Shell Chemical Appalachia LLC
300 Frankfort Rd.
Monaca, PA 15061

April 7, 2025

Mr. Ryan Decker
Clean Water Program
PA Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: Water Quality Management (WQM) Permit 0417201 Amendment
Shell Chemical Appalachia LLC
Beaver County, Pennsylvania

Dear Mr. Decker:

Shell Chemical Appalachia LLC ("Shell") has enclosed an application to amend the Shell Polymers Monaca (SPM) existing Water Quality Management (WQM) permit. Shell is proposing to implement the Wastewater Treatment Plant (WWTP) Permanent Controls Project to install permanent equipment at SPM that will improve the oils, grease, and VOC removal efficiency of the primary treatment section of SPM' s WWTP.

If you have any questions or require additional information, please contact me at kimberly.kaal@shell.com or 724.709.2467.

Sincerely,

Kimberly Kaal

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

Enclosures - WQM Application including Engineers Report

SHELL CHEMICAL APPALACHIA LLC
PETROCHEMICALS COMPLEX
POTTER AND CENTER TOWNSHIPS
BEAVER COUNTY, PENNSYLVANIA

Application for Amendment to Water Quality Management Permit 0417201 (Part II Permit)

April 7, 2025

Prepared for:
Shell Chemical Appalachia LLC

Prepared by:

AECOM

TABLE OF CONTENTS

Section

Section 1

General Information Form (GIF)

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#	311950	**APS ID#**		Date Received & General Notes
Site ID#	102360	**Auth ID#**		
Facility ID#	**775836**			

CLIENT INFORMATION

DEP Client ID#	Client Type/Code	Dun & Bradstreet ID#
311950	LLC	13148917

Legal Organization Name or Registered Fictitious Name	Employer ID# (EIN)	Is the EIN a SSN?
Shell Chemical Appalachia LLC	46-1624986	☐ Yes ☒ No

State of Incorporation or Registration of Fictious Name
Delaware Limited Liability Company

☐ 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
300 Frankfort Rd	

Address Last Line – City	State	ZIP+4	Country
Monaca	PA	15061	Beaver

Client Contact Last Name	First Name	MI	Suffix
Kaal	Kimberly		

Client Contact Title	Phone	Ext	Cell Phone
Environmental Manager (Attorney-in-Fact)	724-709-2467		

Email Address	FAX
Kimberly.kaal@shell.com	

SITE INFORMATION

DEP Site ID#	Site Name
102360	Shell Polymers Monaca

EPA ID# 1506WSHLL3FRAN **Estimated Number of Employees to be Present at Site** 600

Description of Site
Ethylene manufacturing, polyethylene manufacturing, and cogeneration power plant

Tax Parcel ID(s):

County Name(s)	Municipality(ies)	City	Boro	Twp	State
Beaver	Potter	☐	☐	☒	PA
Beaver	**Center**	☐	☐	☒	PA
		☐	☐	☐	

☐	☐	☐	

Site Location Line 1	Site Location Line 2
300 Frankfort Rd	

Site Location Last Line – City	State	ZIP+4
Monaca	PA	15061

Detailed Written Directions to Site

From Pittsburgh International Airport - 376 North to Exit 39 (Monaca). Turn left onto Rt 18 South and proceed for 1.5 miles. Then turn right at light into plant.

Site Contact Last Name	First Name	MI	Suffix
Kaal	Kimberly		

Site Contact Title	Site Contact Firm
Environmental Manager (Attourney-in-Fact)	Shell

Mailing Address Line 1	Mailing Address Line 2
300 Fankfort Rd	

Mailing Address Last Line – City	State	ZIP+4
Monaca	PA	15061

Phone	Ext	FAX	Email Address
724-709-2467			Kimberly.kaal@shell.com

NAICS Codes (Two- & Three-Digit Codes – List All That Apply)	6-Digit Code (Optional)
325 and 221	325110, 325211, and 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	775836	☐	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	417201
☐	Erosion & Sediment Control Facility		☐	Water Resource	
☐	Explosive Storage Location		☐	Other:	

Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
	40	40	17.724	80	20	**10**

Horizontal Accuracy Measure	Feet	18	*--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	GISDR				
Reference Point Code	CNTER				
Altitude	Feet	785.91	*--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		SRVEY			
Geometric Type Code	POINT				
Data Collection Date	5/26/2012				
Source Map Scale Number	1	Inch(es)	=	Feet	
--or--		Centimeter(s)	=	Meters	

PROJECT INFORMATION

Project Name

Modification of Water Quality Permit 417201

Project Description

Addition of equipment to enhance hydrocarbon removal from wastewater

Project Consultant Last Name	First Name	MI	Suffix
Joseph	Jerry		

Project Consultant Title **Consulting Firm**

Mailing Address Line 1 **Mailing Address Line 2**

Address Last Line – City **State** **ZIP+4**

Phone **Ext** **FAX** **Email Address**

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: Municipal Small Community Group meetings, Community Advisory Panel meetings, meetings with Elected Officials, and notification letters.

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 ~ 1 acre		
	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. Air Plan Approval Modification has been submitted to address de minimus emissions from this project

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** Center Township Water Authority (existing)

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 Nathan Levin

Signature	Title	Date
	Operations Manager	3-20-25

Section 2

Acts 14/67/68/127 Notifications and Receipts

- Beaver County
- Potter Township
- Center Township

Shell Chemical Appalachia LLC
300 Frankfort Road
Monaca, PA 15061

February 17, 2025

Daniel C. Camp III
Chairman, Beaver County Commissioners
Beaver County Courthouse
810 Third Street
Beaver, PA 15009

RE: Public Notice for Shell Chemical Appalachia LLC Water Quality Management Permit Amendment

Dear Mr. Camp,

This notice is to inform you of Shell Chemical Appalachia LLC's intent to submit an amendment to Water Quality Management Permit (No. 0417201) to the Pennsylvania Department of Environmental Protection (PADEP) with the Permitting and Technical Services Section, Bureau of Water Standards and Facility Regulations for the following project:

Project:	Shell is proposing to implement the Wastewater Treatment Plant (WWTP) Permanent Controls Project to install permanent equipment at SPM that will improve the oils, grease, and VOC removal efficiency of the primary treatment section of SPM's WWTP
Applicant Name:	Shell Chemical Appalachia LLC
Project Location:	300 Frankfort Road, Monaca, PA 15061
Applicant Contact:	Kimberly Kaal Shell Chemical Appalachia LLC 300 Frankfort Road Monaca, Beaver County, Pennsylvania 15061
Municipality/County:	Potter Township, Beaver County, PA

This letter is intended to satisfy the requirements of Pennsylvania Acts 14, 67, 68, and 127 and the Pennsylvania Municipalities Planning Code. Section 1905-A of the Commonwealth Administrative Code as amended by Act 14, requires that each applicant for a PADEP permit must give written notice to the municipality(ies) and the county(ies) in which the permitted activity is located. The written notices shall be received by the municipality(ies) and county(ies) at least 30 days before the PADEP may issue or deny the permit.

Acts 67 and 68, which amended the Municipalities Planning Code 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 Sections 619.2 and 1105 of the Municipalities Planning Code.

PADEP invites you to review the attached information and comment on the land use aspects of this project; please be specific to PADEP when identifying any areas of conflict. If you wish to submit comments for PADEP to consider in a land use review of this project, you must respond within 30 days to the PADEP regional office listed below. If no land use comments are received by the end of the comment period,

PADEP will assume that there are not substantive land use conflicts and proceed with the normal application review process.

Please submit any comments concerning this project within 30 days from the date of receipt of this letter to the PADEP, Southwest Regional Office, Bureau of Water Standards and Facility Regulation, 400 Waterfront Drive, Pittsburgh, PA 15222-4745.

For more information about this project, please contact Kimberly Kaal at (724) 709-2467 or me at (724) 709-6068.

Sincerely,

Nathan Levin
Operations Manager

April 07, 2025

Dear Customer,

The following is the proof-of-delivery for tracking number: 772526010437

Delivery Information:

Status:	Delivered	**Delivered To:**	Shipping/Receiving
Signed for by:	C.Carlyn	**Delivery Location:**	
Service type:	FedEx 2Day		
Special Handling:	Deliver Weekday		BEAVER, PA,
		Delivery date:	Mar 7, 2025 09:01

Shipping Information:

Tracking number:	772526010437	**Ship Date:**	Mar 6, 2025
		Weight:	0.5 LB/0.23 KG

Recipient:

BEAVER, PA, US,

Shipper:

PITTSBURGH, PA, US,

FedEx Express proof-of-delivery details appear below; however, no signature is currently available for this shipment. Please check again later for a signature.

Thank you for choosing FedEx

Shell Chemical Appalachia LLC
300 Frankfort Road
Monaca, PA 15061

February 17, 2025

Rebecca Matsco
Chairwoman, Potter Township Supervisors
206 Mowry Road
Monaca, PA 15061

RE: Public Notice for Shell Chemical Appalachia LLC Water Quality Management Permit Amendment

Dear Ms. Matsco,

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Applicant Name:	Shell Chemical Appalachia LLC
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Applicant Contact:	Kimberly Kaal Shell Chemical Appalachia LLC 300 Frankfort Road Monaca, Beaver County, Pennsylvania 15061
Municipality/County:	Potter Township, Beaver County, PA

This letter is intended to satisfy the requirements of Pennsylvania Acts 14, 67, 68, and 127 and the Pennsylvania Municipalities Planning Code. Section 1905-A of the Commonwealth Administrative Code as amended by Act 14, requires that each applicant for a PADEP permit must give written notice to the municipality(ies) and the county(ies) in which the permitted activity is located. The written notices shall be received by the municipality(ies) and county(ies) at least 30 days before the PADEP may issue or deny the permit.

Acts 67 and 68, which amended the Municipalities Planning Code 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 Sections 619.2 and 1105 of the Municipalities Planning Code.

PADEP invites you to review the attached information and comment on the land use aspects of this project; please be specific to PADEP when identifying any areas of conflict. If you wish to submit comments for PADEP to consider in a land use review of this project, you must respond within 30 days to the PADEP regional office listed below. If no land use comments are received by the end of the comment period, PADEP will assume that there are not substantive land use conflicts and proceed with the normal application review process.

Please submit any comments concerning this project within 30 days from the date of receipt of this letter to the PADEP, Southwest Regional Office, Bureau of Water Standards and Facility Regulation, 400 Waterfront Drive, Pittsburgh, PA 15222-4745.

For more information about this project, please contact Kimberly Kaal at (724) 709-2467 or me at (724) 709-6068.

Sincerely,

Nathan Levin
Operations Manager

April 07, 2025

Dear Customer,

The following is the proof-of-delivery for tracking number: 772526050419

Delivery Information:			
Status:	Delivered	**Delivered To:**	Shipping/Receiving
Signed for by:	R.Maestro	**Delivery Location:**	
Service type:	FedEx 2Day		
Special Handling:	Deliver Weekday		MONACA, PA,
		Delivery date:	Mar 7, 2025 17:34

Shipping Information:			
Tracking number:	772526050419	**Ship Date:**	Mar 6, 2025
		Weight:	0.5 LB/0.23 KG

Recipient:	**Shipper:**
MONACA, PA, US,	PITTSBURGH, PA, US,

FedEx Express proof-of-delivery details appear below; however, no signature is currently available for this shipment. Please check again later for a signature.

Thank you for choosing FedEx

Shell Chemical Appalachia LLC
300 Frankfort Road
Monaca, PA 15061

February 17, 2025

Bill DiCioccio, Jr.
Chairman, Center Township Supervisors
Center Township Municipal Building
3468 Brodhead Road, Suite 7
Monaca, PA 15061

RE: Public Notice for Shell Chemical Appalachia LLC Water Quality Management Permit Amendment

Dear Mr. DiCioccio,

This notice is to inform you of Shell Chemical Appalachia LLC's intent to submit an amendment to Water Quality Management Permit (No. 0417201) to the Pennsylvania Department of Environmental Protection (PADEP) with the Permitting and Technical Services Section, Bureau of Water Standards and Facility Regulations for the following project:

Project:	Shell is proposing to implement the Wastewater Treatment Plant (WWTP) Permanent Controls Project to install permanent equipment at SPM that will improve the oils, grease, and VOC removal efficiency of the primary treatment section of SPM's WWTP
Applicant Name:	Shell Chemical Appalachia LLC
Project Location:	300 Frankfort Road, Monaca, PA 15061
Applicant Contact:	Kimberly Kaal Shell Chemical Appalachia LLC 300 Frankfort Road Monaca, Beaver County, Pennsylvania 15061
Municipality/County:	Potter Township, Beaver County, PA

This letter is intended to satisfy the requirements of Pennsylvania Acts 14, 67, 68, and 127 and the Pennsylvania Municipalities Planning Code. Section 1905-A of the Commonwealth Administrative Code as amended by Act 14, requires that each applicant for a PADEP permit must give written notice to the municipality(ies) and the county(ies) in which the permitted activity is located. The written notices shall be received by the municipality(ies) and county(ies) at least 30 days before the PADEP may issue or deny the permit.

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PADEP invites you to review the attached information and comment on the land use aspects of this project; please be specific to PADEP when identifying any areas of conflict. If you wish to submit comments for PADEP to consider in a land use review of this project, you must respond within 30 days to the PADEP regional office listed below. If no land use comments are received by the end of the comment period,

PADEP will assume that there are not substantive land use conflicts and proceed with the normal application review process.

Please submit any comments concerning this project within 30 days from the date of receipt of this letter to the PADEP, Southwest Regional Office, Bureau of Water Standards and Facility Regulation, 400 Waterfront Drive, Pittsburgh, PA 15222-4745.

For more information about this project, please contact Kimberly Kaal at (724) 709-2467 or me at (724) 709-6068.

Sincerely,

Nathan Levin
Operations Manager

April 07, 2025

Dear Customer,

The following is the proof-of-delivery for tracking number: 772526097737

Delivery Information:

Status:	Delivered	**Delivered To:**	Shipping/Receiving
Signed for by:	M.Palumbo	**Delivery Location:**	
Service type:	FedEx 2Day		
Special Handling:	Deliver Weekday		MONACA, PA,
		Delivery date:	Mar 7, 2025 15:44

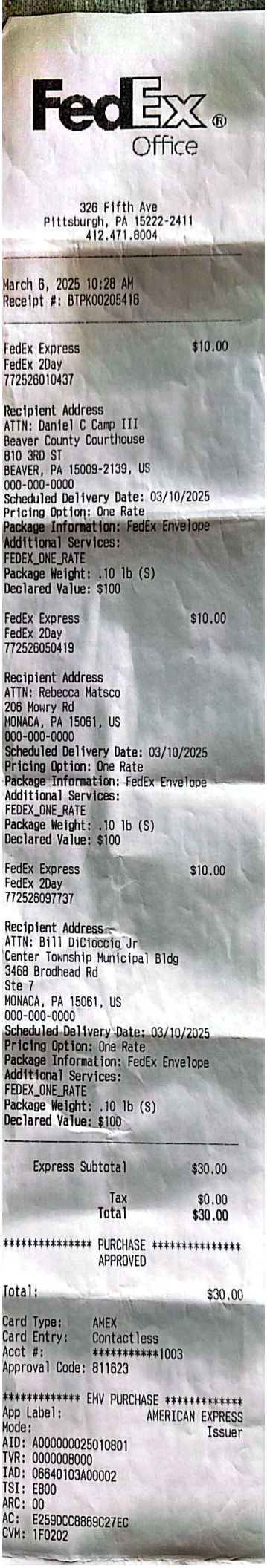
Shipping Information:

Tracking number:	772526097737	**Ship Date:**	Mar 6, 2025
		Weight:	0.5 LB/0.23 KG

Recipient:	**Shipper:**
MONACA, PA, US,	PITTSBURGH, PA, US,

FedEx Express proof-of-delivery details appear below; however, no signature is currently available for this shipment. Please check again later for a signature.

Thank you for choosing FedEx



FedEx Office

326 Fifth Ave
Pittsburgh, PA 15222-2411
412.471.8004

March 6, 2025 10:28 AM
Receipt #: BTPK00205416

FedEx Express $10.00
FedEx 2Day
772526010437

Recipient Address
ATTN: Daniel C Camp III
Beaver County Courthouse
810 3RD ST
BEAVER, PA 15009-2139, US
000-000-0000
Scheduled Delivery Date: 03/10/2025
Pricing Option: One Rate
Package Information: FedEx Envelope
Additional Services:
FEDEX_ONE_RATE
Package Weight: .10 lb (S)
Declared Value: $100

FedEx Express $10.00
FedEx 2Day
772526050419

Recipient Address
ATTN: Rebecca Matsco
206 Mowry Rd
MONACA, PA 15061, US
000-000-0000
Scheduled Delivery Date: 03/10/2025
Pricing Option: One Rate
Package Information: FedEx Envelope
Additional Services:
FEDEX_ONE_RATE
Package Weight: .10 lb (S)
Declared Value: $100

FedEx Express $10.00
FedEx 2Day
772526097737

Recipient Address
ATTN: Bill DiCioccio Jr
Center Township Municipal Bldg
3468 Brodhead Rd
Ste 7
MONACA, PA 15061, US
000-000-0000
Scheduled Delivery Date: 03/10/2025
Pricing Option: One Rate
Package Information: FedEx Envelope
Additional Services:
FEDEX_ONE_RATE
Package Weight: .10 lb (S)
Declared Value: $100

Express Subtotal $30.00

Tax $0.00
Total **$30.00**

********** PURCHASE **********
APPROVED

Total: $30.00

Card Type: AMEX
Card Entry: Contactless
Acct #: **********1003
Approval Code: 811623

********** EMV PURCHASE **********
App Label: AMERICAN EXPRESS
Mode: Issuer
AID: A0000000025010801
TVR: 0000008000
IAD: 06640103A00002
TSI: E800
ARC: 00
AC: E259DCC8869C27EC
CVM: 1F0202

Section 3

Evidence of newspaper publication for 4 consecutive weeks

LOCALiQ

Erie Times-News | The Intelligencer
Bucks County Courier Times
The Daily American | Beaver County Times
Pocono Record | Burlington County Times

PO Box 630531 Cincinnati, OH 45263-0531

AFFIDAVIT OF PUBLICATION

5th Floor
AECOM
300 Frankfort Road
Monaca PA 15061

STATE OF PENNSYLVANIA, COUNTY OF BEAVER

The Beaver County Times, Ellwood City Ledger, a daily newspaper of general circulation, published and having its place of business at Aliquippa, Beaver County, PA; that attached hereto is a facsimile of the printed notice which is exactly as printed and published in said newspaper issue dated on:

03/02/2025, 03/04/2025, 03/05/2025, 03/06/2025, 03/07/2025, 03/09/2025, 03/11/2025, 03/12/2025, 03/13/2025, 03/14/2025, 03/16/2025, 03/18/2025, 03/19/2025, 03/20/2025, 03/21/2025, 03/23/2025, 03/25/2025, 03/26/2025, 03/27/2025, 03/28/2025, 03/30/2025

That said newspaper was regularly issued and circulated on those dates.

Sworn to and subscribed before on 03/30/2025

Legal Clerk

Notary, State of WI, County of Brown

8.25.26

My commission expires

Publication Cost:	$5258.97	
Tax Amount:	$0.00	
Payment Cost:	$5258.97	
Order No:	11082071	# of Copies:
Customer No:	1516490	0
PO #:	LSOM0248405	

THIS IS NOT AN INVOICE!

Please do not use this form for payment remittance.

MARIAH VERHAGEN
Notary Public
State of Wisconsin

Notice is hereby given that Shell Chemical Appalachia LLC at 300 Frankfort Road, Monaca, PA 15061, (Phone - 724.709.6429) intends to submit an application to the Department of Environmental Protection (DEP) to amend the existing Water Quality Management Permit (WQM No. 0417201) in a manner which meets DEP requirements, from its facility located in Potter and Center Townships, Beaver County.

The application is to amend the existing WQM permit to add equipment to enhance removal of hydrocarbons in the wastewater prior to treatment in the existing biotreater. This application is made under the provision of the Clean Streams Law, the Act of June 22, 1937, P.L. 1987, as amended. Persons desiring additional information should contact the Company as indicated above. Those wishing to provide comment or ask additional questions regarding the permit application should contact the DEP at the following address: Southwest Regional Office, Clean Water Environmental Program Manager, 400 Waterfront Drive, Pittsburgh, PA 15222-4745, (Phone 412.442.4000) after March 30, 2025.

March 2, 4, 5, 6, 7, 9, 11, 12, 13, 14, 16, 18, 19, 20, 21, 23, 25, 26, 27, 28, 30 2025

LSOM0248405

Section 4

PADEP WQM Checklist, Forms and Modules

- WQM Application 3850-PM-BCW0400 b
- WQM Checklist 3850-PM-BCW0400 c
- Module 15 - Industrial Wastewater Treatment Facility

Permit Application

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

APPLICATION FOR WATER QUALITY MANAGEMENT PERMIT

Before completing this form, read the step-by-step instructions provided in this application package.

Related ID#s (If Known)				DEP USE ONLY
Client ID#	311950	APS ID#	_____	Date Received & General Notes
Site ID#	102360	Auth ID#	_____	
Facility ID#	_____			

APPLICANT IDENTIFIER

Application Type: ☐ New ☒ Modification ☐ Renewal Permit Number (if modification or renewal) 417201

Applicant Name: Shell Chemical Appalachia LLC

Current Mailing Address: 300 Frankfort Rd, Monaca, PA 15061

Current Phone Number: (724) 7096429

FACILITY TYPE (Check all appropriate boxes below)

- ☐ Treatment Plant Summary – Module 1
- ☐ Sewer System – Module 2
- ☐ Flow Equalization and Grit Chambers – Module 3
- ☐ Screening and Settling – Module 4
- ☐ Trickling Filters and Aeration – Module 5
- ☐ Chemical Treatment – Module 6
- ☐ Rapid Sand Filters – Module 7
- ☐ Other Filters and Disinfection – Module 8
- ☐ Aerobic Digestion Tanks – Module 9
- ☐ Anaerobic Digestion – Module 10
- ☐ Sludge Filters and Centrifuges – Module 11
- ☐ Sludge Drying Beds – Module 12
- ☐ Stream Encroachment and Crossings – Module 13
- ☐ Spray Irrigation – Module 14
- ☒ Industrial Wastewater Treatment Facility – Module 15
- ☐ Small Flow Treatment Facility – Module 16
- ☐ Sewer Extensions – Module 17
- ☐ Manure Storage Facilities – Module 18
- ☐ Supplementary Geology and Groundwater Information – Module 19
- ☐ Impoundments – Module 20
- ☐ Sequencing Batch Reactor – Module 21
- ☐ Pump Stations – Module 22

COMPLIANCE HISTORY REVIEW		
Is/was 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 and schedule of compliance and provide compliance status. Use additional sheets to provide information on all permits.		
Permit Program **See Attached List**	Permit No.	
Brief Description of Noncompliance		
Steps Taken to Achieve Compliance	Date(s) Compliance Achieved	
Current Compliance Status ☐ In Compliance	☐ In Noncompliance	

CERTIFICATION (Check appropriate box below.)

I certify under penalty of law that I

- ☐ am the applicant
- ☐ am an officer or official of the applicant
- ☒ have the authority to make this application (attach delegation of signatory authority) and that the plans, reports and documents designated and attached here with part of the application are true and correct to the best of my knowledge and belief.

Nathan Levin	Operations Manager
Name (type or print legibly)	Official Title
Nathan Levin	3-20-25
Signature	Date

(Use corporate or professional seal as appropriate.)

Taken, sworn and subscribed before me, this 20th day of March 20 25

Notary Seal

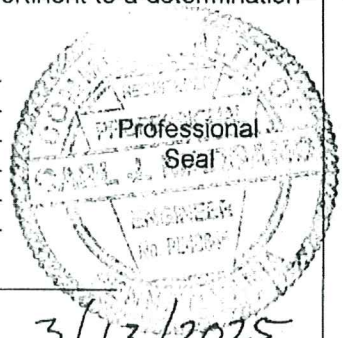
Commonwealth of Pennsylvania - Notary Seal
TERRI PIZOR-LEVENTHAL - Notary Public
Beaver County
My Commission Expires February 16, 2027
Commission Number 1095096

Terri Pizor-Leventhal

LICENSED PROFESSIONAL ENGINEER

This is to certify that I have personally reviewed all engineering information contained in the accompanying modules, drawings, specifications and other documents which are part of this application and that I have found it to be of good engineering quality, true and correct, and is in conformance with the requirements of the Department of Environmental Protection (DEP), and it does not, to the best of my knowledge, withhold information that is pertinent to a determination of compliance with the requirements of DEP.

Name of Design Engineer:	Carl J. Marsano, P.E.
Design Firm:	Wood Engineering & Architectural Services, P.C.
Mailing Address:	1979 Lakeside Parkway, Suite 400
	Tucker, GA 30084
Telephone Number:	(207) 286-7608
E-mail Address:	carl.marsano@woodplc.com



Carl J Marsano
Signature of Professional Engineer

3/13/2025

NOTICE: It is an offense under Pennsylvania Criminal Code to affirm a false statement in documents submitted to DEP.

DEP will consider the licensed professional engineer whose seal is affixed to design documents to be fully responsible for the adequacy of all aspects of facility designs. The application and supporting documentation submitted for sewerage projects will be reviewed to ensure general consistency with good engineering practices, and the applicable design guidelines of DEP.

COMPLIANCE HISTORY REVIEW SUMMARY

Date	Location	Plan Approval/ Operating Permit#	Nature of Deviation/ Documented Conduct	Type of Department Action	Status Litigation; Existing / Continuing; or corrected/Date	Dollar Amount Penalty
5/24/2023 to present	Shell Polymers Monaca	04-00740A/C	Site-wide NOx 12-month rolling limitation: The COA expired end of January 2024. Site remains non-compliant with NOx emission limitation.		Continuing deviation. Engineering improvements and permitting corrections to match facility design. Proposed to be resolved in plan approval modification application.	• $4,935,023 • $5,000,000: Projects to Benefit Community, Environment and Health • $521,549.62: Monthly emissions for May 2023 • $1,046,766.94: Monthly emissions for June 2023 • $844,373.39: Monthly emissions for July 2023 • $250,791.20: Monthly emissions for August 2023 • $0: Monthly emissions for September 2023 • $0: Monthly emissions for October and November 2023 · • $7,563.60: Monthly emissions for December 2023 · • $90,484.90: Monthly emissions for January 2024
9/11/2023	Shell Polymers Monaca	PA-04-00740A/B/C	NOV for Benzene Waste NESHAP (BWON)	Notice of Violation	Pending	TBD
12/4/2023	Shell Polymers Monaca	PA-04-00740A/B/C	Visible Emissions >5 min in consecutive 2 hrs. MPGF, Source C204B, and TEGF A C205A and HPEF C205C	Notice of Violation	Pending	TBD
3/6/2024	Shell Polymers Monaca	PA-04-00740A/B/C	Visible Emissions >5 min in consecutive 2 hrs. MPGF, Source TEGFA C205A	Notice of Violation	Pending	TBD
6/17/2024	Shell Polymers Monaca	PA-04-00740A/B/C	Visible Emissions >5 min in consecutive 2 hrs from the MPGF Source C204B.	Notice of Violation	Pending	TBD
8/19/2024	Shell Polymers Monaca	PA-04-00740A/B/C	Visible Emissions >5 min in consecutive 2 hrs from the MPGF 204B, TEGF A C205A and TEGF B C205B	Notice of Violation	Pending	TBD

Date	Location	Plan Approval/ Operating Permit#	Nature of Deviation/ Documented Conduct	Type of Department Action	Status Litigation; Existing / Continuing; or corrected/Date	Dollar Amount Penalty
9/5/2024-present	Shell Polymers Monaca	PA-04-00740A/B/C	Exceedances of 12-Month Emission Limitations for NOx (ongoing)	Notice of Violation(s)	Pending	TBD
2/12/2025	Shell Polymers Monaca	PA-04-00740A/B/C	Cogen Units NOx Emission Limit Exceedances: - 2/23/2024 Cogen Unit 103 - 7/4/2024 Cogen Unit 102	Notice of Violation	Pending	TBD
2/12/2025	Shell Polymers Monaca	PA-04-00740A/B/C	Ethane Cracking Furnaces NOx Emission Limit Exceedances: - 1/20/2024: Furnace 1 (031) and Furnace 2 (032) - 3/18/2024 Furnace 3 (033) - 6/21-22/2024 Furnace 3 (033) - 9/30/2024 Furnace 6 (036)	Notice of Violation	Pending	TBD
2/12/2025	Shell Polymers Monaca	PA-04-00740A/B/C	Ethane Cracking Furnaces NOx Emission Limit Exceedances: - 11/8/2024 Furnace 1 (031), Furnace 3 (033), Furnace 4 (034), Furnace 5 (035); Furnace 6 (036) - 11/9/2024 Furnace 6 (036) Visible Emissions >5 min in consecutive 2 hrs from the TEGF A C205A, TEGF B C205B, and HPEF C205C on 11/8/2024	Notice of Violation	Pending	TBD
2/12/2025	Shell Polymers Monaca	PA-04-00740A/B/C	Visible Emissions >5 min in consecutive 2 hrs from the MPGF C204B on 9/16/2024 and 9/18/2024	Notice of Violation	Pending	TBD
2/12/2025	Shell Polymers Monaca	PA-04-00740A/B/C	Visible Emissions >5 min in consecutive 2 hrs from the MPGF C204B on 12/6/2024	Notice of Violation	Pending	TBD

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

CHECKLIST FOR WATER QUALITY MANAGEMENT PERMIT

	APPLICANT'S √ CHECKLIST	
APPLICANT NAME	Shell Chemical Appalachia LLC	

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

ENCLOSE THIS CHECKLIST WITH YOUR APPLICATION FORM.

		Check √ If Included	DEP Use Only
1.	General Information Form (GIF).	☒	
2.	Appropriate application fee, with check payable to the Commonwealth of PA	☒	
3.	Two (2) copies (original and 1 copy) of application, design module(s), and accompanying drawings and plans.	☒	
	a. Certification and proper signatures.	☒	
	b. Engineer's professional seal on each plan sheet.	☒	
	c. *Design Engineer's Report* with signature and seal on cover	☒	
	d. Properly notarized (original).	☒	
	e. Technical specifications with engineer's seal and signature on cover	☒	
	f. Additional copy for Delaware River Basin or Erie and Allegheny counties (if required).	☐	
4.	Supplemental Information:	☐	
	a. General Layout Diagram (unless design plans provide this information).	☐	
	b. Sizes, Capacities and Dimensions Diagram (unless design plans provide this information).	☐	
5.	Design Modules.	☒	
6.	Topographic map with appropriate details.	☐	
7.	Act 14 Notification.	☒	
8.	Act 537 Approval (if required).	☐	
9.	Cultural Resources Notification	☐	
10.	Acts 67, 68 and 127 Notification (IW and Manure Storage Facilities only).	☒	
11.	Proof of Public Notification (IW and Manure Storage Facilities only)	☒	
12.	DRBC Notification (if required).	☐	
13.	Other (specify):	☐	

Module 15

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DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

INDUSTRIAL WASTEWATER TREATMENT FACILITY
MODULE 15

APPLICANT NAME	Shell Chemical Appalachia LLC

Note: A copy of the *Design Engineer's Report* must be attached to this module.

SIC/NAICS CODES

	SIC CODE	NAICS CODE	Corresponding SIC/NAICS Description
1st		32	Manufacturing
2nd		22	Utilities
3rd			
4th			

GENERAL DESCRIPTION AND NATURE OF BUSINESS

Petrochemical Complex

LIST OF PERMITS (List all NPDES and WQM permits presently held for this facility.)

NPDES Permit PA0002208

Water QualityPermit 417201

TREATMENT PROCESS CODES

PHYSICAL TREATMENT PROCESSES

Treatment Process	Code
Ammonia Stripping	AS
Dialysis	DIALY
Diatomaceous Earth Filtration	DEF
Electrodialysis	ELECT
Evaporation	EVAP
Flocculation	FLOCC
Flotation	FLOT
Foam Fractionation	FF
Freezing	FREEZ
Gas-Phase Separation (air stripping)	GPS
Grinding	GRIND
Flow Equalization	FE
Eutectic Freezing	EUTEC
Screening	SCRN
Microstraining	MSTRN
Grit Removal	GR
Mixing	MIX
Moving Bed Filters	MBF
Intermittent Sand Filters	ISF
Reverse Osmosis (Hyperfiltration)	RO
Rapid Sand Filtration	RSF
Sedimentation	SEDI
Slow Sand Filtration	SSF
Solvent Extraction	SE
Sorption (not Carbon)	SORPT
Distillation	DISTL
Multimedia Filtration	MF
Filtration	FILTR

DISINFECTION

Hypochlorite	HYPO
Chlorine Gas	CL
Ozone	OZONE
Ultraviolet	UV

BIOLOGICAL TREATMENT PROCESSES

Treatment Process	Code
Activated Sludge	ACTSL
Aerated Lagoons	AERLG
Anaerobic Treatment	ANAE
Nitrification – Denitrification	NIDI
Pre-Aeration	PA
Spray Irrigation/Land Application	SILA
Stabilization Ponds	SP
Rotating Biological Contactors	RBC
Post Aeration	POA
Holding or Detention Pond	HOLD
Treatment by Plain Aeration	PLAIN
Ridge & Furrow Irrigation	RFI
Sheet or Overland Flow Irrigation	SOFI
Surface/Subsurface Injection	SSSI
Sequence Batch Reactor	SBR
Artificial Wetlands	ARTWL
Imhoff Tank	IMHOF
Polishing Lagoons	POL
Biological Hydrolysis	BIOHY
Trickling Filtration	TF

BIOSOLID USE/DISPOSAL

Incineration	INCIN
Land Application	LNDAP
Landfill	LNDFL
Pyrolysis	PYRO

DISPOSAL

Discharge to Surface Water	
Ocean Discharge through Outfall	OCEAN
Reuse/Recycle of Treated Outfall	RCYEF
Underground Injection	UI
Reuse or Sale of Wastewater or Raw Material for Other Processes	REUSE

CHEMICAL TREATMENT AND OTHER PROCESSES

Treatment Process	Code
Carbon Adsorption	CA
Chemical Oxidation	CO
Chemical Precipitation	CP
Chemical Hydrolysis	CH
Coagulation	COAG
Dechlorination	DC
Electrochemical Treatment	ET
Ion Exchange	IE
Neutralization	NEUT
Oxidation	OX
Temperature Control	TEMP
Oil & Grease Removal, Including Skimming & Separators	OGREM
Reduction	RD
Odor Control	OC

BIOSOLID TREATMENT PROCESSES

Aerobic Digestion	AERON
Anaerobic Digestion	ANEDN
Belt Filtration	BELT
Centrifugation	CENT
Conditioning (Chemical, Heat)	COND
Chlorine Treatment	CHTR
Composting	COMP
Drying	DRY
Elutriation	ELU
Flotation Thickening	FLOT
Freezing	FREEZ
Gravity Thickening	GRAV
Sludge Lagoons	SLAG
Vacuum Filtration	VAC
Vibration	VIB
Wet Oxidation	WETOX
Pressure Filtration	PRESS

Module 15

Summary of Wastewater Source and Treatment Unit Information	1. SOURCE OF WASTE ECU wastewater 2. OUTFALL NO. NA -discharge is to other treatment systems	1. SOURCE OF WASTE Settlement Drum 2. OUTFALL NO. NA -discharge is to other treatment systems
3. TYPE(S) OF WASTE (i.e., Sanitary, Process . . .)	Process and general wastewater	Process and general wastewater
4. WASTE FLOW PATTERN	☒ Continuous ☐ Intermittent From (am) To (pm) ☐ Batch	☒ Continuous ☐ Intermittent From (am) To (pm) ☐ Batch
5. DAILY WASTE VOLUME TOTAL	Batches/day Gallons/batch 970,000 Gallons/day	Batches/day 946,400 Gallons/batch Gallons/day

6. DESIGN FLOW AVERAGE MAXIMUM	MGD 0.97 MGD	(Check) Existing	(Check) Proposed	Code for Treatment Unit	MGD 0.946 MGD	(Check) Existing	(Check) Proposed	Code for Treatment Unit
General Sequence of Treatment Units (See Treatment Process Code List)	Unit (1)				Unit (1)			
	Settlement Drum	☐	☒	OGREM	DNF #1	☐	☒	FLOT
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	

(1) If impoundments are proposed and the wastewater entering the impoundment meets the definition of Residual Waste at Title 25 Pa. Code Chapter 287, the design must be in accordance with Title 25 Pa. Code § 299.144.

Use Additional Sheets If Necessary

Summary of Wastewater Source and Treatment Unit Information	1. SOURCE OF WASTE DNF #1 2. OUTFALL NO. NA -discharge is to other treatment systems	1. SOURCE OF WASTE Settlement Drum 2. OUTFALL NO. NA -discharge is to other treatment systems
3. TYPE(S) OF WASTE (i.e., Sanitary, Process . . .)	Process and general wastewater	Process and general wastewater
4. WASTE FLOW PATTERN	☒ Continuous ☐ Intermittent From (am) To (pm) ☐ Batch	☒ Continuous ☐ Intermittent From (am) To (pm) ☐ Batch
5. DAILY WASTE VOLUME TOTAL	Batches/day Gallons/batch 412,000 Gallons/day	Batches/day Gallons/batch 1,585,000 Gallons/day

6. DESIGN FLOW AVERAGE MAXIMUM	MGD 0.41 MGD Unit (1)	(Check) Existing	(Check) Proposed	Code for Treatment Unit	MGD 1.58 MGD Unit (1)	(Check) Existing	(Check) Proposed	Code for Treatment Unit
General Sequence of Treatment Units (See Treatment Process Code List)	Steam Stripper	☐	☒	GPS	DNF #2	☐	☒	FLOT
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	
		☐	☐			☐	☐	

Applicant Name: Shell Chemical Appalachia LLC

Module 15

WASTE CHARACTERISTICS	OUTFALL 101 SOURCE OF WASTE: Process and General Wastewater	SAMPLING PERIOD: From To ☐ Yes ☒ No NPDES Permit application submitted within last 3 years for this outfall.	NAME OF LABORATORY/CONSULTANT Telephone No.: ( )

SAMPLING LOCATION * -- TREATMENT FACILITY INFLUENT						EXISTING TREATMENT FACILITY EFFLUENT				NEW TREATMENT FACILITY EFFLUENT (Expected)				ANALYTICAL METHOD USED (AA, GC/MS, etc.)
PARAMETER	UNITS	MONTHLY AVERAGE	24 HR. MAX.	MIN.	MAX.	MONTHLY AVERAGE	24 HR. MAX.	MIN.	MAX.	MONTHLY AVERAGE	24 HR. MAX.	MIN.	MAX.	
O&G	mg/L			30	714								30	
Benzene	mg/L			4	938								0.17	
Ethylbenzene	mg/L			1	17								0.135	
Toluene	mg/L			4	195								0.1	
Xylene	mg/L			1	53								0.8	
Stryrene	mg/L			2	210								0.05	
Napthtalene	mg/L			1	3120								0.073	

***Use Additional Sheets as Necessary**

Comments/additional information: Influent data is basis for design of the new equipment proposed in this application. Treatment facility effluent are from the entire wastewater facility (new and existing equipment).

Section 5

Design Engineers Report

Project No.: P-00052		
WOOD No.:		Rev. No.: 1
Customer No.:		Issue purpose: PERMIT

Shell Polymers Monaca WWTU Improvement Project

ADDENDUM
TO
DESIGN ENGINEER'S REPORT
(Prepared as Amendment No. 3 to the WQM Part II Permit No. 0417201)

Preparer

wood.

for

Shell Chemical Appalachia LLC

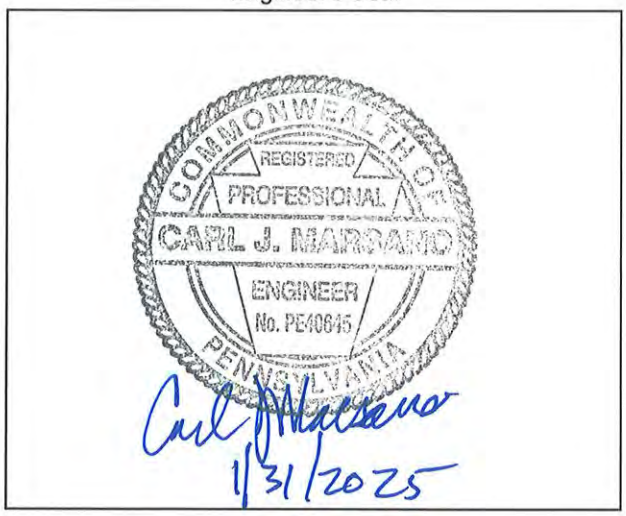
Date of Preparation: January 28, 2025

WOOD Document Number: 100412-P00052-AA0-RPT-0001

Shell Document Number: SPM-805-U59700-HE-7180-00001

Rev	Date	Issued For	Prepared	Checked	Approved	Client
0	1/17/2025	Preliminary - Live Review	CJM			
1	1/28/2025	Permit Application	CJM	TEAM	CJM	

Engineer's Seal



CONTENTS

DEFINITIONS

Term	Definition
AC Pond	Accidentally Contaminated collection Pond
API	American Petroleum Institute
BfD	Basis for Design
BDEP	Basic Design Engineering Work Package
BETX	Benzene, Ethylbenzene, Toluene & Xylene
DNF	Dissolved Nitrogen Floatation unit
ECU	Ethylene Cracking Unit
EHT	Electric Heat Trace
FEOR	Flow Equalization and Oil Removal
HAZOP	Hazard and Operability Analysis
IGF	Induced Gas Floatation
ITP	Inspection and Test Plan
ITR	Inspection and Test Report
KOD	Knock Out Drum
KSV	Severe Service Knife Gate Valve
LDT	Line Designation Table
LV	Low Voltage (<1000V)
MCC	Motor Control Center
MDR	Master Document Register
MOC	Management of Change
MV	Medium Voltage (1000V to 35 KV)
O&G	Oil and Grease
P&ID	Process & Instrumentation Diagram
PFD	Process Flow Diagram
PHA	Process Hazard Analysis
PVRV	Pressure Vacuum Relief Valve
QTB	Quench Tower Bottoms
ROT	Recovered Oil Tank
SAT	Site Acceptance Test
SCTO	Spent Caustic Thermal Oxidizer
SPM	Shell Polymers Monaca
TDA	Temporary Discharge Authorization
VLV	Valve
VTC	Vendor To Confirm
WW	Waste Water
XMTR	Transmitter

I. GENERAL INFORMATION

1.0 SUMMARY

This is an addendum to the original "Design Engineer's Report" for the existing Wastewater Treatment Plant (WWTP) under Water Quality Management (WQM) Permit Number 0417201. This addendum describes the new permanent equipment proposed to be added to the existing WWTP process for the purpose of source control for wastewater produced from the Ethylene Cracking Unit (ECU) and for enhancing wastewater treatment capability in Shell Polymers Monaca (SPM).

In the original Engineers Report (Section 1.5 – ECU Off-spec Wastewater Management), the design premise based on preliminary engineering data was:

"ECU may on occasion produce off-spec wastewater that cannot be readily treated in the WWTP. During such infrequent events, the off-spec wastewater flows through one of the two flow equalization and oil recovery (FEOR) tanks and fluids are pumped at a controlled rate using Process Wastewater Bleed Pumps to the other FEOR tank where it comingles with stored wastewater."

Since SPM startup, the ECU wastewater has occasionally been off-spec in O&G and VOC/ BETX resulting in the following challenges:

- Benzene and VOC at higher-than initially estimated were routed to the bio-treaters, causing occasional odor and benzene detection at the fence line,
- Elevated O&G, especially during upset, was routed to the bioreactors resulting in occasional oil sheen on the bioreactors,

SPM has installed temporary wastewater treatment facilities (reference: **Water Quality Management (WQM) Permit No. 0417201 A-2 (Amendment No. 2) January 4, 2024** which will be replaced by the permanent facilities proposed in this report.

1.1 WASTEWATER TREATMENT FACILITIES – ORIGINAL DESIGN

The WWTP is comprised of two Flow Equalization and Oil Removal (FEOR) tanks, followed by concentric extended aeration activated sludge bioreactors and tertiary sand filters. The FEOR Tanks are designed for hydraulic flow and organic load equalization and oil removal. The water from FEOR Tank is transferred to the Bioreactors. (Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD)). Clarified wastewater flow by gravity to the sand filters for additional Total Suspended Solids (TSS) removal. Oil separated from the wastewater in the FEOR tanks is pumped to a Recovered Oil Tank (ROT) for off-site disposal/reuse.

Treated wastewater (after filtration) is discharged to the Ohio River via Outfall #001.

Excess sludge from the WWTP is dewatered in a centrifuge and the dewatered bio-solids are disposed of off-site in a landfill.

1.2 WASTEWATER TREATMENT FACILITIES – EXISTING TEMPORARY

SPM has installed temporary wastewater treatment facilities (refer **Water Quality Management (WQM) Permit No. 0417201 A-2 (Amendment No. 2) January 4, 2024)** which will be replaced by the permanent facilities proposed in this report.

The temporary system takes de-oiled wastewater from the FEOR Tanks is treated in two temporary Induced Gas Floatation (IGF) units (Wemco and EC-15) to remove oil and the treated de-oiled water is then transferred to the bioreactors for removal of dissolved contaminants, as in above.

1.3 WASTEWATER TREATMENT FACILITIES – (PROPOSED IN THIS ADDENDUM)

The wastewater treatment will be enhanced with following improvements:

- ECU wastewater will be segregated and, after addition of coagulant and flocculant, diverted to Settlement Drum for emulsion breaking, light oil and heavy sludge (viscous hydrocarbon) separation.
- Settlement Drum effluent water will be routed to Dissolved Nitrogen Flotation #1 (DNF-1) for removal of any remaining oil & grease.
- DNF-1 effluent will be routed to a steam stripper for VOC and odor removal.
- Stripper bottom will be routed to FEOR tanks where it will be mixed with existing streams from Spent Caustic Oxidation Unit (SCOU), AC Pond and Diversion Box. De-oiled combined wastewater from FEOR will be routed to DNF-2 for final polishing. DNF-2 effluent water will be routed to existing bioreactors.

Note: Operational flexibility to route water (when oil free) from AC Pond and Diversion Box to DNF-2 directly has been provided.

- Oil separated in Settlement Drum, DNF-1 and DNF-2 will be routed to Float and Sludge Drum from which it will be pumped to existing ROT.
- Collected viscous hydrocarbon sludge in Settlement Drum will be pumped to truck-loading area for off-site disposal.

Vapor streams, with potential VOC, from new and modified wastewater streams will be routed to existing Spent Caustic Thermal Oxidizer.

Refer to the following block diagram for system design / integration:

Case 1 Simulation: Max ECU WW Flow in Summer

FLOW: M^3/HR

ISBL | OSBL

- EXISTING WASTE WATER FLOWS FROM FACILITY
- EXISTING WASTE WATER TREATMENT EQUIPMENT
- NEW WASTE WATER PRETREATMENT EQUIPMENT
- CHEMICAL/NUTRIENT ADDITION

ECU

PE 1/
PE 2/
PE 3/

FILTRATION OF PE PELLETS AND OTHER SOLIDS

FILTRATION OF PE PELLETS AND OTHER SOLIDS

FILTRATION OF PE PELLETS AND OTHER SOLIDS

WASH WATER / RAINFALL RUNOFF FROM ECU & PE UNITS

WASH WATER FROM EWSS & PE SILO WASHING

DEMINERALIZER PLANT

COOLING WATER TOWER

OFF GAS TO THERMAL OXIDIZER

SPENT CAUSTIC OXIDIZER

153

FLOW DIVERSION BOX

76.2

76.2

ACCIDENTLY CONTAMINATED (AC) WATER POND

OFF GAS TO THERMAL OXIDIZER

SETTLEMENT DRUM

149.3

DNF UNIT -1

98.2

STEAM STRIPPER

68.8

NNF

7.0

1.6

0.2

80.0

0.03

FLOW EQUALIZATION AND OIL REMOVAL TANK (OFF SPEC)

NNF

FLOATS / SLUDGE DRUM

RECOVERED OIL STORAGE TANK

OFF GAS TO THERMAL OXIDIZER

FLOW EQUALIZATION AND OIL REMOVAL TANK (STRIPPED WW)

80.8

DNF UNIT -2

231.5

NUTRIENTS (N & P)

pH ADJUSTMENT

231.5

BIOREACTOR AERATION TANK

SECONDARY CLARIFIER

TERTIARY SAND FILTER

TREATED EFFLUENT SUMP

SLUDGE THICKENER TANK

POLYMER FEED SYSTEM

DEWATERING CENTRIFUGE

SAND FILTER BACKWASH & SLUDGE DEWATERING WASTE SUMP

1 COOLING TOWER BLOWDOWN ROUTED TO FEOR TANKS, IF THE HYDROCARBON CONTAMINATION LASTS MORE THAN A DAY

2 COOLING TOWER BLOWDOWN ROUTED TO BIOTREATER, IF THE HYDROCARBON CONTAMINATION LASTS LESS THAN A DAY

3 COOLING TOWER BLOWDOWN NORMALLY COMINGLES WITH TREATED EFFLUENT DOWNSTREAM OF WWTP

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
CARL J. MARSANO
ENGINEER
No. PE40645

11/3/2025

1.4 WASTEWATER CHARACTERISTICS

Continuously Contaminated (CC) streams that contain significant levels of hydrocarbons are pumped to FEOR tanks and include ECU process blowdown (after pre-treatment in proposed Settlement Drum, DNF-1 and Steam Stripper systems) and oxidized spent caustic.

A separate AC system collects surface water from all areas not designated as Clean Rainwater (CR) as well as other water streams, which normally meet the required water effluent specifications but could on occasion become potentially contaminated. Typical streams include surface water runoff from inside battery limits (ISBL), process areas where routine maintenance activities are carried out, tank bottom water draw-off, surface water runoff from curbed "dirty" process areas, process equipment drains; oil drip and drain collection from base plates and drip pans, etc. These streams are gravity drained to a Flow Diversion Box for regulated flow to the FEOR tanks, and excess AC water flows to the AC pond. Polyethylene (PE) main areas are also subject to spillage of polymer, additive powder, and pellets. Within process units the segregation of AC water from CR system is achieved by curbing or final grading and surface slopes. In the Polyethylene (PE) units, screens are included to remove the PE pellets and fibers prior to routing AC water to the AC collection system.

ECU process include scrubbing of gases from ethane cracking furnaces with a dilute caustic solution to remove contaminants from the cracked gases. Spent caustic is treated in a wet air oxidation system where the spent caustic is oxidized under pressure and temperature to oxidize carbon and sulfur species present to their stable oxidative forms. The off-gases produced are routed to a thermal oxidizer. The oxidized spent caustic (brine) is then pumped to FEOR tanks where it comingles with the process WW for treatment at the WWTP.

Wastewater streams routed to the Settlement Drum, DNF-1 and Stripper system include the following:

- ECU Process wastewater.
- Recycle wastewater from FEOR (normally no flow).
- Slip stream (normally no flow) of accidentally contaminated run-off from process paved areas (from Flow Diversion Box and AC pond).

Following table presents the expected ECU wastewater characteristics to be treated in the Settlement Drum, DNF-1 and Stripper systems:

		Min	Normal	Max
ECU Wastewater Feed	m^3/h	30	40	65
Total Oil and Grease	mg/L	30	280	714
TSS	mg/L	---	---	600
Benzene	mg/L	4	13	938
Ethylbenzene	mg/L	1	5	17
Toluene	mg/L	4	9	195
Xylene (Total)	mg/L	1	15	53
Styrene	mg/L	2	20	210
Naphthalene	mg/L	1	22	3120

Wastewater streams routed to the FEOR tanks will include the following:

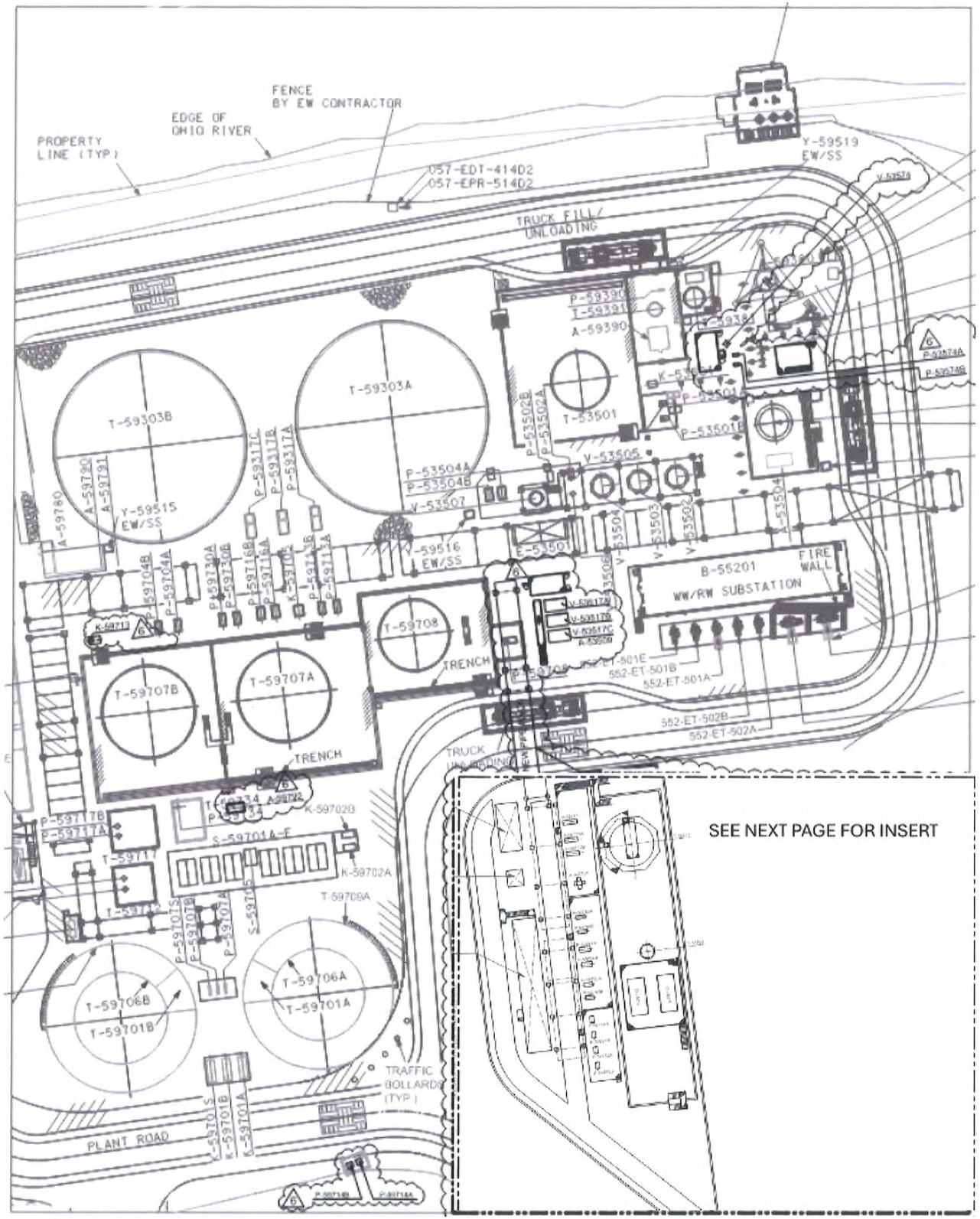
- Treated Process wastewater from Steam Stripper.
- Oxidized Spent caustic from wet air oxidation unit
- Overflow water from PE units' pellet water tanks.
- Wastewater from drips and drains, maintenance pad washing, exchanger bundle cleaning, sample collection, rotary equipment drip pans, water draws from tanks, and flare system, etc.
- Cooling tower blowdown; if contaminated.
- Accidently contaminated runoff from process paved areas (from Flow Diversion Box and AC pond).
- Boiler blowdown and neutralized regeneration waste streams from the demineralizer plant.
- Miscellaneous non-process contaminated wastewater streams consistent with those identified in the EPA Development Document for the Effluent Limit Guidelines (ELG) for the Organic, Chemicals, Plastics, and Synthetic Fibers (OCPSF) facilities

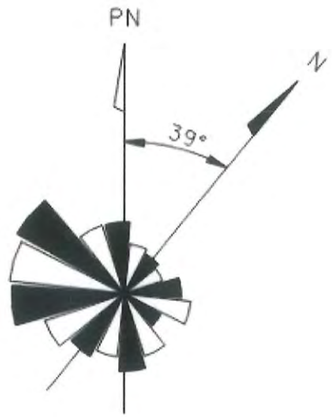
1.5 GENERAL FACILITY LAYOUT DIAGRAM

Following pages shows the general facility layout and are located in Appendix – C

- Shell Drawing No.: SPM-805-U59700-MP-4024-00001_R3
- Wood Drawing No.: GM1-700-U59700-MX-4024-00001_R6

Shell Drawing No.: SPM-805-U59700-MP-4024-00001_R3

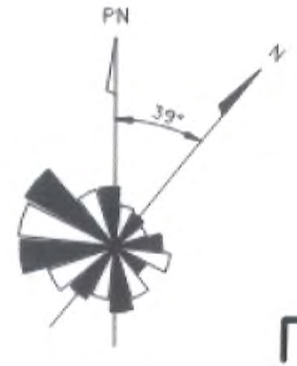


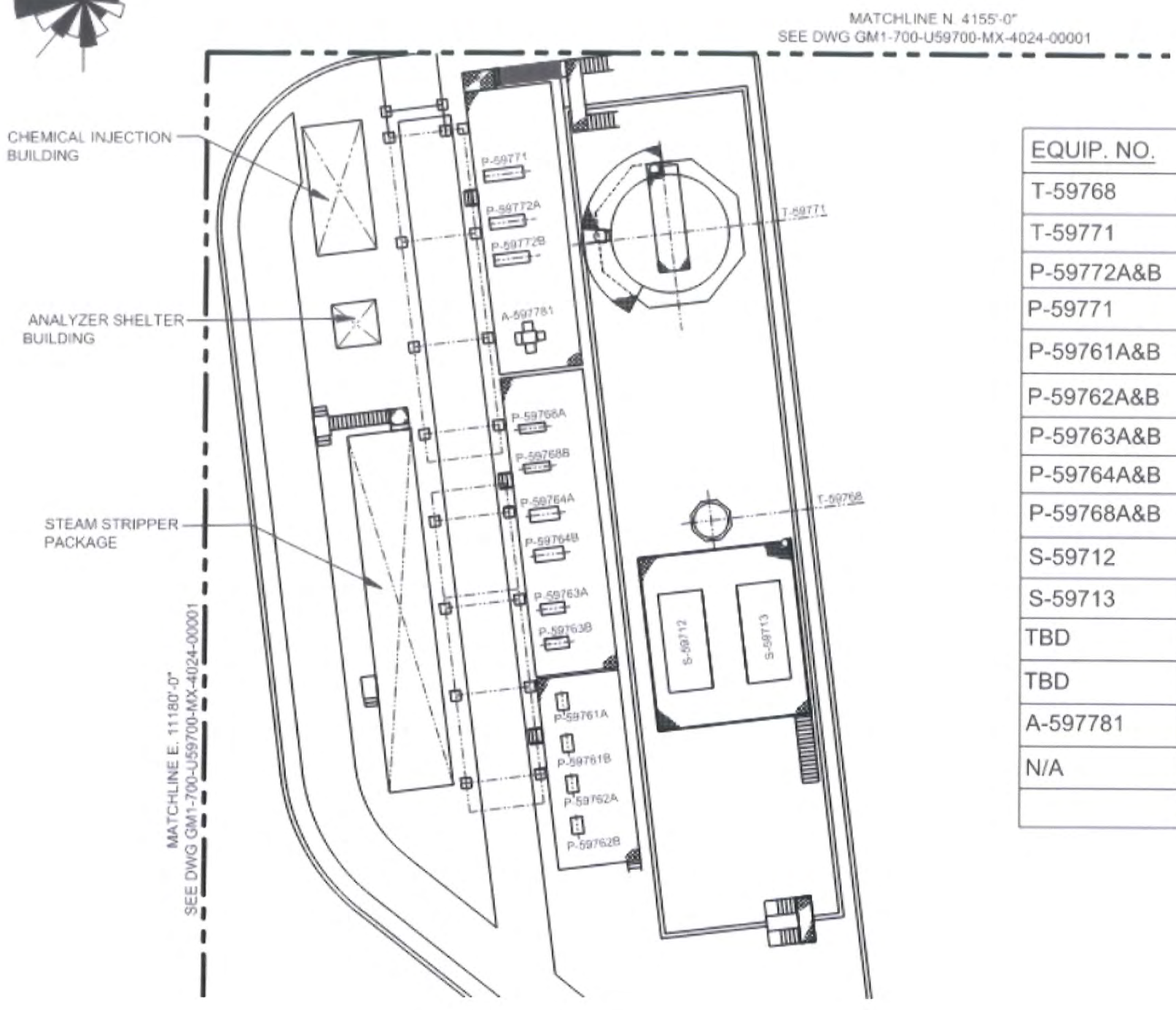


EQPT. NO.	DESCRIPTION
A-50001	OIL MIST GENERATOR
A-53501	THERMAL OXIDIZER FOR SPENT CAUSTIC
A-53504	93% SULPHURIC ACID DOSING PUMP PKG
A-59380	COAGULANT FEED PKG.
A-59390	SODIUM HYPOCHL PKG.
A-59750	CLARIFIER POLYMER FEED PKG.
A-59780	BIOTREATER PH CONTROL SYSTEM PKG.
A-59790	BIOTREATER NITROGEN NUTRIENT FEED
A-59791	BIOTREATER PHOSPHORUS NUTRIENT FEED
E-53501	AQUEOUS EFFLUENT COOLER
K-53501	SPENT CAUSTIC STORAGE TANK BLOWER
K-59701A/B/S	AERATION TANK BLOWERS
K-59702A/B	GRAVITY FILTER BLOWERS
K-59705	WASTE WATER TANKS VENT BLOWER
P-53501A/B	SPENT CAUSTIC FEED PUMPS
P-53502A/B	NEUTRALIZATION FEED PUMPS
P-53504A/B	NEUT. SPENT CAUSTIC PUMPS
P-59317A/B	FILTERED WATER FORWARDING PUMPS
P-59390	12% SODIUM HYPOCHL. UNLOADING PUMP
P-59704A/B	BIOREACTOR FEED PUMPS
P-59707A/B/S	CENTRIFUGE FEED PUMPS
P-59708	RECOVERED OIL TANK SKIMMER PUMP
P-59713A/B	RECOVERED OIL DRAWOFF PUMPS
P-59714A/B	AC POND TRANSFER PUMPS
P-59715A/B	WASTE WATER SUMP PUMPS
P-59716A/B	PROCESS WASTE WTR. BLEED PUMPS
P-59717A/B	TREATED EFFLUENT PUMPS
P-59730A/B	FLOW EQUALIZ. & OIL SKIMMER PUMPS
P-59734	WWT AREA DAC SUMP PUMP
S-59701A-F	WASTE WATER GRAVITY FILTERS
S-59702	BIOSLUDGE CENTRIFUGE
S-59705	SPLITTER BOX
T-53501	SPENT CAUSTIC STORAGE TANK
T-53503	93% SULFURIC ACID STORAGE TANK
T-59303A/B	FILTERED WATER STORAGE TANKS
T-59381	COAGULANT BULK STORAGE TANK
T-59391	12% SODIUM HYPOCHL. BULK STORAGE TK
T-59701A/B	WAS STORAGE TANKS
T-59706A/B	SECONDARY CLARIFIERS
T-59707A/B	FLOW EQUALIZ. & OIL REMOVAL TANKS
T-59708	RECOVERED OIL TANK
T-59709A/B	AERATION TANKS
T-59712	WASTE WATER SUMP
T-59717	TREATED EFFLUENT SUMP
T-59734	WWT AREA DAC SUMP
V-53502	SPENT CAUSTIC OXIDIZER #1
V-53503	SPENT CAUSTIC OXIDIZER #2
V-53504	SPENT CAUSTIC OXIDIZER #3
V-53505	PLANT AIR SAFEGUARDING DRUM
V-53506	OXIDIZED SPENT CAUSTIC SEPARATOR
V-53507	OXIDIZED CAUSTIC DEGASSING DRUM

Carl J Marsano
1/31/2025

Wood Drawing No.: GM1-700-U59700-MX-4024-00001_R6





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REGISTERED PROFESSIONAL
CARL J. MARSALO
ENGINEER
No. PE40645

Carl J Marsalo 1/31/2025

EQUIP. NO.	DESCRIPTION
T-59768	FLOAT/SLUDGE DRUM
T-59771	SETTLEMENT DRUM
P-59772A&B	SETTLEMENT DRUM EFFLUENT PUMPS
P-59771	SETTLEMENT DRUM SLUDGE PUMP
P-59761A&B	DNF UNIT-1 RECIRCULATION PUMPS
P-59762A&B	DNF UNIT-2 RECIRCULATION PUMPS
P-59763A&B	DNF UNIT-1 EFFLUENT PUMPS
P-59764A&B	DNF UNIT-2 EFFLUENT PUMPS
P-59768A&B	FLOAT/SLUDGE PUMPS
S-59712	DISSOLVED NITROGEN FLOATATION UNIT 1
S-59713	DISSOLVED NITROGEN FLOATATION UNIT 2
TBD	CHEMICAL INJECTION BUILDING
TBD	ANALYZER SHELTER BUILDING
A-597781	OIL MIST GENERATOR
N/A	STEAM STRIPPER PACKAGE

II. PROJECT DESCRIPTION

2.1 WASTEWATER TREATMENT FACILITIES – EXISTING ORIGINAL DESIGN

The WWTP comprises of two Flow Equalization and Oil Removal (FEOR) tanks, followed by concentric extended aeration activated sludge bioreactors and tertiary sand filters. The FEOR Tanks are designed for hydraulic flow and organic load equalization and oil removal. The de-oiled wastewater from the FEOR Tanks was to be treated in the bioreactors for removal of dissolved contaminants (Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD)). Clarified wastewater flow by gravity to the sand filters for additional Total Suspended Solids (TSS) removal. Oil separated from the wastewater in the FEOR tanks is pumped to a Recovered Oil Tank (ROT) for off-site disposal/reuse.

