4 0.282E+01   0.21    31.61    0.66    0.45   .10999E+04
     44.04    11.13    0.66    10.1 0.263E+01   0.22    32.81    0.66    0.45   .11983E+04
     47.62    11.13    0.66    10.7 0.246E+01   0.22    33.98    0.66    0.44   .12968E+04
     51.20    11.13    0.66    11.4 0.230E+01   0.23    35.12    0.66    0.43   .13952E+04
     54.78    11.13    0.66    12.2 0.215E+01   0.24    36.24    0.66    0.42   .14937E+04
 Cumulative travel time =        1493.6667 sec  (    0.41 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
     54.78    11.13    0.66    12.2 0.215E+01   0.24    36.24    0.66    0.42   .14937E+04
    201.70    11.13    0.66    16.2 0.145E+01   0.31    36.24    0.66    0.35   .55332E+04
    348.62    11.13    0.66    28.4 0.738E+00   0.55    36.24    0.66    0.11   .95728E+04
    495.54    11.13    0.66    38.7 0.483E+00   0.75    36.24    0.66    0.00   .13612E+05
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    642.47    11.13    0.66    38.7 0.431E+00   0.75    36.24    0.66    0.00   .17652E+05
    789.39    11.13    0.66    38.7 0.385E+00   0.75    36.24    0.66    0.00   .21692E+05
    936.31    11.13    0.66    38.7 0.343E+00   0.75    36.24    0.66    0.00   .25731E+05
   1083.23    11.13    0.66    38.7 0.306E+00   0.75    36.24    0.66    0.00   .29771E+05
   1230.16    11.13    0.66    38.7 0.273E+00   0.75    36.24    0.66    0.00   .33810E+05
   1377.08    11.13    0.66    38.7 0.244E+00   0.75    36.24    0.66    0.00   .37850E+05
   1524.00    11.13    0.66    38.7 0.218E+00   0.75    36.24    0.66    0.00   .41889E+05
 Cumulative travel time =       41889.3516 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 347

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S347U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S347U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:51:51
******************************************************************************
SUMMARY OF INPUT DATA:
------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.44 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.19 m
  Number of openings            NOPEN   = 4
  Number of Risers              NRISER = 4
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.81 m
  Port/Nozzle diameter          D0      = 0.2530 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.061843 m
  Total area of openings        TA0     = 0.2011 m^2
  Discharge velocity            U0      = 0.13 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.010479 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000999 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.001332 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000124 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000166 m^3/s^3
------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.08 m          Lm  = 1.06 m          LM  = 0.40 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 4.06
  Port/nozzle Froude number     FRD0   = 2.01
  Velocity ratio                R      = 3.59
------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.97 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 8.030800 deg.F
  Dilution at edge of NFR              s = 3.4
  NFR Location:                        x = 1.03 m
    (centerline coordinates)           y = -0.65 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 0.91 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       16.7755 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 18.46 m downstream.
  Plume contacts second bank at 55.60 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ***********************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 347

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S347U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S347U.prd
 Time stamp:        12/21/2025--14:51:51

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.97  YB1   =      9.75  YB2   =     12.19
 LD    =      2.44  NOPEN =    4       NRISER=    4       SPAC  =      0.81    NPPERR =    1
 D0    =     0.253 A0    =     0.050 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.253 CR0   =     1.000 B0    =0.6184E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     0.127 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1048E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9987E-03   j0 =U0*GP0*B0 =0.1243E-03   (based on slot width B0)
 m0 =U0*q0   =0.1332E-02   j0 =q0*GP0    =0.1657E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.082 lM    =     0.40  lm    =      1.06
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.2435E-02  J0    =0.3030E-03
 Associated 3-d length scales (meters)
 LQ    =      0.22  LM    =      0.63  Lm    =      1.61  Lb    =      9.08
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      4.06  FRD0  =      2.01  R     =      3.59  PL    =    4.84
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     0.127 D0    =     0.253 A0    =     0.050 THETA =      0.00
 FR0   =      4.06  FRD0  =      2.01  R     =      3.59
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.97 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.05     1.22     0.097   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.05     1.22 .00000E+00
     0.10    -0.06    0.21     1.8 0.155E+02   0.07     1.14 .11339E+01
     0.21    -0.13    0.21     2.1 0.132E+02   0.13     1.08 .25251E+01
     0.31    -0.19    0.22     2.3 0.118E+02   0.20     1.03 .40558E+01
     0.41    -0.26    0.22     2.5 0.108E+02   0.26     0.99 .56871E+01
     0.52    -0.32    0.23     2.7 0.101E+02   0.33     0.96 .73978E+01
     0.62    -0.39    0.23     2.9 0.955E+01   0.40     0.94 .91741E+01
```

```
      0.72    -0.45    0.24     3.0 0.908E+01   0.46     0.93 .11007E+02
      0.83    -0.52    0.24     3.2 0.868E+01   0.53     0.92 .12888E+02
      0.93    -0.58    0.25     3.3 0.833E+01   0.60     0.91 .14812E+02
      1.03    -0.65    0.25     3.4 0.803E+01   0.66     0.91 .16775E+02
 Cumulative travel time =          16.7755 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  2.00 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
      1.03    -0.65    0.66     3.4 0.803E+01   0.66     1.81    0.66    0.00   .16775E+02
      2.78    -0.65    0.66     4.0 0.685E+01   0.42     3.38    0.66    0.25   .64690E+02
      4.52    -0.65    0.66     4.3 0.630E+01   0.33     4.64    0.66    0.33   .11260E+03
      6.26    -0.65    0.66     4.6 0.593E+01   0.28     5.74    0.66    0.38   .16052E+03
      8.00    -0.65    0.66     4.8 0.564E+01   0.25     6.74    0.66    0.41   .20843E+03
      9.75    -0.65    0.66     5.0 0.540E+01   0.23     7.66    0.66    0.43   .25635E+03
     11.49    -0.65    0.66     5.2 0.518E+01   0.22     8.53    0.66    0.45   .30426E+03
     13.23    -0.65    0.66     5.4 0.499E+01   0.20     9.36    0.66    0.46   .35218E+03
     14.98    -0.65    0.66     5.6 0.480E+01   0.20    10.14    0.66    0.47   .40009E+03
     16.72    -0.65    0.66     5.9 0.462E+01   0.19    10.90    0.66    0.47   .44801E+03
     18.46    -0.65    0.66     6.1 0.445E+01   0.18    11.62    0.66    0.48   .49592E+03
 Cumulative travel time =         495.9195 sec  (    0.14 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
     18.46    10.97    0.66     6.1 0.445E+01   0.18    23.24    0.66    0.48   .49592E+03
     22.17    10.97    0.66     6.5 0.417E+01   0.18    24.73    0.66    0.48   .59803E+03
     25.89    10.97    0.66     6.9 0.390E+01   0.19    26.16    0.66    0.48   .70015E+03
     29.60    10.97    0.66     7.4 0.364E+01   0.19    27.55    0.66    0.47   .80226E+03
     33.32    10.97    0.66     7.9 0.340E+01   0.19    28.89    0.66    0.47   .90438E+03
     37.03    10.97    0.66     8.4 0.317E+01   0.20    30.19    0.66    0.47   .10065E+04
     40.74    10.97    0.66     9.0 0.295E+01   0.20    31.46    0.66    0.46   .11086E+04
     44.46    10.97    0.66     9.6 0.275E+01   0.21    32.70    0.66    0.45   .12107E+04
     48.17    10.97    0.66    10.3 0.255E+01   0.21    33.91    0.66    0.45   .13128E+04
     51.89    10.97    0.66    11.1 0.238E+01   0.22    35.09    0.66    0.44   .14149E+04
     55.60    10.97    0.66    11.9 0.221E+01   0.23    36.24    0.66    0.43   .15171E+04
 Cumulative travel time =        1517.0625 sec  (    0.42 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
     55.60    10.97    0.66    11.9 0.221E+01   0.23    36.24    0.66    0.43   .15171E+04
    202.44    10.97    0.66    15.7 0.150E+01   0.30    36.24    0.66    0.36   .55544E+04
    349.28    10.97    0.66    27.2 0.768E+00   0.53    36.24    0.66    0.13   .95917E+04
    496.12    10.97    0.66    38.7 0.483E+00   0.75    36.24    0.66    0.00   .13629E+05
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    642.96    10.97    0.66    38.7 0.431E+00   0.75    36.24    0.66    0.00   .17666E+05
    789.80    10.97    0.66    38.7 0.384E+00   0.75    36.24    0.66    0.00   .21704E+05
    936.64    10.97    0.66    38.7 0.343E+00   0.75    36.24    0.66    0.00   .25741E+05
   1083.48    10.97    0.66    38.7 0.306E+00   0.75    36.24    0.66    0.00   .29778E+05
   1230.32    10.97    0.66    38.7 0.273E+00   0.75    36.24    0.66    0.00   .33816E+05
   1377.16    10.97    0.66    38.7 0.244E+00   0.75    36.24    0.66    0.00   .37853E+05
   1524.00    10.97    0.66    38.7 0.218E+00   0.75    36.24    0.66    0.00   .41890E+05
 Cumulative travel time =       41890.1172 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 348

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S348U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S348U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:50:03
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.13 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 11.89 m
  Number of openings            NOPEN   = 3
  Number of Risers              NRISER = 3
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 1.07 m
  Port/Nozzle diameter          D0      = 0.3048 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.068397 m
  Total area of openings        TA0     = 0.2189 m^2
  Discharge velocity            U0      = 0.12 m/s
  Total discharge flowrate      Q0      = 0.025552 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.011976 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.000932 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.001398 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000126 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000189 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.10 m          Lm  = 1.11 m          LM  = 0.37 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 3.55
  Port/nozzle Froude number     FRD0   = 1.68
  Velocity ratio                R      = 3.29
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 38.7

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.82 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 9.063600 deg.F
  Dilution at edge of NFR              s = 3.0
  NFR Location:                        x = 0.90 m
    (centerline coordinates)           y = -0.57 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 0.79 m
                           thickness (bv) = 0.66 m
  Cumulative travel time:       14.4079 sec.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),
  but RE-STRATIFIES LATER.
  Plume becomes vertically fully mixed again at 0 m downstream.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 17.98 m downstream.
  Plume contacts second bank at 56.46 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 348

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S348U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S348U.prd
 Time stamp:        12/21/2025--14:50:03

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.82  YB1   =      9.75  YB2   =     11.89
 LD    =      2.13  NOPEN =    3       NRISER=    3       SPAC  =      1.07    NPPERR =    1
 D0    =     0.305 A0    =     0.073 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.305 CR0   =     1.000 B0    =0.6840E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =      0.117 Q0    =     0.026 Q0A   =0.2555E-01
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1198E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9319E-03   j0 =U0*GP0*B0 =0.1263E-03   (based on slot width B0)
 m0 =U0*q0   =0.1398E-02   j0 =q0*GP0    =0.1894E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.103 lM    =     0.37  lm    =      1.11
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2555E-01  M0    =0.1988E-02  J0    =0.2694E-03
 Associated 3-d length scales (meters)
 LQ    =      0.27  LM    =      0.57  Lm    =      1.54  Lb    =      9.08
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      3.55  FRD0  =      1.68  R     =      3.29  PL    =    5.33
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      0.117 D0    =      0.305 A0    =      0.073 THETA =      0.00
 FR0   =      3.55  FRD0  =      1.68  R     =      3.29
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=    38.68     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.82 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.05     1.07     0.087   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.05     1.07 .00000E+00
     0.09    -0.06    0.21     1.6 0.167E+02   0.08     0.99 .10006E+01
     0.18    -0.11    0.21     1.9 0.144E+02   0.13     0.94 .22061E+01
     0.27    -0.17    0.22     2.1 0.130E+02   0.20     0.90 .35246E+01
     0.36    -0.23    0.22     2.3 0.120E+02   0.26     0.87 .49253E+01
     0.45    -0.28    0.22     2.4 0.113E+02   0.33     0.84 .63914E+01
     0.54    -0.34    0.23     2.6 0.107E+02   0.40     0.82 .79118E+01
```

```
      0.63    -0.40    0.23     2.7 0.102E+02   0.46     0.81 .94789E+01
      0.72    -0.45    0.24     2.8 0.975E+01   0.53     0.80 .11087E+02
      0.81    -0.51    0.24     2.9 0.939E+01   0.60     0.79 .12731E+02
      0.90    -0.57    0.25     3.0 0.906E+01   0.66     0.79 .14408E+02
 Cumulative travel time =          14.4079 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  2.03 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.
-------------------------------------------------------------------------------------------------
BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = top-hat half-width, measured horizontally in y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 1 (not bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
      0.90    -0.57    0.66     3.0 0.906E+01   0.66     1.61    0.66    0.00   .14408E+02
      2.61    -0.57    0.66     3.6 0.760E+01   0.39     3.20    0.66    0.27   .61350E+02
      4.32    -0.57    0.66     3.9 0.696E+01   0.31     4.46    0.66    0.35   .10829E+03
      6.03    -0.57    0.66     4.2 0.654E+01   0.26     5.56    0.66    0.40   .15524E+03
      7.73    -0.57    0.66     4.4 0.622E+01   0.23     6.55    0.66    0.43   .20218E+03
      9.44    -0.57    0.66     4.6 0.595E+01   0.22     7.47    0.66    0.45   .24912E+03
     11.15    -0.57    0.66     4.8 0.571E+01   0.20     8.33    0.66    0.46   .29606E+03
     12.86    -0.57    0.66     5.0 0.548E+01   0.19     9.15    0.66    0.47   .34301E+03
     14.56    -0.57    0.66     5.1 0.527E+01   0.18     9.93    0.66    0.48   .38995E+03
     16.27    -0.57    0.66     5.3 0.507E+01   0.18    10.67    0.66    0.49   .43689E+03
     17.98    -0.57    0.66     5.5 0.488E+01   0.17    11.39    0.66    0.49   .48383E+03
 Cumulative travel time =         483.8340 sec  (    0.13 hrs)

-------------------------------------------------------------------------------------------------
 Plume is ATTACHED to LEFT  bank/shore.
   Plume width is now determined from LEFT  bank/shore.

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
     17.98    10.82    0.66     5.5 0.488E+01   0.17    22.78    0.66    0.49   .48383E+03
     21.83    10.82    0.66     5.9 0.455E+01   0.17    24.33    0.66    0.49   .58965E+03
     25.68    10.82    0.66     6.4 0.423E+01   0.17    25.82    0.66    0.49   .69546E+03
     29.52    10.82    0.66     6.8 0.393E+01   0.18    27.26    0.66    0.49   .80128E+03
     33.37    10.82    0.66     7.3 0.364E+01   0.18    28.65    0.66    0.48   .90709E+03
     37.22    10.82    0.66     7.9 0.338E+01   0.18    30.00    0.66    0.48   .10129E+04
     41.07    10.82    0.66     8.5 0.313E+01   0.19    31.31    0.66    0.47   .11187E+04
     44.92    10.82    0.66     9.2 0.289E+01   0.20    32.59    0.66    0.46   .12245E+04
     48.77    10.82    0.66     9.9 0.268E+01   0.20    33.83    0.66    0.46   .13304E+04
     52.62    10.82    0.66    10.6 0.248E+01   0.21    35.05    0.66    0.45   .14362E+04
     56.46    10.82    0.66    11.5 0.229E+01   0.22    36.24    0.66    0.44   .15420E+04
 Cumulative travel time =        1541.9807 sec  (    0.43 hrs)
 Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING
-------------------------------------------------------------------------------------------------
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.727E-03 m^2/s
  Horizontal diffusivity (initial value) = 0.909E-03 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

 Plume Stage 2 (bank attached):
       X        Y        Z        S        C        BV       BH      ZU      ZL       TT
     56.46    10.82    0.66    11.5 0.229E+01   0.22    36.24    0.66    0.44   .15420E+04
    203.22    10.82    0.66    15.0 0.156E+01   0.29    36.24    0.66    0.37   .55769E+04
    349.97    10.82    0.66    25.9 0.808E+00   0.50    36.24    0.66    0.16   .96118E+04
    496.72    10.82    0.66    38.7 0.482E+00   0.75    36.24    0.66    0.00   .13647E+05
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
    643.48    10.82    0.66    38.7 0.431E+00   0.75    36.24    0.66    0.00   .17682E+05
    790.23    10.82    0.66    38.7 0.384E+00   0.75    36.24    0.66    0.00   .21717E+05
    936.99    10.82    0.66    38.7 0.343E+00   0.75    36.24    0.66    0.00   .25752E+05
   1083.74    10.82    0.66    38.7 0.306E+00   0.75    36.24    0.66    0.00   .29787E+05
   1230.49    10.82    0.66    38.7 0.273E+00   0.75    36.24    0.66    0.00   .33821E+05
   1377.25    10.82    0.66    38.7 0.244E+00   0.75    36.24    0.66    0.00   .37856E+05
   1524.00    10.82    0.66    38.7 0.218E+00   0.75    36.24    0.66    0.00   .41891E+05
 Cumulative travel time =       41891.3047 sec  (   11.64 hrs)

 Simulation limit based on maximum specified distance =   1524.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 349

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S349U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S349U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:24:53
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 4.88 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 14.63 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.49 m
  Port/Nozzle diameter          D0      = 0.1405 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.031794 m
  Total area of openings        TA0     = 0.1706 m^2
  Discharge velocity            U0      = 1.48 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.051747 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.069606 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.076566 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000744 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000818 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.03 m          Lm  = 60.99 m          LM  = 8.46 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 65.99
  Port/nozzle Froude number     FRD0   = 31.39
  Velocity ratio                R      = 41.76
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    12.19 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.5492 deg.F
  Dilution at edge of NFR              s = 10.7
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 36.89 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 29.48 m
                           thickness (bv) = 0.30 m
  Cumulative travel time:       4787.6514 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 10.75 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 349

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                    HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S349U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S349U.prd
 Time stamp:        12/21/2025--14:24:53

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     12.19  YB1   =      9.75  YB2   =     14.63
 LD    =      4.88  NOPEN =   11       NRISER=   11       SPAC  =      0.49    NPPERR =    1
 D0    =     0.141 A0    =     0.016 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     0.850 B0    =0.3179E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.480 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.5175E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.6961E-01   j0 =U0*GP0*B0 =0.7439E-03   (based on slot width B0)
 m0 =U0*q0   =0.7657E-01   j0 =q0*GP0    =0.8183E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.035 lM    =     8.46  lm    =     60.99
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.3395E+00  J0    =0.3628E-02
 Associated 3-d length scales (meters)
 LQ    =      0.12  LM    =      7.38  Lm    =     17.25  Lb    =     89.72
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     65.99  FRD0  =     31.39  R     =     41.76  PL    =    1.21
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     1.480 D0    =     0.141 A0    =     0.016 THETA =      0.00
 FR0   =     65.99  FRD0  =     31.39  R     =     41.76
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        12.19 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.03     2.44     1.450   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.03     2.44 .00000E+00
      0.21    -0.13    0.21     1.7 0.158E+02   0.07     2.15 .27383E+00
      0.41    -0.26    0.22     2.0 0.135E+02   0.13     1.93 .63896E+00
      0.62    -0.39    0.23     2.3 0.121E+02   0.20     1.76 .10623E+01
      0.83    -0.52    0.24     2.5 0.111E+02   0.26     1.62 .15319E+01
      1.03    -0.65    0.25     2.6 0.104E+02   0.33     1.52 .20411E+01
      1.24    -0.78    0.26     2.8 0.982E+01   0.40     1.44 .25853E+01
```

Scenario 350

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S350U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S350U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:22:11
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.96 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.72 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.40 m
  Port/Nozzle diameter          D0      = 0.1405 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.039131 m
  Total area of openings        TA0     = 0.1706 m^2
  Discharge velocity            U0      = 1.48 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.063689 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.085669 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.094235 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000916 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001007 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.04 m          Lm  = 75.07 m          LM  = 9.07 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 59.48
  Port/nozzle Froude number     FRD0   = 31.39
  Velocity ratio                R      = 41.76
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.73 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.5723 deg.F
  Dilution at edge of NFR              s = 10.7
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 38.46 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 28.75 m
                          thickness (bv) = 0.30 m
  Cumulative travel time:       4704.4595 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 10.65 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

```
      1.45    -0.90    0.27     2.9 0.934E+01   0.46     1.38 .31610E+01
      1.65    -1.03    0.28     3.1 0.894E+01   0.53     1.34 .37657E+01
      1.86    -1.16    0.29     3.2 0.859E+01   0.60     1.32 .43973E+01
      2.07    -1.29    0.30     3.3 0.828E+01   0.66     1.31 .50540E+01
 Cumulative travel time =          5.0540 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      2.07    -1.29    0.66     3.3 0.828E+01   0.66     1.46 .50540E+01
     11.07     2.63    0.66     4.1 0.670E+01   0.66     2.20 .13294E+03
     20.07     6.24    0.66     4.7 0.577E+01   0.66     2.92 .28536E+03
     29.07     9.56    0.66     5.3 0.515E+01   0.66     3.62 .45885E+03
     38.07    12.63    0.66     5.8 0.469E+01   0.66     4.32 .65111E+03
     47.06    15.47    0.66     6.3 0.434E+01   0.66     5.00 .86045E+03
     56.06    18.11    0.66     6.8 0.405E+01   0.66     5.67 .10856E+04
     65.06    20.55    0.66     7.2 0.382E+01   0.66     6.34 .13255E+04
     74.06    22.81    0.66     7.6 0.362E+01   0.66     6.99 .15793E+04
     83.06    24.89    0.66     7.9 0.345E+01   0.66     7.64 .18462E+04
     92.06    26.80    0.66     8.3 0.330E+01   0.66     8.28 .21257E+04
 Cumulative travel time =        2125.7434 sec  (    0.59 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     92.06    26.80    0.66     8.3 0.330E+01   0.66     8.28 .21257E+04
     99.33    28.23    0.66     8.6 0.320E+01   0.49    11.87 .23602E+04
    106.59    29.56    0.66     8.8 0.310E+01   0.43    14.27 .26023E+04
    113.86    30.79    0.66     9.1 0.301E+01   0.40    16.41 .28517E+04
    121.13    31.93    0.66     9.4 0.293E+01   0.37    18.43 .31083E+04
    128.40    32.97    0.66     9.6 0.285E+01   0.35    20.37 .33718E+04
    135.66    33.93    0.66     9.8 0.278E+01   0.34    22.26 .36421E+04
    142.93    34.80    0.66    10.1 0.272E+01   0.32    24.10 .39189E+04
    150.20    35.58    0.66    10.3 0.266E+01   0.31    25.92 .42022E+04
    157.46    36.28    0.66    10.5 0.260E+01   0.31    27.71 .44919E+04
    164.73    36.89    0.66    10.7 0.255E+01   0.30    29.48 .47877E+04
 Cumulative travel time =        4787.6494 sec  (    1.33 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.86 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of    10.7 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.76

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.05    0.66     4.8 0.569E+01   0.66    36.24    0.66    0.00   .47877E+04
 Cumulative travel time =        4787.6514 sec  (    1.33 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 350

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S350U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S350U.prd
 Time stamp:        12/21/2025--14:22:11

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.73  YB1   =      9.75  YB2   =     13.72
 LD    =      3.96  NOPEN =   11       NRISER=   11       SPAC  =      0.40    NPPERR =    1
 D0    =     0.141 A0    =     0.016 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     0.850 B0    =0.3913E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.480 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.6369E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.8567E-01   j0 =U0*GP0*B0 =0.9156E-03   (based on slot width B0)
 m0 =U0*q0   =0.9424E-01   j0 =q0*GP0    =0.1007E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.043 lM    =     9.07  lm    =     75.07
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.3395E+00  J0    =0.3628E-02
 Associated 3-d length scales (meters)
 LQ    =      0.12  LM    =     7.38  Lm    =     17.25  Lb    =     89.72
                                      Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     59.48  FRD0  =     31.39  R     =     41.76  PL    =    0.92
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     1.480 D0    =     0.141 A0    =     0.016 THETA =      0.00
 FR0   =     59.48  FRD0  =     31.39  R     =     41.76
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.73 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.03     1.98     1.450   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.03     1.98 .00000E+00
      0.17    -0.10    0.21     1.6 0.169E+02   0.07     1.74 .20887E+00
      0.34    -0.21    0.22     1.9 0.146E+02   0.13     1.56 .48113E+00
      0.50    -0.31    0.23     2.1 0.132E+02   0.20     1.42 .79391E+00
      0.67    -0.42    0.23     2.2 0.122E+02   0.26     1.31 .11391E+01
      0.84    -0.52    0.24     2.4 0.115E+02   0.33     1.23 .15118E+01
      1.01    -0.63    0.25     2.5 0.109E+02   0.40     1.16 .19091E+01
```

```
      1.18    -0.73    0.26     2.6 0.104E+02   0.46     1.11 .23285E+01
      1.34    -0.84    0.26     2.8 0.995E+01   0.53     1.08 .27683E+01
      1.51    -0.94    0.27     2.9 0.958E+01   0.60     1.06 .32269E+01
      1.68    -1.05    0.28     3.0 0.925E+01   0.66     1.06 .37033E+01
 Cumulative travel time =          3.7033 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.68    -1.05    0.66     3.0 0.925E+01   0.66     1.18 .37033E+01
    11.02     3.16    0.66     3.8 0.713E+01   0.66     1.95 .12600E+03
    20.35     7.00    0.66     4.6 0.601E+01   0.66     2.70 .27648E+03
    29.69    10.52    0.66     5.2 0.530E+01   0.66     3.44 .45060E+03
    39.03    13.77    0.66     5.7 0.479E+01   0.66     4.16 .64550E+03
    48.37    16.77    0.66     6.2 0.440E+01   0.66     4.87 .85915E+03
    57.70    19.54    0.66     6.7 0.410E+01   0.66     5.57 .10901E+04
    67.04    22.10    0.66     7.1 0.385E+01   0.66     6.26 .13370E+04
    76.38    24.46    0.66     7.5 0.364E+01   0.66     6.94 .15990E+04
    85.71    26.63    0.66     7.9 0.346E+01   0.66     7.62 .18752E+04
    95.05    28.62    0.66     8.3 0.331E+01   0.66     8.28 .21650E+04
 Cumulative travel time =        2164.9583 sec  (    0.60 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
    95.05    28.62    0.66     8.3 0.331E+01   0.66     8.28 .21650E+04
   102.02    29.99    0.66     8.6 0.320E+01   0.49    11.76 .23897E+04
   108.99    31.27    0.66     8.8 0.311E+01   0.44    14.08 .26213E+04
   115.95    32.46    0.66     9.1 0.302E+01   0.40    16.16 .28598E+04
   122.92    33.56    0.66     9.3 0.294E+01   0.37    18.11 .31048E+04
   129.89    34.58    0.66     9.5 0.287E+01   0.35    19.98 .33563E+04
   136.86    35.52    0.66     9.8 0.280E+01   0.34    21.80 .36140E+04
   143.83    36.37    0.66    10.0 0.274E+01   0.33    23.57 .38778E+04
   150.79    37.14    0.66    10.2 0.268E+01   0.32    25.32 .41475E+04
   157.76    37.84    0.66    10.4 0.262E+01   0.31    27.05 .44231E+04
   164.73    38.46    0.66    10.7 0.257E+01   0.30    28.75 .47045E+04
 Cumulative travel time =        4704.4614 sec  (    1.31 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.87 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of    10.7 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.76

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.51    0.66     4.8 0.569E+01   0.66    36.24    0.66    0.00   .47045E+04
 Cumulative travel time =        4704.4595 sec  (    1.31 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 353
Scenario 351

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S351U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S351U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:19:45
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.35 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.11 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.67 m
  Port/Nozzle diameter          D0      = 0.1883 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.041519 m
  Total area of openings        TA0     = 0.1670 m^2
  Discharge velocity            U0      = 1.51 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.075269 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.094758 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.113709 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000992 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001190 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.05 m          Lm  = 90.58 m         LM  = 9.51 m
  lm' = 99999 m          Lb' = 99999 m         La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 58.96
  Port/nozzle Froude number     FRD0   = 27.69
  Velocity ratio                R      = 42.64
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.43 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.5613 deg.F
  Dilution at edge of NFR              s = 10.7
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 40.16 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 28.68 m
                          thickness (bv) = 0.30 m
  Cumulative travel time:       4599.7139 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 10.70 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY ***********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 351

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S351U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S351U.prd
 Time stamp:        12/21/2025--14:19:45

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.43  YB1   =      9.75  YB2   =     13.11
 LD    =      3.35  NOPEN =    6       NRISER=    6       SPAC  =      0.67    NPPERR =    1
 D0    =     0.188 A0    =     0.028 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     0.850 B0    =0.4152E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.511 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7527E-01         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9476E-01   j0 =U0*GP0*B0 =0.9919E-03   (based on slot width B0)
 m0 =U0*q0   =0.1137E+00   j0 =q0*GP0    =0.1190E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.050 lM    =      9.51  lm    =     90.58
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.3177E+00  J0    =0.3326E-02
 Associated 3-d length scales (meters)
 LQ    =      0.17  LM    =      7.34  Lm    =     17.43  Lb    =     89.72
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     58.96  FRD0  =     27.69  R     =     42.64  PL    =    1.16
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.511 D0    =      0.188 A0    =      0.028 THETA =      0.00
 FR0   =     58.96  FRD0  =     27.69  R     =     42.64
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.43 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.03     1.68     1.481   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.03     1.68 .00000E+00
     0.14    -0.09    0.21     1.5 0.177E+02   0.07     1.47 .16588E+00
     0.28    -0.18    0.22     1.8 0.154E+02   0.13     1.32 .37854E+00
     0.43    -0.27    0.22     2.0 0.140E+02   0.20     1.20 .62115E+00
     0.57    -0.36    0.23     2.1 0.131E+02   0.26     1.11 .88773E+00
     0.71    -0.44    0.24     2.2 0.123E+02   0.33     1.03 .11748E+01
     0.85    -0.53    0.24     2.3 0.117E+02   0.40     0.98 .14801E+01
```

```
      1.00    -0.62    0.25     2.5 0.112E+02   0.46     0.94 .18018E+01
      1.14    -0.71    0.26     2.6 0.107E+02   0.53     0.91 .21387E+01
      1.28    -0.80    0.26     2.6 0.103E+02   0.60     0.90 .24896E+01
      1.42    -0.89    0.27     2.7 0.100E+02   0.66     0.89 .28537E+01
 Cumulative travel time =          2.8537 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.42    -0.89    0.66     2.7 0.100E+02   0.66     1.00 .28537E+01
    10.72     3.43    0.66     3.7 0.744E+01   0.66     1.77 .11568E+03
    20.02     7.35    0.66     4.4 0.618E+01   0.66     2.52 .25772E+03
    29.32    10.96    0.66     5.1 0.540E+01   0.66     3.26 .42386E+03
    38.62    14.29    0.66     5.6 0.486E+01   0.66     3.98 .61101E+03
    47.92    17.36    0.66     6.2 0.445E+01   0.66     4.69 .81702E+03
    57.22    20.21    0.66     6.6 0.413E+01   0.66     5.39 .10403E+04
    66.52    22.85    0.66     7.1 0.387E+01   0.66     6.09 .12796E+04
    75.82    25.28    0.66     7.5 0.365E+01   0.66     6.77 .15339E+04
    85.12    27.53    0.66     7.9 0.347E+01   0.66     7.44 .18025E+04
    94.42    29.60    0.66     8.3 0.331E+01   0.66     8.11 .20844E+04
 Cumulative travel time =        2084.4316 sec  (    0.58 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
    94.42    29.60    0.66     8.3 0.331E+01   0.66     8.11 .20844E+04
   101.45    31.05    0.66     8.5 0.321E+01   0.49    11.59 .23062E+04
   108.48    32.41    0.66     8.8 0.311E+01   0.43    13.92 .25351E+04
   115.51    33.67    0.66     9.1 0.302E+01   0.40    16.00 .27709E+04
   122.54    34.85    0.66     9.3 0.294E+01   0.37    17.96 .30134E+04
   129.57    35.94    0.66     9.6 0.287E+01   0.35    19.84 .32623E+04
   136.60    36.95    0.66     9.8 0.280E+01   0.34    21.67 .35177E+04
   143.64    37.87    0.66    10.0 0.273E+01   0.33    23.46 .37793E+04
   150.67    38.71    0.66    10.3 0.267E+01   0.32    25.22 .40469E+04
   157.70    39.48    0.66    10.5 0.261E+01   0.31    26.96 .43204E+04
   164.73    40.16    0.66    10.7 0.256E+01   0.30    28.68 .45997E+04
 Cumulative travel time =        4599.7139 sec  (    1.28 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.88 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of    10.7 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.76

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.81    0.66     4.8 0.569E+01   0.66    36.24    0.66    0.00   .45997E+04
 Cumulative travel time =        4599.7139 sec  (    1.28 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 352

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S352U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S352U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:17:43
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.74 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.50 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.55 m
  Port/Nozzle diameter          D0      = 0.1883 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.050746 m
  Total area of openings        TA0     = 0.1670 m^2
  Discharge velocity            U0      = 1.51 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.091995 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.115815 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.138978 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001212 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001455 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 110.71 m          LM  = 10.16 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 53.33
  Port/nozzle Froude number     FRD0   = 27.69
  Velocity ratio                R      = 42.64
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.13 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.5768 deg.F
  Dilution at edge of NFR              s = 10.6
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 41.22 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 28.21 m
                          thickness (bv) = 0.30 m
  Cumulative travel time:       4543.4336 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 10.63 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY ***********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 352

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S352U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S352U.prd
 Time stamp:        12/21/2025--14:17:43

