Pennsylvania Department of Environmental Protection

Northwest Regional Office
CLEAN WATER PROGRAM

Application Type	**Renewal**	Application No.	**PA0101923**
Facility Type	**Municipal**	APS ID	**1101993**
Major / Minor	**Minor**	Authorization ID	**1463770**

NPDES PERMIT FACT SHEET INDIVIDUAL SEWAGE

Applicant and Facility Information

Applicant Name	**Saegertown Borough Area Sewer Authority Crawford County**	Facility Name	**Saegertown Area STP**
Applicant Address	PO Box 334 180 Park Avenue Ext Saegertown, PA 16433-0334	Facility Address	Park Avenue Ext Saegertown, PA 16433
Applicant Contact	Phil Koon	Facility Contact	Phil Koon
Applicant Phone	(814) 763-7404	Facility Phone	(814) 763-7404
Client ID	75365	Site ID	263762
Ch 94 Load Status	Not Overloaded	Municipality	Saegertown Borough
Connection Status	No Limitations	County	Crawford
Date Application Received	November 13, 2023	EPA Waived?	Yes
Date Application Accepted		If No, Reason	

Purpose of Application: NPDES Renewal of a treated sewage discharge.

Summary of Review

Due to the presence of endangered mussels and critical habitat in French Creek, the permitting of this facility will be coordinated through the US Fish & Wildlife Service and the Pennsylvania Fish and Boat Commission.

E. Coli monitoring has been added per Department SOP.

Sludge use and disposal description and location(s): Chatataqua County Landfill in Jamestown, NY.

There are currently two open violations for this client (75365) as of 1/22/2025 for operator certifications.

Public Participation

DEP will publish notice of the receipt of the NPDES permit application and a tentative decision to issue the individual NPDES permit in the *Pennsylvania Bulletin* in accordance with 25 Pa. Code § 92a.82. Upon publication in the *Pennsylvania Bulletin*, DEP will accept written comments from interested persons for a 30-day period (which may be extended for one additional 15-day period at DEP's discretion), which will be considered in making a final decision on the application. Any person may request or petition for a public hearing with respect to the application. A public hearing may be held if DEP determines that there is significant public interest in holding a hearing. If a hearing is held, notice of the hearing will be published in the *Pennsylvania Bulletin* at least 30 days prior to the hearing and in at least one newspaper of general circulation within the geographical area of the discharge.

Approve	Deny	Signatures	Date
X		Jordan A. Frey, E.I.T. Jordan A. Frey, E.I.T. / Project Manager	June 12, 2025
X		Adam Olesnanik Adam Olesnanik, P.E. / Environmental Engineer Manager	June 13, 2025

Discharge, Receiving Waters and Water Supply Information			
Outfall No.	001	Design Flow (MGD)	.491
Latitude	41º 42' 23.05"	Longitude	-80º 8' 42.87"
Quad Name		Quad Code	
Wastewater Description:	Sewage Effluent		
Receiving Waters	French Creek (WWF)	Stream Code	51591
NHD Com ID	127350489	RMI	37.78 mi
Drainage Area	631	Yield (cfs/mi^2)	0.075
Q_{7-10} Flow (cfs)	47.325	Q_{7-10} Basis	Streamstats
Elevation (ft)	1096	Slope (ft/ft)	---
Watershed No.	16-A	Chapter 93 Class.	WWF
Existing Use		Existing Use Qualifier	
Exceptions to Use		Exceptions to Criteria	None
Assessment Status	Impaired		
Cause(s) of Impairment	MERCURY		
Source(s) of Impairment	SOURCE UNKNOWN		
TMDL Status		Name	
Background/Ambient Data		Data Source	
pH (SU)	7.0	Default	
Temperature (°F)	25	Default	
Hardness (mg/L)	100	Default	
Other:			
Nearest Downstream Public Water Supply Intake		Aqua Pennsylvania, Inc. - Emlenton	
PWS Waters	Allegheny River	Flow at Intake (cfs)	1376
PWS RMI	90.0	Distance from Outfall (mi)	>25

Changes Since Last Permit Issuance: None.

Other Comments: Facility had to replace a rotating biological contactor (RBC) due to mechanical failure, but as the component is replaced in-kind, an amendment to the WQM permit is not required.

Permittee submitted a Pollutant Reduction Evaluation during the previous permit term in accordance with their previous permit. Results of that study were not definitive.

Compliance History

DMR Data for Outfall 001 (from November 1, 2023 to October 31, 2024)

Parameter	OCT-24	SEP-24	AUG-24	JUL-24	JUN-24	MAY-24	APR-24	MAR-24	FEB-24	JAN-24	DEC-23	NOV-23
Flow (MGD) Average Monthly	0.325	0.306	0.322	0.303	0.341	0.371	0.584	0.499	0.394	0.466	0.341	0.251
Flow (MGD) Weekly Average	0.362	0.333	0.348	0.319	0.370	0.383	1.160	0.583	0.403	0.813	0.406	0.320
pH (S.U.) Instantaneous Minimum	6.9	6.9	6.7	6.1	6.1	6.9	6.6	6.4	6.8	6.8	6.3	6.4
pH (S.U.) Instantaneous Maximum	7.4	7.6	7.4	7.5	7.5	7.4	7.4	7.4	7.9	7.4	7.4	7.5
DO (mg/L) Instantaneous Minimum	6.6	4.9	5.4	5.0	4.2	6.3	5.0	6.9	6.5	6.3	4.6	5.5
TRC (mg/L) Average Monthly	0.3	0.1	0.1	0.1	0.1	0.1	0.3	0.4	0.4	0.4	0.3	0.1
TRC (mg/L) Instantaneous Maximum	0.6	0.1	0.6	0.1	0.3	0.4	0.9	0.7	0.7	0.8	0.6	0.5
CBOD5 (lbs/day) Average Monthly	22	28	< 20	31	51	65	70	35	22	18	10	12
CBOD5 (lbs/day) Weekly Average	29	34	45	47	67	82	111	76	25	28	16	16
CBOD5 (mg/L) Average Monthly	8	11	< 6	11	17	19	17	7	7	5	3	5
CBOD5 (mg/L) Weekly Average	11	13	13	15	21	26	27	14	9	8	5	7
BOD5 (lbs/day) Raw Sewage Influent Average Monthly	410	417	449	316	418	389	348	241	406	340	234	212
BOD5 (mg/L) Raw Sewage Influent Average Monthly	142	160	151	112	139	116	78	55	126	91	83	100
TSS (lbs/day) Average Monthly	30	21	< 17	< 30	33	40	< 51	< 34	19	< 23	< 14	< 11