Treated wastewater (after filtration) is discharged to the Ohio River via Outfall #001.

Excess sludge from the WWTP is dewatered in a centrifuge and the dewatered bio-solids are disposed of off-site in a landfill.

2.2 WASTEWATER TREATMENT FACILITIES – EXISTING (TEMPORARY FACILITIES)

SPM has installed temporary wastewater treatment facilities (refer Water Quality Management (WQM) Permit No. 0417201 A-2 (Amendment No. 2) January 4, 2024) which will be replaced by the permanent facilities proposed in this report.

The de-oiled wastewater from the FEOR Tanks is treated in two temporary Induced Gas Floatation (IGF) units (Wemco and EC-15) and treated de-oiled water is then transferred to the bioreactors for removal of dissolved contaminants (Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD)). Clarified wastewater flow by gravity to the sand filters for additional Total Suspended Solids (TSS) removal. Oil separated from the wastewater in the FEOR tanks is pumped to a Recovered Oil Tank (ROT) for off-site disposal/reuse.

Treated wastewater (after filtration) is discharged to the Ohio River via Outfall #001.

Excess sludge from the WWTP is dewatered in a centrifuge and the dewatered bio-solids are disposed of off-site in a landfill.

2.3 WASTEWATER TREATMENT FACILITIES – PROPOSED IN THIS SYSTEM

The wastewater treatment will be enhanced with the following improvements:

- ECU wastewater will be segregated and, after addition of coagulant and flocculant, diverted to Settlement Drum for emulsion breaking, light oil and heavy sludge (viscous hydrocarbon) separation.

- Settlement Drum effluent water will be routed to Dissolved Nitrogen Flotation Unit #1 (DNF-1) for removal of any remaining oil & grease.
- DNF-1 effluent will be routed to a steam stripper for VOC and odor removal. Stripper bottom will be routed to FEOR tanks where it will be mixed with existing streams from Spent Caustic Oxidation Unit (SCOU), AC Pond and Diversion Box. De-oiled combined wastewater from FEOR will be routed to DNF-2 for final polishing. DNF-2 effluent water will be routed to existing bioreactors.

Note: Operational flexibility to route water (when oil free) from AC Pond and Diversion Box to DNF-2 directly has been provided.

- Oil separated in Settlement Drum, DNF-1 and DNF-2 will be routed to Float and Sludge Drum from which it will be pumped to existing ROT or to truck-loading area for off-site disposal.
- Collected viscous hydrocarbon sludge in Settlement Drum will be pumped to truck-loading area for off-site disposal.

Vapor streams, with potential VOC, from new and modified wastewater streams will be routed to existing Spent Caustic Thermal Oxidizer.

2.4 DESCRIPTION OF INDUSTRIAL OPERATION – EXISTING

Seven (7) cracking furnaces are used to "crack" ethane (C2H6) to produce ethylene (C2H4) by heating the ethane to greater than 1500°F (800°C). "Tail gas", a byproduct from the cracker furnaces containing methane and hydrogen is recycled to fuel the process, with supplemental natural gas as required.

The ethylene that is produced is used to feed two gas and one slurry phase polyethylene (PE) units to produce specific grades of polyethylene. Each unit has separate pellet handling systems prior to blending. Common storage equipment, rail car, and truck loading operations follow the blending unit.

Three on-site natural gas-fired combustion turbines/duct burners, two steam turbines and heat recovery steam generators (HRSGs) are used to generate electricity and steam. Other ancillary equipment includes two cooling towers, a raw water treatment plant (RWTP), demineralizers and a WWTP.

2.5 WASTEWATER COLLECTION SYSTEM – EXISTING

The wastewaters generated from the operation of the proposed petrochemical plant is segregated into process wastewater, accidentally contaminated (AC) water, sanitary wastewater, and clean storm water. Process wastewater streams from the process units and OSBL (Outside Process Boundary Limit), neutralized regeneration waste from the demineralizer plants, AC water, and hydrocarbon contaminated cooling tower blow down is routed to a wastewater treatment plant. The treated effluent from the WWTP is combined with uncontaminated cooling tower blowdown downstream of Internal Monitoring Point 101 (IMP-101) and discharged to the Ohio River through Outfall #001.

Continuously Contaminated (CC) streams that contain significant levels of hydrocarbons are pumped to FEOR tanks. These include ECU process blowdown (after segregation and treatment in new Settlement Drum, DNF-1 and Stripper) and oxidized spent caustic.

A separate AC system collects surface water from all areas not designated as Clean Rainwater (CR) as well as other water streams, which normally meet the required water effluent specifications but could on occasion become potentially contaminated. Typical streams include surface water runoff from inside battery limits (ISBL), process areas where routine maintenance activities are carried out, tank bottom water draw-off, surface water runoff from curbed "dirty" process areas, process equipment drains; oil drip and drain collection from base plates and drip pans, etc. These streams are gravity drained to a Flow Diversion Box for regulated flow to the FEOR tanks, and excess AC water flows to the AC pond. PE main areas are also subject to spillage of polymer, additive powder, and pellets. Within process units the segregation of AC water from CR system is achieved by curbing or final grading and surface slopes.

In the Polyethylene (PE) units, screens are included to remove the PE pellets and fibers prior to routing AC water to the AC collection system.

ECU process include scrubbing of gases from ethane cracking furnaces with a dilute caustic solution to remove contaminants from the cracked gases. Spent caustic is treated in a wet air oxidation system where the spent caustic is oxidized under pressure and temperature to oxidize carbon and sulfur species present to their stable oxidative forms. The off-gases produced are routed to a thermal oxidizer. The oxidized spent caustic (brine) is then pumped to FEOR tanks where it comingles with the process WW for treatment at the WWTP.

The following streams are treated in the wastewater treatment plant (WWTP):

- Process wastewater from ECU excluding Pyrolysis fuel oil (PFO) from quench tower. ECU wastewater will be pre-treated in new Settlement Drum, DNF-1, Steam Stripper before mixing with other streams in FEOR.
- PFO will be shipped offsite for disposal and/or reuse.
- Oxidized Spent caustic from spent caustic oxidation unit
- Overflow water from PE units' pellet water tanks.
- Wastewater from open drips and drain system, maintenance pad washing, exchanger bundle cleaning, sample collection, rotary equipment drip pans, water draws from tanks, and flare system, etc.
- Cooling tower blowdown from cooling towers, only in case of hydrocarbon contamination. (Provisions are made to use a portion of blow down water to provide necessary micro-nutrients needed for biological growth and to heat FEOR tanks, if required.)
- AC runoff from process paved areas.
- Internal recycle streams such as centrifuge centrate, sand filter backwash waste, and off-spec effluents.

- Boiler blowdown and neutralized regeneration wastewater from demineralizers.
- Miscellaneous non-process contaminated wastewater streams consistent with those identified in the EPA Development Document for the Effluent Limit Guidelines (ELG)for the Organic, Chemicals, Plastics, and Synthetic Fibers (OCPSF) facilities.

2.6 WASTEWATER TREATMENT PLANT (MODIFIED)

2.6.1 OVERVIEW

The primary function of the WWTP is to ensure that all wastewater streams generated from the process units and utilities as well as the process paved area runoff from rain events are sufficiently treated in compliance with the effluent limits for discharging treated effluent to the Ohio River.

The modified WWTP will comprise of ECU wastewater pre-treatment section (new), primary flow equalization and oil removal - EXISTING, followed by DNF-2 (new), followed by secondary extended aeration activated sludge bioreactor (including clarifier) and tertiary sand filters - EXISTING.

2.6.2 DETAILED DESCRIPTION

ECU wastewater stream will be routed to Settlement Drum where chemicals (coagulant and flocculant) will be added to aid in breaking of emulsion. The settlement drum will separate settled floc and skim light oil. Settlement Drum effluent will be routed to DNF-1 for further removal of oil & grease and suspended solids. DNF-1 effluent will be routed to Steam stripper for removal of any VOC's. Stripped water, after cooling, will be routed to the existing FEOR tanks.

Above mentioned wastewater streams flow into one or two FEOR tanks. Each tank is a fixed roof tank equipped with an internal floating roof. Oil rising to the surface of the wastewater in these tanks is skimmed off and transferred by FEOR Tanks Oil Skimmer Pumps to a Recovered Oil Tank from where it is being pumped out by Recovered Oil Tank Oil Skimmer Pump for off-site disposal/reuse while separated water from the Recovered Oil Tank is pumped back to FEOR tanks by Recovered Oil Tank Water Draw Off Pumps.

The Recovered Oil Tank - EXISTING is also a fixed roof tank with an internal floating roof and oil skimmer.

The Settlement Drum, DNF-1, DNF-2, Float and Sludge Drum, FEOR and Recovered Oil Tanks are nitrogen blanketed and purged to existing Spent Caustic Thermal Oxidizer (SCTO) using Wastewater Tank Vent Blower. Vapor leaving stripper system will also be purged to SCTO.

Effluent (de-oiled WW) from the FEOR tanks is pumped to DNF-2 for final removal of any oil & grease. DNF-2 effluent will be routed to the extended air activated sludge

plant (Bioreactors). Two (2) Bioreactors operated in parallel are provided, each with a dedicated clarifier. Internal WWTP recycle streams as well as nutrient additives and pH adjustment chemicals are added upstream of the Bioreactors. The effluent from secondary clarifiers is combined with the neutralized regeneration waste from demineralizers. The mixed stream flows to the tertiary sand filter for final TSS removal. Sand filter backwash is recycled back to the Bioreactors via Wastewater Sump using Wastewater Sump pumps.

Excess waste activated sludge (WAS) from the clarifiers is pumped to sludge holding tanks that feed a centrifuge for dewatering sludge into a cake for off-site disposal. Centrifuge centrate is recycled to the bioreactors.

The treated effluent from the sand filter combines with Cooling Tower blowdown (uncontaminated) downstream of IMP-101 and discharged to the Ohio River through Outfall Number 001. Any off-spec effluent is diverted to AC Pond.

The off-spec water from AC pond is mixed with process wastewater and then flow to the bioreactors for reprocessing. Cooling tower blowdown, in case of hydrocarbon contamination, is routed directly to the bioreactors for hydrocarbon removal with provisions to send it to AC pond if capacity of bioreactors is exceeded.

The capacity of the WW treatment equipment is based on the peak WW flows during the wet weather conditions. Storm water runoff from process paved areas where there is the potential of accidental hydrocarbon or PE solids spillage is routed to the AC pond. PE main process areas are also subject to spillage of polymer, additive powder, and pellets. Process paved area runoff water is collected and screened to remove PE solids before it is released to the AC system. The AC water is pumped at a regulated rate to the FEOR tank for treatment.

The water/wastewater balance and WW treatment unit flow diagrams show the proposed uses of water, the anticipated generation of all process wastewater streams, the collection of various streams for treatment through the WWTP, the handling of AC water from the AC pond to the WWTP and the final collection of stream into the final effluent stream.

The WWTP including ancillary equipment such as chemical feed systems are installed over paved area to prevent contamination from spills. Secondary containment is provided for all chemical feed systems including Settlement Drum, DNF-1, DNF-2, FEOR and Oil storage tanks. Chemical storage tanks and unloading area are also provided with secondary containment. Leaks and spills from all secondary containment areas are contained within the curbed area and removed via vacuum trucks. Washdown water from containment areas and rainwater gravity flow to the AC collection system and treated in WWTP.

2.6.3 ECU OFF-SPEC WASTEWATER TREATMENT (MODIFIED)

The ECU wastewater pre-treatment section in WWTP (i.e. Settlement Drum, DNF-1, Steam Stripper and DNF-2) are designed to treat off-spec wastewater from ECU. Further, Settlement Drum has dedicated surge volume for handling the off-spec ECU wastewater. One of the two FEOR tanks may also handle off-spec ECU wastewater (if required). Facilities are provided to recycle off-spec wastewater from FEOR to the Settlement Drum, DNF-1 and Stripper system for effective removal of contaminants before diverting to DNF-2 and bioreactors.

2.6.4 STORM WATER MANAGEMENT - EXISTING

The primary function of the Storm Water Management system is to ensure that drainage networks are suitable for collecting and conveying specific effluents and runoffs from catchments and sub-catchments, and designed such that optimum segregation of different effluent streams is achieved.

A review was conducted by Civil & Environmental Consultants, Inc to determine the effects on stormwater runoff of the new treatment equipment and paving. Stormwater for the area will be collected and sent to the AC Pond and subsequently routed back into the treatment process.
It was found to have a "de minimus impact on the site's drainage patterns". The report can be found in Appendix – D.

2.6.5 ACCIDENTALLY CONTAMINATED (AC) WATER SYSTEM - EXISTING

The AC system collects mainly surface water (rainfall and or firewater) from ISBL process areas where spills or leakages of hydrocarbons or chemicals or solid PE pellets may be anticipated, but not expected. The philosophy is to route AC water to the FEOR tanks - EXISTING and / or to DNF-2 (new) via a Flow Diversion Box and AC pond. The AC underground network is composed of trenches, catch basins, manholes, perimeter drainage channels and pipes.

AC water collection philosophy remains unchanged from the original WQM. AC water treatment is enhanced by addition of DNF-2.

2.6.6 FLOW DIVERSION BOX (AC SYSTEM) -EXISTING

Rainwater run-off and washdown water from ECU, PE1, PE2, PE3, Co-Gen, Tanks area, Rail Yard flows into a concrete Diversion Box provided with equipment to screen out PE particles and remove oil from dry weather flows. Provisions are made to send excess water (stormwater) to AC pond via underflow and overflow weir arrangement. Separated PE solids are manually removed. Separated Oil is pumped to Recovered Oil Tank. Pumps are provided to send de-oiled AC water to FEOR tanks. Two pumps are provided with one in operation and one in standby mode. See Appendix V-1 for AC system stormwater run-off hydrographs.

Flow Diversion Box system remains unchanged from original design. De-oiled AC water will be routed to FEOR tanks and / or DNF-2 by a new dedicated line. Some Flow Diversion Box water may also be routed to the Settlement Drum under control.

2.6.7 AC POND - EXISTING

Excess water from the Flow Diversion Box gravity flows to the AC pond. AC pond is a concrete sump with HDPE liner on outside. Pond is provided with pumps to send collected wastewater to FEOR tanks. Two pumps are provided with one in operation and one in standby mode. Excess water from AC pond that cannot be sent to FEOR in an emergency outflows over a weir into existing Poorhouse Run Creek via outfall # 004 through a spillway. A handrail is provided all around the AC pond. A platform at the top of wall of AC pond is provided to facilitate manual sample withdrawal.

AC Pond system remains unchanged from original design. AC Pond water will be routed to FEOR tanks and / or DNF-2. Some AC Pond water may also be routed to the Settlement Drum under control.

2.6.8 WASTEWATER CHARACTERISTICS

The estimated volume and strength of the wastewater treated in FEOR and downstream system remains unchanged from table IC-1 of the original Design Engineers' Report (GM1-700-U50000-HE-7180-00010).

Wastewater Characteristics (Comprehensive List)

WASTEWATER PARAMETERS	BIOREACTOR FEED		
Case	DRY	WET	CASE 3
Flow Type	Continuous		
Phase	Liquid		
Flow, m^3/hr.	137	212	528
Flow, gpm	603	934	2325
pH	6.5-8	6.5-8	6.5-8
Temp, °C	5-37	5-37	5-37
BOD, mg/L	240	173	85
COD, mg/L	441	321	160
TSS, mg/L	81	76	69
TDS, mg/L	6851	4171	3075
TOC, mg/L	136	102	46
Oil and grease, mg/L	33	32	12
Methanol, mg/L	15	10	4
Benzene, mg/L	1.13	0.73	0.29
Phenols, mg/L	0.76	0.49	0.20
3,4-Benzofluoranthene, mg/L	0.01	0.01	0.00
Acenaphthene, mg/L	0.30	0.19	0.08
Acenaphthylene, mg/L	0.30	0.19	0.08
Acetaldehyde, mg/L	0.74	0.48	0.19
Acetic Acid, mg/L	0.74	0.48	0.19
Anthracene, mg/L	0.30	0.19	0.08
Benzo(a)anthracene, mg/L	0.01	0.01	0.00
Benzo(a)pyrene, mg/L	0.01	0.01	0.00
Ethylbenzene, mg/L	0.30	0.19	0.08
Fluorene, mg/L	0.30	0.19	0.08
Formaldehyde, mg/L	2.22	1.44	0.58
Formic Acid, mg/L	0.74	0.48	0.19
Propionic Acid, mg/L	0.74	0.48	0.19
Styrene, mg/L	0.07	0.05	0.02
Toluene, mg/L	0.44	0.29	0.12
Xylene, mg/L	1.18	0.77	0.31
Xylenol, mg/L	1.18	0.77	0.31
Nitrate as N, mg/L	0.94	0.61	0.24
Nitrite as N, mg/L	0.10	0.07	0.03
Ammonia as N, mg/L	0.47	0.31	0.12

WASTEWATER PARAMETERS	BIOREACTOR FEED		
Case	DRY	WET	CASE 3
Total Nitrogen, mg/L	4.62	7.10	13.80
Total Phosphorous, mg/L	4.53	4.85	5.30
Sulfide, mg/L	0.74	0.48	0.19
Sulfite, mg/L	0.74	0.48	0.19
Sulfate, mg/L	129.12	83.50	639.37
Na_2S (as Na_2S), mg/L	0.21	0.14	0.05
Na_2CO_3, mg/L	1233.69	797.81	320.37
Na_2SO_4, mg/L	3004.85	1943.20	780.32
Thiosulfates, mg/L	56.85	36.77	14.76
H_2SO_4, mg/L	559.93	362.10	145.41
Hardness as $CaCO_3$, mg/L	172.38	111.47	677.20
Alkalinity as $CaCO_3$, mg/L	38.97	25.20	120.94
Aluminum, mg/L	0.87	0.56	4.66
Calcium, mg/L	39.18	25.33	183.06
Chloride, mg/L	60.51	39.13	296.47
Chromium. Total	0.74	0.48	0.19
Copper, Total, mg/L	0.30	0.19	0.08
Cyanide, Total, mg/L	0.30	0.19	0.08
Fluoride, mg/L	0.98	0.63	1.14
Iron, mg/L	4.88	3.16	7.47
Magnesium, mg/L	11.25	7.28	51.68
Manganese, Total, mg/L	0.74	0.48	0.19
Nickel, Total, mg/L	0.07	0.05	0.02
Potassium, mg/L	2.53	1.64	12.48
Silica as SiO_2, mg/L	4.00	2.59	21.73
Sodium, mg/L	47.75	30.88	210.40

Dry Weather Flow – includes wastewater from ECU, Oxidized Spent Caustic, AC water from Diversion Box and a portion of Cooling Tower blowdown for micronutrient supply, wastewater temperature maintenance in cold climate

Wet Weather Flow – includes Dry weather flow plus AC water from AC pond

Case 3 includes Dry weather flow plus Cooling Tower blowdown when contaminated with hydrocarbons.

Treated Effluent limits for the permitted discharges from the WWTP are as follows:

The WWTP is designed to meet the effluent limits listed in NPDES Permit PA 0002208 issued June 23, 2017 for discharge point IMP101.

2.6.9 SCHEMATIC WATER / WASTEWATER FLOW RATE

Case 1 Simulation: Max ECU WW Flow in Summer

FLOW: M^3/HR

ISBL | OSBL

- EXISTING WASTE WATER FLOWS FROM FACILITY
- EXISTING WASTE WATER TREATMENT EQUIPMENT
- NEW WASTE WATER PRETREATMENT EQUIPMENT
- CHEMICAL/ NUTRIENT ADDITION

ECU

PE 1/
PE 2/
PE 3/

FILTRATION OF PE PELLETS AND OTHER SOLIDS

FILTRATION OF PE PELLETS AND OTHER SOLIDS

FILTRATION OF PE PELLETS AND OTHER SOLIDS

WASH WATER / RAINFALL RUNOFF FROM ECU & PE UNITS

WASH WATER FROM EWSS & PE SILO WASHING

DEMINERALIZER PLANT

COOLING WATER TOWER

OFF GAS TO THERMAL OXIDIZER

SPENT CAUSTIC OXIDIZER

153

FLOW DIVERSION BOX

76.2

76.2

ACCIDENTLY CONTAMINATED (AC) WATER POND

OFF GAS TO THERMAL OXIDIZER

SETTLEMENT DRUM

149.3

1.6

DNF UNIT -1

66.2

STEAM STRIPPER

68.8

0.03

NNF

7.0

FLOW EQUALIZATION AND OIL REMOVAL TANK (OFF SPEC)

NNF

0.2

80.0

FLOATS / SLUDGE DRUM

RECOVERED OIL STORAGE TANK

OFF GAS TO THERMAL OXIDIZER

FLOW EQUALIZATION AND OIL REMOVAL TANK (STRIPPED WW)

80.8

DNF UNIT -2

251.5

251.5

NUTRIENTS (N & P)

pH ADJUSTMENT

BIOREACTOR AERATION TANK

SECONDARY CLARIFIER

TERTIARY SAND FILTER

TREATED EFFLUENT SUMP

POLYMER FEED SYSTEM

SLUDGE THICKENER TANK

DEWATERING CENTRIFUGE

SAND FILTER BACKWASH & SLUDGE DEWATERING WASTE SUMP

1 COOLING TOWER BLOWDOWN ROUTED TO FEOR TANKS, IF THE HYDROCARBON CONTAMINATION LASTS MORE THAN A DAY

2 COOLING TOWER BLOWDOWN ROUTED TO BIOTREATER, IF THE HYDROCARBON CONTAMINATION LASTS LESS THAN A DAY

3 COOLING TOWER BLOWDOWN NORMALLY COMINGLES WITH TREATED EFFLUENT DOWNSTREAM OF WWTP

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
CARL J. MARKWARD
ENGINEER
No. PE40945

1/31/2025

2.6.10 TREATMENT FACILITY, SIZE, CAPACITY & DIMENSIONS DIAGRAM

Process Flow Diagrams with size, capacity, and dimensions of the additions to the WWTP and associated Units are included in Appendix – B.

III. DETAIL DESCRIPTION OF PROPOSED MODIFICATIONS TO THE WASTEWATER TREATMENT PROCESSES

3.0 BASIS FOR THE DESIGN OF INDIVIDUAL TREATMENT UNIT PROCESSES

Process flow diagrams included in Appendix B, depict equipment associated with the modified wastewater collection, treatment and disposal system including dimensions and capacities of all unit process equipment. In this section, the modified WWTP process and design basis are summarized.

Process Description of the Modifications

Wastewater from existing Ethylene Cracking Unit (ECU) will be routed to the new Settlement Drum, where the bulk of free oil and solids are separated from the ECU WW. Effluent water from the drum is routed to DNF-1 to be further treated for free oil and solids via nitrogen flotation. The DNF-1 effluent water is pumped to a steam stripper where almost all its soluble VOCs and residual oil are separated. The stream stripped WW is pumped to one of the existing Flow Equalization & Oil Removal (FEOR) tanks designated to receive treated water. Any excess unstripped WW as well as off-spec WW from the stripping unit will be diverted to the FEOR tank designated to receive off-spec wastewater.

AC Pond Water and Diversion Box Water existing route to FEOR Tanks will be modified such that they can also be diverted to a new DNF-2 unit (if required), while maintaining their existing destination to FEORs.

Settlement Drum sludge will be pumped to a truck-out connection near the existing Recovered Oil Tank (ROT). Skimmed oil from the drum flows by gravity to Froth/ Sludge Drum, where skimmed oil and solids from both DNF units are stored. The combined oil and solids will be pumped to ROT.

The Settlement Drum, DNFs, and Froth/ Sludge Drum will be nitrogen blanketed, and the vent streams from these vessels will be combined with existing vents from FEOR tanks and ROT tanks and routed to existing SCTO via a common vent blower. Off-gas from the stripper overhead reflux drum will join the Vent Blower discharge line and routed to SCTO after mixing with vent stream from existing Spent Caustic Oxidation Unit (SCOU).

A carbon canister package will serve as a backup to the SCTO for short-term SCTO outage. In case of short-term SCTO trip, spent caustic oxidation plant may relieve from relief valves to atmosphere on a short-term basis while automatic trip is activated, and all other vent streams from blowers (including stripper reflux off-gas) will divert to the new carbon canister package.

The WWTP improvement project has the following targets for effluent water:

- O&G to bio-treaters at the outlet of DNF-2: < 10 ppmv (and < 30 ppmv (when DNF-2 acts as spare to DNF-1)
- Benzene to bio-treaters at the outlet of Stripper: < 1 ppmv

For proposed new equipment, sizing basis and sparing philosophy is following:

Settlement Drum	Number of Vessel	One
	Type of Vessel	Cylindrical Shell, conical bottom
	Total Volume	~ 900 m3
DNF-1	Number of Unit	One
	Flow Rate (Normal Max) Flow Rate (Hydraulic Max)	65 m^3/hr 110 m^3/hr
Stripper Column	Number of Unit	One
	Dimensions	54'-3" T/T / 58'-9" OAH 48" ID (Tray Section) 78" ID Sump
	Number of Trays	25 Fixed Valve
	Flow Rate (Maximum)	65 m^3/hr
DNF-2 (Spare to DNF-1)	Number of Unit	One
	Flow Rate (Normal Max)	250 m^3/hr

Design of existing WWTP equipment remain unchanged and the Design Engineer's Report (**GM1-700-U50000-HE-7180-00010)** submitted as part of original WQM is referred to.

3.1 PUMPING EQUIPMENT

Refer to the following table for pumps and blowers added / modified as part of this WWTP improvement project:

Equipment No.	Pump Name	Function	Number of Pumps	Capacity, gpm (m^3/hr.)	Controls
P-53504A/B	Neutralized Spent Caustic Circulation Pumps	Spent Caustic to Aqueous Effluent Cooler	Service and Standby	756 (171.68)	Level/Manual
P-59317 A/B	Filtered Water Forwarding Pumps	Service Water to WWT Utility Stations	Service and Standby	5720 (1300)	Flow/Pressure
P-53574 A/B	Vent Knock out Drum Pumps	Knockout Drum Liquids to Settlement Drum or T-53501 (TBD)	Service and Standby	8.8 (2)	Level
P59761 A/B	DNF Unit-1 Recirculation Pump	Raise System Pressure to dissolve N_2 into Effluent	Service and Standby	198 (45)	Manual
P59762 A/B	DNF Unit-2 Recirculation Pump	Raise System Pressure to dissolve N_2 into Effluent	Service and Standby	198 (45)	Manual
P-59763 A/B	DNF Unit-1 Effluent Pumps	Effluent to Settlement Drum	Service and Standby	484 (110)	Level Control via VFD
P-59768 A/B	Float / Sludge Pump	Froth / Sludge to Recovered Oil Tank	Service and Standby	66 (15)	Level Control via VFD, Pressure Relief to a Safe location
P-59679 A/B	Stripper Effluent Pumps	Stripped Wastewater to Wastewater Pre-Heater	Service and Standby	(TBD)	Level and Flow Control

Equipment No.	Pump Name	Function	Number of Pumps	Capacity, gpm (m^3/hr.)	Controls
P-5977A A/B	Steam Stripper Reflux Pump	Reflux Wastewater to Stripping Column	Service and Standby	(TBD)	Level via VFD, Pressure Control
K-50713	Wastewater Tanks Vent Blower	Transfer Off Gases to Thermal Oxidizer	Service and Standby	(TBD)	Pressure control
P-59772 A/B	Settlement Drum Effluent Pumps	Transfer Effluent to DNF Unit-1	Service and Standby	286 (65)	Flow Control
P-59771	Settlement Drum Sludge Pump	Sludge to Recovered Oil Tank Truck Out Connection	Service	66 (15)	VFD Speed Control
P-59764 A/B	DNF Unit-2 Effluent Pumps	Transfer Effluent to Bio-treatment Package	Service and Standby	1100 (250)	Level Control
P-59750 A/B/S	Secondary Clarifier Polymer Injection Pumps	Clarifier Feedwell	2 - Service and 1 standby	(TBD)	Proportional to Mass flow
P-59765 A/B/C/S	Coagulant Injection Pumps	Flocculant to Settlement Drum, DNF-1, and DNF-2	3 - Service and 1 Standby	(TBD)	Proportional to Mass flow
P-59766 A/B/C/S	Flocculant Injection Pumps	Flocculant to Settlement Drum, DNF-1, and DNF-2	4 - Service and 1 Standby	(TBD)	Proportional to Mass flow
P-53504A/B	Diversion Box Transfer Pumps	AC water to FEOR tanks	Service and Standby	330 (75)	Level
	Diversion Box Oil Skimmer Pump	Skimmed Oil to Recovered Oil Tank	Service (intermittent)	66 (15)	Level/Manual
P-5971 A/B	AC Pond Transfer Pumps	AC Water to FEOR Tanks	Service and Standby	330 (75)	Pressure Control

Equipment No.	Pump Name	Function	Number of Pumps	Capacity, gpm (m^3/hr.)	Controls
P-59716 A/B	Process WW Bleed Pumps	Transfer off-spec wastewater (from ECU) between FEOR tanks (ECU upset stream)	Service and Standby	44 (10)	Variable Speed
P-59704 A/B	Bioreactor Feed Pumps	Transfer de-oiled WW from FEOR tanks to Bioreactors	Service and Standby	823 (187)	Flow control
P-59730 A/B	FEOR Oil Skimmer Pumps	Transfer skimmed oil from FEOR tanks to Recovered Oil Tank	Service and Standby	66 (15)	Manual/Level
K-50705	Wastewater Tanks Vent Blower	Transfer off-gases to thermal oxidizer	Service and Standby	772 Nm^3/hr.	Pressure control
P-59713 A/B	Recovered Oil Tank Water Draw-off Pumps	Transfer water draw-off from Recovered Oil Tank to FEOR Tanks	Service and Standby	44 (10)	Pressure Control
P-59708	Recovered Oil Tank Oil Skimmer Pump	Transfer Recovered Oil to Truck (off-site disposal/reuse)	Service (Intermittent)	66 (15)	Manual

3.2 MONITORING AND CONTROL EQUIPMENT

3.2.1 MONITORING AND CONTROL EQUIPMENT FOR THE WWTP PROJECT (MODIFIED)

Following objectives/provisions are implemented to control the System and ensure its successful operation without Permit limits' exceedances. Refer to Unit 597 Wastewater collection / Treatment Plant Process Control Narrative 25873-001-J5R-597-00001 (GM1-700-U59700-IN-5306-00001) Appendix F.

Following are the key control objectives for new / modified system:

Objective 26: To protect Settlement Drum pump from dry running by stopping Settlement Drum effluent pumps when low level above water draw-off nozzle is detected. This is achieved by measuring level above water draw-off nozzle and stopping pump in case low level is detected.

Objective 27: To prevent DNF-1 overflow by auto-starting spare pump in case main pump shuts down. This is done by sensing run-status signal of the pump and starting spare pump when level in DNF-1 effluent compartment is higher than minimum level.

Objective 28: To ensure that DNF-1 always has a path forward in case stripper system rate is limited. This is achieved by measuring net flow going to the stripper and opening the stripper bypass control valve in case excess flow is detected.

Objective 29: To protect DNF-1 pumps from dry running by stopping DNF-1 effluent pumps when low level in DNF-1 effluent compartment is detected. This is achieved by measuring level above water draw-off nozzle and stopping pump in case low level is detected.

Objective 30: To provide sufficient stripping steam to stripper column for all operating cases. This is achieved by direct injection of steam to control inlet wastewater temperature to the stripping column and by injecting steam into the bottom of the column. This steam flow is ratio-controlled based on wastewater flow measurement to the stripper and by outlet vapor flow temperature.

Objective 31: To prevent stripper pumps from dry running by stopping stripper bottom pumps when low level in column bottom compartment is detected. This is achieved by measuring level in the column bottom compartment and stopping pump automatically in case low level is detected.

Objective 32: To ensure optimum operating pressure in stripper by controlling vapor rate from stripper overhead drum. This is achieved by measuring column pressure and applying split range control methodology - controlling opening of the pressure control valve situated in the vapor line leaving overhead vessel when pressure is high and automatically adding nitrogen when low pressure is detected.

Objective 33: To prevent stripper reflux pumps from dry running by stopping stripper reflux drum pumps on detection of low level. This is achieved by measuring level in the reflux drum and stopping pump automatically in case low level is detected.

3.3 HANDLING, CONDITIONING AND STORAGE OF RESIDUAL MATERIALS

3.3.1 HANDLING, CONDITIONING AND STORAGE OF RESIDUAL MATERIALS

1) Recovered Oil (Modified)

ECU wastewater, after mixing with coagulant, flocculant) will be routed to the Settlement Drum (new) which will separate light oil, effluent water and heavy sludge / floc. Light oil from Settlement drum will be skimmed to the Float and Sludge Drum (new) under gravity. Any light froth (light oil) separated in DNF-1, DNF-2 and the stripper reflux drum will also be routed to the Float and Sludge Drum (new) under gravity. The light oil from the Float and Sludge drum will be pumped to the Recovered Oil Tank (ROT). (Note: The Settlement Drum, DNF-1, DNF-2, Float and Sludge Drum are under nitrogen blanket with off-gases routed to SCTO).

Stripped ECU wastewater, AC Pond water, Flow Diversion Box water and Oxidized Spent Caustic streams will be routed to FEOR tanks where some residual oil may separate from water under quiescent conditions. The FEOR tanks are equipped with floating oil skimmers and oil skimmer pumps. The separated oil is pumped to Recovered Oil storage tank. The FEOR tanks are nitrogen blanketed with off-gases sent to SCTO.

The ROT is also provided with a floating oil skimmer where entrained water is separated under quiescent conditions. The tank is provided with sampling nozzles and periodically water is pumped to FEOR tanks. The separated oil is pumped out periodically and sent off-site for disposal/reuse. ROT tank is also nitrogen blanketed with off-gases sent to a thermal oxidizer.

2) ECU Process water Sludge Handling

The heavy sludge/floc will settle in the Settlement Drum which is provided with a conical bottom section. The Settlement drum bottom section has at least 104 m3 storage volume for settled sludge. The Settlement drum bottom is also equipped with electric heat tracing, water jet and steam injections for facilitating sludge movement. Collected sludge will be pumped out periodically and sent off-site for disposal.

3) DNF-1, DNF-2 and Float / Sludge Drum Sludge Handling

DNF-1 and DNF-2 are provided with sludge storage compartments which may occasionally capture heavy flocculant. Collected sludge within DNF-1 and DNF-2 sludge compartments will be periodically gravity drained to Float and Sludge drum.

When DNF-1 and DNF-2 have off-loaded sludge to the Float and Sludge drum, the material in float / sludge drum will be pumped either to truck-out for offsite disposal or to the ROT.

3.4 OPERATIONAL FLEXIBILITY AND RELIABILITY OF TREATMENT SYSTEMS

3.4.1 ALARMS AND SENSING DEVICES

For a detailed discussion, refer to Unit 597 Wastewater Collection / Treatment Plant Process Control Narrative 25873-001-J5R-597-00001 (GM1-700-U59700-IN-5306-00001) located in Appendix - E.

3.5 SUMMARY SENSING DEVICES

The listing below is a summary of the new devices installed as part of the improvement project.

Table Summary Sensing Devices

AC Diversion and Pond

P-59714A/B AC POND TRANSFER PUMP DISCH FLOW CONTROL XMTR (597F-059)
P-59714A/B AC POND TRANS PUMP DISCH XMTR PWR SIGNAL (597F-059)
AC POND & DIV BOX WATER TO SET DRUM FLOW (597F-061)
WW FRM T-59714 AC POND & T-59703 DIVERSION BOX PRESS XMTR (597P-203)
P-59714A/B AC POND PMP WW TO T-59707A/B PRESS CONTROL XMTR (597P-208)
AC POND/DIVERSION BOX WATER TO SETTLEMENT DRUM (597T-070)
AC POND/DIVERSION BOX WATER TO SETTLEMENT DRUM (597T-070)
AC POND/DIVERSION BOX WATER TO SETTLEMENT DRUM (597T-070)
AC POND/DIVERSION BOX WATER TO SETTLEMENT DRUM (597T-070)

FEOR Tanks

P-59704A/B FEOR RECYCLE TO T-59771 FLOW XMTR (597F-063)
P-59704A MIN FLOW TO FEOR TANK T-59707A VLV (597K-084)
P-59704A MIN FLOW TO FEOR TANK T-59707B VLV (597K-085)
P-59704B MIN FLOW TO FEOR TANK T-59707A VLV (597K-086)

P-59704B MIN FLOW TO FEOR TANK T-59707B VLV (597K-088)
WW FR FEOR T-59707A TO P-59704A/B VLV (597K-096)
WW FR FEOR T-59707A TO P-59704A/B VLV (597K-097)
EFF COOLER(E-59703) STRPD WW TO FEOR TK PRESSURE XMTR (T-59707A/B) (597P-173)
E-59703 STRPD WW TO FEOR TK T-59707A/B ANLZR (597Q-184)
E-59703 STRPD WW TO FEOR TK T-59707A/B ANLZR PROBE (597Q-184)
E-59703 STRPD WW TO FEOR TK T-59707A/B LOW FLOW (597Q-184)

SETTLEMENT DRUM

Rupture Disk ECU PROCESS WW TO T-59771 SETTLEMENT DRUM (597RD-001)
Rupture Disk ECU PROCESS WW TO T-59771 SETTLEMENT DRUM (597RD-002)
SETTLEMENT EFF PMPS P-59772A/B MIN FLOW CONTROL XMTR (597F-041)
T-59707A/B DEOILED WW TO S-59713 FLOW CONTROL XMTR (597F-042)
SET DRM EFF TO DNF UNIT-1 (S-59712) FLOW CONTROL XMTR (597F-043)
P-59772A/B SET DRUM EFF PMPS DISCH FLOW CONTROL XMTR (597F-043)
P-59771A/B SET DRUM SLUDGE PMP DISCH FLOW (597F-054)
T-59771 SETTLEMENT DRUM TEMP (597T-093)
T-59771 SETTLEMENT DRUM TEMP (597T-093)
T-59771 SET DRUM INTERFACE LEVEL WATER/OIL (597L-060)
T-59771 SET DRUM INTERFACE LEVEL WATER/OIL (597L-061)
T-59771 SETTTLEMENT DRUM BOTTOM CONE LEVEL (597L-062)
P-59772A/B SET DRM EFF PMPS DISCH PRESS (597P-154)
59771A/B SET DRM SLUD PMPS DISCH PRESS (597P-159)
T-59771 SET DRUM PRESSURE (597P-177)
PROCESS WW FROM ECU TO SET DRUM (T-59771) PRESSURE (597P-200)
SET DRM EFF PMPS (P-59772A/B) DISCH OIW (597Q-185)
SET DRM EFF PMPS (P-59772A/B) DISCH OIW PROBE (597Q-185)
P-59772A SETTLEMENT DRUM EFFLUENT PUMP DISCHARGE (597R-703)
P-59772B SETTLEMENT DRUM EFFLUENT PUMP DISCHARGE (597R-704)
T-59771 SETTLER TANK RTD (597T-071)
T-59771 SETTLER DRUM TEMP (597T-071)
P-59772A/B SET DRUM EFF PMPS DISCH TEMP (597T-117)
P-59771A/B SET DRM SLUD PMPS DISCH TEMP (597T-119)
ECU WW TO T-59771 SETTLER TANK PH XMTR (597Q-167)
ECU WW TO SETTLEMENT DRUM (T-59771) SS (597Q-166)

Float Sludge Drum

T-59768 FLOAT/SLUDGE DRUM LEVEL (597L-044)
T-59768 FLOAT/SLUDGE DRUM LEVEL (597L-045)
T-59768 FLOAT/SLUDGE DRUM TEMP (597T-078)

DNF UNIT-1

P-59763A/B DNF UNIT-1 EFF PMPS MIN FLOW CONTROL XMTR (597F-050)
P-59763A/B DNF UNIT-1 EFF PMPS DISCH FLOW CONTROL XMTR (597F-064)

P-59763A/C DNF UNIT-1 EFF PMPS DISCH FLOW XMTR (597F-064)
EFF FROM DNF-1 TO SET DRUM (T-59771) FLOW GAUGE (597F-072)
P-59761A DNF UNIT-1 RECIRCULATION PUMP DISCHARGE (597R-707)
P-59761B DNF UNIT-1 RECIRCULATION PUMP DISCHARGE (597R-708)
P-59763A DNF UNIT-1 EFFLUENT PUMP DISCHARGE (597R-701)
P-59763B DNF UNIT-1 EFFLUENT PUMP DISCHARGE (597R-702)
S-59712 DNF UNIT-1 LEVEL (597L-041)
S-59712 DNF UNIT-1 LEVEL (597L-043)
P-59763A/B DNF UNIT-1 EFF PMP DISCH PRESSURE (597P-178)
P-59761 A/B & P-59762A/B PRESSURE REGULATOR (597P-205)
P-59761 A/B & P-59762A/B PRESSURE REGULATOR (597P-209)
PMP (P-59772A/B) TO DNF UNIT-1 (S-59712) ANLZR SS (597Q-180)
P-59763A/B DNF UNIT-1 EFF PMP DISCH TEMP (597T-118)
P-59763A/B DNF UNIT-1 EFF PMP DISCH (597Q-163)

DNF UNIT-2

P-59764A/B DNF UNIT-2 EFF PMPS MIN FLOW CONTROL XMTR (597F-049)
WW TO DNF-2 COAGULANT/FLOC INJ FLOW CONTROL XMTR (597F-066)
AC AND DIVERSION WATER / DNF-2 EFF TO A-59705 BIOTRE (597F-070)
P-59764A DNF UNIT-2 EFFLUENT PUMP DISCHARGE (597R-705)
P-59764B DNF UNIT-2 EFFLUENT PUMP DISCHARGE (597R-706)
P-59762A DNF UNIT-2 RECIRCULATION PUMP DISCHARGE (597R-709)
P-59762B DNF UNIT-2 RECIRCULATION PUMP DISCHARGE (597R-710)
S-59713 DNF UNIT-2 LEVEL (597L-042)
S-59713 DNF UNIT-2 LEVEL (597L-048)
S-59713 DISSOLVED NITROGEN FLOATATION UNIT-2 PRESS (597P-179)
DNF UNIT-2 EFF PMP (59764A) DISCH ANLZR SS (597Q-183)
T-59707A/B DEOIL WW TO DNF UNIT-2 (S-59713) SS (597Q-175)

STEAM STRIPPER

STEAM TO WW STEAM STRIPPER C-59769 FLOW VLV (597F-055)
STEAM TO WW STEAM STRIPPER C-59769 FLOW XMTR (597F-055)
STRIPPED WW TO T-59707A/B FLOW XMTR (597F-056)
WW STREAM STRIPPER (C-59769) FLOW CONTROL XMTR VLV (597F-060)
STRIPPER EFF PMPS (C59769A/B) DISCH FLOW XMTR (597F-060)
STM STPR REFX PMPS (P-59773A/B) WW TO C-59769 FLOW (597F-069)
AC AND DIVERSION WATER / DNF-2 EFF TO A-59705 BIOTRE (597F-070)
EFF FROM DNF-1 TO SET DRUM (T-59771) FLOW GAUGE (597F-072)
EFF COOLER (E-59703) FILTERED W DISCH FLOW XMTR (597F-077)
WW PRE-HEATER (E-59701A) LINE FLOW XMTR (597F-078)
WW PRE-HEATER (E-59701B) TO STRIPPER FLOW XMTR (597F-079)
WW PRE-HEATER (E-59701C) LINE FLOW XMTR (597F-080)
WASTE WATER STEAM STRIPPER (C-59769) LEVEL GAUGE (597L-049)

C-59769 WASTE WATER STEAM STRIPPER LEVEL (597L-049)
C-59769 WASTE WATER STEAM STRIPPER LEVEL (597L-050)
V-59773 STEAM STRIPPER OH REFLUX DRM LEVEL (597L-051)
V-59773 STEAM STRIPPER OH REFLUX DRM LEVEL (597L-052)
STEAM STRIPPER OH REFLUX DRM (V-59773) LEVEL GAUGE (597L-053)
V-59773 STEAM STRIPPER OH REFLUX DRM LEVEL (597L-053)
STEAM STRIPPER OH REFLUX DRM (V-59773) LEVEL GAUGE (597L-054)
V-59773 STEAM STRIPPER OH REFLUX DRM LEVEL (597L-054)
V-59773 STEAM STRIPPER OH REFLUX DRM LEVEL (597L-058)
C-59769 WW STEAM STRIPPER LEVEL (597L-059)
STRIPPER EFF PMP P-59769A AND B DISCHARGE RTD (597T-090)
STRIPPER EFF PMP P-59769A AND B DISCHARGE TEMP (597T-090)
WASTE WATER PRE-HEATER (E-59701B) INLET RTD (597T-091)
WASTE WATER PRE-HEATER (E-59701B) INLET TEMP (597T-091)
WW PRE-HEATER (E-59701B) BYPASS TEMP VLV (597T-092)
WW PRE-HEATER (E-59701B) BYPASS RTD (597T-092)
WASTE WATER PRE-HEATER (E-59701B) BYPASS TEMP (597T-092)
STRIPPER OH CONDENSER AIR PLENUM RTD (597T-097)
STRIPPER OH CONDENSER AIR PLENUM RTD (597T-097)
STRIPPER OH CONDSR AIR PLENUM TEMPERATURE XMTR (597T-097)
E-59702 STRIPPER OH CONDSR AIR PLENUM TEMP (597T-097)
E-59702 STRIPPER OH CONDSR AIR PLENUM TEMP (597T-097)
STM STPR OH CONDSR (E-59702) CONDSD LIQ TO V-59773 (597T-098)
E-59702 STM STPR OH CONDSR DISCH TEMP (597T-098)
EFF COOLER (E-59703) FILTERED WATER IN RTD (597T-111)
E-59703 EFF COOLER FILTERED WATER IN TEMP (597T-111)
EFF COOLER (E-59703) FILTERED W OUT TEMP CONTROL VLV (597T-113)
EFF COOLER (E-59703) FILTERED WATER DISCH RTD (597T-113)
E-59703 EFF COOLER FILTERED WATER DISCH TEMP (597T-113)
EFF COOLER (E-59703) FILTERED W DISCH TEMP RTD (597T-121)
E-59703 EFF COOLER FILTERED WATER DISCH TEMP (597T-121)
OH REFLUX DRUM (V-59773) VENT RTD (597T-122)
V-59773 OH REFLUX DRUM VENT TEMP (597T-122)
WW PRE-HEATER (E-59701B/C) LINE RTD (597T-124)
E-59701A WW PRE-HEATER TO STEAM STRIPPER TEMP (597T-124)
WW PRE-HEATER (E-59701B) TO E-59703 RTD (597T-125)
E-59701B WW PRE-HEATER TO E-59703 TEMP (597T-125)
WW PRE-HEATER (E-59701B) TO STRIPPER RTD (597T-126)
E-59701B WW PRE-HEATER TO STRIPPER TEMP (597T-126)
WW PRE-HEATER (E-59701B/C) LINE RTD (597T-127)
E-59701C WW PRE-HEATER TO STRIPPER TEMP (597T-127)

STRIPPER OH CONDSR FAN A VIBRATION TRANSMITTER (597V-003)
STRIPPER OH CONDSR FAN B VIBRATION TRANSMITTER (597V-004)
C-59769 STRIPPER OH TEMP RTD (597T-085)
C-59769 STRIPPER OH TEMP (597T-085)
E-59703 STRPD WW TO FEOR TK T-59707A/B ANLZR (597Q-184)
E-59703 STRPD WW TO FEOR TK T-59707A/B ANLZR PROBE (597Q-184)
E-59703 STRPD WW TO FEOR TK T-59707A/B LOW FLOW (597Q-184)
P-59769A/B STRIPPER EFF PMPS DISCH PRESS (597P-099)
P-59773A DISCH PRESSURE CONTROL VLV (SELF REGULATED) (597P-175)
P-59773B DISCH PRESSURE CONTROL VLV (SELF REGULATED) (597P-176)
P-59773A/B STM STPR REFX PMPS WW TO C-59769 PRESS (597P-180)
E-59701B WW PRE-HEATER INLET PRESS (597P-182)
E-59701B WW PRE-HEATER TO E-59703 PRESS (597P-183)
E-59701B WW PRE-HEATER TO WW STEAM STRIPPER PRESS (597P-184)

CARBON CANNISTERS

V-53517A/B CARBON CANNISTERS VENT GAS FLOW (535F-002)
59701A/B CARBON CANSTR DISCH FLAME ARRESTER DP (535P-008)
53517A/B CARBON CANSTR INLET FLAME ARRESTER DP (535P-009)
VG FRM BLWRS TO CARBON CANSTR V-53517A/B PRESS (535P-010)
CARBON CANSTRS DISCH (V-59710A/B) VOC ANLZR PROBE (535Q-002)
VG FRM BLWRS TO CANSTR PKG (A-59709) RTD (535T-007)

KNOCKOUT DRUM

KO DRUM (V-59774) LEVEL GAUGE (535L-002)
V-53574 KO DRUM LEVEL (535L-002)
V-53574 KO DRUM LEVEL (535L-003)
V-53574 KO DRUM VENT PRESSURE (535P-011)
Y-53587A/B FLAMES ARRESTERS (KOD INLET) DP (535P-015)
Y-53594A/B FLAME ARRESTERS DP (535P-016)
VENT GAS TO A-53501 ANLZR PRESSURE (535P-080)
COMBINED OFF GASES O2 TO THERMAL OXIDIZER (535Q-080)
A-53501 STACK ANLZR CO (535Q-186)
Y-53593A FLAME ARRESTOR TEMP (535T-001)
Y-53593B FLAME ARRESTOR TEMP (535T-002)
Y-53588A FLAME ARRESTOR TEMP (535T-003)
Y-53588B FLAME ARRESTOR TEMP (535T-004)
VENT GAS FROM K53501, K-59705, K-59706 RTD (535T-008)
VENT KO DRUM (V-59774) VENT TEMPERATURE RTD (535T-009)
Y-53587A FLAME ARRESTOR TEMP (535T-010)
Y-53587B FLAME ARRESTOR TEMP (535T-011)
Y53594A FLAME ARRESTOR TEMP (535T-012)
Y53594B FLAME ARRESTOR TEMP (535T-014)

VENT GAS TO A-53501 ANLZR TEMP. (535T-080)
VENT GAS TO A-53501 ANLZR TEMP. (535T-080)
BIOREACTOR
P-59704B BIOREACTOR FEED PUMP MIN FLOW CTRL (597F-062)
P-59704A BIOREACTOR FEED PUMP TOC (597Q-169)
P-59704A BIOREACTOR FEED PUMP DISCH OIL PROBE (597Q-176)
P-59704A BIOREACTOR FEED PUMP DISCH SAMPLE LOW FLOW (597Q-176)

MISC

PIPE RACK AREA GAS MEASURMENT (597D-001)
DNF UNIT - 1 & 2 AREA GAS MEASURMENT (597D-001)
T-59771 SETTLEMENT DRUM AREA GAS MEASURMENT (597D-001)
EFFLUENT PMPS AREA GAS MEASURMENT (597D-002)
EFFLUENT PMPS AREA GAS MEASURMENT (597D-002)
STRIPPER EFFLUENT PMPS AREA GAS MEASURMENT (597D-002)
T-59771 SETTLEMENT DRUM AREA GAS MEASURMENT (597D-003)
EFFLUENT PMPS AREA GAS MEASURMENT (597D-004)

3.6 CONTROL AND QUANTITY AND QUALITY OF WASTEWATER WHEN THE TREATMENT SYSTEM IS INOPERATIVE.

The AC system's Diversion Box is an in-ground concrete structure baffled to promote separation of oil and to minimize oil entrainment in wastewater flowing to the AC pond. Dry weather flows pass through two screens arranged in series in case the primary removable screen is taken out for cleaning. A pipe skimmer with one oil removal pump is provided. Oil removal is operator initiated allowing storage in box in case maintenance of skimming system is required. Service and stand-by pumps are provided to pump out wastewater to FEOR tank allowing maintenance of a pump.

From the Diversion Box wastewater flows by gravity to AC pond. The surface area of the pond is 16,500 ft2 (1,532.9 m2). Service and stand-by pumps are provided to pump out wastewater to FEOR tank allowing maintenance of a pump. Contaminated cooling tower blowdown and off-spec effluent from Bio-treatment plant's clarifiers or filtered water can be diverted to AC pond for temporary storage. Release of water through emergency spillway can be monitored visually and a sample can be withdrawn manually from a sampling pad provided at the grade level.

The performance of the WWTP (and Bioreactor system) can be affected by power loss, mechanical failure and process upsets.

The ECU wastewater pre-treatment system (Settlement Drum, DNF-1 and Steam Stripper system) is provided with a working capacity of at 540 m3 which is adequate to temporarily accumulate ECU wastewater pumped to them for at least 12 hours. Following operational flexibility provisions have been provided to maximize system reliability:

(i) Provisions are made to isolate Settlement Drum and route ECU wastewater directly to downstream DNF-1 in case Settlement Drum is unavailable.

(ii) In case of DNF-1 shutdown, provisions exist to bring DNF-2 in between Settlement Drum and Steam Stripper thereby treating Settlement Drum effluent water before routing to Steam Stripper.

(iii) In case of Steam Stripper shutdown, provisions exist to route DNF-1 effluent water (De-oiled) to FEOR tanks.

(iv) In case entire ECU wastewater pre-treatment system (Settlement Drum, DNF-1 and Steam Stripper) shuts down, ECU wastewater can be routed to existing FEOR tanks and treated in downstream DNF-2.

(v) In case DNF-2 shuts down / unavailable, FEOR water (ECU wastewater, Oxidized Spent Caustic, AC Pond Water, Diversion Box water with ECU wastewater pre-treated in Settlement Drum, DNF-1 and Steam Stripper) can be routed to bioreactor.

The FEOR and Recovered Oil tanks are installed in a dike that in conjunction with the AC pond provide secondary containment in case of tank rupture.

Settlement Drum, DNF-1, DNF-2 and Float / Sludge drum are installed in a dike providing secondary containment in case of vessel rupture.

From the FEOR tanks wastewater is pumped to the Bio-treatment plant using spared pumps. The Bio-treatment plant comprises of two (2) identical trains each with aeration tank and a clarifier. It is possible to take any train out of service. Each aeration tank is sized to treat 70% of design BOD load and each clarifier can handle the wet weather design flows. Six dual cell DGF filters, sized conservatively, are provided designed to filter maximum expected flow during wet weather including cooling tower blowdown. Any cell of the filter can be taken out of service leaving the other eleven in operation.

All pumps, in continuous service, in WWTP plants have been provided an installed spare that can be put in service since loss of equipment is alarmed in the BPCS.

Power failure lasting several hours is not expected to irreversibly impair the operation of the plant. Wastewater can be accumulated in Settlement Drum and FEOR tanks which are sized to

temporarily hold wastewater pumped to them for combined 57 hours which is ample to restore power.

3.7 PERSONNEL TRAINING

Personnel Training (Unchanged from Original WQM Permit)

This section describes the Training of personnel responsible for the Operation, maintenance, permit compliance and management of the WWTP. This description is not exhaustive and is intended to generally specify the extent of required training for successful operation of the WWTP.

The facility will be operated from a Centralized Control Room (CCR) for the control and monitoring of the WWTP.

Ensure Safe Production (ESP) program will be implemented to enable operators and support staff to clearly understand and operate within their operational limits.

As part of the pre-commissioning and post-commissioning activities the supplier of the WWTP will provide a classroom and hands-on training to ensure that personnel understand the WWTP's Operation and Maintenance manuals, MSDS for all chemicals and lubricants, sources of wastewater, process flow diagrams and P&IDs, permit conditions, troubleshooting guide for the plant, controls and instrumentation including BPCS control loops and monitored parameters.

All management, tools, supplies, equipment, certified personnel and labor necessary to ensure operation of all equipment in accordance with chemical industry practices and standards typically used for such facilities will be made. All local rules & regulations including NPDES permit requirements shall be discussed and made available to Operators.

WWTP will be staffed 24 hours, 7 days a week including periods of adverse weather conditions. Operation shall include operation of all plant equipment, valves, sampling, and lab analyses. Dewatering, Testing and Hauling of dewatered sludge cake to an approved landfill for final disposal shall be included.

Centrifuge operators will be trained to understand that only sludge that passes US EPA "Paint Filter Liquids Test (Method 9095B), meeting no free/dripping liquids criteria, can be sent to landfill and how to achieve this by controlling centrifuge's process and mechanical variables. Personnel training will include taking representative samples for laboratory analyses including preservation requirements.

Personnel training will include how to generate various "Reports" of all major and minor components for review and records including creating, maintaining, and dispositioning of reports that are specifically required for NPDES permit compliance, daily operating logs of plant including establishing process control set points. Importance of reporting equipment deficiencies promptly will be emphasized. Corrective maintenance in an emergency that is required to return a system or component to proper operating condition will be discussed.

All employees responsible for plant operation will possess a current appropriate wastewater treatment training for their assigned work duties. Management is responsible for maintaining a list of all their employees including their current training.

Separately Shell will train their personnel on Project's Standard Operating Procedures including Safety, lock-out tag-out procedures, confined entry permit requirement, PPE, site evacuation, work permits, etc.

WWTP operators shall be trained with regards to operation of the new and modified equipment.

3.8 AVAILABILITY OF INSTRUCTIONS AND GUIDELINES FOR THE OPERATION AND MAINTENANCE OF TREATMENT UNITS

Availability of Instruction and Guidelines for The Operation and Maintenance of Treatment Units

A complete Operations and Maintenance manual (O&M) covering the WWTP (Existing and modified) will be available to Operators.

Vendor literature include installation, operation and maintenance of specific equipment such as pumps, blowers, centrifuge, instruments and analyzers including PLC panel components. These manuals are provided when the equipment is shipped, and the information is reviewed during the Training.

3.9 SITE SECURITY

Site Security (Unchanged from original WQM)

The Petrochemical Project is completely fenced in with access into plant via manned Guard houses. The entire fence area and accesses into plant are also monitored using security cameras. The wastewater treatment plant is located within the Project.

Security fences and gates are installed to prevent unauthorized entry into the Project. Main entry gates are automatic motorized, sliding type gates. All other gates shall be swing type gates. A card activated stile is provided adjacent to plant main entrances. A single swing type man entry gate is located adjacent to the turnstile. Panic hardware are used at all gates with prevention of opening the gate from outside of the gate.

Perimeter illumination is installed around the perimeter of the fence.

A CCTV surveillance system provides visual information of activity in key areas of the site. The monitoring and surveillance system provide security personnel with camera and monitor selection facilities with the ability to display individual full screen pictures or combination of pictures from any camera or monitor selected.

A number of radio channels that allow for site-wide radio coverage is provided including an Emergency Response Channel for the Emergency Response Team. An Emergency Control Center (ECC) is provided in the facility for coordination of major incidents. The emergency control center will be equipped with modern communication facilities, power back up, BPCS consoles, telecoms and access to CCTV, F & G system panel and hotline to government agencies etc.

3.10 PRELIMINARY AND SUPPLEMENTAL GROUNDWATER, SOILSAND GEOLOGY INFORMATION (UNCHANGED FROM ORIGINAL WQM)

Groundwater and Soils studies were conducted and submitted to PADEP as part of the Applications for the Water Obstruction and Encroachment (Joint Permit) and the ACT2 approval.

For construction of the proposed plant, Geotechnical analyses were conducted and can be provided to PADEP if required for their review.