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.13  YB1   =      9.75  YB2   =     12.50
 LD    =      2.74  NOPEN =    6       NRISER=    6       SPAC  =      0.55    NPPERR =    1
 D0    =     0.188 A0    =     0.028 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     0.850 B0    =0.5075E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.511 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.9200E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1158E+00   j0 =U0*GP0*B0 =0.1212E-02   (based on slot width B0)
 m0 =U0*q0   =0.1390E+00   j0 =q0*GP0    =0.1455E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.061 lM    =     10.16  lm    =    110.71
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.3177E+00  J0    =0.3326E-02
 Associated 3-d length scales (meters)
 LQ    =      0.17  LM    =      7.34  Lm    =     17.43  Lb    =     89.72
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     53.33  FRD0  =     27.69  R     =     42.64  PL    =    0.87
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.511 D0    =      0.188 A0    =      0.028 THETA =      0.00
 FR0   =     53.33  FRD0  =     27.69  R     =     42.64
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.13 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.04     1.37     1.481   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.04     1.37 .00000E+00
      0.12    -0.07    0.21     1.5 0.187E+02   0.07     1.20 .12834E+00
      0.23    -0.15    0.21     1.7 0.166E+02   0.13     1.08 .28904E+00
      0.35    -0.22    0.22     1.8 0.152E+02   0.20     0.98 .47051E+00
      0.47    -0.29    0.23     1.9 0.142E+02   0.26     0.90 .66862E+00
      0.58    -0.36    0.23     2.0 0.135E+02   0.33     0.84 .88100E+00
      0.70    -0.44    0.24     2.1 0.129E+02   0.40     0.80 .11060E+01
```

```
      0.81    -0.51    0.24     2.2 0.123E+02   0.46     0.76 .13426E+01
      0.93    -0.58    0.25     2.3 0.119E+02   0.53     0.74 .15896E+01
      1.05    -0.65    0.25     2.4 0.115E+02   0.60     0.73 .18465E+01
      1.16    -0.73    0.26     2.5 0.111E+02   0.66     0.72 .21127E+01
 Cumulative travel time =          2.1127 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.16    -0.73    0.66     2.5 0.111E+02   0.66     0.81 .21127E+01
    10.68     3.79    0.66     3.5 0.782E+01   0.66     1.61 .10975E+03
    20.20     7.88    0.66     4.3 0.637E+01   0.66     2.38 .24968E+03
    29.71    11.63    0.66     5.0 0.551E+01   0.66     3.14 .41564E+03
    39.23    15.07    0.66     5.6 0.492E+01   0.66     3.88 .60405E+03
    48.75    18.26    0.66     6.1 0.449E+01   0.66     4.61 .81249E+03
    58.27    21.19    0.66     6.6 0.416E+01   0.66     5.33 .10392E+04
    67.78    23.91    0.66     7.0 0.389E+01   0.66     6.04 .12828E+04
    77.30    26.41    0.66     7.5 0.367E+01   0.66     6.74 .15422E+04
    86.82    28.72    0.66     7.9 0.348E+01   0.66     7.43 .18165E+04
    96.33    30.84    0.66     8.3 0.331E+01   0.66     8.11 .21049E+04
 Cumulative travel time =        2104.9441 sec  (    0.58 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
    96.33    30.84    0.66     8.3 0.331E+01   0.66     8.11 .21049E+04
   103.17    32.25    0.66     8.5 0.321E+01   0.49    11.52 .23206E+04
   110.01    33.58    0.66     8.8 0.312E+01   0.44    13.80 .25429E+04
   116.85    34.81    0.66     9.0 0.303E+01   0.40    15.84 .27718E+04
   123.69    35.97    0.66     9.3 0.295E+01   0.37    17.75 .30071E+04
   130.53    37.04    0.66     9.5 0.288E+01   0.35    19.59 .32485E+04
   137.37    38.03    0.66     9.8 0.281E+01   0.34    21.37 .34960E+04
   144.21    38.94    0.66    10.0 0.274E+01   0.33    23.12 .37493E+04
   151.05    39.78    0.66    10.2 0.269E+01   0.32    24.84 .40084E+04
   157.89    40.54    0.66    10.4 0.263E+01   0.31    26.53 .42732E+04
   164.73    41.22    0.66    10.6 0.258E+01   0.30    28.21 .45434E+04
 Cumulative travel time =        4543.4316 sec  (    1.26 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.88 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of    10.6 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.76

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.12    0.66     4.8 0.569E+01   0.66    36.24    0.66    0.00   .45434E+04
 Cumulative travel time =        4543.4336 sec  (    1.26 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 353

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                         CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:               Homer City
  DESIGN CASE:                 HC S353U
  FILE NAME:                   T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling files\Updated Runs\HC S353U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:13:52
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                        = bounded
  Width                        BS      = 36.24 m
  Channel regularity           ICHREG = 1
  Ambient flowrate             QA      = 0.96 m^3/s
  Average depth                HA      = 0.75 m
  Depth at discharge           HD      = 0.66 m
  Ambient velocity             UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F    = 0.0540
    Calculated from Manning's n        = 0.025
  Wind velocity                UW      = 4.47 m/s
  Stratification Type          STRCND = U
  Surface temperature                  = 4.00 degC
  Bottom temperature                   = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density              RHOAS  = 999.9749 kg/m^3
  Bottom density               RHOAB  = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:          Submerged Multiport Diffuser Discharge
  Diffuser type                DITYPE = unidirectional perpendicular
  Diffuser length              LD      = 2.44 m
  Nearest bank                         = left
  Diffuser endpoints           YB1     = 9.75 m;    YB2 = 12.19 m
  Number of openings           NOPEN  = 4
  Number of Risers             NRISER = 4
  Ports/Nozzles per Riser      NPPERR  = 1
  Spacing between risers/openings SPAC   = 0.81 m
  Port/Nozzle diameter         D0      = 0.2332 m
    with contraction ratio             = 0.85
  Equivalent slot width        B0      = 0.052567 m
  Total area of openings       TA0     = 0.1709 m^2
  Discharge velocity           U0      = 1.48 m/s
  Total discharge flowrate     Q0      = 0.252361 m^3/s
  Discharge port height        H0      = 0.20 m
  Nozzle arrangement           BETYPE = unidirectional without fanning
  Diffuser alignment angle     GAMMA  = 90 deg
  Vertical discharge angle     THETA  = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle   SIGMA  = 328 deg
  Relative orientation angle   BETA   = 58 deg
  Discharge temperature (freshwater)     = 19.22 degC
  Corresponding density        RHO0   = 998.3625 kg/m^3
  Density difference           DRHO   = 1.6125 kg/m^3
  Buoyant acceleration         GP0    = 0.0158 m/s^2
  Discharge concentration      C0     = 27.400000 deg.F
  Surface heat exchange coeff. KS     = 0.000019 m/s
  Coefficient of decay         KD     = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)      q0     = 0.103494 m^2/s
  Momentum flux
      (based on slot width B0) m0 =U0^2*B0   = 0.114616 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.152821 m^3/s^2
  Buoyancy flux
      (based on slot width B0) j0 =U0*GP0*B0 = 0.001227 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001637 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m         Lm  = 121.74 m         LM  = 9.98 m
  lm' = 99999 m         Lb' = 99999 m         La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number             FR0    = 51.22
  Port/nozzle Froude number    FRD0   = 24.31
  Velocity ratio               R      = 41.68
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                      = no
  Water quality standard specified     = no
  Regulatory mixing zone               = no
  Region of interest                   = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.97 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.614 deg.F
  Dilution at edge of NFR              s = 10.5
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 41.07 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 30.31 m
                         thickness (bv) = 0.28 m
  Cumulative travel time:       4567.1265 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 10.48 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
```

```
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************** REGULATORY MIXING ZONE SUMMARY ************************
No RMZ and no ambient water quality standard have been specified.
********************* FINAL DESIGN ADVICE AND COMMENTS ***********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 353

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S353U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S353U.prd
 Time stamp:        12/21/2025--14:13:52

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.97  YB1   =      9.75  YB2   =     12.19
 LD    =      2.44  NOPEN =    4       NRISER=    4       SPAC  =      0.81    NPPERR =    1
 D0    =     0.233 A0    =     0.043 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.253 CR0   =     0.850 B0    =0.5257E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.477 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1035E+00         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1146E+00   j0 =U0*GP0*B0 =0.1227E-02   (based on slot width B0)
 m0 =U0*q0   =0.1528E+00   j0 =q0*GP0    =0.1637E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.070 lM    =     9.98  lm    =    121.74
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2795E+00  J0    =0.2993E-02
 Associated 3-d length scales (meters)
 LQ    =      0.21  LM    =      7.03  Lm    =     17.23  Lb    =     89.72
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     51.22  FRD0  =     24.31  R     =     41.68  PL    =    1.05
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.477 D0    =      0.233 A0    =      0.043 THETA =      0.00
 FR0   =     51.22  FRD0  =     24.31  R     =     41.68
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.97 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.04     1.22     1.447   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.04     1.22 .00000E+00
      0.10    -0.06    0.21     1.4 0.195E+02   0.07     1.07 .11241E+00
      0.21    -0.13    0.21     1.6 0.174E+02   0.13     0.96 .25080E+00
      0.31    -0.19    0.22     1.7 0.161E+02   0.20     0.87 .40588E+00
      0.41    -0.26    0.22     1.8 0.151E+02   0.26     0.80 .57437E+00
      0.52    -0.32    0.23     1.9 0.143E+02   0.33     0.75 .75434E+00
      0.62    -0.39    0.23     2.0 0.137E+02   0.40     0.71 .94451E+00
```

```
      0.72    -0.45    0.24     2.1 0.132E+02   0.46     0.68 .11439E+01
      0.83    -0.52    0.24     2.2 0.127E+02   0.53     0.66 .13519E+01
      0.93    -0.58    0.25     2.2 0.123E+02   0.60     0.65 .15678E+01
      1.03    -0.65    0.25     2.3 0.120E+02   0.66     0.64 .17911E+01
 Cumulative travel time =          1.7911 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.03    -0.65    0.66     2.3 0.120E+02   0.66     0.72 .17911E+01
     8.99     3.20    0.66     3.2 0.853E+01   0.66     1.39 .86647E+02
    16.95     6.72    0.66     3.9 0.698E+01   0.66     2.04 .19609E+03
    24.91     9.98    0.66     4.5 0.605E+01   0.66     2.68 .32547E+03
    32.86    13.00    0.66     5.1 0.542E+01   0.66     3.31 .47209E+03
    40.82    15.83    0.66     5.5 0.495E+01   0.66     3.93 .63412E+03
    48.78    18.46    0.66     6.0 0.458E+01   0.66     4.53 .81020E+03
    56.73    20.92    0.66     6.4 0.429E+01   0.66     5.14 .99930E+03
    64.69    23.23    0.66     6.8 0.404E+01   0.66     5.73 .12006E+04
    72.65    25.38    0.66     7.1 0.384E+01   0.66     6.32 .14133E+04
    80.61    27.38    0.66     7.5 0.366E+01   0.66     6.90 .16370E+04
 Cumulative travel time =        1636.9547 sec  (    0.45 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
    80.61    27.38    0.66     7.5 0.366E+01   0.66     6.90 .16370E+04
    89.02    29.35    0.66     7.8 0.349E+01   0.46    10.70 .18847E+04
    97.43    31.17    0.66     8.2 0.335E+01   0.40    13.29 .21435E+04
   105.84    32.85    0.66     8.5 0.322E+01   0.37    15.64 .24129E+04
   114.26    34.40    0.66     8.8 0.311E+01   0.34    17.87 .26925E+04
   122.67    35.82    0.66     9.1 0.301E+01   0.33    20.03 .29820E+04
   131.08    37.10    0.66     9.4 0.291E+01   0.31    22.14 .32811E+04
   139.49    38.27    0.66     9.7 0.283E+01   0.30    24.21 .35894E+04
   147.91    39.32    0.66    10.0 0.275E+01   0.29    26.26 .39066E+04
   156.32    40.25    0.66    10.2 0.268E+01   0.28    28.29 .42326E+04
   164.73    41.07    0.66    10.5 0.261E+01   0.28    30.31 .45671E+04
 Cumulative travel time =        4567.1270 sec  (    1.27 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.87 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of    10.5 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.76

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.27    0.66     4.8 0.569E+01   0.66    36.24    0.66    0.00   .45671E+04
 Cumulative travel time =        4567.1265 sec  (    1.27 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 354

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S354U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S354U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:12:16
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.13 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 11.89 m
  Number of openings            NOPEN   = 3
  Number of Risers              NRISER = 3
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 1.07 m
  Port/Nozzle diameter          D0      = 0.2810 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.058137 m
  Total area of openings        TA0     = 0.1861 m^2
  Discharge velocity            U0      = 1.36 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.118279 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.106950 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.160425 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001247 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001870 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.09 m          Lm  = 127.80 m          LM  = 9.21 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 44.73
  Port/nozzle Froude number       FRD0   = 20.35
  Velocity ratio                R       = 38.28
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.82 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.735 deg.F
  Dilution at edge of NFR              s = 10.0
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 38.98 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 33.69 m
                           thickness (bv) = 0.25 m
  Cumulative travel time:       4736.0293 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 10.02 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 354

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S354U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S354U.prd
 Time stamp:        12/21/2025--14:12:16

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.82  YB1   =      9.75  YB2   =     11.89
 LD    =      2.13  NOPEN =    3       NRISER=    3       SPAC  =      1.07    NPPERR =    1
 D0    =     0.281 A0    =     0.062 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.305 CR0   =     0.850 B0    =0.5814E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.356 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1183E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1069E+00    j0 =U0*GP0*B0 =0.1247E-02   (based on slot width B0)
 m0 =U0*q0   =0.1604E+00    j0 =q0*GP0    =0.1870E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.087 lM    =     9.21  lm    =    127.80
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2282E+00  J0    =0.2660E-02
 Associated 3-d length scales (meters)
 LQ    =      0.25  LM    =      6.40  Lm    =     16.51  Lb    =     89.72
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     44.73  FRD0  =     20.35  R     =     38.28  PL    =    1.16
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.356 D0    =      0.281 A0    =      0.062 THETA =      0.00
 FR0   =     44.73  FRD0  =     20.35  R     =     38.28
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.82 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.05     1.07     1.326   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.05     1.07 .00000E+00
     0.09    -0.06    0.21     1.3 0.206E+02   0.07     0.94 .10122E+00
     0.18    -0.11    0.21     1.5 0.187E+02   0.13     0.84 .22256E+00
     0.27    -0.17    0.22     1.6 0.174E+02   0.20     0.76 .35685E+00
     0.36    -0.23    0.22     1.7 0.165E+02   0.26     0.70 .50154E+00
     0.45    -0.28    0.22     1.7 0.157E+02   0.33     0.65 .65516E+00
     0.54    -0.34    0.23     1.8 0.151E+02   0.40     0.62 .81670E+00
```

```
      0.63    -0.40    0.23     1.9 0.146E+02   0.46     0.59 .98544E+00
      0.72    -0.45    0.24     1.9 0.141E+02   0.53     0.57 .11608E+01
      0.81    -0.51    0.24     2.0 0.137E+02   0.60     0.57 .13424E+01
      0.90    -0.57    0.25     2.0 0.134E+02   0.66     0.56 .15297E+01
 Cumulative travel time =          1.5297 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.90    -0.57    0.66     2.0 0.134E+02   0.66     0.63 .15297E+01
      6.24     2.06    0.66     2.7 0.101E+02   0.66     1.08 .54876E+02
     11.57     4.51    0.66     3.2 0.847E+01   0.66     1.52 .12126E+03
     16.90     6.81    0.66     3.7 0.743E+01   0.66     1.96 .19850E+03
     22.23     8.99    0.66     4.1 0.670E+01   0.66     2.38 .28522E+03
     27.56    11.06    0.66     4.5 0.615E+01   0.66     2.81 .38050E+03
     32.89    13.02    0.66     4.8 0.572E+01   0.66     3.22 .48362E+03
     38.22    14.89    0.66     5.1 0.536E+01   0.66     3.64 .59402E+03
     43.55    16.67    0.66     5.4 0.507E+01   0.66     4.04 .71126E+03
     48.88    18.35    0.66     5.7 0.482E+01   0.66     4.45 .83495E+03
     54.21    19.96    0.66     6.0 0.460E+01   0.66     4.85 .96478E+03
 Cumulative travel time =          964.7779 sec  (    0.27 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     54.21    19.96    0.66     6.0 0.460E+01   0.66     4.85 .96478E+03
     65.26    23.05    0.66     6.5 0.423E+01   0.41     9.12 .12523E+04
     76.31    25.84    0.66     7.0 0.394E+01   0.35    12.18 .15631E+04
     87.37    28.33    0.66     7.4 0.370E+01   0.32    15.02 .18953E+04
     98.42    30.56    0.66     7.8 0.350E+01   0.30    17.77 .22479E+04
    109.47    32.54    0.66     8.2 0.332E+01   0.29    20.47 .26195E+04
    120.52    34.27    0.66     8.6 0.318E+01   0.27    23.14 .30094E+04
    131.57    35.77    0.66     9.0 0.305E+01   0.27    25.78 .34167E+04
    142.63    37.05    0.66     9.3 0.293E+01   0.26    28.42 .38406E+04
    153.68    38.12    0.66     9.7 0.283E+01   0.25    31.06 .42806E+04
    164.73    38.98    0.66    10.0 0.274E+01   0.25    33.69 .47360E+04
 Cumulative travel time =        4736.0278 sec  (    1.32 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.84 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of    10.0 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.76

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.42    0.66     4.8 0.569E+01   0.66    36.24    0.66    0.00   .47360E+04
 Cumulative travel time =        4736.0293 sec  (    1.32 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 355

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S355U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S355U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:10:21
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 4.88 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;     YB2 = 14.63 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.49 m
  Port/Nozzle diameter          D0      = 0.1524 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.037405 m
  Total area of openings        TA0     = 0.2007 m^2
  Discharge velocity            U0      = 1.26 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.051747 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.059165 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.065081 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000744 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000818 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.04 m          Lm  = 51.84 m          LM  = 7.19 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 51.71
  Port/nozzle Froude number     FRD0   = 25.62
  Velocity ratio                R      = 35.50
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    12.19 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.762 deg.F
  Dilution at edge of NFR              s = 9.9
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 31.44 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 34.98 m
                          thickness (bv) = 0.25 m
  Cumulative travel time:       5198.9199 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 9.92 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 164.73 m downstream.
  Plume contacts second bank at 164.73 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 355

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S355U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S355U.prd
 Time stamp:        12/21/2025--14:10:21

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     12.19  YB1   =      9.75  YB2   =     14.63
 LD    =      4.88  NOPEN =   11       NRISER=   11       SPAC  =      0.49    NPPERR =    1
 D0    =     0.152 A0    =     0.018 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     1.000 B0    =0.3740E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.258 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.5175E-01         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.5916E-01   j0 =U0*GP0*B0 =0.7439E-03   (based on slot width B0)
 m0 =U0*q0   =0.6508E-01   j0 =q0*GP0    =0.8183E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.041 lM    =     7.19  lm    =     51.84
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2885E+00  J0    =0.3628E-02
 Associated 3-d length scales (meters)
 LQ    =      0.14  LM    =      6.54  Lm    =     15.90  Lb    =     89.72
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     51.71  FRD0  =     25.62  R     =     35.50  PL    =    1.21
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     1.258 D0    =     0.152 A0    =     0.018 THETA =      0.00
 FR0   =     51.71  FRD0  =     25.62  R     =     35.50
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        12.19 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.03     2.44     1.228   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.03     2.44 .00000E+00
     0.21    -0.13    0.21     1.7 0.166E+02   0.08     2.15 .30654E+00
     0.41    -0.26    0.22     1.9 0.142E+02   0.13     1.93 .70838E+00
     0.62    -0.39    0.23     2.1 0.128E+02   0.20     1.76 .11709E+01
     0.83    -0.52    0.24     2.3 0.119E+02   0.26     1.63 .16817E+01
     1.03    -0.65    0.25     2.5 0.111E+02   0.33     1.52 .22336E+01
     1.24    -0.78    0.26     2.6 0.105E+02   0.40     1.44 .28220E+01
```

```
      1.45    -0.90    0.27     2.7 0.100E+02   0.46     1.38 .34432E+01
      1.65    -1.03    0.28     2.9 0.961E+01   0.53     1.35 .40945E+01
      1.86    -1.16    0.29     3.0 0.924E+01   0.60     1.33 .47738E+01
      2.07    -1.29    0.30     3.1 0.892E+01   0.66     1.32 .54792E+01
 Cumulative travel time =          5.4792 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     2.07    -1.29    0.66     3.1 0.892E+01   0.66     1.47 .54792E+01
     6.92    -1.29    0.66     3.5 0.788E+01   0.66     1.86 .76980E+02
    11.77     2.76    0.66     3.8 0.714E+01   0.66     2.25 .15683E+03
    16.62     4.63    0.66     4.2 0.657E+01   0.66     2.64 .24424E+03
    21.47     6.41    0.66     4.5 0.612E+01   0.66     3.02 .33860E+03
    26.32     8.10    0.66     4.8 0.575E+01   0.66     3.39 .43943E+03
    31.17     9.71    0.66     5.0 0.544E+01   0.66     3.76 .54634E+03
    36.02    11.25    0.66     5.3 0.518E+01   0.66     4.13 .65900E+03
    40.87    12.71    0.66     5.5 0.495E+01   0.66     4.50 .77714E+03
    45.72    14.11    0.66     5.8 0.475E+01   0.66     4.86 .90050E+03
    50.57    15.43    0.66     6.0 0.457E+01   0.66     5.22 .10289E+04
 Cumulative travel time =        1028.8822 sec  (    0.29 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
    50.57    15.43    0.66     6.0 0.457E+01   0.66     5.22 .10289E+04
    61.98    18.31    0.66     6.5 0.422E+01   0.41     9.67 .13499E+04
    73.40    20.86    0.66     7.0 0.394E+01   0.35    12.84 .16956E+04
    84.82    23.10    0.66     7.4 0.370E+01   0.32    15.78 .20643E+04
    96.23    25.05    0.66     7.8 0.351E+01   0.30    18.62 .24548E+04
   107.65    26.73    0.66     8.2 0.334E+01   0.29    21.40 .28658E+04
   119.06    28.15    0.66     8.6 0.320E+01   0.27    24.14 .32964E+04
   130.48    29.32    0.66     8.9 0.307E+01   0.27    26.87 .37457E+04
   141.90    30.26    0.66     9.3 0.296E+01   0.26    29.58 .42130E+04
   153.31    30.96    0.66     9.6 0.285E+01   0.25    32.28 .46976E+04
   164.73    31.44    0.66     9.9 0.276E+01   0.25    34.98 .51989E+04
 Cumulative travel time =        5198.9199 sec  (    1.44 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.80 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of     9.9 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.76

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.05    0.66     4.8 0.569E+01   0.66    36.24    0.66    0.00   .51989E+04
 Cumulative travel time =        5198.9199 sec  (    1.44 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 356

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S356U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S356U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:08:32
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.96 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.72 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.40 m
  Port/Nozzle diameter          D0      = 0.1524 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.046036 m
  Total area of openings        TA0     = 0.2007 m^2
  Discharge velocity            U0      = 1.26 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.063689 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.072818 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.080100 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000916 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001007 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.05 m          Lm  = 63.81 m          LM  = 7.71 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 46.61
  Port/nozzle Froude number     FRD0   = 25.62
  Velocity ratio                R      = 35.50
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.73 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.7876 deg.F
  Dilution at edge of NFR              s = 9.8
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 33.12 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 34.26 m
                          thickness (bv) = 0.25 m
  Cumulative travel time:       5107.1855 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 9.83 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 164.73 m downstream.
  Plume contacts second bank at 164.73 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 356

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S356U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S356U.prd
 Time stamp:        12/21/2025--14:08:32

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.73  YB1   =      9.75  YB2   =     13.72
 LD    =      3.96  NOPEN =   11       NRISER=   11       SPAC  =      0.40    NPPERR =    1
 D0    =     0.152 A0    =     0.018 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     1.000 B0    =0.4604E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.258 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.6369E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.7282E-01   j0 =U0*GP0*B0 =0.9156E-03   (based on slot width B0)
 m0 =U0*q0   =0.8010E-01   j0 =q0*GP0    =0.1007E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.051 lM    =     7.71  lm    =     63.81
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2885E+00  J0    =0.3628E-02
 Associated 3-d length scales (meters)
 LQ    =      0.14  LM    =      6.54  Lm    =     15.90  Lb    =     89.72
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     46.61  FRD0  =     25.62  R     =     35.50  PL    =    0.92
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.258 D0    =      0.152 A0    =      0.018 THETA =      0.00
 FR0   =     46.61  FRD0  =     25.62  R     =     35.50
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.73 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.04     1.98     1.228   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.04     1.98 .00000E+00
      0.17    -0.10    0.21     1.6 0.177E+02   0.08     1.74 .23427E+00
      0.34    -0.21    0.22     1.8 0.154E+02   0.13     1.56 .53427E+00
      0.50    -0.31    0.23     2.0 0.140E+02   0.20     1.43 .87626E+00
      0.67    -0.42    0.23     2.1 0.130E+02   0.26     1.32 .12518E+01
      0.84    -0.52    0.24     2.2 0.123E+02   0.33     1.23 .16559E+01
      1.01    -0.63    0.25     2.4 0.116E+02   0.40     1.16 .20853E+01
```

```
      1.18    -0.73    0.26     2.5 0.111E+02   0.46     1.12 .25377E+01
      1.34    -0.84    0.26     2.6 0.107E+02   0.53     1.09 .30111E+01
      1.51    -0.94    0.27     2.7 0.103E+02   0.60     1.07 .35040E+01
      1.68    -1.05    0.28     2.7 0.998E+01   0.66     1.06 .40152E+01
 Cumulative travel time =          4.0152 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.68    -1.05    0.66     2.7 0.998E+01   0.66     1.19 .40152E+01
     6.87     1.27    0.66     3.2 0.851E+01   0.66     1.61 .73911E+02
    12.07     3.45    0.66     3.6 0.754E+01   0.66     2.03 .15415E+03
    17.26     5.51    0.66     4.0 0.684E+01   0.66     2.45 .24353E+03
    22.45     7.46    0.66     4.3 0.630E+01   0.66     2.86 .34121E+03
    27.64     9.30    0.66     4.7 0.588E+01   0.66     3.26 .44653E+03
    32.84    11.06    0.66     5.0 0.553E+01   0.66     3.66 .55897E+03
    38.03    12.72    0.66     5.2 0.523E+01   0.66     4.05 .67810E+03
    43.22    14.30    0.66     5.5 0.498E+01   0.66     4.44 .80358E+03
    48.42    15.80    0.66     5.8 0.476E+01   0.66     4.83 .93508E+03
    53.61    17.22    0.66     6.0 0.457E+01   0.66     5.22 .10724E+04
 Cumulative travel time =       1072.3591 sec  (    0.30 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
    53.61    17.22    0.66     6.0 0.457E+01   0.66     5.22 .10724E+04
    64.72    20.03    0.66     6.5 0.423E+01   0.42     9.58 .13845E+04
    75.83    22.52    0.66     6.9 0.395E+01   0.36    12.68 .17200E+04
    86.94    24.72    0.66     7.4 0.372E+01   0.32    15.55 .20775E+04
    98.06    26.64    0.66     7.8 0.353E+01   0.30    18.32 .24556E+04
   109.17    28.31    0.66     8.1 0.337E+01   0.29    21.03 .28534E+04
   120.28    29.73    0.66     8.5 0.322E+01   0.28    23.70 .32697E+04
   131.39    30.91    0.66     8.9 0.309E+01   0.27    26.36 .37040E+04
   142.51    31.87    0.66     9.2 0.298E+01   0.26    29.00 .41554E+04
   153.62    32.60    0.66     9.5 0.288E+01   0.25    31.63 .46233E+04
   164.73    33.12    0.66     9.8 0.279E+01   0.25    34.26 .51072E+04
 Cumulative travel time =       5107.1870 sec  (    1.42 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.81 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of     9.8 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.76

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.51    0.66     4.8 0.569E+01   0.66    36.24    0.66    0.00   .51072E+04
 Cumulative travel time =       5107.1855 sec  (    1.42 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 357

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S357U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S357U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--14:06:35
********************************************************************************
SUMMARY OF INPUT DATA:
--------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
--------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.35 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.11 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.67 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.048846 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 1.28 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
--------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.075269 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.080544 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.096653 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000992 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001190 m^3/s^3
--------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 76.99 m         LM  = 8.08 m
  lm' = 99999 m          Lb' = 99999 m         La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
--------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 46.20
  Port/nozzle Froude number     FRD0   = 22.60
  Velocity ratio                R      = 36.24
--------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
********************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.43 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.7761 deg.F
  Dilution at edge of NFR              s = 9.9
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 34.95 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 34.03 m
                          thickness (bv) = 0.25 m
  Cumulative travel time:       4992.5571 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 9.87 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 164.73 m downstream.
  Plume contacts second bank at 164.73 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 357

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S357U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S357U.prd
 Time stamp:        12/21/2025--14:06:35

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.43  YB1   =      9.75  YB2   =     13.11
 LD    =      3.35  NOPEN =    6       NRISER=    6       SPAC  =      0.67    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.4885E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.284 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7527E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.8054E-01   j0 =U0*GP0*B0 =0.9919E-03   (based on slot width B0)
 m0 =U0*q0   =0.9665E-01   j0 =q0*GP0    =0.1190E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.059 lM    =     8.08  lm    =     76.99
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2700E+00  J0    =0.3326E-02
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =      6.50  Lm    =     16.07  Lb    =     89.72
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     46.20  FRD0  =     22.60  R     =     36.24  PL    =    1.16
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.284 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =     46.20  FRD0  =     22.60  R     =     36.24
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.43 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.04     1.68     1.254   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.04     1.68 .00000E+00
     0.14    -0.09    0.21     1.5 0.184E+02   0.07     1.47 .18633E+00
     0.28    -0.18    0.22     1.7 0.162E+02   0.13     1.32 .42087E+00
     0.43    -0.27    0.22     1.8 0.149E+02   0.20     1.20 .68629E+00
     0.57    -0.36    0.23     2.0 0.139E+02   0.26     1.11 .97640E+00
     0.71    -0.44    0.24     2.1 0.131E+02   0.33     1.04 .12876E+01
     0.85    -0.53    0.24     2.2 0.125E+02   0.40     0.98 .16176E+01
```

```
      1.00    -0.62    0.25     2.3 0.120E+02   0.46     0.94 .19644E+01
      1.14    -0.71    0.26     2.4 0.115E+02   0.53     0.91 .23269E+01
      1.28    -0.80    0.26     2.5 0.112E+02   0.60     0.90 .27038E+01
      1.42    -0.89    0.27     2.5 0.108E+02   0.66     0.89 .30943E+01
 Cumulative travel time =          3.0943 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.42    -0.89    0.66     2.5 0.108E+02   0.66     1.00 .30943E+01
     6.68     1.53    0.66     3.1 0.896E+01   0.66     1.44 .68193E+02
    11.94     3.81    0.66     3.5 0.782E+01   0.66     1.86 .14447E+03
    17.20     5.95    0.66     3.9 0.702E+01   0.66     2.29 .23048E+03
    22.46     7.98    0.66     4.3 0.643E+01   0.66     2.70 .32521E+03
    27.72     9.91    0.66     4.6 0.597E+01   0.66     3.11 .42794E+03
    32.98    11.73    0.66     4.9 0.559E+01   0.66     3.52 .53808E+03
    38.23    13.46    0.66     5.2 0.528E+01   0.66     3.92 .65517E+03
    43.49    15.11    0.66     5.5 0.501E+01   0.66     4.32 .77880E+03
    48.75    16.67    0.66     5.7 0.478E+01   0.66     4.71 .90866E+03
    54.01    18.16    0.66     6.0 0.458E+01   0.66     5.11 .10445E+04
 Cumulative travel time =        1044.4540 sec  (    0.29 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
    54.01    18.16    0.66     6.0 0.458E+01   0.66     5.11 .10445E+04
    65.08    21.04    0.66     6.5 0.423E+01   0.41     9.43 .13487E+04
    76.16    23.61    0.66     6.9 0.395E+01   0.36    12.52 .16762E+04
    87.23    25.89    0.66     7.4 0.372E+01   0.32    15.37 .20255E+04
    98.30    27.91    0.66     7.8 0.353E+01   0.30    18.13 .23953E+04
   109.37    29.66    0.66     8.2 0.336E+01   0.29    20.83 .27844E+04
   120.44    31.17    0.66     8.5 0.321E+01   0.28    23.50 .31920E+04
   131.51    32.45    0.66     8.9 0.308E+01   0.27    26.15 .36173E+04
   142.59    33.50    0.66     9.2 0.297E+01   0.26    28.78 .40596E+04
   153.66    34.33    0.66     9.6 0.287E+01   0.25    31.41 .45182E+04
   164.73    34.96    0.66     9.9 0.278E+01   0.25    34.03 .49926E+04
 Cumulative travel time =        4992.5591 sec  (    1.39 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.82 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of     9.9 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.76

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.81    0.66     4.8 0.569E+01   0.66    36.24    0.66    0.00   .49926E+04
 Cumulative travel time =        4992.5571 sec  (    1.39 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 358

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S358U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S358U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--12:41:21
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.74 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.50 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.55 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.059701 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 1.28 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.091995 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.098443 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.118131 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001212 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001455 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 94.10 m          LM  = 8.64 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 41.79
  Port/nozzle Froude number     FRD0   = 22.60
  Velocity ratio                R      = 36.24
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.13 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.7931 deg.F
  Dilution at edge of NFR              s = 9.8
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 36.09 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 33.57 m
                          thickness (bv) = 0.25 m
  Cumulative travel time:       4930.6543 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 9.81 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 358