TSS (lbs/day) Raw Sewage Influent Average Monthly	515	406	359	147	311	253	259	114	102	274	118	109
TSS (lbs/day) Weekly Average	48	25	20	54	46	52	68	64	24	28	< 15	14
TSS (mg/L) Average Monthly	11	8	< 6	< 9	11	12	< 12	< 8	6	< 7	< 5	< 5
TSS (mg/L) Raw Sewage Influent Average Monthly	175	159	125	51	102	76	60	27	33	72	42	51
TSS (mg/L) Weekly Average	19	10	7	17	12	16	14	12	8	8	5	6
Fecal Coliform (No./100 ml) Geometric Mean	173	70	< 33	42	< 48	< 16	< 20	186	< 158	186	< 141	70
Fecal Coliform (No./100 ml) Instantaneous Maximum	657	494	131	443	986	611	121	925	1378	1936	1538	725
Total Nitrogen (mg/L) Average Monthly	16.2	17.9	14.5	17.3	13.2	16	14.4	13.3	14.5	12.2	14.1	16
Ammonia (mg/L) Average Monthly	5.09	10.4	13.8	12.8	10.8	1.13	10.1	3.28	4.99	2.15	3.2	< 0.4
Total Phosphorus (lbs/day) Average Monthly	3.9	1.7	1.9	< 1.6	2.4	1.7	< 3.1	5.0	1.7	2.7	1.7	1.1
Total Phosphorus (mg/L) Average Monthly	1.4	1	1	< 0.5	1	0.5	< 1	1	0.5	0.8	0.6	< 1
Total Nickel (mg/L) Average Quarterly		0.024			0.013			0.016			< 0.044	
Chloride (mg/L) Average Monthly	181	164	158	172	190	111	156	161	175	114	149	178

Development of Effluent Limitations

Outfall No. 001 **Design Flow (MGD)** .491
Latitude 41º 42' 23.00" **Longitude** -80º 8' 43.00"
Wastewater Description: Sewage Effluent

Technology-Based Limitations

The following technology-based limitations apply, subject to water quality analysis and BPJ where applicable:

Pollutant	Limit (mg/l)	SBC	Federal Regulation	State Regulation
$CBOD_5$	25	Average Monthly	133.102(a)(4)(i)	92a.47(a)(1)
	40	Average Weekly	133.102(a)(4)(ii)	92a.47(a)(2)
Total Suspended Solids	30	Average Monthly	133.102(b)(1)	92a.47(a)(1)
	45	Average Weekly	133.102(b)(2)	92a.47(a)(2)
pH	6.0 – 9.0 S.U.	Min – Max	133.102(c)	95.2(1)
Fecal Coliform (5/1 – 9/30)	200 / 100 ml	Geo Mean	-	92a.47(a)(4)
Fecal Coliform (5/1 – 9/30)	1,000 / 100 ml	IMAX	-	92a.47(a)(4)
Fecal Coliform (10/1 – 4/30)	2,000 / 100 ml	Geo Mean	-	92a.47(a)(5)
Fecal Coliform (10/1 – 4/30)	10,000 / 100 ml	IMAX	-	92a.47(a)(5)
Total Residual Chlorine	0.5	Average Monthly	-	92a.48(b)(2)
E. Coli (No./100ml)	Report	IMAX		92a.61

Comments: E. Coli monitoring was added in accordance with the Department’s SOP on new and reissued permits.

Water Quality-Based Limitations

The following limitations were determined through water quality modeling (output files attached):

Parameter	Limit (mg/l)	SBC	Model
Ammonia-Nitrogen	25	Average Monthly	WQM v.1.0b
CBOD5	25	Average Monthly	WQM v1.0b
Dissolved Oxygen	3.0	Daily Minimum	WQM v.1.0b
Total Residual Chlorine	0.5	Average Monthly	TRC Spreadsheet

Comments: Ammonia-Nitrogen (NH3N) & CBOD5 limits of 25 mg/l, and a Dissolved Oxygen limit of 3.0 mg/l were determined by WQM modeling to be protective. When an NH3-N limit of 25 mg/l is acceptable, monitoring-only can be imposed per the Department’s SOP. The Department’s TRC Spreadsheet determined a limit of 0.5 mg/l.

Best Professional Judgment (BPJ) Limitations

Comments: A Dissolved Oxygen limit of 4.0 mg/l shall be imposed as a BPJ limit consistent with Department policy.

An Aquatic Biological Investigation was conducted in August of 2019, and a report was drafted in February of 2020, on French Creek in the immediate downstream vicinity of the Saegertown STP discharge. Based on the survey, which is attached, there is no impact to the protected species of mussels from the STP discharge.

Anti-Backsliding

N/A

Treatment Facility Summary				
Treatment Facility Name: Saegertown Area STP				

WQM Permit No.	Issuance Date
2077403	5/8/78
2077403-A1	7/1/14

Waste Type	Degree of Treatment	Process Type	Disinfection	Avg Annual Flow (MGD)
Sewage	Secondary	Rotating Biological Contactors	Gas Chlorine	---
Hydraulic Capacity (MGD)	**Organic Capacity (lbs/day)**	**Load Status**	**Biosolids Treatment**	**Biosolids Use/Disposal**
0.491	835	Existing Organic Overload	Aerobic Digestion	Landfill

#2077403: Comminutor, Primary Settling, RBC's, Final Clarifiers and Chlorination. Sludge handling by a primary and a secondary anaerobic digester and sludge drying beds.

#2077403-A1: Replace the comminutor with a mechanically cleaned bar screen and washer, convert the anaerobic digesters to aerobic and install a new alum feed system.

Note: The discharge is located just upstream of the confluence of Woodcock Creek and French Creek. The outfall is configured as a diffuser that extends approximately 30-feet into French Creek. A 1997 study observed the discharge mixes with approximately 20% of the stream, 1,000-feet downstream. In August 1999, DEP observed the discharge plume mixing with 50% of the stream at a point 255-feet downstream. This location is considered the first reasonable location for suitable endangered mussel habitat. [excerpt from the 2/2/00 Saegertown WQPR] The Department conducted its own Biological Investigation of the stream that was drafted in 2020, and the investigation's findings were consistent with the 1997 stream study.

Threatened and Endangered Mussel Species Concerns and Considerations

The main segment of French Creek from the Union City Reservoir to the confluence with the Allegheny River was designated by the United States Fish and Wildlife Services (USFWS) as "Critical Habitat" for the rabbitsfoot mussel, a federally listed threatened species, and is known to also contain other threatened and endangered mussel species. Due to this being a direct discharge to French Creek, potential impacts were evaluated.

The USFWS has indicated in comment letters on other NPDES permits that to protect threatened and endangered mussel species, wastewater discharges containing ammonia-nitrogen (NH_3-N), chloride (Cl^-), zinc and nickel, where mussels or their habitat exist, can be no more than 1.9 mg/l, 78 mg/l, 13.18 µg/l and 7.3 µg/l, respectively. The Department reviewed sampling data for these three parameters to determine potential impacts that the discharge may have to threatened and endangered mussel species.

The Department completed an aquatic biological investigation on French Creek in Woodcock Township of Crawford County, concerning stream impacts from this facility and Lord Corporation's industrial wastewater discharge. The study was completed in 2019, and the report was finalized on May 29, 2025. The investigation concluded aquatic communities appeared to be driven by habitat throughout the study area. The Department's study found no evidence the discharge was impacting water quality or aquatic life. The Aquatic Biological Investigation is included as an attachment to this Fact Sheet.
The Department utilized its Impact Evaluation spreadsheet to calculate the maximum potential impact area of the STP discharge under the worst-case theoretical scenario. The spreadsheet is attached to this fact sheet. This yielded a maximum potential impact area of approximately 73.95 square meters (796 ft^2) for ammonia-nitrogen, 6.25 square meters (67 ft^2) for nickel, 0.99 square meters (11 ft^2) for Zinc, 0.80 square meters (9 ft^2) for Chloride, and 0.75 square meters (8 ft^2) for Copper, and it is noted that the maximum area potentially impacted of approximately 73.95 square meters for ammonia-nitrogen is not a favorable habitat for freshwater mussels and it did not appear to be having any adverse

impacts to mussels or other aquatic life as noted in the May 29, 2025 Aquatic Biological Investigation. The Department will retain monitoring for Chloride, Nickel, and Zinc for the next permit term and may conduct an additional survey. Since this is a sewage discharge, Ammonia-Nitrogen monitoring is already required.