IV. APPENDICES CONTAINING SUPPORTING INFORMATION

A. Block Flow Diagram

Case 1 Simulation: Max ECU WW Flow in Summer

FLOW: M^3/HR

ISBL | OSBL

- EXISTING WASTE WATER FLOWS FROM FACILITY
- EXISTING WASTE WATER TREATMENT EQUIPMENT
- NEW WASTE WATER PRETREATMENT EQUIPMENT
- CHEMICAL/ NUTRIENT ADDITION

ECU

SPENT CAUSTIC OXIDIZER

OFF GAS TO THERMAL OXIDIZER

153

PE 1/
PE 2/
PE 3/

FILTRATION OF PE PELLETS AND OTHER SOLIDS

FILTRATION OF PE PELLETS AND OTHER SOLDS

FILTRATION OF PE PELLETS AND OTHER SOLDS

NUTRIENTS (N & P)

pH ADJUSTMENT

OFF GAS TO THERMAL OXIDIZER

SETTLEMENT DRUM

149.3

DNF UNIT -1

1.6

66.2

STEAM STRIPPER

68.8

FLOW EQUALIZATION AND OIL REMOVAL TANK (STRIPPED WW)

231.5

BIOREACTOR AERATION TANK

SECONDARY CLARIFIER

TERTIARY SAND FILTER

TREATED EFFLUENT SUMP

NNF

0.03

80.8

7.0

0.2

80.9

FLOW EQUALIZATION AND OIL REMOVAL TANK (OFF SPEC)

NNF

OFF GAS TO THERMAL OXIDIZER

SLUDGE THICKENER TANK

POLYMER FEED SYSTEM

DEWATERING CENTRIFUGE

WASH WATER / RAINFALL RUNOFF FROM ECU & PE UNITS

FLOW DIVERSION BOX

76.2

FLOATS / SLUDGE DRUM

DNF UNIT -2

231.5

SAND FILTER BACKWASH & SLUDGE DEWATERING WASTE SUMP

WASH WATER FROM EWSS & PE SILO WASHING

DEMINERALIZER PLANT

76.2

RECOVERED OIL STORAGE TANK

COOLING WATER TOWER

1

2

3

ACCIDENTLY CONTAMINATED (AC) WATER POND

1 COOLING TOWER BLOWDOWN ROUTED TO FEOR TANKS, IF THE HYDROCARBON CONTAMINATION LASTS MORE THAN A DAY

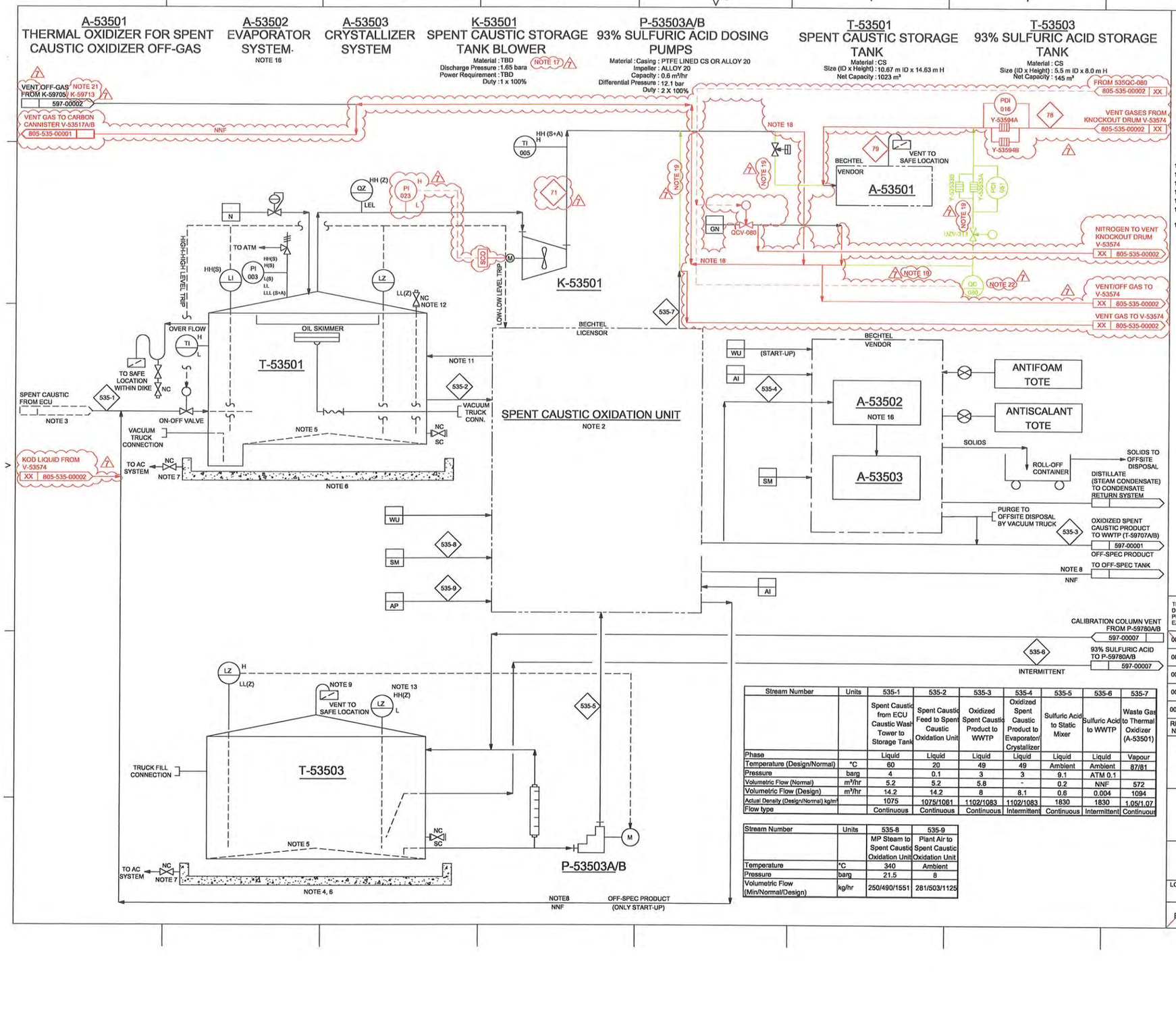
2 COOLING TOWER BLOWDOWN ROUTED TO BIOTREATER, IF THE HYDROCARBON CONTAMINATION LASTS LESS THAN A DAY

3 COOLING TOWER BLOWDOWN NORMALLY COMINGLES WITH TREATED EFFLUENT DOWNSTREAM OF WWTP

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
CARL J. MARRARO
ENGINEER
No. PE406715

1/31/2025

B. Process Flow Diagrams



Stream Number	Units	535-1	535-2	535-3	535-4	535-5	535-6	535-7
		Spent Caustic from ECU Caustic Wash Tower to Storage Tank	Spent Caustic Feed to Spent Caustic Oxidation Unit	Oxidized Spent Caustic Product to WWTP	Oxidized Spent Caustic Product to Evaporator/ Crystallizer	Sulfuric Acid to Static Mixer	Sulfuric Acid to WWTP	Waste Gas to Thermal Oxidizer (A-53501)
Phase		Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Vapour
Temperature (Design/Normal)	°C	60	20	49	49	Ambient	Ambient	87/81
Pressure	barg	4	0.1	3	3	9.1	ATM 0.1	
Volumetric Flow (Normal)	m³/hr	5.2	5.2	5.8	-	0.2	NNF	572
Volumetric Flow (Design)	m³/hr	14.2	14.2	8	8.1	0.6	0.004	1094
Actual Density (Design/Normal) kg/m³		1075	1075/1061	1102/1083	1102/1083	1830	1830	1.05/1.07
Flow type		Continuous	Continuous	Continuous	Intermittent	Continuous	Intermittent	Continuous

Stream Number	Units	535-8	535-9
		MP Steam to Spent Caustic Oxidation Unit	Plant Air to Spent Caustic Oxidation Unit
Temperature	°C	340	Ambient
Pressure	barg	21.5	8
Volumetric Flow (Min/Normal/Design)	kg/hr	250/490/1551	281/503/1125

NOTES:

1. SEE PEFS DRAWINGS GM1-700-G0000-PX-2365-00001 THROUGH GM1-700-G0000-PX-2365-00008 FOR ALL SYMBOLOGY.
2. PROCESS DESIGN PACKAGE IS BY LICENSOR. REFER TO DWGS. 25873-100-V14-GOOY-00003/4 FOR DETAILS.
3. STREAM DATA IS FROM ECU PROCESS LICENSOR.
4. SECONDARY CONTAINMENT FOR 110% OF TANK VOLUME.
5. 1% SLOPE UP TO TANK CENTER.
6. CONCRETE TO BE LINED IN ACCORDANCE WITH PROJECT SPECIFICATION FOR MAXIMUM RESISTANCE TO SPILLS AND LEAKS.
7. BEFORE ROUTING DRAINAGE TO AC SYSTEM, DRAINAGE FROM THE CURBED/ CONTAINMENT AREA TO BE CHECKED/TESTED TO VERIFY ABSENCE OF ANY SPILLS/ LEAKS OF CHEMICALS THAT MAY REQUIRE AT SOURCE CLEANUP/COLLECTION.
8. OFF-SPEC PRODUCT TO BE RECYCLED TO T-53501 FEED TANK ONLY AT START-UP. DURING NORMAL OPERATION, DESTINATION OF OFF-SPEC PRODUCT TBD.
9. PROVIDE DESSICANT FILTER.
10. DELETED.
11. PUMP MINIMUM FLOW.
12. FOR MANUAL TANK GAUGING.
13. HIGH-HIGH LEVEL IN THE TANK WILL STOP THE FILLING OPERATION.
14. DELETED.
15. OUTLET NOZZLES SHALL BE FITTED WITH AN INTERNAL ELBOW TURNED DOWN WITH A PLATE ATTACHED TO BOTTOM PLATE.
16. EVAPORATOR SYSTEM A-53502 SUBJECT TO DELETION, PENDING EVALUATION OF VENDOR PROPOSALS.

REFERENCE

- STREAM NUMBER
- TEMPERATURE, °C
- PRESSURE barg
- FLOW, kg/hr
- GAS FLOW, Nm3/hr
- LIQUID FLOW, m3/hr

THE PROCESS CONDITIONS OF FLOW QUANTITIES, TEMPERATURES, PRESSURES, COMPOSITIONS, DESCRIPTIONS, AND EQUIPMENT DUTIES SHOWN ON THIS FLOW DIAGRAM ARE FOR DESIGN PURPOSES ONLY, WHILE USEFUL AS A GUIDE FOR OPERATIONS, THIS DOES NOT REPRESENT EXACT OR GUARANTEED OPERATING CONDITIONS.

REV No.	DATE	DESCRIPTION	PROC. ENGR	CHK	PROC. EGS	APE	PEM	CLIENT
003	06OCT15	RE-ISSUED FOR DESIGN	LK	KD	KD	NK	DP	-
002	24AUG15	RE-ISSUED FOR DESIGN	KM	LK	KD	CC	DP	-
001	23JUN15	ISSUED FOR DESIGN	KM	LK	KD	CC	DP	-
000	04AUG14	ISSUED FOR FEED	SP	KM	NTV	KB	DP	-
00C	04/29/14	RE-ISSUED FOR APPROVAL	SP	NTV	LK	KB	DP	-

BECHTEL OG&C
PROJECT FRANKLIN
UTILITIES AND GENERAL FACILITIES

25873-001
ECCN: EAR99

BECHTEL DRAWING No: 25873-001-M5-535-00001 Rev. 003

UTILITY FLOW SCHEME
SPENT CAUSTIC TREATMENT SYSTEM

LOCATION:	PLANT AREA:	COMPANY PROJECT No.
Monaca, PA	OSBL	GM1

PROJECT FRANKLIN	SCALE: NTS	COMPANY DRG No. GM1-700-U53500-PX-2366-00001	Rev. 003

PCAP-1390

NOTES

17. SPARE BLOWER TO K-53501 WILL NOT BE INSTALLED IN PROJECT P-00052, ONLY TIE-INS FOR FUTURE SPARE BLOWER ARE PROVIDED.
18. RED LINE REPRESENTS FUTURE OPERATION, GREEN LINE REPRESENTS EXISTING OPERATION THAT WILL BE DEMOLISHED IN THE FUTURE BY CONTRACTOR (TBD) AFTER NEW WWTP IS SET UP.
19. TO BE DEMOLISHED UPON COMMISSIONING OF NEW KOD V-53574.
20. DELETED.
21. K-59713 (SPARE BLOWER TO K-59705) WILL NOT BE INSTALLED IN PROJECT P-00052, ONLY TIE-INS FOR FUTURE SPARE BLOWER ARE PROVIDED.
22. ANALYZER TO BE RE-USED.

SCOPE CLOUD
REVISION CLOUD
HOLD CLOUD

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(ii) MAY BE USED BY THE CLIENT ONLY IN THE CONTEXT AND FOR THE EXPRESS PURPOSE FOR WHICH IT WAS INTENDED, ANY USE OF, OR RELIANCE ON, THIS DOCUMENT BY ANY THIRD PARTY IS AT THAT PARTY'S SOLE RISK.

wood.

REFERENCE DRAWINGS

FOR P-00052 PROJECT USE ONLY

WOOD DRAWING NO.:
100412-P00052-DC0-PFD-0010-01

REV.	DATE	DESCRIPTION	BY	CHK	ENG.	APP
7	25 01 15	ISSUED FOR DESIGN	SD	SP	DCC	PF
6	24 10 25	RE-ISSUED FOR HAZOP (P00052)	SD	SP	DC	RE
5	24 07 24	ISSUED FOR HAZOP (P00052)	SD	CH	SM	RE
4	24 05 08	ISSUED FOR REVIEW	SD	AC	NY	RE

PROFESSIONAL ENGINEER CARL J. MARSICO No. PE10645
3/1/2025

SHELL POLYMERS MONACA

TITLE
UTILITY FLOW SCHEME
SPENT CAUSTIC TREATMENT SYSTEM

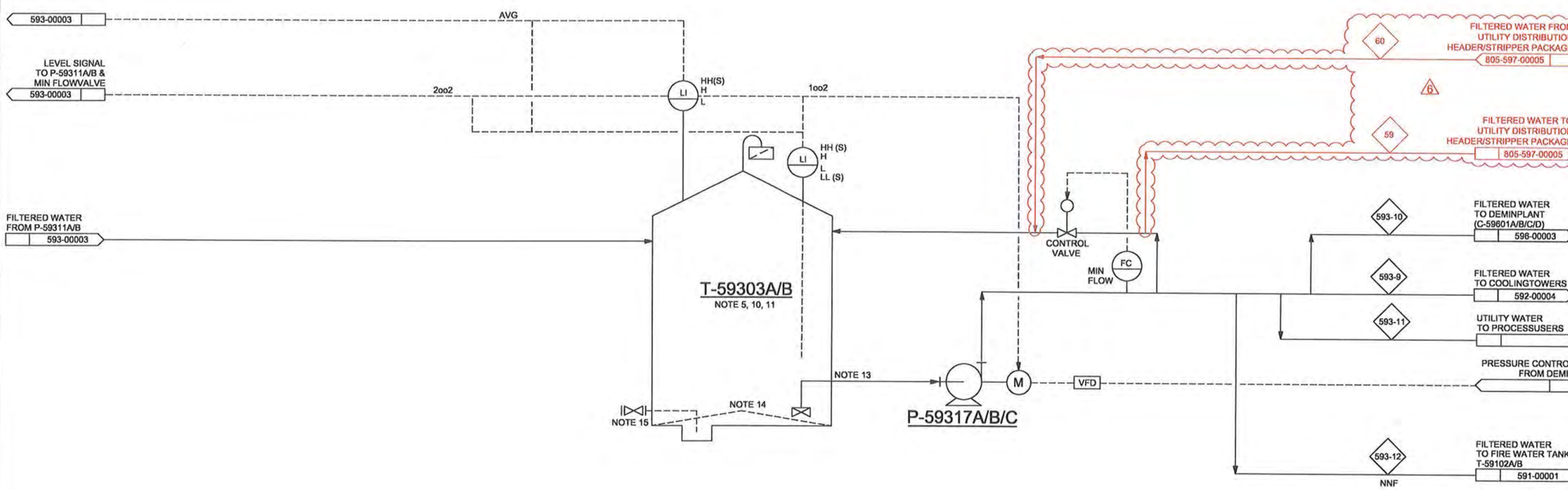
EQUIP. NO.		PLANT AREA OSBL	
PROJECT NO. P-00052	SCALE		FILE NAME
DRAWN BY	CHECKED BY		MICRO. REV.
APPROVED	DRAWING NO. GM1-700-U53500-PX-2366-00001		REV. 7

P-59317A/B/C
FILTEREDWATER FORWARDING PUMPS

Material : DI
Capacity : 1300 m3/hr
Differential Pressure : 14.4 bar
Duty : 3 x 50%

T-59303A/B
FILTEREDWATERSTORAGE TANKS

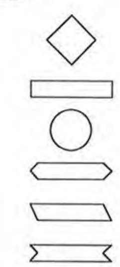
Material Shell, Bottom, Sump : CS+1/8 in CA
Material Roof : CS+ 1/16 in CA
Size (ID x Height): 35.5 m x 19.5 m
Duty : 2 x 50%
Net Capacity : 15,600 m3



NOTES:

1. SEE PEFS DRAWINGS GM1-700-G0000-PX-2365-00001 THROUGH GM1-700-G0000-PX-2365-00008 FOR ALL SYMBOLOGY.
2. DELETED.
3. FOR STREAM DATA VALUES, SEE DRAWING 25873-001-M5-593-00006.
4. DELETED.
5. NET WORKING CAPACITY (15,600 m3) PER TANK IS BASED ON 6 HRS. STORAGE FOR DOWNSTREAM FILTERED WATER DEMAND.
6. DELETED.
7. DELETED.
8. DELETED.
9. DELETED.
10. TANKS TO BE LINED IN ACCORDANCE WITH PROJECT SPECIFICATION FOR EPOXY TANK LINING. FABRICATION SHALL COMPLY WITH NACE SP0178.
11. INTERNAL CATHODIC PROTECTION REQUIRED, EXTERNAL CATHODIC PROTECTION IS REQUIRED FOR TANK BOTTOM ON RINGWALL FOUNDATION.
12. DELETED.
13. OUTLET NOZZLE SHALL BE FITTED WITH AN INTERNAL ELBOW TURNED DOWN WITH A VORTEX BREAKER PLATE ATTACHED.
14. TANK BOTTOM SHALL BE CONE UP, SLOPE SHALL BE 1:120.
15. TWO (2) DRAW-OFF SUMPS.

REFERENCE



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REV No.	DATE	DESCRIPTION	PROC ENGR	CHK	PROC EGS	APE	PEM	CLIENT
003	30AUG17	RE-ISSUED FOR DESIGN	GS	MM	AS	SG	SS	-
002	18OCT16	RE-ISSUED FOR DESIGN	LK	KD	KD	NL	JW	-
001	08APR15	ISSUED FOR DESIGN	KM	LK	KD	CC	DP	-
000	01AUG14	ISSUED FOR FEED	KM	LK	NTV	KB	DP	-
00B	05/08/14	RE-ISSUED FOR APPROVAL	KM	SP	NTV	KB	DP	-

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BECHTEL OG&C
PROJECT FRANKLIN
UTILITIES AND GENERAL FACILITIES

25873-001
ECCN: EAR99

BECHTEL DRAWING No: 25873-001-M5-593-00005 Rev. 003

UTILITY FLOW SCHEME
RAW WATER PRETREATMENT

LOCATION: Monaca, PA	PLANT AREA: OSBL	COMPANY PROJECT No. GM1
PROJECT FRANKLIN	SCALE: NTS	COMPANY DRG No. GM1-700-U59300-PX-2366-00005 Rev. 003

PCAP-D1390

NOTES

SCOPE CLOUD
REVISION CLOUD
HOLD CLOUD

wood.

REFERENCE DRAWINGS

FOR P-00052
PROJECT USE ONLY
6

WOOD DRAWING NO.:
100412-P00052-DCO-PFD-0018-01

REV.	DATE (Y)	(M)	(D)	DESCRIPTION	BY	CHK.	ENG.	APP
6	25	01	15	ISSUED FOR DESIGN (P00052)	SD	SP	CH	PP
5	24	10	25	RE-ISSUED FOR HAZOP (P00052)	SD	SP	BW	RB
4	24	07	24	ISSUED FOR HAZOP (P00052)	SD	CH	SM	RB

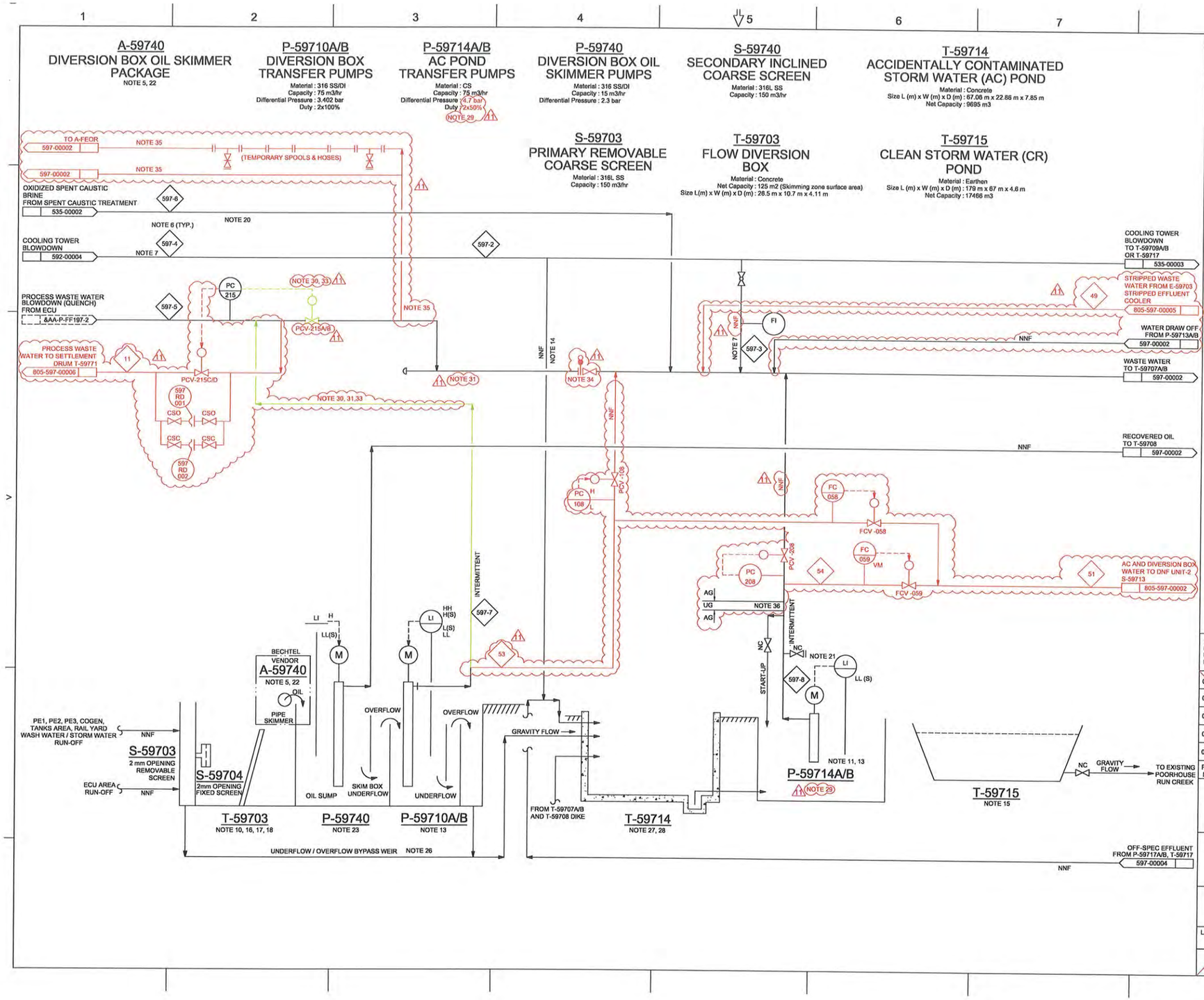
REGISTERED PROFESSIONAL ENGINEER
CARL J. MARSICO
No. PE106415

Carl J Marsico
1/31/2025

SHELL POLYMERS
MONACA

TITLE
UTILITY FLOW SCHEME
RAW WATER PRETREATMENT

EQUIP. NO.	PLANT AREA OSBL	
PROJECT NO. P-00052	SCALE	FILE NAME
DRAWN BY	CHECKED BY	MICRO. REV.
APPROVED	DRAWING NO. GM1-700-U59300-PX-2366-00005	REV. 6



NOTES:

1. SEE PEFS DRAWINGS GM1-700-G0000-PX-2365-00001 THROUGH GM1-700-G0000-PX-2365-00008 FOR ALL SYMBOLOGY.
2. DELETED.
3. DELETED.
4. DELETED.
5. INFORMATION SHOWN IN THE VENDOR BOX IS ONLY FOR REPRESENTATION PURPOSE AND IS NOT MEANT TO SHOW PACKAGE DETAILS PROCESS DATA WITHIN VENDOR PACKAGE WILL BE PART OF THE VENDOR DESIGN. ONLY MAJOR SIZING DATA IS REFLECTED WHERE APPLICABLE. OTHER DATA WILL BE INCLUDED IN THE PROCESS DATA SHEETS.
6. FOR STREAM DATA VALUES, SEE DRAWING 25873-001-M5-597-00008.
7. CT BLOWDOWN NORMALLY ROUTED DOWNSTREAM OF WW GRAVITY FILTER S-59701. OPTION EXISTS TO TAKE UPTO 75 m3/hr (EQUIVALENT TO AC POND FLOW)TO EQUALIZATION TANK FOR HEATING DURING WINTER AND FOR MICRONUTRIENT SUPPLY.
8. DELETED.
9. DELETED.
10. PROVIDE VACUUM TRUCK ACCESSIBILITY TO CLEAN OUT DIVERSION BOX AND REMOVE TRAPPED SOLIDS FROM S-59704.
11. P-59714 WILL BE DISABLED WHEN CT BLOWDOWN (EQUIVALENT TO AC POND FLOW) IS DIVERTED TO T-59707A/B.
12. DELETED.
13. PUMPS WILL TRIP ON HIGH-HIGH LEVEL IN T-59707A/B.
14. CT BLOWDOWN CAN BE ROUTED TO AC POND DURING UPSET (HYDROCARBON CONTAMINATION) AND /OR ELEVATED TEMPERATURE CONDITIONS.
15. PROVISION SHALL BE MADE FOR USE OF TEMPORARY PUMPS TO PUMP OUT POND IF NEEDED UNDER EXTREME CONDITIONS.
16. SKIMMING ZONE SURFACE AREA IS BASED ON DESIGN FLOW RATE OF 75 m3/hr AND SURFACE LOADING RATE OF 0.6 m3/hr/m2.
17. PUMP-OUT BASIN FOR PUMPS P-59710A/B IS SIZED TO PROVIDE 20 m3 NET VOLUME BASED ON 15 MINS RESIDENCE TIME AT DESIGN FLOW RATE OF 75 m3/hr.
18. P-59740 IS OPERATED MANUALLY. SKIM BOX IS SIZED TO PROVIDE 15 m3 NET VOLUME TO ALLOW INTERMITTENT OPERATION OF PUMPS.
19. DELETED.
20. THE STREAM TABLE (MASS BALANCE) FLOW OF 5.8 m3/hr (NORMAL) IS BASED ON THE ALLOWABLE TDS IN TREATED EFFLUENT TO OUTFALL. TO BE VERIFIED PENDING NPDES PERMIT.
21. TIE-IN CONNECTION FOR CR POND TEMPORARY PUMP.
22. ROTATING TROUGH SKIMMER (HAND WHEEL OPERATED) COMPLETE WITH PIPE, WALL BEARING ASSEMBLY AND WORM GEAR ASSEMBLY, TO REMOVE FLOATING MATERIAL INCLUDING ENTRAINED SOLIDS.
23. HIGH-HIGH LEVEL IN T-59708 WILL TRIP THE OIL SKIMMER PUMP.
24. DELETED.
25. DELETED.
26. PROVIDE SCREEN(S) WITH 6 mm OPENINGS FOR OVER FLOW WEIR TO PREVENT DEBRIS FROM PASSING THROUGH TO AC POND.
27. IN CASE OF OVERFLOW, THE OVERFLOW FROM AC POND WILL BE DIRECTLY ROUTED TO POORHOUSE CREEK VIA OUTFALL 004.
28. THE AC POND IS A STORM WATER MANAGEMENT SURGE TANK.

REFERENCE

- STREAM NUMBER
- TEMPERATURE, °C
- PRESSURE barg
- FLOW, kg/hr
- GAS FLOW, Nm3/hr
- LIQUID FLOW, m3/hr

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REV No.	DATE	DESCRIPTION	PROC ENGR	CHK	PROC EGS	APE	PEM	CLIENT
007	16NOV20	ISSUED FOR AS-BUILT	MC	JJ	MC	JW	NF	
006	01NOV18	RE-ISSUED FOR DESIGN	PAP	JW	SD	SG	DP	-
005	19DEC19	RE-ISSUED FOR DESIGN	MM	MVA	AS	SG	SS	-
004	31AUG17	RE-ISSUED FOR DESIGN	PKD	MM	AS	SK	SS	-
003	22SEP16	RE-ISSUED FOR DESIGN	LK	KD	KD	NL	JW	-

25873-001
ECCN: EAR99

BECHTEL OG&C
PROJECT FRANKLIN
UTILITES AND GENERAL FACILITIES
BECHTEL DRAWING No: 25873-001-M5-597-00001 Rev. 007

UTILITY FLOW SCHEME
WASTE WATER COLLECTION/TREATMENT

LOCATION:	PLANT AREA:	COMPANY PROJECT No.
Monaca, PA	OSBL	GM1
PROJECT FRANKLIN	SCALE: NTS	COMPANY DRG No. GM1-700-U59700-PX-2366-00001 Rev. 007

PCAP-D1390

NOTES

29. EXISTING PUMP IMPELLER SIZE TO BE REPLACED BY THE MAX. SIZE (196 mm) AND MOTOR TO BE REPLACED WITH LARGER POWER PER THE DIVERSION BOX AND AC POND NEW HYDRAULICS STUDY.
30. TO BE DEMOLISHED IN THE FUTURE.
31. NO PHYSICAL WORK DONE AS PART OF PROJECT P-00052 THE WASTE WATER SELECT PHASE SCOPE, UPDATED ONLY TO ALIGN PFD STREAMS TO EXISTING P&ID.
32. DELETED.
33. RED LINE REPRESENTS FUTURE OPERATION, GREEN LINE REPRESENTS EXISTING OPERATION THAT WILL BE DEMOLISHED IN THE FUTURE AFTER WWTP IS SET UP.
34. THE SPECTACLE BLIND IS INSTALLED AT THE TIE-IN LOCATION DOWNSTREAM OF THE CONTROL VALVE STATION. IT WILL APPLY AFTER WWTP COMMISSIONING, AND ITS DOWNSTREAM LINE IS RATED 15 BARG FOR WWTP.
35. EXISTING TEMPORARY FACILITY WILL BE UTILIZED FOR ISOLATION PHILOSOPHY FOR EARLY WORKS ONLY TO EXECUTION OF ALL TIE-IN POINTS DOWNSTREAM OF 597PCV-215A UP TO FEOR TANKS.
36. EXISTING UNDERGROUND HDPE PIPING SECTION.

SCOPE CLOUD
REVISION CLOUD
HOLD CLOUD

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wood.

REFERENCE DRAWINGS

FOR P-00052
PROJECT USE ONLY

WOOD DRAWING NO.:
100412-P00052-DCO-PFD-0011-01

REV.	Y	M	D	DESCRIPTION	BY	CHK.	ENG.	APP.
11	25	01	15	ISSUED FOR DESIGN (P00052)	SD	SP	CH	PP
10	24	10	25	RE-ISSUED FOR HAZOP (P00052)	SD	SP	BW	RB
9	24	07	24	ISSUED FOR HAZOP (P00052)	SD	CH	SM	RB
8	24	05	08	ISSUED FOR REVIEW	SD	MC	NY	RB

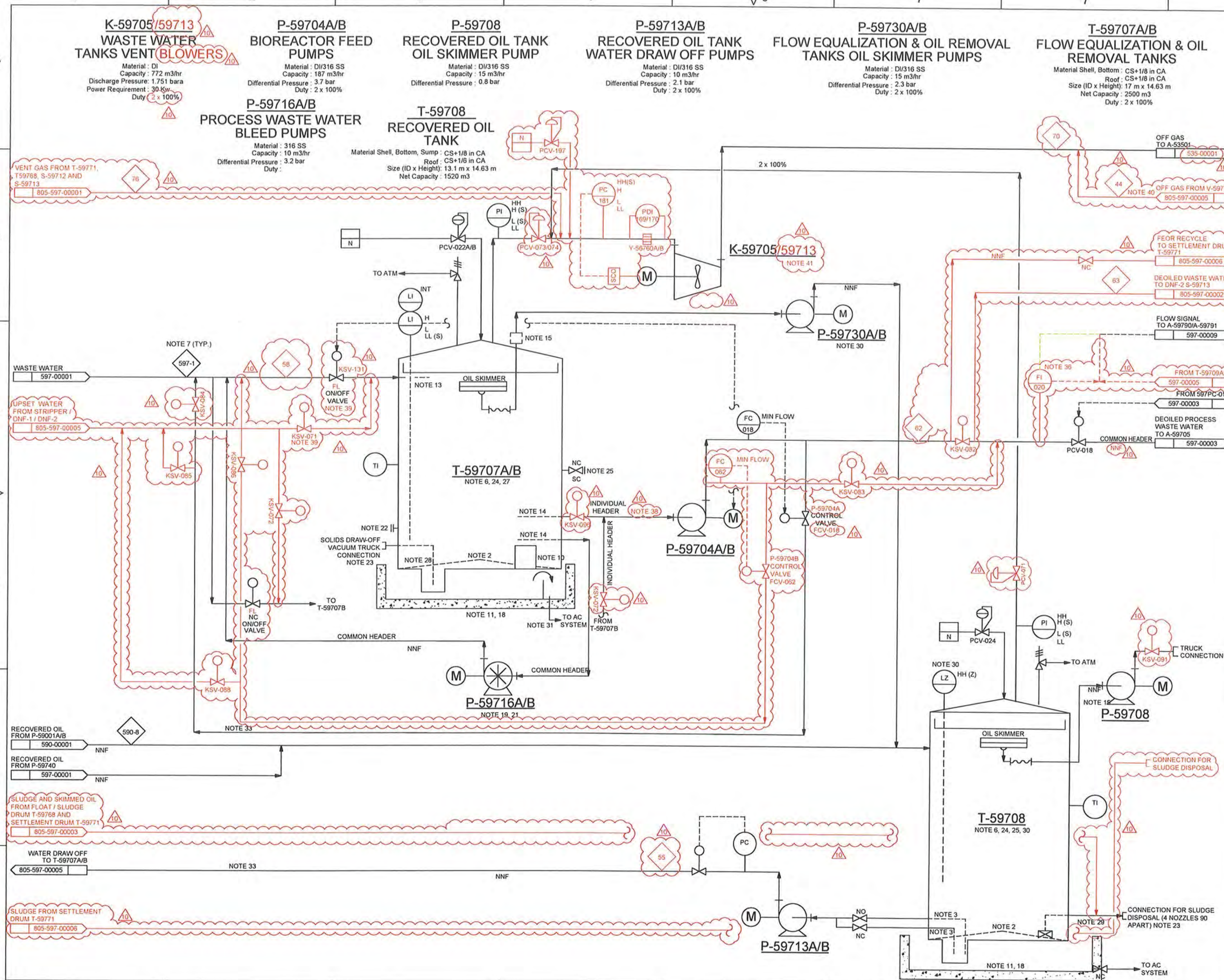
PROFESSIONAL ENGINEER No. PE406419

11/31/2025

SHELL POLYMERS MONACA

TITLE
UTILITY FLOW SCHEME
WASTE WATER COLLECTION/TREATMENT

EQUIP. NO.		PLANT AREA OSBL
PROJECT NO. P-00052	SCALE	FILE NAME
DRAWN BY	CHECKED BY	MICRO. REV.
APPROVED	DRAWING NO. GM1-700-U59700-PX-2366-00001	REV. 11



NOTES:

1. SEE PEFS DRAWINGS GM1-700-G0000-PX-2365-00001 THROUGH GM1-700-G0000-PX-2365-00008 FOR ALL SYMBOLOGY.
2. TANK BOTTOM SHALL BE CONE UP, SLOPE SHALL NOT EXCEED 1%.
3. TWO (2) WATER DRAWOFF NOZZLES SHALL BE PROVIDED TO DRAIN SEPARATED WATER.
4. DELETED.
5. DELETED.
6. TANK VENDOR SHALL PROVIDE OIL SKIMMER FOR REMOVING FLOATING MATERIAL INCLUDING ENTRAINED SOLIDS.
7. FOR STREAM DATA VALUES, SEE DRAWING 25873-001-M5-597-00008.
8. DELETED.
9. DELETED.
10. FLUSH-TYPE CLEANOUT FITTING..
11. CONCRETE TO BE LINED IN ACCORDANCE WITH PROJECT SPECIFICATION FOR MAXIMUM RESISTANCE TO SPILLS AND LEAKS.
12. DELETED.
13. TANK VENDOR SHALL PROVIDE INTERNAL DISTRIBUTION FOR INFLUENT NOZZLE.
14. TANK VENDOR SHALL PROVIDE OUTLET MANIFOLD.
15. NOZZLE EXTENDED INTO TANK, LOCATE NEAR BOTTOM OF TANK.
16. DELETED.
17. DELETED.
18. SECONDARY CONTAINMENT WITH 4 FEET HIGH WALLS.ADDITIONAL CAPACITY IS PROVIDED IN AC POND. T-59707A/B AND T-59708 ARE INSTALLED IN A COMMON DIKE WITH CURB TO CONTAIN T-59708 MINOR SPILLS.
19. PROGRESSIVE CAVITY VFD PUMPS.
20. DELETED.
21. ECU PROCESS WATER BLOWDOWN AND UPSET WATER WILL BE TREATED IN THE NEW IMPROVEMENT PROJECT. ~~OFF-SPEC FLOW WILL BE DIRECTED TO SELECTED TANK AND THEN FED~~ BACK TO OPERATING TANK AT A CONTROLLED, ADJUSTABLE RATE FOR EQUALIZED FEED LOAD TO THE BIOTREATER.
22. EACH TANK WILL BE PROVIDED WITH TWO (2) NOZZLES FOR EMULSION PROBE (FROM TRANSDUCER USA OR APPROVED EQUAL) LOCATED AT ELEVATION BELOW INTERNAL FLOATING ROOF BOTTOM (APPROXIMATELY 1.524m ABOVE THE TANK BOTTOM).
23. FOUR (90 DEGREE APART) 6" DIAMETER NOZZLES WITH VALVE TO ALLOW HOSE CONNECTION TO VACUUM OUT THE SETTLED SOLIDS FROM THE TANK FOR OFFSITE DISPOSAL.
24. TANK VENDOR TO PROVIDE SLOTTED PIPE STILLING WELL FOR GWR. TYPE LEVEL MEASUREMENT.
25. PROVIDE 3/4" NOZZLES ALONG THE STAIRWELL FOR SAMPLING.
26. DELETED.
27. ADD FOUR (4) EVENLY SPACED 12" DIA. INSPECTION HATCHES WITH TRANSPARENT COVERS ON ROOF, RAILING TO BE PROVIDED AROUND ROOF OF TANK.
28. FOUR (4) DRAW-OFF SUMPS & SOLIDS DRAW-OFF CONNECTIONS.
29. OUTLET NOZZLES SHALL BE FITTED WITH AN INTERNAL ELBOW TURNED DOWN WITH A VORTEX BREAKER PLATE ATTACHED.
30. HIGH-HIGH LEVEL IN T-59708, WILL TRIP THE OIL SKIMMER PUMPS.
31. PROVIDE OVERFLOW WEIR BOX WITH OUTLET PIPE SIZED FOR 455 m3/hr FLOW.
32. DELETED.
33. WHEN UPSET ECU STREAM IS DIVERTED TO T-59707A OR B, STOP FLOWS FROM OTHER SOURCES TO THE GREATEST EXTENT POSSIBLE.

REFERENCE

- STREAM NUMBER
- TEMPERATURE, °C
- PRESSURE barg
- FLOW, kg/hr
- GAS FLOW, Nm3/hr
- LIQUID FLOW, m3/hr

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REV No.	DATE	DESCRIPTION	PROC. ENGR	CHK	PROC. EGS	APE	PEM	CLIENT
006	16NOV20	ISSUED FOR AS-BUILT	MC	JJ	MC	JW	NF	
005	30OCT17	RE-ISSUED FOR DESIGN	MM	MVA	AS	SG	SS	-
004	31AUG17	RE-ISSUED FOR DESIGN	PKD	MM	AS	SK	SS	-
003	22SEP16	RE-ISSUED FOR DESIGN	LK	KD	KD	NL	JW	-
002	18JUL16	RE-ISSUED FOR DESIGN	KM	LK	KD	NL	DP	-

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BECHTEL OG&C
PROJECT FRANKLIN
UTILITES AND GENERAL FACILITIES

25873-001
ECCN: EAR99

BECHTEL DRAWING No: 25873-001-M5-597-00002 — Rev. 006

UTILITY FLOW SCHEME
WASTE WATER COLLECTION/TREATMENT

LOCATION: Monaca, PA	PLANT AREA: OSBL	COMPANY PROJECT No. GM1	
PROJECT FRANKLIN	SCALE: NTS	COMPANY DRG No. GM1-700-U59700-PX-2366-00002	Rev. 006

PCAP-D1390

NOTES

34. DELETED
35. DELETED
36. EXISTING FI TO BE UNINSTALLED DURING PHASE 1 DEMOLITION /CONSTRUCTION. INSTRUMENT AND TAG NUMBER TO BE REUSED
37. DELETED
38. ONE 597KSV-098 ON THE COMMON LINE CONNECTING BIOREACTOR PUMP SUCTION LINES
39. THE EXISTING KSV-131 AND 151 ARE INTERLOCKED WITH EXISTING HS-110, AND THE NEW KSV-071 AND 072 ARE INTERLOCKED WITH NEW HS-XX
40. TWO PHASE FLOW EXPECTED FROM V-59773 TO V-53574.
41. K-59713 (SPARE BLOWER TO K-59705) WILL NOT BE INSTALLED IN PROJECT P-00052. ONLY TIE-INS FOR FUTURE SPARE BLOWER ARE PROVIDED

- SCOPE CLOUD
- REVISION CLOUD
- HOLD CLOUD

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wood.

REFERENCE DRAWINGS

FOR P-00052 PROJECT USE ONLY

WOOD DRAWING NO.: 100412-P00052-DC0-PFD-0012-01

REV.	DATE Y	M	D	DESCRIPTION	BY	CHK.	ENG.	APP.
10	25	01	15	ISSUED FOR DESIGN (P00052)	SD	CH	SM	PP
9	24	10	25	RE-ISSUED FOR HAZOP (P00052)	SD	SP	SM	RB
8	24	07	24	ISSUED FOR HAZOP (P00052)	SD	CH	SM	RB
7	24	05	08	ISSUED FOR REVIEW	SD	AC	NY	RB

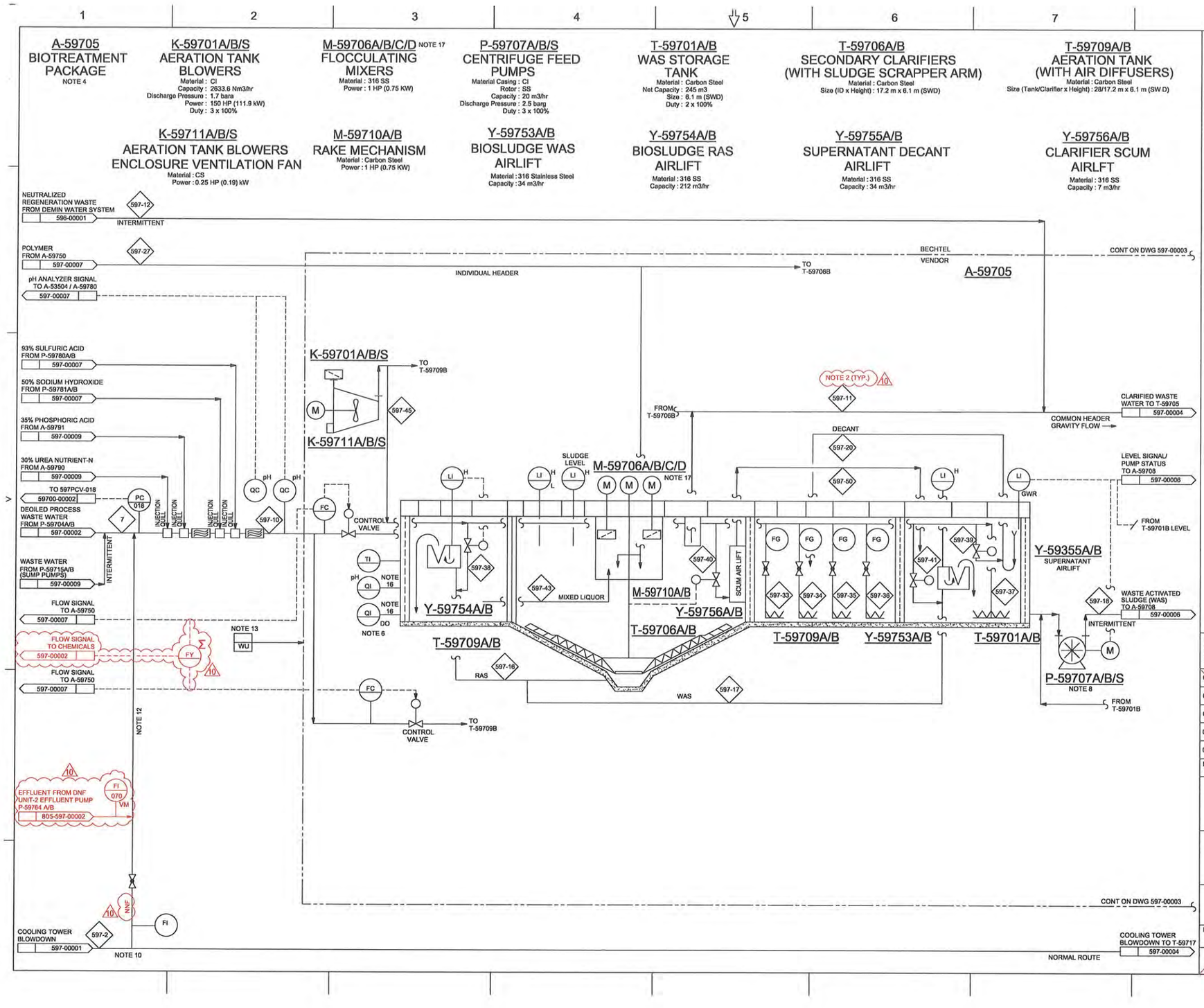
REGISTERED PROFESSIONAL ENGINEER CARL J. MAGNAN No. PE40645

Carl J Magnan 1/31/2025

SHELL POLYMERS MONACA

TITLE: UTILITY FLOW SCHEME WASTE WATER COLLECTION/TREATMENT

EQUIP. NO.		PLANT AREA OSBL	
PROJECT NO. P-00052	SCALE	FILE NAME	
DRAWN BY	CHECKED BY	MICRO. REV.	
APPROVED	DRAWING NO. GM1-700-U59700-PX-2366-00002		REV. 10



NOTES:

1. SEE PEFS DRAWINGS GM1-700-G0000-PX-2365-00001 THROUGH GM1-700-G0000-PX-2365-00008 FOR ALL SYMBOLOGY.
2. FOR STREAM DATA VALUES, SEE DRAWING 25873-001-M5-547-00008.
3. DELETED.
4. INFORMATION SHOWN IN THE VENDOR BOX IS ONLY FOR REPRESENTATION PURPOSE AND IS NOT MEANT TO SHOW PACKAGE DETAILS. PROCESS DATA WITHIN VENDOR PACKAGE WILL BE PART OF THE VENDOR DESIGN. ONLY MAJOR SIZING DATA IS REFLECTED WHERE APPLICABLE. OTHER DATA WILL BE INCLUDED IN THE PROCESS DATA SHEETS.
5. DELETED.
6. AERATION TANK BLOWERS VFD SHALL BE CONTROLLED WITH THE DO ANALYZER WITHIN THE AERATION TANKS. PROVIDE TWO (2) DO PROBES PER AERATION TANK FOR REDUNDANCY SINCE THESE PROBES ARE HIGHLY SUSCEPTIBLE TO MALFUNCTION.
7. DELETED.
8. PROGRESSIVE CAVITY VFD PUMPS.
9. DELETED.
10. CT BLOWDOWN IS NORMALLY ROUTED DOWNSTREAM OF WW GRAVITY FILTER S-59701. OPTION EXISTS TO TAKE UPTO 75 m3/hr (EQUIVALENT TO AC POND) FLOW TO EQUALIZATION TANK FOR HEATING DURING WINTER AND MICRONUTRIENT SUPPLY.
11. DELETED.
12. CT BLOWDOWN WILL BE ROUTED TO BIOTREATER-AERATION TANK DURING UPSET (HYDROCARBON CONTAMINATION).
13. UTILITY WATER WILL BE SUPPLIED AS PER VENDOR REQUIREMENT FOR FLUSHING OF SLUDGE LINES.
14. DELETED.
15. DELETED.
16. INSTRUMENT BY BECHTEL.
17. M-59706C/D ARE MIXERS FOR T-59706B CLARIFIER.

REFERENCE

- STREAM NUMBER
- TEMPERATURE, °C
- PRESSURE barg
- FLOW, kg/hr
- GAS FLOW, Nm3/hr
- LIQUID FLOW, m3/hr

THE PROCESS CONDITIONS OF FLOW QUANTITIES, TEMPERATURES, PRESSURES, COMPOSITIONS, DESCRIPTIONS, AND EQUIPMENT DUTIES SHOWN ON THIS FLOW DIAGRAM ARE FOR DESIGN PURPOSES ONLY. WHILE USEFUL AS A GUIDE FOR OPERATIONS, THIS DOES NOT REPRESENT EXACT OR GUARANTEED OPERATING CONDITIONS.

REV No.	DATE	DESCRIPTION	PROC ENGR	CHK	PROC. EGS	APE	PEM	CLIENT
006	16NOV20	ISSUED FOR AS-BUILT	MC	JJ	MC	JW	NF	
005	30OCT17	RE-ISSUED FOR DESIGN	MM	MVA	AS	SG	SS	-
004	31AUG17	RE-ISSUED FOR DESIGN	PKD	MM	AS	SK	SS	-
003	22SEP16	RE-ISSUED FOR DESIGN	LK	KD	KD	NL	JW	-
002	18JUL16	RE-ISSUED FOR DESIGN	LK	KD	KD	NL	DP	-

BECHTEL OG&C
PROJECT FRANKLIN
UTILITES AND GENERAL FACILITIES

25873-001
ECCN: EAR99

BECHTEL DRAWING No: 25873-001-M5-597-00003 Rev. 006

UTILITY FLOW SCHEME
WASTE WATER COLLECTION/TREATMENT

LOCATION:	PLANT AREA:	COMPANY PROJECT No.
Monaca, PA	OSBL	GM1
PROJECT FRANKLIN	SCALE: NTS	COMPANY DRG No. GM1-700-U59700-PX-2366-00003 Rev. 006

NOTES

18. DELETED. 10

SCOPE CLOUD
REVISION CLOUD
HOLD CLOUD

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wood.

REFERENCE DRAWINGS

FOR P-00052
PROJECT USE ONLY
10

WOOD DRAWING NO.:
100412-P00052-DCO-PFD-0016-01

REV.	DATE	DESCRIPTION	BY	CHK	ENG.	AP
10	25 01 15	ISSUED FOR DESIGN. (P00052)	SD	CH	SM	P
9	24 10 25	RE-ISSUED FOR HAZOP (P00052)	SD	SP	SM	R
8	24 07 24	ISSUED FOR HAZOP (P00052)	SD	CH	SM	R
7	24 05 08	ISSUED FOR REVIEW	SD	AC	NY	R

PROFESSIONAL ENGINEER
CARL J. MARGRAVE
No. PE100645
1/31/2025
SHELL POLYMERS MONACA

TITLE
UTILITY FLOW SCHEME
WASTE WATER COLLECTION/TREATMENT

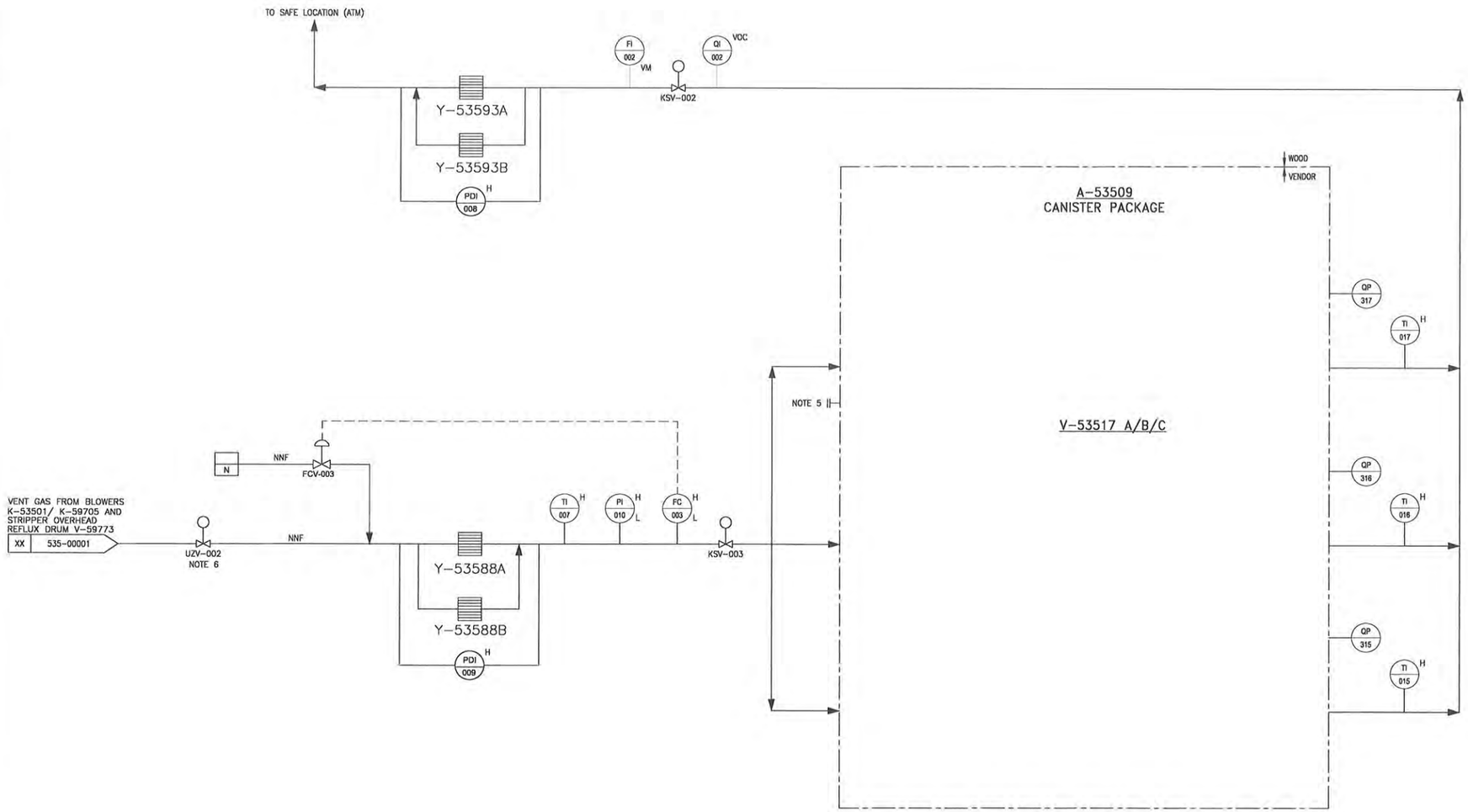
EQUIP. NO.		PLANT AREA OSBL	
PROJECT NO. P-00052	SCALE		FILE NAME
DRAWN BY T.KUMARASWAMY	CHECKED BY		MICRO. REV.
APPROVED	DRAWING NO. GM1-700-U59700-PX-2366-00003		REV. 10

Y-53588A/B
FLAMES ARRESTERS (CANNISTERS INLET)
DIMENSION: XX OD x XX TT
DESIGN PRESSURE: 8.0 barg/FV
DESIGN TEMPERATURE: -29°C/+100°C
MATERIAL:

Y-53593A/B
FLAMES ARRESTERS (CANNISTERS OUTLET)
DIMENSION: XX OD x XX TT
DESIGN PRESSURE: 3.5 barg/FV
DESIGN TEMPERATURE: -29°C/+100°C
MATERIAL:

V-53517A/B/C
CARBON CANISTER A/B/C
DIMENSION: 2134 mm OD x 3658 mm TT
DESIGN PRESSURE: 0.35 BAR-G (TBD)
DESIGN TEMPERATURE: -29°C/+100°C
MATERIAL: CARBON STEEL

A-53509
CANISTERS PACKAGE



NOTES:
1. DELETED.
2. DELETED.
3. DELETED.
4. DELETED.
5. UTILITY WATER SERVICE CONNECTION.
6. OPEN 535UZV-002 UPON LOSS OF OPEN INDICATION OF 535UZV-001. CLOSE 535UZV-003 UPON LOSS OF OPEN INDICATION OF 535UZV-001. CLOSE 535UZV-004 UPON LOSS OF OPEN INDICATION OF 535UZV-001.

HOLDS:
1. DELETED.

SCOPE CLOUD
HOLD CLOUD
REVISION CLOUD

wood.

REFERENCE DRAWINGS

WOOD DRAWING NO.:
100412-P00052-DC0-DIA-0016-01

REV.	DATE Y	M	D	DESCRIPTION	BY	CHK.	ENG.	APP.
2	25	01	15	ISSUED FOR DESIGN (P00052)	SD	SP	DGC	PP
1	24	10	29	RE-ISSUED FOR HAZOP (P00052)	SD	SP	DGC	RB
0	24	07	24	ISSUED FOR HAZOP (P00052)	SD	CH	SP	RB

PROFESSIONAL ENGINEER
CARL J. MARSAGLIA
No. PE40845
01/31/2025

SHELL POLYMERS MONACA

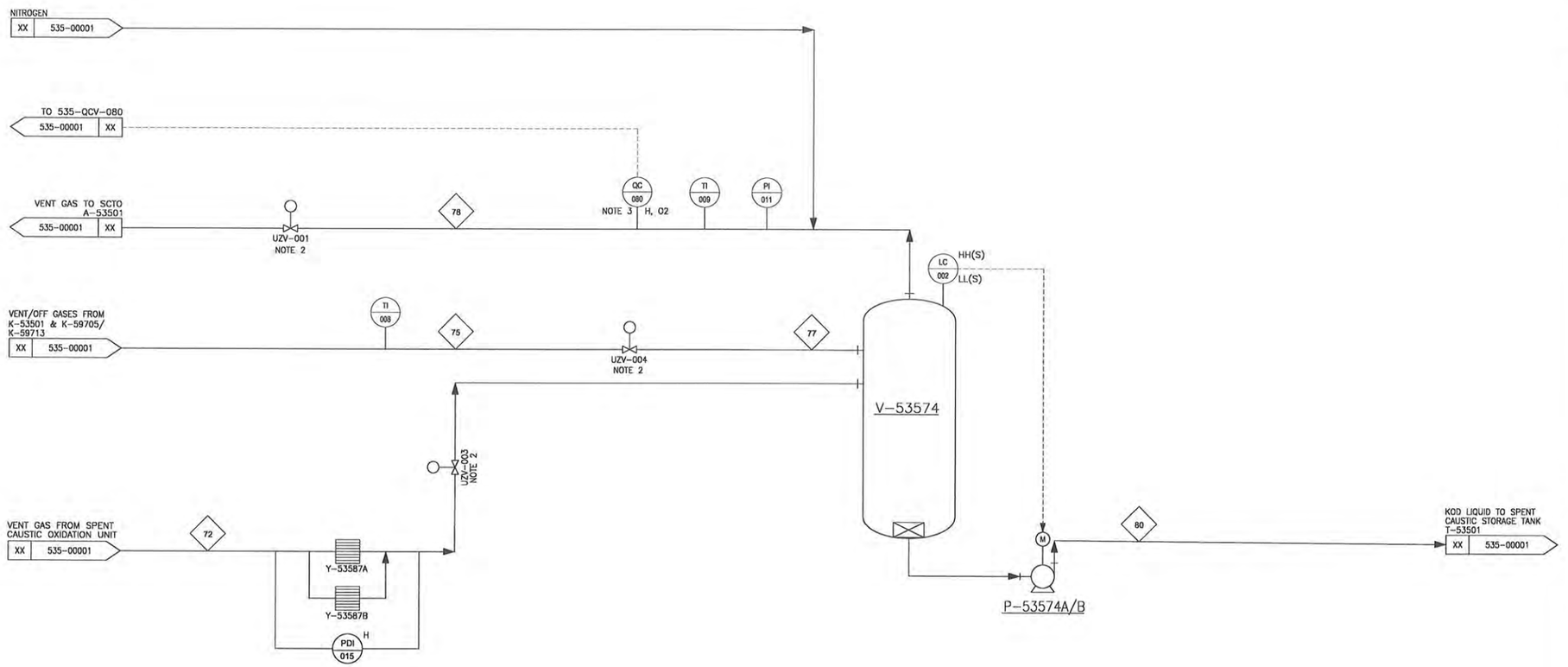
TITLE
PROCESS FLOW DIAGRAM (PFD)
CARBON CANISTERS

EQUIP. NO.		PLANT AREA XX
PROJECT NO. P-00052	SCALE	FILE NAME
DRAWN BY	CHECKED BY	MICRO. REV.
APPROVED	DRAWING NO. SPM-805-U53500-PX-2366-00001	REV. 2

Y-53587 A/B
FLAMES ARRESTERS (KOD INLET)
DIMENSION: XX OD x XX TT
DESIGN PRESSURE: 3.5 barg
DESIGN TEMPERATURE: -29°C/+200°C
MATERIAL:

V-53574
VENT KNOCK OUT DRUM
MATERIAL:
CAPACITY:
DUTY:1 X 100%

P-53574A/B
VENT KNOCK OUT DRUM PUMPS
MATERIAL:
CAPACITY: 2.0 M³/HR
DIFF.PRESSURE: 2.7 BAR
DUTY:2 X 100%



NOTES:
1. DELETED.
2. OPEN 535UZV-002 UPON LOSS OF OPEN INDICATION OF 535UZV-001. CLOSE UZV-003 UPON LOSS OF OPEN INDICATION OF 535UZV-001. CLOSE UZV-004 UPON LOSS OF OPEN INDICATION OF 535UZV-001.
3. EXISTING ANALYZER RE-USED.

HOLDS:
1. DELETED.

SCOPE CLOUD
HOLD CLOUD
REVISION CLOUD

wood.

REFERENCE DRAWINGS

WOOD DRAWING NO.:
100412-P00052-DCO-DIA-0017-01

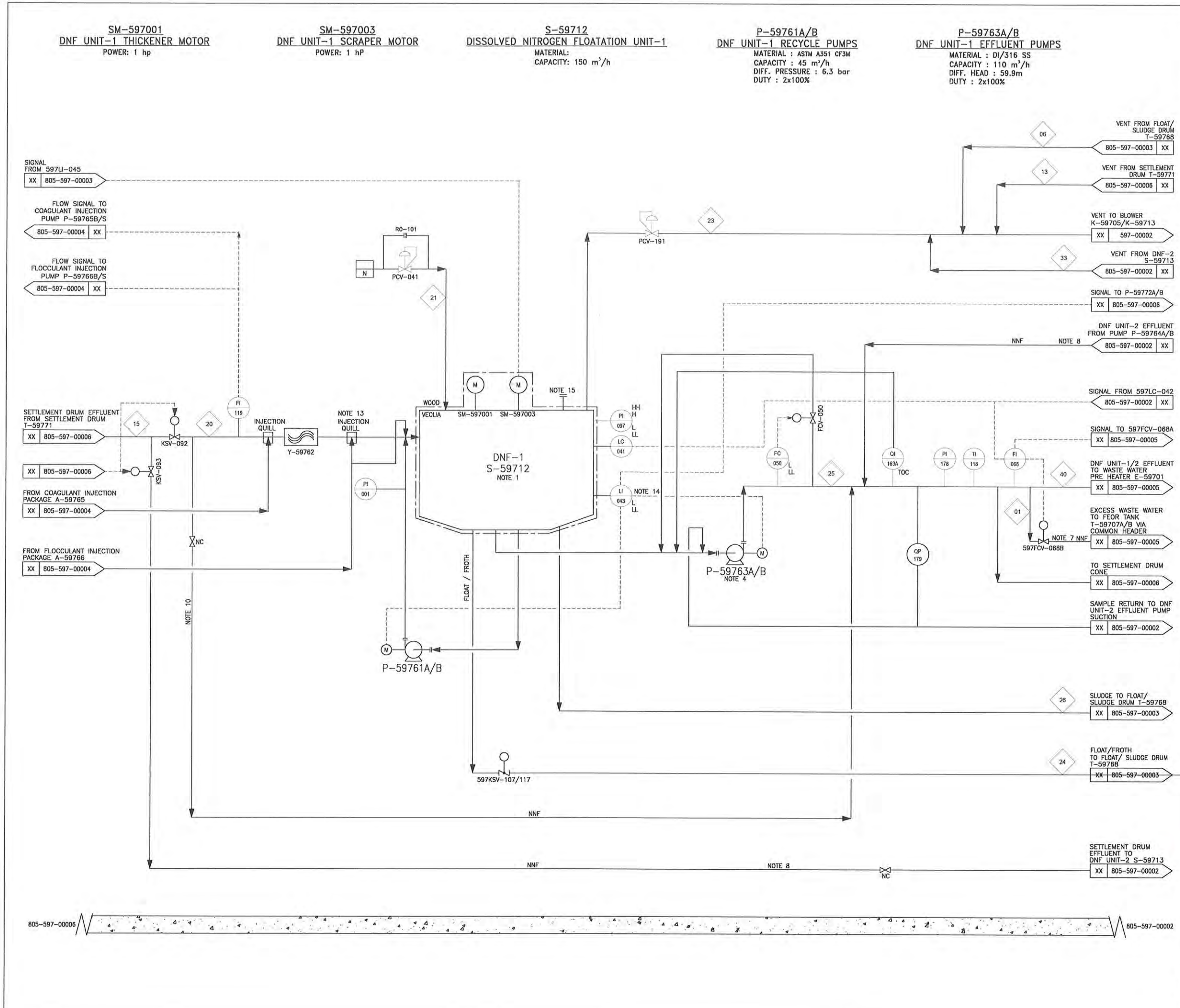
REV.	Y	M	D	DESCRIPTION	BY	CHK.	ENG.	APP.
2	25	01	15	ISSUED FOR DESIGN (P00052)	SD	SP	DGC	PP
1	24	10	29	RE-ISSUED FOR HAZOP (P00052)	SD	HG	SP	RB
0	24	07	24	ISSUED FOR HAZOP (P00052)	SD	CH	SP	RB

REGISTERED PROFESSIONAL ENGINEER
CARL J. MASARO
ENGINEER
(N.J. PE40645)
1/31/2025

SHELL POLYMERS
MONACA

TITLE
PROCESS FLOW DIAGRAM (PFD)
VENT KNOCK OUT DRUM

EQUIP. NO.		PLANT AREA XX
PROJECT NO. P-00052	SCALE	FILE NAME
DRAWN BY	CHECKED BY	MICRO. REV.
APPROVED	DRAWING NO. SPM-805-U53500-PX-2366-00002	REV. 2



NOTES:

1. ALL INSTRUMENTATION OUTSIDE VENDOR SCOPE AS SHOWN WILL BE IN WOOD SCOPE.
2. DELETED.
3. DELETED.
4. THE SPARE PUMP WILL AUTOMATICALLY TURN ON, WHEN NEEDED, UPON RISE OF LEVEL IN DNF UNIT-1.
5. DELETED.
6. DELETED.
7. LINE TO BE USED DURING ECU UPSET TO HANDLE EXCESS ECU QUENCH TOWER BOTTOM FLOW.
8. LINE ALLOWS TO USE DNF-2 IN LIEU OF DNF-1.
9. DELETED.
10. FOR SHORT TERM OUTAGE OF DNF 1.
11. DELETED.
12. DELETED.
13. DELETED.
14. P-59761 A/B AND P-59763 A/B WILL TRIP ON LOW-LOW LIQUID LEVEL.
15. SERVICE WATER HOSE CONNECTION FOR SIGHT GLASS.