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S358U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S358U.prd
 Time stamp:        12/21/2025--12:41:21

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.13  YB1   =      9.75  YB2   =     12.50
 LD    =      2.74  NOPEN =    6       NRISER=    6       SPAC  =      0.55    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.5970E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.284 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.9200E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9844E-01   j0 =U0*GP0*B0 =0.1212E-02   (based on slot width B0)
 m0 =U0*q0   =0.1181E+00   j0 =q0*GP0    =0.1455E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.072 lM    =     8.64  lm    =     94.10
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2700E+00  J0    =0.3326E-02
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =      6.50  Lm    =     16.07  Lb    =     89.72
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     41.79  FRD0  =     22.60  R     =     36.24  PL    =    0.87
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.284 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =     41.79  FRD0  =     22.60  R     =     36.24
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.13 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.05     1.37     1.254   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.05     1.37 .00000E+00
     0.12    -0.07    0.21     1.4 0.195E+02   0.08     1.20 .14444E+00
     0.23    -0.15    0.21     1.6 0.174E+02   0.13     1.08 .32192E+00
     0.35    -0.22    0.22     1.7 0.161E+02   0.20     0.98 .52061E+00
     0.47    -0.29    0.23     1.8 0.151E+02   0.26     0.91 .73629E+00
     0.58    -0.36    0.23     1.9 0.144E+02   0.33     0.85 .96653E+00
     0.70    -0.44    0.24     2.0 0.138E+02   0.40     0.80 .12097E+01
```

```
      0.81    -0.51    0.24     2.1 0.132E+02   0.46     0.76 .14645E+01
      0.93    -0.58    0.25     2.1 0.128E+02   0.53     0.74 .17302E+01
      1.05    -0.65    0.25     2.2 0.124E+02   0.60     0.73 .20058E+01
      1.16    -0.73    0.26     2.3 0.120E+02   0.66     0.73 .22909E+01
 Cumulative travel time =          2.2909 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.16    -0.73    0.66     2.3 0.120E+02   0.66     0.81 .22909E+01
     6.64     1.87    0.66     2.9 0.954E+01   0.66     1.27 .64860E+02
    12.12     4.29    0.66     3.4 0.815E+01   0.66     1.72 .14039E+03
    17.60     6.56    0.66     3.8 0.723E+01   0.66     2.16 .22693E+03
    23.08     8.71    0.66     4.2 0.657E+01   0.66     2.60 .32325E+03
    28.56    10.74    0.66     4.5 0.606E+01   0.66     3.03 .42842E+03
    34.04    12.66    0.66     4.8 0.565E+01   0.66     3.45 .54176E+03
    39.52    14.48    0.66     5.2 0.532E+01   0.66     3.87 .66272E+03
    45.00    16.20    0.66     5.4 0.504E+01   0.66     4.29 .79084E+03
    50.48    17.84    0.66     5.7 0.480E+01   0.66     4.70 .92575E+03
    55.96    19.38    0.66     6.0 0.459E+01   0.66     5.11 .10671E+04
 Cumulative travel time =        1067.1108 sec  (    0.30 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
    55.96    19.38    0.66     6.0 0.459E+01   0.66     5.11 .10671E+04
    66.84    22.22    0.66     6.5 0.424E+01   0.42     9.38 .13658E+04
    77.71    24.75    0.66     6.9 0.396E+01   0.36    12.41 .16870E+04
    88.59    27.01    0.66     7.3 0.373E+01   0.32    15.23 .20292E+04
    99.47    29.00    0.66     7.7 0.354E+01   0.30    17.94 .23912E+04
   110.34    30.75    0.66     8.1 0.337E+01   0.29    20.59 .27721E+04
   121.22    32.25    0.66     8.5 0.323E+01   0.28    23.22 .31708E+04
   132.10    33.53    0.66     8.8 0.310E+01   0.27    25.82 .35867E+04
   142.98    34.59    0.66     9.2 0.299E+01   0.26    28.41 .40190E+04
   153.85    35.44    0.66     9.5 0.289E+01   0.25    30.99 .44672E+04
   164.73    36.09    0.66     9.8 0.279E+01   0.25    33.57 .49307E+04
 Cumulative travel time =        4930.6558 sec  (    1.37 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.82 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of     9.8 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.76

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.12    0.66     4.8 0.569E+01   0.66    36.24    0.66    0.00   .49307E+04
 Cumulative travel time =        4930.6543 sec  (    1.37 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 359

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S359U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S359U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--12:39:39
********************************************************************************
SUMMARY OF INPUT DATA:
--------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS  = 999.9749 kg/m^3
  Bottom density                RHOAB  = 999.9749 kg/m^3
--------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.44 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.19 m
  Number of openings            NOPEN  = 4
  Number of Risers              NRISER = 4
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC   = 0.81 m
  Port/Nozzle diameter          D0      = 0.2530 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.061843 m
  Total area of openings        TA0     = 0.2011 m^2
  Discharge velocity            U0      = 1.26 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA  = 90 deg
  Vertical discharge angle      THETA  = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA  = 328 deg
  Relative orientation angle    BETA   = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0   = 998.3625 kg/m^3
  Density difference            DRHO   = 1.6125 kg/m^3
  Buoyant acceleration          GP0    = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
--------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.103494 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.097424 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.129898 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001227 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001637 m^3/s^3
--------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.08 m          Lm  = 103.48 m          LM  = 8.48 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
--------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 40.14
  Port/nozzle Froude number       FRD0   = 19.84
  Velocity ratio                R      = 35.42
--------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
********************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.97 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.8337 deg.F
  Dilution at edge of NFR              s = 9.7
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 35.91 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 34.73 m
                          thickness (bv) = 0.24 m
  Cumulative travel time:       4956.0063 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 9.67 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 164.73 m downstream.
  Plume contacts second bank at 164.73 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 359

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S359U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S359U.prd
 Time stamp:        12/21/2025--12:39:39

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.97  YB1   =      9.75  YB2   =     12.19
 LD    =      2.44  NOPEN =    4       NRISER=    4       SPAC  =      0.81    NPPERR =    1
 D0    =     0.253 A0    =     0.050 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.253 CR0   =     1.000 B0    =0.6184E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.255 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1035E+00         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9742E-01   j0 =U0*GP0*B0 =0.1227E-02   (based on slot width B0)
 m0 =U0*q0   =0.1299E+00   j0 =q0*GP0    =0.1637E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.082 lM    =     8.48  lm    =    103.48
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.2376E+00  J0    =0.2993E-02
 Associated 3-d length scales (meters)
 LQ    =      0.22  LM    =      6.22  Lm    =     15.88  Lb    =     89.72
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     40.14  FRD0  =     19.84  R     =     35.42  PL    =    1.05
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.255 D0    =      0.253 A0    =      0.050 THETA =      0.00
 FR0   =     40.14  FRD0  =     19.84  R     =     35.42
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.97 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.05     1.22     1.225   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.05     1.22 .00000E+00
     0.10    -0.06    0.21     1.4 0.202E+02   0.07     1.07 .12667E+00
     0.21    -0.13    0.21     1.5 0.183E+02   0.13     0.96 .27966E+00
     0.31    -0.19    0.22     1.6 0.170E+02   0.20     0.87 .44956E+00
     0.41    -0.26    0.22     1.7 0.160E+02   0.26     0.80 .63304E+00
     0.52    -0.32    0.23     1.8 0.153E+02   0.33     0.75 .82814E+00
     0.62    -0.39    0.23     1.9 0.147E+02   0.40     0.71 .10336E+01
```

```
      0.72    -0.45    0.24     1.9 0.142E+02   0.46     0.68 .12484E+01
      0.83    -0.52    0.24     2.0 0.137E+02   0.53     0.66 .14718E+01
      0.93    -0.58    0.25     2.1 0.133E+02   0.60     0.65 .17033E+01
      1.03    -0.65    0.25     2.1 0.129E+02   0.66     0.65 .19422E+01
 Cumulative travel time =          1.9422 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.03    -0.65    0.66     2.1 0.129E+02   0.66     0.72 .19422E+01
     5.60     1.55    0.66     2.6 0.104E+02   0.66     1.11 .51197E+02
    10.16     3.62    0.66     3.1 0.891E+01   0.66     1.48 .11022E+03
    14.73     5.58    0.66     3.5 0.793E+01   0.66     1.85 .17760E+03
    19.29     7.44    0.66     3.8 0.722E+01   0.66     2.22 .25240E+03
    23.85     9.21    0.66     4.1 0.667E+01   0.66     2.58 .33395E+03
    28.42    10.90    0.66     4.4 0.622E+01   0.66     2.94 .42173E+03
    32.98    12.51    0.66     4.7 0.586E+01   0.66     3.29 .51533E+03
    37.55    14.04    0.66     4.9 0.555E+01   0.66     3.64 .61440E+03
    42.11    15.51    0.66     5.2 0.529E+01   0.66     3.99 .71866E+03
    46.67    16.91    0.66     5.4 0.506E+01   0.66     4.33 .82787E+03
 Cumulative travel time =        827.8670 sec  (    0.23 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
    46.67    16.91    0.66     5.4 0.506E+01   0.66     4.33 .82787E+03
    58.48    20.26    0.66     6.0 0.458E+01   0.40     8.71 .11318E+04
    70.29    23.22    0.66     6.5 0.422E+01   0.34    11.90 .14644E+04
    82.09    25.83    0.66     7.0 0.393E+01   0.31    14.88 .18235E+04
    93.90    28.12    0.66     7.4 0.370E+01   0.29    17.78 .22071E+04
   105.70    30.10    0.66     7.8 0.350E+01   0.27    20.63 .26138E+04
   117.51    31.79    0.66     8.2 0.333E+01   0.26    23.47 .30424E+04
   129.31    33.21    0.66     8.6 0.318E+01   0.26    26.29 .34918E+04
   141.12    34.36    0.66     9.0 0.305E+01   0.25    29.10 .39610E+04
   152.92    35.25    0.66     9.3 0.294E+01   0.24    31.92 .44493E+04
   164.73    35.91    0.66     9.7 0.283E+01   0.24    34.73 .49560E+04
 Cumulative travel time =       4956.0063 sec  (    1.38 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.81 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of     9.7 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.76

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.27    0.66     4.8 0.569E+01   0.66    36.24    0.66    0.00   .49560E+04
 Cumulative travel time =       4956.0063 sec  (    1.38 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 360

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S360U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S360U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--12:37:19
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.13 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;     YB2 = 11.89 m
  Number of openings            NOPEN   = 3
  Number of Risers              NRISER = 3
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 1.07 m
  Port/Nozzle diameter          D0      = 0.3048 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.068397 m
  Total area of openings        TA0     = 0.2189 m^2
  Discharge velocity            U0      = 1.15 m/s
  Total discharge flowrate      Q0      = 0.252361 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.118279 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.090907 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.136361 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001247 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001870 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.10 m          Lm  = 108.63 m          LM  = 7.83 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 35.06
  Port/nozzle Froude number     FRD0   = 16.61
  Velocity ratio                R      = 32.54
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.8

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.82 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.965 deg.F
  Dilution at edge of NFR              s = 9.2
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 33.64 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 36.94 m
                           thickness (bv) = 0.22 m
  Cumulative travel time:       5138.9858 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.82
 This value is below the computed dilution of 9.24 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 164.73 m downstream.
  Plume contacts second bank at 164.73 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 360

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------

CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S360U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S360U.prd
 Time stamp:        12/21/2025--12:37:19

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.82  YB1   =      9.75  YB2   =     11.89
 LD    =      2.13  NOPEN =    3       NRISER=    3       SPAC  =      1.07    NPPERR =    1
 D0    =     0.305 A0    =     0.073 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.305 CR0   =     1.000 B0    =0.6840E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.153 Q0    =     0.252 Q0A   =0.2524E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1183E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.9091E-01   j0 =U0*GP0*B0 =0.1247E-02   (based on slot width B0)
 m0 =U0*q0   =0.1364E+00   j0 =q0*GP0    =0.1870E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.103 lM    =     7.83  lm    =    108.63
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2524E+00  M0    =0.1940E+00  J0    =0.2660E-02
 Associated 3-d length scales (meters)
 LQ    =      0.27  LM    =      5.67  Lm    =     15.22  Lb    =     89.72
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     35.06  FRD0  =     16.61  R     =     32.54  PL    =    1.16
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.153 D0    =      0.305 A0    =      0.073 THETA =      0.00
 FR0   =     35.06  FRD0  =     16.61  R     =     32.54
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.82     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.82 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.05     1.07     1.123   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.05     1.07 .00000E+00
      0.09    -0.06    0.21     1.3 0.213E+02   0.08     0.94 .11428E+00
      0.18    -0.11    0.21     1.4 0.196E+02   0.13     0.84 .24862E+00
      0.27    -0.17    0.22     1.5 0.184E+02   0.20     0.76 .39587E+00
      0.36    -0.23    0.22     1.6 0.175E+02   0.26     0.70 .55350E+00
      0.45    -0.28    0.22     1.6 0.168E+02   0.33     0.66 .72002E+00
      0.54    -0.34    0.23     1.7 0.162E+02   0.40     0.62 .89446E+00
```

```
      0.63    -0.40    0.23     1.8 0.157E+02   0.46     0.59 .10761E+01
      0.72    -0.45    0.24     1.8 0.152E+02   0.53     0.58 .12643E+01
      0.81    -0.51    0.24     1.9 0.148E+02   0.60     0.57 .14587E+01
      0.90    -0.57    0.25     1.9 0.144E+02   0.66     0.56 .16588E+01
 Cumulative travel time =          1.6588 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.90    -0.57    0.66     1.9 0.144E+02   0.66     0.63 .16588E+01
      3.90     0.90    0.66     2.3 0.121E+02   0.66     0.88 .32298E+02
      6.89     2.30    0.66     2.6 0.107E+02   0.66     1.13 .67835E+02
      9.88     3.64    0.66     2.8 0.964E+01   0.66     1.38 .10767E+03
     12.87     4.93    0.66     3.1 0.885E+01   0.66     1.62 .15138E+03
     15.86     6.17    0.66     3.3 0.824E+01   0.66     1.86 .19864E+03
     18.86     7.37    0.66     3.5 0.773E+01   0.66     2.10 .24922E+03
     21.85     8.53    0.66     3.7 0.731E+01   0.66     2.34 .30289E+03
     24.84     9.64    0.66     3.9 0.695E+01   0.66     2.57 .35950E+03
     27.83    10.73    0.66     4.1 0.664E+01   0.66     2.81 .41890E+03
     30.83    11.77    0.66     4.3 0.636E+01   0.66     3.04 .48097E+03
 Cumulative travel time =        480.9683 sec  (    0.13 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     30.83    11.77    0.66     4.3 0.636E+01   0.66     3.04 .48097E+03
     44.22    16.06    0.66     5.0 0.546E+01   0.36     7.52 .78873E+03
     57.61    19.75    0.66     5.6 0.485E+01   0.30    10.95 .11405E+04
     71.00    22.94    0.66     6.2 0.441E+01   0.28    14.24 .15314E+04
     84.39    25.65    0.66     6.7 0.407E+01   0.26    17.48 .19578E+04
     97.78    27.92    0.66     7.2 0.380E+01   0.25    20.71 .24169E+04
    111.17    29.79    0.66     7.7 0.358E+01   0.24    23.94 .29066E+04
    124.56    31.28    0.66     8.1 0.339E+01   0.24    27.17 .34251E+04
    137.95    32.40    0.66     8.5 0.323E+01   0.23    30.42 .39708E+04
    151.34    33.19    0.66     8.9 0.309E+01   0.23    33.67 .45425E+04
    164.73    33.64    0.66     9.2 0.296E+01   0.22    36.94 .51390E+04
 Cumulative travel time =       5138.9854 sec  (    1.43 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.79 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.8
   This value is LESS than the predicted dilution of     9.2 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.8

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.76

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.42    0.66     4.8 0.569E+01   0.66    36.24    0.66    0.00   .51390E+04
 Cumulative travel time =       5138.9858 sec  (    1.43 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 361

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S361U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S361U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--12:34:50
******************************************************************************
SUMMARY OF INPUT DATA:
------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 4.88 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;     YB2 = 14.63 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.49 m
  Port/Nozzle diameter          D0      = 0.1124 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.020348 m
  Total area of openings        TA0     = 0.1092 m^2
  Discharge velocity            U0      = 2.75 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.061450 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.153367 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.168704 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000883 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000972 m^3/s^3
------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.02 m          Lm  = 134.39 m          LM  = 16.61 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 153.05
  Port/nozzle Froude number     FRD0    = 65.12
  Velocity ratio                R       = 77.49
------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    12.19 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.0478 deg.F
  Dilution at edge of NFR              s = 13.4
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 57.79 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 14.15 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       3211.3152 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 13.38 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ***********************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 361

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S361U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S361U.prd
 Time stamp:        12/21/2025--12:34:50

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     12.19  YB1   =      9.75  YB2   =     14.63
 LD    =      4.88  NOPEN =   11       NRISER=   11       SPAC  =      0.49    NPPERR =    1
 D0    =     0.112 A0    =     0.010 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.122 CR0   =     0.850 B0    =0.2035E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     2.745 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.6145E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1534E+00   j0 =U0*GP0*B0 =0.8834E-03   (based on slot width B0)
 m0 =U0*q0   =0.1687E+00   j0 =q0*GP0    =0.9717E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.022 lM    =     16.61  lm    =    134.39
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.7479E+00  J0    =0.4308E-02
 Associated 3-d length scales (meters)
 LQ    =      0.10  LM    =     12.25  Lm    =     25.60  Lb    =    106.55
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =    153.05  FRD0  =     65.12  R     =     77.49  PL    =    1.08
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      2.745 D0    =      0.112 A0    =      0.010 THETA =      0.00
 FR0   =    153.05  FRD0  =     65.12  R     =     77.49
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        12.19 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.02     2.44     2.715   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.02     2.44 .00000E+00
      0.21    -0.13    0.21     2.0 0.140E+02   0.07     2.14 .16988E+00
      0.41    -0.26    0.22     2.4 0.116E+02   0.13     1.91 .40669E+00
      0.62    -0.39    0.23     2.7 0.103E+02   0.20     1.74 .68640E+00
      0.83    -0.52    0.24     2.9 0.938E+01   0.26     1.60 .10004E+01
      1.03    -0.65    0.25     3.1 0.870E+01   0.33     1.49 .13439E+01
      1.24    -0.78    0.26     3.4 0.817E+01   0.40     1.41 .17133E+01
```

```
      1.45    -0.90    0.27     3.5 0.773E+01   0.46     1.35 .21063E+01
      1.65    -1.03    0.28     3.7 0.737E+01   0.53     1.31 .25211E+01
      1.86    -1.16    0.29     3.9 0.706E+01   0.60     1.29 .29560E+01
      2.07    -1.29    0.30     4.0 0.678E+01   0.66     1.28 .34098E+01
 Cumulative travel time =          3.4098 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     2.07    -1.29    0.66     4.0 0.678E+01   0.66     1.44 .34098E+01
    18.33     6.68    0.66     5.7 0.480E+01   0.66     2.81 .16882E+03
    34.60    14.00    0.66     7.0 0.392E+01   0.66     4.15 .38294E+03
    50.87    20.80    0.66     8.1 0.340E+01   0.66     5.46 .63646E+03
    67.13    27.15    0.66     9.0 0.304E+01   0.66     6.76 .92399E+03
    83.40    33.10    0.66     9.9 0.277E+01   0.66     8.03 .12419E+04
    99.67    38.67    0.66    10.7 0.257E+01   0.66     9.28 .15875E+04
   115.93    43.91    0.66    11.4 0.240E+01   0.66    10.52 .19588E+04
   132.20    48.83    0.66    12.1 0.226E+01   0.66    11.74 .23541E+04
   148.46    53.45    0.66    12.8 0.215E+01   0.66    12.95 .27720E+04
   164.73    57.79    0.66    13.4 0.205E+01   0.66    14.15 .32113E+04
 Cumulative travel time =        3211.3152 sec  (    0.89 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  4.61 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 Flow appears highly UNSTEADY in transition to the far-field and prediction resu
 lts MAY be UNRELIABLE!

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of    13.4 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.71

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.05    0.66     4.2 0.650E+01   0.66    36.24    0.66    0.00   .32113E+04
 Cumulative travel time =        3211.3152 sec  (    0.89 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 362

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  S362U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S362U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--12:32:11
********************************************************************************
SUMMARY OF INPUT DATA:
--------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
--------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.96 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.72 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.40 m
  Port/Nozzle diameter          D0      = 0.1405 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.039131 m
  Total area of openings        TA0     = 0.1706 m^2
  Discharge velocity            U0      = 1.76 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
--------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.075631 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.120806 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.132887 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001087 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001196 m^3/s^3
--------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.04 m          Lm  = 105.86 m          LM  = 11.40 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
--------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 70.63
  Port/nozzle Froude number     FRD0    = 37.28
  Velocity ratio                R       = 49.59
--------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
********************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

Scenario 362

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       S362U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S362U.prd
 Time stamp:        12/21/2025--12:32:11

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.73  YB1   =      9.75  YB2   =     13.72
 LD    =      3.96  NOPEN =   11       NRISER=   11       SPAC  =      0.40    NPPERR =    1
 D0    =     0.141 A0    =     0.016 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     0.850 B0    =0.3913E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.757 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7563E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1208E+00   j0 =U0*GP0*B0 =0.1087E-02   (based on slot width B0)
 m0 =U0*q0   =0.1329E+00   j0 =q0*GP0    =0.1196E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.043 lM    =     11.40  lm    =    105.86
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.4787E+00  J0    =0.4308E-02
 Associated 3-d length scales (meters)
 LQ    =      0.12  LM    =      8.77  Lm    =     20.48  Lb    =    106.55
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     70.63  FRD0  =     37.28  R     =     49.59  PL    =    0.82
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.757 D0    =      0.141 A0    =      0.016 THETA =      0.00
 FR0   =     70.63  FRD0  =     37.28  R     =     49.59
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.73 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.03     1.98     1.727   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.03     1.98 .00000E+00
      0.17    -0.10    0.21     1.6 0.170E+02   0.07     1.74 .17590E+00
      0.34    -0.21    0.22     1.9 0.147E+02   0.13     1.56 .40505E+00
      0.50    -0.31    0.23     2.1 0.133E+02   0.20     1.42 .66833E+00
      0.67    -0.42    0.23     2.2 0.123E+02   0.26     1.31 .95893E+00
      0.84    -0.52    0.24     2.4 0.116E+02   0.33     1.22 .12729E+01
      1.01    -0.63    0.25     2.5 0.110E+02   0.40     1.15 .16076E+01
```

```
      1.18    -0.73    0.26     2.6 0.105E+02   0.46     1.10 .19611E+01
      1.34    -0.84    0.26     2.7 0.100E+02   0.53     1.07 .23319E+01
      1.51    -0.94    0.27     2.8 0.968E+01   0.60     1.05 .27187E+01
      1.68    -1.05    0.28     2.9 0.935E+01   0.66     1.05 .31206E+01
 Cumulative travel time =          3.1206 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.68    -1.05    0.66     2.9 0.935E+01   0.66     1.17 .31206E+01
    17.99     6.56    0.66     4.4 0.628E+01   0.66     2.53 .19748E+03
    34.29    13.32    0.66     5.4 0.505E+01   0.66     3.84 .45614E+03
    50.60    19.40    0.66     6.3 0.434E+01   0.66     5.12 .76584E+03
    66.90    24.90    0.66     7.1 0.386E+01   0.66     6.38 .11192E+04
    83.21    29.88    0.66     7.8 0.351E+01   0.66     7.61 .15114E+04
    99.51    34.40    0.66     8.4 0.325E+01   0.66     8.81 .19390E+04
   115.82    38.48    0.66     9.0 0.303E+01   0.66    10.00 .23991E+04
   132.12    42.16    0.66     9.6 0.285E+01   0.66    11.17 .28897E+04
   148.43    45.46    0.66    10.1 0.270E+01   0.66    12.33 .34089E+04
   164.73    48.40    0.66    10.6 0.258E+01   0.66    13.47 .39552E+04
 Cumulative travel time =        3955.2312 sec  (    1.10 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
   164.73    48.40    0.66    10.6 0.258E+01   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.258E+01   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.258E+01   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.258E+01   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.258E+01   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.258E+01   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.258E+01   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.258E+01   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.258E+01   0.66    13.47 .39552E+04
   164.73    48.40    0.66    10.6 0.258E+01   0.66    13.47 .39552E+04
 Cumulative travel time =        3955.2319 sec  (    1.10 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.85 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of    10.6 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.71

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
   164.73   -24.51    0.66     4.2 0.650E+01   0.66    36.24    0.66    0.00   .39552E+04
 Cumulative travel time =        3955.2312 sec  (    1.10 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.73 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.5765 deg.F
  Dilution at edge of NFR              s = 10.6
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 48.40 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.47 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       3955.2312 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 10.63 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY ***********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 363

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S363U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S363U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--12:28:13
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.13 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 11.89 m
  Number of openings            NOPEN   = 3
  Number of Risers              NRISER = 3
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 1.07 m
  Port/Nozzle diameter          D0      = 0.3048 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.068397 m
  Total area of openings        TA0     = 0.2189 m^2
  Discharge velocity            U0      = 1.37 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.140457 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.128193 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.192290 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001481 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.002221 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.10 m          Lm  = 153.18 m          LM  = 9.85 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 41.63
  Port/nozzle Froude number     FRD0   = 19.72
  Velocity ratio                R      = 38.64
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.82 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.9681 deg.F
  Dilution at edge of NFR              s = 9.2
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 44.45 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 32.09 m
                           thickness (bv) = 0.26 m
  Cumulative travel time:       4324.0986 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.23 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 363

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S363U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S363U.prd
 Time stamp:        12/21/2025--12:28:13

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.82  YB1   =      9.75  YB2   =     11.89
 LD    =      2.13  NOPEN =    3       NRISER=    3       SPAC  =      1.07    NPPERR =    1
 D0    =     0.305 A0    =     0.073 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.305 CR0   =     1.000 B0    =0.6840E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.369 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1405E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1282E+00   j0 =U0*GP0*B0 =0.1481E-02   (based on slot width B0)
 m0 =U0*q0   =0.1923E+00   j0 =q0*GP0    =0.2221E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.103 lM    =     9.85  lm    =    153.18
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.2735E+00  J0    =0.3159E-02
 Associated 3-d length scales (meters)
 LQ    =      0.27  LM    =      6.73  Lm    =     18.08  Lb    =    106.55
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     41.63  FRD0  =     19.72  R     =     38.64  PL    =    1.03
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.369 D0    =      0.305 A0    =      0.073 THETA =      0.00
 FR0   =     41.63  FRD0  =     19.72  R     =     38.64
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.82 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.05     1.07     1.339   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.05     1.07 .00000E+00
      0.09    -0.06    0.21     1.3 0.214E+02   0.08     0.93 .96436E-01
      0.18    -0.11    0.21     1.4 0.197E+02   0.13     0.84 .20967E+00
      0.27    -0.17    0.22     1.5 0.185E+02   0.20     0.76 .33374E+00
      0.36    -0.23    0.22     1.6 0.176E+02   0.26     0.70 .46652E+00
      0.45    -0.28    0.22     1.6 0.169E+02   0.33     0.65 .60678E+00
      0.54    -0.34    0.23     1.7 0.163E+02   0.40     0.62 .75370E+00
```

```
      0.63    -0.40    0.23     1.7 0.158E+02   0.46     0.59 .90666E+00
      0.72    -0.45    0.24     1.8 0.153E+02   0.53     0.57 .10652E+01
      0.81    -0.51    0.24     1.8 0.149E+02   0.60     0.56 .12289E+01
      0.90    -0.57    0.25     1.9 0.146E+02   0.66     0.56 .13975E+01
 Cumulative travel time =          1.3975 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.90    -0.57    0.66     1.9 0.146E+02   0.66     0.63 .13975E+01
      7.58     2.77    0.66     2.6 0.105E+02   0.66     1.19 .64202E+02
     14.25     5.87    0.66     3.2 0.858E+01   0.66     1.75 .14485E+03
     20.93     8.78    0.66     3.7 0.745E+01   0.66     2.29 .24001E+03
     27.60    11.52    0.66     4.1 0.668E+01   0.66     2.83 .34773E+03
     34.27    14.11    0.66     4.5 0.610E+01   0.66     3.36 .46669E+03
     40.95    16.57    0.66     4.8 0.565E+01   0.66     3.88 .59592E+03
     47.62    18.90    0.66     5.2 0.529E+01   0.66     4.40 .73465E+03
     54.29    21.11    0.66     5.5 0.499E+01   0.66     4.91 .88227E+03
     60.97    23.21    0.66     5.8 0.474E+01   0.66     5.41 .10383E+04
     67.64    25.20    0.66     6.1 0.452E+01   0.66     5.91 .12022E+04
 Cumulative travel time =        1202.2477 sec  (    0.33 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     67.64    25.20    0.66     6.1 0.452E+01   0.66     5.91 .12022E+04
     77.35    27.93    0.66     6.5 0.425E+01   0.44     9.98 .14542E+04
     87.06    30.45    0.66     6.8 0.402E+01   0.38    12.82 .17213E+04
     96.77    32.78    0.66     7.2 0.382E+01   0.35    15.42 .20027E+04
    106.48    34.93    0.66     7.5 0.366E+01   0.32    17.92 .22977E+04
    116.19    36.92    0.66     7.8 0.351E+01   0.31    20.34 .26057E+04
    125.90    38.73    0.66     8.1 0.338E+01   0.29    22.73 .29262E+04
    135.60    40.38    0.66     8.4 0.326E+01   0.28    25.09 .32586E+04
    145.31    41.89    0.66     8.7 0.315E+01   0.28    27.44 .36027E+04
    155.02    43.24    0.66     9.0 0.306E+01   0.27    29.77 .39580E+04
    164.73    44.45    0.66     9.2 0.297E+01   0.26    32.09 .43241E+04
 Cumulative travel time =        4324.0986 sec  (    1.20 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.88 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.2 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.71

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.42    0.66     4.2 0.650E+01   0.66    36.24    0.66    0.00   .43241E+04
 Cumulative travel time =        4324.0986 sec  (    1.20 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 364

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S364U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S364U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--12:25:39
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.74 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.50 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.55 m
  Port/Nozzle diameter          D0      = 0.1883 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.050746 m
  Total area of openings        TA0     = 0.1670 m^2
  Discharge velocity            U0      = 1.79 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.109244 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.163317 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.195981 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001440 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001727 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 156.12 m          LM  = 12.78 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 63.33
  Port/nozzle Froude number     FRD0   = 32.88
  Velocity ratio                R      = 50.63
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.13 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.5797 deg.F
  Dilution at edge of NFR              s = 10.6
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 50.79 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.23 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       3822.3010 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 10.62 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 364

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S364U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S364U.prd
 Time stamp:        12/21/2025--12:25:39

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.13  YB1   =      9.75  YB2   =     12.50
 LD    =      2.74  NOPEN =    6       NRISER=    6       SPAC  =      0.55    NPPERR =    1
 D0    =     0.188 A0    =     0.028 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     0.850 B0    =0.5075E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.794 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1092E+00         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1633E+00   j0 =U0*GP0*B0 =0.1440E-02   (based on slot width B0)
 m0 =U0*q0   =0.1960E+00   j0 =q0*GP0    =0.1728E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.061 lM    =     12.78  lm    =    156.12
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.4480E+00  J0    =0.3949E-02
 Associated 3-d length scales (meters)
 LQ    =      0.17  LM    =      8.71  Lm    =     20.69  Lb    =    106.55
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     63.33  FRD0  =     32.88  R     =     50.63  PL    =    0.78
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.794 D0    =      0.188 A0    =      0.028 THETA =      0.00
 FR0   =     63.33  FRD0  =     32.88  R     =     50.63
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.13 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.04     1.37     1.764   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.04     1.37 .00000E+00
     0.12    -0.07    0.21     1.5 0.188E+02   0.07     1.20 .10817E+00
     0.23    -0.15    0.21     1.6 0.167E+02   0.13     1.07 .24349E+00
     0.35    -0.22    0.22     1.8 0.153E+02   0.20     0.98 .39629E+00
     0.47    -0.29    0.23     1.9 0.143E+02   0.26     0.90 .56312E+00
     0.58    -0.36    0.23     2.0 0.136E+02   0.33     0.84 .74199E+00
     0.70    -0.44    0.24     2.1 0.130E+02   0.40     0.79 .93154E+00
```

```
      0.81    -0.51    0.24     2.2 0.124E+02   0.46     0.76 .11308E+01
      0.93    -0.58    0.25     2.3 0.120E+02   0.53     0.73 .13390E+01
      1.05    -0.65    0.25     2.4 0.116E+02   0.60     0.72 .15555E+01
      1.16    -0.73    0.26     2.4 0.112E+02   0.66     0.72 .17799E+01
 Cumulative travel time =          1.7799 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.16    -0.73    0.66     2.4 0.112E+02   0.66     0.81 .17799E+01
    17.52     7.21    0.66     4.1 0.672E+01   0.66     2.18 .17397E+03
    33.88    14.22    0.66     5.2 0.524E+01   0.66     3.51 .41593E+03
    50.23    20.52    0.66     6.2 0.444E+01   0.66     4.81 .71130E+03
    66.59    26.23    0.66     7.0 0.393E+01   0.66     6.07 .10517E+04
    82.95    31.40    0.66     7.7 0.356E+01   0.66     7.31 .14319E+04
    99.30    36.10    0.66     8.4 0.327E+01   0.66     8.53 .18480E+04
   115.66    40.36    0.66     9.0 0.305E+01   0.66     9.73 .22972E+04
   132.02    44.21    0.66     9.6 0.287E+01   0.66    10.91 .27771E+04
   148.37    47.68    0.66    10.1 0.271E+01   0.66    12.08 .32860E+04
   164.73    50.79    0.66    10.6 0.258E+01   0.66    13.23 .38223E+04
 Cumulative travel time =        3822.3018 sec  (    1.06 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.91 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of    10.6 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.71