Proposed Effluent Limitations and Monitoring Requirements

The limitations and monitoring requirements specified below are proposed for the draft permit, and reflect the most stringent limitations amongst technology, water quality and BPJ. Instantaneous Maximum (IMAX) limits are determined using multipliers of 2 (conventional pollutants) or 2.5 (toxic pollutants). Sample frequencies and types are derived from the "NPDES Permit Writer's Manual" (386-0400-001), SOPs and/or BPJ.

Outfall 001, Effective Period: Permit Effective Date through Permit Expiration Date.

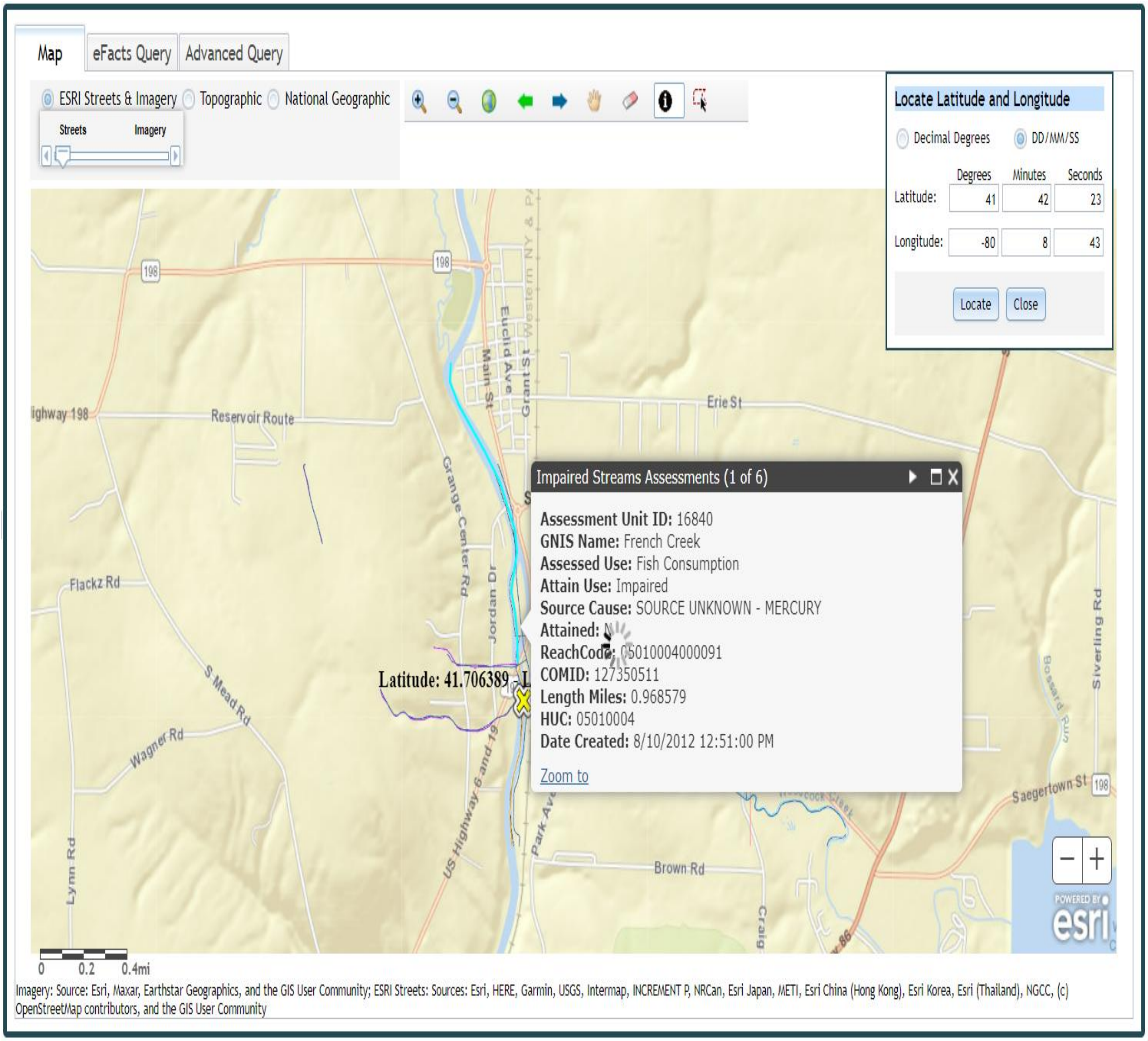
Parameter	Effluent Limitations						Monitoring Requirements	
	Mass Units (lbs/day) (1)		Concentrations (mg/L)				Minimum (2) Measurement Frequency	Required Sample Type
	Average Monthly	Weekly Average	Minimum	Average Monthly	Weekly Average	Instant. Maximum		
Flow (MGD)	Report	Report	XXX	XXX	XXX	XXX	Continuous	Measured
pH (S.U.)	XXX	XXX	6.0 Inst Min	XXX	XXX	9.0	1/day	Grab
DO	XXX	XXX	4.0 Inst Min	XXX	XXX	XXX	1/day	Grab
TRC	XXX	XXX	XXX	0.5	XXX	1.6	1/day	Grab
CBOD5	102	163	XXX	25.0	40.0	50	1/week	24-Hr Composite
BOD5 Raw Sewage Influent	Report	XXX	XXX	Report	XXX	XXX	1/week	24-Hr Composite
TSS	123	184	XXX	30.0	45.0	60	1/week	24-Hr Composite
TSS Raw Sewage Influent	Report	XXX	XXX	Report	XXX	XXX	1/week	24-Hr Composite
Fecal Coliform (No./100 ml) Nov 1 - Apr 30	XXX	XXX	XXX	2000 Geo Mean	XXX	10000	1/week	Grab
Fecal Coliform (No./100 ml) May 1 - Oct 31	XXX	XXX	XXX	200 Geo Mean	XXX	1000	1/week	Grab
E. Coli (No./100 ml)	XXX	XXX	XXX	XXX	XXX	Report	1/quarter	Grab
Total Nitrogen	XXX	XXX	XXX	Report	XXX	XXX	1/week	24-Hr Composite
Ammonia	XXX	XXX	XXX	Report	XXX	XXX	1/month	24-Hr Composite
Total Phosphorus	8.2	XXX	XXX	2.0	XXX	4	1/week	24-Hr Composite

Outfall 001 , Continued (from Permit Effective Date through Permit Expiration Date)

Parameter	Effluent Limitations						Monitoring Requirements	
	Mass Units (lbs/day) (1)		Concentrations (mg/L)				Minimum (2) Measurement Frequency	Required Sample Type
	Average Monthly	Weekly Average	Minimum	Average Monthly	Weekly Average	Instant. Maximum		
Total Nickel (µg/L)	XXX	XXX	XXX	Report Avg Qrtly	XXX	XXX	1/quarter	24-Hr Composite
Total Zinc (µg/L)	XXX	XXX	XXX	Report Avg Qrtly	XXX	XXX	1/quarter	24-Hr Composite
Chloride	XXX	XXX	XXX	Report	XXX	XXX	1/month	24-Hr Composite

Compliance Sampling Location: Outfall 001, after disinfection, except for the influent testing.