SCOPE CLOUD

HOLD CLOUD

REVISION CLOUD

wood.

REFERENCE DRAWINGS

WOOD DRAWING NO.:
100412-P00052-DC0-PFD-0001-01

REV.	Y	M	D	DESCRIPTION	BY	CHK.	ENG.	APP.
3	25	01	15	ISSUED FOR DESIGN (P00052)	SD	HG	SP	PP
2	24	10	25	RE-ISSUED FOR HAZOP (P00052)	SD	HG	SP	RB
1	24	07	24	ISSUED FOR HAZOP (P00052)	SD	CH	SP	RB
0	24	05	08	ISSUED FOR REVIEW (P00052)	SD	NY	KW	RB

REGISTERED PROFESSIONAL CARL J. MARSICO ENGINEER No. PE40845

SHELL POLYMERS
MONACA

TITLE

PROCESS FLOW DIAGRAM (PFD)
DNF UNIT-1
DISSOLVED NITROGEN FLOATATION

EQUIP. NO.	PLANT AREA XX	
PROJECT NO. P-00052	SCALE	FILE NAME
DRAWN BY	CHECKED BY	MICRO. REV.
APPROVED	DRAWING NO. SPM-805-U59700-PX-2366-00001	REV. 3

SM-597002
DNF UNIT-2 THICKENER MOTOR
POWER: 1 hp

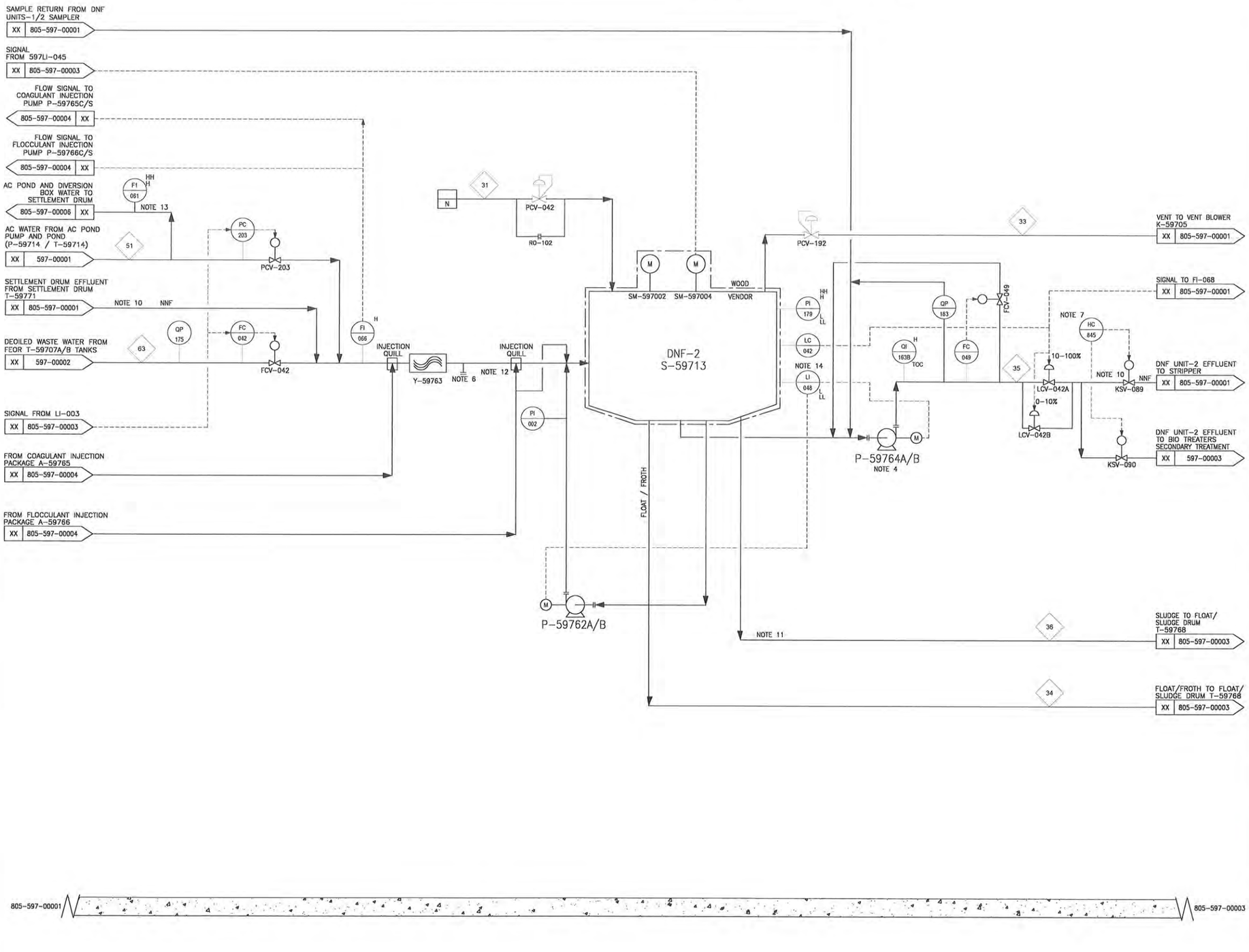
SM-597004
DNF UNIT-2 SCRAPER MOTOR
POWER: 1 hP

S-59713
DISSOLVED NITROGEN FLOATATION UNIT-2
MATERIAL:
CAPACITY: 150 m³/h

P-59762A/B
DNF UNIT-2 RECYCLE PUMPS
MATERIAL: ASTM A351 CF3M
CAPACITY: 45.00 m³/h
DIFF.PRESSURE: 6.3 bar
DUTY: 2x100%

P-59764A/B
DNF UNIT-2 EFFLUENT PUMPS
MATERIAL: DI/316 SS
CAPACITY: 250 m³/h
DIFF. HEAD: 61.4 m
DUTY: 2x100%

13. QUENCH LINE TO CONTROL THE ECU WASTE WATER TEMPERATURE BELOW 45°C.
14. P-59762 A/B AND P-59764 A/B WILL TRIP ON LOW-LOW LIQUID LEVEL.



NOTES:

1. ALL INSTRUMENTATION OUTSIDE VENDOR SCOPE AS SHOWN WILL BE IN WOOD SCOPE.
2. DELETED.
3. DELETED.
4. SECONDARY (STAND BY) PUMP WILL AUTO START UPON LOSS OF RUN STATUS OF PRIMARY PUMP.
5. DELETED.
6. FUTURE DEFOAMER CONNECTION.
7. SELECTOR SWITCH TO SELECT BETWEEN DNF-2 TO ACT AS DNF-1 OR DNF-2 TO ACT AS DNF-2.
8. DELETED.
9. DELETED.
10. LINE ALLOWS TO USE DNF-2 IN LIEU OF DNF-1.
11. DELETED.
12. DELETED.

SCOPE CLOUD
HOLD CLOUD
REVISION CLOUD

wood.

REFERENCE DRAWINGS

WOOD DRAWING NO.:
100412-P00052-DCO-PFD-0002-01

REV.	Y	M	D	DESCRIPTION	BY	CHK.	ENG.	APP.
3	25	01	15	ISSUED FOR DESIGN (P00052)	SD	HG	SP	PP
2	24	10	25	RE-ISSUED FOR HAZOP (P00052)	SD	HG	SP	RB
1	24	07	24	ISSUED FOR HAZOP (P00052)	SD	CH	SP	RB
0	24	05	08	ISSUED FOR REVIEW (P00052)	SD	NY	KW	RB

REGISTERED PROFESSIONAL CARL J. MASSEY ENGINEER No. PE40845
1/31/2025

SHELL POLYMERS MONACA

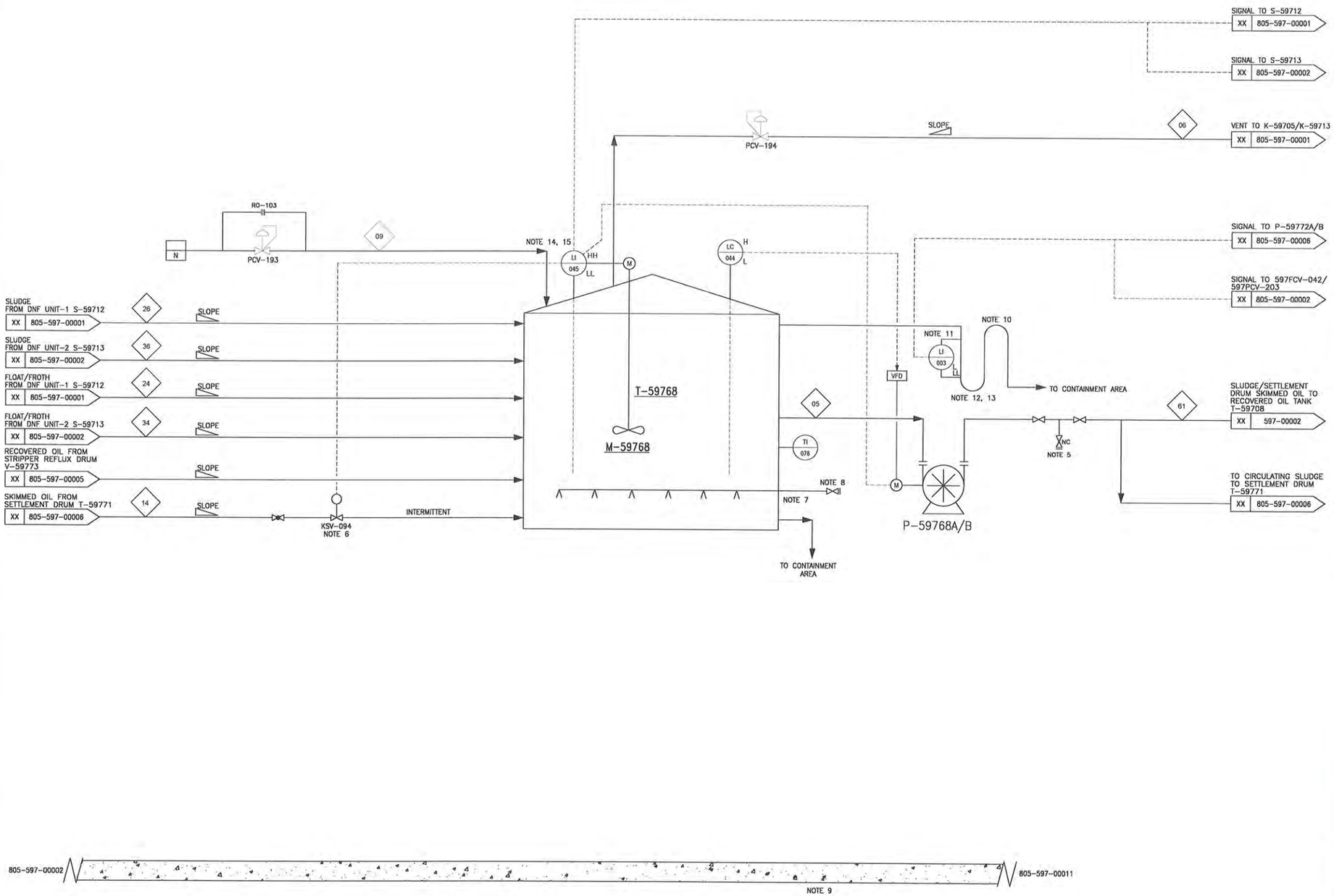
TITLE
PROCESS FLOW DIAGRAM (PFD)
DNF UNIT-2
DISSOLVED NITROGEN FLOATATION

EQUIP. NO.		PLANT AREA XX
PROJECT NO. P-00052	SCALE	FILE NAME
DRAWN BY	CHECKED BY	MICRO. REV.
APPROVED	DRAWING NO. SPM-805-U59700-PX-2366-00002	REV. 3

T-59768
FLOAT/SLUDGE DRUM
MATERIAL SHELL/BOTTOM: CS WITH EPOXY INTERNAL COATING
SIZE (ID X HEIGHT): 2400 MM x 4700 MM
WORKING VOLUME: 13.8 m3
DUTY: 1x100%

P-59768 A/B
FLOAT/SLUDGE PUMP
MATERIAL :
TYPE OF PUMP: ROTARY LOBE
CAPACITY: 15 m^3/h
DIFF. HEAD: 13 m
DUTY: 2x100%

M-59768 NOTE 16
FLOAT/SLUDGE DRUM MIXER



NOTES:

1. DELETED.
2. DELETED.
3. DELETED.
4. DELETED.
5. CONNECTION TO FUTURE FLOAT/SLUDGE DRUM.
6. HIGH HIGH LEVEL IN FLOAT/SLUDGE DRUM T-59768 WILL CLOSE 597KSV-094.
7. FLOAT/SLUDGE DRUM SHALL BE HEAT TRACED UP TO HIGH LIQUID LEVEL FOR 40 °C.
8. UTILITY STEAM SERVICE CONNECTION.
9. CONCRETE TO BE LINED AS PER PROJECT SPECIFICATION MAXIMUM RESISITANCE TO SPILLAGE AND LEAKS.
10. SHOULD BE LOCATED BELOW THE OVERFLOW NOZZLE BASELINE.
11. UPON ACTIVATION OF 597LAL-003, OPERATOR SHOULD FILL UP THE SEAL WITH WATER VIA SERVICE WATER HOSE CONNECTION. UPON ACTIVATION OF 597LALL-003, STOP FEED TO DNF-1 AND DNF-2 (TRIP P-59772A/B AND CLOSE 597FCV-042, 597PCV-203).
12. TRACE THE LIQUID SEAL PORTION ONLY.
13. MINIMUM 12" SEAL HEIGHT NEEDS TO BE MAINTAINED.
14. DNF-1 SCRAPER MOTOR (SM-597003) AND DNF-2 SCRAPER MOTOR (SM-597004) WILL STOP UPON ACTIVATION OF HIGH LEVEL OF FLOAT SLUDGE DRUM (T-59768) 597LAH-045.
15. MIXER STOPS UPON ACTIVATION OF 597LALL-045.
16. MIXER DETAILS WILL BE CONFIRMED BASED ON VENDOR INFORMATION.

wood.

REFERENCE DRAWINGS

SCOPE CLOUD

HOLD CLOUD

REVISION CLOUD

WOOD DRAWING NO.:
100412-P00052-DC0-PFD--0003-01

REV.	DATE Y	M	D	DESCRIPTION	BY	CHK.	ENG.	APP.
3	25	01	15	ISSUED FOR DESIGN (P00052)	SD	SP	HG	PP
2	24	10	25	RE-ISSUED FOR HAZOP (P00052)	SD	SP	HG	RB
1	24	07	24	ISSUED FOR HAZOP (P00052)	SD	CH	HG	RB
0	24	05	08	ISSUED FOR REVIEW (P00052)	SD	NY	KW	RB

CARL J. MARGADO
PROFESSIONAL ENGINEER
Lic. PE40645
11/31/2025

SHELL POLYMERS MONACA

TITLE
PROCESS FLOW DIAGRAM (PFD)
FLOAT / SLUDGE DISPOSAL

EQUIP. NO.		PLANT AREA XX
PROJECT NO. P-00052	SCALE	FILE NAME
DRAWN BY	CHECKED BY	MICRO. REV.
APPROVED	DRAWING NO. SPM-805-U59700-PX-2366-00003	REV. 3

A-59765
COAGULANT INJECTION PACKAGE

A-59766
FLOCCULANT INJECTION PACKAGE

A-59792
ANTI-FOAM INJECTION PACKAGE

P-59765A/B/C/S NOTE 5, 10
COAGULANT INJECTION PUMPS
MATERIAL : PVDF REAGENT HEAD, PTFE DIAPHRAGM
CAPACITY : 20 GPD HOLD 1
DIFF. PRESSURE :

P-59766A/B/C/S NOTE 5, 10
FLOCCULANT INJECTION PUMPS
MATERIAL : PVDF REAGENT HEAD, PTFE DIAPHRAGM
CAPACITY : 0.72 GPH
DIFF. PRESSURE :

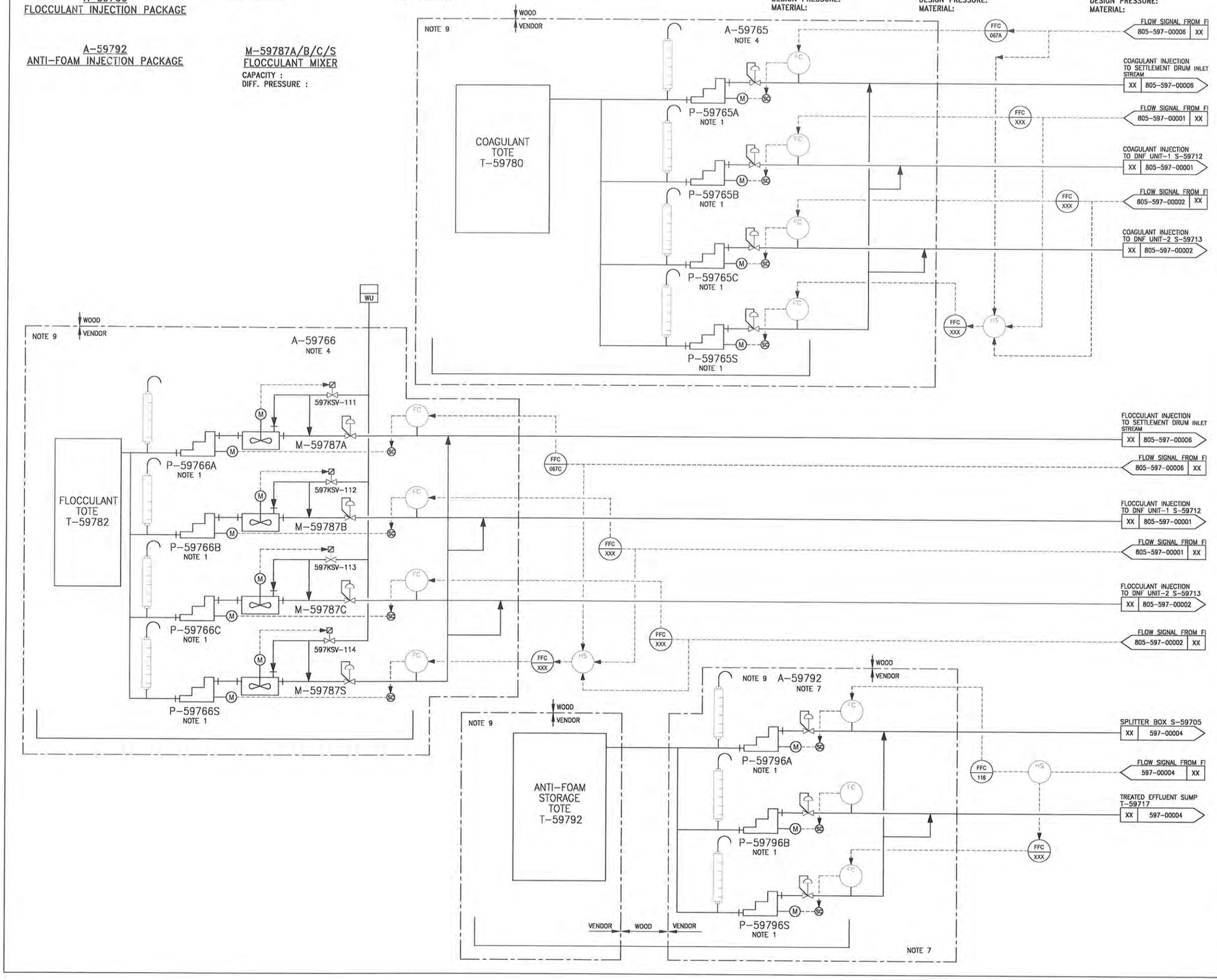
P-59796A/B/S NOTE 5, 10
ANTI-FOAM INJECTION PUMPS
MATERIAL :
CAPACITY :
DIFF. PRESSURE :

T-59780
COAGULANT STORAGE TOTE
SIZE:
WORKING VOLUME:
DESIGN TEMPERATURE:
DESIGN PRESSURE:
MATERIAL:

T-59782
FLOCCULANT STORAGE TOTE
SIZE:
WORKING VOLUME:
DESIGN TEMPERATURE:
DESIGN PRESSURE:
MATERIAL:

T-59792
ANTI-FOAM STORAGE TOTE
SIZE:
WORKING VOLUME:
DESIGN TEMPERATURE:
DESIGN PRESSURE:
MATERIAL:

M-59787A/B/C/S
FLOCCULANT MIXER
CAPACITY :
DIFF. PRESSURE :



NOTES:

1. PUMP STROKE CONTROL TO FLOW RATIO CONTROL.
2. DELETED.
3. DELETED.
4. VENDOR PACKAGE IS INSIDE CHEMICAL INJECTION BUILDING B-59701.
5. P-59765S, P-59766S AND P-59796S ARE INSTALLED STANDBY PUMPS.
6. DELETED.
7. ANTIFOAM INJECTION PACKAGE IS INSIDE A BUILDING SHAPE SHELTER WITH HVAC.
8. COAGULANT AND FLOCCULANT TOTE AND VENDOR PACKAGE ARE INSIDE CHEMICAL INJECTION BUILDING B-59701.
9. CHEMICAL INJECTION PACKAGE WILL BE DESIGNED BY CHEMICAL VENDOR (NALCO) REFER P&IDS SPM-805-U59700-PX-2365-00006, 00025, 00029 FOR MORE DETAILS.
10. PUMP CAPACITY TO BE CONFIRMED BY VENDOR. REFER P&IDS SPM-805-U59700-PX-2365-00006, 00025, 00029 FOR MORE DETAILS.

SCOPE CLOUD
HOLD CLOUD
REVISION CLOUD

wood.

REFERENCE DRAWINGS

WOOD DRAWING NO.:
100412-P00052-DCO-PFD-0004-01

REV.	DATE Y	M	D	DESCRIPTION	BY	CHK.	ENG.	APP.
3	25	01	15	ISSUED FOR DESIGN (P00052)	SD	SP	HG	PP
2	24	10	25	RE-ISSUED FOR HAZOP (P00052)	SD	SP	HG	RB
1	24	07	24	ISSUED FOR HAZOP (P00052)	SD	CH	HG	RB
3	24	05	08	ISSUED FOR REVIEW (P00052)	SD	NY	KW	RB

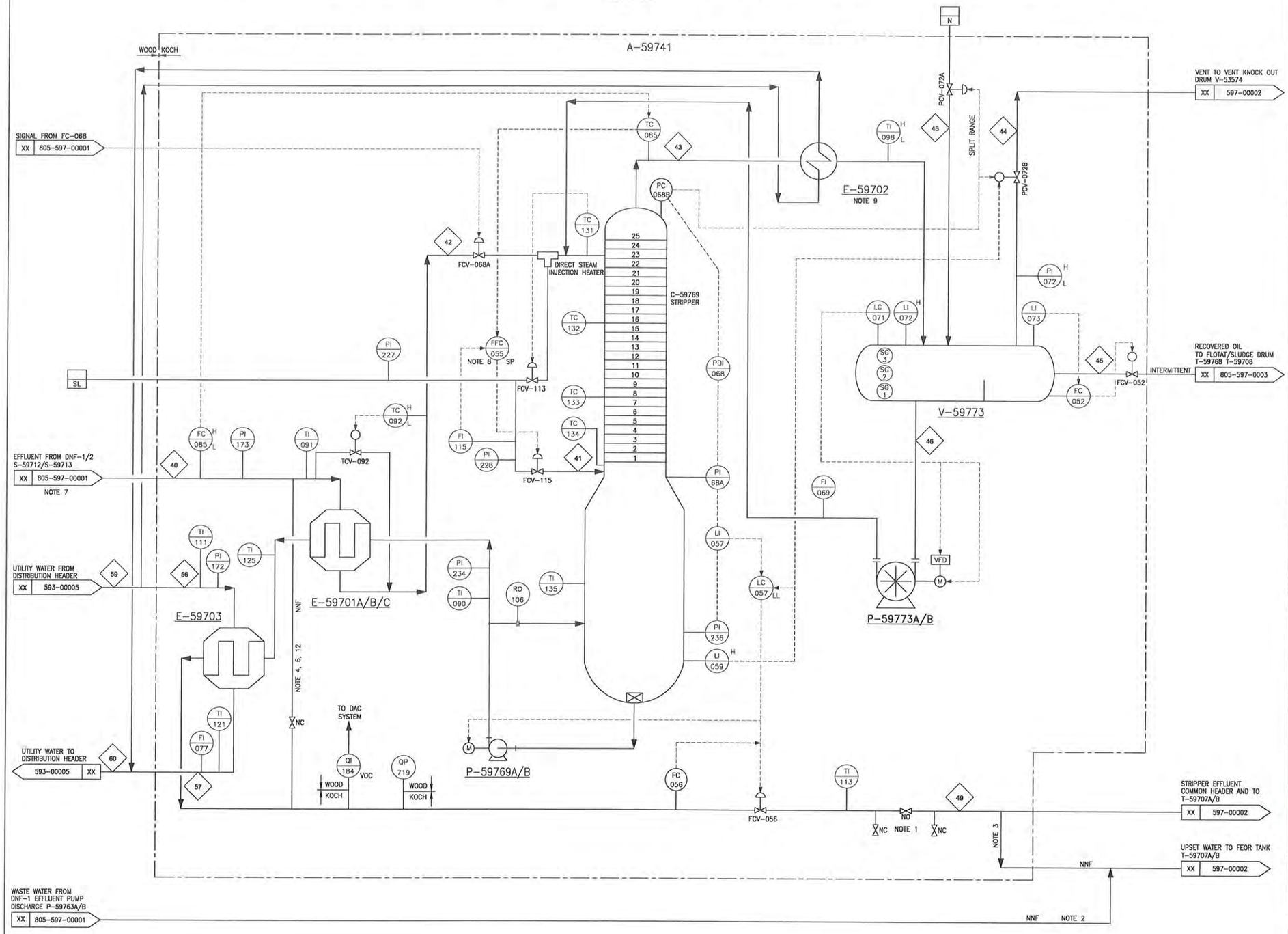
CARL J. MAGNUSON
PROFESSIONAL ENGINEER
No. PE40845
1/31/2025

SHELL POLYMERS MONACA

TITLE
PROCESS FLOW DIAGRAM (PFD)
COAGULANT, FLOCCULANT AND ANTI-FOAM INJECTION PACKAGES

EQUIP. NO.		PLANT AREA XX
PROJECT NO. P-00052	SCALE	FILE NAME
DRAWN BY	CHECKED BY	MICRO. REV.
APPROVED	DRAWING NO. SPM-805-U59700-PX-2366-00004	REV. 3

A-59741 STEAM STRIPPER PACKAGE	E-59703 EFFLUENT COOLER	P-59769A/B STRIPPER EFFLUENT PUMPS	E-59701A/B/C WASTE WATER PRE-HEATER	C-59769 WASTE WATER STEAM STRIPPER	E-59702 STEAM STRIPPER OVERHEAD CONDENSER	P-59773A/B STEAM STRIPPER REFLUX PUMP	V-59773 STEAM STRIPPER OVERHEAD REFLUX DRUM
	HEAT DUTY: (NORMAL CASE) TOTAL HEAT DUTY: (DESIGN CASE)	CAPACITY : 74 m^3/hr DIFF. HEAD : DUTY: 2 X 100%	MATERIAL : HEAT DUTY: DUTY: 3 X 50%	DIMENSIONS (ID/TL) : 1.2 m (TOP); 1.8 m (BOTTOM)/9.58 m MATERIAL :	MATERIAL : HEAT DUTY:	CAPACITY : 1 m^3/h DIFF. HEAD : m DUTY: 2 X 100%	DIMENSIONS (ID/TL) : 1.6 m x 4.5 m MATERIAL :



NOTES:

1. FUTURE TIE-IN PROVIDED FOR ADDITIONAL FILTRATION TO FURTHER MITIGATE MALODOR POTENTIAL.
2. LINE TO BE USED DURING ECU UPSET TO HANDLE EXCESS ECU QUENCH TOWER BOTTOM FLOW.
3. STRIPPER UPSET WATER.
4. START UP LINE.
5. DELETED.
6. TO BE DESIGNED FOR FULL FLOW.
7. WASTE WATER FEED ORIGINATING FROM DNF, ENSURING TOTAL FREE HYDROCARBON CONTENT LESS THAN 100 ppmV.
8. STEAM FLOW IN RATIO WITH FEED FLOW WITH OVERRIDE ON OVERHEAD TEMPERATURE.
9. DELETED.
10. DELETED.
11. DELETED.
12. DELETED.
13. DELETED.

SCOPE CLOUD

HOLD CLOUD

REVISION CLOUD

wood.

REFERENCE DRAWINGS

WOOD DRAWING NO.:
100412-P00052-DCO-PFD-0005-01

REV.	DATE Y	M	D	DESCRIPTION	BY	CHK	ENG.	APP.
3	25	01	15	ISSUED FOR DESIGN (P-00052)	SD	HG	SP	PP
2	24	10	25	RE-ISSUED FOR HAZOP (P00052)	SD	HG	SP	RB
1	24	07	24	ISSUED FOR HAZOP (P00052)	SD	CH	PP	RB
0	24	05	08	ISSUED FOR REVIEW (P00052)	SD	NY	KW	RB

CARL J. MARGIOTTO ENGINEER No. PE10615

01/31/2025

SHELL POLYMERS MONACA

TITLE

PROCESS FLOW DIAGRAM (PFD)
STRIPPER UNIT

EQUIP. NO.		PLANT AREA XX	
PROJECT NO. P-00052	SCALE		FILE NAME
DRAWN BY	CHECKED BY		MICRO. REV.
APPROVED	DRAWING NO. SPM-805-U59700-PX-2366-00005		REV. 3

T-59771
SETTLEMENT DRUM

MATERIAL:
CAPACITY: 850 m^3

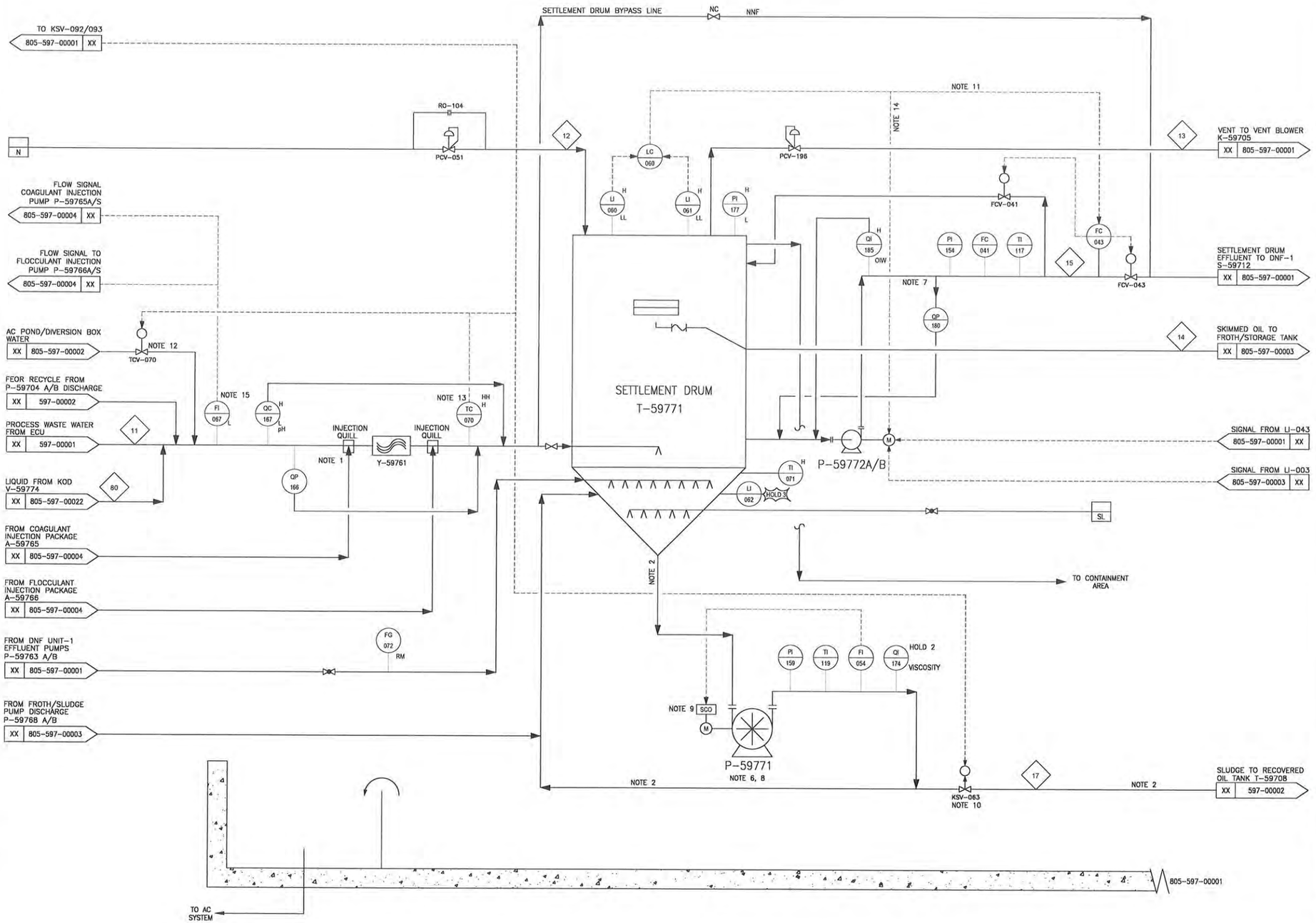
P-59771
SETTLEMENT DRUM SLUDGE PUMP

MATERIAL:
CASING:
IMPELLER:
CAPACITY: 16.5 m^3/hr
DIFF. HEAD: 16 m
DUTY : 2X100%

P-59772A/B
SETTLEMENT DRUM EFFLUENT PUMPS

MATERIAL:
CASING:
IMPELLER:
CAPACITY: 65 m^3/hr
DIFF. HEAD: 55.6 m
DUTY : 2X100%

11. 597LI-060 AND 597LI-061 CAN BE USED INTERCHANGEABLLY FOR LEVEL CONTROL.
12. QUENCH LINE TO CONTROL THE ECU WASTE WATER TEMPERATURE BELOW 45°C.
13. ON HH (50°C), TRIP PUMPS (P-59772A/B) & CLOSE 3 KSV-092 & 093 & KSV-063 & THE NEW KSV ON THE 4" QUENCH LINE.
14. P-59772 A/B WILL BE TRIPPED ON LL LEVEL.
15. OPERATOR TO OPEN 597PCV-215C/D WITHIN THE TIME PERIOD MENTIONED IN THE PROCESS OPERATING MANUAL.



NOTES:

1. COAGULATION INJECTION TO FACILTATE SETTLEMENT.
2. HEAVY SLUDGE / SLURRY SECTIONS TO BE HEATED / TRACED TO 70°C.
3. DELETED.
4. DELETED.
5. DELETED.
6. PUMP WILL OPERATE ONLY IF ONE OF THE KSVs IS OPEN.
7. TOC ANALYZER TO HAVE MULTI-STREAM TAGGING.
8. ELECTRIC TRACE THE PUMP TO HOLD TEMPERATURE OF 70°C.
9. MANUAL SPEED CONTROL.
10. 597KSV-063/064 ARE MANUALLY CONTROLLED.

HOLDS:

1. DELETED.
2. VISCOSITY METER IS ON HOLD.
3. INSTRUMENT DETAILS ON HOLD FOR VENDOR INFORMATION.

SCOPE CLOUD
HOLD CLOUD
REVISION CLOUD

wood.

REFERENCE DRAWINGS

WOOD DRAWING NO.:
100412-P00052-DCO-PFD-0006-01

REV.	DATE Y	M	D	DESCRIPTION	BY	CHK.	ENG.	APP.
3	25	01	15	ISSUED FOR DESIGN (P-00052)	SD	HG	SP	PP
2	24	10	24	RE-ISSUED FOR HAZOP"(P00052)	SD	HG	SP	RB
1	24	07	24	ISSUED FOR HAZOP (P00052)	SD	CH	SP	RB
0	24	05	08	ISSUED FOR REVIEW (P00052)	SD	NY	KW	RB

PROFESSIONAL ENGINEER
CARL L. MORRISON
No. P-20645
1/31/2025

SHELL POLYMERS MONACA

TITLE
PROCESS FLOW DIAGRAM (PFD)
SETTLEMENT DRUM

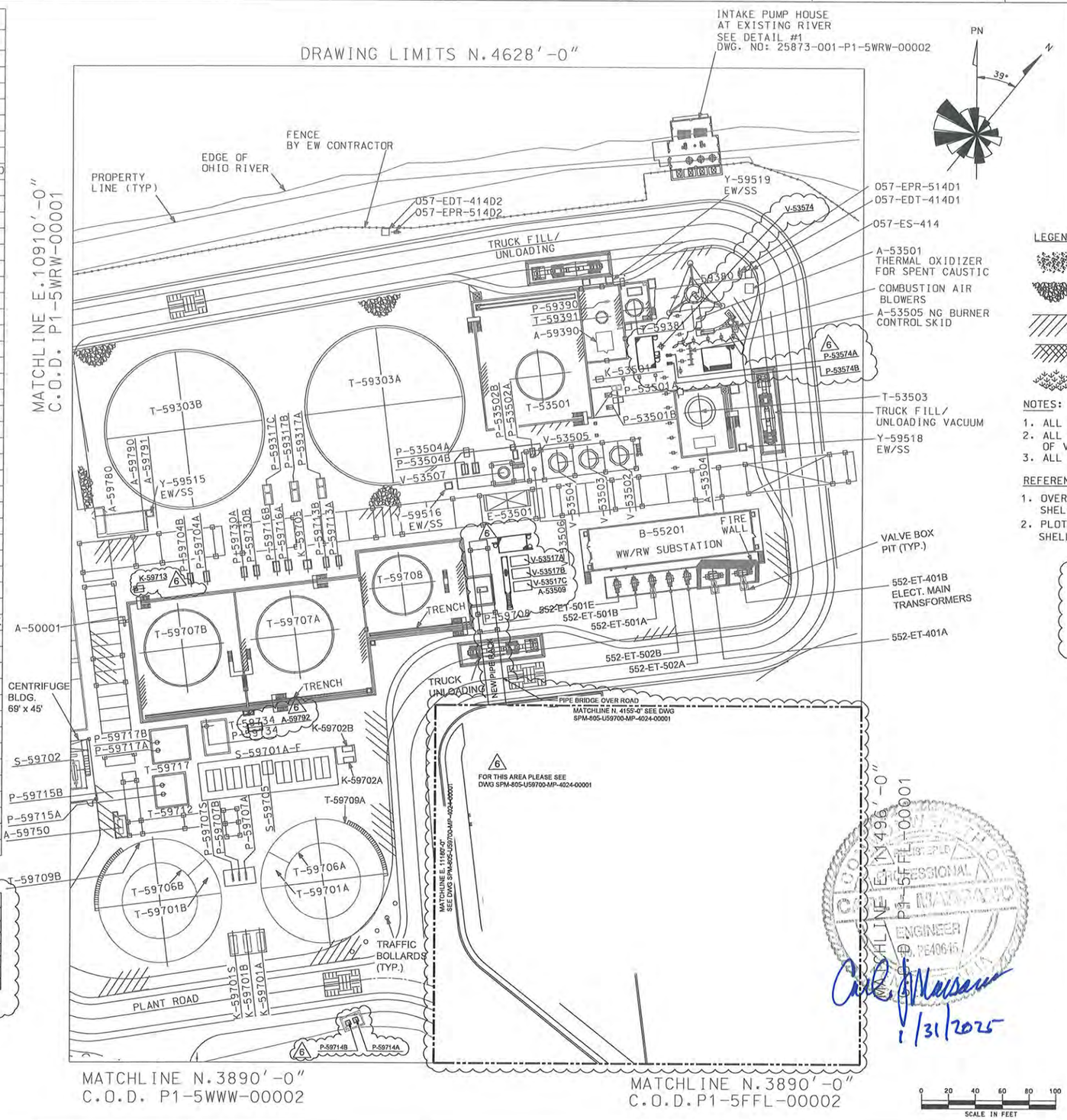
EQUIP. NO.		PLANT AREA XX	
PROJECT NO. P-00052	SCALE		FILE NAME
DRAWN BY	CHECKED BY		MICRO. REV.
APPROVED	DRAWING NO. SPM-805-U59700-PX-2366-00006		REV. 3

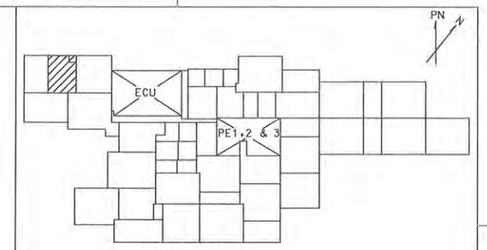
C. PLOT PLAN

EQPT. NO.	DESCRIPTION
A-50001	OIL MIST GENERATOR
A-53501	THERMAL OXIDIZER FOR SPENT CAUSTIC
A-53504	93% SULPHURIC ACID DOSING PUMP PKG
A-59380	COAGULANT FEED PKG.
A-59390	SODIUM HYPOCHL PKG.
A-59750	CLARIFIER POLYMER FEED PKG.
A-59780	BIOTREATER PH CONTROL SYSTEM PKG.
A-59790	BIOTREATER NITROGEN NUTRIENT FEED
A-59791	BIOTREATER PHOSPHORUS NUTRIENT FEED
E-53501	AQUEOUS EFFLUENT COOLER
K-53501	SPENT CAUSTIC STORAGE TANK BLOWER
K-59701A/B/S	AERATION TANK BLOWERS
K-59702A/B	GRAVITY FILTER BLOWERS
K-59705	WASTE WATER TANKS VENT BLOWER
P-53501A/B	SPENT CAUSTIC FEED PUMPS
P-53502A/B	NEUTRALIZATION FEED PUMPS
P-53504A/B	NEUT. SPENT CAUSTIC PUMPS
P-59317A/B	FILTERED WATER FORWARDING PUMPS
P-59390	12% SODIUM HYPOCHL. UNLOADING PUMP
P-59704A/B	BIOREACTOR FEED PUMPS
P-59707A/B/S	CENTRIFUGE FEED PUMPS
P-59708	RECOVERED OIL TANK SKIMMER PUMP
P-59713A/B	RECOVERED OIL DRAWOFF PUMPS
P-59714A/B	AC POND TRANSFER PUMPS
P-59715A/B	WASTE WATER SUMP PUMPS
P-59716A/B	PROCESS WASTE WTR. BLEED PUMPS
P-59717A/B	TREATED EFFLUENT PUMPS
P-59730A/B	FLOW EQUALIZ. & OIL SKIMMER PUMPS
P-59734	WWT AREA DAC SUMP PUMP
S-59701A-F	WASTE WATER GRAVITY FILTERS
S-59702	BIOSLUDGE CENTRIFUGE
S-59705	SPLITTER BOX
T-53501	SPENT CAUSTIC STORAGE TANK
T-53503	93% SULFURIC ACID STORAGE TANK
T-59303A/B	FILTERED WATER STORAGE TANKS
T-59381	COAGULANT BULK STORAGE TANK
T-59391	12% SODIUM HYPOCHL. BULK STORAGE TK
T-59701A/B	WAS STORAGE TANKS
T-59706A/B	SECONDARY CLARIFIERS
T-59707A/B	FLOW EQUALIZ. & OIL REMOVAL TANKS
T-59708	RECOVERED OIL TANK
T-59709A/B	AERATION TANKS
T-59712	WASTE WATER SUMP
T-59717	TREATED EFFLUENT SUMP
T-59734	WWT AREA DAC SUMP
V-53502	SPENT CAUSTIC OXIDIZER #1
V-53503	SPENT CAUSTIC OXIDIZER #2
V-53504	SPENT CAUSTIC OXIDIZER #3
V-53505	PLANT AIR SAFEGUARDING DRUM
V-53506	OXIDIZED SPENT CAUSTIC SEPARATOR
V-53507	OXIDIZED CAUSTIC DEGASSING DRUM

EQUIP. NO.	DESCRIPTION
K-59713	WASTE WATER TANKS VENT BLOWER
V-53574	VENT KNOCK OUT DRUM
P-53574A/B	VENT KNOCK OUT DRUM PUMPS
A-53509	CANISTERS PACKAGE
V-53517A/B/C	CARBON CANISTERS
A-59792	ANTI-FOAM INJECTION PACKAGE

6





KEY PLAN

LEGEND:

- GROUND
- GRAVEL
- CONCRETE PAVING
- CONCRETE MAT
- NATURAL SURFACE
- ASPHALT
- HPFS — HIGH POINT FINISHED SURFACE
- FENCE
- RAIL ROAD TRACK
- —OHE— OVERHEAD ELECTRICAL LINE

NOTES:

1. ALL DIMENSIONS ARE IN US CUSTOMARY UNITS (USC).
2. ALL EQUIPMENT SIZING AND LAYOUT SUBJECT TO RECEIPT OF VENDOR INFORMATION.
3. ALL PLANT ROADS ARE UNRESTRICTED UNLESS NOTED OTHERWISE.

REFERENCE DRAWINGS:

1. OVERALL SITE PLAN:
   SHELL DOC. NUMBER GM1-700-G0000-CX-4024-00002
2. PLOT PLAN KEY PLAN:
   SHELL DOC. NUMBER GM1-700-G0000-MP-4024-00001

6

wood.

FOR PROJECT
P-00052 USE ONLY

REV	DATE	DESCRIPTION	BY	CHK	APP	PEM	CLIENT
6	18JAN25	ISSUED FOR DESIGN	SM	GS	CC	-	-
5	10DEC24	ISSUED FOR REVIEW	CMK	TS	CC	-	-
4	17JUN24	ISSUED FOR INFORMATION	JMG	VS	AR	-	-
3	31MAY24	ISSUED FOR REVIEW	JMG	VS	AR	-	-
2	19DEC23	ISSUED FOR AS-BUILT	KB	DV	NW	-	-
1	09NOV23	ISSUED FOR REVIEW	KB	DV	AE	-	-
00D	01DEC17	ISSUED FOR CONSTRUCTION	PC	DKA	AR	SS	–
00E	03APR17	ISSUED FOR DESIGN	PR	DF	AD	NK	–
00D	18MAR16	ISSUED FOR DESIGN	ZR	FH	WV	DP	–
00C	03AUG15	ISSUED FOR DESIGN	MXJ	LAS	WV	DP	–

COMMONWEALTH OF PENNSYLVANIA
PROFESSIONAL
CHRISTOPHER J. MASSARO
ENGINEER
No. PE406451

1/31/2025

BECHTEL OG&C
PROJECT FRANKLIN

25873-001
ECCN - EAR 99

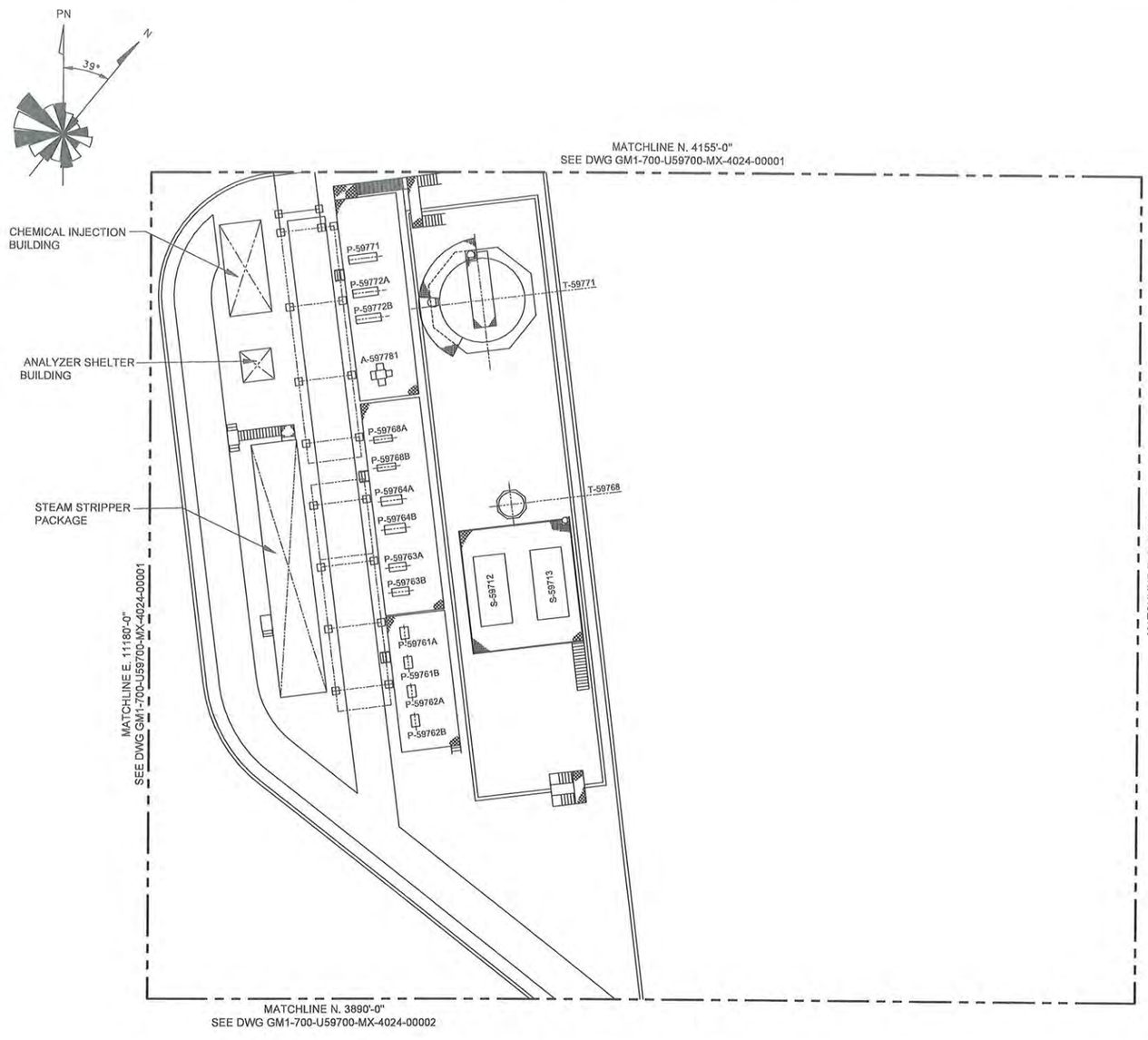
WBS/MODULE NO: 5WWW001, 5WRW001/002/5PPR001 — REV 000
BECHTEL DRAWING NO: 25873-001-P1-5WWW-00001

AREA PLOT PLAN
WASTE WATER TREATMENT &
SPENT CAUSTIC AREA

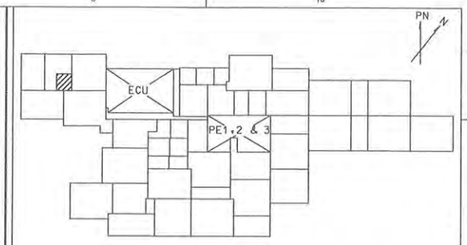
LOCATION:	PLANT AREA:	COMPANY PROJECT NO:	SCALE:	SHEET:
Monaca, PA	OSBL	GM1-700	1"=40'-0"	1 of 1

PROJECT FRANKLIN | COMPANY DRAWING NO: GM1-700-U59700-MX-4024-00001 | REV 6

PCAP-E-1247



EQUIP. NO.	DESCRIPTION
T-59768	FLOAT/SLUDGE DRUM
T-59771	SETTLEMENT DRUM
P-59772A&B	SETTLEMENT DRUM EFFLUENT PUMPS
P-59771	SETTLEMENT DRUM SLUDGE PUMP
P-59761A&B	DNF UNIT-1 RECIRCULATION PUMPS
P-59762A&B	DNF UNIT-2 RECIRCULATION PUMPS
P-59763A&B	DNF UNIT-1 EFFLUENT PUMPS
P-59764A&B	DNF UNIT-2 EFFLUENT PUMPS
P-59768A&B	FLOAT/SLUDGE PUMPS
S-59712	DISSOLVED NITROGEN FLOATATION UNIT 1
S-59713	DISSOLVED NITROGEN FLOATATION UNIT 2
TBD	CHEMICAL INJECTION BUILDING
TBD	ANALYZER SHELTER BUILDING
A-597781	OIL MIST GENERATOR
N/A	STEAM STRIPPER PACKAGE



KEY PLAN

LEGEND:

GROUND
GRAVEL
CONCRETE PAVING
CONCRETE MAT
NATURAL SURFACE
ASPHALT
HPFS HIGH POINT FINISHED SURFACE
FENCE
RAIL ROAD TRACK
—OHE— OVERHEAD ELECTRICAL LINE

NOTES:

1. ALL DIMENSIONS ARE IN US CUSTOMARY UNITS (USC).
2. ALL EQUIPMENT SIZING AND LAYOUT SUBJECT TO RECEIPT OF VENDOR INFORMATION.
3. ALL PLANT ROADS ARE UNRESTRICTED UNLESS NOTED OTHERWISE.
4. ALL CO-ORDINATES, DIMENSIONS AND ELEVATIONS ARE SHOWN IN FEET & INCHES.

REFERENCE DRAWINGS:

1. OVERALL SITE PLAN:
   SHELL DOC. NUMBER GM1-700-G0000-CX-4024-00002
2. PLOT PLAN KEY PLAN:
   SHELL DOC. NUMBER GM1-700-G0000-MP-4024-00001

CLIENT REFERENCE NUMBER
100412-P00052-DE2-PLP-0002

1/31/2025

REV.	DATE	DESCRIPTION	ORIGIN.	CHECK.	APPR.	CLIENT
3	2025 JAN 16	ISSUED FOR DESIGN	SM	GS	CC	-
2	2024 DEC 10	ISSUED FOR REVIEW	SM	TS	CC	-
1	2024 JUN 14	ISSUED FOR INFORMATION	JMG	VS	AR	-
0	2024 MAY 31	ISSUED FOR REVIEW	JMG	VS	AR	-

AREA PLOT PLAN
WASTE WATER TREATMENT
AND & SPENT CAUSTIC AREA

LOCATION:	PLANT AREA:	COMPANY PROJECT NO:	SHEET:	SIZE:
Monaca	OSBL	SPM	1 OF 1	ANSI D

SHELL POLYMERS MONACA	SCALE:	SHELL DRAWING NO:	REV:
-	1"=20'-0"	SPM-805-U59700-MP-4024-00001 DOC NO: -	3

0 20 40 60 80 100
SCALE IN FEET

wood.

FOR PROJECT
P-00052 USE ONLY

WATER TREATMENT AREA 7°
COUNTER CLOCKWISE FROM PLANT NORTH.

D. Post-Construction Stormwater Management (PCSM)

May 23, 2024

Mr. Christopher Dorogy
Shell Chemical Appalachia LLC
4301 Dutch Ridge Road
Beaver, PA 15009

Dear Mr. Dorogy:

Subject: Conceptual PCSM Evaluation
Wastewater Treatment Plant – Site Preparation
Potter Township, Beaver County, Pennsylvania
CEC Project 342-493

1.0 INTRODUCTION

Mascaro Construction LP (Mascaro) engaged Civil & Environmental Consultants, Inc. (CEC) to assist Shell Chemical Appalachia LLC (Shell) in evaluating the construction stormwater impacts of their proposed project to the site's existing NPDES Permit (PA0002208). The proposed project involves construction of an expansion to the existing Wastewater Treatment Plant and associated site infrastructure. The purpose of this document is to discuss the proposed project's applicability for a field change or modification to the existing NPDES Permit as it pertains to Part C Section VIII.

CEC reviewed the approved Post-Construction Stormwater Management (PCSM) documents[1] provided by Shell. CEC assumes that these documents are the most recently approved permit documents as it pertains to stormwater calculations, and CEC reserves the right to update our conclusions herein upon review of additional or updated information. Note that detailed calculations of basin design were not available at the time of CEC's review, and in order to determine the effects of the proposed project on the existing stormwater infrastructure and approved stormwater calculations, a review of the latest approved hydrologic design files would be required.

2.0 ANALYSIS

The above-referenced documents indicate that the total permitted area is 371 acres. The documents also demonstrate that the proposed project area is: in Drainage Area #1; was assumed to have gravel land cover in the post-development condition; and stormwater runoff from the area is routed to the Clean Rainwater (CR) Pond, which discharges to permitted Outfall 008. The documents also indicate that the proposed design exceeds the minimum 2-year volume, all design storm rates, and water quality standards required by 25 Pa. Code Ch. 102. See below Table 1.

[1] "NPDES_PCSM_REV_001_04-25-2016_with_appendicesreduce_1.pdf", provided by Shell on May 7, 2024.

Table 1

Category	Requirement	Design	Difference	Overdesign (%)
Volume (2-year)	931,189 cf	1,414,716 cf	483,527 cf	47%
Rate (2-year)	632 cfs	474 cfs	158 cfs	25%
Water Quality	Manage >90% of site	Managed 95% of site	5%	5%

Based upon conceptual design sketches[2] provided by Shell, the Wastewater Treatment Plant will consist of an approximately 0.9-acre gravel and impervious pad supported by retaining walls. The pad will contain the wastewater treatment plant expansion features, access roads, and appurtenant infrastructure.

The existing permitted facility area totals 371 acres, and the proposed 0.9-acre project is approximately 0.3% of that total 371 acres. The designed drainage area of the CR pond is 87.2 acres, of which the proposed 0.9-acre project represents approximately 1% of the drainage area.

Furthermore, the latest NPDES permit indicates that the area of the proposed project was assumed to be gravel (typically CN 89) in the post-development conditions. The proposed project will increase approximately 0.9 acres of that area to an impervious land cover (CN 98). Standalone preliminary, conceptual calculations demonstrate that for an area of 0.9 acres, a land cover change of this nature may increase the 2-year runoff rate and volume by approximately 1 cfs and approximately 2,500 cf, respectively. Compared to the overall values provided in the approved permit documents and in Table 1 above, this increase represents a *de minimis* change to stormwater flows overall for the site.

However, flows from the majority of the project area will not be routed to the CR pond, and are instead anticipated to be treated as "accidentally contaminated" stormwater routed to the wastewater treatment plant. This will reduce the drainage area of the CR pond by approximately 1%, and therefore slightly reduce the contributory stormwater runoff routed to the CR pond.

3.0 CONCLUSION

Since the NPDES permit has substantially more credits for stormwater runoff rate, volume, and water quality than is required by Ch. 102 (see Table 1), the site will still meet NOI requirements after the implementation of the proposed Wastewater Treatment Plant Expansion project.

[2] "Area Plot Plan, Waste Water Treatment & Spent Caustic Area" dated May 5, 2024, and provided by Shell on May 16, 2024.

Given the overall nature of the proposed project and the *de minimis* impact on the site's drainage patterns, it is practical to consider site improvements resulting from the proposed Wastewater Treatment Plant Project as a redline field change to the site's currently permitted NPDES plans.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Justin C. Wagner, P.E.
Principal

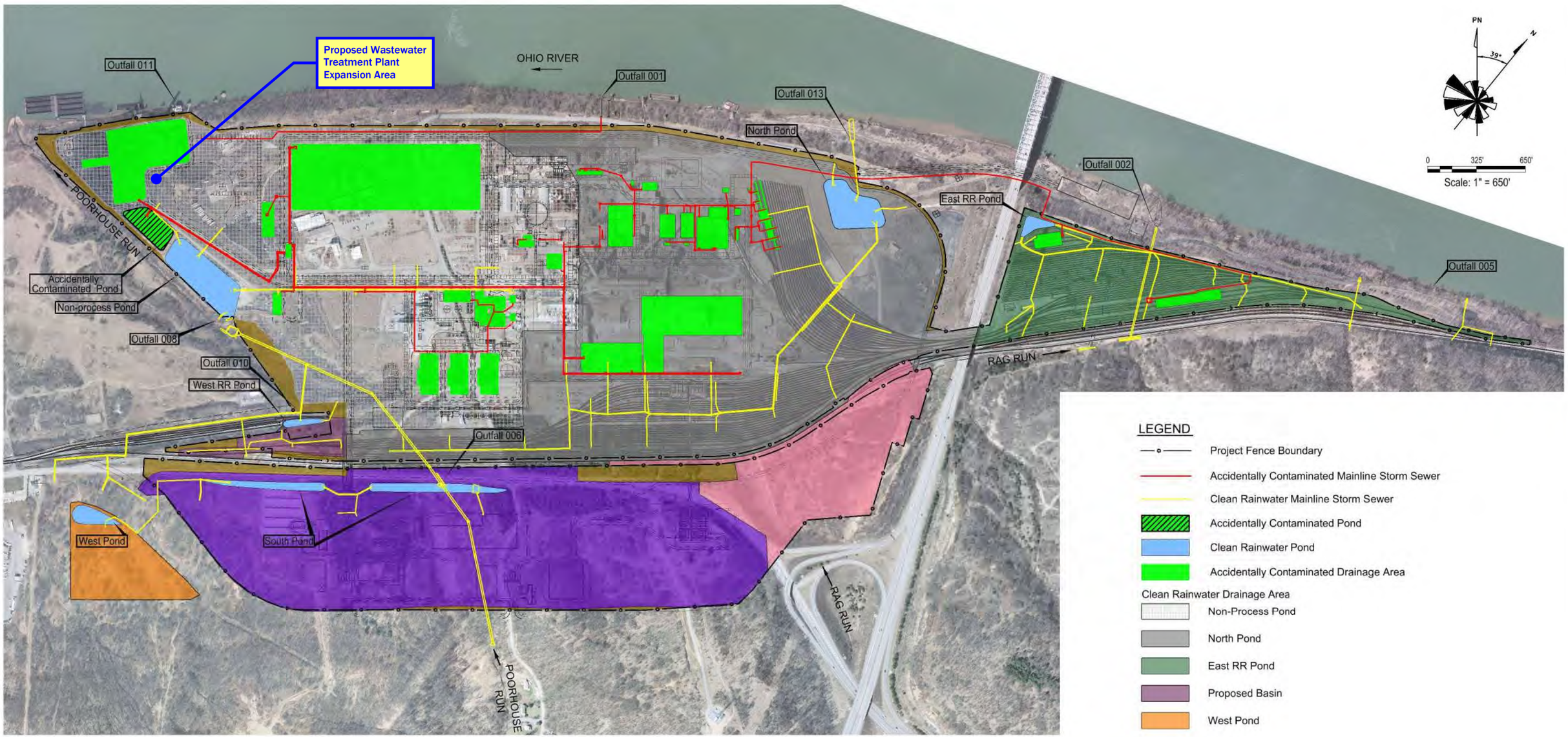
Rachel A. Upadhyay, P.E.
Project Manager

Attachments

342-493_WWTP_2024.05.22

ATTACHMENT A

DRAINAGE AREA MAP ANNOTATED



LEGEND

- Project Fence Boundary
- Accidentally Contaminated Mainline Storm Sewer
- Clean Rainwater Mainline Storm Sewer
- Accidentally Contaminated Pond
- Clean Rainwater Pond
- Accidentally Contaminated Drainage Area

Clean Rainwater Drainage Area

- Non-Process Pond
- North Pond
- East RR Pond
- Proposed Basin
- West Pond
- South Pond
- Rag Run
- Area Inside Fence Draining into Area Outside of Fence

Drainage Area ID	Area (acres)
Accidentally Contaminated Area	34.8
Non-Process Pond	88.0
North Pond	104.2
East RR Pond	23.6
West RR Pond	3.7
West Pond	8.1
South Pond	74.0
Rag Run	19.8
Area Inside Fence Draining Outside	14.6
Total Area	371

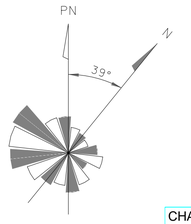
Note:
Annotation by Civil & Environmental Consultants, Inc. on 05/23/2024.