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.12    0.66     4.2 0.650E+01   0.66    36.24    0.66    0.00   .38223E+04
 Cumulative travel time =        3822.3010 sec  (    1.06 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 365

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S365U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S365U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--12:23:05
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.44 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.19 m
  Number of openings            NOPEN   = 4
  Number of Risers              NRISER = 4
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.81 m
  Port/Nozzle diameter          D0      = 0.2332 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.052567 m
  Total area of openings        TA0     = 0.1709 m^2
  Discharge velocity            U0      = 1.75 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.122900 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.161626 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.215502 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001458 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001943 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 171.67 m          LM  = 12.54 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 60.82
  Port/nozzle Froude number     FRD0   = 28.87
  Velocity ratio                R      = 49.49
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.97 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.6167 deg.F
  Dilution at edge of NFR              s = 10.5
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 50.67 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 13.14 m
                          thickness (bv) = 0.66 m
  Cumulative travel time:       3842.7554 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 10.47 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m
  downstream and continues as vertically mixed into the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 365

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S365U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S365U.prd
 Time stamp:        12/21/2025--12:23:05

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.97  YB1   =      9.75  YB2   =     12.19
 LD    =      2.44  NOPEN =    4       NRISER=    4       SPAC  =      0.81    NPPERR =    1
 D0    =     0.233 A0    =     0.043 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.253 CR0   =     0.850 B0    =0.5257E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.753 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1229E+00         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1616E+00   j0 =U0*GP0*B0 =0.1458E-02   (based on slot width B0)
 m0 =U0*q0   =0.2155E+00   j0 =q0*GP0    =0.1943E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.070 lM    =     12.54  lm    =    171.67
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.3941E+00  J0    =0.3554E-02
 Associated 3-d length scales (meters)
 LQ    =      0.21  LM    =      8.34  Lm    =     20.46  Lb    =    106.55
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     60.82  FRD0  =     28.87  R     =     49.49  PL    =    0.94
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     1.753 D0    =     0.233 A0    =     0.043 THETA =      0.00
 FR0   =     60.82  FRD0  =     28.87  R     =     49.49
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.97 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.04     1.22     1.723   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.04     1.22 .00000E+00
     0.10    -0.06    0.21     1.4 0.196E+02   0.07     1.07 .94762E-01
     0.21    -0.13    0.21     1.6 0.175E+02   0.13     0.95 .21132E+00
     0.31    -0.19    0.22     1.7 0.162E+02   0.20     0.87 .34193E+00
     0.41    -0.26    0.22     1.8 0.152E+02   0.26     0.80 .48382E+00
     0.52    -0.32    0.23     1.9 0.144E+02   0.33     0.74 .63539E+00
     0.62    -0.39    0.23     2.0 0.138E+02   0.40     0.70 .79557E+00
```

```
      0.72    -0.45    0.24     2.1 0.133E+02   0.46     0.67 .96357E+00
      0.83    -0.52    0.24     2.1 0.128E+02   0.53     0.65 .11388E+01
      0.93    -0.58    0.25     2.2 0.124E+02   0.60     0.64 .13207E+01
      1.03    -0.65    0.25     2.3 0.121E+02   0.66     0.64 .15089E+01
 Cumulative travel time =          1.5089 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      1.03    -0.65    0.66     2.3 0.121E+02   0.66     0.71 .15089E+01
     17.40     7.34    0.66     3.9 0.694E+01   0.66     2.10 .17027E+03
     33.77    14.37    0.66     5.1 0.537E+01   0.66     3.43 .41140E+03
     50.14    20.68    0.66     6.0 0.454E+01   0.66     4.72 .70734E+03
     66.51    26.37    0.66     6.9 0.400E+01   0.66     5.99 .10493E+04
     82.88    31.52    0.66     7.6 0.362E+01   0.66     7.23 .14319E+04
     99.25    36.19    0.66     8.2 0.333E+01   0.66     8.45 .18510E+04
    115.62    40.41    0.66     8.8 0.310E+01   0.66     9.65 .23038E+04
    131.99    44.21    0.66     9.4 0.291E+01   0.66    10.83 .27879E+04
    148.36    47.63    0.66    10.0 0.275E+01   0.66    11.99 .33014E+04
    164.73    50.67    0.66    10.5 0.262E+01   0.66    13.14 .38428E+04
 Cumulative travel time =        3842.7559 sec  (    1.07 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  3.88 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of    10.5 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Due to the attachment or proximity of the plume to the bottom, the bottom
   coordinate for the FAR-FIELD differs from the ambient depth, ZFB = 0 m.
 In a subsequent analysis set "depth at discharge" equal to "ambient depth".
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
      VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.71

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.27    0.66     4.2 0.650E+01   0.66    36.24    0.66    0.00   .38428E+04
 Cumulative travel time =        3842.7554 sec  (    1.07 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 366

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S366U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S366U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--12:16:48
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.13 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 11.89 m
  Number of openings            NOPEN   = 3
  Number of Risers              NRISER = 3
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 1.07 m
  Port/Nozzle diameter          D0      = 0.2810 m
    with contraction ratio              = 0.85
  Equivalent slot width         B0      = 0.058137 m
  Total area of openings        TA0     = 0.1861 m^2
  Discharge velocity            U0      = 1.61 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.140457 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.150816 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.226224 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001481 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.002221 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.09 m          Lm  = 180.21 m          LM  = 11.58 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 53.12
  Port/nozzle Froude number       FRD0   = 24.16
  Velocity ratio                R       = 45.46
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.82 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.7377 deg.F
  Dilution at edge of NFR              s = 10.0
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 48.94 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 25.59 m
                          thickness (bv) = 0.34 m
  Cumulative travel time:       3985.3035 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 10.01 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY ***********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 366

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S366U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S366U.prd
 Time stamp:        12/21/2025--12:16:48

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.82  YB1   =      9.75  YB2   =     11.89
 LD    =      2.13  NOPEN =    3       NRISER=    3       SPAC  =      1.07    NPPERR =    1
 D0    =     0.281 A0    =     0.062 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.305 CR0   =     0.850 B0    =0.5814E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.611 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1405E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1508E+00   j0 =U0*GP0*B0 =0.1481E-02   (based on slot width B0)
 m0 =U0*q0   =0.2262E+00   j0 =q0*GP0    =0.2221E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =      0.087 lM    =     11.58  lm    =    180.21
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.3218E+00  J0    =0.3159E-02
 Associated 3-d length scales (meters)
 LQ    =      0.25  LM    =      7.60  Lm    =     19.61  Lb    =    106.55
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     53.12  FRD0  =     24.16  R     =     45.46  PL    =    1.03
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.611 D0    =      0.281 A0    =      0.062 THETA =      0.00
 FR0   =     53.12  FRD0  =     24.16  R     =     45.46
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.82 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.05     1.07     1.581   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.05     1.07 .00000E+00
     0.09    -0.06    0.21     1.3 0.207E+02   0.07     0.93 .85372E-01
     0.18    -0.11    0.21     1.5 0.187E+02   0.13     0.84 .18761E+00
     0.27    -0.17    0.22     1.6 0.175E+02   0.20     0.76 .30073E+00
     0.36    -0.23    0.22     1.7 0.166E+02   0.26     0.70 .42259E+00
     0.45    -0.28    0.22     1.7 0.158E+02   0.33     0.65 .55197E+00
     0.54    -0.34    0.23     1.8 0.152E+02   0.40     0.61 .68803E+00
```

```
      0.63    -0.40    0.23     1.9 0.147E+02   0.46     0.59 .83016E+00
      0.72    -0.45    0.24     1.9 0.142E+02   0.53     0.57 .97788E+00
      0.81    -0.51    0.24     2.0 0.138E+02   0.60     0.56 .11308E+01
      0.90    -0.57    0.25     2.0 0.135E+02   0.66     0.56 .12887E+01
 Cumulative travel time =          1.2887 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.90    -0.57    0.66     2.0 0.135E+02   0.66     0.62 .12887E+01
     12.22     5.07    0.66     3.3 0.835E+01   0.66     1.59 .10920E+03
     23.54    10.17    0.66     4.2 0.657E+01   0.66     2.52 .25852E+03
     34.86    14.83    0.66     4.9 0.559E+01   0.66     3.43 .43985E+03
     46.18    19.14    0.66     5.5 0.495E+01   0.66     4.32 .64831E+03
     57.49    23.13    0.66     6.1 0.449E+01   0.66     5.20 .88072E+03
     68.81    26.83    0.66     6.6 0.413E+01   0.66     6.06 .11348E+04
     80.13    30.26    0.66     7.1 0.385E+01   0.66     6.91 .14089E+04
     91.45    33.45    0.66     7.6 0.362E+01   0.66     7.75 .17017E+04
    102.76    36.40    0.66     8.0 0.343E+01   0.66     8.59 .20119E+04
    114.08    39.14    0.66     8.4 0.326E+01   0.66     9.41 .23387E+04
 Cumulative travel time =        2338.7129 sec  (    0.65 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
    114.08    39.14    0.66     8.4 0.326E+01   0.66     9.41 .23387E+04
    119.15    40.30    0.66     8.6 0.320E+01   0.53    12.27 .24901E+04
    124.21    41.41    0.66     8.7 0.313E+01   0.47    14.14 .26446E+04
    129.28    42.49    0.66     8.9 0.308E+01   0.44    15.79 .28022E+04
    134.34    43.52    0.66     9.1 0.302E+01   0.41    17.34 .29627E+04
    139.41    44.52    0.66     9.2 0.297E+01   0.39    18.81 .31261E+04
    144.47    45.48    0.66     9.4 0.292E+01   0.38    20.22 .32924E+04
    149.54    46.40    0.66     9.6 0.287E+01   0.37    21.61 .34615E+04
    154.60    47.28    0.66     9.7 0.282E+01   0.35    22.96 .36334E+04
    159.67    48.13    0.66     9.9 0.278E+01   0.34    24.28 .38080E+04
    164.73    48.94    0.66    10.0 0.274E+01   0.34    25.59 .39853E+04
 Cumulative travel time =        3985.3035 sec  (    1.11 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.94 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of    10.0 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.71

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.42    0.66     4.2 0.650E+01   0.66    36.24    0.66    0.00   .39853E+04
 Cumulative travel time =        3985.3035 sec  (    1.11 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 367

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S367U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S367U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--12:14:02
******************************************************************************
SUMMARY OF INPUT DATA:
------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 4.88 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 14.63 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.49 m
  Port/Nozzle diameter          D0      = 0.1524 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.037405 m
  Total area of openings        TA0     = 0.2007 m^2
  Discharge velocity            U0      = 1.49 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.061450 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.083432 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.091775 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.000883 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.000972 m^3/s^3
------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.04 m          Lm  = 73.11 m          LM  = 9.04 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 61.41
  Port/nozzle Froude number     FRD0    = 30.42
  Velocity ratio                R       = 42.15
------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    12.19 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.7681 deg.F
  Dilution at edge of NFR              s = 9.9
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 42.46 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 26.01 m
                          thickness (bv) = 0.34 m
  Cumulative travel time:       4367.8857 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.90 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 367

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S367U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S367U.prd
 Time stamp:        12/21/2025--12:14:02

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     12.19  YB1   =      9.75  YB2   =     14.63
 LD    =      4.88  NOPEN =   11       NRISER=   11       SPAC  =      0.49    NPPERR =    1
 D0    =     0.152 A0    =     0.018 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     1.000 B0    =0.3740E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.493 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.6145E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.8343E-01   j0 =U0*GP0*B0 =0.8834E-03   (based on slot width B0)
 m0 =U0*q0   =0.9177E-01   j0 =q0*GP0    =0.9717E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.041 lM    =     9.04  lm    =     73.11
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.4069E+00  J0    =0.4308E-02
 Associated 3-d length scales (meters)
 LQ    =      0.14  LM    =      7.76  Lm    =     18.88  Lb    =    106.55
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     61.41  FRD0  =     30.42  R     =     42.15  PL    =    1.08
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     1.493 D0    =     0.152 A0    =     0.018 THETA =      0.00
 FR0   =     61.41  FRD0  =     30.42  R     =     42.15
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        12.19 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.03     2.44     1.463   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.03     2.44 .00000E+00
      0.21    -0.13    0.21     1.6 0.167E+02   0.08     2.14 .25813E+00
      0.41    -0.26    0.22     1.9 0.144E+02   0.13     1.92 .59629E+00
      0.62    -0.39    0.23     2.1 0.130E+02   0.20     1.75 .98558E+00
      0.83    -0.52    0.24     2.3 0.120E+02   0.26     1.62 .14157E+01
      1.03    -0.65    0.25     2.4 0.112E+02   0.33     1.51 .18807E+01
      1.24    -0.78    0.26     2.6 0.106E+02   0.40     1.43 .23765E+01
```

```
      1.45    -0.90    0.27     2.7 0.101E+02   0.46     1.37 .29002E+01
      1.65    -1.03    0.28     2.8 0.972E+01   0.53     1.33 .34496E+01
      1.86    -1.16    0.29     2.9 0.936E+01   0.60     1.31 .40228E+01
      2.07    -1.29    0.30     3.0 0.904E+01   0.66     1.30 .46183E+01
 Cumulative travel time =          4.6183 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     2.07    -1.29    0.66     3.0 0.904E+01   0.66     1.46 .46183E+01
    13.45     3.82    0.66     3.9 0.698E+01   0.66     2.39 .15567E+03
    24.84     8.47    0.66     4.7 0.589E+01   0.66     3.31 .34127E+03
    36.23    12.74    0.66     5.3 0.519E+01   0.66     4.20 .55589E+03
    47.61    16.67    0.66     5.8 0.470E+01   0.66     5.08 .79601E+03
    59.00    20.29    0.66     6.3 0.432E+01   0.66     5.95 .10592E+04
    70.39    23.63    0.66     6.8 0.402E+01   0.66     6.80 .13435E+04
    81.77    26.71    0.66     7.3 0.377E+01   0.66     7.64 .16476E+04
    93.16    29.55    0.66     7.7 0.357E+01   0.66     8.47 .19702E+04
   104.55    32.15    0.66     8.1 0.340E+01   0.66     9.29 .23102E+04
   115.93    34.53    0.66     8.4 0.324E+01   0.66    10.10 .26669E+04
 Cumulative travel time =        2666.9043 sec  (    0.74 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
   115.93    34.53    0.66     8.4 0.324E+01   0.66    10.10 .26669E+04
   120.81    35.49    0.66     8.6 0.318E+01   0.53    12.95 .28247E+04
   125.69    36.41    0.66     8.8 0.313E+01   0.48    14.80 .29853E+04
   130.57    37.29    0.66     8.9 0.308E+01   0.45    16.43 .31487E+04
   135.45    38.13    0.66     9.1 0.303E+01   0.42    17.94 .33149E+04
   140.33    38.94    0.66     9.2 0.298E+01   0.40    19.39 .34839E+04
   145.21    39.71    0.66     9.3 0.293E+01   0.39    20.77 .36555E+04
   150.09    40.45    0.66     9.5 0.289E+01   0.37    22.12 .38297E+04
   154.97    41.15    0.66     9.6 0.285E+01   0.36    23.44 .40066E+04
   159.85    41.82    0.66     9.8 0.281E+01   0.35    24.74 .41860E+04
   164.73    42.46    0.66     9.9 0.277E+01   0.34    26.01 .43679E+04
 Cumulative travel time =        4367.8848 sec  (    1.21 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.89 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.9 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.71

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.05    0.66     4.2 0.650E+01   0.66    36.24    0.66    0.00   .43679E+04
 Cumulative travel time =        4367.8857 sec  (    1.21 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 368

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S368U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S368U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--12:10:43
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.96 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.72 m
  Number of openings            NOPEN   = 11
  Number of Risers              NRISER = 11
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.40 m
  Port/Nozzle diameter          D0      = 0.1524 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.046036 m
  Total area of openings        TA0     = 0.2007 m^2
  Discharge velocity            U0      = 1.49 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.075631 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.102685 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.112954 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001087 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001196 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.05 m          Lm  = 89.98 m          LM  = 9.69 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 55.35
  Port/nozzle Froude number     FRD0   = 30.42
  Velocity ratio                R      = 42.15
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.73 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.7926 deg.F
  Dilution at edge of NFR              s = 9.8
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 43.92 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 25.24 m
                          thickness (bv) = 0.35 m
  Cumulative travel time:       4293.1846 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.81 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 368

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S368U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S368U.prd
 Time stamp:        12/21/2025--12:10:43

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.73  YB1   =      9.75  YB2   =     13.72
 LD    =      3.96  NOPEN =   11       NRISER=   11       SPAC  =      0.40    NPPERR =    1
 D0    =     0.152 A0    =     0.018 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.152 CR0   =     1.000 B0    =0.4604E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.493 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7563E-01          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1027E+00   j0 =U0*GP0*B0 =0.1087E-02   (based on slot width B0)
 m0 =U0*q0   =0.1130E+00   j0 =q0*GP0    =0.1196E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.051 lM    =     9.69  lm    =     89.98
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.4069E+00  J0    =0.4308E-02
 Associated 3-d length scales (meters)
 LQ    =      0.14  LM    =      7.76  Lm    =     18.88  Lb    =    106.55
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     55.35  FRD0  =     30.42  R     =     42.15  PL    =    0.82
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =     1.493 D0    =     0.152 A0    =     0.018 THETA =      0.00
 FR0   =     55.35  FRD0  =     30.42  R     =     42.15
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.73 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.04     1.98     1.463   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.04     1.98 .00000E+00
      0.17    -0.10    0.21     1.5 0.178E+02   0.08     1.74 .19738E+00
      0.34    -0.21    0.22     1.8 0.155E+02   0.13     1.56 .44995E+00
      0.50    -0.31    0.23     1.9 0.141E+02   0.20     1.42 .73787E+00
      0.67    -0.42    0.23     2.1 0.131E+02   0.26     1.31 .10541E+01
      0.84    -0.52    0.24     2.2 0.124E+02   0.33     1.22 .13945E+01
      1.01    -0.63    0.25     2.3 0.118E+02   0.40     1.15 .17563E+01
```

```
      1.18    -0.73    0.26     2.4 0.113E+02   0.46     1.11 .21376E+01
      1.34    -0.84    0.26     2.5 0.108E+02   0.53     1.08 .25367E+01
      1.51    -0.94    0.27     2.6 0.104E+02   0.60     1.06 .29525E+01
      1.68    -1.05    0.28     2.7 0.101E+02   0.66     1.05 .33838E+01
 Cumulative travel time =          3.3838 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.68    -1.05    0.66     2.7 0.101E+02   0.66     1.18 .33838E+01
    13.40     4.36    0.66     3.7 0.739E+01   0.66     2.15 .14737E+03
    25.12     9.26    0.66     4.5 0.610E+01   0.66     3.10 .33021E+03
    36.84    13.73    0.66     5.2 0.532E+01   0.66     4.02 .54490E+03
    48.56    17.84    0.66     5.7 0.477E+01   0.66     4.93 .78727E+03
    60.27    21.62    0.66     6.3 0.437E+01   0.66     5.82 .10545E+04
    71.99    25.09    0.66     6.8 0.405E+01   0.66     6.70 .13443E+04
    83.71    28.29    0.66     7.2 0.380E+01   0.66     7.57 .16552E+04
    95.43    31.23    0.66     7.6 0.358E+01   0.66     8.42 .19859E+04
   107.15    33.92    0.66     8.1 0.340E+01   0.66     9.26 .23351E+04
   118.87    36.37    0.66     8.4 0.325E+01   0.66    10.10 .27019E+04
 Cumulative travel time =        2701.9255 sec  (    0.75 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
   118.87    36.37    0.66     8.4 0.325E+01   0.66    10.10 .27019E+04
   123.46    37.27    0.66     8.6 0.319E+01   0.54    12.82 .28501E+04
   128.04    38.14    0.66     8.7 0.314E+01   0.49    14.59 .30008E+04
   132.63    38.97    0.66     8.9 0.309E+01   0.45    16.14 .31541E+04
   137.21    39.77    0.66     9.0 0.304E+01   0.43    17.59 .33097E+04
   141.80    40.54    0.66     9.2 0.299E+01   0.41    18.96 .34678E+04
   146.39    41.28    0.66     9.3 0.295E+01   0.39    20.28 .36283E+04
   150.97    41.98    0.66     9.4 0.291E+01   0.38    21.56 .37911E+04
   155.56    42.66    0.66     9.6 0.287E+01   0.37    22.81 .39562E+04
   160.14    43.30    0.66     9.7 0.283E+01   0.36    24.04 .41236E+04
   164.73    43.92    0.66     9.8 0.279E+01   0.35    25.24 .42932E+04
 Cumulative travel time =        4293.1836 sec  (    1.19 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.90 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.8 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.71

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.51    0.66     4.2 0.650E+01   0.66    36.24    0.66    0.00   .42932E+04
 Cumulative travel time =        4293.1846 sec  (    1.19 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 369

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S369U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S369U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--11:08:10
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.35 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.11 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.67 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.048846 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 1.52 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.089382 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.113580 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.136296 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001178 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001413 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 108.57 m          LM  = 10.16 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 54.87
  Port/nozzle Froude number     FRD0   = 26.83
  Velocity ratio                R      = 43.04
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
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  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.43 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.7802 deg.F
  Dilution at edge of NFR              s = 9.9
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 45.49 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 25.30 m
                          thickness (bv) = 0.34 m
  Cumulative travel time:       4198.3716 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.86 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
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Scenario 369

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S369U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S369U.prd
 Time stamp:        12/21/2025--11:08:10

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035 F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.43  YB1   =      9.75  YB2   =     13.11
 LD    =      3.35  NOPEN =    6       NRISER=    6       SPAC  =      0.67    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.4885E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.525 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.8938E-01         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1136E+00   j0 =U0*GP0*B0 =0.1178E-02   (based on slot width B0)
 m0 =U0*q0   =0.1363E+00   j0 =q0*GP0    =0.1413E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.059 lM    =     10.16  lm    =    108.57
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.3808E+00  J0    =0.3949E-02
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =      7.71  Lm    =     19.08  Lb    =    106.55
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     54.87  FRD0  =     26.83  R     =     43.04  PL    =    1.03
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.525 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =     54.87  FRD0  =     26.83  R     =     43.04
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
       11.43 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.04     1.68     1.495   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
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-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.04     1.68 .00000E+00
     0.14    -0.09    0.21     1.5 0.185E+02   0.07     1.47 .15704E+00
     0.28    -0.18    0.22     1.7 0.164E+02   0.13     1.32 .35455E+00
     0.43    -0.27    0.22     1.8 0.150E+02   0.20     1.20 .57804E+00
     0.57    -0.36    0.23     2.0 0.140E+02   0.26     1.11 .82235E+00
     0.71    -0.44    0.24     2.1 0.133E+02   0.33     1.03 .10845E+01
     0.85    -0.53    0.24     2.2 0.126E+02   0.40     0.97 .13625E+01
```

```
      1.00    -0.62    0.25     2.3 0.121E+02   0.46     0.93 .16548E+01
      1.14    -0.71    0.26     2.4 0.117E+02   0.53     0.91 .19603E+01
      1.28    -0.80    0.26     2.4 0.113E+02   0.60     0.89 .22780E+01
      1.42    -0.89    0.27     2.5 0.109E+02   0.66     0.89 .26073E+01
 Cumulative travel time =          2.6073 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.42    -0.89    0.66     2.5 0.109E+02   0.66     0.99 .26073E+01
    13.04     4.61    0.66     3.6 0.767E+01   0.66     1.96 .13535E+03
    24.66     9.58    0.66     4.4 0.625E+01   0.66     2.91 .30785E+03
    36.28    14.13    0.66     5.1 0.541E+01   0.66     3.83 .51242E+03
    47.90    18.31    0.66     5.7 0.483E+01   0.66     4.74 .74466E+03
    59.52    22.16    0.66     6.2 0.441E+01   0.66     5.62 .10016E+04
    71.14    25.72    0.66     6.7 0.408E+01   0.66     6.50 .12810E+04
    82.76    28.99    0.66     7.2 0.382E+01   0.66     7.36 .15813E+04
    94.38    32.01    0.66     7.6 0.360E+01   0.66     8.22 .19010E+04
   106.00    34.79    0.66     8.0 0.341E+01   0.66     9.06 .22390E+04
   117.63    37.33    0.66     8.4 0.325E+01   0.66     9.89 .25945E+04
 Cumulative travel time =        2594.4958 sec  (    0.72 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
   117.63    37.33    0.66     8.4 0.325E+01   0.66     9.89 .25945E+04
   122.34    38.30    0.66     8.6 0.319E+01   0.53    12.65 .27434E+04
   127.05    39.23    0.66     8.7 0.314E+01   0.48    14.44 .28949E+04
   131.76    40.13    0.66     8.9 0.309E+01   0.45    16.02 .30491E+04
   136.47    41.00    0.66     9.0 0.304E+01   0.42    17.49 .32058E+04
   141.18    41.83    0.66     9.2 0.299E+01   0.40    18.89 .33651E+04
   145.89    42.62    0.66     9.3 0.294E+01   0.39    20.23 .35269E+04
   150.60    43.39    0.66     9.4 0.290E+01   0.37    21.54 .36912E+04
   155.31    44.12    0.66     9.6 0.286E+01   0.36    22.81 .38578E+04
   160.02    44.82    0.66     9.7 0.282E+01   0.35    24.07 .40269E+04
   164.73    45.49    0.66     9.9 0.278E+01   0.34    25.30 .41984E+04
 Cumulative travel time =        4198.3730 sec  (    1.17 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.91 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.9 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.71

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.81    0.66     4.2 0.650E+01   0.66    36.24    0.66    0.00   .41984E+04
 Cumulative travel time =        4198.3716 sec  (    1.17 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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Scenario 369-40

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CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S369-40FU
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S369-40FU.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--12:08:19
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.35 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.11 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.67 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.048846 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 1.52 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 26.22 degC
  Corresponding density         RHO0    = 996.7250 kg/m^3
  Density difference            DRHO    = 3.2500 kg/m^3
  Buoyant acceleration          GP0     = 0.0319 m/s^2
  Discharge concentration       C0      = 40 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.089382 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.113580 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.136296 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.002374 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.002849 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 108.57 m          LM  = 6.37 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 38.65
  Port/nozzle Froude number     FRD0   = 18.90
  Velocity ratio                R      = 43.04
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 2438.40 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.43 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 4.0587 deg.F
  Dilution at edge of NFR              s = 9.9
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 45.49 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 39.44 m
                          thickness (bv) = 0.22 m
  Cumulative travel time:       4198.3730 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.86 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 164.73 m downstream.
  Plume contacts second bank at 164.73 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 369-40

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S369-40FU
 FILE NAME:         T:\...RMIX\Modeling files\Updated Runs\HC S369-40FU.prd
 Time stamp:        12/21/2025--12:08:19

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.43  YB1   =      9.75  YB2   =     13.11
 LD    =      3.35  NOPEN =    6       NRISER=    6       SPAC  =      0.67    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.4885E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.525 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  996.7250  DRHO0 =0.3250E+01  GP0   =0.3187E-01
 C0    =0.4000E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.8938E-01         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1136E+00   j0 =U0*GP0*B0 =0.2374E-02   (based on slot width B0)
 m0 =U0*q0   =0.1363E+00   j0 =q0*GP0    =0.2849E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.059 lM    =     6.37  lm    =    108.57
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.3808E+00  J0    =0.7960E-02
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =      5.43  Lm    =     19.08  Lb    =    214.75
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     38.65  FRD0  =     18.90  R     =     43.04  PL    =    1.31
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.525 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =     38.65  FRD0  =     18.90  R     =     43.04
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.4000E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   2438.40  XMAX  =   2438.40

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.43 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.400E+02   0.04     1.68     1.495   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.400E+02   0.04     1.68 .00000E+00
      0.14    -0.09    0.21     1.5 0.271E+02   0.07     1.47 .15704E+00
      0.28    -0.18    0.22     1.7 0.239E+02   0.13     1.32 .35455E+00
      0.43    -0.27    0.22     1.8 0.219E+02   0.20     1.20 .57804E+00
      0.57    -0.36    0.23     2.0 0.205E+02   0.26     1.11 .82235E+00
      0.71    -0.44    0.24     2.1 0.193E+02   0.33     1.03 .10845E+01
      0.85    -0.53    0.24     2.2 0.184E+02   0.40     0.97 .13625E+01
```

```
      1.00    -0.62    0.25     2.3 0.177E+02   0.46     0.93 .16548E+01
      1.14    -0.71    0.26     2.4 0.170E+02   0.53     0.91 .19603E+01
      1.28    -0.80    0.26     2.4 0.164E+02   0.60     0.89 .22780E+01
      1.42    -0.89    0.27     2.5 0.159E+02   0.66     0.89 .26073E+01
 Cumulative travel time =          2.6073 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.42    -0.89    0.66     2.5 0.159E+02   0.66     0.99 .26073E+01
     3.43    -0.89    0.66     2.7 0.147E+02   0.66     1.16 .22140E+02
     5.43     1.08    0.66     2.9 0.137E+02   0.66     1.33 .43203E+02
     7.44     2.04    0.66     3.1 0.129E+02   0.66     1.50 .65693E+02
     9.45     2.97    0.66     3.3 0.122E+02   0.66     1.67 .89525E+02
    11.45     3.89    0.66     3.4 0.116E+02   0.66     1.83 .11463E+03
    13.46     4.80    0.66     3.6 0.111E+02   0.66     2.00 .14094E+03
    15.47     5.69    0.66     3.8 0.106E+02   0.66     2.16 .16840E+03
    17.47     6.56    0.66     3.9 0.103E+02   0.66     2.33 .19697E+03
    19.48     7.42    0.66     4.0 0.989E+01   0.66     2.49 .22661E+03
    21.49     8.27    0.66     4.2 0.957E+01   0.66     2.65 .25728E+03
 Cumulative travel time =        257.2843 sec  (    0.07 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
    21.49     8.27    0.66     4.2 0.957E+01   0.66     2.65 .25728E+03
    35.81    13.95    0.66     5.0 0.793E+01   0.34     7.29 .50356E+03
    50.14    19.08    0.66     5.8 0.692E+01   0.30    10.94 .79218E+03
    64.46    23.71    0.66     6.4 0.622E+01   0.27    14.49 .11176E+04
    78.78    27.90    0.66     7.0 0.570E+01   0.26    18.02 .14762E+04
    93.11    31.69    0.66     7.6 0.528E+01   0.25    21.55 .18650E+04
   107.43    35.11    0.66     8.1 0.495E+01   0.24    25.09 .22818E+04
   121.76    38.18    0.66     8.6 0.467E+01   0.24    28.65 .27249E+04
   136.08    40.93    0.66     9.0 0.444E+01   0.23    32.23 .31929E+04
   150.41    43.36    0.66     9.4 0.424E+01   0.23    35.82 .36844E+04
   164.73    45.49    0.66     9.9 0.406E+01   0.22    39.44 .41984E+04
 Cumulative travel time =       4198.3726 sec  (    1.17 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.91 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.9 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.50

 An UPSTREAM INTRUDING WEDGE is formed along the surface/pycnocline.

 UPSTREAM WEDGE INTRUSION PROPERTIES in bounded channel (laterally uniform):
        Wedge length                          =      7.80 m
        X-Position of wedge tip               =     156.93 m
        Thickness at discharge (end of NFR)   =      0.24 m
          (Wedge thickness gradually decreases to zero at wedge tip.)

 In this case, the upstream INTRUSION IS VERY LARGE, exceeding 10 times
   the local water depth.
 This may be caused by a very small ambient velocity, perhaps in combination
   with large discharge buoyancy.
 If the ambient conditions are strongly transient (e.g. tidal), then the
   CORMIX steady-state predictions of upstream intrusion are probably
   unrealistic.
 The plume predictions prior to boundary impingement and wedge formation
  will be acceptable, however.