Other Comments: Special Conditions – Chlorine Minimization, Solids Handling


Map
eFacts Query
Advanced Query
ESRI Streets & Imagery
Topographic
National Geographic
Locate Latitude and Longitude
Decimal Degrees
DD/MM/SS
Degrees Minutes Seconds
Latitude: 41 42 23
Longitude: -80 8 43
Locate
Close
Impaired Streams Assessments (1 of 6)
Assessment Unit ID: 16840
GNIS Name: French Creek
Assessed Use: Fish Consumption
Attain Use: Impaired
Source Cause: SOURCE UNKNOWN - MERCURY
ReachCode: 05010004000091
COMID: 127350511
Length Miles: 0.968579
HUC: 05010004
Date Created: 8/10/2012 12:51:00 PM
Zoom to
Latitude: 41.706389
Erie St
Reservoir Route
Flackz Rd
Brown Rd
Saegertown St
0 0.2 0.4mi
Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community; ESRI Streets: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

TRC Spreadsheet - Saegertown Area STP

TRC EVALUATION

Input appropriate values in A3:A9 and D3:D9

47.325	= Q stream (cfs)	0.5	= CV Daily
0.491	= Q discharge (MGD)	0.5	= CV Hourly
30	= no. samples	1	= AFC_Partial Mix Factor
0.3	= Chlorine Demand of Stream	1	= CFC_Partial Mix Factor
0	= Chlorine Demand of Discharge	15	= AFC_Criteria Compliance Time (min)
0.5	= BAT/BPJ Value	720	= CFC_Criteria Compliance Time (min)
0	= % Factor of Safety (FOS)		=Decay Coefficient (K)

Source	Reference	AFC Calculations	Reference	CFC Calculations
TRC	1.3.2.iii	WLA afc = 19.894	1.3.2.iii	WLA cfc = 19.388
PENTOXSD TRG	5.1a	LTAMULT afc = 0.373	5.1c	LTAMULT cfc = 0.581
PENTOXSD TRG	5.1b	LTA_afc= 7.413	5.1d	LTA_cfc = 11.271

Source		Effluent Limit Calculations	
PENTOXSD TRG	5.1f	AML MULT = 1.231	
PENTOXSD TRG	5.1g	AVG MON LIMIT (mg/l) = 0.500	BAT/BPJ
		INST MAX LIMIT (mg/l) = 1.635	

WLA afc	(.019/e(-k*AFC_tc)) + [(AFC_Yc*Qs*.019/Qd*e(-k*AFC_tc))... ...+ Xd + (AFC_Yc*Qs*Xs/Qd)]*(1-FOS/100)
LTAMULT afc	EXP((0.5*LN(cvh^2+1))-2.326*LN(cvh^2+1)^0.5)
LTA_afc	wla_afc*LTAMULT_afc
WLA_cfc	(.011/e(-k*CFC_tc) + [(CFC_Yc*Qs*.011/Qd*e(-k*CFC_tc))... ...+ Xd + (CFC_Yc*Qs*Xs/Qd)]*(1-FOS/100)
LTAMULT_cfc	EXP((0.5*LN(cvd^2/no_samples+1))-2.326*LN(cvd^2/no_samples+1)^0.5)
LTA_cfc	wla_cfc*LTAMULT_cfc
AML MULT	EXP(2.326*LN((cvd^2/no_samples+1)^0.5)-0.5*LN(cvd^2/no_samples+1))
AVG MON LIMIT	MIN(BAT_BPJ,MIN(LTA_afc,LTA_cfc)*AML_MULT)
INST MAX LIMIT	1.5*((av_mon_limit/AML_MULT)/LTAMULT_afc)

WQM 7.0 Wasteload Allocations

SWP Basin	Stream Code	Stream Name
16D	51591	FRENCH CREEK

NH3-N Acute Allocations

RMI	Discharge Name	Baseline Criterion (mg/L)	Baseline WLA (mg/L)	Multiple Criterion (mg/L)	Multiple WLA (mg/L)	Critical Reach	Percent Reduction
38.890	Saegertown STP	6.76	50	6.76	50	0	0

NH3-N Chronic Allocations

RMI	Discharge Name	Baseline Criterion (mg/L)	Baseline WLA (mg/L)	Multiple Criterion (mg/L)	Multiple WLA (mg/L)	Critical Reach	Percent Reduction
38.890	Saegertown STP	1.34	25	1.34	25	0	0

Dissolved Oxygen Allocations

RMI	Discharge Name	CBOD5		NH3-N		Dissolved Oxygen		Critical Reach	Percent Reduction
		Baseline (mg/L)	Multiple (mg/L)	Baseline (mg/L)	Multiple (mg/L)	Baseline (mg/L)	Multiple (mg/L)		
38.89	Saegertown STP	25	25	25	25	3	3	0	0

WQM 7.0 D.O.Simulation

SWP Basin	Stream Code	Stream Name
16D	51591	FRENCH CREEK

RMI	Total Discharge Flow (mgd)	Analysis Temperature (ºC)	Analysis pH
38.890	0.491	25.000	7.000
Reach Width (ft)	Reach Depth (ft)	Reach WDRatio	Reach Velocity (fps)
124.900	1.062	117.646	0.363
Reach CBOD5 (mg/L)	Reach Kc (1/days)	Reach NH3-N (mg/L)	Reach Kn (1/days)
2.36	0.200	0.39	1.029
Reach DO (mg/L)	Reach Kr (1/days)	Kr Equation	Reach DO Goal (mg/L)
8.160	1.668	Tsivoglou	6
Reach Travel Time (days)			
0.292			

Subreach Results

TravTime (days)	CBOD5 (mg/L)	NH3-N (mg/L)	D.O. (mg/L)
0.029	2.35	0.38	7.54
0.058	2.33	0.37	7.54
0.087	2.31	0.36	7.54
0.117	2.30	0.35	7.54
0.146	2.28	0.34	7.54
0.175	2.26	0.33	7.54
0.204	2.25	0.32	7.54
0.233	2.23	0.31	7.54
0.262	2.21	0.30	7.54
0.292	2.20	0.29	7.54

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RMI	Name	Permit Number	Disc Flow (mgd)	Parameter	Effl. Limit 30-day Ave. (mg/L)	Effl. Limit Maximum (mg/L)	Effl. Limit Minimum (mg/L)
38.890	Saegertown STP	PA0101923	0.491	CBOD5	25		
				NH3-N	25	50	
				Dissolved Oxygen			3

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Input Data WQM 7.0

SWP Basin	Stream Code	Stream Name	RMI	Elevation (ft)	Drainage Area (sq mi)	Slope (ft/ft)	PWS Withdrawal (mgd)	Apply FC
16D	51591	FRENCH CREEK	38.890	1096.00	631.00	0.00000	0.00	☑