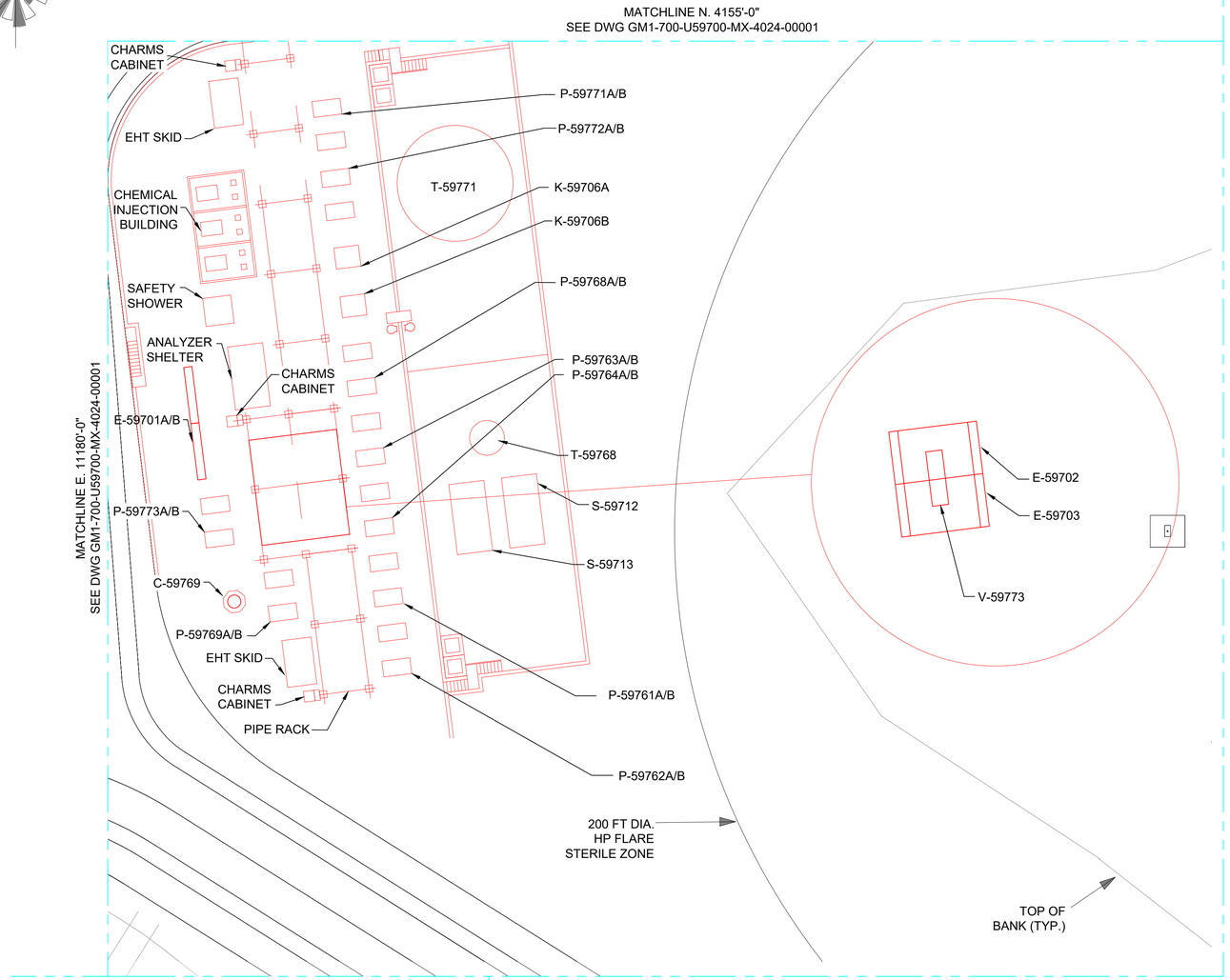
PROJECT FRANKLIN

FIGURE B-4
DRAINAGE AREA MAP

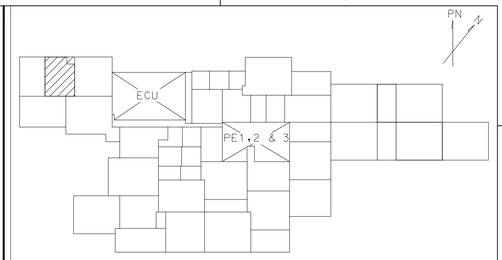
ATTACHMENT B

CONCEPTUAL SKETCH DRAWING FROM SHELL





EQUIP. NO.	EQUIP. DESCRIPTION
C-59769	WASTE WATER STEAM STRIPPER
V-59773	STEAM STRIPPER OVERHEAD REFLUX DRUM
T-59768	FLOAT/SLUDGE DRUM
T-59771	SETTLEMENT DRUM
TBD	SETTLEMENT DRUM SLUDGE HEATER
E-59702	STEAM STRIPPER OVERHEAD CONDENSER
E-59703	EFFLUENT COOLER
E-59701A/B	WASTE WATER PRE-HEATERS (STACKED)
P-59769A	STRIPPER EFFLUENT PUMP
P-59769B	STRIPPER EFFLUENT PUMP
P-59773A	STEAM STRIPPER REFLUX PUMP
P-59773B	STEAM STRIPPER REFLUX PUMP
P-59772A	SETTLEMENT DRUM EFFLUENT PUMP
P-59772B	SETTLEMENT DRUM EFFLUENT PUMP
P-59771A	SETTLEMENT DRUM SLUDGE PUMP
P-59771B	SETTLEMENT DRUM SLUDGE PUMP
P-59761A	DNF-1 RECYCLE PUMP
P-59761B	DNF-1 RECYCLE PUMP
P-59762A	DNF-2 RECYCLE PUMP
P-59762B	DNF-2 RECYCLE PUMP
P-59763A	DNF-1 EFFULENT PUMP
P-59763B	DNF-1 EFFULENT PUMP
P-59764A	DNF-2 EFFULENT PUMP
P-59764B	DNF-2 EFFULENT PUMP
P-59768A	FLOAT/SLUDGE PUMP
P-59768B	FLOAT/SLUDGE PUMP
S-59712	DISSOLVED NITROGEN FLOATATION UNIT 1
S-59713	DISSOLVED NITROGEN FLOATATION UNIT 2
P-59765A	COGULANT INJECTION PUMP
P-59765B	COGULANT INJECTION PUMP
P-59766A	FLOCCULANT INJECTION PUMP
P-59766B	FLOCCULANT INJECTION PUMP
P-59775A	EMULSION BREAKER PUMP
P-59775B	EMULSION BREAKER PUMP
TBD	SAFETY SHOWER & EYEWASH
M-59751	COAGULATION TUBE
K-59706A	VENT BLOWER A
K-59706B	VENT BLOWER B
TBD	EHT SKID
TBD	EHT SKID
TBD	CHARMS CABINET
TBD	CHARMS CABINET
TBD	CHARMS CABINET
TBD	ANALYZER SHELTER



KEY PLAN

LEGEND:

- GROUND
- GRAVEL
- CONCRETE PAVING
- CONCRETE MAT
- NATURAL SURFACE
- ASPHALT
- HPFS — HIGH POINT FINISHED SURFACE
- FENCE
- RAIL ROAD TRACK
- —OHE— OVERHEAD ELECTRICAL LINE

NOTES:

1. ALL DIMENSIONS ARE IN US CUSTOMARY UNITS (USC).
2. ALL EQUIPMENT SIZING AND LAYOUT SUBJECT TO RECEIPT OF VENDOR INFORMATION.
3. ALL PLANT ROADS ARE UNRESTRICTED UNLESS NOTED OTHERWISE.

REFERENCE DRAWINGS:

1. OVERALL SITE PLAN:
   SHELL DOC. NUMBER GM1-700-G0000-CX-4024-00002
2. PLOT PLAN KEY PLAN:
   SHELL DOC. NUMBER GM1-700-G0000-MP-4024-00001

REV.	DATE	DESCRIPTION	ORIGIN.	CHECK.	APPR.	CLIENT
0	05 MAY 24	ISSUED FOR REVIEW	JMG	RJ	AR	-

AREA PLOT PLAN
WASTE WATER TREATMENT & SPENT CAUSTIC AREA

LOCATION:	PLANT AREA:	COMPANY PROJECT NO:	SHEET:	SIZE:
Monaca	OSBL	GM1	1 OF 1	ANSI D

	SCALE:	SHELL DRAWING NO:	REV:
SHELL POLYMERS MONACA	1"=20'-0"	SPM-805-U59700-MP-4024-00001	0
-		DOC NO: -	

0 20 40 60 80 100
SCALE IN FEET

FOR PROJECT P-00052 USE ONLY

wood.

WOOD REFERENCE NUMBER: 100412-P00052-DE2-PLP-0002

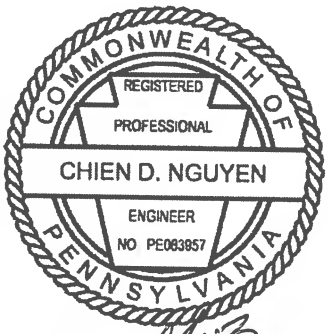
NOTE:
THIS DRAWING IS FOR SITE SELECTION PURPOSES ONLY. FEATURES SHOWN ON THIS DRAWING ARE SUBJECT TO CHANGE AS DESIGN PROGRESSES.

ATTACHMENT C

APPROVED POST-CONSTRUCTION STORMWATER MANAGEMENT DOCUMENTS REVISION 1

PROJECT FRANKLIN

POST CONSTRUCTION
STORMWATER MANAGEMENT PLAN



4/25/2016

REV.	DATE	REASON FOR REVISION	BY	CK'D	APPR'D	CLIENT
001	04/25/2016	REISSUED FOR USE	AG	HS/CN	REP	-
000	11/05/2015	ISSUED FOR USE	AG	HS/CN	REP	-
00C	9/29/2015	ISSUED FOR APPROVAL	AG	HS/CN	REP	-
00A	5/27/2015	ISSUED FOR REVIEW	AG	HS	REP	-

BECHTEL OG & C, INC.	PROJECT FRANKLIN	SHELL DOCUMENT NUMBER	REV.
ECCN – EAR 99		GM1-700-G0000-CX-5880-00021	001
	POST CONSTRUCTION STORMWATER MANAGEMENT	BECHTEL DOCUMENT NUMBER	REV.
		25873-001-30G-C03-00001	001
		BECHTEL PROJECT NO.: 25873-001	Page 1 of 90

Table of Contents

1 Site Description and Analysis

The purpose of this Post Construction Stormwater Management (PCSM) plan is to describe how the Shell Franklin Project (the "Project") will utilize best management practices to control the volume, rate, and water quality of post-construction stormwater runoff so as to protect and maintain the chemical, physical, and biological properties of surrounding surface waters. This PCSM plan was developed using the guidelines contained within the Erosion and Sediment Pollution Control Program Manual (E&S manual), Pennsylvania Department of Environmental Protection Office of Water Management, April 2000, and the PA DEP Stormwater Best Management Practices Manual December 2006.

The project involves operation of a petrochemical complex consisting of a 1500 kiloton per year ethylene cracker utilizing ethane feedstock, three units designed to convert ethylene into polyethylene end-products, an electrical cogeneration facility, waste water and raw water treatment facilities, rail yards, hydrocarbon loading and unloading facilities, and associated permanent plant support buildings. The total acreage for the development is approximately 371 acres and includes a mix of currently undeveloped areas as well as potential historic industrial areas which were previously used as a zinc smelting facility.

As discussed with the Department at several application meetings, this PCSM plan is based on the existing site conditions being defined as prior to any demolition/remediation/earth moving activities and the "post" condition as after construction of the entire petrochemical complex is complete.

1.1 Topographic Features of the Project Site and Surrounding Area

The existing site is located in Potter Township, Beaver County, Pennsylvania and bounded by the Ohio River to the northwest, Poorhouse Run stream to the south, State Route 18 to the southeast and extends 3,600 ft northeast of Interstate 376. The existing elevation within the site ranges from approximately 712 ft to 980 ft, see Figure B-2. The site currently drains in a northwesterly direction towards the Ohio River. Based on the Federal Emergency Management Agency Flood Insurance Rate Map, the 1% Annual Chance Base Flood Elevation ranges from approximately 700' to 702' through the site. The existing ground cover for the site includes a zinc processing facility with gravel and paved areas, undeveloped tracts of land and an existing paved highway, see Figure A-1.

1.2 Site Soils

Based on the information obtained from the geotechnical report, the existing soil based on the boring data consists primarily of fill and alternating layers of alluvial sands and gravels. Thickness of the existing fill would range from 1.5 to 12.0 ft. The deposited sands and gravels underlying the fills were found to be normally loose to very dense. Bedrock consists of the Allegheny Group's Freeport Formation and Conemaugh Group's Glenshaw Formation which comprise of interbedded, cyclic sequences of sedimentary rock consisting of shales, sandstones, limestones, and thin coal seams. For USDA Natural Resources Conservation Service Soil Classification Map and Description, see Figure B-3.

1.3 Project Area Runoff

The previous land usage for the project area was for a zinc processing facility with gravel and paved areas, undeveloped tracts of land, and an existing paved highway. The area of the zinc processing facility is considered a brownfield site. The present land use will be based on the scope of work for Early Works Construction. Early works consists of remediation and site preparation. Major components of Early Works Construction include disposing, reusing and stabilizing cut & fill earthwork; capping, regrading, and leveling the site for future plant construction; and providing major drainage features.

As discussed in the Act 2 Remedial Investigation/Risk Assessment Report and Cleanup Plan (ERM 2015), there are seven areas on the former Smelter Property and one area on the Fly Ash Landfill that exceed Site-Specific soil to groundwater standards (areas identified on ERM Figure 4-8 that are north of existing

SR-18). The soils exceeding these standards which remain after any necessary re-location to facilitate future unit/building foundations or general site development will be graded smooth and covered with a 40 mil PVC geomembrane prior to installing a soil cover that is minimum 2-foot thick. One location on the former Smelter Property will be under the concrete abutment for the new bridge crossing the CSX rail line. Soils in the three northern-most areas on the former Smelter Property (described above) will be designated as "no dig zones" based on the presence of mercury above non-residential direct contact standards. These three areas will be graded smooth and a bentonite mat, or equivalent, will be installed prior to installing an 8-inch thick fiber reinforced concrete slab to create a no dig barrier. The concrete slab will be buried with unimpacted soil to match the new grade.

The "existing" site is comprised of several parcels of land, the majority of which is the former Horsehead Corporation zinc processing facility. The site itself has been an industrial complex for approximately 70 years. The Horsehead property was mostly developed with a stormwater detention pond servicing the main processing area and areas draining outfalls designated as 007 and 009. The remaining Horsehead site areas and adjacent other parcels do not have stormwater detention facilities, and the rainfall runoff flows from these areas is uncontrolled into the Ohio River, Poorhouse Run, and Rag Run.

The proposed land uses for the site will be a 1500 kiloton per year ethylene cracker unit, three polyethylene units, electricity cogeneration facility, waste water & raw water treatment facilities, rail yard, hydrocarbon loading & unloading facility and permanent plant roads & buildings. The drainage system for the proposed plant site will be incorporated into the both the Early Works, and permanent plant surface configurations with major drainage features. All unpaved areas within the plant area will be covered in gravel, see Figure A-2.

An existing drainage report[1], developed by the Early Works Contractor, determined the stormwater impacts and mitigation methods associated with the proposed conditions during early works and construction of the petrochemical facility. The drainage report determined that the proposed project does not cause adverse impacts to the existing flood hazard conditions. The drainage report evaluated the proposed culverts for Poorhouse Run and Rag Run streams, existing site conditions, proposed site conditions and detention ponds for stormwater flow and volume mitigation.

Internal drainage features for the proposed plant site will utilize the drainage system constructed by Early Works, and those constructed as part of the permanent plant surface configuration. The drainage features consist of stormwater manholes, inlets, pipes, trenches, and channels that will eventually discharge into Early Works or permanent plant drainage system. Stormwater outfall from the plant site will be discharged into permitted locations designed to retain and then release stormwater volumes. See Figure B-4 for Overall Proposed Drainage Area.

1.4 Design Rainfall Events

Rainfall data was obtained from PennDOT Drainage Manual Chapter 7, Appendix A. The manual found that different storm durations produce regional discrepancy in rainfall patterns. Five regional maps were created to represent the rainfall patterns. See Table 1.1 for 24-hour rainfall depths in Beaver County, PA.

[1] Shell Document Number GM1-102-E0000-CX-1380-00002, from 1st page of Jacobs drainage calculations.

Table 1.1: Design Rainfall Events

Storm Return Years	Precipitation (in)
1	2.04
2	2.44
5	2.99
10	3.44
25	4.09
50	4.65
100	5.24
500	6.74

2 Runoff Volume Control Analysis

The existing site was the location for a zinc processing facility that has been decommissioned and dismantled, with gravel and paved areas, undeveloped tracts of land, and an existing paved highway. The ground cover for the pre-development condition can be seen in Figure A-1. The existing site lies on the downstream side of the watershed that eventually drains into the Ohio River, Poorhouse Run and Rag Run streams.

Volume Control Guidance 1 (CG-1) will be used to determine the runoff volume required to be offset by using BMPs. This method states:

The Control Guideline 1 is applicable to any size of the Regulated Activity. Use of Control Guideline 1 (CG-1) is recommended where site conditions offer the opportunity to reduce the increase in runoff volume as follows:

> **Do not increase the post-development total runoff volume for all storms equal to or less than the 2-year/24-hour event.**
>
> **Existing (pre-development) non-forested pervious areas must be considered meadow (good condition) or its equivalent.**
>
> **Twenty (20) percent of existing impervious area, when present, shall be considered meadow (good condition) in the model for existing conditions for redevelopment.**

The Soil Conservation Service (SCS) method will be used to calculate runoff volume. The runoff curve number was determined for each area using the SCS soil map and CN values for different types of soil and cover. The covers considered are paved (asphalt or concrete), grass and gravel areas. The 2-year 24hour rainfall depth for the site is 2.44 inches. For summary of calculation of runoff volume for pre- and post-development runoff volumes, see Table 2.1 and Table 2.2.

Table 2.1: Pre-Development Runoff Values

Existing Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (ft^3)
DA #1 - Good Condition Grass Cover	B	1707512	39.2	61	6.39	1.28	0.18	25402
DA #1 - Impervious Area - Paved	B	1318302	30.3	98	0.20	0.04	2.21	242908
DA #1 - Impervious Area - Gravel	B	841244	19.3	85	1.76	0.35	1.13	79278
DA #1 - Good Condition Grass Cover	C	362044	8.3	74	3.51	0.70	0.57	17342
DA #1 - Impervious Area - Paved	C	9301	0.2	98	0.20	0.04	2.21	1714

DA #1 - Impervious Area - Gravel	C	30595	0.7	89	1.24	0.25	1.40	3575
DA #1 - 20% Impervious Area = Good Condition Grass Cover	B	539886	12.4	61	6.39	1.28	0.18	8032
DA #1 - 20% Impervious Area = Good Condition Grass Cover	C	9974	0.2	89	1.24	0.25	1.40	1166
Subtotal DA#1		**4818858**	**111**					**379416**
DA #2 - Good Condition Grass Cover	A	25685	0.6	39	15.64	3.13	0.03	68
DA #2 - Impervious Area - Paved	A	4418	0.1	98	0.20	0.04	2.21	814
DA #2 - Good Condition Grass Cover	B	583076	13.4	61	6.39	1.28	0.18	8674
DA #2 - Impervious Area - Paved	B	1489864	34.2	98	0.20	0.04	2.21	274520
DA #2 - Impervious Area - Gravel	B	311221	7.1	85	1.76	0.35	1.13	29329
DA #2 - Good Condition Grass Cover	C	1059982	24.3	74	3.51	0.70	0.57	50774
DA #2 - Impervious Area - Paved	C	266727	6.1	98	0.20	0.04	2.21	49147
DA #2 - Impervious Area - Gravel	C	612395	14.1	89	1.24	0.25	1.40	71567
DA #2 - 20% Impervious Area = Good Condition Grass Cover	A	1104	0.0	39	15.64	3.13	0.03	3
DA #2 - 20% Impervious Area = Good Condition Grass Cover	B	450271	10.3	61	6.39	1.28	0.18	6698
DA #2 - 20% Impervious Area = Good Condition Grass Cover	C	219781	5.0	74	3.51	0.70	0.57	10528
Subtotal DA#2		**5024524**	**115**					**502121**
DA #3 - Good Condition Grass Cover	C	749604	17.2	74	3.51	0.70	0.57	35906
DA #3 - Impervious Area - Paved	C	198841	4.6	98	0.20	0.04	2.21	36638
DA #3 - Impervious Area - Gravel	C	58709	1.3	89	1.24	0.25	1.40	6861
DA #3 - 20% Impervious Area = Good Condition Grass Cover	C	64387	1.5	90	1.11	0.22	1.48	7928
Subtotal DA#3		**1071541**	**25**					**87333**
DA #3a - Good Condition Grass Cover	A	121745	2.8	39	15.64	3.13	0.03	321
DA #3a - Impervious Area - Paved	A	19790	0.5	98	0.20	0.04	2.21	3646
DA #3a - Impervious Area - Gravel	A	14919	0.3	76	3.16	0.63	0.66	819
DA #3a - 20% Impervious Area = Good Condition Grass Cover	A	8677	0.2	39	15.64	3.13	0.03	23
Subtotal DA#3a		**165131**	**4**					**4809**
DA #4 - Good Condition Grass	A	283140	6.5	39	15.64	3.13	0.03	747

Cover								
DA #4 - 20% Impervious Area = Good Condition Grass Cover	A	70785	1.6	39	15.64	3.13	0.03	187
Subtotal DA#4		**353925**	**8**					**934**
DA #5 - Good Condition Grass Cover	A	994895	22.8	39	15.64	3.13	0.03	2626
DA #5 - Impervious Area - Paved	A	124888	2.9	98	0.20	0.04	2.21	23012
DA #5 - Good Condition Grass Cover	B	37007	0.8	61	6.39	1.28	0.18	551
DA #5 - Impervious Area - Paved	B	15605	0.4	98	0.20	0.04	2.21	2875
DA #5 - Good Condition Grass Cover	C	1844788	42.4	74	3.51	0.70	0.57	88366
DA #5 - Impervious Area - Paved	C	137254	3.2	98	0.20	0.04	2.21	25290
DA #5 - 20% Impervious Area = Good Condition Grass Cover	A	31222	0.7	39	15.64	3.13	0.03	82
DA #5 - 20% Impervious Area = Good Condition Grass Cover	B	3901	0.1	61	6.39	1.28	0.18	58
DA #5 - 20% Impervious Area = Good Condition Grass Cover	C	34312	0.8	74	3.51	0.70	0.57	1644
Subtotal DA#5		**3223872**	**74**					**144504**
DA #6 - Good Condition Grass Cover	B	163717	3.8	61	6.39	1.28	0.18	2436
DA #6 - Impervious Area - Paved	B	6049	0.1	98	0.20	0.04	2.21	1115
DA #6 - Good Condition Grass Cover	C	647270	14.9	74	3.51	0.70	0.57	31005
DA #6 - Impervious Area - Gravel	C	6118	0.1	89	1.24	0.25	1.40	715
DA #6 - Impervious Area - Paved	C	28559	0.7	98	0.20	0.04	2.21	5262
DA #6 - 20% Impervious Area = Good Condition Grass Cover	B	1512	0.0	61	6.39	1.28	0.18	22
DA #6 - 20% Impervious Area = Good Condition Grass Cover	C	8669	0.2	74	3.51	0.70	0.57	415
Subtotal DA#6		**861894**	**20**					**40970**
DA OUT - Good Condition Grass Cover	A	102685	2.4	39	15.64	3.13	0.03	271
DA OUT - Impervious Area - Paved	A	27845	0.6	98	0.20	0.04	2.21	5131
DA OUT - Good Condition Grass Cover	B	163186	3.7	61	6.39	1.28	0.18	2428
DA OUT - Impervious Area - Paved	B	13810	0.3	98	0.20	0.04	2.21	2545
DA OUT - Good Condition Grass Cover	C	226859	5.2	74	3.51	0.70	0.57	10867
DA OUT - Impervious Area -	C	45612	1.0	98	0.20	0.04	2.21	8404

Paved								
DA OUT - Impervious Area - Gravel	C	27458	0.6	89	1.24	0.25	1.40	3209
DA OUT - 20% Impervious Area = Good Condition Grass Cover	A	6961	0.2	39	15.64	3.13	0.03	18
DA OUT - 20% Impervious Area = Good Condition Grass Cover	B	3453	0.1	61	6.39	1.28	0.18	51
DA OUT - 20% Impervious Area = Good Condition Grass Cover	C	18268	0.4	74	3.51	0.70	0.57	875
Subtotal DA OUT		**636137**	**15**					**33799**
TOTAL:		**16155883**	**371**					**1193887**

Table 2.2 presents the post-development runoff volumes with the actual changes in cover and CN values.

Table 2.2: Post-Development Runoff Volumes

Proposed Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (ft^3)
DA #1 - Impervious Area - Paved	B	77181	1.8	98	0.204	0.041	2.21	14221
DA #1 - Impervious Area - Gravel	B	334699	7.7	85	1.765	0.353	1.13	31542
DA #1 - Impervious Area - Paved	C	1875723	43.1	98	0.204	0.041	2.21	345618
DA #1 - Impervious Area - Gravel	C	2531255	58.1	89	1.236	0.247	1.40	295814
Subtotal DA#1		**4818858**	**111**					**687194**
DA #2 - Impervious Area - Paved	A	290994	6.7	98	0.204	0.041	2.21	53618
DA #2 - Impervious Area - Gravel	A	1868300	42.9	76	3.158	0.632	0.66	102525
DA #2 - Impervious Area - Paved	B	952192	21.9	98	0.204	0.041	2.21	175449
DA #2 - Impervious Area - Gravel	B	1881880	43.2	85	1.765	0.353	1.13	177346
DA #2 - Impervious Area - Gravel	C	23563	0.5	89	1.236	0.247	1.40	2754
DA #2 - Impervious Area - Paved	C	7595	0.2	98	0.204	0.041	2.21	1399
Subtotal DA#2		**5024524**	**115**					**513091**
DA #3 - Impervious Area - Paved	C	66177	1.5	98	0.204	0.041	2.21	12194
DA #3 - Impervious Area - Gravel	C	1005364	23.1	89	1.236	0.247	1.40	117491
Subtotal DA#3		**1071541**	**25**					**129685**
DA #3a - Impervious Area - Paved	A	17322	0.4	98	0.204	0.041	2.21	3192
DA #3a - Impervious Area - Gravel	A	147809	3.4	76	3.158	0.632	0.66	8111
Subtotal DA#3a		**165131**	**4**					**11303**

DA #4 - Impervious Area - Paved	A	19045	0.4	98	0.204	0.041	2.21	3509
DA #4 - Impervious Area - Gravel	A	334880	7.7	76	3.158	0.632	0.66	18377
Subtotal DA#4		**353925**	**8**					**21886**
DA #5 - Impervious Area - Paved	A	320397	7.4	98	0.204	0.041	2.21	59036
DA #5 - Impervious Area - Gravel	A	830504	19.1	76	3.158	0.632	0.66	45575
DA #5 - Impervious Area - Paved	B	19910	0.5	98	0.204	0.041	2.21	3669
DA #5 - Impervious Area - Gravel	B	36577	0.8	85	1.765	0.353	1.13	3447
DA #5 - Impervious Area - Paved	C	885803	20.3	98	0.204	0.041	2.21	163217
DA #5 - Impervious Area - Gravel	C	1130681	26.0	89	1.236	0.247	1.40	132137
Subtotal DA#5		**3223872**	**74**					**407079**
DA #6 - Impervious Area - Paved	B	7206	0.2	98	0.204	0.041	2.21	1328
DA #6 - Impervious Area - Gravel	B	164072	3.8	85	1.765	0.353	1.13	15462
DA #6 - Impervious Area - Paved	C	39560	0.9	98	0.204	0.041	2.21	7289
DA #6 - Impervious Area - Gravel	C	651056	14.9	89	1.236	0.247	1.40	76085
Subtotal DA#6		**861894**	**20**					**100164**
DA OUT - Impervious Area - Paved	A	24578	0.6	98	0.204	0.041	2.21	20799
DA OUT - Impervious Area - Gravel	A	112879	2.6	76	3.158	0.632	0.66	1470
DA OUT - Good Condition Grass Cover	B	26780	0.6	61	6.39	1.28	0.18	398
DA OUT - Impervious Area - Paved	B	20049	0.5	98	0.204	0.041	2.21	3694
DA OUT - Impervious Area - Gravel	B	133456	3.1	85	1.765	0.353	1.13	12577
DA OUT - Impervious Area - Paved	C	33765	0.8	98	0.204	0.041	2.21	6221
DA OUT - Impervious Area - Gravel	C	284630	6.5	89	1.236	0.247	1.40	33263
Subtotal DA OUT		**636137**	**15**					**254672**
TOTAL:		**16155882**	**371**					**2125076**

Best Management practices (BMPs) have been applied to the extent possible in order to prevent an increase in total runoff volume. These BMPs are described in Section 5 of this report. In addition to the BMP's listed in section 5, gravel will be utilized instead of pavement wherever possible. As gravel allows for greater infiltration, the use of gravel instead of pavement where possible reduces the total runoff volume from 3,256,037 ft^3 (in the pavement only case) to 2,125,076 ft^3, a reduction of 35%.

While there is a net increase in runoff volume of 931,189 ft^3 in the post-development case, CG-1 is met by managing the runoff volume through the use of several detention basins. Worksheet 5, shown in Appendix D, demonstrates compliance with CG-1.

3 Runoff Peak Rate Analysis

A drainage report has been developed by Early Works contractor to determine the stormwater impacts and mitigation methods associated with the proposed plant surface conditions. The drainage report determined that the proposed project does not cause adverse impacts to the existing flood hazard conditions at the site. The drainage report evaluated the proposed culverts for Poorhouse Run and Rag Run streams, existing site conditions, proposed site conditions and detention ponds for stormwater flow mitigation. The drainage report utilized the SCS method in Hydrologic Engineering Center – Hydrologic Modeling System (HEC-HMS) to determine the 2, 10, 25, 50, and 100-year peak flows for the pre- and post- development condition. The increase in peak flow was then mitigated by the use of multiple detention basins. For detention pond plans, see Appendix F. Potter Township General Code Section 176 requires that detention facilities be designed such that the post-development peak runoff rates from the developed site surface conditions are controlled to the rates defined by the subarea release rate percentages for the 2, 10, 25, 50, and 100-year storm frequencies. The drainage report concluded that the proposed development will not increase flow rates to the Ohio River. For a summary and comparison of the pre- and post-development conditions peak stormwater discharge rates, see Table 3.1.

Table 3.1: Comparison of Peak Flow Rates

Storm Return Years	Pre-Develop Condition Flows (cfs)	Post-Develop Condition Flows (cfs)	Difference (cfs)
2	632	474	-158
10	1624	1384	-240
25	2073	1855	-218
50	2436	2223	-213
100	2744	2508	-236

As can be seen, in all cases the post-development peak discharge rates are less than the pre-development rates.

4 Water Quality Analysis

The recommended control guideline for total water quality control from the Pennsylvania Stormwater Best Practices is:

> **Achieve an 85 percent reduction in post-development particulate associated pollutant load (as represented by Total Suspended Solids), an 85 percent reduction in post-development total phosphorus loads, and a 50 percent reduction in post-development solute loads (as represented by NO3-N), all based on post-development land use.**

Flow chart D from Chapter 8 of the manual illustrates several pathways to water quality compliance. Attached in Appendix D is a copy of Flowchart D with this project's compliance plan highlighted. Worksheets 10, 12, and 13, located in Appendix D, demonstrate compliance with the water quality control guideline.

5 BMPs Utilized

5.1 Non-Structural BMPs.

Various non-structural BMPs will be used for the site, the BMPs included are:

> **BMP 5.6.3" Re-Vegetate/Re-Forest Disturbed Areas (Native Species):** This BMP is being utilized for Water Quality Nitrate Control. Exposed slopes are being hydro-seeded with fast growing grasses to stabilize and prevent erosion in these areas. These areas will not be maintained other

than to monitor for erosion and to re-establish vegetative cover as necessary. Natural succession from adjacent forest stands will be encouraged in these areas and clusters of native trees will also be planted in lower slope areas. Native tree seedlings of American Chestnut are to be planted in an area of approximately 2 acres.

An area of approximately 5 acres along the riverbank east of I-376 will be re-vegetated utilizing upland wildlife forage and cover using meadow native seed mix. The area will also be replanted with large caliper native trees to establish a low maintenance area and to minimize impacts from the project. Native trees include Black Locust, Red Oak, Silver/Red Maples, Shagbark Hickory, Serviceberry, Dogwood, and Redbuds.

BMP "5.7.1" Reducing Street Imperviousness: Asphalt pavement shoulders for the entire site from the original design have been reduced from 5' asphalt paved shoulder to 2' asphalt with 3' gravel paved shoulders. The gravel shoulder will be less impervious than the asphalt paved shoulders.

BMP "5.9.1" Street Sweeping: This BMP is being utilized for Water Quality Nitrate Control Street sweeping will be incorporated in the normal maintenance program and shall be done in accordance with the Pennsylvania Stormwater BMP Manual procedures. Paved areas with regular vehicular traffic will be swept on periodic intervals, (currently schedule for every 6 months) while paved areas without regular vehicular traffic (e.g. those which will be used by vehicles only in maintenance situations) will be swept following use.

Management-based activities not mentioned in Pennsylvania Stormwater BMP Manual procedures: Items to be included are training and educational programs, proper vehicle equipment fueling and washing practices, good housekeeping, and proper sanitary waste disposal.

5.2 Structural BMPs

The entire site will be heavily compacted due to the required laydown, equipment, foundation, parking, roads, buildings and heavy equipment access. Listed below are structural BMPs that were considered. BMPs being utilized are shown in bold. For each BMP that is not utilized, a brief explanation of why the BMP is not applicable to the project is provided.

BMP "6.4.1" Pervious Pavement with Infiltration Bed, BMP "6.4.2" Infiltration Basin: Subgrade for the proposed site will be compacted to no less than 95% of the maximum dry density and will contain as much as 80% fines which will tend to severely limit infiltration. The BMPs require the subgrade to be uncompacted and should not be placed on areas of recent fill or compacted fill.

BMP "6.4.3" Subsurface Infiltration Bed, BMP "6.4.4" Infiltration Trench, BMP "6.4.5" Rain Garden/Bioretention, BMP "6.4.6" Dry Well / Seepage Pit, BMP "6.4.7" Constructed Filter, BMP "6.4.8" Vegetated Swale, BMP "6.4.9" Vegetated Filter Strip, BMP "6.4.10" Infiltration Berm & Retentive Grading: Subgrade for the proposed site will be compacted to no less than 95% of the maximum dry density and will contain as much as 80% fines which will tend to severely limit infiltration. The BMPs require the subgrade to be uncompacted.

BMP "6.5.1" Vegetated Roof: Buildings for the site are pre-engineered building with gable and hip (sloped) roof. Pitch on roof will be too steep to use vegetative roof. Design for flat-topped buildings were considered but had no cost saving. Building contractor recommended and designed buildings with gable and hip roof. Also, buildings are design for typical dead and live loads, incorporating load for the vegetative loads would have economic impacts to the project.

BMP "6.5.2" Runoff Capture & Reuse: Adding storage containers to store and reuse stormwater were considered but no applicable reuse was found for the project site. Based on the design

criteria for the facility, there is minimal opportunity for incorporating grassing in open areas. Using the stormwater for firewater tanks and cooling water would require the stormwater to be processed to meet required water quality specifications.

BMP "6.6.1" Constructed Wetland: Constructed wetlands required drainage area of at least 10 acres (5 acres for "pocket" wetlands) or some means of sustaining constant inflow. Drainage area if created for wetlands would be less than 10 acres and will not meet the requirements.

BMP "6.6.2" Wet Pond/Retention Basin: Due to the site constraint, dry detention basins were used to mitigate post-development conditions flow. To incorporate wet pond/retention basin into design would require more plot space which will have economical and design impacts to the project.

BMP "6.6.3" Dry Extended Detention Basin: Dry extended detention basins have been incorporated in the project site. The basins were designed so that the post-development peak runoff rates will not exceed pre-development peak runoff rates for the 2, 10, 25, 50, and 100-year storm frequencies. All detention ponds have a valve box at the outfall and stormwater will be visually inspected for contaminant prior to release. Net volume reduction or storage will not be considered for structural BMP volume credits. Drainage area #1, 2, 3, 3a, 4, 5 will be routed to detention ponds.

BMP "6.6.4" Water Quality Filters & Hydrodynamic Devices: Water quality filters have been incorporated in to the design. Area where polyethylene pellets are produced and handled will have a pellet separator to remove pellets before entering the storm sewer system. The storm system for the process area will have a different storm system from the clean rainwater storm system. Accidentally Contaminated stormwater from the process areas will be treated in the wastewater treatment plant. The total area of the site draining from the process area is approximately 34.7 acres.

BMP "6.7.1" Riparian Buffer Restoration: Due to the limited plot space, riparian buffer restoration is not considered for the site.

BMP "6.7.2" Landscape Restoration, BMP 6.7.3 Soil Amendment & Restoration: Per the request of the owner, the proposed site will have no grassing and open areas will be covered with gravel. Landscape restoration and soil amendment & restoration are not considered for the site.

BMP 6.7.4 Floodplain Restoration: Project site is not located within floodplain.

5.3 BMP Controlled Areas

Table 5.1 presents the BMP controlled areas:

Table 5.1: BMP Controlled Areas

Area Name	BMP	Area (sf)
DA #1	BMP 6.6.3 Dry Extended Detention Basin/ BMP 6.6.4 Water Quality Filters & Hydrodynamic Devices	4818371
DA #2	BMP 6.6.3 Dry Extended Detention Basin/ BMP 6.6.4 Water Quality Filters & Hydrodynamic Devices	4962254
DA #3	BMP 6.6.3 Dry Extended Detention Basin/ BMP 6.6.4 Water Quality Filters & Hydrodynamic Devices	1146920
DA #4	BMP 6.6.3 Dry Extended Detention Basin/ BMP 6.6.4 Water Quality Filters & Hydrodynamic Devices	353925
DA #5	BMP 6.6.3 Dry Extended Detention Basin/ BMP 6.6.4 Water Quality Filters & Hydrodynamic Devices	3372289
Total BMP Area		14653759

Total Project Area BMP Drainage %		15504379 95%

5.4 Thermal Impact Analysis

Thermal impact is not anticipated for the site. All stormwater will drain into an underground storm sewer system and eventually be detained in a detention pond prior to discharge at the outfalls.

Plan Preparer

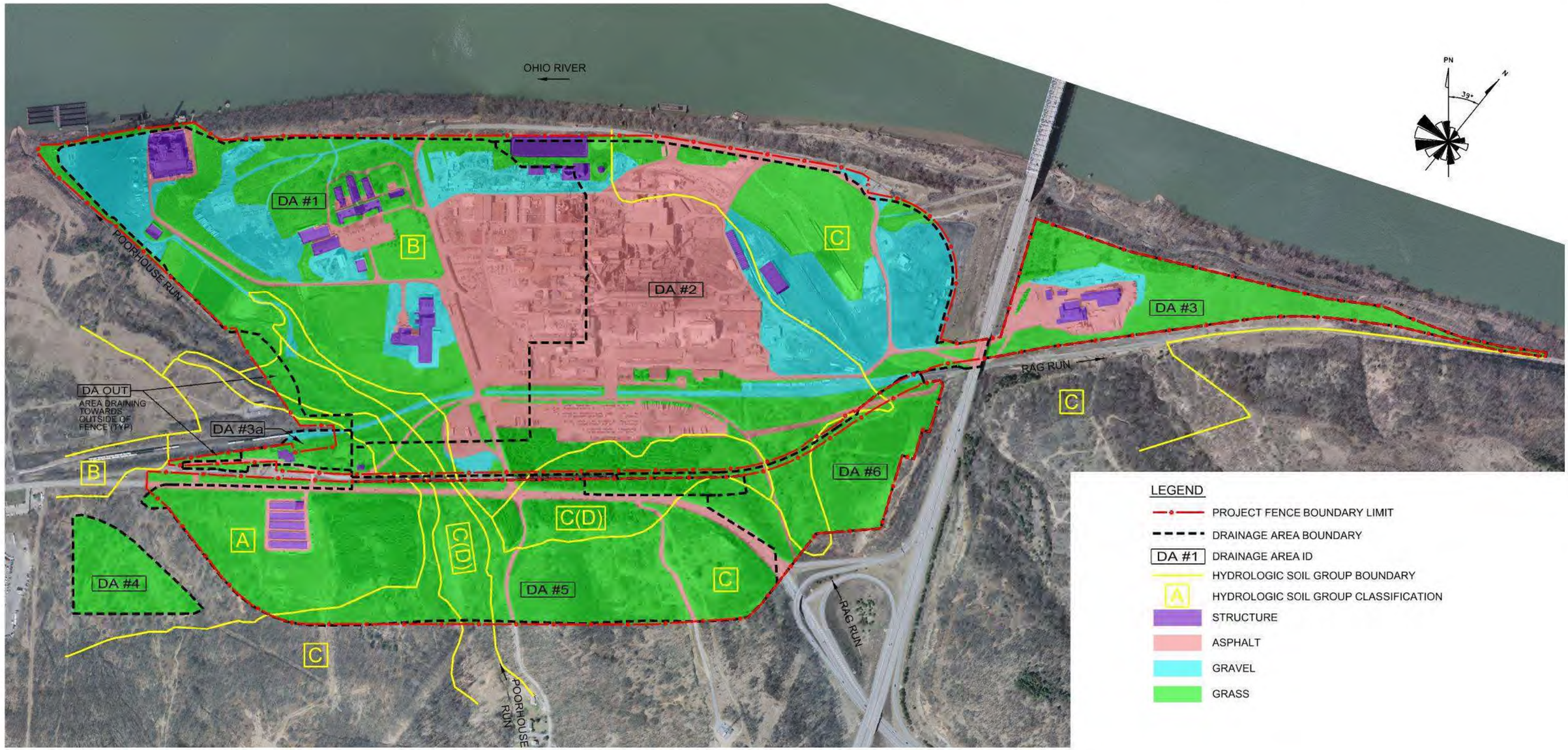
Name of Preparer: Ari Gordin
Education:

2004-2009
Georgia Institute of Technology
B.S. Chemistry

2009-2014
Georgia Institute of Technology
Ph.D. Materials Science and Engineering

Employment: Bechtel Oil, Gas & Chemicals, Inc.

APPENDIX A: Plan Drawings



LEGEND

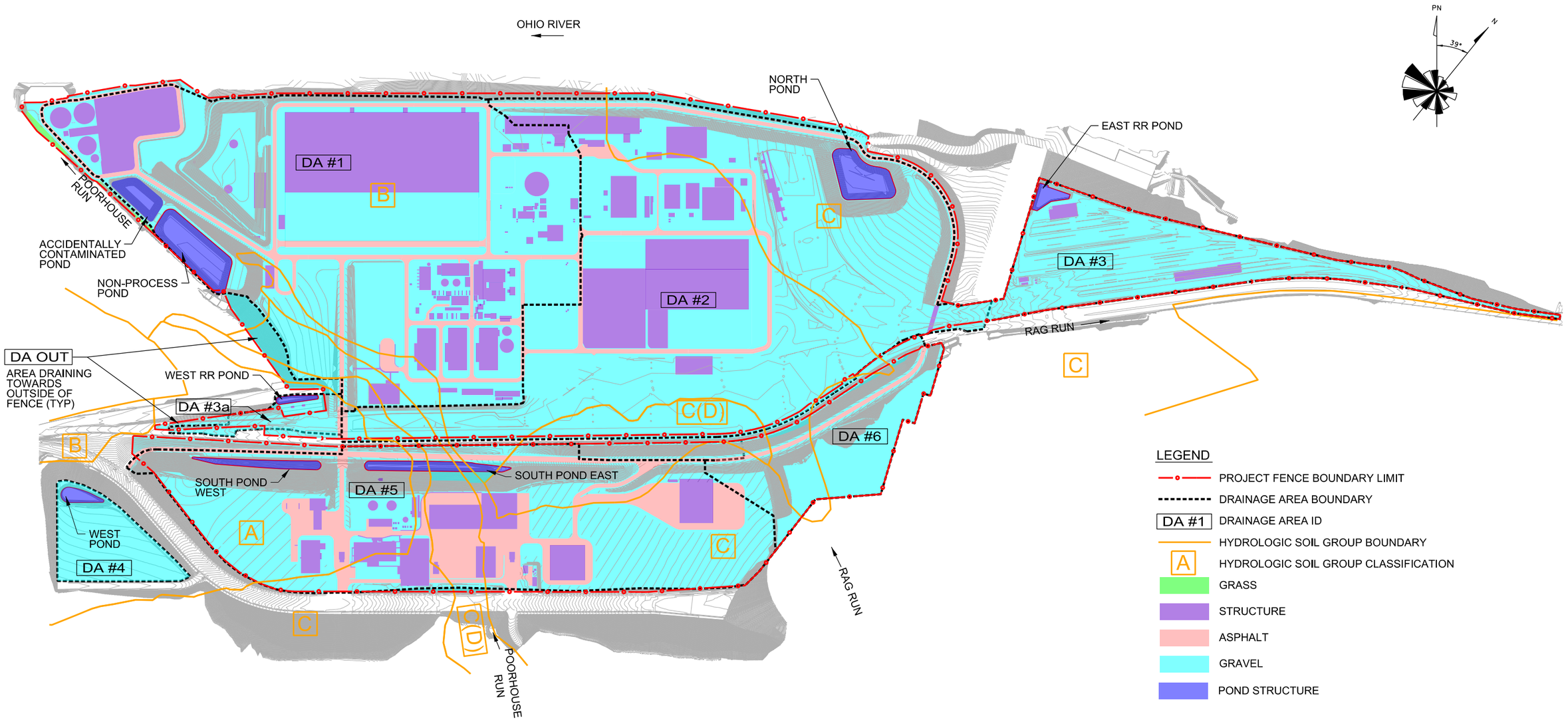
- PROJECT FENCE BOUNDARY LIMIT
- DRAINAGE AREA BOUNDARY
- DA #1 DRAINAGE AREA ID
- HYDROLOGIC SOIL GROUP BOUNDARY
- A HYDROLOGIC SOIL GROUP CLASSIFICATION
- STRUCTURE
- ASPHALT
- GRAVEL
- GRASS

0 325' 650'

Scale: 1" = 650'

PROJECT FRANKLIN

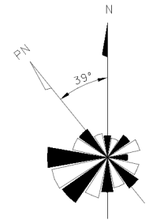
FIGURE A-1
SITE PRE-DEVELOPMENT CONDITIONS



PROJECT FRANKLIN

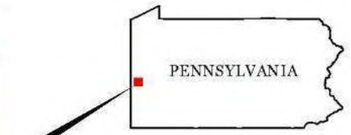
FIGURE A-2
SITE POST-DEVELOPMENT CONDITIONS

APPENDIX B: Location and Soil Maps



LEGEND

PROJECT FENCE BOUNDARY LIMIT



PROJECT LOCATION
POTTER TOWNSHIP,
BEAVER COUNTY, PA

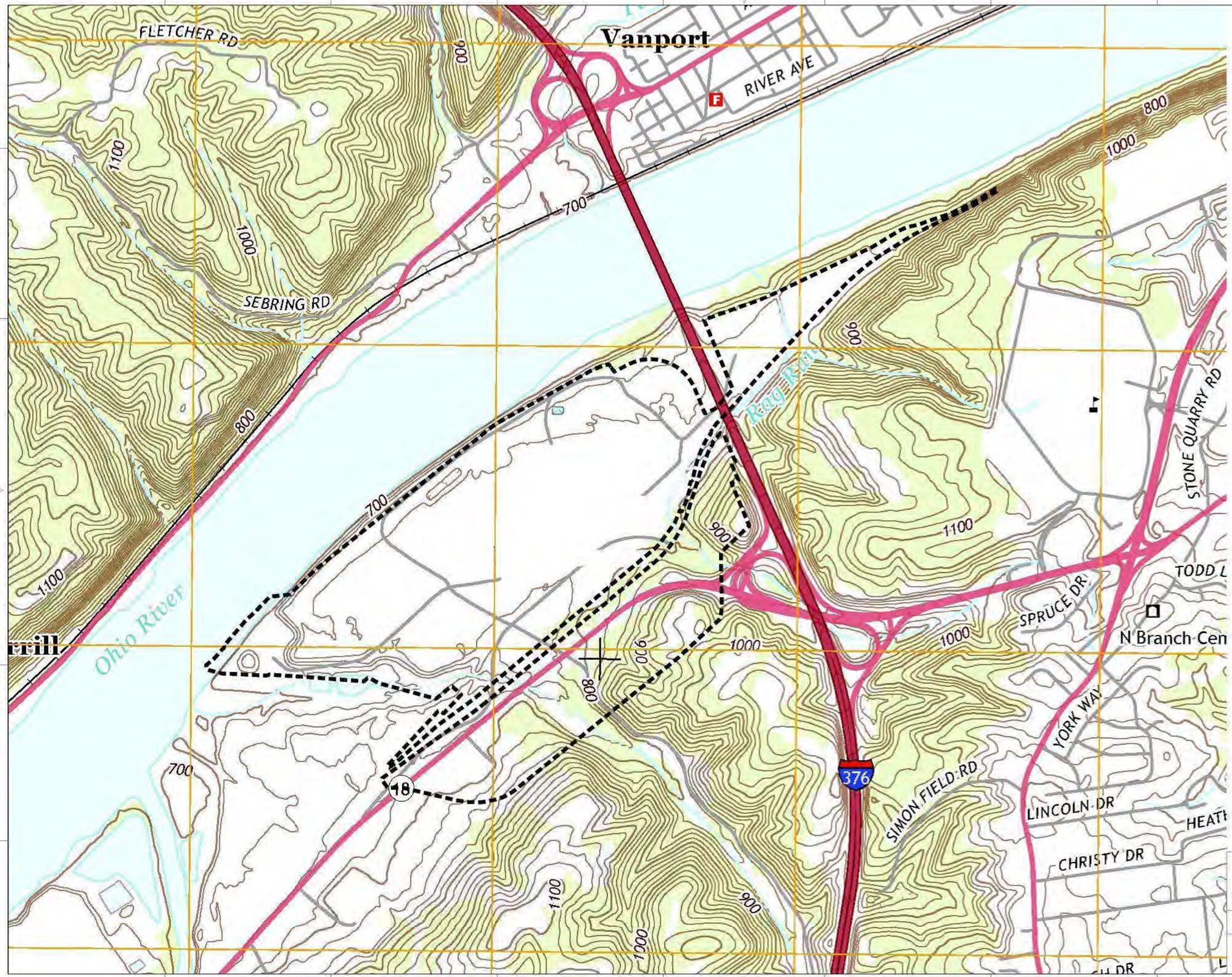
0 500' 1000'

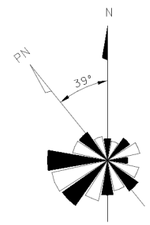
Scale: 1" = 1000'

Aerial Info: PAMAP Mosaic Beaver 2006 sid

PROJECT FRANKLIN

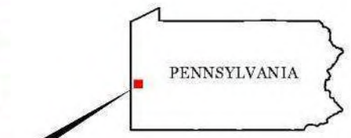
FIGURE B-1
PROJECT SITE AREA INCLUDING BOUNDARY





LEGEND

PROJECT FENCE BOUNDARY LIMIT



PROJECT LOCATION
POTTER TOWNSHIP,
BEAVER COUNTY, PA

0 500' 1000'

Scale: 1" = 1000'

Background Info: Beaver Quadrangle, Pennsylvania - Beaver Co., 7.5 - Minute Series

PROJECT FRANKLIN

FIGURE B-2
USGS TOPOGRAPHIC MAP
WITH PROJECT AREA

Hydrologic Soil Group Description Based on USDA Web Soil Survey

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

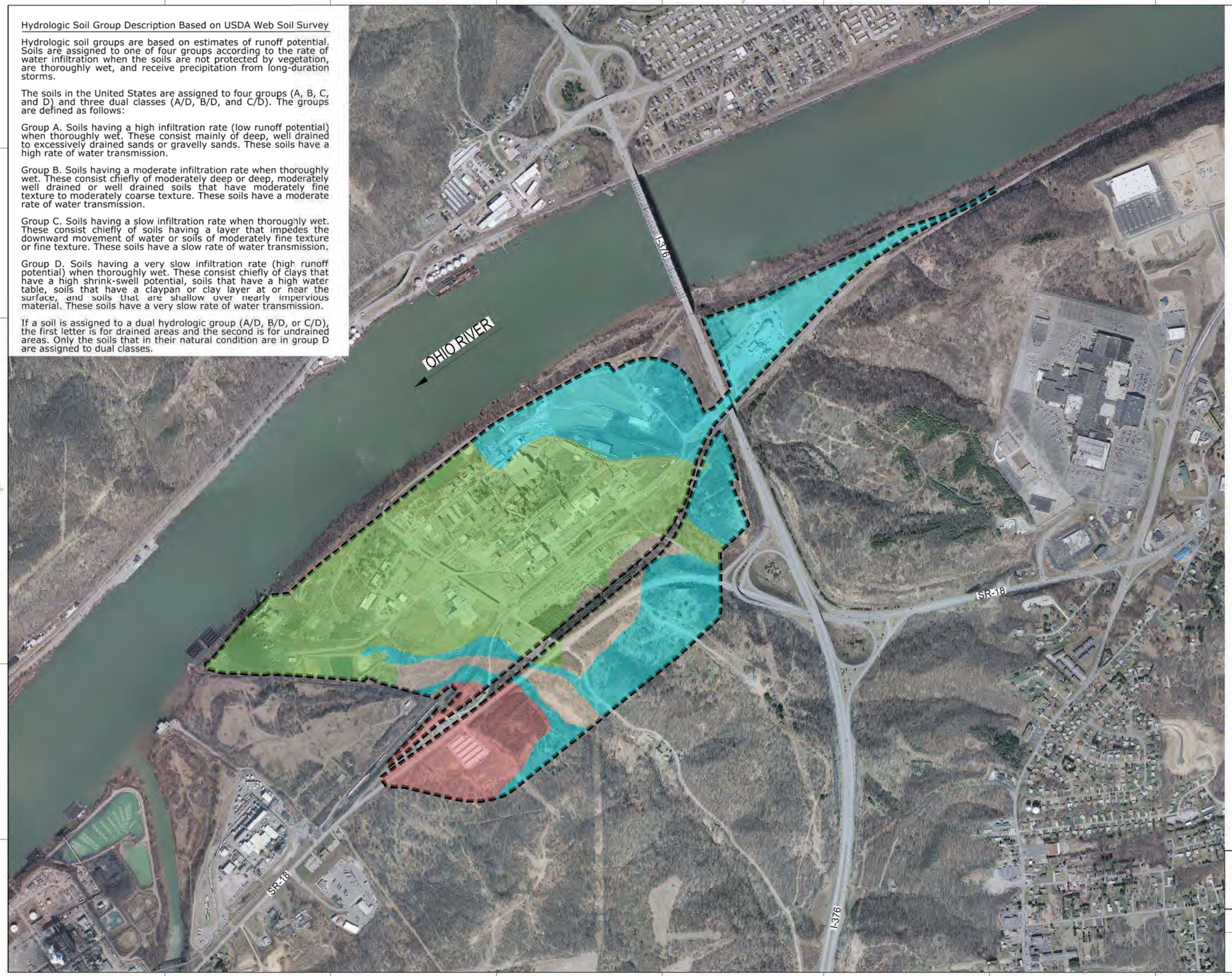
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

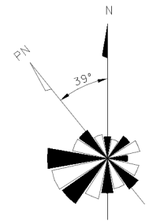
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.





LEGEND

PROJECT FENCE BOUNDARY LIMIT

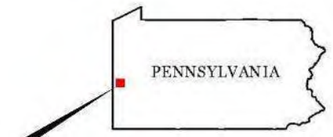
HYDROLOGIC SOIL GROUP CLASSIFICATION

GROUP A

GROUP B

GROUP C

GROUP C/D



PROJECT LOCATION
POTTER TOWNSHIP,
BEAVER COUNTY, PA

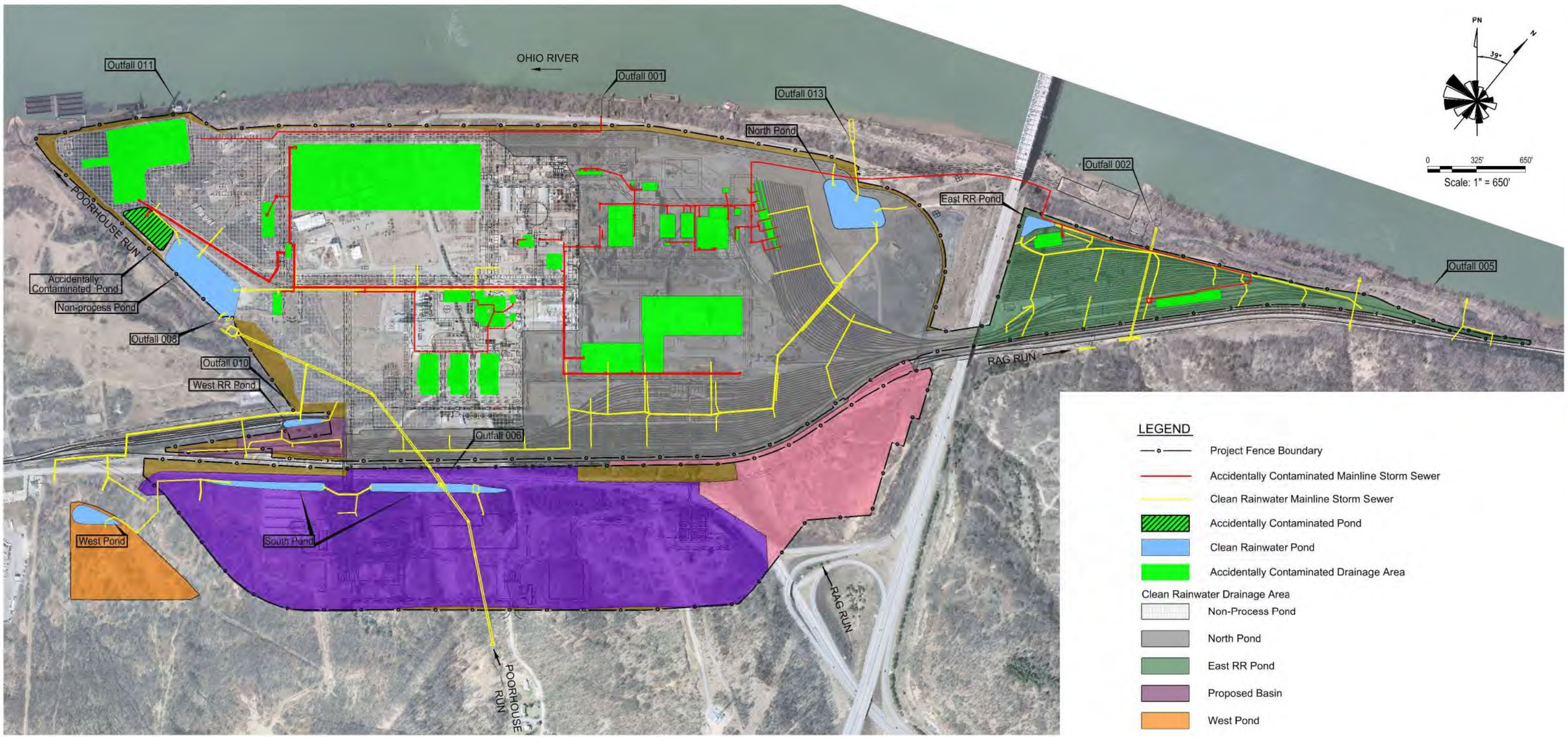
0 500' 1000'

Scale: 1" = 1000'

Aerial Info: PAMAP Mosaic Beaver 2006 sid

PROJECT FRANKLIN

FIGURE B-3
SOILS MAP



LEGEND

- Project Fence Boundary
- Accidentally Contaminated Mainline Storm Sewer
- Clean Rainwater Mainline Storm Sewer
- Accidentally Contaminated Pond
- Clean Rainwater Pond
- Accidentally Contaminated Drainage Area

Clean Rainwater Drainage Area

- Non-Process Pond
- North Pond
- East RR Pond
- Proposed Basin
- West Pond
- South Pond
- Rag Run
- Area Inside Fence Draining into Area Outside of Fence

Drainage Area ID	Area (acres)
Accidentally Contaminated Area	34.8
Non-Process Pond	88.0
North Pond	104.2
East RR Pond	23.6
West RR Pond	3.7
West Pond	8.1
South Pond	74.0
Rag Run	19.8
Area Inside Fence Draining Outside	14.6
Total Area	371

PROJECT FRANKLIN

FIGURE B-4
DRAINAGE AREA MAP

APPENDIX C: Rainwater Data

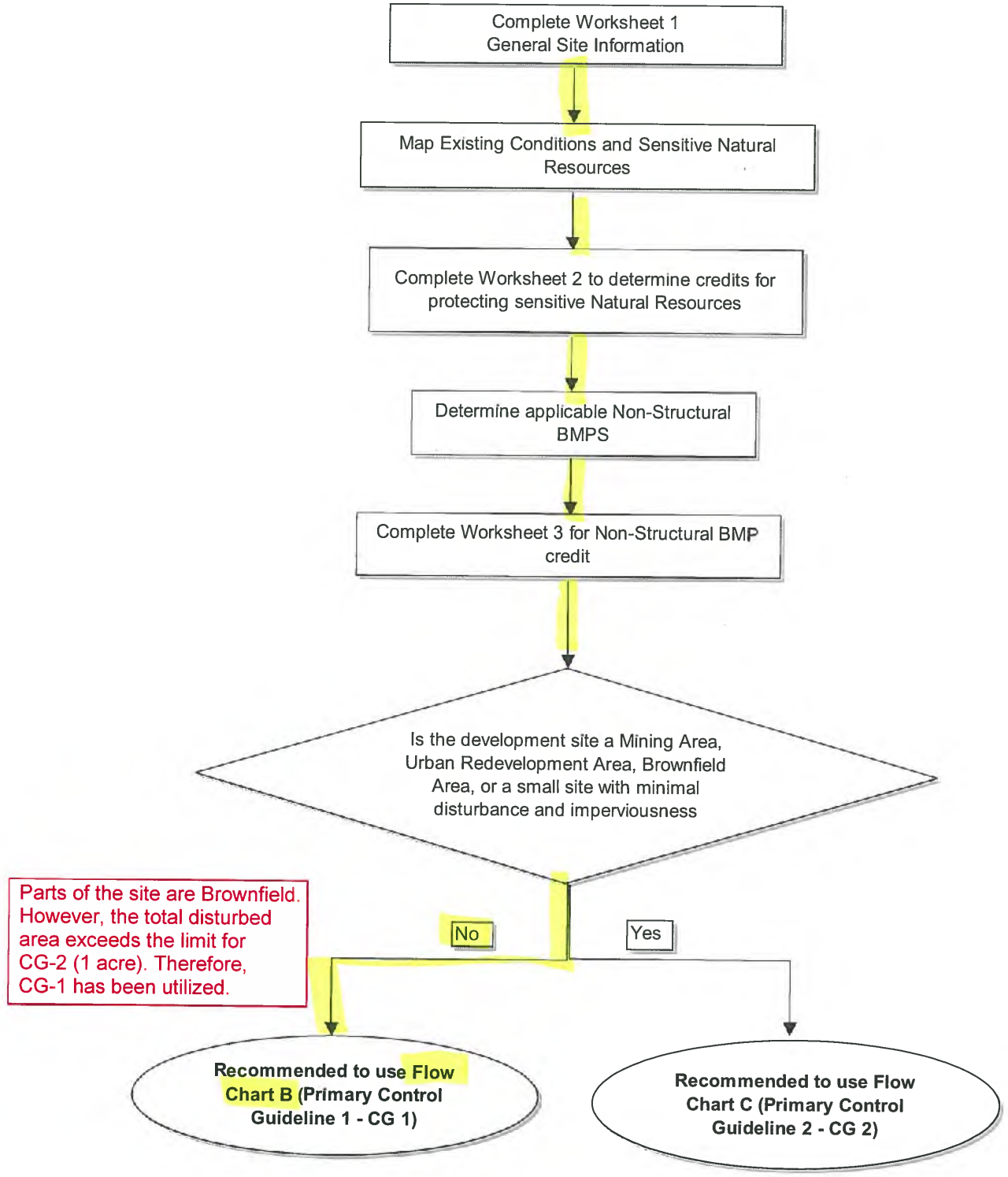
5-Minute through 24-Hour Rainfall Depths for Beaver County (Inches)

Rainfall Duration	1 yr	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
5 min	0.32	0.39	0.46	0.51	0.59	0.65	0.71
10 min	0.5	0.6	0.71	0.8	0.91	0.99	1.06
15 min	0.62	0.74	0.88	0.98	1.12	1.22	1.32
30 min	0.82	0.99	1.2	1.37	1.59	1.75	1.92
60 min	1.01	1.23	1.53	1.77	2.08	2.32	2.57
2 hr	1.09	1.32	1.65	1.92	2.29	2.6	2.94
3 hr	1.2	1.45	1.81	2.1	2.52	2.87	3.25
6 hr	1.37	1.64	2.04	2.37	2.84	3.19	3.56
12 hr	1.69	2.02	2.49	2.91	3.52	3.97	4.46
24 hr	2.04	2.44	2.99	3.44	4.09	4.65	5.24

Note: Rainfall data was obtain from PennDOT Drainage Manual Chapter 7, Appendix A.