       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.81    0.66     4.2 0.950E+01   0.66    36.24    0.66    0.00   .41984E+04
 Cumulative travel time =       4198.3730 sec  (    1.17 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!
```

Scenario 369-50

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S369-50FU
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S369-50FU.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--12:04:55
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 3.35 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 13.11 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.67 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.048846 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 1.52 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 32.22 degC
  Corresponding density         RHO0    = 994.9541 kg/m^3
  Density difference            DRHO    = 5.0209 kg/m^3
  Buoyant acceleration          GP0     = 0.0492 m/s^2
  Discharge concentration       C0      = 50.800000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.089382 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.113580 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.136296 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.003668 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.004401 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.06 m          Lm  = 108.57 m          LM  = 4.77 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 31.09
  Port/nozzle Froude number     FRD0   = 15.21
  Velocity ratio                R      = 43.04
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 2438.40 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.43 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 5.1546 deg.F
  Dilution at edge of NFR              s = 9.9
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 45.49 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 44.36 m
                           thickness (bv) = 0.20 m
  Cumulative travel time:       4198.3721 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.86 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 164.73 m downstream.
  Plume contacts second bank at 164.73 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

Scenario 369-50

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
               Subsystem CORMIX2: Multiport Diffuser Discharges
                          CORMIX Version 12.0GT
                    HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S369-50FU
 FILE NAME:         T:\...RMIX\Modeling files\Updated Runs\HC S369-50FU.prd
 Time stamp:        12/21/2025--12:04:55

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.43  YB1   =      9.75  YB2   =     13.11
 LD    =      3.35  NOPEN =    6       NRISER=    6       SPAC  =      0.67    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.4885E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.525 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  994.9540  DRHO0 =0.5021E+01  GP0   =0.4924E-01
 C0    =0.5080E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.8938E-01         SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1136E+00   j0 =U0*GP0*B0 =0.3668E-02   (based on slot width B0)
 m0 =U0*q0   =0.1363E+00   j0 =q0*GP0    =0.4401E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.059 lM    =     4.77  lm    =    108.57
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.3808E+00  J0    =0.1230E-01
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =      4.37  Lm    =     19.08  Lb    =    331.77
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     31.09  FRD0  =     15.21  R     =     43.04  PL    =    1.51
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.525 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =     31.09  FRD0  =     15.21  R     =     43.04
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.5080E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   2438.40  XMAX  =   2438.40

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.43 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.508E+02   0.04     1.68     1.495   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.508E+02   0.04     1.68 .00000E+00
      0.14    -0.09    0.21     1.5 0.344E+02   0.07     1.47 .15704E+00
      0.28    -0.18    0.22     1.7 0.303E+02   0.13     1.32 .35455E+00
      0.43    -0.27    0.22     1.8 0.278E+02   0.20     1.20 .57804E+00
      0.57    -0.36    0.23     2.0 0.260E+02   0.26     1.11 .82235E+00
      0.71    -0.44    0.24     2.1 0.246E+02   0.33     1.03 .10845E+01
      0.85    -0.53    0.24     2.2 0.234E+02   0.40     0.97 .13625E+01
```

```
      1.00    -0.62    0.25     2.3 0.224E+02   0.46     0.93 .16548E+01
      1.14    -0.71    0.26     2.4 0.216E+02   0.53     0.91 .19603E+01
      1.28    -0.80    0.26     2.4 0.209E+02   0.60     0.89 .22780E+01
      1.42    -0.89    0.27     2.5 0.202E+02   0.66     0.89 .26073E+01
 Cumulative travel time =           2.6073 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      1.42    -0.89    0.66     2.5 0.202E+02   0.66     0.99 .26073E+01
      1.60    -0.89    0.66     2.5 0.201E+02   0.66     1.01 .43179E+01
      1.79    -0.89    0.66     2.6 0.199E+02   0.66     1.02 .60420E+01
      1.97    -0.89    0.66     2.6 0.198E+02   0.66     1.04 .77797E+01
      2.15    -0.89    0.66     2.6 0.196E+02   0.66     1.05 .95308E+01
      2.33    -0.89    0.66     2.6 0.195E+02   0.66     1.07 .11295E+02
      2.52    -0.89    0.66     2.6 0.193E+02   0.66     1.08 .13073E+02
      2.70    -0.89    0.66     2.6 0.192E+02   0.66     1.10 .14863E+02
      2.88    -0.89    0.66     2.7 0.190E+02   0.66     1.12 .16667E+02
      3.06    -0.89    0.66     2.7 0.189E+02   0.66     1.13 .18484E+02
      3.25    -0.89    0.66     2.7 0.188E+02   0.66     1.15 .20313E+02
 Cumulative travel time =          20.3133 sec  (    0.01 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      3.25    -0.89    0.66     2.7 0.188E+02   0.66     1.15 .20313E+02
     19.40     7.39    0.66     4.0 0.126E+02   0.29     5.72 .22534E+03
     35.54    13.85    0.66     5.0 0.101E+02   0.25     9.80 .49855E+03
     51.69    19.60    0.66     5.9 0.868E+01   0.24    13.92 .82584E+03
     67.84    24.74    0.66     6.6 0.773E+01   0.23    18.10 .11994E+04
     83.99    29.32    0.66     7.2 0.703E+01   0.22    22.35 .16141E+04
    100.14    33.42    0.66     7.8 0.649E+01   0.21    26.66 .20661E+04
    116.29    37.05    0.66     8.4 0.606E+01   0.21    31.02 .25527E+04
    132.43    40.26    0.66     8.9 0.571E+01   0.20    35.42 .30714E+04
    148.58    43.06    0.66     9.4 0.541E+01   0.20    39.87 .36205E+04
    164.73    45.49    0.66     9.9 0.515E+01   0.20    44.36 .41984E+04
 Cumulative travel time =        4198.3726 sec  (    1.17 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.91 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.9 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.40

 An UPSTREAM INTRUDING WEDGE is formed along the surface/pycnocline.

 UPSTREAM WEDGE INTRUSION PROPERTIES in bounded channel (laterally uniform):
        Wedge length                          =      17.96 m
        X-Position of wedge tip               =     146.77 m
        Thickness at discharge (end of NFR)   =       0.30 m
         (Wedge thickness gradually decreases to zero at wedge tip.)

 In this case, the upstream INTRUSION IS VERY LARGE, exceeding 10 times
   the local water depth.
 This may be caused by a very small ambient velocity, perhaps in combination
   with large discharge buoyancy.
 If the ambient conditions are strongly transient (e.g. tidal), then the
   CORMIX steady-state predictions of upstream intrusion are probably
   unrealistic.
 The plume predictions prior to boundary impingement and wedge formation
  will be acceptable, however.

        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -24.81    0.66     4.2 0.121E+02   0.66    36.24    0.66    0.00   .41984E+04
 Cumulative travel time =        4198.3721 sec  (    1.17 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!
```

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

Scenario 370

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CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S370U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S370U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--11:03:51
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.74 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.50 m
  Number of openings            NOPEN   = 6
  Number of Risers              NRISER = 6
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.55 m
  Port/Nozzle diameter          D0      = 0.2042 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.059701 m
  Total area of openings        TA0     = 0.1965 m^2
  Discharge velocity            U0      = 1.52 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.109244 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.138820 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.166584 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001440 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001727 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.07 m          Lm  = 132.70 m          LM  = 10.86 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 49.63
  Port/nozzle Froude number     FRD0   = 26.83
  Velocity ratio                R      = 43.04
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    11.13 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.7967 deg.F
  Dilution at edge of NFR              s = 9.8
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 46.47 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 24.81 m
                           thickness (bv) = 0.35 m
  Cumulative travel time:       4147.6982 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.80 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY ***********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 370

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                     HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S370U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S370U.prd
 Time stamp:        12/21/2025--11:03:51

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     11.13  YB1   =      9.75  YB2   =     12.50
 LD    =      2.74  NOPEN =    6       NRISER=    6       SPAC  =      0.55    NPPERR =    1
 D0    =     0.204 A0    =     0.033 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.204 CR0   =     1.000 B0    =0.5970E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.525 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1092E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1388E+00   j0 =U0*GP0*B0 =0.1440E-02   (based on slot width B0)
 m0 =U0*q0   =0.1666E+00   j0 =q0*GP0    =0.1728E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.072 lM    =     10.86  lm    =    132.70
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.3808E+00  J0    =0.3949E-02
 Associated 3-d length scales (meters)
 LQ    =      0.18  LM    =      7.71  Lm    =     19.08  Lb    =    106.55
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     49.63  FRD0  =     26.83  R     =     43.04  PL    =    0.78
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.525 D0    =      0.204 A0    =      0.033 THETA =      0.00
 FR0   =     49.63  FRD0  =     26.83  R     =     43.04
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        11.13 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.05     1.37     1.495   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.05     1.37 .00000E+00
     0.12    -0.07    0.21     1.4 0.196E+02   0.08     1.20 .12179E+00
     0.23    -0.15    0.21     1.6 0.175E+02   0.13     1.08 .27129E+00
     0.35    -0.22    0.22     1.7 0.162E+02   0.20     0.98 .43863E+00
     0.47    -0.29    0.23     1.8 0.153E+02   0.26     0.90 .62028E+00
     0.58    -0.36    0.23     1.9 0.145E+02   0.33     0.84 .81420E+00
     0.70    -0.44    0.24     2.0 0.139E+02   0.40     0.79 .10190E+01
```

```
      0.81    -0.51    0.24     2.1 0.133E+02   0.46     0.76 .12337E+01
      0.93    -0.58    0.25     2.1 0.129E+02   0.53     0.74 .14576E+01
      1.05    -0.65    0.25     2.2 0.125E+02   0.60     0.73 .16899E+01
      1.16    -0.73    0.26     2.3 0.121E+02   0.66     0.72 .19302E+01
 Cumulative travel time =          1.9302 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.16    -0.73    0.66     2.3 0.121E+02   0.66     0.81 .19302E+01
    13.00     4.99    0.66     3.4 0.802E+01   0.66     1.80 .12860E+03
    24.83    10.13    0.66     4.3 0.641E+01   0.66     2.77 .29857E+03
    36.67    14.81    0.66     5.0 0.550E+01   0.66     3.71 .50270E+03
    48.50    19.11    0.66     5.6 0.489E+01   0.66     4.64 .73602E+03
    60.34    23.07    0.66     6.2 0.445E+01   0.66     5.54 .99524E+03
    72.17    26.71    0.66     6.7 0.410E+01   0.66     6.44 .12780E+04
    84.01    30.07    0.66     7.2 0.383E+01   0.66     7.32 .15825E+04
    95.84    33.16    0.66     7.6 0.361E+01   0.66     8.18 .19072E+04
   107.68    35.99    0.66     8.0 0.342E+01   0.66     9.04 .22510E+04
   119.52    38.58    0.66     8.4 0.325E+01   0.66     9.89 .26129E+04
 Cumulative travel time =        2612.8857 sec  (    0.73 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
   119.52    38.58    0.66     8.4 0.325E+01   0.66     9.89 .26129E+04
   124.04    39.51    0.66     8.6 0.320E+01   0.54    12.57 .27557E+04
   128.56    40.41    0.66     8.7 0.315E+01   0.49    14.30 .29010E+04
   133.08    41.28    0.66     8.9 0.309E+01   0.45    15.84 .30488E+04
   137.60    42.11    0.66     9.0 0.305E+01   0.43    17.26 .31989E+04
   142.12    42.91    0.66     9.1 0.300E+01   0.41    18.61 .33513E+04
   146.64    43.68    0.66     9.3 0.296E+01   0.39    19.91 .35061E+04
   151.17    44.43    0.66     9.4 0.291E+01   0.38    21.17 .36632E+04
   155.69    45.14    0.66     9.5 0.287E+01   0.37    22.41 .38225E+04
   160.21    45.82    0.66     9.7 0.283E+01   0.36    23.62 .39840E+04
   164.73    46.47    0.66     9.8 0.280E+01   0.35    24.81 .41477E+04
 Cumulative travel time =        4147.6968 sec  (    1.15 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.93 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.8 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.71

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.12    0.66     4.2 0.650E+01   0.66    36.24    0.66    0.00   .41477E+04
 Cumulative travel time =        4147.6982 sec  (    1.15 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 371

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S371U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S371U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--11:00:43
*******************************************************************************
SUMMARY OF INPUT DATA:
-------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
-------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.44 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;    YB2 = 12.19 m
  Number of openings            NOPEN   = 4
  Number of Risers              NRISER = 4
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 0.81 m
  Port/Nozzle diameter          D0      = 0.2530 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.061843 m
  Total area of openings        TA0     = 0.2011 m^2
  Discharge velocity            U0      = 1.49 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
-------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.122900 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.137382 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.183177 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001458 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.001943 m^3/s^3
-------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.08 m          Lm  = 145.92 m          LM  = 10.66 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
-------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 47.66
  Port/nozzle Froude number     FRD0    = 23.56
  Velocity ratio                R       = 42.07
-------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
*******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.97 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.8369 deg.F
  Dilution at edge of NFR              s = 9.7
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 46.34 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 27.75 m
                           thickness (bv) = 0.31 m
  Cumulative travel time:       4169.6377 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.66 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY ***********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 371

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S371U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S371U.prd
 Time stamp:        12/21/2025--11:00:43

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.97  YB1   =      9.75  YB2   =     12.19
 LD    =      2.44  NOPEN =    4       NRISER=    4       SPAC  =      0.81    NPPERR =    1
 D0    =     0.253 A0    =     0.050 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.253 CR0   =     1.000 B0    =0.6184E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.490 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1229E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1374E+00   j0 =U0*GP0*B0 =0.1458E-02   (based on slot width B0)
 m0 =U0*q0   =0.1832E+00   j0 =q0*GP0    =0.1943E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.082 lM    =     10.66  lm    =    145.92
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.3350E+00  J0    =0.3554E-02
 Associated 3-d length scales (meters)
 LQ    =      0.22  LM    =      7.39  Lm    =     18.86  Lb    =    106.55
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     47.66  FRD0  =     23.56  R     =     42.07  PL    =    0.94
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.490 D0    =      0.253 A0    =      0.050 THETA =      0.00
 FR0   =     47.66  FRD0  =     23.56  R     =     42.07
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.97 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
-------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
-------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
      0.00     0.00    0.20     1.0 0.274E+02   0.05     1.22     1.460   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
      0.00    -0.00    0.20     1.0 0.274E+02   0.05     1.22 .00000E+00
      0.10    -0.06    0.21     1.3 0.203E+02   0.07     1.07 .10684E+00
      0.21    -0.13    0.21     1.5 0.184E+02   0.13     0.96 .23574E+00
      0.31    -0.19    0.22     1.6 0.171E+02   0.20     0.87 .37886E+00
      0.41    -0.26    0.22     1.7 0.162E+02   0.26     0.80 .53339E+00
      0.52    -0.32    0.23     1.8 0.154E+02   0.33     0.75 .69772E+00
      0.62    -0.39    0.23     1.9 0.148E+02   0.40     0.70 .87075E+00
```

```
      0.72    -0.45    0.24     1.9 0.143E+02   0.46     0.67 .10517E+01
      0.83    -0.52    0.24     2.0 0.138E+02   0.53     0.65 .12399E+01
      0.93    -0.58    0.25     2.0 0.134E+02   0.60     0.64 .14349E+01
      1.03    -0.65    0.25     2.1 0.130E+02   0.66     0.64 .16363E+01
 Cumulative travel time =          1.6363 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     1.03    -0.65    0.66     2.1 0.130E+02   0.66     0.72 .16363E+01
    10.94     4.22    0.66     3.1 0.876E+01   0.66     1.56 .10149E+03
    20.84     8.64    0.66     3.9 0.704E+01   0.66     2.37 .23442E+03
    30.75    12.72    0.66     4.5 0.605E+01   0.66     3.17 .39360E+03
    40.66    16.50    0.66     5.1 0.538E+01   0.66     3.95 .57524E+03
    50.56    20.02    0.66     5.6 0.490E+01   0.66     4.72 .77685E+03
    60.47    23.29    0.66     6.1 0.452E+01   0.66     5.47 .99661E+03
    70.37    26.34    0.66     6.5 0.423E+01   0.66     6.22 .12331E+04
    80.28    29.18    0.66     6.9 0.398E+01   0.66     6.96 .14853E+04
    90.18    31.83    0.66     7.3 0.377E+01   0.66     7.69 .17522E+04
   100.09    34.30    0.66     7.6 0.359E+01   0.66     8.41 .20331E+04
 Cumulative travel time =        2033.1050 sec  (    0.56 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH        TT
   100.09    34.30    0.66     7.6 0.359E+01   0.66     8.41 .20331E+04
   106.55    35.81    0.66     7.9 0.349E+01   0.50    11.72 .22236E+04
   113.02    37.25    0.66     8.1 0.339E+01   0.44    13.91 .24196E+04
   119.48    38.61    0.66     8.3 0.331E+01   0.41    15.88 .26210E+04
   125.95    39.91    0.66     8.5 0.322E+01   0.38    17.72 .28275E+04
   132.41    41.14    0.66     8.7 0.315E+01   0.36    19.49 .30391E+04
   138.87    42.31    0.66     8.9 0.308E+01   0.35    21.20 .32557E+04
   145.34    43.41    0.66     9.1 0.301E+01   0.34    22.88 .34772E+04
   151.80    44.45    0.66     9.3 0.295E+01   0.33    24.52 .37034E+04
   158.27    45.42    0.66     9.5 0.289E+01   0.32    26.15 .39342E+04
   164.73    46.34    0.66     9.7 0.284E+01   0.31    27.75 .41696E+04
 Cumulative travel time =        4169.6387 sec  (    1.16 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.91 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.7 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.71

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
       X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.27    0.66     4.2 0.650E+01   0.66    36.24    0.66    0.00   .41696E+04
 Cumulative travel time =        4169.6377 sec  (    1.16 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
```

Scenario 372

```
CORMIX SESSION REPORT:
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                      CORMIX MIXING ZONE EXPERT SYSTEM
                          CORMIX Version 12.0GT
                       HYDRO2:Version-12.0.1.0  August,2021
SITE NAME/LABEL:                Homer City
  DESIGN CASE:                  HC S372U
  FILE NAME:                    T:\ACTIVE PROJECTS (Team Folder)\HOMER CITY REDEVELOPMENT\Thermal modeling\CORMIX\Modeling
files\Updated Runs\HC S372U.prd
  Using subsystem CORMIX2:     Multiport Diffuser Discharges
  Start of session:             12/21/2025--10:56:12
******************************************************************************
SUMMARY OF INPUT DATA:
------------------------------------------------------------------------------
AMBIENT PARAMETERS:
  Cross-section                         = bounded
  Width                         BS      = 36.24 m
  Channel regularity            ICHREG = 1
  Ambient flowrate              QA      = 0.96 m^3/s
  Average depth                 HA      = 0.75 m
  Depth at discharge            HD      = 0.66 m
  Ambient velocity              UA      = 0.0354 m/s
  Darcy-Weisbach friction factor  F     = 0.0540
    Calculated from Manning's n         = 0.025
  Wind velocity                 UW      = 4.47 m/s
  Stratification Type           STRCND = U
  Surface temperature                   = 4.00 degC
  Bottom temperature                    = 4.00 degC
  Calculated FRESH-WATER DENSITY values:
  Surface density               RHOAS   = 999.9749 kg/m^3
  Bottom density                RHOAB   = 999.9749 kg/m^3
------------------------------------------------------------------------------
DISCHARGE PARAMETERS:           Submerged Multiport Diffuser Discharge
  Diffuser type                 DITYPE = unidirectional perpendicular
  Diffuser length               LD      = 2.13 m
  Nearest bank                          = left
  Diffuser endpoints            YB1     = 9.75 m;     YB2 = 11.89 m
  Number of openings            NOPEN   = 3
  Number of Risers              NRISER = 3
  Ports/Nozzles per Riser       NPPERR  = 1
  Spacing between risers/openings SPAC  = 1.07 m
  Port/Nozzle diameter          D0      = 0.3048 m
    with contraction ratio              = 1
  Equivalent slot width         B0      = 0.068397 m
  Total area of openings        TA0     = 0.2189 m^2
  Discharge velocity            U0      = 1.37 m/s
  Total discharge flowrate      Q0      = 0.299678 m^3/s
  Discharge port height         H0      = 0.20 m
  Nozzle arrangement            BETYPE = unidirectional without fanning
  Diffuser alignment angle      GAMMA   = 90 deg
  Vertical discharge angle      THETA   = 0 deg
  Actual Vertical discharge angle THEAC  = 0 deg
  Horizontal discharge angle    SIGMA   = 328 deg
  Relative orientation angle    BETA    = 58 deg
  Discharge temperature (freshwater)    = 19.22 degC
  Corresponding density         RHO0    = 998.3625 kg/m^3
  Density difference            DRHO    = 1.6125 kg/m^3
  Buoyant acceleration          GP0     = 0.0158 m/s^2
  Discharge concentration       C0      = 27.400000 deg.F
  Surface heat exchange coeff.  KS      = 0.000019 m/s
  Coefficient of decay          KD      = 0 /s
------------------------------------------------------------------------------
FLUX VARIABLES PER UNIT DIFFUSER LENGTH:
  Discharge (volume flux)       q0      = 0.140457 m^2/s
  Momentum flux
      (based on slot width B0)  m0 =U0^2*B0   = 0.128193 m^3/s^2
      (based on volume flux q0) m0 =U0*q0     = 0.192290 m^3/s^2
  Buoyancy flux
      (based on slot width B0)  j0 =U0*GP0*B0 = 0.001481 m^3/s^3
      (based on volume flux q0) j0 =q0*GP0    = 0.002221 m^3/s^3
------------------------------------------------------------------------------
DISCHARGE/ENVIRONMENT LENGTH SCALES:
  LQ  = 0.10 m          Lm  = 153.18 m          LM  = 9.85 m
  lm' = 99999 m          Lb' = 99999 m          La  = 99999 m
  (These refer to the actual discharge/environment length scales.)
------------------------------------------------------------------------------
NON-DIMENSIONAL PARAMETERS:
Slot Froude number              FR0    = 41.63
  Port/nozzle Froude number       FRD0   = 19.72
  Velocity ratio                R       = 38.64
------------------------------------------------------------------------------
MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:
  Toxic discharge                       = no
  Water quality standard specified      = no
  Regulatory mixing zone                = no
  Region of interest                    = 1524 m downstream
******************************************************************************
HYDRODYNAMIC CLASSIFICATION:
  *-------------------------*
  | FLOW CLASS   = MU2 |
```

```
  *-------------------------*
  This flow configuration applies to a layer corresponding to the full water
  depth at the discharge site.
  Applicable layer depth = water depth = 0.66 m

  Limiting Dilution S = (QA/Q0)+ 1.0 = 4.2

*******************************************************************************
MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-------------------------------------------------------------------------------
X-Y-Z Coordinate system:
  Origin is located at the BOTTOM below the port/diffuser center:
    10.82 m from the left bank/shore.
  Number of display steps NSTEP = 10 per module.
-------------------------------------------------------------------------------
NEAR-FIELD REGION (NFR) CONDITIONS :
Note: The NFR is the zone of strong initial mixing.  It has no regulatory
  implication.  However, this information may be useful for the discharge
  designer because the mixing in the NFR is usually sensitive to the
  discharge design conditions.
  Pollutant concentration at NFR edge  c = 2.9681 deg.F
  Dilution at edge of NFR              s = 9.2
  NFR Location:                        x = 164.73 m
    (centerline coordinates)           y = 44.45 m
                                       z = 0.66 m
  NFR plume dimensions:  half-width (bh) = 32.09 m
                           thickness (bv) = 0.26 m
  Cumulative travel time:       4324.0986 sec.