Stream Data

Design Cond.	LFY (cfsm)	Trib Flow (cfs)	Stream Flow (cfs)	Rch Trav Time (days)	Rch Velocity (fps)	WD Ratio	Rch Width (ft)	Rch Depth (ft)	Tributary Temp (ºC)	Tributary pH	Stream Temp (ºC)	Stream pH
Q7-10	0.075	0.00	0.00	0.000	0.000	0.0	0.00	0.00	25.00	7.00	0.00	0.00
Q1-10		0.00	0.00	0.000	0.000							
Q30-10		0.00	0.00	0.000	0.000							

Discharge Data

Name	Permit Number	Existing Disc Flow (mgd)	Permitted Disc Flow (mgd)	Design Disc Flow (mgd)	Reserve Factor	Disc Temp (ºC)	Disc pH
Saegertown STP	PA0101923	0.4910	0.4910	0.4910	0.000	25.00	7.00

Parameter Data

Parameter Name	Disc Conc (mg/L)	Trib Conc (mg/L)	Stream Conc (mg/L)	Fate Coef (1/days)
CBOD5	25.00	2.00	0.00	1.50
Dissolved Oxygen	3.00	8.24	0.00	0.00
NH3-N	25.00	0.00	0.00	0.70

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Input Data WQM 7.0

SWP Basin	Stream Code	Stream Name	RMI	Elevation (ft)	Drainage Area (sq mi)	Slope (ft/ft)	PWS Withdrawal (mgd)	Apply FC
16D	51591	FRENCH CREEK	37.160	1088.00	685.00	0.00000	0.00	☑

Stream Data

Design Cond.	LFY (cfsm)	Trib Flow (cfs)	Stream Flow (cfs)	Rch Trav Time (days)	Rch Velocity (fps)	WD Ratio	Rch Width (ft)	Rch Depth (ft)	Tributary Temp (ºC)	Tributary pH	Stream Temp (ºC)	Stream pH
Q7-10	0.076	0.00	0.00	0.000	0.000	0.0	0.00	0.00	25.00	7.00	0.00	0.00
Q1-10		0.00	0.00	0.000	0.000							
Q30-10		0.00	0.00	0.000	0.000							

Discharge Data

Name	Permit Number	Existing Disc Flow (mgd)	Permitted Disc Flow (mgd)	Design Disc Flow (mgd)	Reserve Factor	Disc Temp (ºC)	Disc pH
		0.0000	0.0000	0.0000	0.000	25.00	7.00

Parameter Data

Parameter Name	Disc Conc (mg/L)	Trib Conc (mg/L)	Stream Conc (mg/L)	Fate Coef (1/days)
CBOD5	25.00	2.00	0.00	1.50
Dissolved Oxygen	3.00	8.24	0.00	0.00
NH3-N	25.00	0.00	0.00	0.70

WQM 7.0 Hydrodynamic Outputs

SWP Basin	Stream Code	Stream Name
16D	51591	FRENCH CREEK

RMI	Stream Flow (cfs)	PWS With (cfs)	Net Stream Flow (cfs)	Disc Analysis Flow (cfs)	Reach Slope (ft/ft)	Depth (ft)	Width (ft)	W/D Ratio	Velocity (fps)	Reach Trav Time (days)	Analysis Temp (ºC)	Analysis pH
Q7-10 Flow												
38.890	47.33	0.00	47.33	.7596	0.00088	1.062	124.9	117.65	0.36	0.292	25.00	7.00
Q1-10 Flow												
38.890	30.29	0.00	30.29	.7596	0.00088	NA	NA	NA	0.28	0.372	25.00	7.00
Q30-10 Flow												
38.890	64.36	0.00	64.36	.7596	0.00088	NA	NA	NA	0.43	0.246	25.00	7.00

WQM 7.0 Modeling Specifications

Parameters	Both	Use Inputted Q1-10 and Q30-10 Flows	☑
WLA Method	EMPR	Use Inputted W/D Ratio	☐
Q1-10/Q7-10 Ratio	0.64	Use Inputted Reach Travel Times	☐
Q30-10/Q7-10 Ratio	1.36	Temperature Adjust Kr	☑
D.O. Saturation	90.00%	Use Balanced Technology	☑
D.O. Goal	6		

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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MEMO

TO	Adam Olesnanik *Adam Olesnanik* Environmental Group Manager Clean Water Program
FROM	Joe Brancato *Joe Brancato* Aquatic Biologist Supervisor Clean Water Program
THROUGH	Justin Dickey Environmental Program Manager Clean Water Program
DATE	May 29, 2025
RE	Aquatic Biological Investigation Saegertown Sewage Treatment Plant (NPDES No. PA0101923) & Lord Corporation (NPDES No. PA0101800) French Creek (SC 51591) Woodcock Township, Crawford County

INTRODUCTION

At the request of the Clean Water Program, an aquatic biological investigation was completed on French Creek in Woodcock Township, Crawford County, in August 2019. Benthic macroinvertebrates, mussels, water quality, and habitat were examined above and below the joint Saegertown Sewage Treatment Plant (Saegertown) discharge and Lord Corporation Industrial Water (Lord) discharge. The study was conducted to determine the impacts, if any, effluent from the Saegertown and Lord discharges may be having on water quality and aquatic life in French Creek.

Saegertown currently operates a Minor Sewage Facility (greater than 0.05 and less than 1.0 million gallons per day) under National Pollutant Discharge Elimination System (NPDES) Permit No. PA0101923. The permit became effective June 1, 2019, and expires May 31, 2024. The permit is for a design flow of 0.491 MGD. Effluent from Saegertown mixes with industrial wastewater from the Lord Corporation, in pipe, prior to its discharge into French Creek. The discharge (Outfall 001) is located in French Creek, approximately 35' from the left descending bank at 41° 42' 24" N; 80° 08' 42" W. In its current and previous permit cycle (March 1, 2013, through May 31, 2018) combined, Saegertown had 19 effluent violations. These violations included exceedances of total phosphorus, total suspended solids, carbonaceous biochemical oxygen demand, and fecal coliforms. All but two of these violations occurred prior to October 2015. The most recent violation, an instantaneous maximum exceedance of fecal coliforms, occurred in June 2018.

The Lord Corporation operates a Minor Industrial Wastewater Facility without Effluent Limitation Guidelines under NPDES Permit No. PA0101800. The permit became effective September 1, 2014, and has been administratively extended. The discharge is composed of non-contact cooling water and stormwater. The permit is for a design flow of 1.642 MGD. As mentioned above, the Lord effluent mixes with the Saegertown effluent, in pipe, prior to its discharge to French Creek. Through this permit cycle, Lord has not had any effluent violations.

French Creek originates in southwestern New York, just west of the town of Sherman. Flowing southwest into Pennsylvania, the stream travels approximately 117 miles to its confluence with the Allegheny River. At its mouth, French Creek drains 1,240 square miles. The basin is 55% forested with 7% urban cover, including 1% impervious surface (USGS StreamStats 2020). Aside from woodlots, agriculture is the predominant land use. French Creek is composed of two State Water Plans (Upper French Creek – 16A; Lower French Creek – 16D) and is in the French Creek Hydrologic Unit (Hydrologic Unit Code 05010004). French Creek is currently attaining its designated aquatic life use for Warm Water Fishes (WWF) under 25 PA Code §93.9q.