APPENDIX D: Worksheets

Worksheet 1: General Site Information	Provided.
Worksheet 2: Sensitive Natural Resources	Provided.
Worksheet 3: Non-structural BMP Credits	Provided.
Worksheet 4: Change in Runoff Volume for 2-YR storm event	Provided.
Worksheet 5: Structural BMP Volume Credits	Provided.
Flow Chart B: Control Guideline 1 Process	Provided.
Flow Chart D: Water Quality Process	Provided.
Worksheet 6: Small Site/Small Impervious Area Exception for Peak Rate Mitigation Calculations	Not applicable.
Worksheet 7: Calculation of Runoff Volumes for CG-2 Only	Not Applicable.
Worksheet 8: Structural BMP Volume Credits	Not Applicable.
Worksheet 10: Water Quality Compliance for Nitrate	Provided.
Worksheet 11: BMPs for Pollution Prevention	Not Applicable.
Worksheet 12: Water Quality Analysis of Pollutant Loading from All Disturbed Areas	Not Applicable.
Worksheet 13: Pollutant Reduction through BMP Applications	Not Applicable.


Complete Worksheet 1
General Site Information
Map Existing Conditions and Sensitive Natural Resources
Complete Worksheet 2 to determine credits for protecting sensitive Natural Resources
Determine applicable Non-Structural BMPS
Complete Worksheet 3 for Non-Structural BMP credit
Is the development site a Mining Area, Urban Redevelopment Area, Brownfield Area, or a small site with minimal disturbance and imperviousness
No
Yes
Parts of the site are Brownfield. However, the total disturbed area exceeds the limit for CG-2 (1 acre). Therefore, CG-1 has been utilized.
Recommended to use Flow Chart B (Primary Control Guideline 1 - CG 1)
Recommended to use Flow Chart C (Primary Control Guideline 2 - CG 2)

Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: _____

Project Name: Shell Franklin

Municipality: Potter Township

County: Beaver County

Total Area (acres): 371

Major River Basin: Ohio

http://www.dep.state.pa.us/dep/deputate/watermgt/wc/default.htm#newtopics

Watershed: _____

Sub-Basin: _____

Nearest Surface Water(s) to Receive Runoff: Ohio River, Poorhouse Run, Rag Run

Chapter 93 - Designated Water Use: WWF

http://www.pacode.com/secure/data/025/chapter93/chap93toc.html

Impaired according to Chapter 303(d) List? Yes [X] No [ ]

http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/303d-Report.htm

List Causes of Impairment:

PCB, pesticides, dioxins

Is project subject to, or part of:

Municipal Separate Storm Sewer System (MS4) Requirements? Yes [ ] No [X]

http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm

Existing or planned drinking water supply? Yes [ ] No [X]

If yes, distance from proposed discharge (miles): _____

Approved Act 167 Plan? Yes [ ] No [X]

http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html

Existing River Conservation Plan? Yes [ ] No [X]

http://www.dcnr.state.pa.us/brc/rivers/riversconservation/planningprojects/

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS:

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies			
Floodplains			
Riparian Areas			
Wetlands			
Woodlands			
Natural Drainage Ways			
Steep Slopes, 15% - 25%			
Steep Slopes, over 25%			
Other:			
Other:			
TOTAL EXISTING:			0

Existing natural sensitive resources were documented in our Joint Permit (JP) Application. As identified in that application and subsequent issued permit, no resources within the limits-of-disturbance could be protected.

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2) 0 Ac.

1.2 Area of Riparian Forest Buffer Protection 0 Ac.

3.1 Area of Minimum Disturbance/Reduced Grading 0 Ac.

TOTAL 0 Ac.

Site Area	*minus*	Protected Area	=	Stormwater Management Area
371	-	0	=	371 acres

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction

Lawn 0 ft^2 No lawn or meadow x 1/4" x 1/12 = 0 ft^3

Meadow 0 ft^2 x 1/3" x 1/12 = 0 ft^3

3.3 Protect Existing Trees

For Trees within 100 feet of impervious area:

Tree Canopy 0 ft^2 x 1/2" x 1/12 = 0 ft^3

5.1 Disconnect Roof Leaders to Vegetated Areas

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area _____ ft^2 x 1/3" x 1/12 = 0 ft^3

For all other disconnected roof areas

Roof Area _____ ft^2 x 1/4" x 1/12 = 0 ft^3

5.2 Disconnect Non-Roof impervious to Vegetated Areas

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area _____ ft^2 x 1/3" x 1/12 = 0 ft^3

For all other disconnected roof areas

Impervious Area _____ ft^2 x 1/4" x 1/12 = 0 ft^3

0

** For use on Worksheet 5*

WORKSHEET 4 . CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

PROJECT: Shell Franklin
Drainage Area: 371 acres
2-Year Rainfall: 2.44 in

Total Site Area: 371 acres
Protected Site Area: 0 acres
Managed Area: 371 acres

Existing Conditions:

Existing Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (ft^3)
DA #1 - Good Condition Grass Cover	B	1707512	39.2	61	6.39	1.28	0.18	25402
DA #1 - Impervious Area - Paved	B	1318302	30.3	98	0.20	0.04	2.21	242908
DA #1 - Impervious Area - Gravel	B	841244	19.3	85	1.76	0.35	1.13	79278
DA #1 - Good Condition Grass Cover	C	362044	8.3	74	3.51	0.70	0.57	17342
DA #1 - Impervious Area - Paved	C	9301	0.2	98	0.20	0.04	2.21	1714
DA #1 - Impervious Area - Gravel	C	30595	0.7	89	1.24	0.25	1.40	3575
DA #1 - 20% Impervious Area = Good Condition Grass Cover	B	539886	12.4	61	6.39	1.28	0.18	8032
DA #1 - 20% Impervious Area = Good Condition Grass Cover	C	9974	0.2	89	1.24	0.25	1.40	1166
Subtotal DA#1		**4818858**	**111**					**379416**
DA #2 - Good Condition Grass Cover	A	25685	0.6	39	15.64	3.13	0.03	68
DA #2 - Impervious Area - Paved	A	4418	0.1	98	0.20	0.04	2.21	814
DA #2 - Good Condition Grass Cover	B	583076	13.4	61	6.39	1.28	0.18	8674
DA #2 - Impervious Area - Paved	B	1489864	34.2	98	0.20	0.04	2.21	274520
DA #2 - Impervious Area - Gravel	B	311221	7.1	85	1.76	0.35	1.13	29329
DA #2 - Good Condition Grass Cover	C	1059982	24.3	74	3.51	0.70	0.57	50774
DA #2 - Impervious Area - Paved	C	266727	6.1	98	0.20	0.04	2.21	49147
DA #2 - Impervious Area - Gravel	C	612395	14.1	89	1.24	0.25	1.40	71567
DA #2 - 20% Impervious Area = Good Condition Grass Cover	A	1104	0.0	39	15.64	3.13	0.03	3
DA #2 - 20% Impervious Area = Good Condition Grass Cover	B	450271	10.3	61	6.39	1.28	0.18	6698
DA #2 - 20% Impervious Area = Good Condition Grass Cover	C	219781	5.0	74	3.51	0.70	0.57	10528
Subtotal DA#2		**5024524**	**115**					**502121**
DA #3 - Good Condition Grass Cover	C	749604	17.2	74	3.51	0.70	0.57	35906
DA #3 - Impervious Area - Paved	C	198841	4.6	98	0.20	0.04	2.21	36638
DA #3 - Impervious Area - Gravel	C	58709	1.3	89	1.24	0.25	1.40	6861
DA #3 - 20% Impervious Area = Good Condition Grass Cover	C	64387	1.5	90	1.11	0.22	1.48	7928
Subtotal DA#3		**1071541**	**25**					**87333**
DA #3a - Good Condition Grass Cover	A	121745	2.8	39	15.64	3.13	0.03	321
DA #3a - Impervious Area - Paved	A	19790	0.5	98	0.20	0.04	2.21	3646
DA #3a - Impervious Area - Gravel	A	14919	0.3	76	3.16	0.63	0.66	819
DA #3a - 20% Impervious Area = Good Condition Grass Cover	A	8677	0.2	39	15.64	3.13	0.03	23
Subtotal DA#3a		**165131**	**4**					**4809**
DA #4 - Good Condition Grass Cover	A	283140	6.5	39	15.64	3.13	0.03	747
DA #4 - 20% Impervious Area = Good Condition Grass Cover	A	70785	1.6	39	15.64	3.13	0.03	187

Subtotal DA#4		**353925**	**8**					**934**
DA #5 - Good Condition Grass Cover	A	994895	22.8	39	15.64	3.13	0.03	2626
DA #5 - Impervious Area - Paved	A	124888	2.9	98	0.20	0.04	2.21	23012
DA #5 - Good Condition Grass Cover	B	37007	0.8	61	6.39	1.28	0.18	551
DA #5 - Impervious Area - Paved	B	15605	0.4	98	0.20	0.04	2.21	2875
DA #5 - Good Condition Grass Cover	C	1844788	42.4	74	3.51	0.70	0.57	88366
DA #5 - Impervious Area - Paved	C	137254	3.2	98	0.20	0.04	2.21	25290
DA #5 - 20% Impervious Area = Good Condition Grass Cover	A	31222	0.7	39	15.64	3.13	0.03	82
DA #5 - 20% Impervious Area = Good Condition Grass Cover	B	3901	0.1	61	6.39	1.28	0.18	58
DA #5 - 20% Impervious Area = Good Condition Grass Cover	C	34312	0.8	74	3.51	0.70	0.57	1644
Subtotal DA#5		**3223872**	**74**					**144504**
DA #6 - Good Condition Grass Cover	B	163717	3.8	61	6.39	1.28	0.18	2436
DA #6 - Impervious Area - Paved	B	6049	0.1	98	0.20	0.04	2.21	1115
DA #6 - Good Condition Grass Cover	C	647270	14.9	74	3.51	0.70	0.57	31005
DA #6 - Impervious Area - Gravel	C	6118	0.1	89	1.24	0.25	1.40	715
DA #6 - Impervious Area - Paved	C	28559	0.7	98	0.20	0.04	2.21	5262
DA #6 - 20% Impervious Area = Good Condition Grass Cover	B	1512	0.0	61	6.39	1.28	0.18	22
DA #6 - 20% Impervious Area = Good Condition Grass Cover	C	8669	0.2	74	3.51	0.70	0.57	415
Subtotal DA#6		**861894**	**20**					**40970**
DA OUT - Good Condition Grass Cover	A	102685	2.4	39	15.64	3.13	0.03	271
DA OUT - Impervious Area - Paved	A	27845	0.6	98	0.20	0.04	2.21	5131
DA OUT - Good Condition Grass Cover	B	163186	3.7	61	6.39	1.28	0.18	2428
DA OUT - Impervious Area - Paved	B	13810	0.3	98	0.20	0.04	2.21	2545
DA OUT - Good Condition Grass Cover	C	226859	5.2	74	3.51	0.70	0.57	10867
DA OUT - Impervious Area - Paved	C	45612	1.0	98	0.20	0.04	2.21	8404
DA OUT - Impervious Area - Gravel	C	27458	0.6	89	1.24	0.25	1.40	3209
DA OUT - 20% Impervious Area = Good Condition Grass Cover	A	6961	0.2	39	15.64	3.13	0.03	18
DA OUT - 20% Impervious Area = Good Condition Grass Cover	B	3453	0.1	61	6.39	1.28	0.18	51
DA OUT - 20% Impervious Area = Good Condition Grass Cover	C	18268	0.4	74	3.51	0.70	0.57	875
Subtotal DA OUT		**636137**	**15**					**33799**
TOTAL:		**16155883**	**371**					**1193887**

Developed Conditions:

Proposed Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (ft^3)
DA #1 - Impervious Area - Paved	B	77181	1.8	98	0.204	0.041	2.21	14221
DA #1 - Impervious Area - Gravel	B	334699	7.7	85	1.765	0.353	1.13	31542
DA #1 - Impervious Area - Paved	C	1875723	43.1	98	0.204	0.041	2.21	345618
DA #1 - Impervious Area - Gravel	C	2531255	58.1	89	1.236	0.247	1.40	295814
Subtotal DA#1		**4818858**	**111**					**687194**
DA #2 - Impervious Area - Paved	A	290994	6.7	98	0.204	0.041	2.21	53618
DA #2 - Impervious Area - Gravel	A	1868300	42.9	76	3.158	0.632	0.66	102525
DA #2 - Impervious Area - Paved	B	952192	21.9	98	0.204	0.041	2.21	175449
DA #2 - Impervious Area - Gravel	B	1881880	43.2	85	1.765	0.353	1.13	177346
DA #2 - Impervious Area - Gravel	C	23563	0.5	89	1.236	0.247	1.40	2754
DA #2 - Impervious Area - Paved	C	7595	0.2	98	0.204	0.041	2.21	1399
Subtotal DA#2		**5024524**	**115**					**513091**

DA #3 - Impervious Area - Paved	C	66177	1.5	98	0.204	0.041	2.21	12194
DA #3 - Impervious Area - Gravel	C	1005364	23.1	89	1.236	0.247	1.40	117491
Subtotal DA#3		**1071541**	**25**					**129685**
DA #3a - Impervious Area - Paved	A	17322	0.4	98	0.204	0.041	2.21	3192
DA #3a - Impervious Area - Gravel	A	147809	3.4	76	3.158	0.632	0.66	8111
Subtotal DA#3a		**165131**	**4**					**11303**
DA #4 - Impervious Area - Paved	A	19045	0.4	98	0.204	0.041	2.21	3509
DA #4 - Impervious Area - Gravel	A	334880	7.7	76	3.158	0.632	0.66	18377
Subtotal DA#4		**353925**	**8**					**21886**
DA #5 - Impervious Area - Paved	A	320397	7.4	98	0.204	0.041	2.21	59036
DA #5 - Impervious Area - Gravel	A	830504	19.1	76	3.158	0.632	0.66	45575
DA #5 - Impervious Area - Paved	B	19910	0.5	98	0.204	0.041	2.21	3669
DA #5 - Impervious Area - Gravel	B	36577	0.8	85	1.765	0.353	1.13	3447
DA #5 - Impervious Area - Paved	C	885803	20.3	98	0.204	0.041	2.21	163217
DA #5 - Impervious Area - Gravel	C	1130681	26.0	89	1.236	0.247	1.40	132137
Subtotal DA#5		**3223872**	**74**					**407079**
DA #6 - Impervious Area - Paved	B	7206	0.2	98	0.204	0.041	2.21	1328
DA #6 - Impervious Area - Gravel	B	164072	3.8	85	1.765	0.353	1.13	15462
DA #6 - Impervious Area - Paved	C	39560	0.9	98	0.204	0.041	2.21	7289
DA #6 - Impervious Area - Gravel	C	651056	14.9	89	1.236	0.247	1.40	76085
Subtotal DA#6		**861894**	**20**					**100164**
DA OUT - Impervious Area - Paved	A	24578	0.6	98	0.204	0.041	2.21	20799
DA OUT - Impervious Area - Gravel	A	112879	2.6	76	3.158	0.632	0.66	1470
DA OUT - Good Condition Grass Cover	B	26780	0.6	61	6.39	1.28	0.18	398
DA OUT - Impervious Area - Paved	B	20049	0.5	98	0.204	0.041	2.21	3694
DA OUT - Impervious Area - Gravel	B	133456	3.1	85	1.765	0.353	1.13	12577
DA OUT - Impervious Area - Paved	C	33765	0.8	98	0.204	0.041	2.21	6221
DA OUT - Impervious Area - Gravel	C	284630	6.5	89	1.236	0.247	1.40	33263
Subtotal DA OUT		**636137**	**15**					**254672**
TOTAL:		**16155882**	**371**					**2125076**

2-Year Volume Increase (ft3):	931189

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = $Q = (P - 0.2S)^2 / (P + 0.8S)$ where
   P = 2-Year Rainfall (in)
   S = (1000/ CN)-10
2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI.
The use of a weighted CN value for volume calculations is not acceptable.

WORKSHEET 5 . STRUCTURAL BMP VOLUME CREDITS

PROJECT: Shell-Franklin
SUB-BASIN: Ohio River

Required Control Volume (ft^3) - *from Worksheet 4*: 931189
Non-structural Volume Credit (ft^3) - *from Worksheet 3*: - 0

Structural Volume Reqmt (ft^3) 931189
(Required Control Volume minus Non-structural Credit)

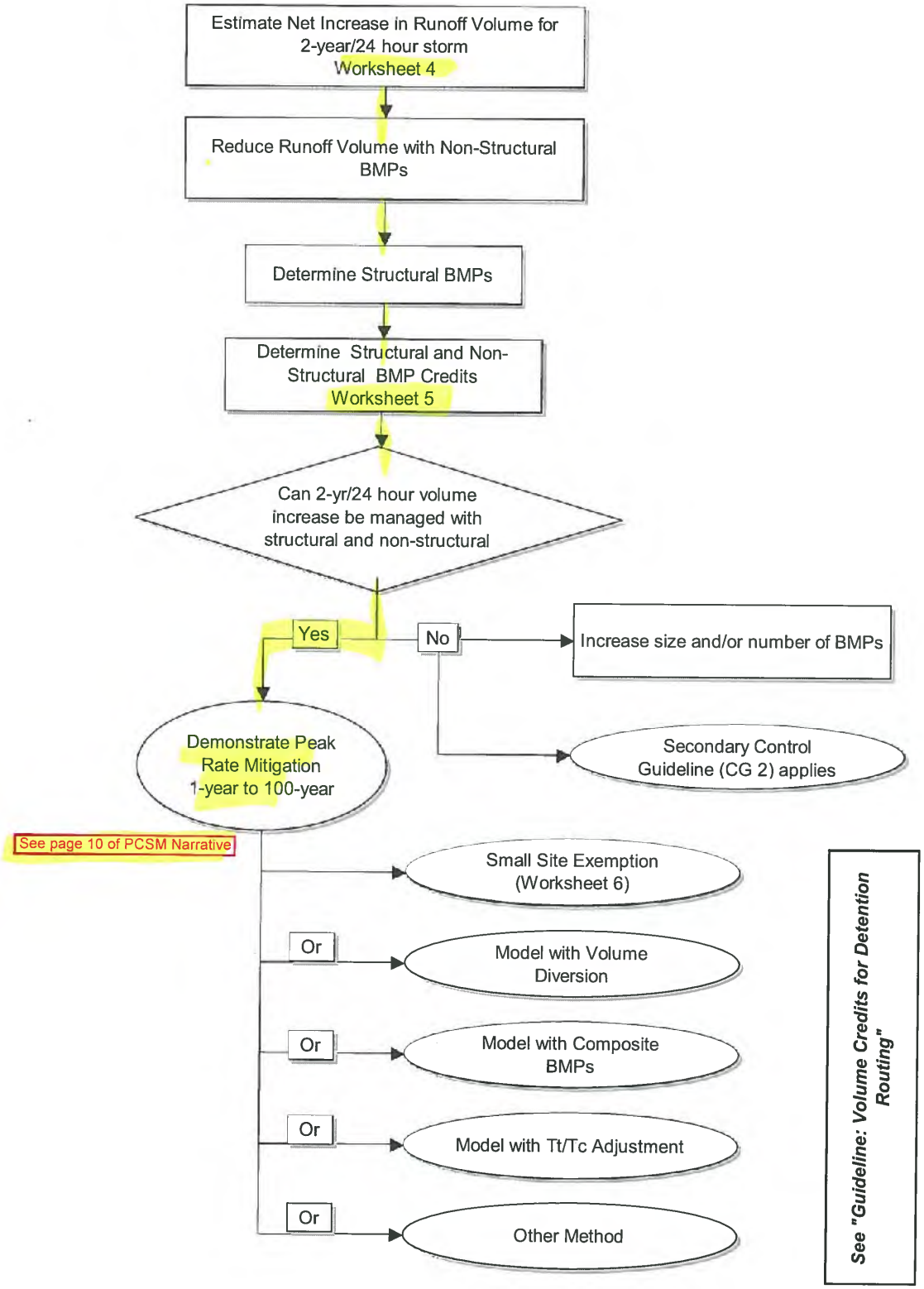
Proposed BMP		Area (ft^2)	Storage Volume (ft^3)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.6.3	Dry Extended Detention Basin	251092 *	1414716 *
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other			

Total Structural Volume (ft^3): 1414716
Structural Volume Requirement (ft^3): 931189

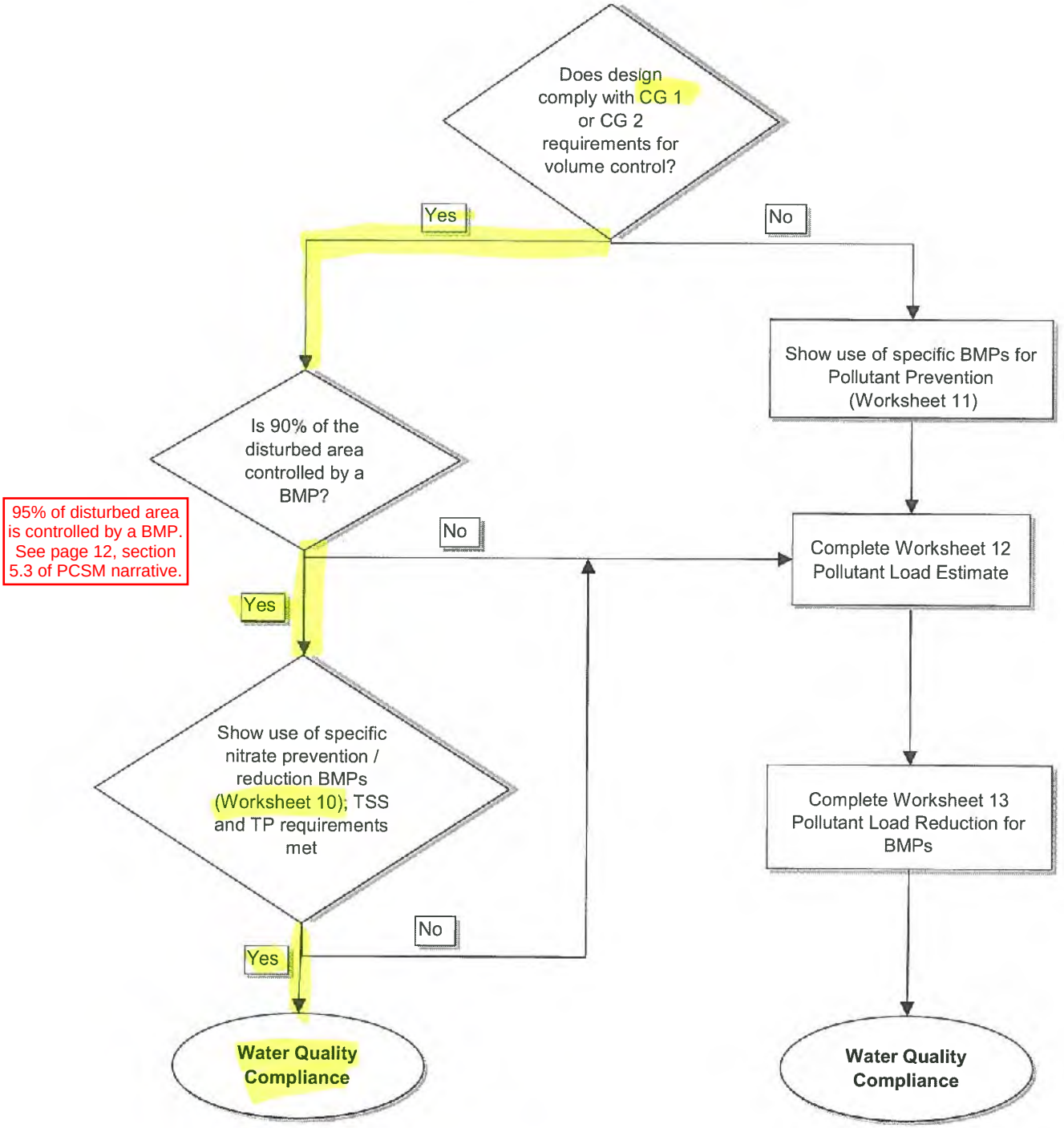
DIFFERENCE 483527

*The total area and storage volume of the ponds are based on the maximum water surface elevation in the ponds before it overflows into the weir or orifice structure. The detention pond is used to manage, not reduce, the stormwater volume.

FLOW CHART B
Control Guideline 1 Process



Flow Chart D
Water Quality Process



WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or the

PRIMARY BMPs FOR NITRATE:

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		
NS BMP 5.5.4 - Cluster Uses at Each Site		
NS BMP 5.6.1 - Minimize Total Disturbed Area		
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native Species)	X	
NS BMP 5.9.1 - Street Sweeping / Vacuuming	X	
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		

SECONDARY BMPs FOR NITRATE:

NS BMP 5.4.1 - Protect Sensitive / Special Value Features		
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features		
NS BMP 5.6.2 - Minimize Soil Compaction		
Structural BMP 6.4.5 - Rain Garden / Bioretention		
Structural BMP 6.4.8 - Vegetated Swale		
Structural BMP 6.4.9 - Vegetated Filter Strip		
Structural BMP 6.6.1 - Constructed Wetland		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		
Structural BMP 6.7.3 - Soils Amendment/Restoration		

APPENDIX E: Hydrological and Hydraulic Calculation References

Existing Areas	
Subbasin	Area (Ac)
RR 1	135.28
RR 2	62.11
RR 3	16.88
RR 4	8.66
RR 5	25.27
RR 6	15.36
RR 7	9.76
RR 8	9.20
RR 9	37.81
RR 10	86.97
RR 11	7.86
RR 12	65.63
PR 1	291.36
PR 2	201.13
PR 3	30.09
PR 4	72.45
PR 5	324.85
PR 6	55.01
PR 7	51.76
PR 8	22.33
I-376	6.97
RC1	62.31
OH1	61.13
OH2	90.48
OH3	29.39

Abbreviation	Watershed
PR	Poorhouse Run
RR	Rag Run
RC	Racoon Creek
CSX	CSX Rail
SR18	SR18 Highway

Document Path: I:\projects11\Shell_Franklin\58NQ1140\WORKFORCE\600 DISCIPLINE\606 GIS\WORKING MXDS\07232014-100% Hydrologic Exhibits\Exhibit 3- Existing Drainage Area Delineations.mxd

Exhibit 3

JACOBS

Existing Conditions Hydrology: Drainage Area Delineations

Project No.	58NQ1140	Original size	22" x 34"
Drawn By	JVK		Notes: Not intended for construction. For permit use only.
Approved By	DEC		
Revised By	JDF		
Date	10/2/2014		

N

HORSEHEAD CORPORATION

SHELL PROPOSED PETROCHEMICAL COMPLEX

Existing CN's	
Subbasin	CN
RR 1	86
RR 2	77
RR3	79
RR4	80
RR5	79
RR6	79
RR7	84
RR8	79
RR9	76
RR10	78
RR11	77
RR12	81
PR1	78
PR2	78
PR3	77
PR4	78
PR5	75
PR6	84
PR7	66
PR8	83
I-376	83
RC1	60
OH1	88
OH2	90
OH3	88

0 1,600 3,200 Feet

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Legend

Existing Drainage Area

Land Use

Green

Asphalt

Structures

Gravel

Exhibit 5	JACOBS	Existing Conditions Hydrology: Land Use and Curve Numbers	Project No. 58NQ1140	Original size 22" x 34"	N	HORSEHEAD CORPORATION	25873-001-30G-00001, Rev 001, Page 39 of 90
			Drawn By JVK	Notes: Not intended for construction. For permit use only.			SHELL PROPOSED PETROCHEMICAL COMPLEX
			Approved By DEC				
			Revised By JDF				
			Date 10/2/2014				

Proposed Drainage Areas	
Subbasin	Area (Ac)
RR 1	134.15
RR 2	61.01
RR 3	17.00
RR 4	9.74
RR 5	25.24
RR 6	10.82
RR 7	17.22
RR 9	11.13
RR 10	86.89
RR 11	7.38
RR 12	64.19
PR 1	291.03
PR 2	200.62
PR 3	30.09
PR 4	72.17
PR 5	221.04
PR 7	32.83
SR18	See Ex 8.2
Non-Process Pond	132.60
North Pond	89.38
East Pond	30.68
South Pond East	53.09
West Pond	8.20
CSX	See Ex 8.2
I376	7.75
South Pond West	20.31
RR9NE	5.88
Basin Pond	4.27
RC1	26.23

0 1,600 3,200 Feet

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Abbreviation	Watershed
PR	Poorhouse Run
RR	Rag Run
RC	Racoon Creek
CSX	CSX Rail
SR18	SR18 Highway

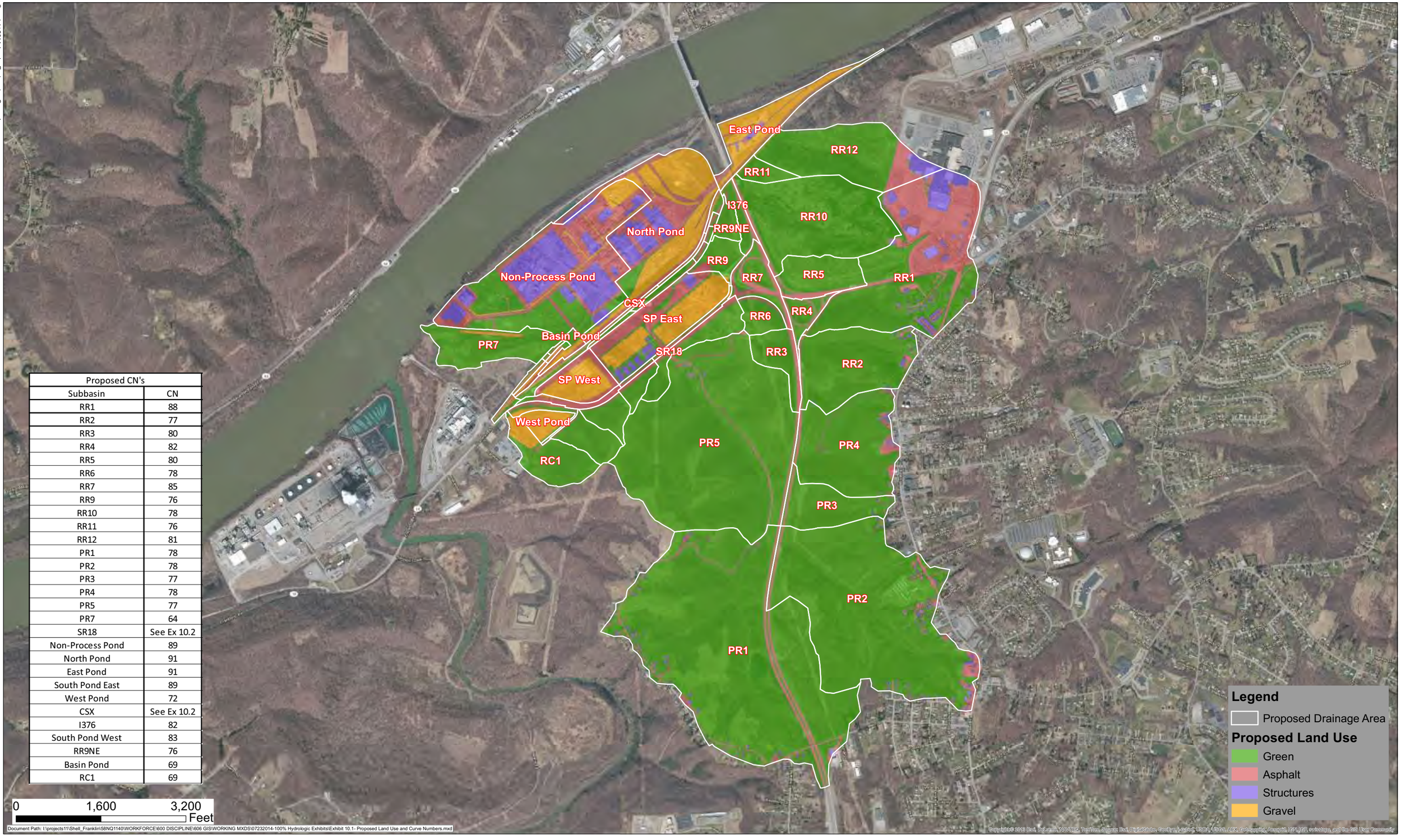
Legend

- Existing Rag Run Culvert
- Proposed Rag Run Culvert
- Rag Run Channel
- Poorhouse Run Channel
- Box Culvert Outfall Structure
- Existing Culvert
- Off-Basin Culvert
- Proposed Poorfarm Culvert
- Proposed Poorhouse Run Culvert
- Proposed Pond
- Proposed Drainage Area

Exhibit 8.1	JACOBS	**Proposed Conditions Hydrology: Drainage Area Delineations**	Project No. 58NQ1140 · Original size 22" x 34" · Drawn By JVK · Approved By DEC · Revised By JDF · Date 10/2/2014 · Notes: Not intended for construction. For permit use only.	N

HORSEHEAD CORPORATION

SHELL PROPOSED PETROCHEMICAL COMPLEX



Proposed CN's	
Subbasin	CN
RR1	88
RR2	77
RR3	80
RR4	82
RR5	80
RR6	78
RR7	85
RR9	76
RR10	78
RR11	76
RR12	81
PR1	78
PR2	78
PR3	77
PR4	78
PR5	77
PR7	64
SR18	See Ex 10.2
Non-Process Pond	89
North Pond	91
East Pond	91
South Pond East	89
West Pond	72
CSX	See Ex 10.2
I376	82
South Pond West	83
RR9NE	76
Basin Pond	69
RC1	69

Exhibit
10.1

JACOBS

Proposed Conditions Hydrology: Land Use and Curve Numbers

Project No.	58NQ1140	Original size	22" x 34"
Drawn By	JVK		Notes: Not intended for construction. For permit use only.
Approved By	DEC		
Revised By	JDF		
Date	10/2/2014		

N

HORSEHEAD CORPORATION

SHELL PROPOSED PETROCHEMICAL COMPLEX

Table 6: Existing Drainage Area Peak Flows						
Drainage Area	*Area (Ac)*	*Peak Flows (cfs)*				
		100-YR	*50-YR*	*25-YR*	*10-YR*	*2-YR*
RR12	65.63	231.7	200.9	170.7	130.1	55.6
I-376	6.97	33.6	29.4	25.3	19.6	9.1
OH1	61.13	152.6	134.2	116.2	92.2	45.8
OH2	90.48	372.2	333.4	294.7	240.3	130.9
OH3	29.3	192.5	171.7	150.9	121.6	64.4
RC1	62.31	116.5	87.8	61.8	32.6	1.8

H. Existing Site Drainage and Detention

The existing site does not detain stormwater runoff for extreme events. Internal site drainage mostly occurs through storm sewers. The existing site has three temporary holding ponds adequate to control the runoff from the 2-yr event. Runoff in excess of the 2-yr event flows uncontrolled to the Ohio River. Exhibit 7 shows the permitted stormwater outfalls for the current site.

I. PA StreamSTATS

Utilizing the PA StreamSTATS web-based GIS tool, drainage area contributing to flow in Poorhouse Run was generated. Subsequently the drainage area was used within the web-based tool to estimate peak flows using the Regression Equations per Scientific Investigations Report 2008-5102[2]. The output of the web application is included as Appendix 4. Key findings from the web-based GIS tool are outlined below:

- Drainage area delineated by the web-based GIS tool is similar to the delineation as shown in Exhibit 3 for existing Poorhouse Run and Rag Run watersheds;
- The total drainage area estimated by the program is outside the recommended range for the regression equations to be valid; and
- The 100-yr peak flow estimated by the program has a 36% prediction error. There is no justification for a direct comparison to the flows obtained by a more detailed hydrologic study.

IV. Proposed Condition Hydrology

As part of the early works preparation for the proposed project, existing drainage features and drainage areas could be impacted. The proposed condition hydrology study will establish flow rates to compare to the base condition and determine any potential impacts upstream or downstream of the project area.

[2] Issued by U.S. Geological Survey

Existing TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
1788	772.77	Channel36	194.7	1643	771.65
1643	771.65	Channel37	194.2	1540	770.67
1540	770.67	Channel38	213.3	1441	769.16
1441	769.16	Channel39	213.1	1338	766.76
1338	766.76	Culvert7	212.8	1238	764.66
1238	764.66	Channel40	212.8	1165	762.38
1165	762.38	Channel41	212.7	1118	760.98
1118	760.98	Channel42	212.5	1029	759.07
1029	759.07	Channel43	212.1	991	758.64
991	758.64	Culvert8	211.6	287	694.81
287	694.81	Channel44	233.0	161	694.10
161	694.10	Outfall			

Existing TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
1643	773.05	Channel37	453.6	1540	772.12
1540	772.12	Channel38	496.4	1441	771.11
1441	771.11	Channel39	496.1	1338	770.74
1338	770.74	Culvert7	495.9	1238	766.02
1238	766.02	Channel40	495.8	1165	763.63
1165	763.63	Channel41	495.8	1118	762.67
1118	762.67	Channel42	495.7	1029	762.19
1029	762.19	Channel43	495.2	991	762.12
991	762.12	Culvert8	494.9	287	696.14
287	696.14	Channel44	525.0	161	694.10
161	694.10	Outfall			

Existing TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
1643	774.27	Channel37	577.2	1540	773.84
1540	773.84	Channel38	624.6	1441	773.54
1441	773.54	Channel39	623.1	1338	773.43
1338	773.43	Culvert7	624.0	1238	766.49
1238	766.49	Channel40	624.1	1165	764.72
1165	764.72	Channel41	624.1	1118	764.17
1118	764.17	Channel42	624.2	1029	763.61
1029	763.61	Channel43	624.2	991	763.58
991	763.58	Culvert8	624.2	287	699.52
287	699.52	Channel44	646.3	161	699.50
161	699.50	Outfall			

Existing TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
1643	775.56	Channel37	655.5	1540	775.34
1540	775.34	Channel38	717.6	1441	775.19
1441	775.19	Channel39	713.8	1338	775.14
1338	775.14	Culvert7	711.5	1238	766.47
1238	766.47	Channel40	711.4	1165	765.42
1165	765.42	Channel41	710.7	1118	765.02
1118	765.02	Channel42	710.4	1029	764.58
1029	764.58	Channel43	710.5	991	764.56
991	764.56	Culvert8	710.6	287	700.99
287	700.99	Channel44	744.4	161	700.63
161	700.63	Outfall			

Existing TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
1643	776.84	Channel37	736.1	1540	776.71
1540	776.71	Channel38	791.2	1441	776.62
1441	776.62	Channel39	789.5	1338	776.58
1338	776.58	Culvert7	789.6	1238	767.03
1238	767.03	Channel40	789.6	1165	765.99
1165	765.99	Channel41	789.6	1118	765.67
1118	765.67	Channel42	789.4	1029	765.31
1029	765.31	Channel43	789.1	991	765.29
991	765.29	Culvert8	788.9	287	701.01
287	701.01	Channel44	822.7	161	701.00
161	701.00	Outfall			

Existing TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6229	784.13	Channel 43	257.8	6045	780.09
6045	780.09	Channel 44	257.8	5900	777.02
5900	777.02	Channel 45	258.2	5755	773.30
5755	773.30	Channel 46	258.5	5601	770.82
5601	770.82	Channel 47	258.7	5427	765.80
5427	765.80	Channel 48	258.8	5288	762.15
5288	762.15	Channel 49	258.7	5090	759.14
5090	759.14	Channel 50	258.6	4937	751.90
4937	751.90	Channel 51	258.0	4732	747.98
4732	747.98	Culvert 2	257.2	4585	743.59
4585	743.59	Channel 52	256.9	4448	741.33
4448	741.33	Channel 53	265.7	4309	738.61
4309	738.61	Channel 54	265.6	4257	736.83
4257	736.83	Culvert 3	265.4	4232	736.38
-	-	Culvert 3 Road	0.0	-	-
4232	736.38	Channel 55	265.2	4111	734.76
4111	734.76	Culvert 4	264.9	3993	730.29
3993	730.29	Channel 56	265.2	3718	726.24
3718	726.24	Channel 57	267.6	3516	722.68
3516	722.68	Channel 58	268.2	3025	714.15
3025	714.15	Channel 59	268.3	2747	710.01
2747	710.01	Channel 60	268.2	2485	702.23
2485	702.23	Channel 61	267.2	2269	700.20
2269	700.20	Channel 62	266.1	1991	697.82
1991	697.82	Channel 63	284.6	1489	693.08
1489	693.08	Channel 64	267.5	1106	693.00
1106	693.00	Outfall			

Existing TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6392	789.09	Channel 42	813.7	6229	785.91
6229	785.91	Channel 43	813.6	6045	781.60
6045	781.60	Channel 44	813.4	5900	778.17
5900	778.17	Channel 45	812.8	5755	774.49
5755	774.49	Channel 46	812.2	5601	771.77
5601	771.77	Channel 47	811.0	5427	766.95
5427	766.95	Channel 48	809.2	5288	763.37
5288	763.37	Channel 49	806.5	5090	759.97
5090	759.97	Channel 50	805.0	4937	753.33
4937	753.33	Channel 51	805.9	4732	751.14
4732	751.14	Culvert 2	808.6	4585	744.88
4585	744.88	Channel 52	809.1	4448	742.43
4448	742.43	Channel 53	840.1	4309	740.02
4309	740.02	Channel 54	844.0	4257	739.63
4257	739.63	Culvert 3	843.5	4232	739.31
-	-	Culvert 3 Road	0.0	-	-
4232	739.31	Channel 55	842.7	4111	739.10
4111	739.10	Culvert 4	841.8	3993	731.79
3993	731.79	Channel 56	841.4	3718	727.93
3718	727.93	Channel 57	856.1	3516	724.33
3516	724.33	Channel 58	854.9	3025	715.46
3025	715.46	Channel 59	852.5	2747	711.05
2747	711.05	Channel 60	850.5	2485	704.84
2485	704.84	Channel 61	850.3	2269	702.10
2269	702.10	Channel 62	852.3	1991	699.76
1991	699.76	Channel 63	858.0	1489	693.87
1489	693.87	Channel 64	858.7	1106	693.00
1106	693.00	Outfall			

Existing TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6229	786.52	Channel 43	1076.6	6045	782.08
6045	782.08	Channel 44	1078.8	5900	778.54
5900	778.54	Channel 45	1081.1	5755	774.79
5755	774.79	Channel 46	1083.4	5601	772.07
5601	772.07	Channel 47	1084.9	5427	767.32
5427	767.32	Channel 48	1086.9	5288	763.76
5288	763.76	Channel 49	1088.4	5090	760.25
5090	760.25	Channel 50	1089.0	4937	753.84
4937	753.84	Channel 51	1089.4	4732	752.49
4732	752.49	Culvert 2	1087.3	4585	745.33
4585	745.33	Channel 52	1086.9	4448	743.03
4448	743.03	Channel 53	1122.7	4309	742.49
4309	742.49	Channel 54	1115.3	4257	742.44
4257	742.44	Culvert 3	1112.5	4232	742.29
-	-	Culvert 3 Road	0.0	-	-
4232	742.29	Channel 55	1107.8	4111	742.23
4111	742.23	Culvert 4	1104.8	3993	732.30
3993	732.30	Channel 56	1105.4	3718	728.42
3718	728.42	Channel 57	1123.8	3516	724.76
3516	724.76	Channel 58	1125.4	3025	715.86
3025	715.86	Channel 59	1126.4	2747	711.47
2747	711.47	Channel 60	1126.8	2485	705.58
2485	705.58	Channel 61	1126.8	2269	702.70
2269	702.70	Channel 62	1126.7	1991	700.24
1991	700.24	Channel 63	1131.4	1489	698.61
1489	698.61	Channel 64	1131.6	1106	698.00
1106	698.00	Outfall			

Existing TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6229	787.15	Channel 43	1417.4	6045	782.60
6045	782.60	Channel 44	1418.7	5900	778.91
5900	778.91	Channel 45	1419.7	5755	775.14
5755	775.14	Channel 46	1420.4	5601	772.31
5601	772.31	Channel 47	1420.7	5427	767.70
5427	767.70	Channel 48	1420.4	5288	764.14
5288	764.14	Channel 49	1418.7	5090	760.54
5090	760.54	Channel 50	1417.3	4937	754.62
4937	754.62	Channel 51	1399.9	4732	753.90
4732	753.90	Culvert 2	1390.7	4585	746.54
4585	746.54	Channel 52	1384.9	4448	746.07
4448	746.07	Channel 53	1407.9	4309	746.00
4309	746.00	Channel 54	1370.9	4257	745.99
4257	745.99	Culvert 3	1360.0	4232	745.67
-	-	Culvert 3 Road	0.0	-	-
4232	745.67	Channel 55	1341.4	4111	745.65
4111	745.65	Culvert 4	1333.8	3993	732.68
3993	732.68	Channel 56	1333.8	3718	728.81
3718	728.81	Channel 57	1356.7	3516	725.09
3516	725.09	Channel 58	1357.0	3025	716.15
3025	716.15	Channel 59	1356.7	2747	711.81
2747	711.81	Channel 60	1356.2	2485	706.12
2485	706.12	Channel 61	1354.9	2269	703.11
2269	703.11	Channel 62	1353.7	1991	700.61
1991	700.61	Channel 63	1358.7	1489	698.60
1489	698.60	Channel 64	1358.6	1106	698.00
1106	698.00	Outfall			

Existing TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6229	787.60	Channel 43	1717.8	6045	782.99
6045	782.99	Channel 44	1714.2	5900	779.12
5900	779.12	Channel 45	1711.1	5755	775.41
5755	775.41	Channel 46	1711.0	5601	772.50
5601	772.50	Channel 47	1714.0	5427	767.99
5427	767.99	Channel 48	1717.7	5288	764.43
5288	764.43	Channel 49	1721.2	5090	760.77
5090	760.77	Channel 50	1723.2	4937	755.79
4937	755.79	Channel 51	1715.3	4732	755.36
4732	755.36	Culvert 2	1706.7	4585	749.42
4585	749.42	Channel 52	1681.8	4448	749.33
4448	749.33	Channel 53	1671.6	4309	749.31
4309	749.31	Channel 54	1587.9	4257	749.31
4257	749.31	Culvert 3	1567.1	4232	748.78
-	-	Culvert 3 Road	37.4	-	-
4232	748.78	Channel 55	1528.5	4111	748.78
4111	748.78	Culvert 4	1513.4	3993	732.95
3993	732.95	Channel 56	1512.8	3718	729.10
3718	729.10	Channel 57	1541.4	3516	725.36
3516	725.36	Channel 58	1540.4	3025	716.33
3025	716.33	Channel 59	1539.2	2747	712.05
2747	712.05	Channel 60	1538.3	2485	706.51
2485	706.51	Channel 61	1538.9	2269	703.41
2269	703.41	Channel 62	1539.6	1991	700.90
1991	700.90	Channel 63	1548.2	1489	700.08
1489	700.08	Channel 64	1548.6	1106	700.00
1106	700.00	Outfall			

Table 9: Proposed Drainage Area Peak Flows						
Drainage Area	*Area (Ac)*	*Peak Flows (cfs)*				
		100-YR	*50-YR*	*25-YR*	*10-YR*	*2-YR*
PR 1	291.03	591.25	499.85	413.13	302.56	110.58
PR 2	200.62	490.15	416.59	345.93	254.65	94.57
PR 3	30.09	91.51	77.94	64.78	47.57	17.40
PR 4	72.17	300.77	257.46	215.07	160.29	62.55
PR 5	221.04	514.95	435.23	359.32	261.91	93.10
PR 7	32.83	50.38	39.42	29.41	17.71	2.33
RR 1	134.15	393.11	346.95	301.82	240.54	121.05
RR 2	61.01	96.58	80.85	66.07	47.61	16.44
RR 3	17.00	55.05	47.45	40.07	30.27	12.41
RR 4	9.74	45.77	39.88	34.05	26.17	11.81
RR 5	25.24	56.72	48.42	40.47	30.23	11.96
RR 6	10.82	28.42	24.20	20.14	14.85	5.56
RR 7	17.22	87.50	77.18	66.88	52.70	25.86
RR 9	11.13	43.40	36.79	30.43	22.24	7.93
RR 10	86.89	182.52	154.51	127.79	93.64	34.33
RR 11	7.38	20.13	17.02	14.03	10.19	3.53
RR 12	64.19	226.61	196.50	166.92	127.25	54.34
I-376	7.75	33.63	29.36	25.12	19.37	8.64
RR 9 NE	5.88	22.93	19.44	16.08	11.75	4.19
SR18-1	5.22	35.20	31.91	28.59	23.84	14.33
SR18-2	5.19	18.28	14.87	11.67	7.69	1.51
SR18-3	14.70	56.87	47.71	39.00	27.90	9.00
SR18-4	9.96	41.64	35.56	29.61	21.80	8.16
SR18-5	1.36	9.63	8.67	7.70	6.33	3.65
SR18-6	6.35	26.18	22.41	18.79	14.00	5.44
SR18-7	3.19	21.45	19.33	17.20	14.17	8.18
SR18-8	19.43	90.94	78.27	65.83	49.33	20.08
NON-PROCESS POND	102.15	33.90	20.77	12.42	6.06	0.00
NORTH POND	110.80	59.50	50.99	41.54	25.42	0.00
SOUTH POND - WEST	20.30	N/A	N/A	N/A	N/A	N/A
SOUTH POND - EAST	53.16	217.21	158.19	108.56	52.49	0.00

Proposed TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	US Node H	Channel ID	Channel Q	DS Node	DS Node H
	ft		cfs		ft
6737	905.55	Channel 1	120.5	6681	900.06
6681	900.06	Channel 2	120.4	6569	894.97
6569	894.97	Channel 3	120.2	6437	888.52
6437	888.52	Channel 4	119.9	6364	887.11
6364	887.11	Channel 5	120.1	6275	882.99
6275	882.99	Culvert 1	119.6	5899	864.80
5899	864.80	Channel 6	119.6	5816	860.56
5816	860.56	Channel 7	122.5	5744	858.94
5744	858.94	Channel 8	152.9	5707	858.84
5707	858.84	Channel 9	152.8	5650	856.65
5650	856.65	Culvert 2	153.4	4878	831.17
4878	831.17	Channel 10	158.7	4772	827.50
4772	827.50	Channel 11	158.8	4677	824.38
4677	824.38	Channel 12	163.4	4595	821.35
4595	821.35	Channel 13	163.4	4493	818.81
4493	818.81	Channel 14	163.6	4443	818.75
4443	818.75	Culvert 3	163.9	4015	808.08
4015	808.08	Channel 15	164.2	3896	805.53
3896	805.53	Channel 16	166.3	3773	803.34
3773	803.34	Channel 17	166.3	3634	797.80
3634	797.80	Box Culv 1	164.4	RR MH1	774.85
RR MH1	774.85	Box Culv 2	164.0	RR MH2	774.12
RR MH2	774.12	Box Culv 3	164.0	RR MH3	773.37
RR MH3	773.37	Box Culv 4	164.5	RR MH4	772.73
RR MH4	772.73	Box Culv 5	165.5	2346	772.28
2346	772.28	Channel 18	168.9	2257	772.27
2257	772.27	Culvert 4	169.0	2033	767.68
2033	767.68	Channel 19	202.8	1974	767.48
1974	767.48	Channel 20	204.7	1896	767.18
1896	767.18	Channel 21	204.7	1790	766.25
1790	766.25	Channel 22	204.7	1644	764.97
1644	764.97	Channel 23	204.8	1541	764.15
1541	764.15	Channel 24	223.6	1442	763.24
1442	763.24	Channel 25	223.7	1353	762.38
1353	762.38	Channel 26	223.8	1235	760.69
1235	760.69	Channel 27	223.9	1166	760.66
1166	760.66	Channel 28	223.8	1119	760.56
1119	760.56	Channel 29	223.6	1030	760.51
1030	760.51	Channel 30	223.3	1001	760.50
1001	760.50	Culvert 6a	223.0	RRO MH1	746.92
RRO MH1	746.92	Culvert 6b	222.9	RRO MH2	745.08
RRO MH2	745.08	Culvert 6c	222.5	RRO MH3	701.19
RRO MH3	701.19	Culvert 6d	222.5	Culvert HW	701.00
Culvert HW	701.00	Channel 31	222.5	213	701.00
213	701.00	Channel 32	222.5	160	701.00
160	701.00	Channel 33	222.5	95	701.00
95	701.00	Outfall			

Proposed TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	US Node H	Channel ID	Channel Q	DS Node	DS Node H
	ft		cfs		ft
6737	906.45	Channel 1	239.7	6681	900.83
6681	900.83	Channel 2	241.4	6569	895.55
6569	895.55	Channel 3	239.7	6437	889.40
6437	889.40	Channel 4	239.1	6364	887.03
6364	887.03	Channel 5	238.9	6275	885.23
6275	885.23	Culvert 1	238.0	5899	865.45
5899	865.45	Channel 6	237.7	5816	861.26
5816	861.26	Channel 7	245.2	5744	859.54
5744	859.54	Channel 8	328.2	5707	859.35
5707	859.35	Channel 9	328.5	5650	859.07
5650	859.07	Culvert 2	329.1	4878	831.62
4878	831.62	Channel 10	340.9	4772	827.91
4772	827.91	Channel 11	340.9	4677	824.81
4677	824.81	Channel 12	352.7	4595	821.79
4595	821.79	Channel 13	352.8	4493	821.38
4493	821.38	Channel 14	353.1	4443	821.35
4443	821.35	Culvert 3	353.4	4015	808.62
4015	808.62	Channel 15	353.5	3896	806.03
3896	806.03	Channel 16	359.3	3773	803.64
3773	803.64	Channel 17	359.3	3634	800.35
3634	800.35	Box Culv 1	356.0	RR MH1	777.49
RR MH1	777.49	Box Culv 2	355.3	RR MH2	777.04
RR MH2	777.04	Box Culv 3	358.0	RR MH3	776.53
RR MH3	776.53	Box Culv 4	360.3	RR MH4	775.87
RR MH4	775.87	Box Culv 5	362.9	2346	775.22
2346	775.22	Channel 18	370.9	2257	775.22
2257	775.22	Culvert 4	372.2	2033	769.05
2033	769.05	Channel 19	463.1	1974	768.88
1974	768.88	Channel 20	468.3	1896	768.57
1896	768.57	Channel 21	468.3	1790	767.67
1790	767.67	Channel 22	468.2	1644	766.52
1644	766.52	Channel 23	468.0	1541	765.85
1541	765.85	Channel 24	519.8	1442	765.23
1442	765.23	Channel 25	518.8	1353	764.82
1353	764.82	Channel 26	517.2	1235	764.49
1235	764.49	Channel 27	515.2	1166	764.40
1166	764.40	Channel 28	513.8	1119	764.37
1119	764.37	Channel 29	512.2	1030	764.34
1030	764.34	Channel 30	512.4	1001	764.34
1001	764.34	Culvert 6a	512.4	RRO MH1	750.45
RRO MH1	750.45	Culvert 6b	512.4	RRO MH2	748.27
RRO MH2	748.27	Culvert 6c	532.8	RRO MH3	702.09
RRO MH3	702.09	Culvert 6d	532.8	Culvert HW	701.00
Culvert HW	701.00	Channel 31	532.8	213	701.00
213	701.00	Channel 32	532.8	160	701.00
160	701.00	Channel 33	532.8	95	701.00
95	701.00	Outfall			

Proposed TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	US Node H	Channel ID	Channel Q	DS Node	DS Node H
	ft		cfs		ft
6737	906.78	Channel 1	301.3	6681	901.14
6681	901.14	Channel 2	301.1	6569	895.86
6569	895.86	Channel 3	300.6	6437	889.61
6437	889.61	Channel 4	300.5	6364	887.21
6364	887.21	Channel 5	299.8	6275	886.28
6275	886.28	Culvert 1	298.5	5899	865.71
5899	865.71	Channel 6	298.1	5816	861.54
5816	861.54	Channel 7	308.0	5744	860.48
5744	860.48	Channel 8	422.1	5707	860.41
5707	860.41	Channel 9	422.4	5650	860.32
5650	860.32	Culvert 2	422.6	4878	831.90
4878	831.90	Channel 10	437.9	4772	828.12
4772	828.12	Channel 11	437.9	4677	824.98
4677	824.98	Channel 12	453.8	4595	822.83
4595	822.83	Channel 13	453.7	4493	822.68
4493	822.68	Channel 14	453.3	4443	822.66
4443	822.66	Culvert 3	453.2	4015	808.77
4015	808.77	Channel 15	453.1	3896	806.22
3896	806.22	Channel 16	460.6	3773	803.75
3773	803.75	Channel 17	460.5	3634	801.49
3634	801.49	Box Culv 1	455.9	RR MH1	780.65
RR MH1	780.65	Box Culv 2	456.7	RR MH2	779.87
RR MH2	779.87	Box Culv 3	456.8	RR MH3	778.85
RR MH3	778.85	Box Culv 4	457.0	RR MH4	777.75
RR MH4	777.75	Box Culv 5	460.1	2346	776.69
2346	776.69	Channel 18	469.6	2257	776.69
2257	776.69	Culvert 4	470.4	2033	769.68
2033	769.68	Channel 19	593.9	1974	769.53
1974	769.53	Channel 20	601.3	1896	769.25
1896	769.25	Channel 21	601.6	1790	768.52
1790	768.52	Channel 22	601.9	1644	767.78
1644	767.78	Channel 23	602.3	1541	767.44
1541	767.44	Channel 24	672.3	1442	767.18
1442	767.18	Channel 25	670.3	1353	767.03
1353	767.03	Channel 26	667.7	1235	766.90
1235	766.90	Channel 27	665.0	1166	766.86
1166	766.86	Channel 28	663.0	1119	766.84
1119	766.84	Channel 29	662.6	1030	766.83
1030	766.83	Channel 30	662.9	1001	766.83
1001	766.83	Culvert 6a	663.0	RRO MH1	752.12
RRO MH1	752.12	Culvert 6b	663.1	RRO MH2	749.92
RRO MH2	749.92	Culvert 6c	699.6	RRO MH3	702.90
RRO MH3	702.90	Culvert 6d	699.6	Culvert HW	701.01
Culvert HW	701.01	Channel 31	699.5	213	701.01
213	701.01	Channel 32	699.6	160	701.01
160	701.01	Channel 33	699.6	95	701.00
95	701.00	Outfall			

Proposed TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	US Node H	Channel ID	Channel Q	DS Node	DS Node H
	ft		cfs		ft
6737	907.01	Channel 1	346.6	6681	901.33
6681	901.33	Channel 2	346.4	6569	896.11
6569	896.11	Channel 3	345.6	6437	889.70
6437	889.70	Channel 4	345.6	6364	887.59
6364	887.59	Channel 5	344.2	6275	887.01
6275	887.01	Culvert 1	342.6	5899	865.88
5899	865.88	Channel 6	342.3	5816	861.72
5816	861.72	Channel 7	353.9	5744	861.30
5744	861.30	Channel 8	493.2	5707	861.26
5707	861.26	Channel 9	493.2	5650	861.21
5650	861.21	Culvert 2	493.1	4878	832.07
4878	832.07	Channel 10	511.1	4772	828.32
4772	828.32	Channel 11	511.1	4677	825.11
4677	825.11	Channel 12	530.1	4595	823.68
4595	823.68	Channel 13	529.6	4493	823.59
4493	823.59	Channel 14	528.5	4443	823.58
4443	823.58	Culvert 3	527.9	4015	808.88
4015	808.88	Channel 15	527.6	3896	806.35
3896	806.35	Channel 16	536.6	3773	803.82
3773	803.82	Channel 17	536.4	3634	802.32
3634	802.32	Box Culv 1	533.3	RR MH1	784.91
RR MH1	784.91	Box Culv 2	534.0	RR MH2	783.77
RR MH2	783.77	Box Culv 3	534.1	RR MH3	782.25
RR MH3	782.25	Box Culv 4	534.2	RR MH4	780.60
RR MH4	780.60	Box Culv 5	537.9	2346	778.97
2346	778.97	Channel 18	547.7	2257	778.96
2257	778.96	Culvert 4	548.3	2033	770.35
2033	770.35	Channel 19	696.7	1974	770.23
1974	770.23	Channel 20	704.9	1896	770.02
1896	770.02	Channel 21	704.6	1790	769.52
1790	769.52	Channel 22	703.9	1644	769.10
1644	769.10	Channel 23	702.9	1541	768.91
1541	768.91	Channel 24	778.7	1442	768.78
1442	768.78	Channel 25	774.9	1353	768.70
1353	768.70	Channel 26	770.2	1235	768.63
1235	768.63	Channel 27	768.5	1166	768.61
1166	768.61	Channel 28	767.5	1119	768.60
1119	768.60	Channel 29	766.3	1030	768.59
1030	768.59	Channel 30	764.6	1001	768.59
1001	768.59	Culvert 6a	763.9	RRO MH1	753.87
RRO MH1	753.87	Culvert 6b	763.8	RRO MH2	750.90
RRO MH2	750.90	Culvert 6c	805.9	RRO MH3	704.09
RRO MH3	704.09	Culvert 6d	805.9	Culvert HW	701.99
Culvert HW	701.99	Channel 31	805.9	213	701.01
213	701.01	Channel 32	805.9	160	701.01
160	701.01	Channel 33	806.0	95	701.00
95	701.00	Outfall			