WARNING:
 The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 4.21
 This value is below the computed dilution of 9.23 at the end of the
 Near Field Region (NFR). Mixing for this discharge configuration is
 constrained by the ambient flow.
 Please carefully review the prediction file for additional warnings and information.
-------------------------------------------------------------------------------
Buoyancy assessment:
  The effluent density is less than the surrounding ambient water
  density at the discharge level.
  Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards
  the surface.
-------------------------------------------------------------------------------
Near-field instability behavior:
  The diffuser flow will experience instabilities with full vertical mixing
  in the near-field.
  There may be benthic impact of high pollutant concentrations.
-------------------------------------------------------------------------------
FAR-FIELD MIXING SUMMARY:
  Plume becomes vertically fully mixed WITHIN NEAR-FIELD at 0 m
  downstream, but RE-STRATIFIES LATER and is not mixed in the far-field.
-------------------------------------------------------------------------------
PLUME BANK CONTACT SUMMARY:
  Plume in bounded section contacts nearest bank at 0 m downstream.
  Plume contacts second bank at 0 m downstream.
********************** TOXIC DILUTION ZONE SUMMARY ************************
No TDZ was specified for this simulation.
********************* REGULATORY MIXING ZONE SUMMARY **********************
No RMZ and no ambient water quality standard have been specified.
******************** FINAL DESIGN ADVICE AND COMMENTS **********************
CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent
  the actual three-dimensional diffuser geometry.  Thus, it approximates
  the details of the merging process of the individual jets from each
  port/nozzle.
In the present design, the spacing between adjacent ports/nozzles
  (or riser assemblies) is of the order of, or less than, the local
  water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a
  final CORMIX1 (single port discharge) analysis, with discharge data
  for an individual diffuser jet/plume, in order to compare to
  the present near-field prediction.
-------------------------------------------------------------------------------
REMINDER:  The user must take note that HYDRODYNAMIC MODELING by any known
  technique is NOT AN EXACT SCIENCE.
Extensive comparison with field and laboratory data has shown that the
  CORMIX predictions on dilutions and concentrations (with associated
  plume geometries) are reliable for the majority of cases and are accurate
  to within about +-50% (standard deviation).
As a further safeguard, CORMIX will not give predictions whenever it judges
  the design configuration as highly complex and uncertain for prediction.
```

Scenario 372

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                        CORMIX MIXING ZONE EXPERT SYSTEM
                Subsystem CORMIX2: Multiport Diffuser Discharges
                           CORMIX Version 12.0GT
                      HYDRO2 Version 12.0.1.0 August 2021
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   Homer City
 Design case:       HC S372U
 FILE NAME:         T:\...g\CORMIX\Modeling files\Updated Runs\HC S372U.prd
 Time stamp:        12/21/2025--10:56:12

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =     36.24  AS    =     27.17  QA    =      0.96  ICHREG= 1
 HA    =      0.75  HD    =      0.66
 UA    =     0.035  F     =     0.054 USTAR =0.2910E-02
 UW    =     4.470 UWSTAR=0.5205E-02
 Uniform density environment
 STRCND=  U         RHOAM =  999.9750

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= unidirectional_perpendicular
 BANK  =  LEFT      DISTB =     10.82  YB1   =      9.75  YB2   =     11.89
 LD    =      2.13  NOPEN =    3       NRISER=    3       SPAC  =      1.07    NPPERR =    1
 D0    =     0.305 A0    =     0.073 H0    =      0.20  SUB0  =      0.46
 D0INP =     0.305 CR0   =     1.000 B0    =0.6840E-01
 Nozzle/port arrangement:   unidirectional_without_fanning
 GAMMA =     90.00  THETA =      0.00  SIGMA =    328.00  BETA  =     58.00
 U0    =     1.369 Q0    =     0.300 Q0A   =0.2997E+00
 RHO0  =  998.3625  DRHO0 =0.1612E+01  GP0   =0.1581E-01
 C0    =0.2740E+02  CUNITS=  deg.F
 IPOLL =  3         KS    =0.1863E-04  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1405E+00          SIGNJ0=      1.0
 m0 =U0^2*B0 =0.1282E+00   j0 =U0*GP0*B0 =0.1481E-02   (based on slot width B0)
 m0 =U0*q0   =0.1923E+00   j0 =q0*GP0    =0.2221E-02   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.103 lM    =     9.85  lm    =    153.18
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2997E+00  M0    =0.2735E+00  J0    =0.3159E-02
 Associated 3-d length scales (meters)
 LQ    =      0.27  LM    =      6.73  Lm    =     18.08  Lb    =    106.55
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =     41.63  FRD0  =     19.72  R     =     38.64  PL    =    1.03
 (slot)             (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR RISER GROUPS:
 Properties of riser group with  1 ports/nozzles each:
 U0    =      1.369 D0    =      0.305 A0    =      0.073 THETA =      0.00
 FR0   =     41.63  FRD0  =     19.72  R     =     38.64
 (slot)             (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU2          2
 2  Applicable layer depth HS =     0.66        2
 2  Limiting Dilution S=QA/Q0 + 1=     4.21     2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    =0.2740E+02  CUNITS=  deg.F
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   1524.00  XMAX  =   1524.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        10.82 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP =  10 display intervals per module
------------------------------------------------------------------------------------------------

NOTE on dilution/concentration values for this HEATED DISCHARGE (IPOLL=3):
   S  = hydrodynamic dilutions, include buoyancy (heat) loss effects, but
        provided plume has surface contact
   C  = corresponding temperature values (in "deg.F"!) include heat loss,
        if any
------------------------------------------------------------------------------------------------
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   Uc = Local centerline excess velocity (above ambient)
   TT = Cumulative travel time

       X        Y       Z        S       C       BV       BH       Uc        TT
     0.00     0.00    0.20     1.0 0.274E+02   0.05     1.07     1.339   .00000E+00

END OF MOD201: DIFFUSER DISCHARGE MODULE
------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------
BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

 In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY
  MIXED over the entire layer depth (HS =    0.66m).
   Full mixing is achieved after a plume distance of about five
   layer depths from the diffuser.

 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = top-hat half-width, in horizontal plane normal to trajectory
   S  = hydrodynamic average (bulk) dilution
   C  = average (bulk) concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     0.00    -0.00    0.20     1.0 0.274E+02   0.05     1.07 .00000E+00
     0.09    -0.06    0.21     1.3 0.214E+02   0.08     0.93 .96436E-01
     0.18    -0.11    0.21     1.4 0.197E+02   0.13     0.84 .20967E+00
     0.27    -0.17    0.22     1.5 0.185E+02   0.20     0.76 .33374E+00
     0.36    -0.23    0.22     1.6 0.176E+02   0.26     0.70 .46652E+00
     0.45    -0.28    0.22     1.6 0.169E+02   0.33     0.65 .60678E+00
     0.54    -0.34    0.23     1.7 0.163E+02   0.40     0.62 .75370E+00
```

```
      0.63    -0.40    0.23     1.7 0.158E+02   0.46     0.59 .90666E+00
      0.72    -0.45    0.24     1.8 0.153E+02   0.53     0.57 .10652E+01
      0.81    -0.51    0.24     1.8 0.149E+02   0.60     0.56 .12289E+01
      0.90    -0.57    0.25     1.9 0.146E+02   0.66     0.56 .13975E+01
 Cumulative travel time =          1.3975 sec  (    0.00 hrs)
   Plume centerline may exhibit slight discontinuities in transition
     to subsequent far-field module.

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

 Phase 1: Vertically mixed, Phase 2: Re-stratified

 Phase 1: The diffuser plume is VERTICALLY FULLY MIXED over the
          entire layer depth.
 Profile definitions:
   BV = layer depth (vertically mixed)
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
      0.90    -0.57    0.66     1.9 0.146E+02   0.66     0.63 .13975E+01
      7.58     2.77    0.66     2.6 0.105E+02   0.66     1.19 .64202E+02
     14.25     5.87    0.66     3.2 0.858E+01   0.66     1.75 .14485E+03
     20.93     8.78    0.66     3.7 0.745E+01   0.66     2.29 .24001E+03
     27.60    11.52    0.66     4.1 0.668E+01   0.66     2.83 .34773E+03
     34.27    14.11    0.66     4.5 0.610E+01   0.66     3.36 .46669E+03
     40.95    16.57    0.66     4.8 0.565E+01   0.66     3.88 .59592E+03
     47.62    18.90    0.66     5.2 0.529E+01   0.66     4.40 .73465E+03
     54.29    21.11    0.66     5.5 0.499E+01   0.66     4.91 .88227E+03
     60.97    23.21    0.66     5.8 0.474E+01   0.66     5.41 .10383E+04
     67.64    25.20    0.66     6.1 0.452E+01   0.66     5.91 .12022E+04
 Cumulative travel time =        1202.2477 sec  (    0.33 hrs)
 End of Phase 1:
   The mixed diffuser flow has RESTRATIFIED and is now detached
   from the bottom or surface interface.
-------------------------------------------------------------------------------------------------
 Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

 Profile definitions:
   BV = top-hat thickness, measured vertically
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
   TT = Cumulative travel time

        X        Y       Z        S       C       BV       BH        TT
     67.64    25.20    0.66     6.1 0.452E+01   0.66     5.91 .12022E+04
     77.35    27.93    0.66     6.5 0.425E+01   0.44     9.98 .14542E+04
     87.06    30.45    0.66     6.8 0.402E+01   0.38    12.82 .17213E+04
     96.77    32.78    0.66     7.2 0.382E+01   0.35    15.42 .20027E+04
    106.48    34.93    0.66     7.5 0.366E+01   0.32    17.92 .22977E+04
    116.19    36.92    0.66     7.8 0.351E+01   0.31    20.34 .26057E+04
    125.90    38.73    0.66     8.1 0.338E+01   0.29    22.73 .29262E+04
    135.60    40.38    0.66     8.4 0.326E+01   0.28    25.09 .32586E+04
    145.31    41.89    0.66     8.7 0.315E+01   0.28    27.44 .36027E+04
    155.02    43.24    0.66     9.0 0.306E+01   0.27    29.77 .39580E+04
    164.73    44.45    0.66     9.2 0.297E+01   0.26    32.09 .43241E+04
 Cumulative travel time =        4324.0986 sec  (    1.20 hrs)

END OF MOD251: DIFFUSER PLUME IN CO-FLOW
-------------------------------------------------------------------------------------------------
** End of NEAR-FIELD REGION (NFR) **

 Bank nearest to plume centerline has changed.
   Nearest bank is now on RIGHT.

 The initial plume WIDTH values in the next far-field module will be
  CORRECTED by a factor  1.88 to conserve the mass flux in the far-field!
 The correction factor is quite large because of the small ambient velocity
   relative to the strong mixing characteristics of the discharge!
   This indicates localized RECIRCULATION REGIONS and INTERNAL HYDRAULIC JUMPS.
   Width predictions show discontinuities. Dilution values should be acceptable.

 The LIMITING DILUTION (given by ambient flow/discharge ratio) is:     4.2
   This value is LESS than the predicted dilution of     9.2 at the end
   of the NFR.
   Mixing for this discharge configuration is constrained by the ambient flow.

 The previous module predictions MAYBE UNRELIABLE since the limiting dilution
   cannot be exceeded for this unstable shallow discharge configuration.
 CAREFULLY evalute the degree of near-field lateral boundary interaction.

 A subsequent module (MOD281) will predict the properties of the
   cross-sectionally fully mixed plume with limiting dilution and will
   compute a POSSIBLE UPSTREAM WEDGE INTRUSION.
 Bottom coordinate for FAR-FIELD is determined by average depth, ZFB = -0.09m
-------------------------------------------------------------------------------------------------
BEGIN MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION

 The DOWNSTREAM flow field for this unstable shallow water discharge is
     VERTICALLY FULLY MIXED.
 The mixing is controlled by the limiting dilution =      4.2

 Channel DENSIMETRIC FROUDE NUMBER (FCHAN) for this mixed flow =     0.71

 No upstream wedge intrusion takes place since FCHAN exceeds the critical
   value of 0.7.
        X        Y       Z        S       C       BV       BH      ZU      ZL       TT
    164.73   -25.42    0.66     4.2 0.650E+01   0.66    36.24    0.66    0.00   .43241E+04
 Cumulative travel time =        4324.0986 sec  (    1.20 hrs)

 VERTICALLY AND LATERALLY FULLY MIXED over layer depth: END OF SIMULATION!

END OF MOD281: MIXED PLUME/BOUNDED CHANNEL/POSSIBLE UPSTREAM WEDGE INTRUSION
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
CORMIX2: Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
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APPENDIX B – TABLE WITH SUMMARY CORMIX OUTPUT VALUES

Table B-2

Table B-2: Outfall 027 - CORMIX Results

Scenario Number	Configuration	Flow Rate	Discharge Temperature Excess	Ambient Temperature	Effluent Temperature	Uamax	U0	X	Y	Z	TT		Diffuser Length	LD1	LD2	Port Diameter	Total Number of Openings	Excess Temperature at Distance (X)
		MGD	°F	°F	°F	fps	fps	ft	ft	ft	s		ft	ft	ft	ft	ft	°F
C301	C1	405	5.8	73.9	79.7	0.11	0.5	6.1	-3.8	19.0	36		16	32	48	0.50	11	1
C301	C1	405	5.8	73.9	79.7	0.11	0.5	0.7	-0.4	0.7	3		16	32	48	0.50	11	3
C302	C2	405	5.8	73.9	79.7	0.11	0.5	23.2	-3.4	2.2	179		13	32	45	0.50	11	1
C302	C2	405	5.8	73.9	79.7	0.11	0.5	0.6	0.3	0.7	2		13	32	45	0.50	11	3
C303	C3	405	5.8	73.9	79.7	0.11	0.5	30.1	-2.9	2.2	238		11	32	43	0.67	6	1
C303	C3	405	5.8	73.9	79.7	0.11	0.5	0.5	-0.3	0.7	2		11	32	43	0.67	6	3
C304	C4	405	5.8	73.9	79.7	0.11	0.5	44.5	-2.4	2.2	359		9	32	41	0.67	6	1
C304	C4	405	5.8	73.9	79.7	0.11	0.5	0.8	-0.5	0.7	3		9	32	41	0.67	6	3
C304	C4	405	5.8	73.9	79.7	0.11	0.5	0.4	-0.2	0.7	1		9	32	41	0.67	6	5
C305	C5	405	5.8	73.9	79.7	0.11	0.5	51.2	-2.1	2.2	416		8	32	40	0.83	4	1
C305	C5	405	5.8	73.9	79.7	0.11	0.5	0.7	-0.4	0.7	2		8	32	40	0.83	4	3
C305	C5	405	5.8	73.9	79.7	0.11	0.5	0.3	-0.2	0.7	1		8	32	40	0.83	4	5
C306	C6	405	5.8	73.9	79.7	0.11	4.5	65.5	-1.9	2.2	537		7	32	39	1.00	3	1
C306	C6	405	5.8	73.9	79.7	0.11	4.5	0.6	-0.4	0.7	2		7	32	39	1.00	3	3
C306	C6	405	5.8	73.9	79.7	0.11	4.5	0.3	-0.2	0.7	1		7	32	39	1.00	3	5
C307	C1	405	5.8	73.9	79.7	0.11	4.2	6.8	-4.2	1.0	43		16	32	48	0.50	11	1
C307	C1	405	5.8	73.9	79.7	0.11	4.2	0.7	-0.4	0.7	3		16	32	48	0.50	11	3
C308	C2	405	5.8	73.9	79.7	0.11	4.2	23.4	-3.4	2.2	182		13	32	45	0.50	11	1
C308	C2	405	5.8	73.9	79.7	0.11	4.2	0.6	-0.3	0.7	2		13	32	45	0.50	11	3
C309	C3	405	5.8	73.9	79.7	0.11	4.3	30.3	-2.9	2.2	241		11	32	43	0.67	6	1
C309	C3	405	5.8	73.9	79.7	0.11	4.3	0.5	-0.3	0.7	2		11	32	43	0.67	6	3
C310	C4	405	5.8	73.9	79.7	0.11	4.3	52.9	-2.4	2.2	431		9	32	41	0.67	6	1
C310	C4	405	5.8	73.9	79.7	0.11	4.3	0.8	-0.5	0.7	2		9	32	41	0.67	6	3
C310	C4	405	5.8	73.9	79.7	0.11	4.3	0.4	-0.2	0.7	1		9	32	41	0.67	6	5
C311	C5	405	5.8	73.9	79.7	0.11	4.2	59.4	-2.1	2.2	487		8	32	40	0.83	4	1
C311	C5	405	5.8	73.9	79.7	0.11	4.2	0.7	-0.4	0.7	3		8	32	40	0.83	4	3
C311	C5	405	5.8	73.9	79.7	0.11	4.2	0.3	-0.2	0.7	1		8	32	40	0.83	4	5
C312	C6	405	5.8	73.9	79.7	0.11	0.4	65.7	-1.9	2.2	540		7	32	39	1.00	3	1
C312	C6	405	5.8	73.9	79.7	0.11	0.4	0.9	-0.6	0.7	4		7	32	39	1.00	3	3
C312	C6	405	5.8	73.9	79.7	0.11	0.4	0.3	-0.2	0.7	1		7	32	39	1.00	3	5
C313	C1	4000	5.8	73.9	79.7	0.11	4.9	166.9	54.5	2.2	954		16	32	48	0.50	11	1
C313	C1	4000	5.8	73.9	79.7	0.11	4.9	1.3	-0.9	0.7	1		16	32	48	0.50	11	3
C313	C1	4000	5.8	73.9	79.7	0.11	4.9	0.7	-0.4	0.7	0		16	32	48	0.50	11	5
C314	C2	4000	5.8	73.9	79.7	0.11	4.9	166.0	57.2	2.2	922		13	32	45	0.50	11	1
C314	C2	4000	5.8	73.9	79.7	0.11	4.9	1.6	-1.0	0.8	1		13	32	45	0.50	11	3
C314	C2	4000	5.8	73.9	79.7	0.11	4.9	0.6	-0.3	0.7	0		13	32	45	0.50	11	5
C315	C3	4000	5.8	73.9	79.7	0.11	5.0	165.3	59.5	2.2	875		11	32	43	0.67	6	1
C315	C3	4000	5.8	73.9	79.7	0.11	5.0	1.4	-0.9	0.7	1		11	32	43	0.67	6	3
C315	C3	4000	5.8	73.9	79.7	0.11	5.0	0.5	-0.3	0.7	0		11	32	43	0.67	6	5
C316	C4	4000	5.8	73.9	79.7	0.11	5.0	164.8	61.4	2.2	847		9	32	41	0.67	6	1
C316	C4	4000	5.8	73.9	79.7	0.11	5.0	1.9	-1.2	0.8	1		9	32	41	0.67	6	3
C316	C4	4000	5.8	73.9	79.7	0.11	5.0	0.4	-0.2	0.7	0		9	32	41	0.67	6	5
C317	C5	4000	5.8	73.9	79.7	0.11	4.8	194.0	62.0	2.2	842		8	32	40	0.83	4	1
C317	C5	4000	5.8	73.9	79.7	0.11	4.8	2.0	-1.3	0.8	1		8	32	40	0.83	4	3
C317	C5	4000	5.8	73.9	79.7	0.11	4.8	0.3	-0.2	0.7	0		8	32	40	0.83	4	5
C318	C6	4000	5.8	73.9	79.7	0.11	4.4	217.9	76.6	2.2	1248		7	32	39	1.00	3	1
C318	C6	4000	5.8	73.9	79.7	0.11	4.4	2.4	-1.5	0.8	1		7	32	39	1.00	3	3

Table B-2

C318	C6	4000	5.8	73.9	79.7	0.11	4.4	0.3	-0.2	0.7	0		7	32	39	1.00	3	5
C319	C1	4000	5.8	73.9	79.7	0.11	4.1	166.9	50.9	2.2	1037		16	32	48	0.50	11	1
C319	C1	4000	5.8	73.9	79.7	0.11	4.1	2.0	-1.3	0.8	1		16	32	48	0.50	11	3
C319	C1	4000	5.8	73.9	79.7	0.11	4.1	0.7	-0.4	0.7	0		16	32	48	0.50	11	5
C320	C2	4000	5.8	73.9	79.7	0.11	4.1	166.0	53.8	2.2	992		13	32	45	0.50	11	1
C320	C2	4000	5.8	73.9	79.7	0.11	4.1	1.6	-1.0	0.8	1		13	32	45	0.50	11	3
C320	C2	4000	5.8	73.9	79.7	0.11	4.1	0.6	-0.3	0.7	0		13	32	45	0.50	11	5
C321	C3	4000	5.8	73.9	79.7	0.11	4.2	165.3	56.3	2.2	951		11	32	43	0.67	6	1
C321	C3	4000	5.8	73.9	79.7	0.11	4.2	1.9	-1.2	0.8	1		11	32	43	0.67	6	3
C321	C3	4000	5.8	73.9	79.7	0.11	4.2	0.5	-0.3	0.7	0		11	32	43	0.67	6	5
C322	C4	4000	5.8	73.9	79.7	0.11	4.2	218.4	72.7	2.2	1359		9	32	41	0.67	6	1
C322	C4	4000	5.8	73.9	79.7	0.11	4.2	2.3	-1.4	0.8	1		9	32	41	0.67	6	3
C322	C4	4000	5.8	73.9	79.7	0.11	4.2	0.4	-0.2	0.7	0		9	32	41	0.67	6	5
C323	C5	4000	5.8	73.9	79.7	0.11	4.1	218.2	73.2	2.2	1356		8	32	40	0.83	4	1
C323	C5	4000	5.8	73.9	79.7	0.11	4.1	2.7	-1.7	0.8	1		8	32	40	0.83	4	3
C323	C5	4000	5.8	73.9	79.7	0.11	4.1	0.3	-0.2	0.7	0		8	32	40	0.83	4	5
C324	C6	4000	5.8	73.9	79.7	0.11	3.8	223.8	73.2	2.2	1448		7	32	39	1.00	3	1
C324	C6	4000	5.8	73.9	79.7	0.11	3.8	47.1	18.2	2.2	175		7	32	39	1.00	3	3
C324	C6	4000	5.8	73.9	79.7	0.11	3.8	0.3	-0.2	0.7	0		7	32	39	1.00	3	5
C325	C1	4750	5.8	73.9	79.7	0.11	5.8	166.9	61.2	2.2	799		16	32	48	0.50	11	1
C325	C1	4750	5.8	73.9	79.7	0.11	5.8	1.3	-0.9	0.7	1		16	32	48	0.50	11	3
C325	C1	4750	5.8	73.9	79.7	0.11	5.8	0.7	-0.4	0.7	0		16	32	48	0.50	11	5
C326	C2	4750	5.8	73.9	79.7	0.11	5.8	166.0	63.6	2.2	766		13	32	45	0.50	11	1
C326	C2	4750	5.8	73.9	79.7	0.11	5.8	1.6	-1.0	0.8	1		13	32	45	0.50	11	3
C326	C2	4750	5.8	73.9	79.7	0.11	5.7	0.6	-0.3	0.7	0		13	32	45	0.50	11	5
C326	C2	4750	5.8	73.9	79.7	0.11	5.8	1.6	-1.0	0.8	1		13	32	45	0.50	11	3
C326	C2	4750	5.8	73.9	79.7	0.11	5.7	0.6	-0.3	0.7	0		13	32	45	0.50	11	5
C327	C3	4750	5.8	73.9	79.7	0.11	5.9	165.3	65.6	2.2	735		11	32	43	0.67	6	1
C327	C3	4750	5.8	73.9	79.7	0.11	5.9	1.4	-0.9	0.7	1		11	32	43	0.67	6	3
C327	C3	4750	5.8	73.9	79.7	0.11	5.9	0.5	-0.3	0.7	0		11	32	43	0.67	6	5
C328	C4	4750	5.8	73.9	79.7	0.11	5.9	164.8	67.3	2.2	711		9	32	41	0.67	6	1
C328	C4	4750	5.8	73.9	79.7	0.11	5.9	1.9	-1.2	0.8	1		9	32	41	0.67	6	3
C328	C4	4750	5.8	73.9	79.7	0.11	5.9	0.4	-0.2	0.8	0		9	32	41	0.67	6	5
C329	C5	4750	5.8	73.9	79.7	0.11	5.7	164.5	67.8	2.2	707		8	32	40	0.83	4	1
C329	C5	4750	5.8	73.9	79.7	0.11	5.7	2.0	-1.3	0.8	1		8	32	40	0.83	4	3
C329	C5	4750	5.8	73.9	79.7	0.11	5.7	0.3	-0.2	0.7	0		8	32	40	0.83	4	5
C330	C6	4750	5.8	73.9	79.7	0.11	5.3	217.9	85.5	2.2	1080		7	32	39	1.00	3	1
C330	C6	4750	5.8	73.9	79.7	0.11	5.3	2.7	-1.7	0.8	1		7	32	39	1.00	3	3
C330	C6	4750	5.8	73.9	79.7	0.11	5.3	0.3	-0.2	0.7	0		7	32	39	1.00	3	5
C331	C1	4750	5.8	73.9	79.7	0.11	4.9	166.9	58.2	2.2	869		16	32	48	0.50	11	1
C331	C1	4750	5.8	73.9	79.7	0.11	4.9	2.0	-1.3	0.8	1		16	32	48	0.50	11	3
C331	C1	4750	5.8	73.9	79.7	0.11	4.9	0.7	-0.4	0.7	0		16	32	48	0.50	11	5
C332	C2	4750	5.8	73.9	79.7	0.11	4.9	166.0	60.7	2.2	832		13	32	45	0.50	11	1
C332	C2	4750	5.8	73.9	79.7	0.11	4.9	1.6	-1.0	0.8	1		13	32	45	0.50	11	3
C332	C2	4750	5.8	73.9	79.7	0.11	4.9	0.6	-0.3	0.7	0		13	32	45	0.50	11	5
C333	C3	4750	5.8	73.9	79.7	0.11	5.0	218.9	80.0	2.2	1173		11	32	43	0.67	6	1
C333	C3	4750	5.8	73.9	79.7	0.11	5.0	1.9	-1.2	0.8	1		11	32	43	0.67	6	3
C333	C3	4750	5.8	73.9	79.7	0.11	5.0	0.5	-0.3	0.7	0		11	32	43	0.67	6	5
C334	C4	4750	5.8	73.9	79.7	0.11	5.0	218.4	82.1	2.2	1141		9	32	41	0.67	6	1
C334	C4	4750	5.8	73.9	79.7	0.11	5.0	2.3	-1.4	0.8	1		9	32	41	0.67	6	3
C334	C4	4750	5.8	73.9	79.7	0.11	5.0	0.4	-0.2	0.7	0		9	32	41	0.67	6	5
C335	C5	4750	5.8	73.9	79.7	0.11	4.9	218.2	82.6	2.2	1139		8	32	40	0.83	4	1
C335	C5	4750	5.8	73.9	79.7	0.11	4.9	2.7	-1.7	0.8	1		8	32	40	0.83	4	3

Table B-2

C335	C5	4750	5.8	73.9	79.7	0.11	4.9	0.3	-0.2	0.7	0		8	32	40	0.83	4	5
C336	C6	4750	5.8	73.9	79.7	0.11	4.5	217.9	81.5	2.2	1172		7	32	39	1.00	3	1
C336	C6	4750	5.8	73.9	79.7	0.11	4.5	56.7	23.7	2.2	186		7	32	39	1.00	3	3
C336	C6	4750	5.8	73.9	79.7	0.11	4.5	0.3	-0.2	0.7	0		7	32	39	1.00	3	5
C337	C1	405	27.4	39.2	66.6	0.11	0.5	5.4	-3.4	0.9	31		16	32	48	0.50	11	5
C338	C2	405	27.4	39.2	66.6	0.11	0.5	11.8	-3.4	2.2	84		13	32	45	0.50	11	5
C339	C3	405	27.4	39.2	66.6	0.11	0.5	16.8	-2.9	2.2	126		11	32	43	0.67	6	5
C340	C4	405	27.4	39.2	66.6	0.11	0.5	32.9	-2.4	2.2	262		9	32	41	0.67	6	5
C341	C5	405	27.4	39.2	66.6	0.11	0.5	43.2	-2.1	2.2	350		8	32	40	0.83	4	5
C342	C6	405	27.4	39.2	66.6	0.11	0.4	53.2	-1.9	2.2	434		7	32	39	1.00	3	5
C343	C1	405	27.4	39.2	66.6	0.11	0.4	16.8	-3.8	1.0	38		16	32	48	0.50	11	5
C344	C2	405	27.4	39.2	66.6	0.11	0.4	32.9	-3.4	2.2	86		13	32	45	0.50	11	5
C345	C3	405	27.4	39.2	66.6	0.11	0.4	23.0	-2.9	2.2	179		11	32	43	0.67	6	5
C346	C4	405	27.4	39.2	66.6	0.11	0.4	38.9	-2.4	2.2	313		9	32	41	0.67	6	5
C347	C5	405	27.4	39.2	66.6	0.11	0.4	43.4	-2.1	2.2	352		8	32	40	0.83	4	5
C348	C6	405	27.4	39.2	66.6	0.11	0.4	59.0	-1.9	2.2	484		7	32	39	1.00	3	5
C349	C1	4000	27.4	39.2	66.6	0.11	4.9	124.9	41.4	2.2	651		16	32	48	0.50	11	5
C350	C2	4000	27.4	39.2	66.6	0.11	4.9	128.0	45.2	2.2	646		13	32	45	0.50	11	5
C351	C3	4000	27.4	39.2	66.6	0.11	5.0	126.7	46.9	2.2	611		11	32	43	0.67	6	5
C352	C4	4000	27.4	39.2	66.6	0.11	5.0	128.7	49.4	2.2	604		9	32	41	0.67	6	5
C353	C5	4000	27.4	39.2	66.6	0.11	4.8	133.9	51.9	2.2	634		8	32	40	0.83	4	5
C354	C6	4000	27.4	39.2	66.6	0.11	4.4	160.3	60.2	2.2	835		7	32	39	1.00	3	5
C355	C1	4000	27.4	39.2	66.6	0.11	4.1	134.1	41.7	2.2	777		16	32	48	0.50	11	5
C356	C2	4000	27.4	39.2	66.6	0.11	4.1	141.8	46.9	2.2	804		13	32	45	0.50	11	5
C357	C3	4000	27.4	39.2	66.6	0.11	4.2	156.9	54.7	2.2	909		11	32	43	0.67	6	5
C358	C4	4000	27.4	39.2	66.6	0.11	4.2	165.6	58.5	2.2	926		9	32	41	0.67	6	5
C359	C5	4000	27.4	39.2	66.6	0.11	4.1	191.8	66.5	2.2	1132		8	32	40	0.83	4	5
C360	C6	4000	27.4	39.2	66.6	0.11	3.8	189.0	64.8	2.2	1141		7	32	39	1.00	3	5
C361	C1	4750	27.4	39.2	66.6	0.11	9.0	60.1	21.9	2.2	169		16	32	48	0.50	11	5
C362	C2	4750	27.4	39.2	66.6	0.11	5.8	166.0	63.6	2.2	766		13	32	45	0.50	11	5
C363	C3	4750	27.4	39.2	66.6	0.11	4.5	178.1	69.2	2.2	882		11	32	43	0.67	6	5
C364	C4	4750	27.4	39.2	66.6	0.11	5.9	164.8	67.3	2.2	711		9	32	41	0.67	6	5
C365	C5	4750	27.4	39.2	66.6	0.11	5.7	164.5	67.8	2.2	707		8	32	40	0.83	4	5
C366	C6	4750	27.4	39.2	66.6	0.11	5.3	151.5	62.8	2.2	648		7	32	39	1.00	3	5
C367	C1	4750	27.4	39.2	66.6	0.11	4.9	156.2	54.7	2.2	796		16	32	48	0.50	11	5
C368	C2	4750	27.4	39.2	66.6	0.11	4.9	159.3	58.5	2.2	787		13	32	45	0.50	11	5
C369	C3	4750	27.4	39.2	66.6	0.11	5.0	157.1	60.1	2.2	745		11	32	43	0.67	6	5
C370	C4	4750	27.4	39.2	66.6	0.11	5.0	159.1	62.7	2.2	736		9	32	41	0.67	6	5
C371	C5	4750	27.4	39.2	66.6	0.11	4.9	165.8	65.7	2.2	777		8	32	40	0.83	4	5
C372	C6	4750	27.4	39.2	66.6	0.11	4.5	178.1	69.2	2.2	882		7	32	39	1.00	3	5

C369-40F	C3	4750	40	39.2	79.2	0.11	5.0	352.4	115.2	2.2	2282		11	32	43	0.67	6	5
C369-50F	C3	4750	50.8	39.2	90	0.11	5.0	540.3	-81.4	2.2	4198		11	32	43	0.67	6	5

This table summarizes key output information in conventional units.

APPENDIX C – PADEP THERMAL LIMITS SPREADSHEET

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Thermal Limits Spreadsheet
Version 1.0, April 2024

Instructions | Inputs

Facility: Homer City Generating Station
Permit No.: PA0005037
Stream Name: Blacklick Creek
Analyst/Engineer: Radhika de Silva
Stream Q7-10 (cfs)*: 34.0
Outfall No.: 027
Analysis Type*: TSF

	Facility Flows				Stream Flows				Temperature
Semi-Monthly Increment	Intake (Stream) (MGD)*	Intake (External) (MGD)*	Consumptive Loss (MGD)*	Discharge Flow (MGD)	Q7-10 Multipliers (Default Shown)	PMF	Seasonal Stream Flow (cfs)	Downstream Stream Flow (cfs)	Ambient Stream Temperature (°F)*
Jan 1-31		36	29.16	6.84	3.2	1.00	108.80	119.38	35
Feb 1-29		36	29.16	6.84	3.5	1.00	119.00	129.58	35
Mar 1-31		36	29.16	6.84	7	1.00	238.00	248.58	40
Apr 1-15		36	29.16	6.84	9.3	1.00	316.20	326.78	47
Apr 16-30		36	29.16	6.84	9.3	1.00	316.20	326.78	53
May 1-15		36	29.16	6.84	5.1	1.00	173.40	183.98	58
May 16-31		36	29.16	6.84	5.1	1.00	173.40	183.98	62