French Creek is one of the most biologically diverse streams in the northeastern United States. Over 80 fish species inhabit the watershed. Additionally, the French Creek basin has historically supported 31 mussel species, including 28 in the mainstem. At the time of the survey, six French Creek mussel species are listed and protected as endangered by the Commonwealth of Pennsylvania (Table 1). The Northern riffleshell (*Epioblasma rangiana*), snuffbox (*Epioblasma triquetra*), clubshell (*Pleurobema clava*), and rayed bean (*Villosa fabalis*) are federally listed and protected as endangered under the Endangered Species Act. Additionally, the rabbitsfoot (*Theliderma cylindrica*) is federally listed and protected as threatened with the reach of French Creek from Union City Dam downstream to its mouth designated as critical rabbitsfoot habitat. The salamander mussel (*Simpsonaias ambigua*) is the only state endangered French Creek mussel not federally listed as endangered or threatened.

A previous mussel survey was conducted by EnviroScience, Inc. on behalf of the Department in 1997. Sampling consisted of conducting mussel searches along several transects across the width of French Creek. One of the transects were completed 20' upstream of the Saegertown/Lord discharge (noted as "the discharge" through the rest of this report), while seven transects were conducted downstream of the discharge. The downstream transects ranged from 20' to 2000' below the discharge. Additionally, ten evenly spaced quadrats (1 square meter) were examined across each transect line. While no narrative was written, data from the EnviroScience study found a robust mussel assemblage in the 2020' sampling reach encompassing the discharge. At the station upstream and extending approximately 500-1000' downstream of the discharge, mussels were most densely concentrated mid-channel. At this same reach, mussel densities were few to moderate along the right descending bank and mostly absent in the final 20-25 meters of the left descending bank. Mussels were more widely dispersed across the width of French Creek at the two transects 1000' and 2000' downstream of the discharge, though were still concentrated mid-channel.

METHODS AND MATERIALS

General Site Description

At the sampling reach, French Creek drains 682 square miles. Upstream of the sampling location, the basin is 53% forested with 6% urban cover, including 1% impervious surface (USGS StreamStats 2020). Aside from woodlots, agriculture is the predominant land use. The sampling location falls within the Upper French Creek State Water Plan (16A). The discharge and sampling reach was located just south of Saegertown, the US Route 6 Bridge, and the Pennsylvania Fish and Boat Commission Saegertown Launch. The entirety of the study area began just below the US Route 6 Bridge and extended downstream to 2000' below the discharge (Figure 1).

As described above, the discharge emerges from a pipe running approximately 35' into French Creek, off the left descending bank. The discharge is located approximately 110-meters downstream of the US Route 6 Bridge. Flow in French Creek, taken in Meadville approximately 6 miles downstream of the study area, during the survey is summarized below (Table 2). Flow in French Creek on August 5-6 was at average flow for this time of year, while flow on the other dates was slightly elevated. The discharge is located approximately 35' upstream of French Creek's confluence with Woodcock Creek. Woodcock Creek is a small to moderate size stream, draining approximately 51 squares miles. The Woodcock Creek watershed consists of a mix of woodlots, agriculture, and protected wetlands (Erie National Wildlife Refuge). Additionally, Woodcock Creek drains Woodcock Creek Reservoir, a 325-acre U.S. Army Corps of Engineers Impoundment. The outfall of Woodcock Creek Reservoir lies 3.9 miles upstream of Woodcock Creek's confluence with French Creek. These last 3.9 miles, Woodcock Creek generally meanders along row crop farms and old fields. The stream carries fine sediment loads from cut banks during moderate to high flow events. Flow from Woodcock Creek during this survey is summarized below (Table 2). Flow in Woodcock Creek was slightly elevated during all sampling dates compared to normal flow for this time of year.

French Creek is largely a shallow run upstream of its confluence with Woodcock Creek to the US Route 6 Bridge. The stream was approximately 55-meters wide and ranged from 1-4' deep. Substrate was predominantly cobble and gravel with some sand. Substrate was loosely compacted mid-channel with greater embeddedness along the right descending bank. The left descending bank was more depositional, as sand and silt accumulated along the bank. The closer to the mouth of Woodcock Creek, the finer the substrate became, largely due to eddies formed by flow from Woodcock Creek. Macrophyte growth was heavy in the sand and silt along the left descending bank. Vegetation was light to absent at the rest of the survey location above Woodcock Creek.

At the mouth of Woodcock Creek was a large, deep hole up to 10' deep. The bottom was silty and, when diving, visibility approached zero if sediment was disturbed. Approximately 75 meters downstream of its confluence with Woodcock Creek, the stream narrowed to approximately 40-45 meters wide and entered a heavy riffle. Substrate in the riffle was predominantly boulder and cobble with some gravel. Depth ranged from 1-4' deep. The riffle extended approximately 135-meters downstream before French Creek widened into a shallow run. This run extended below the end of the sampling area. Width ranged from 50-65 meters and depth ranged from 1-5'. Substrate consisted primarily of cobble, gravel, and sand. Some bedrock was found along the right descending bank. Again, substrate was loosely compacted mid-channel. Substrate became more compacted with moderate to high embeddedness along the left descending bank.

Discharge Plume Delineation

The discharge flows from a pipe in French Creek, approximately 35' from the left descending bank. The pipe was encased in a submerged concrete pad, which extended out from the bank. Fine sediment and vegetation covered the concrete pad near the bank, becoming sparse closer to the discharge pipe. At the pipe, stream depth increased by approximately 18-24". Immediately adjacent to the pipe was a depositional area which collected fine sediment and dead mussel shells. The plume delineation was conducted using a multiparameter field meter. Starting just above the discharge, temperature, dissolved oxygen, specific conductivity, and pH were measured *in situ*. Width of the discharge plume was determined at each location using specific conductance readings and a tape measure. Measurements were conducted every five feet downstream of the discharge until French Creek became too deep to accurately conduct recordings. The increase in depth approximately 25-35' below the discharge was likely due to Woodcock Creek, which enters French Creek at this location. Measurements were also taken from Woodcock Creek, approximately 100' upstream of its confluence with French Creek, and in French Creek, approximately 200' downstream of the confluence with Woodcock Creek and 300' downstream of the discharge.

Water Quality Sampling

Grab water samples were collected at six locations in the vicinity of the discharge on August 5, 2019 (Figure 2, Table 3). Samples were collected in French Creek upstream of the discharge, directly in the discharge (on the left descending bank), on the right descending bank at the discharge (opposite bank of discharge), 25' below the discharge (within the plume), and approximately 100-meters downstream of discharge (within the influence of Woodcock Creek). An additional sample was taken in Woodcock Creek, approximately 100' upstream of its confluence with French Creek.