Proposed TUFLOW Hydraulic Model Results

TUFLOW Results					
US Node	US Node H	Channel ID	Channel Q	DS Node	DS Node H
	ft		cfs		ft
6737	907.22	Channel 1	392.8	6681	901.51
6681	901.51	Channel 2	392.6	6569	896.33
6569	896.33	Channel 3	392.1	6437	889.81
6437	889.81	Channel 4	391.9	6364	888.09
6364	888.09	Channel 5	389.6	6275	887.71
6275	887.71	Culvert 1	387.7	5899	866.04
5899	866.04	Channel 6	388.0	5816	862.49
5816	862.49	Channel 7	403.1	5744	862.11
5744	862.11	Channel 8	565.8	5707	862.09
5707	862.09	Channel 9	564.6	5650	862.06
5650	862.06	Culvert 2	563.8	4878	832.24
4878	832.24	Channel 10	584.5	4772	828.47
4772	828.47	Channel 11	584.5	4677	825.28
4677	825.28	Channel 12	606.8	4595	824.89
4595	824.89	Channel 13	602.8	4493	824.68
4493	824.68	Channel 14	596.5	4443	824.64
4443	824.64	Culvert 3	597.0	4015	808.99
4015	808.99	Channel 15	597.6	3896	806.45
3896	806.45	Channel 16	606.6	3773	803.89
3773	803.89	Channel 17	606.7	3634	803.22
3634	803.22	Box Culv 1	603.8	RR MH1	788.05
RR MH1	788.05	Box Culv 2	603.6	RR MH2	786.60
RR MH2	786.60	Box Culv 3	603.5	RR MH3	784.67
RR MH3	784.67	Box Culv 4	603.4	RR MH4	782.56
RR MH4	782.56	Box Culv 5	607.9	2346	780.39
2346	780.39	Channel 18	618.6	2257	780.39
2257	780.39	Culvert 4	618.3	2033	771.44
2033	771.44	Channel 19	792.6	1974	771.37
1974	771.37	Channel 20	801.5	1896	771.25
1896	771.25	Channel 21	800.1	1790	770.99
1790	770.99	Channel 22	798.1	1644	770.78
1644	770.78	Channel 23	795.6	1541	770.69
1541	770.69	Channel 24	883.4	1442	770.63
1442	770.63	Channel 25	877.9	1353	770.59
1353	770.59	Channel 26	871.2	1235	770.55
1235	770.55	Channel 27	868.2	1166	770.53
1166	770.53	Channel 28	866.4	1119	770.53
1119	770.53	Channel 29	864.0	1030	770.52
1030	770.52	Channel 30	860.9	1001	770.52
1001	770.52	Culvert 6a	861.1	RRO MH1	755.69
RRO MH1	755.69	Culvert 6b	861.8	RRO MH2	751.76
RRO MH2	751.76	Culvert 6c	903.0	RRO MH3	704.83
RRO MH3	704.83	Culvert 6d	903.0	Culvert HW	701.03
Culvert HW	701.03	Channel 31	903.0	213	701.01
213	701.01	Channel 32	903.0	160	701.01
160	701.01	Channel 33	903.0	95	701.00
95	701.00	Outfall			

Proposed TUFLOW Hydraulic Model Results

TUFLOW Main Channel Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
6034	783.85	Channel 43	245.3	5850	780.30
5850	780.30	Channel 44	244.7	5794	780.27
5794	780.27	Box Culv 1	245.8	PR MH 1	772.37
PR MH 1	772.37	Box Culv 2	246.0	PR MH 2	765.52
PR MH 2	765.52	Box Culv 3	245.8	PR MH 3	753.48
PR MH 3	753.48	Box Culv 4	245.7	PR MH 4	752.44
PR MH 4	752.44	Box Culv 5	245.8	PR MH 5	747.27
PR MH 5	747.27	Box Culv 6	245.2	PR MH 6	740.46
PR MH 6	740.46	Box Culv 7	244.4	PR MH 7	732.33
PR MH 7	732.33	Box Culv 8	249.5	Headwall	721.07
Headwall	721.07	Headwall	263.6	Basin US	710.17
Basin US	710.17	Basin	251.1	Basin DS	710.15
Basin DS	710.15	Orifice	243.4	Tran US	709.96
-	-	Weir	6.60	-	-
Tran US	709.96	Transition	247.5	Tran DS	709.96
Tran DS	709.96	Channel 64	250.6	2747	709.94
2747	709.94	Channel 65	250.0	2485	702.11
2485	702.11	Channel 66	250.8	2269	700.45
2269	700.45	Channel 67	250.9	1991	700.04
1991	700.04	Channel 68	251.1	1489	700.00
1489	700.00	Channel 69	251.2	1106	700.00
1106	700.00	Outfall			
TUFLOW PoorFarm Culvert Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
OBL MH 3	752.74	OB 1	8.1	OBL MH 2	750.92
OBL MH 2	750.92	OB 2	8.3	OBL MH 1	750.45
OBL MH 1	750.45	OB 3	10.4	PF MH 5	750.36
PFL MH 3	768.62	PFL 2	13.9	PF MH 4	755.29
Inlet 62	762.40	PFL 1a	0.7	Inlet 69	752.85
Inlet 69	752.85	PFL 1b	0.8	PF MH 9	746.04
PF MH 3	759.27	PF 1	17.3	PF MH 4	755.29
PF MH 4	755.29	PF 2	28.4	PF MH 5	750.36
PF MH 5	750.36	PF 3	39.7	PF MH 6	750.03
PF MH 6	750.03	PF 4	40.2	PF MH 7	749.60
PF MH 7	749.60	PF 5	42.5	PF MH 8	749.15
PF MH 8	749.15	PF 6	41.6	PF MH 9	746.04
PF MH 9	746.04	PF 7	40.3	PF BEND	745.22
PF BEND	745.22	PF 8	41.4	PF MH 10	744.50
PF MH 10	744.50	PF 9	42.9	PR MH 7	732.33
PR MH 7	732.33				

Proposed TUFLOW Hydraulic Model Results

6034	786.06	Channel 43	743.5	5850	784.95
5850	784.95	Channel 44	744.4	5794	784.95
5794	784.95	Box Culv 1	743.8	PR MH 1	777.03
PR MH 1	777.03	Box Culv 2	743.1	PR MH 2	770.18
PR MH 2	770.18	Box Culv 3	742.3	PR MH 3	758.77
PR MH 3	758.77	Box Culv 4	792.8	PR MH 4	757.50
PR MH 4	757.50	Box Culv 5	792.9	PR MH 5	752.34
PR MH 5	752.34	Box Culv 6	792.8	PR MH 6	745.54
PR MH 6	745.54	Box Culv 7	793.1	PR MH 7	737.57
PR MH 7	737.57	Box Culv 8	821.7	Headwall	722.83
Headwall	722.83	Headwall	781.9	Basin US	711.74
Basin US	711.74	Basin	831.9	Basin DS	711.86
Basin DS	711.86	Orifice	533.8	Tran US	711.02
-	-	Weir	290.1	-	-
Tran US	711.02	Transition	824.4	Tran DS	711.01
Tran DS	711.01	Channel 64	823.3	2747	710.95
2747	710.95	Channel 65	822.7	2485	704.78
2485	704.78	Channel 66	828.2	2269	702.04
2269	702.04	Channel 67	825.3	1991	700.32
1991	700.32	Channel 68	825.5	1489	700.03
1489	700.03	Channel 69	826.2	1106	700.00
1106	700.00	Outfall			

TUFLOW PoorFarm Culvert Results

US Node	US Node H	Channel ID	Channel Q	DS Node	DS Node H
	ft		cfs		ft
OBL MH 3	754.08	OB 1	34.6	OBL MH 2	753.04
OBL MH 2	753.04	OB 2	36.2	OBL MH 1	752.91
OBL MH 1	752.91	OB 3	42.5	PF MH 5	752.77
PFL MH 3	769.16	PFL 2	23.5	PF MH 4	756.59
Inlet 62	763.01	PFL 1a	4.1	Inlet 69	753.59
Inlet 69	753.59	PFL 1b	4.7	PF MH 9	748.06
PF MH 3	760.49	PF 1	52.7	PF MH 4	756.59
PF MH 4	756.59	PF 2	74.1	PF MH 5	752.77
PF MH 5	752.77	PF 3	111.4	PF MH 6	752.26
PF MH 6	752.26	PF 4	114.5	PF MH 7	751.51
PF MH 7	751.51	PF 5	119.4	PF MH 8	751.04
PF MH 8	751.04	PF 6	124.5	PF MH 9	748.06
PF MH 9	748.06	PF 7	129.1	PF BEND	747.20
PF BEND	747.20	PF 8	128.6	PF MH 10	746.48
PF MH 10	746.48	PF 9	131.3	PR MH 7	737.57
PR MH 7	737.57				

Proposed TUFLOW Hydraulic Model Results

6034	787.73	Channel 43	985.3	5850	787.34
5850	787.34	Channel 44	984.3	5794	787.34
5794	787.34	Box Culv 1	984.8	PR MH 1	779.43
PR MH 1	779.43	Box Culv 2	984.6	PR MH 2	772.57
PR MH 2	772.57	Box Culv 3	984.1	PR MH 3	762.94
PR MH 3	762.94	Box Culv 4	1057.4	PR MH 4	760.51
PR MH 4	760.51	Box Culv 5	1058.5	PR MH 5	755.36
PR MH 5	755.36	Box Culv 6	1058.7	PR MH 6	748.56
PR MH 6	748.56	Box Culv 7	1058.9	PR MH 7	740.74
PR MH 7	740.74	Box Culv 8	1084.5	Headwall	723.42
Headwall	723.42	Headwall	1030.8	Basin US	712.39
Basin US	712.39	Basin	1097.7	Basin DS	712.56
Basin DS	712.56	Orifice	619.6	Tran US	711.44
-	-	Weir	466.1	-	-
Tran US	711.44	Transition	1085.4	Tran DS	711.44
Tran DS	711.44	Channel 64	1085.8	2747	711.37
2747	711.37	Channel 65	1096.8	2485	705.62
2485	705.62	Channel 66	1111.4	2269	702.66
2269	702.66	Channel 67	1111.5	1991	700.52
1991	700.52	Channel 68	1111.8	1489	700.04
1489	700.04	Channel 69	1112.6	1106	700.00
1106	700.00	Outfall			

TUFLOW PoorFarm Culvert Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
OBL MH 3	754.96	OB 1	51.5	OBL MH 2	754.56
OBL MH 2	754.56	OB 2	53.0	OBL MH 1	754.26
OBL MH 1	754.26	OB 3	58.9	PF MH 5	753.95
PFL MH 3	769.40	PFL 2	28.3	PF MH 4	757.18
Inlet 62	763.31	PFL 1a	6.7	Inlet 69	753.96
Inlet 69	753.96	PFL 1b	7.7	PF MH 9	749.03
PF MH 3	761.06	PF 1	75.1	PF MH 4	757.18
PF MH 4	757.18	PF 2	101.1	PF MH 5	753.95
PF MH 5	753.95	PF 3	147.0	PF MH 6	753.28
PF MH 6	753.28	PF 4	151.1	PF MH 7	752.39
PF MH 7	752.39	PF 5	157.5	PF MH 8	751.82
PF MH 8	751.82	PF 6	166.9	PF MH 9	749.03
PF MH 9	749.03	PF 7	177.5	PF BEND	748.19
PF BEND	748.19	PF 8	178.9	PF MH 10	747.53
PF MH 10	747.53	PF 9	186.9	PR MH 7	740.74
PR MH 7	740.74				

Proposed TUFLOW Hydraulic Model Results

6034	790.49	Channel 43	1228.8	5850	790.38
5850	790.38	Channel 44	1190.7	5794	790.38
5794	790.38	Box Culv 1	1192.1	PR MH 1	782.47
PR MH 1	782.47	Box Culv 2	1192.1	PR MH 2	775.62
PR MH 2	775.62	Box Culv 3	1192.1	PR MH 3	768.12
PR MH 3	768.12	Box Culv 4	1284.9	PR MH 4	764.12
PR MH 4	764.12	Box Culv 5	1286.4	PR MH 5	759.20
PR MH 5	759.20	Box Culv 6	1290.1	PR MH 6	752.22
PR MH 6	752.22	Box Culv 7	1290.1	PR MH 7	744.73
PR MH 7	744.73	Box Culv 8	1329.5	Headwall	723.90
Headwall	723.90	Headwall	1370.4	Basin US	713.03
Basin US	713.03	Basin	1323.5	Basin DS	713.16
Basin DS	713.16	Orifice	684.2	Tran US	711.83
-	-	Weir	644.0	-	-
Tran US	711.83	Transition	1329.3	Tran DS	711.83
Tran DS	711.83	Channel 64	1329.2	2747	711.76
2747	711.76	Channel 65	1348.3	2485	706.39
2485	706.39	Channel 66	1362.7	2269	703.13
2269	703.13	Channel 67	1362.7	1991	700.74
1991	700.74	Channel 68	1364.4	1489	700.07
1489	700.07	Channel 69	1366.2	1106	700.00
1106	700.00	Outfall			

TUFLOW PoorFarm Culvert Results					
US Node	**US Node H**	**Channel ID**	**Channel Q**	**DS Node**	**DS Node H**
	ft		**cfs**		**ft**
OBL MH 3	757.00	OB 1	63.1	OBL MH 2	756.40
OBL MH 2	756.40	OB 2	65.2	OBL MH 1	755.99
OBL MH 1	755.99	OB 3	71.9	PF MH 5	755.61
PFL MH 3	769.59	PFL 2	31.6	PF MH 4	757.58
Inlet 62	763.52	PFL 1a	8.8	Inlet 69	754.24
Inlet 69	754.24	PFL 1b	10.2	PF MH 9	749.57
PF MH 3	761.44	PF 1	92.7	PF MH 4	757.58
PF MH 4	757.58	PF 2	122.2	PF MH 5	755.61
PF MH 5	755.61	PF 3	186.6	PF MH 6	754.34
PF MH 6	754.34	PF 4	191.7	PF MH 7	753.24
PF MH 7	753.24	PF 5	201.3	PF MH 8	752.40
PF MH 8	752.40	PF 6	196.1	PF MH 9	749.57
PF MH 9	749.57	PF 7	207.2	PF BEND	748.76
PF BEND	748.76	PF 8	208.2	PF MH 10	748.11
PF MH 10	748.11	PF 9	217.2	PR MH 7	744.73
PR MH 7	744.73				

Proposed TUFLOW Hydraulic Model Results

5850	793.17	Channel 44	1337.5	5794	793.17
5794	793.17	Box Culv 1	1340.7	PR MH 1	785.52
PR MH 1	785.52	Box Culv 2	1341.3	PR MH 2	779.24
PR MH 2	779.24	Box Culv 3	1340.0	PR MH 3	773.49
PR MH 3	773.49	Box Culv 4	1448.0	PR MH 4	768.87
PR MH 4	768.87	Box Culv 5	1465.9	PR MH 5	763.83
PR MH 5	763.83	Box Culv 6	1469.9	PR MH 6	756.26
PR MH 6	756.26	Box Culv 7	1466.3	PR MH 7	747.91
PR MH 7	747.91	Box Culv 8	1496.3	Headwall	724.22
Headwall	724.22	Headwall	1525.7	Basin US	713.38
Basin US	713.38	Basin	1480.4	Basin DS	713.56
Basin DS	713.56	Orifice	722.6	Tran US	712.09
-	-	Weir	771.8	-	-
Tran US	712.09	Transition	1491.9	Tran DS	712.09
Tran DS	712.09	Channel 64	1491.7	2747	712.01
2747	712.01	Channel 65	1523.6	2485	706.77
2485	706.77	Channel 66	1545.8	2269	703.42
2269	703.42	Channel 67	1544.9	1991	700.90
1991	700.90	Channel 68	1545.0	1489	700.08
1489	700.08	Channel 69	1544.6	1106	700.00
1106	700.00	Outfall			

TUFLOW PoorFarm Culvert Results

US Node	US Node H	Channel ID	Channel Q	DS Node	DS Node H
	ft		cfs		ft
OBL MH 3	761.37	OB 1	76.4	OBL MH 2	760.43
OBL MH 2	760.43	OB 2	79.9	OBL MH 1	759.63
OBL MH 1	759.63	OB 3	88.8	PF MH 5	758.82
PFL MH 3	769.78	PFL 2	35.0	PF MH 4	759.12
Inlet 62	763.74	PFL 1a	11.1	Inlet 69	754.52
Inlet 69	754.52	PFL 1b	12.8	PF MH 9	750.84
PF MH 3	761.81	PF 1	111.0	PF MH 4	759.12
PF MH 4	759.12	PF 2	130.0	PF MH 5	758.82
PF MH 5	758.82	PF 3	213.3	PF MH 6	757.23
PF MH 6	757.23	PF 4	220.0	PF MH 7	755.46
PF MH 7	755.46	PF 5	228.1	PF MH 8	754.44
PF MH 8	754.44	PF 6	236.1	PF MH 9	750.84
PF MH 9	750.84	PF 7	248.7	PF BEND	749.89
PF BEND	749.89	PF 8	248.6	PF MH 10	748.86
PF MH 10	748.86	PF 9	258.3	PR MH 7	747.91
PR MH 7	747.91				

APPENDIX F: Detention Pond Plans

0 150 300 600 Feet
SCALE: 1"=300'

OHIO RIVER

C720

EAST RR DETENTION POND

NORTH DETENTION POND

PROPOSED RAG RUN OUTFALL SEE SHEET C632

C710

PROCESS DETENTION POND

C730

NON - PROCESS DETENTION POND

PROPOSED BASIN

PROPOSED POORFARM RUN CULVERT

C760

PROPOSED RAG RUN CULVERT REPLACEMENT

C740

C750

EXISTING SR-18

PROPOSED RAG RUN CULVERT

WEST DETENTION POND

SOUTH DETENTION POND

PROPOSED POORHOUSE RUN CULVERT

PROPOSED SR-18

EXISTING RAG RUN

EXISTING POORHOUSE RUN

ENTIRE SHEET UPDATED 1

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JACOBS
JACOBS ENGINEERING GROUP, INC.
5995 ROGERDALE ROAD
HOUSTON, TEXAS 77072
281.351.6000

SHELL CHEMICALS
FRANKLIN PROJECT
MONACA, PENNSYLVANIA

DETENTION POND OVERALL

MVH	10/19/15	58NQ1160	S2001	MVH	10/19/15	IFC, UPDATED ENTIRE SHEET	2	INITIALS-	DATE
MVH	09/18/14	58NQ1160	S2001	MVH	09/18/14	ISSUED FOR CONSTRUCTION	1	DWN BY AQR/JDZ	10-16-15
BY	DATE	ESTIMATE	B.M.	BY	DATE	DESCRIPTION	SYMBOL	CHKD BY TDP	10-16-15
APPROVED		JOB		REVISIONS				APRVD BY RJA	10-16-15
								SUPERVISOR MVH	10-16-15

SCALE 1" = 300'
SHELL DOC NO. GM1-102-E0000-CX-4038-00087
GRID NUMBER | DRAWING NUMBER C700 | REV NO 1

E. Chemical Injection

APPENDIX D

NALCO Water
An Ecolab Company

1601 W. DIEHL ROAD
NAPERVILLE, IL 60563-1198

Date: June 28, 2024

To: Garrett Brewer, Kapil Dwivedi, Chris Dorogy, John Roble, Steve Oberhofer

CC: Josh Sutter, Brian Graham

From: Lee Baughman – Area Manager, Nalco Water

Re: Nalco Water's Treatment Recommendations for Permanent WWT Project

BACKGROUND

Nalco Water appreciates the opportunity to partner with Shell Monaca for the permanent wastewater expansion project. Effective primary treatment is essential for preparing wastewater for biological treatment and meeting environmental permit limits. Shell Monaca's new plant design is a substantial upgrade from the current temporary facilities and will provide reliable oil & grease and VOC removal in normal operating conditions, as well as more robust handling of upset ECU process water.

Nalco has intermittently treated the temporary flotation units with coagulant and flocculant chemistries, utilizing products that were already on the SPM additive permit. Despite using temporary injection equipment and chemistry that was not fully optimized, these temporary systems improve O&G and turbidity removal and more recently were utilized to significantly clean up the off-spec Alpha FEOR tank.

Evaluating the full Nalco Water product line to determine optimal chemistries and utilizing properly designed and automated feed systems will greatly improve the performance of the Settlement Drum and DNF flotation units.

PERMANENT WWT PLANT DESIGN

The new plant design separately processes the ECU wastewater stream which is the primary source of hydrocarbons entering the WWT plant. ECU process wastewater flow is typically 30-40 m^3/hr, consisting of:

- 16-24 m^3/hr V-13031 dilution steam separator blowdown
- 13-14 m^3/hr V-18233 furnace boiler blowdown
- < 1 m^3/hr quench tower bottoms blowdown
- Intermittent system slop

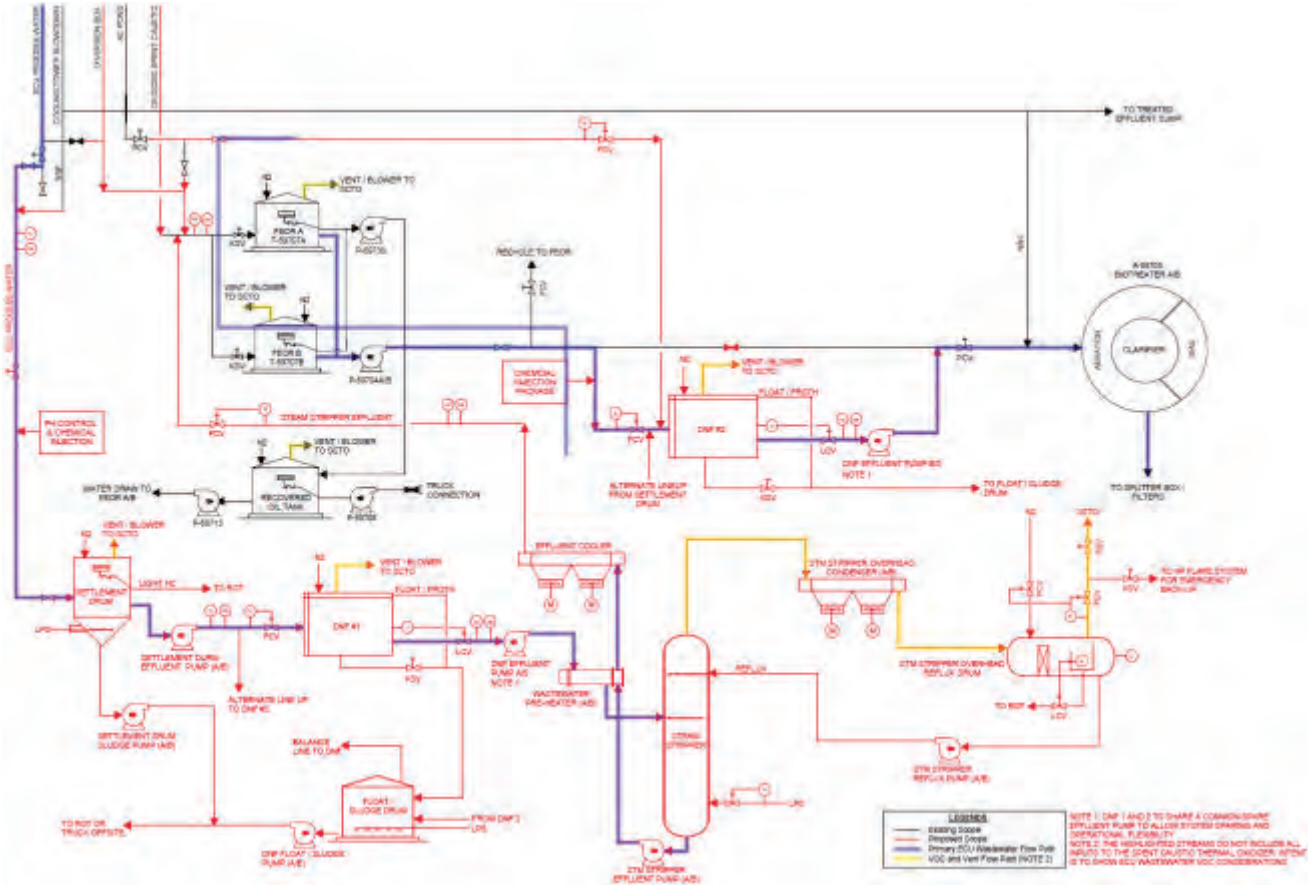
NALCO Water
An Ecolab Company

1601 W. DIEHL ROAD
NAPERVILLE, IL 60563-1198

In the new WWT plant, the ECU wastewater will first enter a Settlement Drum designed to provide the retention time to separate and remove both heavy and light oils from the process water. Light oil will be skimmed off to the Recovered Oil Tank (ROT) and settled material will be pumped to the ROT. The effluent Settlement Drum water will then be processed by a Dissolved Nitrogen Flotation (DNF1) unit. DNF1 effluent water is further treated in a Steam Stripper unit to strip volatile components from the liquid stream prior to entering the FEOR equalization tanks.

FEOR tank effluent will be composed of the treated ECU process water plus oxidized spent caustic, AC pond and diversion box water. This blended stream will then be processed by a second DNF (DNF2).

Under normal conditions, one FEOR will be filled from the various WWT streams while the other is being emptied and processed by DNF2. Both FEOR's will have the ability to be lined up to DNF1 for reprocessing off-spec wastewater.



Proposed Permanent WWT PFD

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CHEMICAL TESTING SUMMARY

Nalco tested a range of products on multiple dates and during a variety of conditions for the process water leaving ECU battery limits (197QP-607). The process water quality has ranged from a viscous yellow emulsion to a lower turbidity sample with dispersed, soluble hydrocarbon. Turbidity ranged from 20 to over 1,000 NTU.

Comprehensive wastewater polymer testing evaluates the entire Nalco product line to first determine which class of products provides the strongest response. From there, similar products are tested to determine the optimal chemistry and dosages for the application.

Product Name	Type	Basic Chemistry
8187	Inorganic Coagulant	ACH
8105	Organic Coagulant	EPIDMA
8103	Organic Coagulant	DADMAC
8176	Blended Coagulant	ACH + EPIDMA
8185	Blended Coagulant	ACH + EPIDMA
8177	Blended Coagulant	ACH + DADMAC
8186	Blended Coagulant	ACH + DADMAC
4954	Blended Coagulant	ACH + DADMAC
DT-9472	Blended Coagulant	ACH + Starch
8140	Blended Coagulant	PACl + EPIDMA
EC2059A	W/O Emulsion Breaker	Organic sulfonic acid
9969	W/O Emulsion Breaker	Heavy Aromatic Naphtha
71700	W/O Emulsion Breaker	Ethoxylated Olyl Amine

Nalco Coagulants Tested on ECU Process Water

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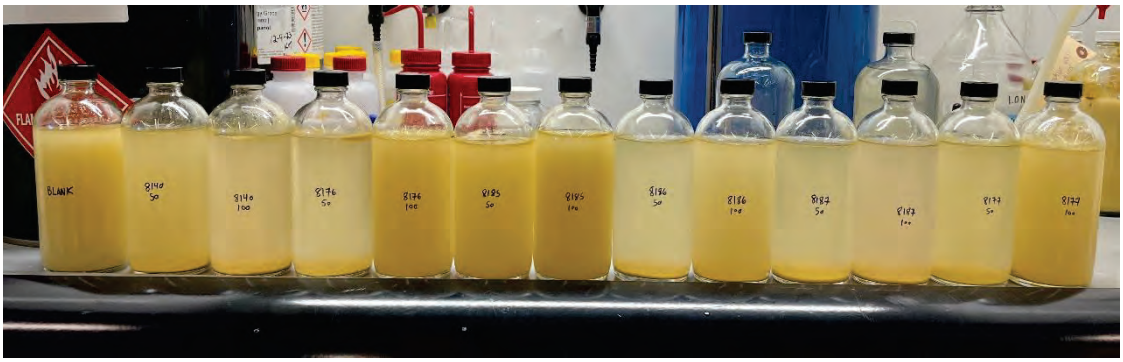
Nalco products containing ACH (aluminum chlorohydrate) and ACH/organic blends provided excellent performance cleaning up the ECU process water. Nalco 8187 consistently provided the best results in all conditions and was quickly brought to site during the testing process to be utilized in the temporary systems.

5/22/24 – Coagulant Product Line Screening



5/31/24 – ACH & ACH/Organic Coagulant Screening

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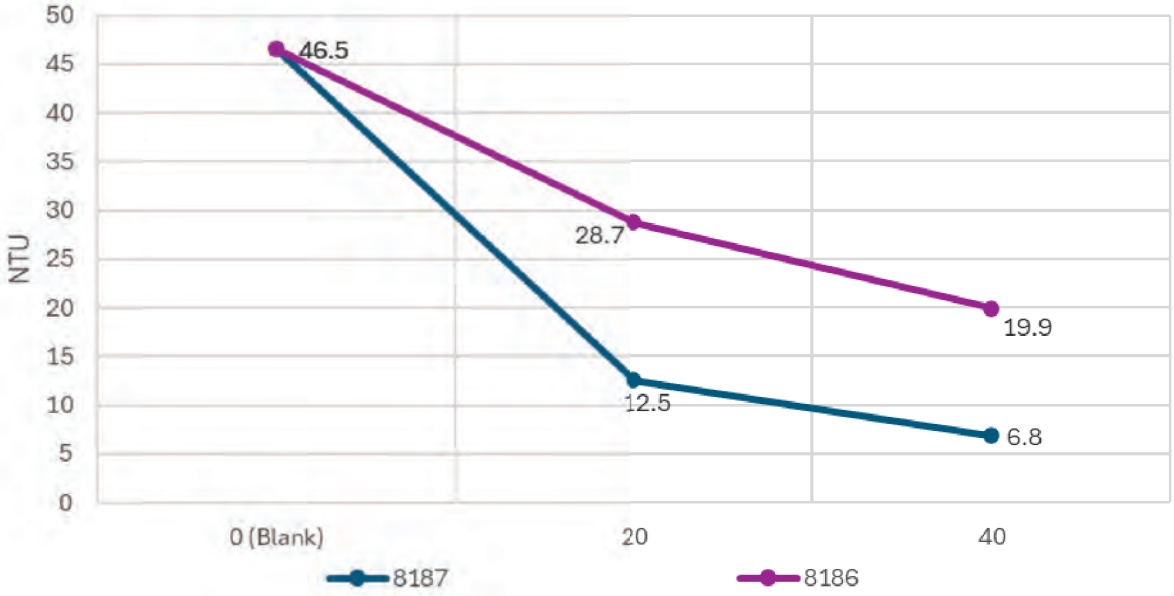
6/13/24 - Nalco 8186 & 8187 Coagulant Testing



6/13/24 - Nalco 8186 & 8187 Coagulant Testing

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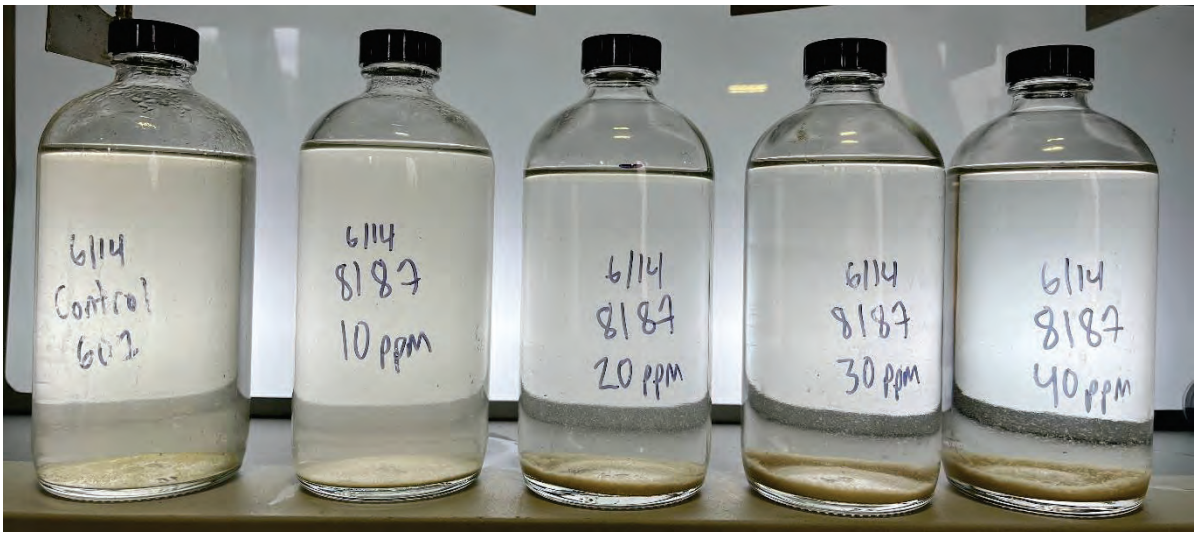
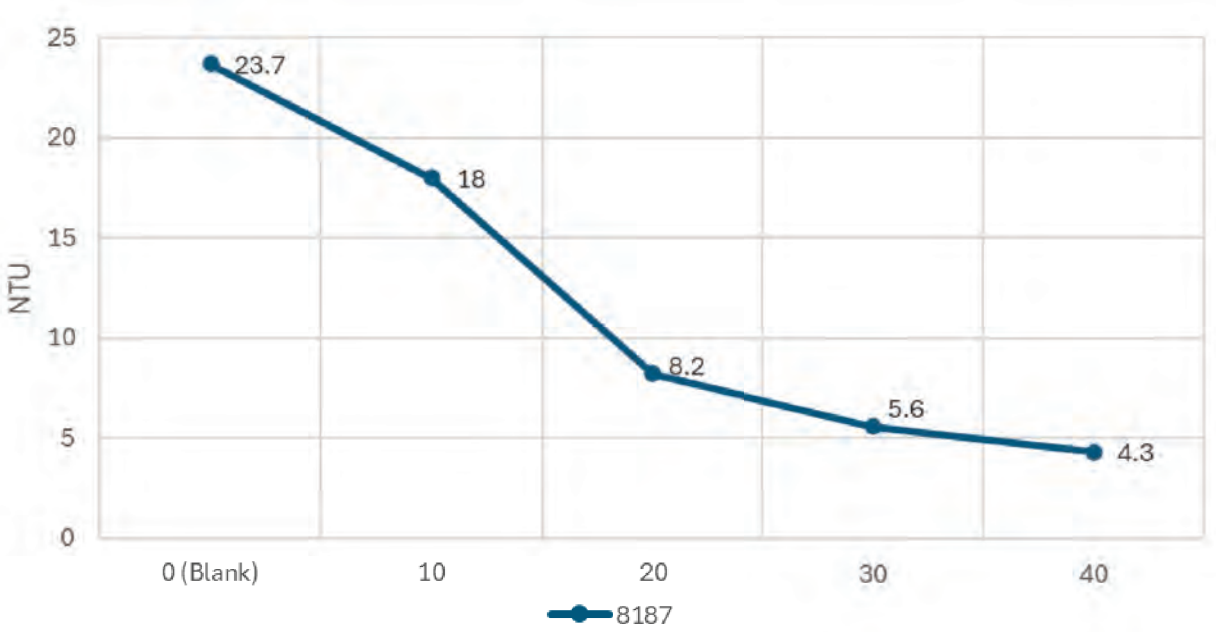


6/14/24 - Nalco 8187 Coagulant Dosage Testing



6/14/24 - Nalco 8187 Coagulant Dosage Testing

Free oil and water gravity separation is typically the first process equipment utilized when treating oily wastewater streams. After free oil separation, the free oil ideally will have been removed to a level such that the remaining emulsified oil can be removed by dissolved air flotation (or similar equipment). DAF or DNF flotation units are utilized at nearly every Downstream (refinery and petrochemical) facility processing oily

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wastewater, followed by biological treatment of the water. The majority of Downstream wastewater plants utilize a two-chemical approach for flotation units – coagulant followed by a flocculant. The addition of polymers improves flotation by increasing the size of the particles in the waste, increasing the rise rate and increased the robustness of the float.

Nalco tested numerous flocculants across various charge strength, molecular weight, and degree of structuring. Selection is made based on the speed of floc formation, robustness of the floc and the clarity of the resulting water.

Product Name	Type	% Charge	Molecular Weight
7768	Anionic Flocculant	30	Very V. High
7767	Anionic Flocculant	50	V. High
71305	Cationic Flocculant	10	V. High
71303	Cationic Flocculant	30	V. High
7196	Cationic Flocculant	30	High
7751	Cationic Flocculant	35	Medium
71301	Cationic Flocculant	50	V. High
71321	Cationic Flocculant	50	High
7194	Cationic Flocculant	50	High
71306	Cationic Flocculant	65	V. High
7752	Cationic Flocculant	85	Medium

Nalco Flocculants Tested with 8187 Coagulant

Nalco 71305 and 7768 flocculants both provided very strong performance and would be excellent options for the Settlement Drum and DNF applications. Both products formed the most robust floc and also had the lowest turbidity after settling.

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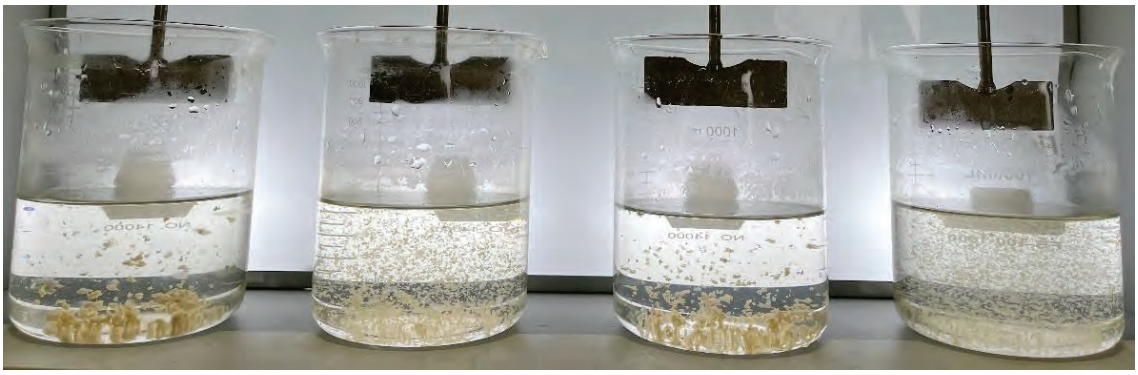
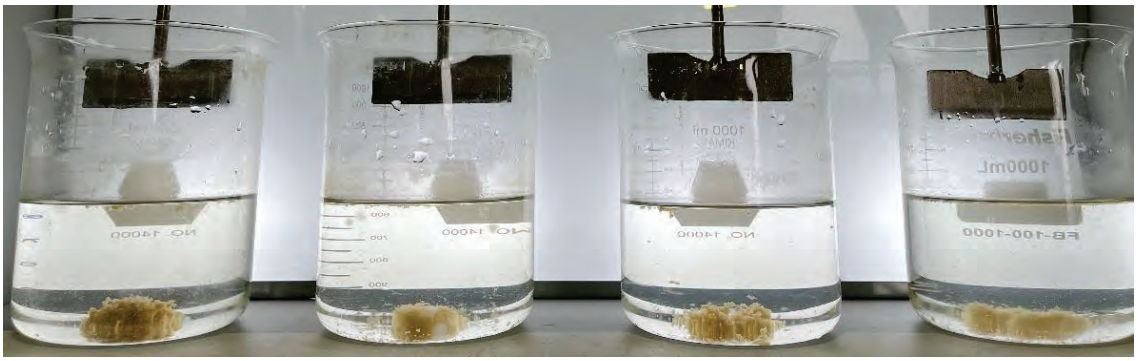
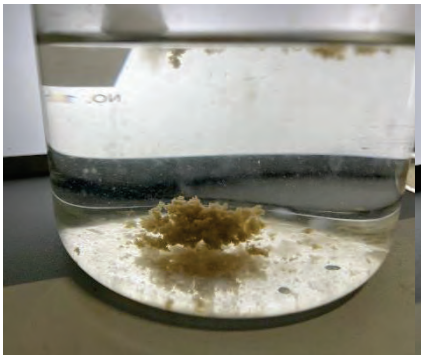
The following photos represent further testing of 7768, 71303, and 71305 compared to the current 71306 product:



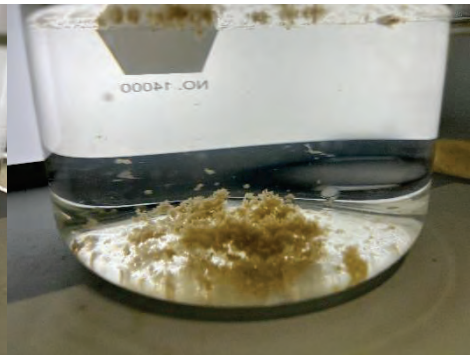
8187 +5 ppm Flocculant immediately post-mixing (L-R: 7768, 71303, 71305, 71306)



8187 +5 ppm Flocculant after 4-min settling (L-R: 7768, 71303, 71305, 71306)



8187+7768 Floc



8187+71305 Floc

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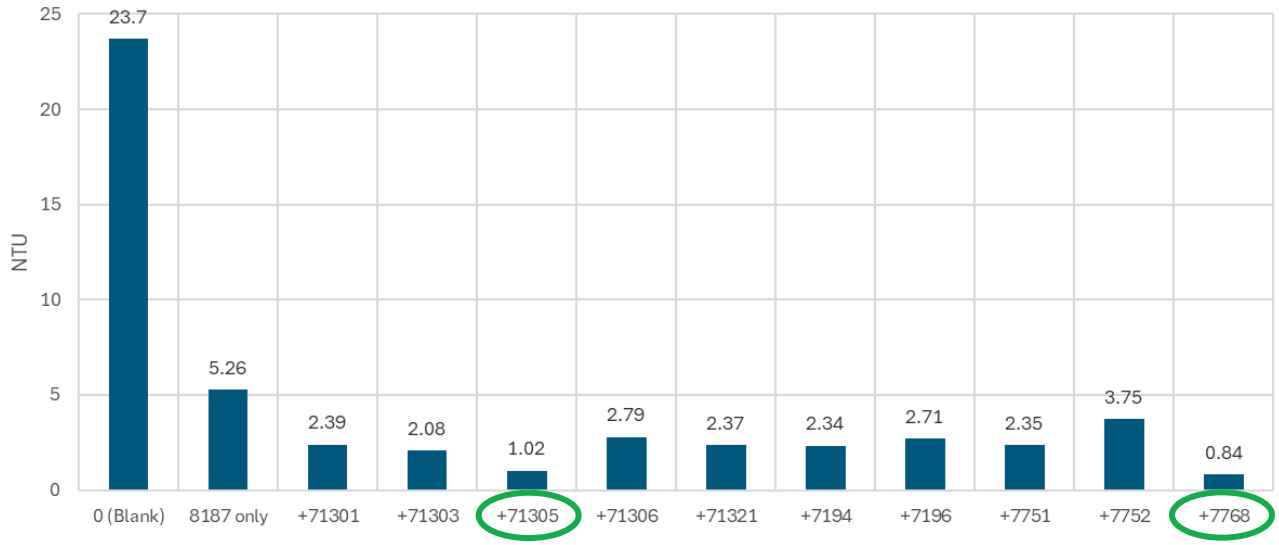

30 ppm Nalco 8187 Coagulant +5 ppm Various Flocculants

SETTLEMENT DRUM TREATMENT RECOMMENDATIONS

Application	Product	Process Flow (m3/hr)	Dosage Range (ppm)	Average Dosage (ppm)	Average Usage (GPD)	Cost/lb	Annual Costs
Settlement Drum	8187 Coagulant	30	10-60	30	4.2	$0.78	$13,410.22
Settlement Drum	7768 Flocculant	30	2-6	3	0.5	$1.26	$2,001.32

Nalco recommends treatment of the settlement drum with 8187 coagulant and 7768 flocculant. The 8187 coagulant has already been adopted on site after showing significant improvement compared to the temporary 8140 coagulant. Nalco 7768 provided the most robust floc and has the additional benefits of PADEP approval and already being used at several locations at SPM. It is also the most cost-efficient option when compared to other viable flocculant options 71305 and 71306.

Reverse emulsion breakers were tested in combination with various coagulants. The results were not definitively supportive of immediately implementing reverse EB treatment prior to the coagulant. However, accommodations could be made to quickly implement a program based on long-term evaluation of Settlement Drum performance and process water conditions. This could include providing the future injection location, space for feed systems and potentially the injection equipment.

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Due to its' high basicity, Nalco 8187 can be effectively used over a wide pH range of 5-10. The pH of the ECU process water at 197QP-607 has consistently measured in the 8.20-9.40 range (after temperature compensation). 197QI-600A analyzer pH also shows a consistent 8.0-9.50 pH range. Under the conditions observed to date, Nalco does not anticipate the need for routine pH adjustment. However, if the process water is consistently above a pH of 10, the addition of acid could be utilized to target and maintain a more neutral pH of 5.5-7.5. A low pH limit of 4 is typically used to minimize corrosion rates. Based on historical pH to date, Nalco does not anticipate the need for caustic addition unless the process water changes and pH is consistently under 4-5.

Pump control of the Settlement Drum products can be DCS ppm and flow based and tied to 197FI-602, however this flowmeter will need to be cleaned and functional for reliable control.

DNF TREATMENT RECOMMENDATIONS

Application	Product	Process Flow (m3/hr)	Dosage Range (ppm)	Average Dosage (ppm)	Average Usage (GPD)	Cost/lb	Annual Costs
DNF1	8187 Coagulant	30	5-40	10	1.5	$0.78	$4,789.37
DNF1	7768 Flocculant	30	2-4	2	0.4	$1.26	$1,601.06

Application	Product	Process Flow (m3/hr)	Dosage Range (ppm)	Average Dosage (ppm)	Average Usage (GPD)	Cost/lb	Annual Costs
DNF2	8187 Coagulant	250	5-40	8	9.4	$0.78	$30,013.36
DNF2	7768 Flocculant	250	2-4	2	3	$1.26	$12,007.94

Nalco strongly recommends treating both DNF units with 8187 coagulant and 7768 flocculant. Despite the planned upgrades in equipment, influent wastewater quality in Downstream facilities is highly variable and subject to the performance of other process units. It is critical to have the ability to optimize both DNF's with chemical treatment as needed. Coagulant demand is expected to be relatively low downstream of the settlement drum. Typically, a low dosage of flocculant (around 2-3 ppm) is sufficient for improving performance of flotation units.

Both DNF control schemes should be DCS ppm and flow based, with DNF1 tied to 197FI-602 ECU process water flow (once cleaned and functional) and DNF2 tied to the biotreater inlet flow rates.

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Standardizing the chemistries for the Settlement Drum and DNF applications simplifies the storage and feed systems and minimizes both on-site inventory and handling requirements.

ANTIFOAM RECOMMENDATIONS

Application	Type	Process Flow (m3/hr)	Dosage Range (ppm)	Average Dosage (ppm)	Average Usage (GPD)	Cost/lb	Annual Costs
Antifoam (split. box)	Nalco 7473	250	1-3	1	2	$3.42	$20,978.93
Antifoam (T.E. sump)	Nalco 7473	250	1-2	1	2	$3.42	$20,978.93

Nalco 7473 antifoam has been utilized at SPM since 2022. 7473 has proven to be highly effective for both preventing and eliminating foam in the outfall. The injection was initially set up to dose the treated effluent sump (near the weir where the WWT filtered water enters the sump). Operations have since moved the injection location to the WWT filter splitter box (S-59705) and continues to tout the benefit of dosing at this location at 2-3 ppm to minimize foamy buildup at the filters. Manual dosing of Nalco 7473 is performed when foam is present in the sump or at the outfall. Adding a few ounces in the sump quickly eliminates foam in both the treated effluent sump and in the outfall.

Nalco recommends implementing proper dosing systems to minimize daily adjustments, manual dosing and to respond to changing process conditions. A 2-pump system injecting into both the filter splitter box and the treated effluent sump would provide robust foam control for the outfall and ensure environmental compliance.

Pump 1 would dose into the splitter box and could be controlled by 597FI-120 filter flow. Pump 2 would dose into the treated effluent sump at a minimum rate. This second injection discharge could also be split to inject at both the WWT filtered water and the cooling tower blowdown mixing locations, eliminating foam from both sources at minimal usage.

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NALCO PRODUCT STORAGE AND PUMP REQUIREMENTS

Product	Combined Usage (GPD)	Storage Type	Refill Frequency
8187 Coagulant	15	400-gal SS PF Tote	17 days
7768 Flocculant	4	400-gal SS PF Tote	66 days
7473 Antifoam	4	400-gal SS PF Tote	66 days

Based on the expected flow rates for the ECU process water, biotreater influent and the treated filter effluent, all three products can be stored in Nalco 400-gallon stainless steel Portafeed™ base totes and refilled with 265-gallon one-way containers (OWC).

The largest variable for usage is the coagulant demand for DNF2, based on the higher DNF2 flow rate and typical coagulant dosages. Higher coagulant dosages at DNF2 could lead to overall coagulant usage above 20 GPD and at that rate Nalco would strongly recommend moving to a bulk storage tank and receiving bulk truck deliveries.

An optional arrangement would utilize 800-gallon Hoover totes for base totes and to use Nalco Transfer Services to pump off totes into the Hoover totes as needed. This would reduce tote storage on site and eliminate the need for gravity forklift transfers. This scope and chemical pricing is not reflective in this proposal and would require further evaluation for SPM suitability.

Both 8187 coagulant and the 7473 antifoam are fed neat. 8187 coagulant should be injected via quill as far upstream in the process as possible to ensure adequate mixing. A static mixer can be utilized to achieve proper mixing if adequate distance is unavailable.

Neat polymer flocculants such as Nalco 7768 are delivered to SPM with active sites coiled and must be properly inverted prior to injection to prevent polymer overfeed. The product is not ready for application until the long polymer chains are unwound and fully dispersed in water. Nalco recommends the pre-engineered Prominent ProMix as the best-in-class polymer feeder, with three distinct mixing zones to ensure 100% activation of the polymer and reliable injection.

Prominent ProMix feeders are equipped with all necessary components for easy installation, reliable performance, and safe operation. The design incorporates an electric solenoid valve (water inlet), flow meter/switch, manually adjustable rotameters

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for primary and secondary dilution flow, peristaltic neat polymer pump, microprocessor based controller, manual ball valves, pump calibration column, PVC piping and components, and polymer mixing chamber mounted on a skid to facilitate proper mixing and delivery. Once the polymer is properly activated, it can be fed with dilution water to the Settlement Drum influent and the DNF flocculator zone. Similar to other ProMix units on site, utility water will be required to achieve final dilution between 0.1-0.5%.

With ten (10) ProMix feeders already in use at SPM, this would provide commonality for maintenance and spare parts support.

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NALCO PRODUCT INFORMATION

Product	pH	Freeze Point	Density (lbs/gal)
8187 Coagulant	3.5	23°F (-5°C)	11.215
7768 Flocculant	6.5-7.5 (1% solution)	26°F (-3°C)	8.703
7473 Antifoam	--	5°F (-15°C)	8.403

ULTRION 8187

ULTRION 8187 is a high-actives, low molecular weight liquid cationic coagulant designed for potable and non-potable water treatment applications. Can reduce or eliminate the need for pH adjustment; forms a compact, easily dewatered sludge; and functions over a pH range of 5-10. This product is resistant to chlorine and can be used in pre-chlorinated water without a reduction in activity. Principal Uses: primary and secondary clarification, municipal and industrial raw water clarification, lime softening, heavy metal removal and oily emulsions.

NALCLEAR 7768

NALCLEAR 7768 anionic flocculant is a very high molecular weight product. Uses include primary metals wastewater clarification, sludge dewatering, cold lime softening, and as a filter aid. This product functions well with all types of equipment including twin-belt presses, screw presses, dissolved air flotation/induced air flotation, plate- and-frame presses, vacuum filter presses, as well as high shear applications.

NALCO 7473

NALCO 7473 is strong general-purpose antifoam used in industrial wastewater applications. It is a 100% active concentrate defoamer with an oil-free, water-free chemistry. Being hydrocarbon oil free, the concentrates are free from hydrocarbon oil borne dioxin precursors.

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Nalco Water would like to thank you again for the opportunity to service your wastewater plant. We are confident that we have the expertise and chemistry to exceed your expectations and overcome challenges. We look forward to further discussion and answering any questions regarding this proposal.

Regards,

Lee Baughman

Area Manager – Downstream
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F. Control Philosophy

Project No.: P-00052		
WOOD No.:	100412-P00052-DC0-PHL-0002	Rev. No.: 1
Customer No.:	SPM-805-U59700-PX-5527-00001	Issue purpose: Hazop

Shell Polymers Monaca WWTU Improvement Project

Operation and Control Philosophy

Revision: 1

Date of Issue: November 06, 2024

WOOD Document Number: 100412-P00052-DC0-PHL-0002

Shell Document Number: SPM-805-U59700-PX-5527-00001

Project No.: P-00052		
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This document contains a total of 23 pages.

Rev	Date	Issued For	WOOD		Department Manager/ Technical Authority	Project Manager	Customer
			Prepared	Checked			
0	26 Jul 2024	Review	SHA	CH, PP, SP, HG	RB		
1	06 Nov 2024	Hazop	SHA	RB, SP, DC, HG	PP		

1/31/2025

Table of Contents

Tables

1 Process Information

Shell Polymers Monaca (SPM) operates a wastewater treatment plant (WWTP) at its Monaca polymer facility. The inlet to the plant comprises of Ethane Cracking Unit (ECU) wastewater, Diversion Box system water, oxidized spent caustic, and accidentally contaminated (AC) water from AC Pond. The combined wastewater contains Oil and Grease (O&G), suspended solids, VOCs, and BOD/COD. The existing facility uses gravity tank deoiling followed by conventional biological aeration treatment. Upset conditions from ECU process water and quench tower bottoms (QTB) water, indicated by high Benzene/ VOC levels, have been particularly problematic at the existing facility. Shell intends to add a new wastewater treatment unit (WWTU) to the existing facility, as a part of the Improvement Project. The project will fully reduce O&G of the WW upstream of the bio-treaters and will offer significant betterment in operability/ reliability of the WWTP.

1.1 General Description

The new facility will comprise of a Settlement Drum, two identical Dissolved Nitrogen Flotation (DNF) units, a complete steam stripper and all associated pumps, vent gas blowers, heat exchangers, and control systems. Parts of the existing piping and control systems will be modified or demolished, where necessary, to integrate the new plant with the existing facility. KSV valves will be provided to achieve various operational modes intended by SPM Operations.

Existing ECU WW piping is modified such that the WW flows to the Settlement Drum, where bulk of free oil and solids are separated from the ECU WW. Effluent from the drum is pumped to DNF-1 to be further treated for free oil and solids via nitrogen flotation. Up to 65 m3/hr of the DNF-1 effluent is pumped to a steam stripping unit where almost all its soluble VOCs and residual oil are separated. The stream stripped WW is pumped to one of the existing Flow Equalization & Oil Removal (FEOR) tanks designated to receive treated water. Excess unstripped WW as well as off-spec WW from the stripping unit will be sent to the FEOR tank designated to receive off-spec wastewater. The destination of stripped and unstripped WW can be selected to either of the existing FEORs, via KSVs.

AC Pond Water and Diversion Box Water existing routes to FEOR Tanks will be modified such that they flow to a new DNF-2 unit or to Bio-treaters using manual valve, while maintaining their existing destination to FEORs. Settlement Drum sludge will be pumped to a truck-out connection near the existing Recovered Oil Tank (ROT). Skimmed oil from the drum flows by gravity to Froth/ Sludge Drum, where skimmed oil and solids from both DNF units are stored. The combined oil and solids will be pumped to ROT.

The Settlement Drum, DNFs, and Froth/ Sludge Drum will be blanketed with nitrogen; each will have one PCV on the inlet nitrogen line and one PCV on the outlet vent line. The exiting FEOR Tanks and ROT are nitrogen blanketed; one PSV will be added on the Vent line from each FEOR Tank and the ROT. The existing WW Tanks Vent Blower will be twined to offer 100% spare unit; vent streams from Settlement Drum, DNFs, Froth/ Sludge Drum, FEOR Tanks and ROT will be routed to the suction of the WW Tanks Vent

Blowers. Nitrogen header pressure is controlled by 597PCV-158/597PCV-198 to around 2.5 barg.

Off-gas from the stripper Overhead Reflux Drum will join the WW Tank Vent Blower discharge line. The discharge line mixes in with vents from Caustic Tank Blower and routed to a new Vent Knockout Drum (KOD). Modifications will be made to existing spent caustic oxidation plant vent stream such that it also enters the Vent KOD during normal operation. The intention is for the KOD to separate any water from the inlet vent streams prior to thermal oxidation. The collected water from KOD returns to the Settlement Drum. Dry vent from the KOD will join the existing pipe to Sour Caustic Thermal Oxidizer` SCTO. The collected water from KOD returns to the Settlement Drum.

A carbon canister package is considered in the improvement project as a backup to the SCTO. In case of short-term SCTO trip, spent caustic oxidation plant vent will be sent to atmosphere, and all other vent streams from blowers (including stripper reflux off-gas) will divert to the new carbon canister package. This will be achieved with KSVs.

Coagulant and flocculant injection to inlet of Settlement Drum and both DFNs have been considered. Anti-foam injection can be added to inlet of Treated Effluent Sump (T-59717) and to bio-treatment package Splitter Box (S-59705).

2 Settlement Drum Control Philosophy

ECU wastewater flows under pressure to Settlement Drum, the Drum operates 4" water column. Coagulant and flocculant are added to the influent stream prior to entering the Drum. Unstripped WW will be pumped to the Settlement Drum at a reduced rate for treatment. Most of the influent free oil and sludge are separated by gravity in this drum. Additionally, the drum provides surge capacity to contain the entire ECU Upset wastewater volume. Figure 1 shows the control sketch of the Settlement Drum.

2.1 ECU WW Pressure Control into Settlement Drum

ECU wastewater flow to Settlement Drum is pressure controlled identical to the existing ECU WW pressure control philosophy, via PCV-215. Two pressure control valves (PCV-215 C/D) cover the entire ECU WW flow range. Low flow during normal conditions (30-40 m^3/hr) is handled via the smaller control valve, the larger valve opens to allow higher flow rates to the drum, during other flow scenarios including upset flow.

2.2 Chemical Dosing to ECU WW Control

Coagulant and flocculant are added to the ECU WW at inlet of the Settlement Drum via dedicated pumps. Each chemical enters the wastewater stream via an injection quill. The chemicals injection rate is achieved automatically, via flow ratio controllers, by sending ECU WW flow signal (597FI-067) to duty dosing pump to adjust the pump speed.

Individual selector switches are provided, for coagulant and flocculant injection, to allow the selection of duty/ spare dosing pump.

2.3 Level Control in Settlement Drum

Oil and water levels are monitored in the cylindrical part of the Settlement Drum via two overall (oil)-interface (water) transmitter (LIT-060 and LIT-061. A selector switch allows either of LITs to be used for level control and low-level protection of the Settlement Drum Effluent Pumps. The drum is provided with an overflow line with liquid seal; the overflow line releases liquid to the containment area.

- Settlement Drum Effluent Pump transfers the WW from the Drum under flow-interface level cascade control to either DNF-1 or DNF-2.
- KSV-092 on inlet line to DNF-1 and KSV-093 on inlet to DNF-2 control the Settlement Drum effluent flow destination. In case both KSVs are open or closed at the same time, an alarm will activate.
- A minimum flow protection (FCV-041) is provided on the effluent pumps common discharge line. The duty pump trips on Settlement Drum 'Low Low' (LL) liquid level (measured by a separate level transmitter) or LL flow signal on the minimum flow line transmitter (FC-041).

The Settlement Drum oil level is monitored via LIT-060 or LIT-061. The collected oil is manually drained to the Froth/ Sludge Drum (T-59768) by gravity. A globe valve on this line assists a controlled flow. KSV-094 on the skimmed oil line closes on 'High High' liquid level in Froth/ Sludge Drum (measured by LI-045 installed in the Froth/ Sludge Drum).

Liquid level in the cylindrical portion of the drum at 'High High' level setting will trip the duty WW Tanks Vent Blower (K-59705/ 59713 (Installation of K-59713 is on HOLD).

Low-pressure steam may be added to the Settlement Drum cone to loosen up the sludge and to promote water disengagement from the sludge. Steam addition is manually performed via a globe valve on the steam line. The cone content is manually turned around using Sludge Pump and monitoring the sludge temperature in the cone.

The sludge level in the cone is indicated using a level transmitter (LI-062). The cone level is manually controlled by turning on Settlement Drum Sludge Pump (P-59771) and transferring it to the truck-out connection that is located near ROT. If the sludge viscosity is high or if sludge dewatering is intended, steam can be added to the cone, and sludge can be circulated. Truck-out or sludge circulation operation is done manually by operating KSV-063 and KSV-064 on sludge line to ROT and on sludge circulation line, respectively.

A bypass with a rupture disk is provided around PCV –215 to ensure uninterrupted flow to settlement drum if PCV-215 fail closes. Also, a low flow alarm on ECU water settlement drum is added to alert operator.

2.4 Pressure Control of Settlement Drum

Vapor space of the drum is nitrogen blanketed. A nitrogen pressure control valve (PCV-051) on nitrogen inlet line adjusts the nitrogen admission into the drum, another control valve (PCV-196) is installed on vent outlet line to maintain the target operating pressure in the drum. The setpoint of the two PCVs are staggered such that the two valves will not open at the same time.

A restriction orifice (RO-104) on the inlet nitrogen line provides a constant nitrogen sweep flow to the drum to minimize the risk of combustible gas formation in the vapor space.

The drum outlet vent line is connected to suction line of WW Tanks Vent Blowes (K-59705/ 59713 (Installation of K-59713 is on HOLD)).

2.5 Temperature Control of ECU WW

A 4" combined AC pond WW and Diversion Box WW quench line is provided to cool the ECU WW temperature into Settlement Drum below 45°C, when needed. The operation of the quench line is automatic via 597TCV-070.

The temperature of mixed stream (ECU WW and quench line) to the drum in controlled and monitored by TC-070, by adjusting the quench flow rate via TCV-070. 'High' and 'High High' alarms on FI-061 set at

110 m^3/hr and 120 m^3/hr, respectively, alert the operator if the quench water flow exceeds the maximum allowable water. The target is to cool down the WW flow to Settlement Drum to below 45°C.

A 'High High' temperature alarm on TI-070 set at 50°C, the following actions are taken:

- Settlement Drum Effluent Pump (P-59772) is tripped,
- KSV-092 and KSV-093 on P-59772 outlet line to DNF-1 and DNF-2 respectively will close,
- KSV-063 on Settlement Drum sludge to truck-out will close.

2.6 Modes of Operation

Selector Switch 597HS-092 decides the destination of effluent stream from Settlement Drum.

- During DNF-2 normal operation, the Settlement Drum effluent is routed to DNF-1 by keeping 597KSV-092 open and 597KSV-093 closed.
- When DNF-1 is unavailable, DNF-2 is used as a backup to DNF-2. In this operating mode, the open/ closed position of KSV-092/ 093 are switched.

3 DNF Vessels Control Philosophy

Settlement Drum effluent with free oil and solids enters DNF-1 (S-59712). Combined AC Pond WW, Diversion Box WW, and Deoiled WW from Bio-reactors Feed Pumps enter DNF-2 (S-59713). The two DNFs have the same design capacity and operation mechanism, e.g., dissolved nitrogen floats the free oil and light solids, where heavier solids settle to the bottom of the DNF vessel. The floating oil and scum from both DNF vessels are continuously skimmed into a common Froth/ Sludge Drum (T-59768). The settled sludge discharges into the drum intermittently under DNF liquid head.