Jun 1-15		36	29.16	6.84	3	1.00	102.00	112.58	67
Jun 16-30		36	29.16	6.84	3	1.00	102.00	112.58	71
Jul 1-31		36	29.16	6.84	1.7	1.00	57.80	68.38	75
Aug 1-15		36	29.16	6.84	1.4	1.00	47.60	58.18	74
Aug 16-31		36	29.16	6.84	1.4	1.00	47.60	58.18	74
Sep 1-15		36	29.16	6.84	1.1	1.00	37.40	47.98	71
Sep 16-30		36	29.16	6.84	1.1	1.00	37.40	47.98	65
Oct 1-15		36	29.16	6.84	1.2	1.00	40.80	51.38	60
Oct 16-31		36	29.16	6.84	1.2	1.00	40.80	51.38	54
Nov 1-15		36	29.16	6.84	1.6	1.00	54.40	64.98	48
Nov 16-30		36	29.16	6.84	1.6	1.00	54.40	64.98	42
Dec 1-31		36	29.16	6.84	2.4	1.00	81.60	92.18	37

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

Thermal Limits Spreadsheet
Version 1.0, April 2024

Instructions | *TSF Results*

Recommended Limits for Case 1 or Case 2

Semi-Monthly Increment	**TSF** Target Maximum Stream Temp. (°F)	**Case 1** Daily WLA (Million BTUs/day)	**Case 2** Daily WLA (°F)
Jan 1-31	40	N/A -- Case 2	91.4
Feb 1-29	40	N/A -- Case 2	96.2
Mar 1-31	46	N/A -- Case 2	110.0
Apr 1-15	52	N/A -- Case 2	110.0
Apr 16-30	58	N/A -- Case 2	110.0
May 1-15	64	N/A -- Case 2	110.0
May 16-31	68	N/A -- Case 2	110.0
Jun 1-15	70	N/A -- Case 2	98.9
Jun 16-30	72	N/A -- Case 2	81.6
Jul 1-31	76	N/A -- Case 2	81.5
Aug 1-15	80	N/A -- Case 2	107.0
Aug 16-31	87	N/A -- Case 2	110.0
Sep 1-15	84	N/A -- Case 2	110.0
Sep 16-30	78	N/A -- Case 2	110.0
Oct 1-15	72	N/A -- Case 2	110.0
Oct 16-31	66	N/A -- Case 2	110.0
Nov 1-15	58	N/A -- Case 2	109.4
Nov 16-30	50	N/A -- Case 2	91.1
Dec 1-31	42	N/A -- Case 2	80.6

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

Thermal Limits Spreadsheet
Version 1.0, April 2024

Instructions | Inputs | Reference

Semi-Monthly Increment	WWF Criteria (°F)	CWF Criteria (°F)	TSF Criteria (°F)
Jan 1-31	40	38	40
Feb 1-29	40	38	40
Mar 1-31	46	42	46
Apr 1-15	52	48	52
Apr 16-30	58	52	58
May 1-15	64	54	64
May 16-31	72	58	68
Jun 1-15	80	60	70
Jun 16-30	84	64	72
Jul 1-31	87	66	74
Aug 1-15	87	66	80
Aug 16-31	87	66	87
Sep 1-15	84	64	84
Sep 16-30	78	60	78
Oct 1-15	72	54	72
Oct 16-31	66	50	66
Nov 1-15	58	46	58
Nov 16-30	50	42	50
Dec 1-31	42	40	42

Q7-10 Multipliers (Default Values)
3.2
3.5
7
9.3
9.3
5.1
5.1
3
3
1.7
1.4
1.4
1.1
1.1
1.2
1.2
1.6
1.6
2.4

Default Ambient Stream Temperature (°F)		
WWF	CWF	TSF
35	34	34
35	35	35
40	39	39
47	46	46
53	52	52
58	55	56
62	59	60
67	63	65
71	67	69
75	71	73
74	70	72
74	70	70
71	66	68
65	60	62
60	55	57
54	51	53
48	46	47
42	40	41
37	35	36

NOTES:
WWF= Warm water fishes
CWF= Cold water fishes
TSF= Trout stocking
Default PMF = 1

APPENDIX D - PLANING FOR INCREASING DISCHARGE VIA OUTFALL 027

HOMER CITY GENERATING STATION REDEVELOPMENT
PLANING FOR INCREASING DISCHARGE VIA OUTFALL 027

Prepared for:
Homer City Generation LP

Prepared by:

ASA Analysis & Communication, Inc.
4052 Diane Way
Doylestown, PA 18902

Date
February 2026

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EXECUTIVE SUMMARY

Homer City Generating Station (HCGS) withdraws cooling tower makeup and service water from Two Lick and discharges cooling tower blowdown back to Two Lick Creek via Outfall 001. Some other discharges are routed to Outfall 027 at the confluence of Two Lick Creek and Blacklick Creek. All these discharges are authorized under the National Pollutant Discharge Elimination System (NPDES) permit PA0005037. Homer City Generation LP, is contemplating routing more of its discharge (up to 4,750 gpm) to an enlarged Outfall 027 following the facility modernization.

This report evaluates potential alternative outfall configurations for Outfall 027 that would provide sufficient mixing to meet thermal and water quality criteria, and would also be constructable, operable and permittable. The report provides overviews of several outfall alternatives, then short-lists the more promising ones for more detailed assessments. The shortlisted outfall configurations and their relative merits are presented in Table E-1.

Table E-1: Characteristics of Shortlisted Outfall Configurations

Outfall Option	Description
A	Shoreline submerged discharge near current Outfall 027 to Blacklick Creek with headwall and open pipe
B	Shoreline submerged discharge near current Outfall 027 to Blacklick Creek with headwall and duckbill nozzle
G	In-stream discharge to Blacklick Creek with duckbill nozzle
H	Enlarging Outfall 001 on Two Lick Creek
I	Shoreline discharge near current Outfall 027 to Blacklick Creek with headwall and open pipe

The short-listed designs selected here will be modeled usil

ng CORMIX to assist in the selection of a final Outfall 027 design.

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1. PURPOSE

The purpose of this report is to evaluate Outfall 027 configurations and select the configuration that would provide sufficient mixing, and would also be constructible, operable, and permittable.

2. HOMER CITY GENERATING STATION

Homer City Generating Station (HCGS) withdraws cooling tower makeup and service water from Two Lick Creek and discharges cooling tower blowdown back to Two Lick Creek via Outfall 001. Some other discharges are routed to Outfall 027 at the confluence of Two Lick Creek and Blacklick Creek. All these discharges are authorized under the National Pollutant Discharge Elimination System (NPDES) permit PA0005037. Homer City Generation LP, is contemplating routing more of its discharge (up to 4,750 gpm) to an enlarged Outfall 027 following the facility modernization.

The existing pipe (8-inch diameter) would be replaced with an approximately 20-inch inside-diameter (ID) high density polyethylene (HDPE) pipe. The blowdown would be drawn from the cooling tower basin, and therefore, would already be cooled, however, it may still be higher than the receiving water temperature.

Outfall 001 will still serve to discharge various service water effluents from the facility. Two Lick Creek is a tributary to Blacklick Creek and Outfall 027 is at the confluence of Two Lick Creek to Blacklick Creek (Figure 2-1).



Figure 2-1: Homer City facility Layout (Source: Google Maps 2025)

2.1 OUTFALL 001 TWO LICK CREEK

Outfall 001 discharges to Two Lick Creek immediately downstream of the low-head dam (Figure 2-2). Two Lick Creek is the largest tributary to the Black Lick Creek. HCR is required to maintain an 11 cfs conservation flow at the Two Lick Creek dam. Water availability in the watershed changes with season and year. Two Lick Creek discharge flow measured at Graceton[1], PA (Lat 40`31'02", long 79`10'19") during the period of 2018-2023 (USGS, 2025) had an annual average flow of 351 cfs, and 7Q10 flow of 13.6 cfs[2]. A low flow of 11 cfs was assumed for this evaluation.

[1] Graceton is about 1.5 miles upstream of the low-head dam on Two Lick Creek.
[2] 7Q10 is the lowest 7-day average flow that occurs (on average) once every 10 years.

The facility water intake is located on Two Lick Creek above the low-head dam. This withdrawal is used for cooling tower makeup water and other service water applications. A portion of blowdown and service water effluent is discharged back to the Two Lick Creek through Outfall 001.



Figure 2-2: Homer City Outfall 001 (Source: Google Maps 2025)

2.2 OUTFALL 027

Outfall 027 discharges to Blacklick Creek located on the northern bank about 15 ft upstream from the confluence with Two Lick Creek (Figure 2-3). Following HCGS modernization, all or a portion of the cooling water blowdown may be discharged to Blacklick Creek, with a maximum design flow of 4,750 gpm. Blacklick Creek discharge flow measured at Josephine[3], PA (40`28'37" N, 79`11'12" W) during the period of 1995-2025 (USGS, 2025) had an annual average flow of 390 cfs and 7Q10 of 23[4] cfs. Below the confluence with Two Lick Creek a 7Q10 is 34 cfs 23 cfs in Blacklick Creek and the 11 cfs conservation flow of Two Lick Creek..

The existing outfall consists of an 8-inch pipe terminating in a head wall, concrete apron and rip rap apron with the invert of the pipe 1.5 ft above high water (Figure 2-4). The below alternative

[3] Josephine is about ½-mile upstream of Outfall 027 on Blacklick Creek.
[4] Homer City Generation LP evaluated the gaged data indicating a 7Q10 of 23 cfs.

outfall configurations aim to improve mixing, while considering constructability, operability, and permittability constraints.

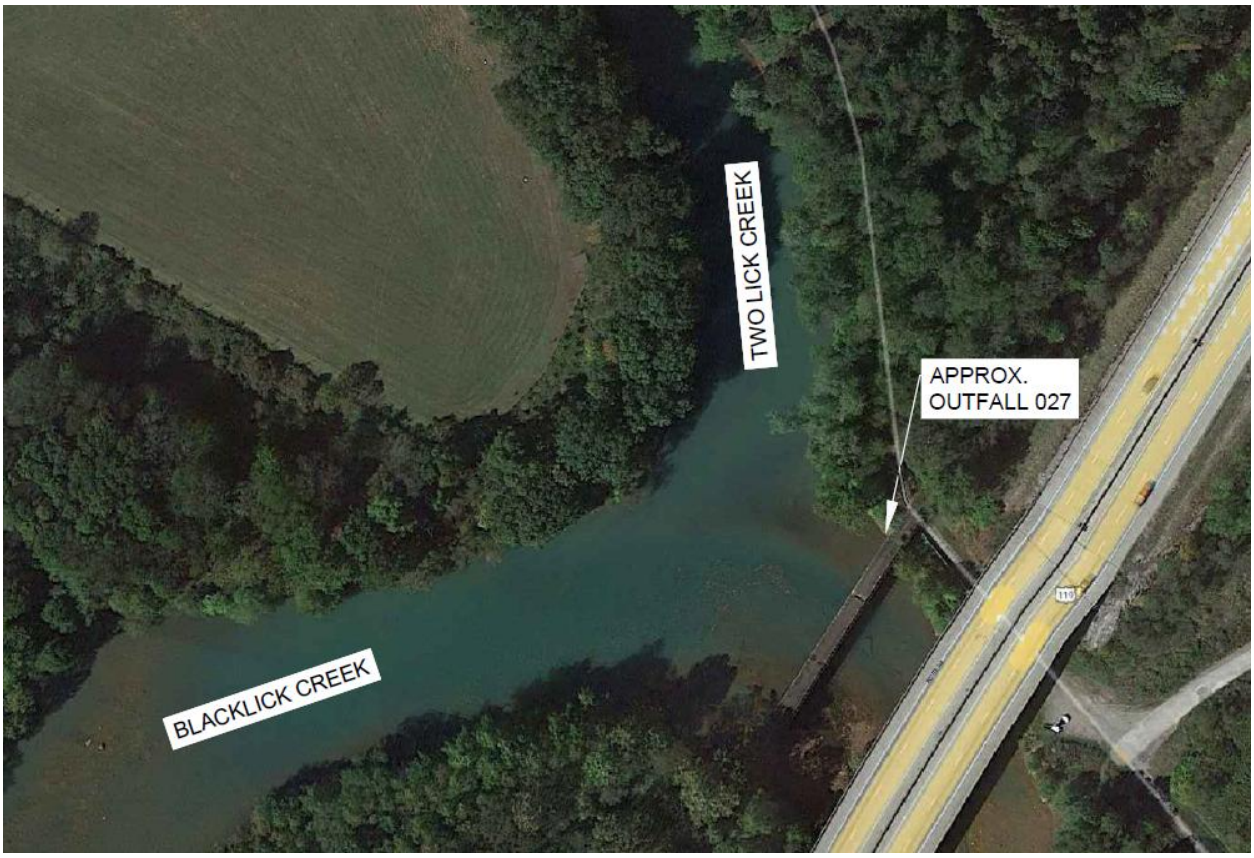
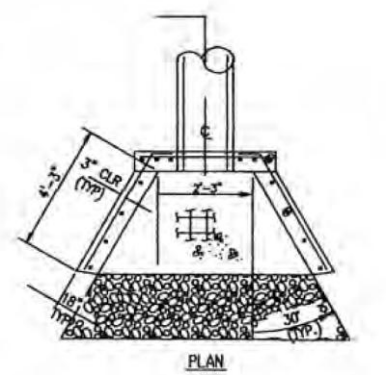


Figure 2-3: Homer City Outfall 027 (Source: Google Maps 2025)



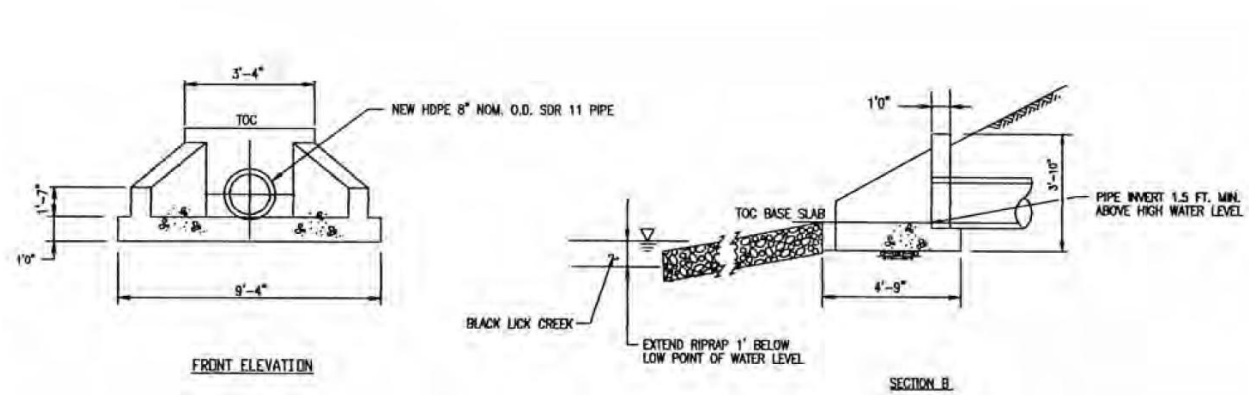
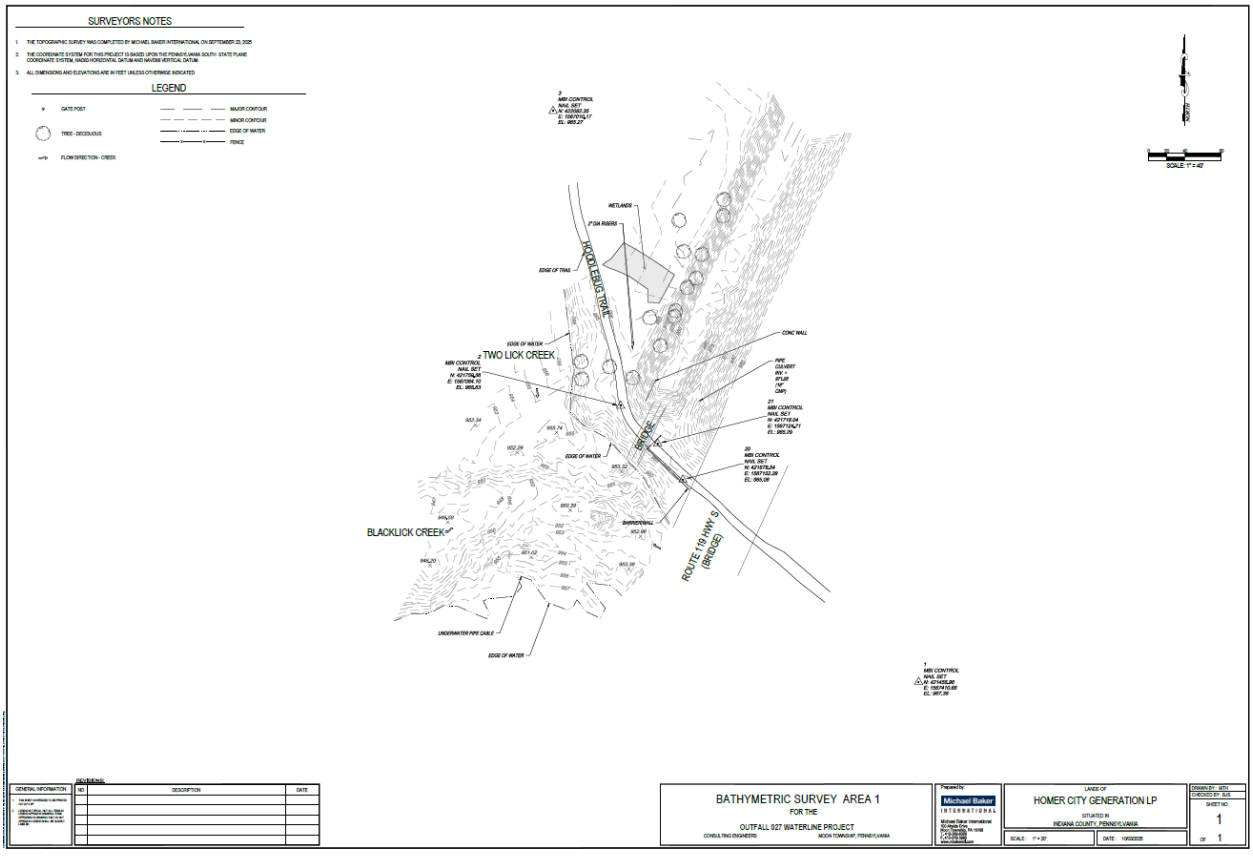
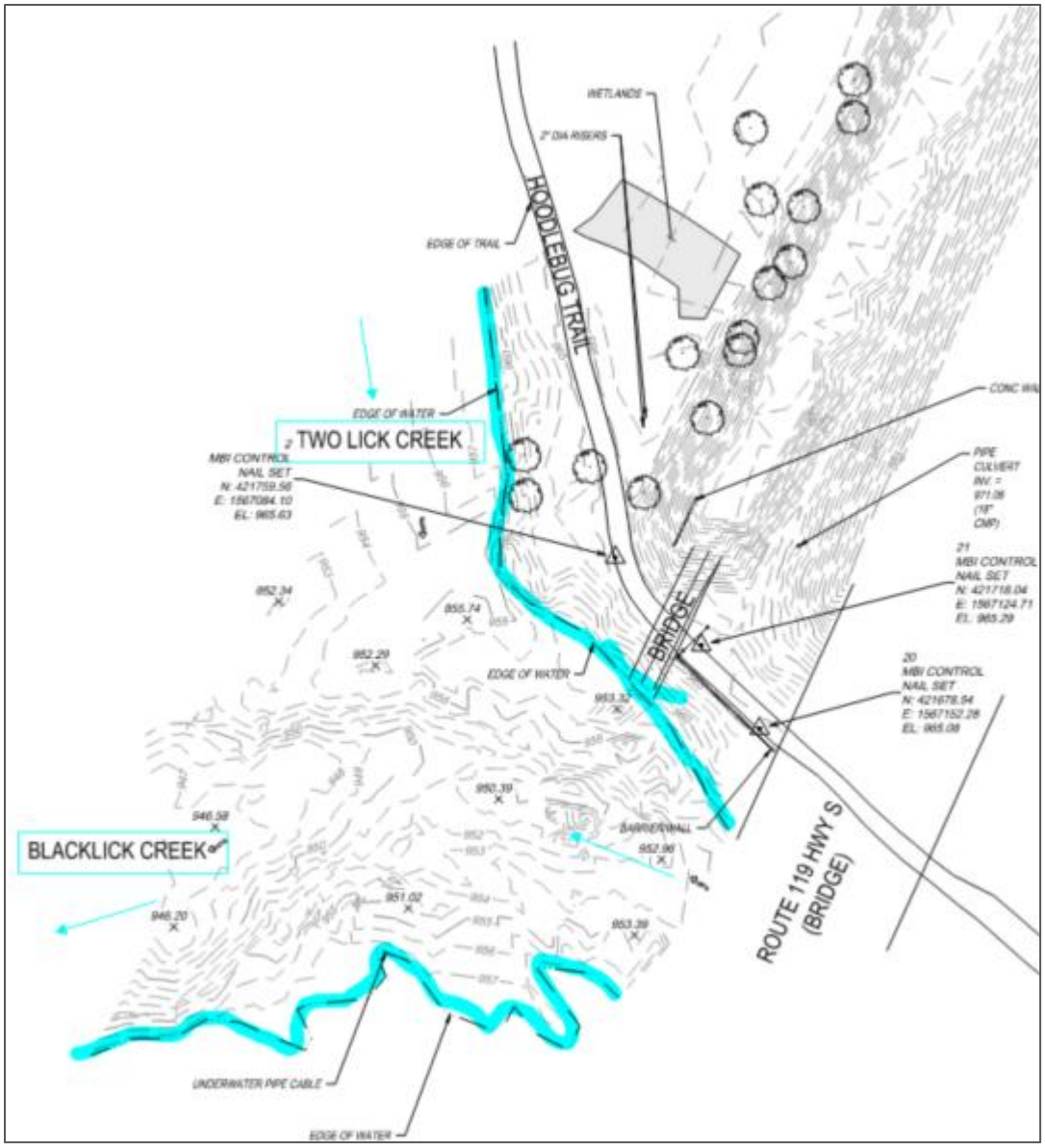


Figure 2-4: Existing Outfall 027 (Source: ENSR 2000)

2.3 BATHYMETERY

A bathymetric survey was conducted on September 23, 2025, in the area of Two Lick Creek and Blacklick Creek confluence. The bathymetry shows Blacklick Creek is shallow (≈3 ft to ≈3.5 ft) along the north bank in the area of outfall 027. A channel towards the centerline is deeper (≈7 ft), the thalweg of the channel at the confluence of Blacklick Creek and Two Lick Creek approximately 10.5 ft deep (Figure 2-5).





(Source: Michael Baker, International, 2025)

Figure 2-5: Bathymetry in Area of Outfall 027

.

2.4 PRESENCE OF THREATENED OR ENDANGERED SPECIES

The Pennsylvania Natural Diversity Inventory (PNDI) was reviewed for Outfall 027 location. Outfall 027 is located on the eastern shore of Blacklick Creek and Two Lick Creek (Lat: 40°28'54.67"N Long: 79°11'35.26"W). The PNDI databased was reviewed for 1 mile in each direction of the waterways; and PNDI-858288 found no known impact and therefore no further review is required. The PNDI-858288 report is provided in Appendix A.

3. OUTFALL ALTERNATIVES EVALUATION OVERVIEW

The purpose of this report is to evaluate Outfall 027 configurations.

Outfall options are evaluated in two phases. Phase 1, discussed in this section, considers all the outfall configurations that have potential for installation as the modified Outfall 027. Then using evaluation criteria, this section short-lists ones that appear more suitable at HCGS. This step will ensure that all discharge options that have potential for installation have been considered. Continued use of Outfall 001 is also discussed.

3.1 EVALUATION CRITERIA

In Phase 1, outfall options will be evaluated for their ability to enhance mixing and meet water quality, constructability, operability and permittability criteria.

Mixing Potential – The primary motivation for routing most of the flow from Outfall 001 to Outfall 027 is to enhance mixing to achieve thermal and water quality criteria at Pennsylvania Code Title 25, Chapters 93 and 96 and guidance in PADEP Document 386-2000-001. In Phase 1, this criterion assesses each of the option's ability to provide sufficient mixing based on past experience. Options that provide rapid and more complete mixing would be preferable. Diffused and faster jet velocities typically provide better mixing. A single duckbill nozzle or multiple smaller duckbill nozzles on a manifold to increase the mixing area will be considered. Submerged discharges could be more effective than discharges above the water surface. Mixing potential can be better understood by modeling; the more promising outfall configurations will therefore be modeled using CORMIX.

Constructability and Construction Period Criteria – These would evaluate construction duration, the extent of disturbance, access during the construction period, available laydown space for the duration of construction, ease of construction, impacts caused by the work, cost of construction. In-water construction is typically costlier than construction over land.

Operability and Operations Period Criteria - These criteria include maintenance cost and burden on the operator; the extent of operational experience needed; potential impact on the waterbody from operating the system; if ambient conditions could pose a hazard to the safe operation of the system and if the system or its operation could pose a hazard to recreational users of the waterbody; the likelihood of the system getting vandalized. Ice and freezing can pose a significant challenge to an intermittent outfall, especially on a small waterbody. The evaluation is cognizant of icing and freezing potential, but they are not addressed in this alternatives evaluation. Icing/ freezing depends on the specific design. ASA suggests revisiting for icing/ freezing as the design progresses.

Permittability Criteria – Any outfall would need various construction permits. Some configurations may necessitate more permits and approvals than others. These criteria would assess the number and complexity of the permit applications; number of permitting agencies that may have jurisdiction. Permits also require various studies and design information; some permit applications require more extensive requirements. This also gives consideration to approval timelines. This evaluation only provides an overview of the types of permits that may be needed. This is by no means a comprehensive permitting analysis.

3.2 PHASE 1 – POTENTIALLY AVAILABLE DISCHARGE OPTIONS

This phase of the evaluation reviewed discharge options that demonstrate potential to meet the thermal discharge requirements, using the aforementioned evaluation criteria and retained five

discharge options for further evaluation in Phase 2. The various options are summarized in Table 3-1.

The existing outfall consists of an 8-inch diameter pipe terminating in a headwall. Based on flow hydraulics, the 8-inch pipe is expected to be replaced with a 20-inch diameter pipe.

A. This alternative is a shoreline discharge with an open pipe and headwall structure similar to the existing discharge. The new 20-inch inside diameter (ID) HDPE pipe would replace the existing 8-inch discharge pipe. The new outfall would be installed such that it would remain submerged under most (if not all) flow conditions in Blacklick Creek. The discharge location may need to be excavated to facilitate pipe submergence (Figure 3-1)This area of the river is very shallow and understanding the impacts of scour that could be caused by the additional discharge flow must be understood; alternatively, the riverbed may be reinforced to reduce scour potential.

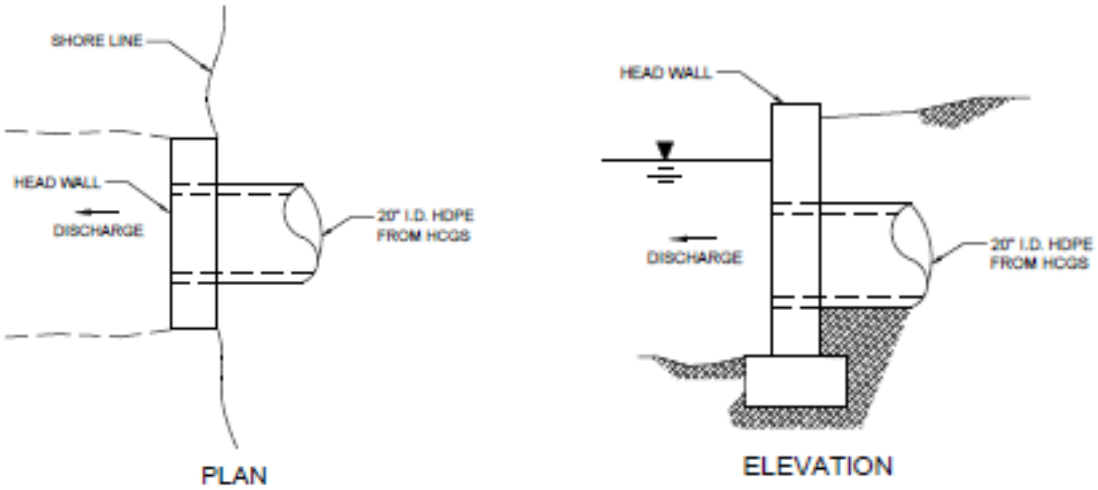


Figure 3-1: Shoreline Discharge with an Open Pipe

B. Alternative B is a shoreline discharge with one or more duckbill nozzle(s) and a headwall structure. This alternative would also be somewhat similar to the existing discharge, except it would improve mixing because of the higher jet velocity[5]. The pipe terminus could have a single 20-inch duckbill nozzle or multiple smaller nozzles[6]. The new 20-inch ID HDPE pipe would replace the existing 8-inch discharge and pipe. The new outfall would be installed such that it would remain submerged under most (if not all) flow conditions in Blacklick Creek. For this alternative too, the discharge location may need to be excavated to achieve the requisite submergence (Figure 3-2). This area of the river is very shallow and understanding the impacts of scour caused by the additional discharge flow must be understood; the duckbill nozzle could increase the jet velocity more than an open pipe would.

[5] Jet velocity is the velocity with which the discharge leaves the outfall structure and enters the receiving waterbody.
[6] Based on a preliminary evaluation six 8-inch nozzles, four 10-inch nozzles, or three 12-inch nozzles would be applicable.

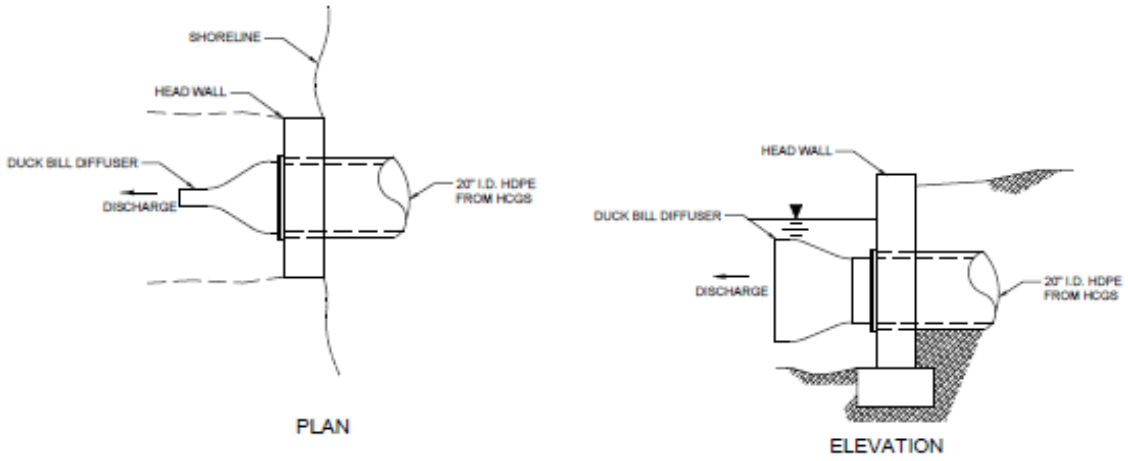


Figure 3-2: Shoreline Discharge Duckbill

C. Alternative C is a shoreline discharge under rip-rap that would spread the discharge, reduce the discharge velocity, protect the discharge pipe from the public eye and avoid scouring the riverbed. This type of configuration would necessitate disturbing a larger riverbank area to ensure bank stability. The new 20-inch ID HDPE pipe would replace the existing 8-inch discharge and pipe. Because the pipe would discharge onto riprap, this configuration is flexible on the elevation of the discharge pipe. It may be configured to be submerged or above water. The discharge would trickle down and out over riprap before entering Blacklick Creek (Figure 3-3). An isolation valve would be located behind the headwall in a valve pit to facilitate maintenance of the outfall.

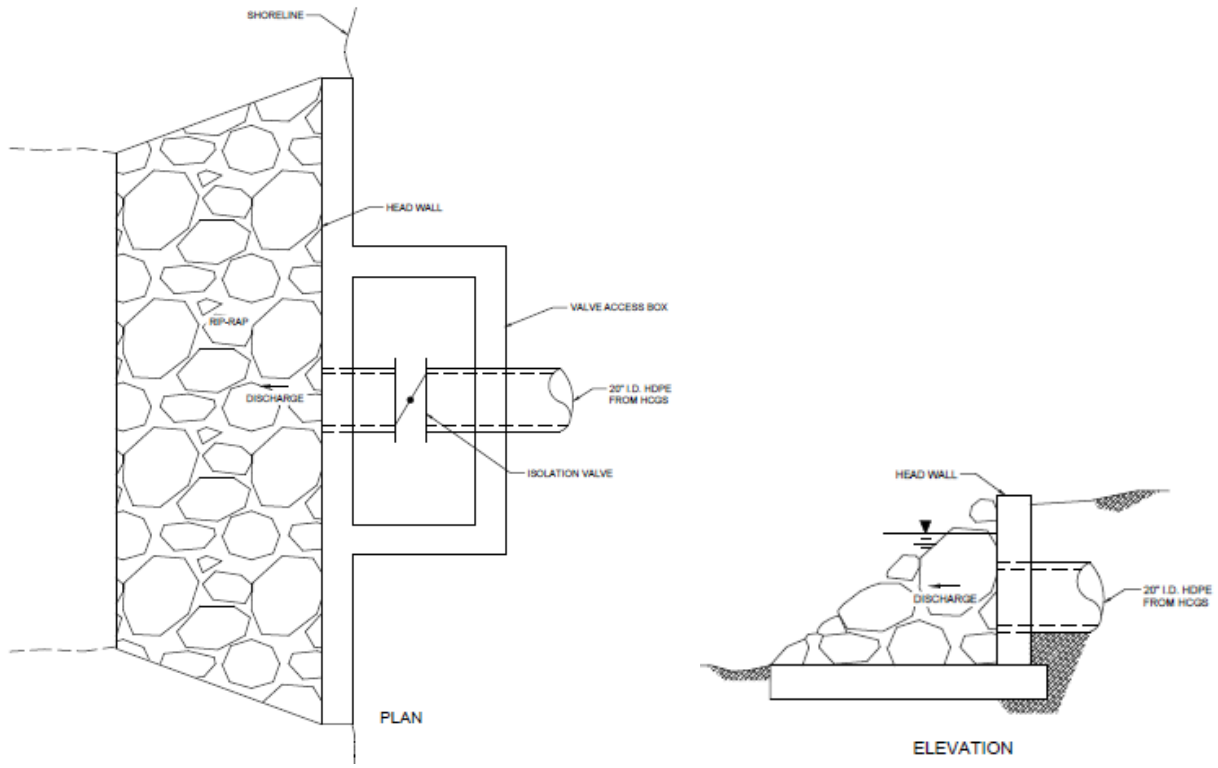


Figure 3-3: Shoreline Discharge Under Rip-rap

D. Alternative D is an in-stream single port discharge that would extend the discharge pipe approximately 160 ft from the current Outfall 027 location to the confluence of Two Lick Creek and Blacklick Creek. The discharge would be an open pipe. The pipe would be buried from the bank to the discharge location to protect it from ice, debris in the river and vandalism (Figure 3-4). The pipe terminus would be above the riverbed and face downstream. This requires extensive in-water construction, necessitating 'pinching' the river during construction. The pipe would be more susceptible to damage from debris and could pose a safety hazard to any recreational users of the Blacklick Creek, especially during low flow conditions). Inspections and maintenance of the outfall would also be more challenging.

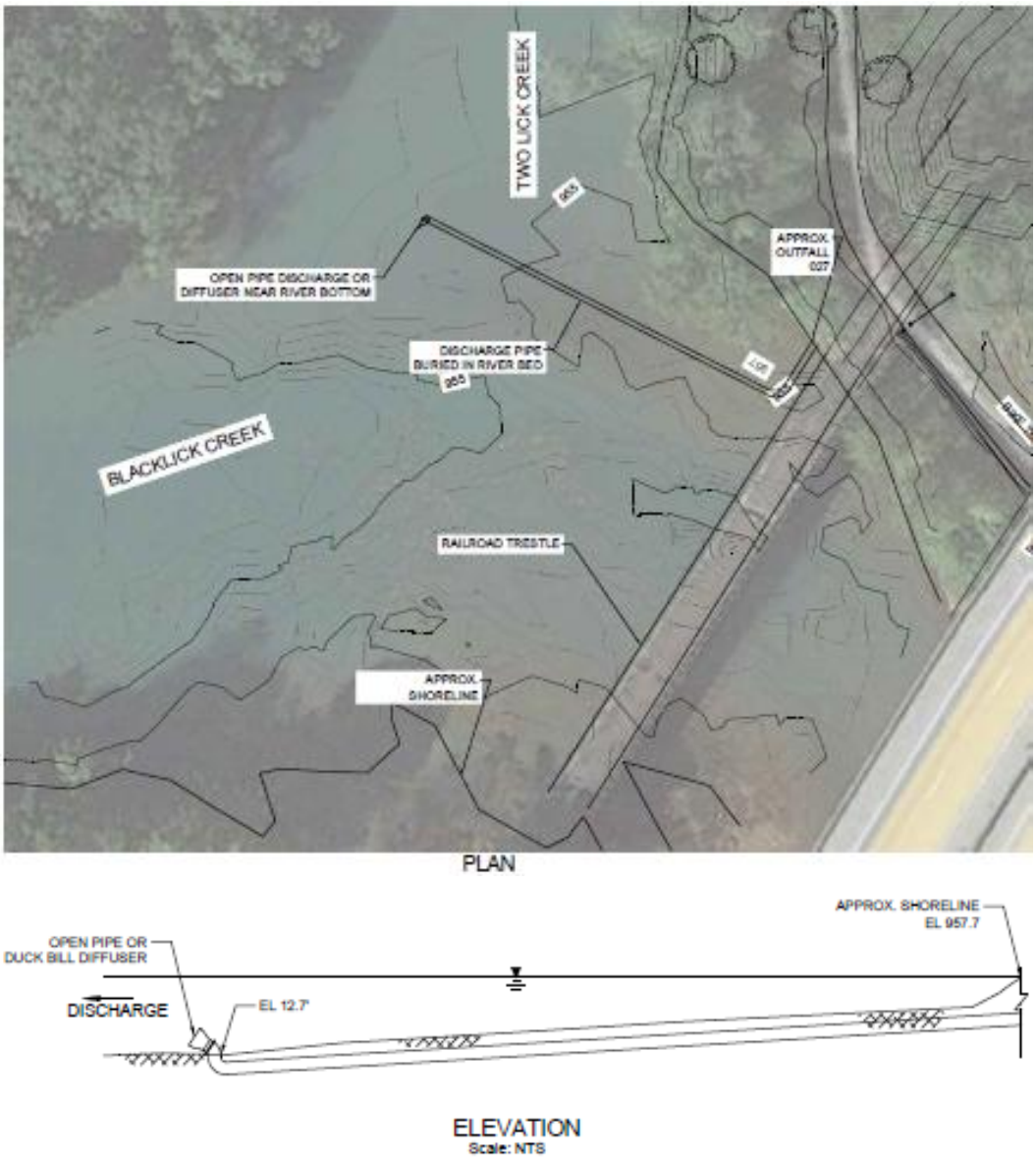


Figure 3-4: Piped to Confluence of Two Lick Creek

E. An in-stream diffuser would entail extending the discharge pipe approximately 160 ft from the current Outfall 027 location to the confluence of Two Lick Creek and Blacklick Creek and installing one or more duckbills to the terminus of the pipe. The pipe terminus and duckbill(s) would remain submerged under most river flow conditions. The duckbill(s) would facilitate better mixing (because of the higher jet velocity) and will also prevent flow back from creek water into the pipe during periods of low or no discharge. As with the previous option, the pipe would be buried from the bank to the discharge location to protect it from ice, debris in the river and vandalism (Figure 3-4). The pipe terminus would extend up out of the riverbed and then face downstream. If multiple ports are desired, then several vertical pipes would extend up from the riverbed and terminate in a duckbill. Similar to the in-stream single port outfall configuration, this one will also require extensive in-water construction, necessitating 'pinching' the river during construction. The one or more vertical pipes would be more

susceptible to damage from debris and could pose a safety hazard to any recreational users of the Blacklick Creek, especially during low flow conditions. Inspections and maintenance of the outfall would also be more challenging.

F. This is an in-stream single port discharge that extends parallel to the bridge, approximately 65 ft from the bank towards the middle of Blacklick Creek. This option would be similar to Option D, except that initial mixing would be driven by Blacklick Creek only. This outfall configuration has the advantage of getting impacted by only flows and debris in Blacklick Creek. While construction and maintenance access to outfall would be challenging and extensive, it would be less challenging than Option D. The discharge would be an open pipe (Figure 3-5).

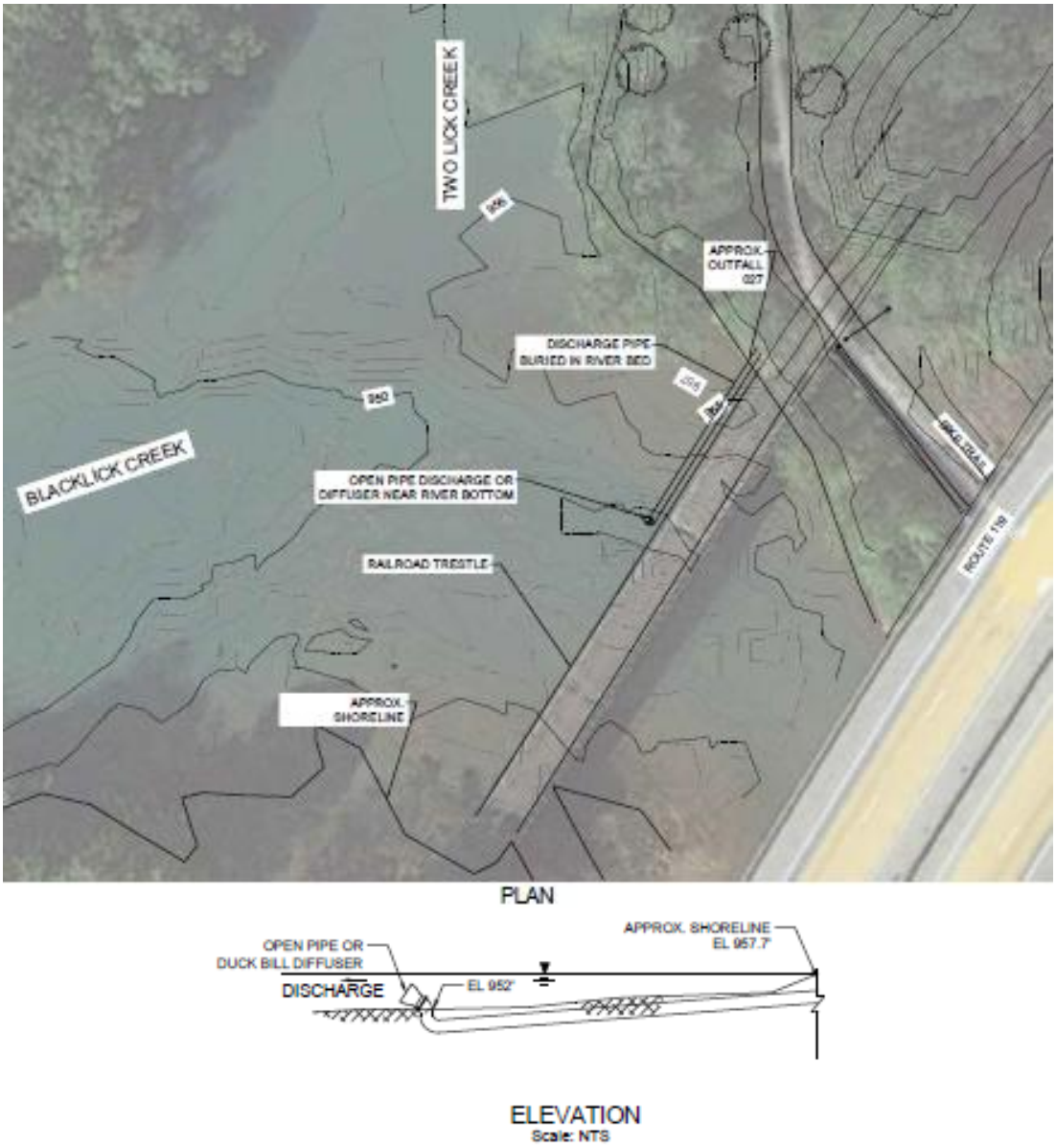


Figure 3-5: In-Creek Diffuser Discharge

G. This is an in-stream diffuser similar to Option E, except that the duckbill(s) would be installed on the pipe terminus. The outfall would be installed in Blacklick Creek (closer to the bridge), similar to Option F. As with Option E, this configuration would improve mixing. The pipe would be buried from the bank to the discharge location to protect it from ice, debris in the river and vandalism (Figure 3-5). While construction and maintenance access to outfall would be challenging and extensive, it would be less challenging than Option E. The pipe terminus would have one or more duckbills instead of an open pipe.

H. Continue to discharge to Outfall 001. Enlarge the existing pipe to accommodate the higher flow. The existing discharge may be reconfigured similar to any of the outfall options discussed above. As with Outfall 027, the short-listed configurations would need to be modeled with CORMIX to understand mixing characteristics and inform the final design.

I. This would be a shoreline discharge with an open pipe and headwall structure similar to the existing discharge. The new 20-inch ID HDPE pipe would replace the existing 8-inch discharge pipe. Unlike Alternative A, the pipe would remain above the water surface under all flow conditions in Blacklick Creek.

Table 3-1: Summary of Discharge Options Evaluated

Discharge Alternative	Description	Construction Period Considerations	Operations Period Considerations	Retained for Further Evaluation (Y/N)	Key Reasons for Evaluating or not Evaluating Further
A - Shoreline discharge with open pipe	Discharge at shoreline headwall with open pipe. Similar to current outfall but submerged	• More straight-forward to construct. • Minimal disturbance to shoreline. • Easier to access during construction. • Some dredging of the channel may be needed to achieve necessary outfall submergence.	• Easier access for maintenance purposes. • Easier access to vandals. • Better protected from floating debris in the creeks.	Y	Lower cost compared to other options. Easier to permit.
B - Shoreline discharge with duckbill nozzle(s)	Discharge at shoreline headwall with and duckbill nozzle(s). Similar to current outfall, but submerged and terminating in one more diffusers and of a duckbill valves.	• More straight-forward to construct. • Minimal disturbance to shoreline. • Easier to access during construction. • Some dredging of the channel may be needed to achieve necessary outfall submergence.	• Easier access for maintenance purposes. • Easier access to vandals. • Better protected from floating debris in the creeks. • Better mixing of discharge in the receiving water, compared to Option A. • Higher jet velocity may result in localized scouring unless outfall surroundings are reinforced.	Y	Lower cost compared to other options. Easier to permit. Better mixing

Discharge Alternative	Description	Construction Period Considerations	Operations Period Considerations	Retained for Further Evaluation (Y/N)	Key Reasons for Evaluating or not Evaluating Further
C - Shoreline discharge under rip-rap	Shoreline outfall structure under rip-rap. Similar to current outfall, except the pipe terminus would be embedded in rip-rap	• Likely excavation / dredging of channel and bank to achieve necessary water depth required and maintain same channel velocity as from before modification. Larger area of disturbance to achieve surface area required for rip-rap. • The most river bank disturbance of all configurations.	• Outfall well-protected. Low likelihood of vandalism. • Low jet velocity will likely result in poorest mixing of all the options.	N	Costlier than Option A or B. More challenging to permit than Option A or B. Better protection of the outfall.
D – In-stream discharge to confluence with open pipe	Discharge piped to the confluence of Two Lick and Blacklick Creeks, with open pipe discharge	• Large area of in-river excavation required to bury approximately 160-ft length of pipe. • Access difficult. • More challenging permitting. • In-water/on-water construction; costlier.	• Better mixing than Option A or B. • In-river infrastructure makes O & M difficult. • Susceptible to damage from large floating debris and vandals.	N	Higher construction and O&M costs compared to Option A or B. More challenging to permit.
E – In-stream discharge to confluence with duckbill nozzle(s)	Discharge piped to the confluence of Two Lick and Blacklick Creeks, with one or more duckbill nozzles	• Large area of in-river excavation required to bury approximately 160-ft length of pipe. • Access difficult. • More challenging permitting.	• Best mixing of all the options. • In-river infrastructure makes O & M difficult. • Susceptible to damage from large floating debris and vandals.	N	Higher construction and O&M costs compared to Option A or B. More challenging to permit.

Discharge Alternative	Description	Construction Period Considerations	Operations Period Considerations	Retained for Further Evaluation (Y/N)	Key Reasons for Evaluating or not Evaluating Further
		• In-water/on-water construction; costlier.			
F – In-stream discharge to Blacklick Creek with open pipe	Open pipe in Blacklick Creek	• Large area of in-river excavation required to bury approximately 65-ft length of pipe. • Access more difficult than Option A or B. • More challenging to permit than Option A or B. • In-water/on-water construction; costlier.	• Good mixing. • In-river infrastructure makes O & M difficult. • Susceptible to damage from large floating debris and vandals.	N	high construction cost, high maintenance cost and difficulty permitting