The Department's Bureau of Laboratories (BOL) Standard Analysis Code (SAC) 087 was used for water analysis. Grab water samples were analyzed for a suite of 46 parameters including several species of dissolved and total nitrogen and phosphorus, dissolved and total metals, and total suspended solids, among other constituents. These samples were collected with HPDE bottles and shipped on ice to the Department's BOL following approved U.S. Environmental Protection Agency (EPA) standards. *In situ* field measurements for temperature, dissolved oxygen, and specific conductivity were recorded using a multiparameter field meter concurrently with the grab water samples. Additional *in situ* field measurements were taken at the benthic macroinvertebrate stations characterized below.

Two continuous instream monitoring (CIM) stations, one approximately 60 meters upstream of the discharge and one within the plume less than a meter from the discharge pipe, were used to document basic water quality (temperature, pH, specific conductivity, and dissolved oxygen) above and below the discharge. The CIM monitors consisted of a multiparameter sonde being placed at each of the two respective stations with measurements recorded every 30-minutes during placement.

Benthic Macroinvertebrates

Benthic macroinvertebrates were collected, processed, and identified following Instream Comprehensive Evaluation (ICE) protocols (PA DEP 2018a) at three stations on August 5, 2019. Though sampling stations were conducted as close to the discharge as possible, sampling locations were limited due to lack of optimal macroinvertebrate habitat (i.e. riffles) immediately above and below the discharge (Figure 3). A station approximately 75-meters upstream of the discharge (1FRC) was established as a reference mid-channel. Two additional stations were established approximately 100-meters downstream of the discharge (5FRC), one on the left descending bank (in discharge and Woodcock Creek influence) and one on the right descending bank (out of discharge and Woodcock Creek influence). Sampling was standard to riffles, utilizing the best available habitat for each station. Six D-frame kicks were completed at each station. The six kicks were combined into a single jar and filled with 95% ethyl alcohol for preservation. Upon arrival at the Department's lab, organisms were subsampled and identified using a dissecting microscope. Peckarsky *et al.* (1990), Stewart and Stark (2002), and Merritt *et al.* (2019) were used as taxonomic references. An Index of Biotic Integrity (IBI) was computed for each station.

Mussels

Transects

The Department's mussel survey of French Creek extended from 20' upstream of the discharge to 2000' downstream of the discharge, which was consistent with the 1997 EnviroScience survey. Mussel sampling was conducted by the Department on August 6, 12, and 29, 2019. Sampling consisted of conducting mussel searches along multiple transects across French Creek (Table 4, Figure 4). A transect was a one-meter-wide line, extending across the width of French Creek. One transect was completed 20' upstream of the discharge, while seven transects were conducted downstream of the discharge. The Department incorporated an additional transect line (T2) even with the discharge to travel directly into its plume. This transect was only examined the last 20-meters from the left descending bank, bracketing the discharge. Additionally, the last twenty meters along the left descending bank of each transect at or below the discharge (T2-T9) were separated and examined as 5-meter segments (Figure 5). Only live mussels were collected and processed.

Quadrats

Ten evenly spaced quadrats (one square meter) were also examined across each transect line. The quadrat searches were completed prior to the full transect-line search. Of the ten quadrats at each transect, three were randomly excavated to a depth of 6-10". Collected mussels at each station or quadrat were placed in uniquely identified mesh bags. Upon completion of each dive substrate composition, dive depth, submerged aquatic vegetation (SAV) and any other relevant information was provided by the diver. Mussels were removed from their respective bags, identified, weighed, measured, photographed for voucher, and placed back into substrate at the reach where they were collected. Care was taken to appropriately place mussels into substrate to limit handling stress and potential mortality.

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Habitat

A physical habitat assessment was completed at the three benthic macroinvertebrate stations. These assessments consisted of twelve criteria, encompassing instream and riparian zone parameters, scored from 0-20. Total scores resulted in habitat characterizations of poor (0-60), marginal (72-120), suboptimal (132-180), or optimal (192-240). Additionally, as stated above, mussel habitat was described through substrate composition and SAV density at the respective mussel sampling locations.

RESULTS AND DISCUSSION

Discharge Plume Delineation

The discharge plume delineation found a slightly greater than two-fold increase in specific conductivity at the discharge pipe (Table 5). Temperature, dissolved oxygen, and pH moderately dropped as well. Immediately upon exit of the discharge pipe, the effluent created a 4.5'-wide plume which expanded modestly to approximately 8' downstream (Figure 6). Specific conductivity gradually decreased, and temperature, dissolved oxygen, and pH gradually increased between the pipe and 35' downstream of the discharge, where the immediate plume delineation ended. At 35' downstream of the discharge, all parameters approached stream conditions. Measurements from the mouth of Woodcock Creek exhibited lower values of all constituents compared to ambient conditions in French Creek. Sampling approximately 300' downstream of discharge found all parameters had been impacted by flow from Woodcock Creek, confounding further delineation of the discharge plume.

Water Quality Sampling

Basic water quality parameters (temperature, pH, dissolved oxygen, and specific conductivity) exhibited some differences (Tables 6 – 7) among stations. Generally, specific conductivity increased, and temperature, dissolved oxygen, and pH decreased downstream of the discharge, especially from the measurements taken during grab water sampling. This is consistent with inputs from wastewater treatment effluent. Measurements from the mouth of Woodcock Creek had lower values of all constituents compared to ambient French Creek conditions. Woodcock Creek appeared to be a significant driver of measurements in French Creek at the most downstream station (5FRC). Measurements taken during macroinvertebrate sampling were significantly different from those taken during the grab water samples. This was likely due to the time-of-day measurements were taken. Grab water samples were collected earlier in the day (0930 – 1115 hrs) than macroinvertebrate samples (1130 – 1230 hours). As temperature reached mid-80^{o}F temperatures, photosynthetic activity approached peak levels. As expected, temperature, dissolved oxygen, and pH increased at all stations later in the day. Measurements taken at all stations were within water quality criteria, as expressed in 25 Pennsylvania Code §93.

Grab water samples exhibited differences among stations (Table 8). Results collected from reference stations 1FRC and 2FRC indicated good water quality exists in French Creek. Concentrations of nutrients, especially dissolved nitrites/nitrates and dissolved orthophosphorus which are readily taken up by aquatic organisms, were low or below detection limits. Most metal concentrations were also low.

Consistent with inputs from wastewater treatment effluent, nutrient concentrations rose modestly at the discharge. Total nitrogen rose from 0.59 to 1.26 mg/L, total phosphorus rose from 0.022 to 0.106 mg/L, and total orthophosphorus rose from non-detect at <0.010 to 0.045 mg/L. Ammonia concentrations were the same above the discharge and immediately below the discharge (0.03 mg/L). Several metal concentrations also rose below the discharge, though like the nutrient concentrations, these increases were modest. Total dissolved solids, a measure of dissolved salts, metals, minerals, cations, or anions in the water column, also rose accordingly from 166 mg/L to 282 mg/L. Twenty-five feet downstream of the discharge, many of the elevated concentrations dropped significantly, and approached ambient conditions. Of notable exception, ammonia rose from 0.03 to 0.04 mg/L, total nitrogen rose from 1.26 to 1.43 mg/L, and total aluminum rose from 80.1 to 96.6 µg/L. This suggests the plume may not have been uniform through the stream column.