Inlet WW stream to DNF-1 can only come from Settlement Drum. However, influent to DNF-2 can be the effluent WW from Settlement Drum, or combined AC Pond WW/ Diversion Box WW/ FEOR Tank Effluent.

Recovered Oil from stripper Overhead Reflux drum and skimmed oil from Settlement Drum flow to the Froth/ Sludge Drum, under operator supervision.

Figure 2 and 3 show control sketches and operating modes on DNF vessels.

3.1 Level Control in DNF-1

DNF-1 Effluent Pump transfers DNF-treated WW under DNF-1 level control to Stripper Package at a maximum flow of 65 m^3/hr; any excess effluent or when off-spec stripped WW (with VOC over the limit) will be sent to either Static or Filling FEOR Tank, at operator's decision.

- Liquid level transmitter (LC-041) in DNF-1 exit compartment controls the flow of treated effluent from the DNF.
- The duty pump (P-59763 A/B) and the recycle pump (P-59761 A/B) trips on DNF-1 'Low Low' (LL) liquid level (measured by a separate level transmitter, LI-043).
- 'High High' level in the DNF vessel closes KSV-092 on inlet line to DNF-1.
- DNF-1 is provided with an overflow line, discharging the excess flow to DNFs containment area.

3.2 Flow Control out of DNF-1

Effluent flow out of DNF-1 may be routed to both Steam Stripper Package and to the FEOR Tanks.

- Up to 65 m^3/hr of the effluent from DNF-1 is flow controlled to the Steam Stripper Package. The balance will be routed to the static or filling FEOR Tank.
- A minimum flow protection (FCV-050) is provided on DNF-1 Effluent Pumps common discharge line. The duty pump trips on DNF-1 'Low Low' (LL) liquid level or LL flow signal on the minimum flow line flow transmitter (FC-050).

3.3 Chemical Dosing Control to DNF-1 and DNF-2 Inlet

Coagulant and flocculant are added to the inlet of both DNFs via dedicated pumps. Each chemical enters the wastewater stream via an injection quill. The chemicals injection rate is achieved automatically, via flow ratio controllers, by sending the corresponding flow signal (597FI-119 for DNF-1 chemicals and 597FI—066 for DNF-2 chemicals) to duty dosing pump to adjust the pump speed.

Individual selector switches are provided, for coagulant and flocculant injection, to allow the selection of duty/ spare dosing pump.

3.4 Level Control in DNF-2

DNF-2 Effluent Pump transfers the DNF-treated WW under DNF-2 level control to:

i. biotreatment package, during DNF-2 normal operation, or

ii. stripper Package/ FEOR Tank when DNF-1 is unavailable (e.g., DNF-2 is used in place of DNF-1)

Liquid level management in DNF-2:

- Liquid level transmitter (LC-042) in DNF-2 exit compartment controls the flow of treated effluent from the DNF.
- The duty pump (P-59764 A/B) and the recycle pump (P-59762 A/B) trips on DNF-2 'Low Low' (LL) liquid level (measured by a separate level transmitter, LI-048).
- 'High High' level in the DNF vessel closes KSV-093 on inlet line to DNF-2.
- DNF-2 is provided with an overflow line, discharging the excess flow to DNFs containment area.

3.5 Flow Control out of DNF-2

- A selector switch will allow DNF-2 target destination to be achieved by toggling the KSVs on the lines.
- Effluent flow to Stripper Package and to FEOR Tank will be controlled as described in Section 3.2.
- A minimum flow protection (FCV-049) is provided on DNF-2 Effluent Pumps common discharge line. The duty pump trips on DNF-2 'Low Low' (LL) liquid level or LL flow signal on the minimum flow line flow transmitter (FC-049).

3.6 Pressure Control of DNF Vessels and Froth/ Sludge Drum

Vapor space of both DNF vessels and Froth/ Sludge Drum is nitrogen blanketed. A nitrogen pressure control valve on nitrogen inlet line to each vessel/ drum adjusts the nitrogen admission. A separate pressure control valve is installed on vent outlet line from each vessel/and the Froth/ Sludge Drum to

maintain the target operating pressure in the drum. The setpoint of inlet/ outlet PCVs on each vessel and on the drum are staggered such that the two valves will not open at the same time.

A restriction orifice is provided on the nitrogen inlet line (to each DNF vessel and Froth/ Sludge Drum) to provide a prescribed nitrogen sweep flow to the respective vessel/ drum.

The outlet line from each DNF vessel and from the Froth/ Sludge Drum is connected to the suction line of WW Tanks Vent Blowes (K-59705/ 59713 (Installation of K-59713 is on HOLD)).

3.7 Level Control in Froth/ Sludge Drum

The height of the Froth/ Sludge Drum (T-59768) is the same as those of the DNF vessels; hence, the drum is hydraulically balanced with the DNFs. High liquid level in the drum will flow back into the DNFs and overflow to DNFs containment area.

- The liquid level in the drum is monitored by a radar transmitter and controlled by LC-044 via changing the Float/ Sludge Pump (P-59768 A/B) speed (outflow from the drum).
- Duty pump trips on 'Low Low' (LL) liquid level in the drum.
- 'High High' liquid level indication in the drum is triggered by a separate level transmitter in the drum. Once activated, it closes KSV-094 on the Settlement Drum skimmed oil line to the drum.

3.8 Temperature Control in Froth/ Sludge Drum

There is no temperature control inside the drum. The drum is electric traced to high liquid level for a hold temperature of 40°C. A temperature indicator (TI-078) provides continuous monitoring of the drum content temperature.

3.9 Modes of Operation

DNF-2 may be selected to act as DNF-2 (e.g., normal operation) or act as a backup to DNF-1 (e.g., when DNF-1 is unavailable).

- In normal operation,
    - Settlement Drum effluent is pumped to DNF-1. Up to 65 m3/hr of DNF-1 effluent is pumped to Steam Stripper and the balance is routed to FEOR Tanks.
    - Combined AC Pond WW and Diversion Box WW, along with deoiled wastewater from bioreactor feed pumps (P-59704 A/B) are fed to DNF-2. DNF-2 effluent is pumped to bio-treatment package.
- When DNF-1 is unavailable, DNF-2 is used in place of DNF-1. In this mode:

- Settlement Drum effluent is pumped to DNF-2 as the only feed stream; other streams will not flow to DNF-2 in this mode. DNF-2 effluent will be routed to Stripper Package up to the target flow, with the balance going to one of the FEOR Tanks.

Selector Switch HS-092 and HS-845 (refer to Figure 2 and 3) will work in tandem to control influent flow to DNF-1 or DNF-2 and effluent flow from DNF-1 or DNF-2, respectively:

- In normal operation:
  - 597KSV-092 is open to allow Settlement Drum effluent flow to DNF-1,
  - 597KSV-093 is closed (e.g., no Settlement Drum effluent flow to DNF-2),
  - 597KSV-090 is open to route DNF-2 effluent to Bio-treaters,
  - 597KSV-089 is closed to the Stripper package.
- When DNF-1 is unavailable and DNF-2 is used as a backup to DNF-1:
  - The open/ closed position of 597KSV-092/ 093/ 090/ 089 are switched.

4 Control System of Steam Stripper Package

The entire control system of the Stripper Package will be provided by the package supplier. The following is a brief description of the stripper package.

Stripper package uses low-pressure steam to strip out the residual volatile organics from DNF-treated effluent. The DNF WW is pumped to WW Pre-heater and is preheated to an approximate temperature of 100°C by cross exchanging heat with hot Stripped WW. The partially heated DNF WW enters the top of stripper column, where the stripped organics and some stripping steam leave the column top and are condensed in a water-cooled condenser. The mixture of condensed vapor and liquid is allowed to separate in Overhead Reflux Drum. The vapor is led to vent handling system for complete destruction of organics in the existing SCTO. The condensed steam and organics is refluxed back to the column top, and the separated oil is sent to Froth/ Sludge Drum, under its pressure head. The stripped WW is sent to the filling FEOR Tank.

On high level in stripper bottoms or stripper reflux drum, control valve on overhead vapor vent to vent KOD will close. On high level of stripper bottoms, steam to stripper column will be closed. Alarms are added to temperature indicators on stripper effluent and wastewater tanks to alert operator in case of high stripper effluent temperature.

Figure 4 shows DNF-1 effluent control system to the stripper package and the associated modes of operation.

4.1 Inlet WW Flow and Steam Flow Control

- Inlet to Stripper Package may be the effluent from DNF-1 or DNF-2. Stripper feed control will be covered in the next revision of the document after discussing with Koch/Shell technical team.
- A fraction of the stripper effluent may bypass the Pre-heaters to attain an inlet-to-the-column target temperature of 107°C. The column inlet temperature is measured by TI-092 that controls the bypass flow through TCV-092.
- Steam flow to below-the-packing section of the stripper column is ratioed (FFC-055) with the inlet WW flow, with a temperature override control via TC-085.
- Stripper feed temperature during start-up will be controlled by Direct injection steam heater by controlling steam flow via FCV-113.

4.2 Column / Reflux Drum Pressure Control

- The pressure in vent line out of Overhead Reflux Drum is monitored and used to control the pressure of the drum via PC-072 that in turn controls the column operating pressure.
- Nitrogen blanketing is provided for the column to be used during startup, or low-pressure instances. Nitrogen flow is admitted to the vapor space of the column and reflux drum via PCV-072A. Nitrogen flow to the stripper overhead section is split-range controlled when the

pressure drops below the target setpoint, using the same pressure controller (PC-072) on the Overhead Reflux Drum vent line, i.e. PCV-072B

4.3 Steam Stripper Sump Level / Outflow Control

Stripped WW leaving the column packing section is stored in the column sump and is pumped out using Stripper Effluent Pump (P-59769 A/B).

- Liquid level transmitter (LC-057) in the sump measures the sump level and controls the flow (FC-056) of the WW from the sump.
- High high level (LI-059) in the sump triggers an alarm and closes the Stripper reflux drum (V-59773) vent valve PCV-072B
- A minimum flow protection is provided on the Stripper Effluent Pumps common discharge line. Restriction orifice 597RO-106 is provided for controlled minimum circulation flow.
- High temperature alarm (TI113) is added to temperature indicators on stripper effluent and wastewater tanks to alert operator in case of high stripper effluent temperature.
-

4.4 Overhead Reflux Drum Level / Outflow Control

The drum is a 3-phase separator, with an oil box and an overflow weir. Any water-insoluble skimmed hydrocarbon flows by gravity into the oil box. The wastewater will go over the weir into the exit compartment where it is pumped as reflux to stripping column.

- Liquid level transmitter (LC-073) in the Overhead reflux drum oil box measures the oil box level and controls the flow (FC-052) of the recovered oil from the Stripper reflux drum to the Float/Sludge drum (T-59768).
- 'High high' level in the oil box triggers an alarm. Currently, no automatic corrective action is taken, except for operator interference to initiate cut off the feed to stripper.
- Liquid level upstream of the weir is monitored by LT-072. 'High high' liquid level (LI-072) triggers an alarm and closes the Stripper reflux drum (V-59773) vent valve PCV-072B.
- Liquid level in heavy liquid phase (water) downstream of the weir is monitored and controlled by LT-071, by adjusting the speed of the operating Steam Stripper Reflux Pump.
- 'High high' level in the liquid phase (water) exit compartment (downstream of the weir) triggers an alarm. Currently, no automatic corrective action is taken, except for operator interference.

'Low low' liquid level (LI-071) downstream of the weir will trip the operating Reflux Pump.

Stripper controls will be updated once updated information from Koch is received.

5 FEOR Tanks and Biotreatment Feed Pumps

The two FEOR Tanks (T-59707 A/B) are currently used to store and separate oil from the facility WW streams. Two Bioreactor Feed Pumps (P-59704 A/B) transfer the WW from FEOR Tanks to Bio-treatment Package. The pumps have a common discharge line with a single minimum flow protection common to both pumps.

In the improved project:

- One FEOR Tank stores the partially treated WW (known as Filling FEOR Tank), the other FEOR Tank may be used to store unstripped/ off-spec WW (known as Static FEOR Tank). Piping and valving allow any of the FEOR tanks to serve in Filling or Static mode. It is noted that unstripped/ off-spec WW may also be routed to the Filling FEOR on operator's discretion. Adequate VOC analyzers are provided to assist the operator in the tank selection.
- Existing pump piping will be modified so both pumps are available to handle WW from either the Filling FEOR or Static FEOR. This is done through overcrossing suction and discharge piping. KSVs will be provided on suction line to each Bioreactor Feed Pumps, as well as on the pumps common suction cross-over line, to allow automatic pump selection from either of the FEOR Tanks. Circulating off-spec WW to Settlement Drum for reprocessing will be done manually.

Figures 3 and 5 show the control sketches for FEOR Tanks/ Bioreactor Feed Pumps systems.

5.1 Bioreactor Feed Pump Control

Hand switch HS-200A allows the operator to select either of P-59704 A or P-59704 B. The following KSVs are controlled by the pumps DCS logic function block 597KS-200:

- Pumps suction lines 597KSV-096/ 097/ 098,
- Pumps discharge line 597KSV-082/ 083,
- Pump min flow lines 597KSV-084/ 085/ 086/ 088.

Hand switch 597HS-880 allows the operator to select the filling tank to either FEOR Tank A (T-59707A) or FEOR Tank B (T-59707B). The following KSVs are controlled by tanks liquid level DCS logic function block 597KS-110:

- Existing 597KSV-131/ 151 on existing inlet lines to FEOR Tanks,
- New 597KSV-071/ 072 on new inlet lines to FEOR Tanks.

Minimum flow protection is provided on the outlet of each pump. The minimum flow line returns to the FEOR Tank that feeds the pump. Each pump trips on the FEOR Tank 'Low Low' (LL) liquid level or LL flow signal on minimum flow line transmitter.

It is noted that wastewater flow to either DNF-2 or Biotreatment Package is manual, by toggling manual isolation valves on the two destinations.

Pumping WW to DNF-2 (Normal Flow Path)

Flow is from Filling FEOR Tank, the WW flow is controlled by FC-042 on the inlet line to DNF-2. This operation is done manually by aligning the isolation valves.

- For this operation, either of 597KSV-082 or 083 should be open to allow flow forward.

Pumping WW to Biotreatment Package

The existing signal from 597FI-020 (that is being currently used to flow-ratio control chemical injection) will be demolished when the new WWTU is commissioned. In the new plant, flow through existing 597FI-100 and 597FI-200 (on WW inlet lines to bio-aeration reactors) will be summed, and the resulting signal by FY-100A will be used to control biotreatment chemicals injection to the WW stream.

The WW flow to the bio-treaters is directly from the Filling FEOR Tank. This route utilizes most of the existing infrastructure.

- Existing pressure controller PC-018 on discharge line of the DNF-2 effluent pumps keep a backpressure in the discharge line of the bioreactor feed pumps.
- Existing flow controller FCV-100/ 200 distributes the flow to each aeration tank of the package.

Pumping Off-Spec WW to Settlement Drum

WW circulates from FEOR Tank with unstripped or off-spec WW to Settlement Drum for further treatment. This operation will be done manually, under operator supervision. In this case, the circulating flow is generally lower than the pump minimum flow requirement.

- Off-spec WW flow is manually controlled with a globe valve. Recycle flow is measured by FI-063. The globe valve may be locked in place, after setting the target flow through the line and FI-063.
- For this operation, either of 597KSV-082 or 083 should be closed to stop flow to bio-treaters/ DNF-2.

5.2 Modes of Operation

5.2.1 Filling FEOR Tanks

The KSVs at the inlet line to each FEOR Tank are interlocked, such that at least one KSV on stripped WW line and one KSV on the unstripped WW line is always open.

- KSV-131 and KSV-151 (on inlet lines to FEORs) are interlocked, so the stripped WW flows into one FEOR tank at a time.
- KSV-071 and KSV-072 (on inlet lines to FEORs) are interlocked, so the unstripped WW flows into one FEOR Tank at a time.

- The 'High High' level signal in FEOR Tank T-59707A or T-59707B closes inlet line KSV-131/ 071 or KSV-151/ 072, respectively.

Table 5-1 shows the KSVs position during Filling of FEOR Tanks.

Table 5-1 - KSV Position for FEOR Tanks Filling

FEOR Filling	597KSV-131 FEOR A Inlet	597KSV-151 FEOR B Inlet	597KSV-071 Stripper Bypass to FEOR A	597KSV-072 Stripper Bypass to FEOR B
A	OPEN	CLOSED	OPEN	CLOSED
B	CLOSED	OPEN	CLOSED	OPEN

5.2.2 Emptying FEOR Tanks

Table 5-2 illustrates the position of KSVs for Biotreatment Feed Pumps, for scenarios when one or both pumps are in operation.

Table 5-2 - KSV Position for FEOR Tanks Emptying

T-59707A/B	P-59704A	P-59704B	597KSV-096	597KSV-097	597KSV-098	597KSV-082	597KSV-084	597KSV-085	597KSV-083	597KSV-086	597KSV-088
FEOR Tank Emptying	Biotreater Feed Pump A	Biotreater Feed Pump B	FEOR A Outlet	FEOR B Outlet	P-59704A/B Suction Cross Tie	P-59704A Discharge	P-59704A Min Flow to FEOR A	P-59704A Min Flow to FEOR B	P-59704B Discharge	P-59704B Min Flow to FEOR A	P-59704B Min Flow to FEOR B
A	RUNNING	OFF	O	C	C	O	O	C	C	C	C
B	RUNNING	OFF	C	O	O	O	C	O	C	C	C
A	OFF	RUNNING	O	C	O	C	C	C	O	O	C
B	OFF	RUNNING	C	O	C	C	C	C	O	C	O

5.2.3 Minimum Flow Recycle Lines

There are four KSVs associated with the two min flow protection lines. These KSVs (597KSV-084/ 085/ 086/ 088) are interlocked with the operating pump to ensure open return path to the same FEOR Tank feeding the pump. For either of the pumps, the minimum flow KSV must be open to at least one FEOR Tank.

6 Vent Collection and Handling System

The vent collection system consists of the following vent streams:

1. Vents from existing WW Tanks (FEORs and ROT) currently handled by WW Tanks Vent Blower (K-59705),

   In the new WWTU, the existing K-59705 will be twined by a new blower (K-59713) of the same size.
2. Vent from existing Spent Caustic Storage Tank handled by Spent Caustic Tank Blower (K-53501),
3. Vent from existing Spent Caustic Oxidation plant under pressure,
4. Vents from new wastewater treatment

The new WWTU vents come from Settlement Drum, DNF vessels, and Froth/ Sludge Drum. These vent streams are collected into a header and will mix in with vents from FEORs and ROT; the mixed vent stream will be routed to suction line of K-59705/ K-59713. The off gas from Stripper Overhead Reflux Drum combines with the Vent Blower outlet line, after leaving the new WWTU.

The vents from K-59705/ 59713, K-53501, and the Reflux Drum are routed to a Vent Knockout Drum (KOD), the Spent Caustic Oxidation plant vent also enters the KOD. The purpose of the KOD is to separate any condensed water and potentially hydrocarbon in the vent lines. Overhead from the KOD is routed to the existing SCTO for organics destruction.

A carbon canister package is foreseen to handle the organic content of the combined vent streams except the Spent Caustic Oxidation plant vent from the blowers, when SCTO is unavailable. The outflow stream from the carbon canister package is void of organics and hydrocarbons and is vented out to atmosphere.

Upon loss of open indication of 535UZV-001 to SCTO or upon loss of SCTO, the below sequence logic will be initiated to switch the vent gases from SCTO to carbon canisters.

- Open Vent gas to carbon canisters (535UZV-002)
- Close Vent gas Oxidized Caustic Degassing Drum from (535KSV-004)
- Close Vent gas to Knock out drum (535KSV-005)
- Close 535UZV-001 upon loss of SCTO

Control scheme for vent gas collection from existing and new equipment are shown in Figure 6. SCTO vent handling control scheme is shown in Figure 7.

6.1 WW Tank Vent Blower Control

- A VFD will be added to the existing K-59705. Additionally, the new WW Tanks Blower (K-59713) will be equipped with a VFD, for speed control. A pressure controller (597PC-181) on common suction line of the blowers will control the speed of the duty blower.
- Nitrogen gas is used for seal flushing of the blower.

- Nitrogen gas make-up with pressure self-regulator is added to the common suction line of the blower to maintain a minimum pressure in the common suction line to protect the blower under no or low tank vent flow conditions.
- Standby blower is automatically started only on suction line high pressure, after having checked the run status of the duty blower to avoid operating both blowers simultaneously.
- Simultaneous closure of both UZV-001 (on vent line to SCTO) and UZV-002 (on vent line to canister package) will trip Caustic tank storage blowers (K-53501) and WW Tanks Vent Blowers (K-59705/59713).
- 'High High' liquid signal from FEOR Tanks or 'High High' liquid signal from Settlement Drum will trip WW Tanks Vent Blower (K-59705/ 59713).
- 'High High' temperature (TI-031) on the blower discharge line trips the running blower.
- 'High High' temperature sensor (TZ-087/ 089) on blowers' suction lines flame arrestors will trip the corresponding blower.

6.2 SCTO Upset Operation

SCTO is normally operating to destroy the organic matter in the vent stream. During SCTO normal operation, UZV-001 (on SCTO vent line) is open. The following conditions will cause UZV-001 to close:

- SCTO temperature below 650°C.
- Temperature sensed by TZ-012/ 014 on new SCTO flame arrestors (Y-53594 A/B) is higher than 150°C,
- Temperature sensed by TZ-010/ 011 on Spent Caustic Oxidation vent line flame arrestors (Y-53587 A/B) is higher than 150°C.

6.3 Carbon Canister Control

Carbon canister package is placed online automatically upon the trip of the SCTO,

- Higher-than 150°C temperature sensed by either TZ-001/ 002 in canister outlet flame arrestors (Y-53593 A/B) or TZ-003/ 004 in canister inlet flame arrestors (Y-53588 A/B) will trip UZV-002.
- High temperature alarm on the gas line between the two canisters will alarm the operator.
- High alarm on the VOC analyzer installed one the gas line between the two canisters will alarm the operator to manually lead-lag the canisters.
- Requested by Carbon Cannister vendor, nitrogen dilution may need to be added to the vent gas feeding to Carbon Cannister to maintain a minimum superficial velocity in the Carbon Cannister. The nitrogen dilution flow is controlled by a flow control valve (535FCV-003) via the flow monitoring (535FT-003) and controller (535FC-003) installed on the Carbon Cannister gas inlet.

6.4 Vent KOD Control

The incoming vent streams meet in the KOD.

- The KOD dehydrated vapor line rides on the vent line to SCTO.
- The separated condensed water is pumped to Settlement Drum under level snap control LC-002. The pump flow is intermittent.
- 'Low Low' liquid level (LI-003) in the drum will trip the running pump.
- 'High High' level in the drum triggers shutdown of SCTO

6.5 Nitrogen Flow Control to SCTO

Nitrogen dilution is added automatically to the KOD vent line en route to SCTO. The vent line oxygen is continuously monitored. Controller 535-QC-080 will control the oxygen by adjusting nitrogen flow to the vent line upstream of SCTO, on high O_2 concentration readings.

6.6 Modes of Operation

- SCTO Normal Operation:
  - 535UZV-001, 535KSV-004, and 535KSV-005 (on vent lines to Vent KOD) are open.
  - 535UZV-002, 535KSV-002, and 535KSV-003 (on vent lines to carbon canister) are closed.
- SCTO trips, carbon canister package is placed online:
  - 535UZV-001, 535KSV-004, and 535KSV-005 are closed,
  - Spent caustic oxidation plant vent is routed to atmosphere,
  - 535UZV-002, 535KSV-002 and 535KSV-003 are open.

7 Abbreviations

Abbreviation	Description
AC	Accidentally Contaminated
BETX	Benzene, Ethylbenzene, Toluene, Xylenes
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
DNF	Dissolved Nitrogen Flotation
ECU	Ethane Cracking Unit
FC	Flow Controller
FCV	Flow Controller Valve
FEOR	Flow Equalization Oil Removal
FI	Flow Indicator
KOD	Knock Out Drum
KSV	Automatic On/ Off Vale
LC	Level Controller
LIT	Level Indicator Transmitter
LL	Low Low
LP	Low Pressure
PCV	Pressure Control Valve
ROT	Recovered Oil Tank
SCTO	Scour Caustic Thermal Oxidizer
SPM	Shell Polymers Monaca
TSS	Total Suspended Solids
UZV	Emergency Shutdown Valve
VOC	Volatile Organic Caron
WW	Wastewater
WWTP	Wastewater Treatment Plant
WWTU	Wastewater Treatment Unit

8 Control Sketches

FIGURE 1. ECU FLOW TO SETTLEMENT DRUM + SETTLEMENT DRUM LEVEL CONTROL SCHEME

NOTES:

1. FLOW SIGNAL TO COAGULANT INJECTION PUMPS (P-59765A/B) SPEED CONTROL.
2. DELETED.
3. FLOW SIGNAL TO FLOCCULANT INJECTION PUMPS (P-59766A/B) SPEED CONTROL.
4. DELETED.
5. OPEN KSV-092 FOR NORMAL FLOW TO DNF 1.
6. OPEN KSV-093 WHEN DNF 2 IS USED IN PLACE OF DNF 1.
7. DELETED.
8. MANUAL SPEED CONTROL. PUMP TO OPERATE ONLY WHEN EITHER 597KSV-063 OR -064 IS OPEN.
9. 597KSV-063/064 ARE MANUALLY CONTROLLED.
10. HIGH-HIGH LEVEL IN FLOAT/SLUDGE DRUM T-59768 WILL CLOSE 597KSV-094.
11. 597LI-060 AND 597LI-061 CAN BE USED INTERCHANGEABLLY FOR LEVEL CONTROL.
12. QUENCH LINE TO CONTROL THE ECU WASTE WATER TEMPERATURE BELOW 45'C ECU QUENCHING IS DONE AUTOMATICALLY VIA TCV-070 TO ACHIEVE WW TARGET TEMPERATURE INTO SETTLMENT DRUM.
13. "HIGH" ALARM SET AT 45'C. ON "HH" (50'C), TRIP PUMPS (P-59772A/B) & CLOSE 3 KSV-092 & 093 & KSV-063.
14. WHEN BOTH 597KSV-092 AND -093 OPEN OR CLOSED AT THE SAME TIME, AN ALARM WILL ACTIVATE.
15. HIGH ALARM AT 110 M3/H; 'HIGH HIGH' AT 120 M3/H TO MANUALLY CLOSE THE VALVE ON QUENCH LINE.

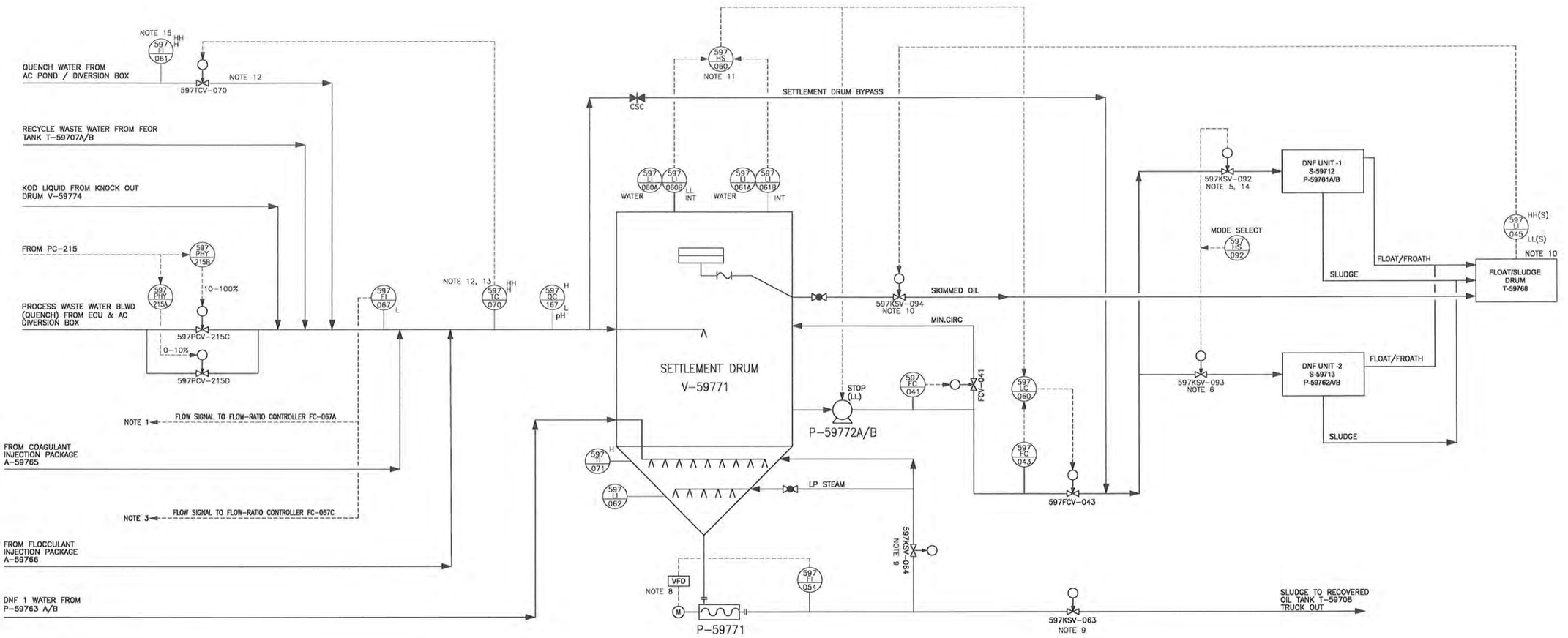

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FIGURE 2. DNF UNIT-2 CONTROLS SYSTEM

NOTES:

1. DELETED.
2. DELETED.
3. SELECTOR SWITCH TO SELECT BETWEEN DNF-2 TO ACT AS DNF-1 OR DNF-2 TO ACT AS DNF-2.
4. DELETED.
5. DELETED.
6. THIS KSV WILL OPEN, WHEN 597-HS-845 IS SELECTED TO ACT DNF-2 AS DNF-1.
7. THIS KSV WILL OPEN WHEN 597-HS-845 IS SELECTED TO ACT DNF-2 AS DNF-2 (e.g., NORMAL OPERATION).
8. STRIPPER SYSTEM CONTROL SYSTEM IS PRELIMINARY AND WILL BE FINALIZED BY VENDOR, AT A LATER STAGE.
9. WHEN BOTH 597KSV-089 AND -090 OPEN OR CLOSED AT THE SAME TIME, AN ALARM WILL ACTIVATE.

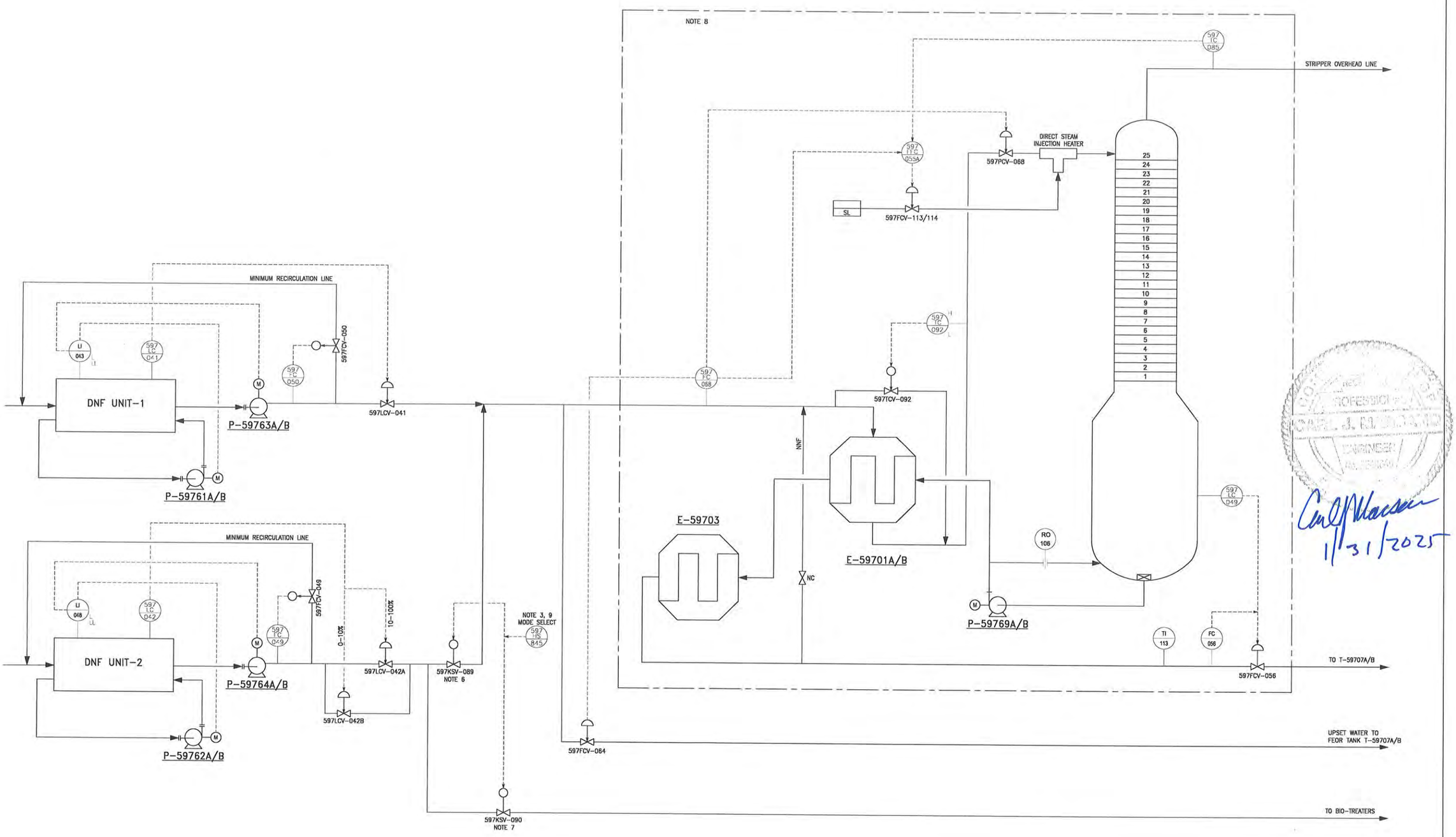

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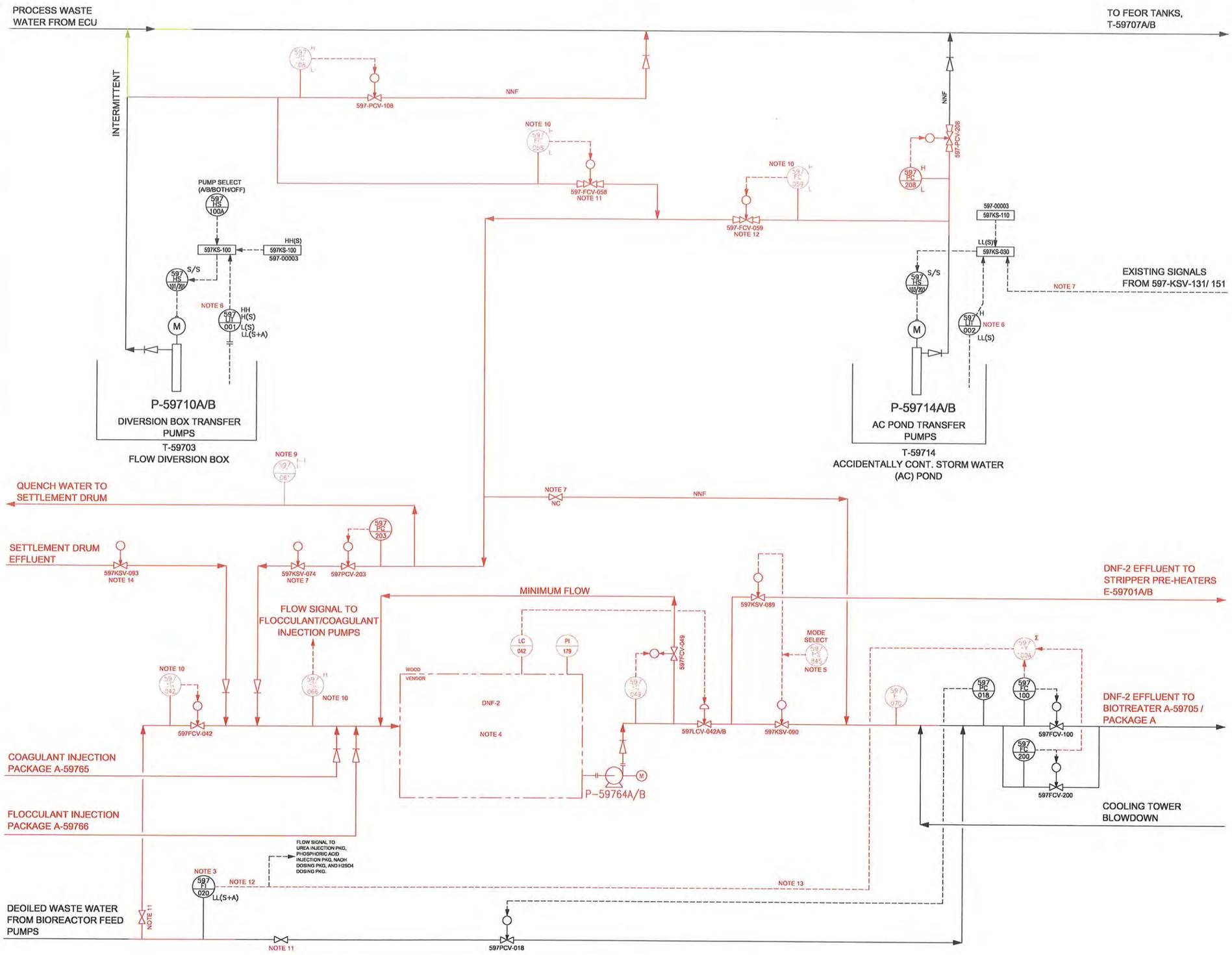
FIGURE 3. DIVERSION BOX AND AC POND WATER TO DNF-2 & BIOTREATER CONTROL SCHEME



NOTES:

1. EXISTING COMPONENTS ARE SHOWN IN BLACK, NEW COMPONENTS ARE IN RED COLOR, AND GREEN COLOR IS FOR EXISTING OPERATION THAT WILL BE DEMOLISHED IN THE FUTURE.
2. THE NORMAL PROCESS IS AC POND WATER, DIVERSION BOX WATER AND DEOILED WASTE WATER TO DNF-2 PACKAGE, AND THEN TO BIOTREATER.
3. EXISTING 597FI-020 TO BE UNISTALLED AND RELOCATED DURING PHASE 1 DEMOLITION CONSTRUCTION. INSTRUMENT AND TAG NUMBER TO BE REUSED.
4. PRIMARY MODE: DNF-2 RECEIVES AC POND, DIVERSION BOX, AND FEOR OUTLET.
   SECONDARY FUNCTION: BACK UP TO DNF-1.
5. SELECTOR SWITCH TO SELECT BETWEEN DNF-2 TO ACT AS DNF-1 OR DNF-2 TO ACT AS DNF-2.
6. AT 'LL' AC POND OR DIVERSION BOX LEVEL, SHUTDOWN THE CORRESPONDING TRANSFER PUMPS.
7. PUMPS P-59714A/B SHALL START WHEN ONLY ONE OF THE 597KSV-131 (TO FEOR-A), OR -135 (TO FEOR B), OR -074 (TO DNF-2), OR THE MANUAL VALVE ON THE NNF LINE (TO BIOTREATERS), OR THE MANUAL VALE ON QUENCH WATER LINE IS OPEN. THE OPERATOR WILL DECIDE THE DESTINATION.
8. DELETED.
9. HIGH ALARM SET AT 110 M3/H; "HIGH HIGH" AT 120 M3/H TO MANUALLY CLOSE THE VALVE ON QUENCH LINE.
10. MANUALLY INPUT SETPOINT FOR 597FCV-042/059/058 PER THE STREAM PRIORITY SEQUENCE; AND "H" ALARM FROM 597PC-066 ALERTS OPERATOR TO ADJUST THE INSTREAM FLOW SETPOINTS.
11. FLOW TO EITHER DNF-2 OR BIOTREATERS IS SELECTED MANUALLY.
12. FLOW SIGNAL FROM EXISTING FLOW METER (597FI-020) IS CURRENTLY USED TO CONTROL CHEMICAL DOSING. THIS SIGNAL WILL BE DEMOLISHED IN THE FUTURE, WHEN THE NEW WWTU PLANT IS COMMISSIONED.
13. IN THE NEW WWTU, SUM OF FLOW SIGNALS FROM 597FY-100A WILL BE USED TO CONTROL CHEMICAL DOSING, IN LIEU OF SIGNAL FROM 597FI-020.
14. IN NORMAL OPERATION WHEN DNF-2 ACTS AS DNF-2, 597-KSV-093 IS CLOSED.

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FIGURE 4. DNF UNIT-1 CONTROLS SYSTEM

NOTES:

1. DELETED.
2. STEAM FLOW IN RATIO WITH FEED FLOW WITH OVERRIDE ON OVERHEAD TEMPERATURE.
3. DELETED.
4. DELETED.
5. DELETED.
6. STRIPPER SYSTEM CONTROL SYSTEM IS PRELIMINARY AND WILL BE FINALIZED BY VENDOR, AT A LATER STAGE.

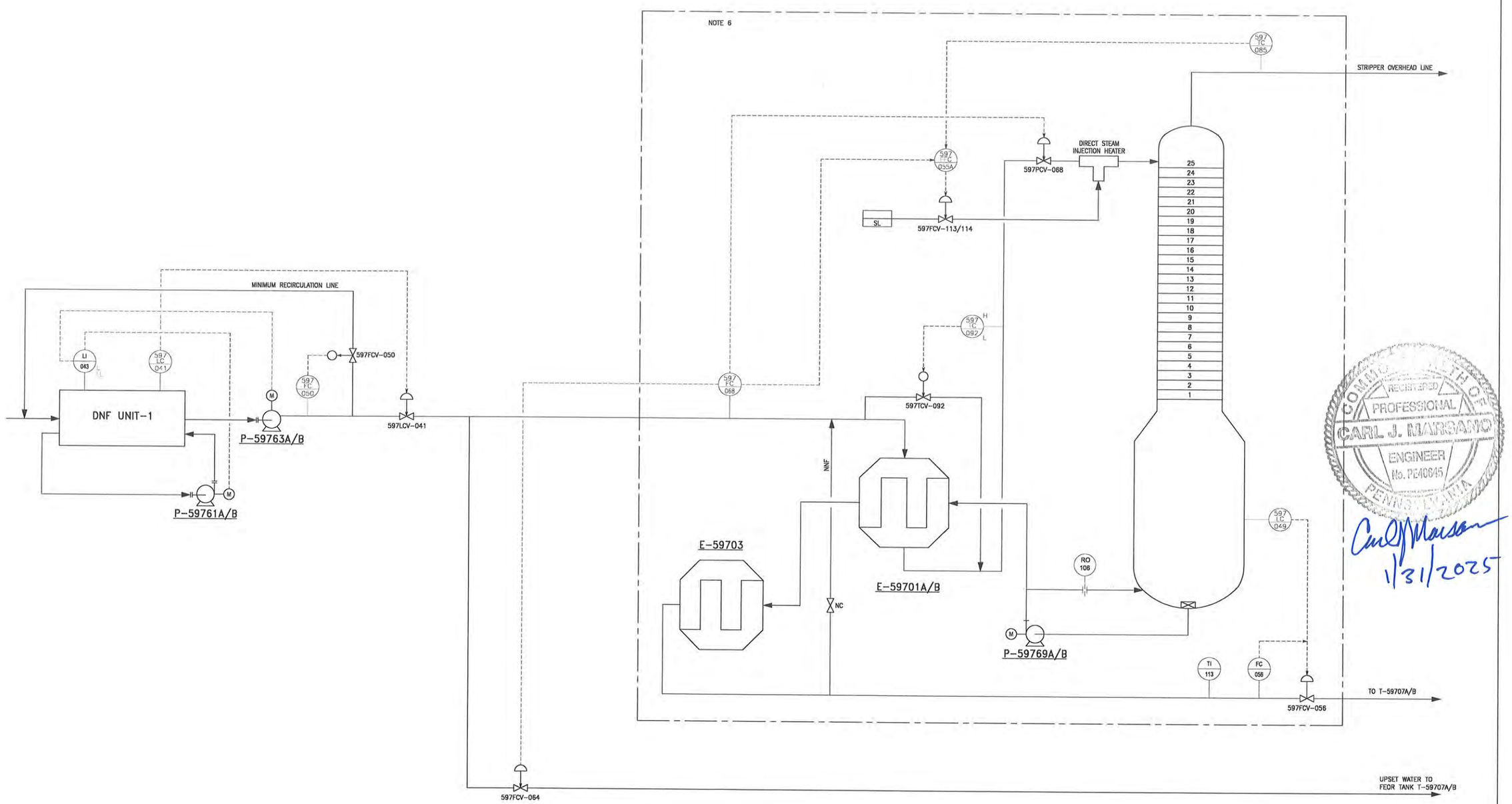

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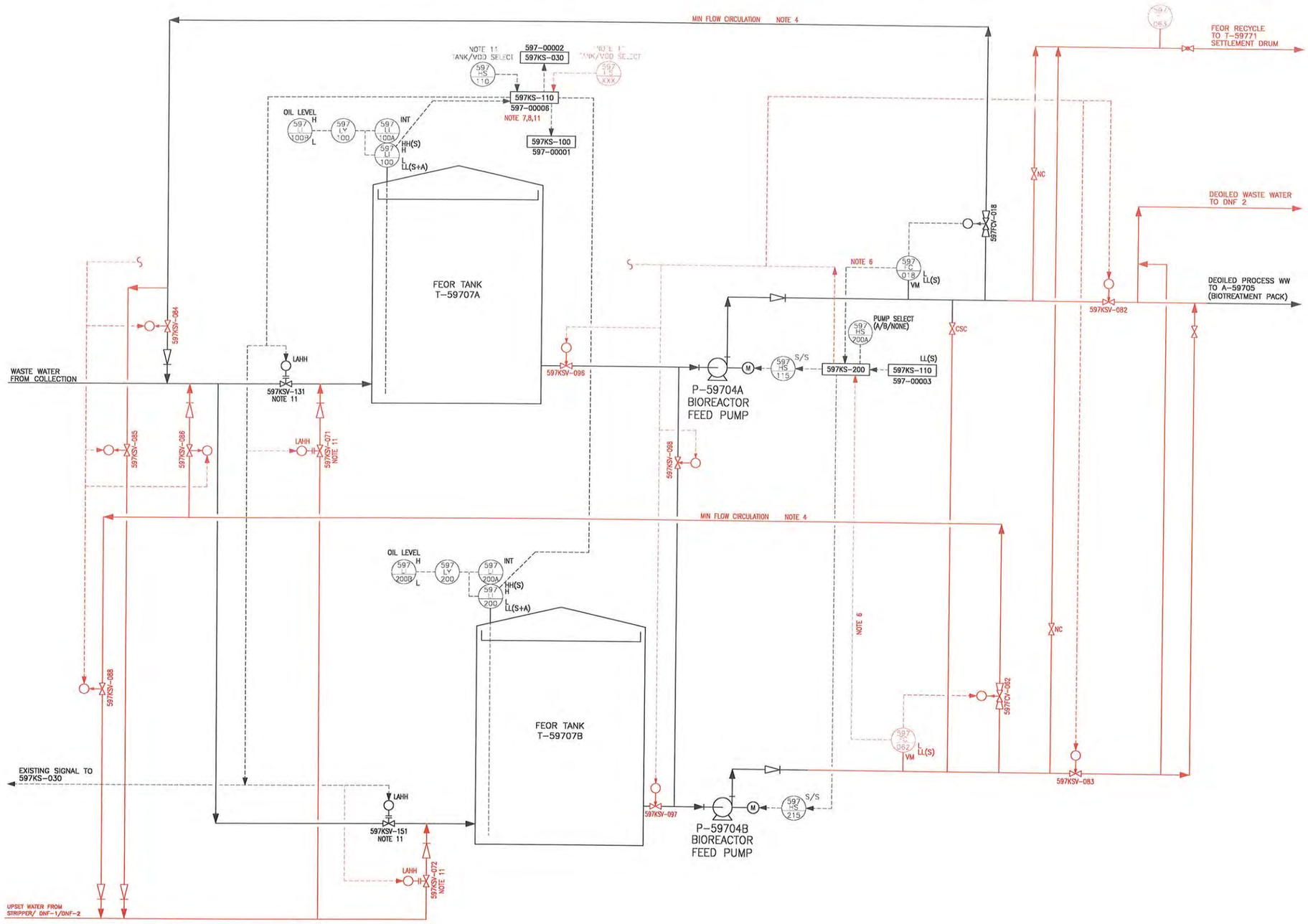
FIGURE 5. FEOR TANKS AND BIOREACTOR FEED PUMPS CONTROL SCHEME

NOTE 1,2,3,10



T-59707A/B	P-59704A	P-59704B	597KSV-096	597KSV-097	597KSV-098	597KSV-082	597KSV-084	597KSV-085	597KSV-083	597KSV-086	597KSV-088
FEOR TANK EMPTYING	BIOTREATER FEED PUMP A	BIOTREATER FEED PUMP B	FEOR A OUTLET	FEOR B OUTLET	P-59704A/B SUCTION CROSS TIE	P-59704A DISCHARGE	P-59704A MIN FLOW TO FEOR A	P-59704A MIN FLOW TO FEOR B	P-59704B DISCHARGE	P-59704B MIN FLOW TO FEOR A	P-59704B MIN FLOW TO FEOR B
A	RUNNING	OFF	O	C	C	O	O	C	C	C	C
B	RUNNING	OFF	C	O	O	O	C	O	C	C	C
A	OFF	RUNNING	O	C	O	C	C	C	O	O	C
B	OFF	RUNNING	C	O	C	C	C	C	O	C	O

NOTE 14

INTERLOCKS	AFFECTED VAVLES	VALVE DESCRIPTION
ATLEAST ONE STRIPPER BYPASS KSV MUST BE OPEN	597KSV-071	STRIPPER BYPASS TO FEOR A
	597KSV-072	STRIPPER BYPASS TO FEOR B
SETTLEMENT DRUM EFFLUENT CAN NOT BE OPEN TO BOTH DNF UNITS AT THE SAME TIME	597KSV-092	DNF 1 INLET
	597KSV-093	DNF 2 INLET

T-59707A/B FEOR FILLING	597KSV-131 FEOR A INLET	597KSV-151 FEOR B INLET	597KSV-071 STRIPPER BYPASS TO FEOR A	597KSV-072 STRIPPER BYPASS TO FEOR B
A	OPEN	CLOSED	OPEN	CLOSED
B	CLOSED	OPEN	CLOSED	OPEN

NOTES:

1. THIS SCHEME IS DEVELOPED BASED ON THE CLIENT's SKETCH. RED COLOR REPRESENTS NEWLY DESIGNED SCOPE, AND BLACK COLOR IS THE EXISTING DESIGN.
2. NORMAL OPERATION
   FEOR TANK T-59707A- SERVED BY (BIOREACTOR FEED PUMP) P-59704A OR P-59704B DISCHARGE TO DNF 2.
   FEOR TANK T-59707B- SERVED BY (BIOREACTOR FEED PUMP) P-59704A OR P-59704B DISCHARGE TO DNF-2.
   INTERCHANGABLE KSV's ARE IN A CLOSED POSITION.
3. SPECIAL MODE- REPROCESSING.
   i) FEOR TANK T-59707A- SERVED BY (BIOREACTOR FEED PUMP) P-59704A DISCHARGE TO SETTLEMENT DRUM. FEOR TANK T-59707B- SERVED BY (BIOREACTOR FEED PUMP) P-59704B DISCHARGE TO DNF-2 OR BIOTREATMENT PACKAGE.
   ii) FEOR TANK T-59707A- SERVED BY (BIOREACTOR FEED PUMP) P-59704A DISCHARGE TO DNF-2 OR BIOTREATMENT PACKAGE. FEOR TANK T-59707B- SERVED BY (BIOREACTOR FEED PUMP) P-59704B DISCHARGE TO SETTLEMENT DRUM. INTERCHANGABLE KSV's ARE IN A CLOSED POSITION.
4. PUMP MINIMUM FLOW CIRCULATION IS LOOPED BACK TO THE SAME TANK THAT SERVES AS THE FLOW SOURCE.
5. DELETED.
6. AT "LL" FLOW THRU THE PUMP SHUTS DOWN THE CORRESPONDING PUMP.
7. AT "LL" TANK LEVEL SHUTS DOWN THE CORRESPONDING OPERATING PUMP.
8. AT "HH" TANK LEVEL CLOSES THE TANK INLET KSVs.
9. DELETED.
10. DURING NORMAL OPERATION, "BAD" WATER GOES TO SETTLEMENT DRUM WHILE "GOOD" WATER TO DNF-2 OR BIOTREATER PACKAGE.
11. THE EXISTING KSV-131 AND 151 ARE INTERLOCKED WITH EXISTING HS-110, AND THE NEW KSV-071 AND 072 ARE INTERLOCKED WITH NEW HS-880.
12. DELETED.
13. DELETED.
14. INTERLOCKS KSVS (597KSV-084/085/086/088) ON THE MINIMUM RECIRCULATION LINES OF THE BIOREACTOR FEED PUMPS SHALL BE INTERLOCKED WITH THE OPERATING PUMP TO ENSURE OPEN ROUTE BACK TO THE FEOR TANK WHERE THE OPERATING PUMP IS PULLING FLUID FROM.

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FIGURE 6. VENT BLOWERS VENT COLLECTION CONTROL SCHEME

NOTES:
1. DELETED.
2. TRIP VENT GAS BLOWER K-59705/59713 WHEN FLAME ARRESTER TEMPERATURE SENSOR TZ-087/088 DETECTS TEMPERATURE ABOVE 150°C.
3. HH LIQUID LEVEL IN FEOR TANK A OR B OR IN SETTLEMENT DRUM TO TRIP DUTY VENT BLOWER (K-59705/ 59713).
4. BLOWER TO RUN FOR A MINIMUM OF 5 (FIVE) MINUTES (CONFIGURABLE) BEFORE TRIPPING ON LOW PRESSURE.
5. HIGH HIGH SUCTION PRESSURE AND INDICATION OF DUTY BLOWER NOT RUNNING SHALL START THE STANDBY BLOWER.

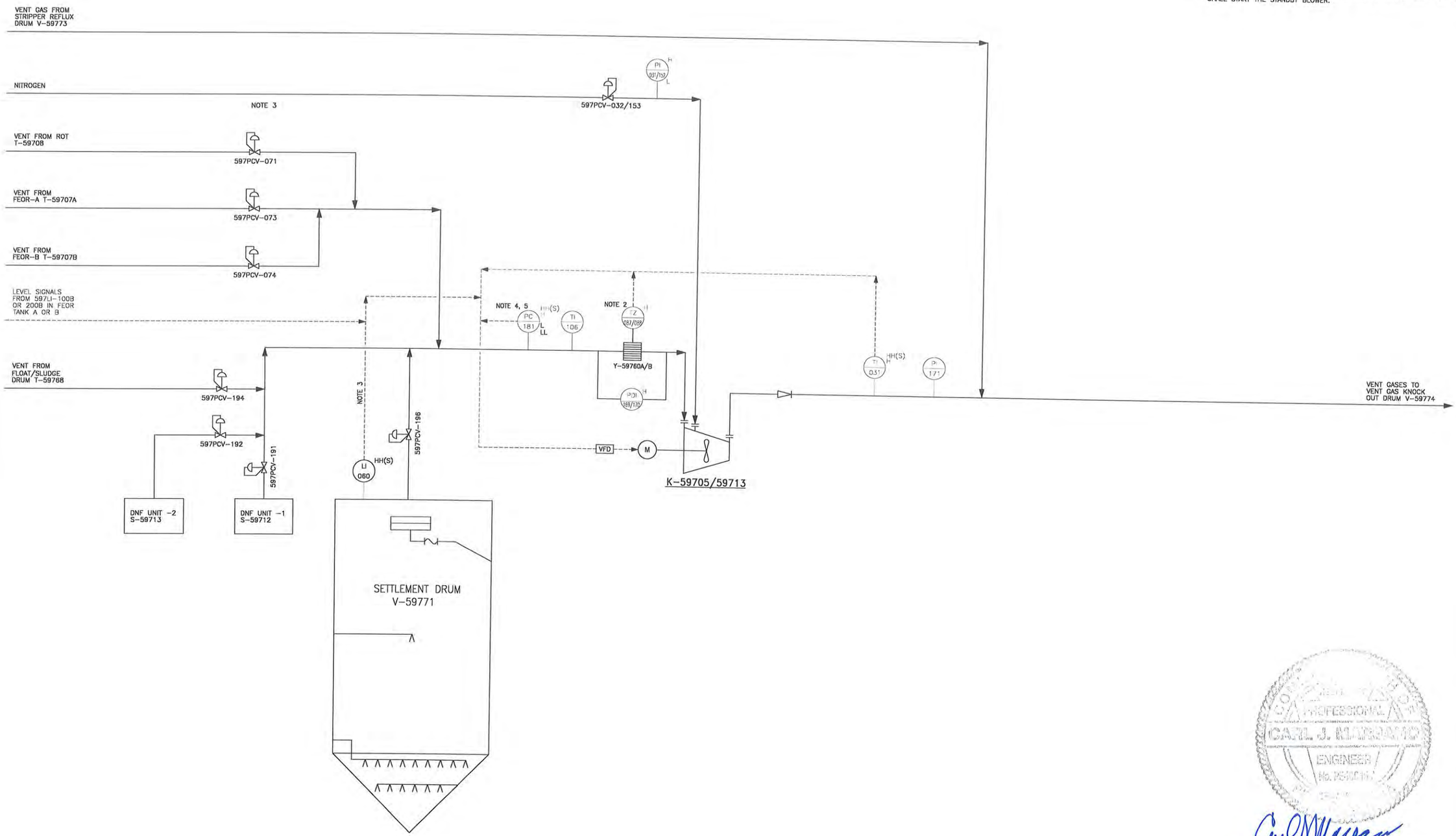

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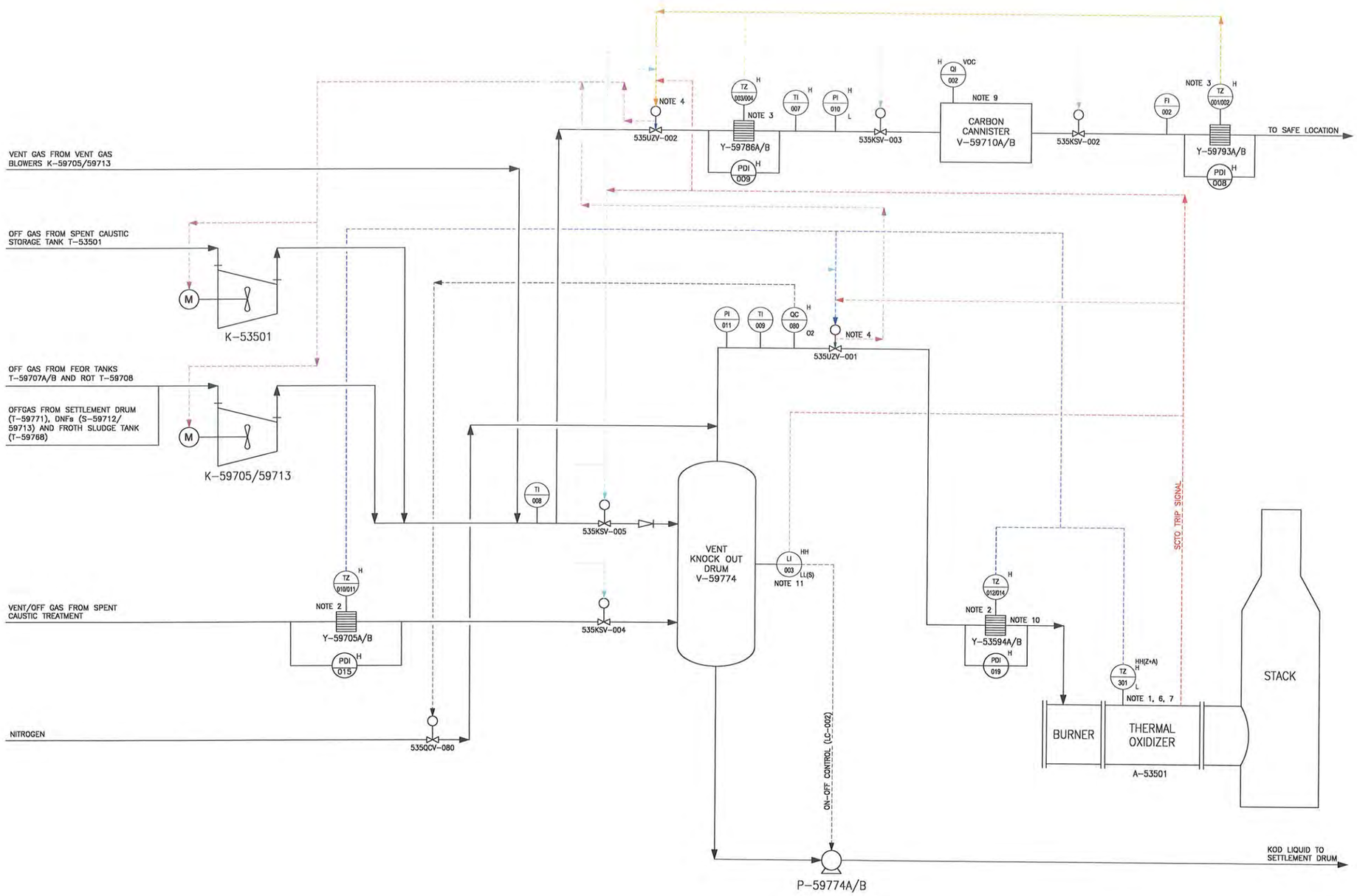
FIGURE 7. SPENT CAUSTIC THERMAL OXIDIZER, VENT KNOCK OUT DRUM AND CARBON CANNISTERS CONTROL SCHEME



NOTES:

1. CLOSE 535UZV-001 AND OPEN 535UZV-002 WHEN SCTO TEMPERATURE IS BELOW 650°C.
2. CLOSE 535UZV-001 WHEN FLAME ARRESTER Y-59705A/B OR Y-53594A/B DETECTS TEMPERATURE ABOVE 150°C.
3. CLOSE 535UZV-002 WHEN FLAME ARRESTER Y-59786A/B OR Y-59793A/B DETECTS TEMPERATURE ABOVE 150°C.
4. SIMULTANEOUS CLOSURE OF 535UZV-001/002 DUE TO ANY REASON WILL TRIP SPENT CAUSTIC TANK STORAGE BLOWERS K-53501, WASTE WATER TANKS VENT BLOWERS K-59705/59713.
5. EXISTING UZV AND TZ (MARKED IN BLACK) ARE SIS CONTROLLED AND THE REST (SHOWN IN RED) ARE CONTROLLED BY DCS.
6. NORMAL SCTO OPERATION : KSV-004/005, UZV-001 ARE OPEN. KSV-002/003, UZV-002 ARE CLOSED.
7. SCTO UPSET OPERATION (i.e., SCTO TRIP OR MALFUNCTION): KSV-004/005, UZV-001 ARE CLOSED. KSV-002/003, UZV-002 ARE OPEN.
8. DELETED.
9. THERE IS A VOC ANALYZER WITH H/HH ALARM BETWEEN THE TWO CARBON BEDS.
10. NEW FLAME ARRESTORS Y-53594 A/B WILL REPLACE EXISTING Y-53533 A/B. NEW TZ-012/ 014 WILL REPLACE EXISTING TZ-304/ 305.
11. LOW LOW LEVEL IN THE DRUM TRIPS THE PUMP. HIGH HIGH TRIPS SCTO.

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