G - In-stream discharge to Blacklick Creek with duckbill nozzle(s)	Duckbill(s)discharge in Blacklick Creek	• Large area of in-river excavation required to bury approximately 65-ft length of pipe. • Access more difficult than Option A or B. • More challenging to permit than Option A or B. • In-water/on-water construction; costlier.	• Good mixing. • In-river infrastructure makes O & M difficult. • Susceptible to damage from large floating debris.	Y	Good mixing, but higher construction and maintenance cost and effort compared to Option A or B.

Discharge Alternative	Description	Construction Period Considerations	Operations Period Considerations	Retained for Further Evaluation (Y/N)	Key Reasons for Evaluating or not Evaluating Further
H - Discharge to Outfall 001	Use existing outfall location 001 but increase capacity. Reconfiguring as a diffuser would improve mixing.	• Lower overall disturbance than moving the outfall.	• Similar to Outfall 027.	Y	Potential lower cost.
I - Shoreline discharge with open pipe	Discharge at shoreline headwall with open pipe. Similar to current outfall	• More straight-forward to construct. • Minimal disturbance to shoreline and creek bed. • Easier to access during construction.	• Easier access for maintenance purposes. • Easier access to vandals. • No impact from floating debris in the creeks.	Y	Lower cost compared to other options. Easier to permit.

Discharge alternatives retained for further evaluation in Phase 2 include the following. The mixing efficacy of each of these short-listed alternatives will be evaluated using CORMIX.

1. Shoreline submerged discharge with open pipe (Alternative A)
2. Shoreline submerged discharge with duckbill nozzle(s)(Alternative B)
3. In-stream discharge to Blacklick Creek with duckbill nozzle(s) (Alternative G)
4. Discharge to Outfall 001 (Alternative H)
5. Shoreline discharge with open pipe (Alternative I)

4. PHASE 2 OUTFALL ALTERNATIVES EVALUATION

4.1 SHORELINE SUBMERGED DISCHARGE WITH OPEN PIPE (ALTERNATIVE A)

4.1.1 Conceptual Design

A shoreline discharge with an open pipe and headwall structure would be located on the northern bank of Blacklick Creek about 15 ft from the confluence with Two Lick Creek similar to the existing discharge. The existing pipe would be replaced with a 20-inch ID HDPE pipe, which would terminate at a head wall structure at the shoreline. The invert of the discharge pipe would be set such that the pipe would remain submerged under most Blacklick Creek flow conditions.

The creek bed may need to be dredged between the outfall and thalweg to improve mixing.

4.1.2 Construction and Maintenance Period Considerations

Construction of the head wall and discharge pipe would require a localized cofferdam, turbidity curtains and dewatering to allow the placement of concrete and installation of the pipe. Dredging between the outfall and thalweg would require turbidity curtains. The bank around the headwall would need to be reinforced with rip rap to provide stability to the outfall and maintain integrity of the creek bank.

Maintenance would include inspecting the outfall structure and the section of Blacklick Creek receiving the discharge. Potential periodic excavation/ dredging may be needed during prolonged low flow periods.

4.1.3 Permitting Effort

The installation and operation of a shoreline discharge with an open pipe could trigger the following federal, state, and local permits and approvals:

1. Army Corps of Engineers Nationwide Permit 7 or Joint Permit Application
    a. If not waived, Chapter 105 Water Obstruction and Encroachment Permit
    b. If not waived, Chapter 105 Environmental Assessment Approval
2. Chapter 106 Floodplain Management permit (potential)
3. Coordination with NOAA, PA Fish & Boat Commission, USFWS, USEPA
4. NPDES permit modification for Outfall 027
5. Erosion and sediment control permit for discharge of stormwater associated with construction – specific permit would depend on the extent of disturbance
6. Local construction permits (potential)

Specific permit requirements depends on the nature of the design. ASA suggests revisiting permitting requirements once the design progresses.

4.1.4 Ancillary Advantages and Disadvantages

The key advantages of this system include:

- Similarity to the existing outfall lending simplicity to the design and construction of the modified outfall.
- This alternative consists of readily available materials, no specialty equipment.

- Reasonably good mixing of effluent with Blacklick Creek.
- Ease of construction period access; ease of access for O&M.
- Less susceptible to damage from large debris in the creek.
- Minimal disturbance to shoreline.
- Likely lower cost than in-stream alternatives.
- Likely easier to permit because of lower disturbance to water way.

The key disadvantages of this system include:

- Freezing potential if low creek conditions occur during winter months; ice/freezing could extend several feet up the pipe if there is not a consistent discharge; potential to crack the pipe.
- Visible to the public; could potentially invite vandals.
- Minor encroachment into the Blacklick Creek.
- Potential need for maintenance dredging.

4.2 SHORELINE SUBMERGED DISCHARGE WITH DUCKBILL NOZZLE (ALTERNATIVE B)

4.2.1 Conceptual Design

This alternative is also a shoreline discharge terminating at a headwall structure located on the northern bank of Blacklick Creek about 15 ft from the confluence with Two Lick Creek similar to the open pipe discharge described in Section 4.1, except that the pipe terminus would have one or more duckbill nozzle(s) instead of an open pipe. The duckbill nozzle(s) will improve mixing, compared to an open pipe, and will also prevent creek water and critters from entering the pipe. The existing pipe would be replaced with a 20-inch ID HDPE pipe. The invert of the discharge pipe would be set such that the pipe would remain submerged under most Blacklick Creek flow conditions.

The creek bed may need to be dredged between the outfall and thalweg to improve mixing.

4.2.2 Construction and Maintenance Period Considerations

Similar to Alternative A, Construction of the head wall and discharge pipe would require a localized cofferdam, turbidity curtains and dewatering to allow the placement of concrete and installation of the pipe. Dredging between the outfall and thalweg would require turbidity curtains. The bank around the headwall would need to be reinforced with rip rap to provide stability to the outfall and maintain integrity of the creek bank.

Maintenance would include inspecting the outfall structure, the duckbill nozzle(s), and the section of Blacklick Creek receiving the discharge. The duckbill nozzle(s) would need replacement approximately once every ten years. The duckbill(s) will result in a higher jet velocity, which could scour the discharge location. Reinforcing the point of discharge would prevent future scouring, and the high jet velocity may eliminate need for maintenance dredging.

4.2.3 Permitting Effort

The permitting effort for this option would be identical to Alternative A.

4.2.4 Ancillary Advantages and Disadvantages

The key advantages of this system include:

- Very good mixing of effluent in Blacklick Creek
- Similarity to the existing outfall lending simplicity to the design and construction of the modified outfall.
- This alternative consists of readily available materials, no specialty equipment.
- Ease of construction period access; ease of access for O&M.
- Less susceptible to damage from large debris in the creek.
- Minimal disturbance to shoreline.
- Likely lower cost than in-stream alternatives.
- Likely easier to permit because of lower disturbance to water way.

The key disadvantages of this system include:

- Freezing potential if low creek conditions occur during winter months; ice/freezing could extend several feet up the pipe if there is not a consistent discharge; potential to crack the pipe; potential to freeze shut the duckbills.
- Visible to the public; could potentially invite vandals.
- Minor encroachment into the Blacklick Creek.

4.3 IN-STREAM DISCHARGE TO BLACKLICK CREEK WITH DUCKBILL NOZZLE (OPTION G)

4.3.1 Conceptual Design

This alternative would discharge directly to Blacklick Creek; the discharge pipe would terminate in one or more duckbill nozzles. The outfall would be located to the southwest of the existing outfall, approximately 20 ft from the confluence with Two Lick Creek. The outfall would be located near the Blacklick Creek thalweg to take advantage of the deeper water. The outfall would remain submerged under most Blacklick Creek flow conditions.

4.3.2 Construction and Maintenance Period Considerations

This alternative may necessitate approximately 70-100 ft of excavation of the creek bed. Installation of the in-stream portion of the pipe and outfall may be performed inside a cofferdam or in-water. In-water construction is costly. The type of cofferdam that may be allowed on a creek like this would be limited by water depth; therefore, construction would need to be planned for a low-flow period.

Inspection of the outfall would require prior planning. During low flow periods, the operator may be able to walk to the outfall wearing a wader. During higher flow conditions, the operator may need a small boat.

4.3.3 Permitting Effort

The installation and operation of an in-stream outfall with a duckbill(s) could trigger the following federal, state, and local permits and approvals:

1. Army Corps of Engineers Nationwide Permit 7 or Joint Permit Application
   c. If not waived, Chapter 105 Water Obstruction and Encroachment Permit
   d. If not waived, Chapter 105 Environmental Assessment Approval
2. Chapter 105 Submerged Lands of the Commonwealth – Submerged Lands License Agreements - required for structures placed on, over, or under Submerged Lands of the Commonwealth and can only be obtained when an applicant applies for a Chapter 105 Dam Permit or Water Obstruction and Encroachment Permit.
3. Chapter 106 Floodplain Management permit
4. Coordination with NOAA, PA Fish & Boat Commission, USFWS, USEPA
5. NPDES permit modification for Outfall 027
6. Erosion and sediment control permit for discharge of stormwater associated with construction – specific permit would depend on the extent of disturbance
7. Local construction permits (potential)

Specific permit requirements depends on the nature of the design. ASA suggests revisiting permitting requirements once the design progresses.

4.3.4 Ancillary Advantages and Disadvantages

The key advantages of this system include:

- Very good mixing of effluent in Blacklick Creek.
- This alternative consists of readily available materials, no specialty equipment.
- Not visible to the public during typical Blacklick Creek flow conditions.

The key disadvantages of this system include:

- Very susceptible to damage from large floating debris.
- Depending on depth of water at the outfall structure, potential for freezing the outfall.
- Potential hazard to recreational users of Blacklick Creek.
- More challenging to inspect and perform maintenance work.
- Encroachment into the Blacklick Creek; construction within the creek; more challenging to permit.
- In-water construction or opportunistic coffer dam use would be costly; construction requires additional coordination.

4.4 DISCHARGE TO OUTFALL 001 (ALTERNATIVE H)

This alternative entrails increasing the capacity of the existing Outfall 001. The outfall could have a duckbill nozzle to enhance mixing. Evaluating cooling tower blowdown to Outfall 001 was not part of the scope, however, after reviewing facility information this option seemed to have merit and therefore was included.

Outfall 001 is located below the low head dam and Two Licks Creek maintains a 11 cfs conservation flow. The reliable 11 cfs flow is an advantage. The 7Q10 in Blacklick Creek is similar to that in Two Lick Creek, except Blacklick Creek does not have a conservation flow requirement.

Additionally, Outfall 001 is significantly closer, about 0.5 miles from the station as opposed to outfall 027 which is 2.25 miles from the station. This alternative assumes that the discharge pipe would be replaced. Mixing potential would need to be evaluated using CORMIX, and assimilative capacity would need to be evaluated using the PADEP Toxics Management Spreadsheet.

4.4.1 Conceptual Design

No conceptual designs were generated for this location; site plans, topography, plans of the dam and existing discharge will be needed for further evaluation. The outfall is expected to look similar to the existing one, except, the modified outfall would be larger and likely terminating in a duckbill nozzle(s) for enhanced mixing.

4.4.2 Construction and Maintenance Period Considerations

Reconstruction of the head wall and discharge pipe would require a localized cofferdam, turbidity curtains and dewatering to allow the placement of concrete and installation of the pipe. The bank around the headwall would need to be reinforced with rip rap to provide stability to the outfall and maintain integrity of the creek bank.

Maintenance would include inspecting the outfall structure and the section of Two Lick Creek receiving the discharge.

4.4.3 Permitting Effort

Modification to this existing outfall could trigger the following federal, state, and local permits and approvals:

1. Army Corps of Engineers Nationwide Permit 7 or Joint Permit Application
2. Chapter 106 Floodplain Management permit (potential)
3. Coordination with NOAA, PA Fish & Boat Commission, USFWS, USEPA
4. NPDES permit modification for Outfall 001
5. Erosion and sediment control permit for discharge of stormwater associated with construction – specific permit would depend on the extent of disturbance
6. Local construction permits (potential)

Specific permit requirements depends on the nature of the design. ASA suggests revisiting permitting requirements once the design progresses.

4.4.4 Ancillary Advantages and Disadvantages

The key advantages of this system include:

- Simplicity of modifying the existing outfall.
- This alternative consists of readily available materials, no specialty equipment.
- Good mixing of effluent in Two Lick Creek.
- Ease of construction period access; ease of access for O&M.
- Less susceptible to damage from large debris in the creek.
- Minimal disturbance to shoreline; minimal disturbance to creek bed.
- Likely lowest cost alternative.
- Likely easier to permit because of lower disturbance to water way and surroundings.

The key disadvantages of this system include:

- Minor encroachment into the Two Lick Creek.
- Less assimilative capacity than Blacklick Creek during normal to high flow conditions.

4.5 SHORELINE DISCHARGE WITH OPEN PIPE (ALTERNATIVE I)

4.5.1 Conceptual Design

A shoreline discharge with an open pipe and headwall structure would be located on the northern bank of Blacklick Creek about 15 ft from the confluence with Two Lick Creek similar to the existing discharge. The existing pipe would be replaced with a 20-inch ID HDPE pipe, which would terminate at a head wall structure at the shoreline. The invert of the discharge pipe would be set such that the pipe would remain above the water under all Blacklick Creek flow conditions.

4.5.2 Construction and Maintenance Period Considerations

Construction of the head wall would require turbidity curtains and dewatering to allow the placement of concrete and installation of the pipe. The bank around the headwall would need to be reinforced with rip rap to provide stability to the outfall and maintain integrity of the creek bank.

Maintenance would include inspecting the outfall structure and the section of Blacklick Creek receiving the discharge.

4.5.3 Permitting Effort

The installation and operation of a shoreline discharge with an open pipe could trigger the following federal, state, and local permits and approvals:

1. Army Corps of Engineers Nationwide Permit 7 or Joint Permit Application
2. Chapter 106 Floodplain Management permit (potential)
3. Coordination with NOAA, PA Fish & Boat Commission, USFWS, USEPA
4. NPDES permit modification for Outfall 027

5. Erosion and sediment control permit for discharge of stormwater associated with construction – specific permit would depend on the extent of disturbance
6. Local construction permits (potential)

4.5.4 Ancillary Advantages and Disadvantages

The key advantages of this system include:

- Similarity to the existing outfall.
- This alternative consists of readily available materials, no specialty equipment.
- Ease of construction period access; ease of access for O&M.
- No impact from large debris in the creek.
- Minimal disturbance to creek bed.
- Likely lower cost than in-stream alternatives.
- Likely easier to permit because of lower disturbance to water way.

The key disadvantages of this system include:

- Visible to the public; could potentially invite vandals.
- Mixing potential uncertain.

5. RECOMMENDATIONS

The evaluation short-listed five configurations listed in Figure 5-1. Outfall Option B was selected for further evaluation because of its lower environmental impact.

Figure 5-1: Characteristics of Shortlisted Outfall Configurations

Outfall Option	Description
A	Shoreline submerged discharge near current Outfall 027 to Blacklick Creek with headwall and open pipe
B	Shoreline submerged discharge near current Outfall 027 to Blacklick Creek with headwall and duckbill nozzle
G	In-stream discharge to Blacklick Creek with duckbill nozzle
H	Enlarging Outfall 001 on Two Lick Creek
I	Shoreline discharge near current Outfall 027 to Blacklick Creek with headwall and open pipe

6. REFERENCES

ASA (2023), Homer City Station, Cooling Water Intake Structure 40 CFR § 122.21(R) Information and Clean Water Act § 316(B) Requirements, June 23,2023

ENSR (2000), Permit Application for the construction of the Discharge Pipeline for treated Waste Water From the Flue Gas Desulfurization (FGD)System, EME Homer City Generation L.P. Homer city PA, 3/28/2000

HDR (2014), Homer City Station Clean Water Act §316(b) Strategic Planning Document, NRG Homer City Services LLC, *Homer City, Pennsylvania,* September 12, 2014

Honor Engineering (2025), Water Availability Report Homer City Redevelopment, Honor Engineer Project #: 4087-25001, 4/22/2025

Michael Baker International (2025), Bathymetric Survey Area 1 for the outfall 027 Waterline Project,10/3/2025

StreamStats (2025), USGS, PA20251013121804079000, 2025-10-13 08:18:25 -0400.

StreamStats (2025), USGS, PA20251013125531180000, 2025-10-13 08:55:52 -0400.

StreamStats (2025), USGS, PA20251013122042897000, 2025-10-13 08:21:03 -0400.

APPENDIX A – PNDI REPORT

1. PROJECT INFORMATION

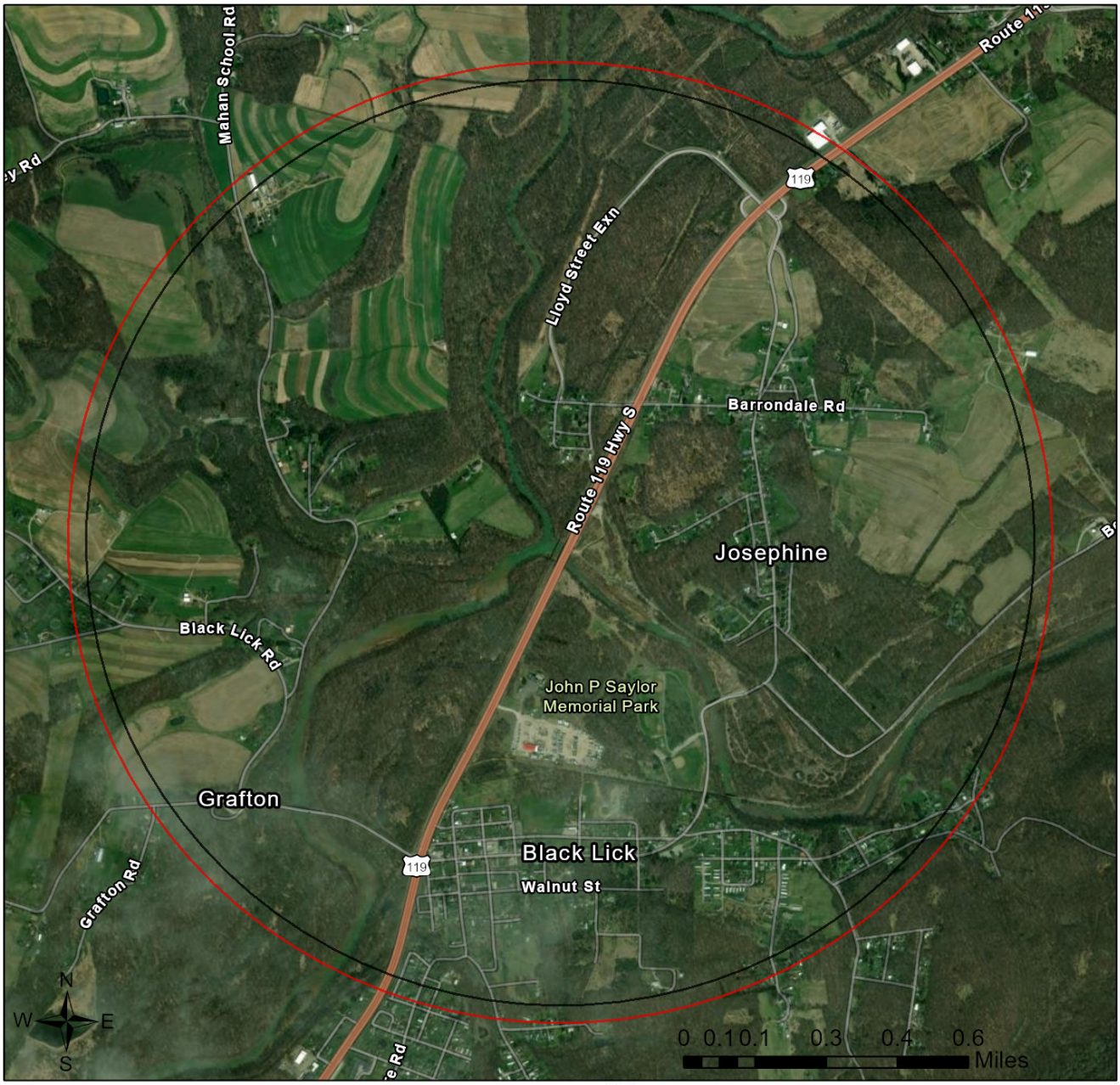
Project Name: **Homer City**
Date of Review: **2/23/2026 11:43:21 AM**
Project Category: **Energy Storage, Production, and Transfer, Energy Production (generation), Coal or gas power plant -- maintenance, modification, or expansion**
Project Area: **2,008.99 acres**
County(s): **Indiana**
Township/Municipality(s): **Blacklick Township; Burrell Township**
ZIP Code:
Quadrangle Name(s): **BOLIVAR**
Watersheds HUC 8: **Conemaugh**
Watersheds HUC 12: **Backlick Creek-Conemaugh River; Two Lick Creek-Blacklick Creek**
Decimal Degrees: **40.481945, -79.193056**
Degrees Minutes Seconds: **40° 28' 55.13" N, 79° 11' 35.0" W**

2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	**Conservation Measure**	**No Further Review Required, See Agency Comments**
PA Department of Conservation and Natural Resources	No Known Impact	No Further Review Required
PA Fish and Boat Commission	No Known Impact	No Further Review Required
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

Pennsylvania Natural Diversity Inventory (PNDI) records indicate that while threatened and endangered and/or special concern species and resources are in the project vicinity and that recommended Conservation Measures should be implemented in their entirety to avoid and minimize impacts to these species, no further coordination is required with the jurisdictional agencies. If a DEP permit is required for this project, DEP has the discretion to incorporate one or more Conservation Measures into its permit. This response does not reflect potential agency concerns regarding potential impacts to other ecological resources, such as wetlands.

Homer City



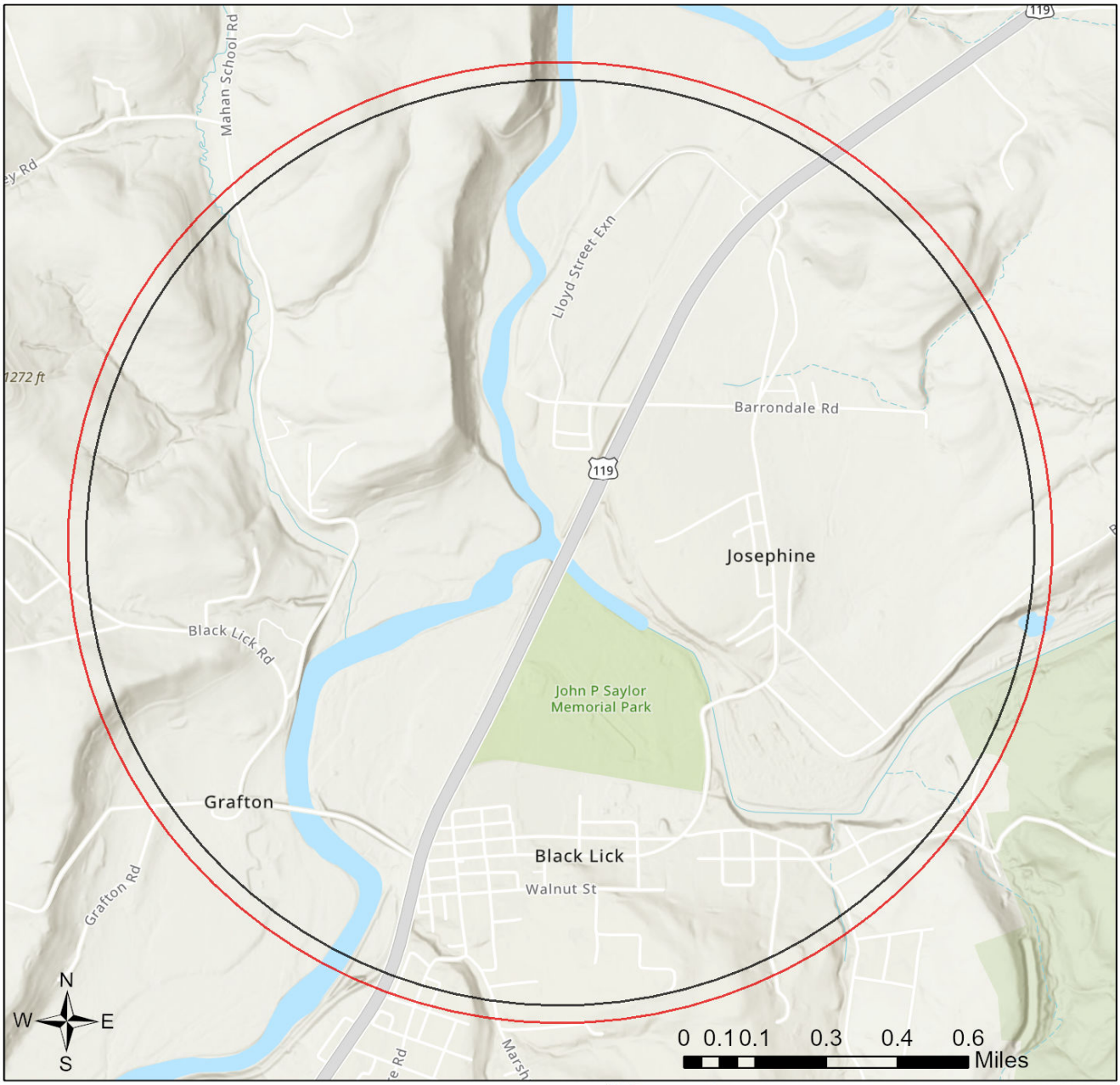
Buffered Project Boundary

Project Boundary



Sources: Esri, Vantor, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, and the GIS user community

Homer City



Sources: Esri, Vantor, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, and the GIS user community

RESPONSE TO QUESTION(S) ASKED

Q1: Will the action include disturbance to trees such as tree cutting (or other means of knocking down, or bringing down trees, tree topping. or tree trimming), pesticide/herbicide application or prescribed fire?
Your answer is: No

Q2: Does the action area contain any caves (or associated sinkholes, fissures, or other karst features), mines, rocky outcroppings, culverts, or tunnels that could provide habitat for hibernating bats?
Your answer is: No

Q3: Will the action include disturbance to trees such as tree cutting (or other means of knocking down, or bringing down trees, tree topping. or tree trimming), pesticide/herbicide application or prescribed fire?
Your answer is: No

Q4: Does the action area contain any caves (or associated sinkholes, fissures, or other karst features), mines, rocky outcroppings, culverts, or tunnels that could provide habitat for hibernating bats?
Your answer is: No

3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for two years** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt. The jursidictional agencies **strongly advise against** conducting surveys for the species listed on the receipt prior to consultation with the agencies.

PA Game Commission
RESPONSE:

Conservation Measure: Potential impacts to state and federally listed species which are under the jurisdiction of both the Pennsylvania Game Commission (PGC) and the U.S. Fish and Wildlife Service may occur as a result of this project. As a result, the PGC defers comments on potential impacts to federally listed species to the U.S. Fish and Wildlife Service. No further coordination with the Pennsylvania Game Commission is required at this time.

PA Department of Conservation and Natural Resources
RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Fish and Boat Commission
RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

U.S. Fish and Wildlife Service
RESPONSE:

No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq. is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. Two review options are available to permit applicants for handling PNDI coordination in conjunction with DEP's permit review process involving either T&E Species or species of special concern. Under sequential review, the permit applicant performs a PNDI screening and completes all coordination with the appropriate jurisdictional agencies prior to submitting the permit application. The applicant will include with its application, both a PNDI receipt and/or a clearance letter from the jurisdictional agency if the PNDI Receipt shows a Potential Impact to a species or the applicant chooses to obtain letters directly from the jurisdictional agencies. Under concurrent review, DEP, where feasible, will allow technical review of the permit to occur concurrently with the T&E species consultation with the jurisdictional agency. The applicant must still supply a copy of the PNDI Receipt with its permit application. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. The applicant and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at https://conservationexplorer.dcnr.pa.gov/content/resources.

5. ADDITIONAL INFORMATION

The PNDI environmental review website is a preliminary screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

6. AGENCY CONTACT INFORMATION

PA Department of Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552
Email: RA-HeritageReview@pa.gov

U.S. Fish and Wildlife Service
Pennsylvania Field Office
Endangered Species Section
110 Radnor Rd; Suite 101
State College, PA 16801
Email: IR1_ESPenn@fws.gov
NO Faxes Please

PA Fish and Boat Commission
Division of Environmental Services
595 E. Rolling Ridge Dr., Bellefonte, PA 16823
Email: RA-FBPACENOTIFY@pa.gov

PA Game Commission
Bureau of Wildlife Management
Division of Environmental Review
2001 Elmerton Avenue, Harrisburg, PA 17110-9797
Email: RA-PGC_PNDI@pa.gov
NO Faxes Please

7. PROJECT CONTACT INFORMATION

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Company/Business Name: ASA Analysis & Communication, Inc.
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8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

Radhika deSilva — 23 February 2026

applicant/project proponent signature — date