Woodcock Creek enters French Creek approximately 35' downstream of the discharge. All nutrient concentrations collected from the mouth of Woodcock Creek were higher than those taken in French Creek above the discharge, suggesting Woodcock Creek is more productive than French Creek and can be a significant source of nutrients. Additionally, iron and manganese had much higher concentrations in Woodcock Creek compared to French Creek. None of the values collected from Woodcock Creek exceeded water quality criteria. At 5FRC, approximately 100 meters downstream of the discharge, and approximately 90 meters downstream of the confluence of French Creek and Woodcock Creek, all nutrient concentrations were lower than those from Woodcock Creek, except for total ammonia (0.04 - 0.06 mg/L) and total nitrogen (0.73 – 0.79 mg/L). Additionally, nearly all other values measured at 5FRC approached ambient French Creek concentrations, such as those seen at 1FRC and 2FRC. Concentrations collected from all stations were within water quality criteria, as expressed in 25 Pennsylvania Code §93.

Continuous Instream Monitoring Units were deployed in French Creek for this study; one just upstream of the outfall's intake structure and one directly within the discharge effluent plume. Measurements were recorded every 30-minutes for temperature, pH, specific conductivity and dissolved oxygen. The full range of data can be found at PADEP Continuous Instream Monitoring Reports:

https://files.dep.state.pa.us/Water/Drinking%20Water%20and%20Facility%20Regulation/WaterQualityPortalFiles/CIMR/51591_French_Creek_Upstream_CIMR.html

https://files.dep.state.pa.us/Water/Drinking%20Water%20and%20Facility%20Regulation/WaterQualityPortalFiles/CIMR/51591_French_Creek_Downstream_CIMR.html

Benthic Macroinvertebrates

Benthic macroinvertebrate assemblages were similar among stations (Table 9). Dominant taxa were the mayfly *Isonychia* (comprising at least 27% of all individuals at each station), the caddisfly *Hydropsyche* (comprising at least 15% of all individuals at each station), and midges from the family Chironomidae (comprising at least 10% of all individuals at each station). At least six mayfly and three caddisfly taxa were observed at each station. Generally, mayflies and caddisflies are among some of the most sensitive taxa to organic pollution. The station most likely to experience impacts from the discharge had the most

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mayfly, stonefly, caddisfly, and total taxa. It also had the least midges, which are sometimes prevalent in waters experiencing organic degradation. All stations contained taxa commonly seen in healthy, large drainage systems indicating good water quality exists in the study area.

Macroinvertebrate assemblages were analyzed through an IBI score (Table 10). This method aids in determining stream health and aquatic life use attainment status of a waterbody (Karr 1981). The Department's IBI scores range from 0-100, with a higher score indicating more pristine conditions (PA DEP 2018b). IBIs are computed using a suite of metrics measuring characteristics of a macroinvertebrate assemblage. Metrics used for the Department's Freestone IBI include taxa richness, Hilsenhoff Biotic Index (HBI), EPT (Ephemeroptera, Plecoptera, Trichoptera) richness with HBI <5, Beck's Index, percentage of sensitive individuals, and Shannon Diversity Index. If a stream designated and protected as WWF has an IBI score greater than 43 in the months of June through October, it is generally considered to be attaining its aquatic life use.

Taxa richness is the overall number of taxa, typically genera, in a sample. Generally, taxa richness will decrease with increasing anthropogenic stress as pollution tolerant taxa dominate the macroinvertebrate assemblage. Taxa richness ranged from 17 upstream (1FRC) of the discharge to 22 below the discharge (5FRC – LDB)

The Hilsenhoff Biotic Index (HBI) is the mean pollution tolerance value (PTV) of macroinvertebrates collected in a sample. Hilsenhoff values reflect the tolerance of organisms to organic pollution. Scores range from zero to ten, with lower values representing increased sensitivity (Hilsenhoff 1987, 1988). Typically, HBIs increase as anthropogenic stress increases due to an abundance of pollution tolerant macroinvertebrates. The HBI ranged from 4.36 upstream of the discharge (1FRC) to 3.95 below the discharge (5FRC – LDB).

EPT richness is the number of mayfly, stonefly, and caddisfly taxa collected at each site. Collectively, these orders are regarded as the most sensitive aquatic macroinvertebrates. This metric only includes EPT taxa with PTVs of four or less. EPT taxa richness typically decreases as anthropogenic stress increases due to the loss of sensitive taxa from the benthic community. EPT richness ranged from six upstream of the discharge (1FRC) to ten below the discharge (5FRC – LDB)

Beck's Index is a weighted count of taxa with a PTV of zero, one, or two. This metric tends to decrease with increasing anthropogenic stress due to a loss of sensitive taxa and dominance of a few pollution tolerant taxa. Beck's Index ranged from four upstream of the discharge (1FRC) to eight below the discharge (5FRC – LDB).

The percentage of sensitive individuals is the percentage of macroinvertebrate individual organisms in a subsample with PTVs of three or less. Generally, this value declines as anthropogenic stress increases. The percentage of sensitive individuals ranged from 35.9% upstream of the discharge (1FRC) to 53.1 below the discharge (5FRC – LDB).

The Shannon Diversity Index is a measure of taxonomic richness and evenness at each station. This metric tends to decrease as anthropogenic stress increases due to the dominance of pollution tolerant taxa. The Shannon Diversity Index ranged from 2.04 below the discharge (5FRC – LDB) to 2.17 below and out of any possible influence of the discharge (5FRC – RDB).

IBI scores varied among stations. The upstream reference station scored poorest in five of the six metrics used to calculate the IBI. Downstream of the discharge, 5FRC – RDB was used as an additional reference station, since it was completely out of the influence of the discharge or Woodcock Creek. 5FRC – LDB was the station most likely to be impacted by the discharge. All metrics at the downstream stations scored very similarly, though 5FRC – LDB scored marginally better in five of the six metrics used to calculate the IBI. This was demonstrated in 5FRC – LDB having a slightly better IBI score (68.0) than 5FRC – RDB (62.1). Both downstream stations scored significantly better than the upstream reference station (53.2). Each of the three stations had scores above the impairment threshold of 43.0 indicating macroinvertebrate assemblages are healthy throughout the reach of French Creek encompassing the discharge.

Mussels

Mussel sampling efforts in French Creek included searching nine transect lines across the width of French Creek, except for Transect 2 where only the last twenty meters from the left descending bank (encompassing the discharge) was examined. Additionally, ten one square meter quadrats were evenly spaced along each transect (including Transect 2) for a total of 90 quadrats examined in this survey. Mussel sampling conducted through this survey showed a diverse and robust mussel community exists upstream of the discharge through at least 2000' downstream of the discharge (Table 11). Five hundred seventy-six (576) mussels, comprising fourteen taxa, were collected through the course of this survey. The community was dominated by the mucket (*Actinonaias ligamentina*), kidneyshell (*Ptychobranchus fasciolaris*), and spike (*Eurynia dilatata*), which comprised 61.8%, 26.7%, and 5.9% of the total mussels collected. Of the species observed, four are currently listed as state or federally threatened or endangered, including the Northern riffleshell, snuffbox, rabbitsfoot, and rayed bean. Listed species comprised 2% of the mussels collected, with the Rabbitsfoot as the most abundant. The mean number of observed mussel species per transect (including transect line and quadrat sampling) was 5.4, while the mean number of collected individuals was 64 mussels per transect. Large and small specimens of multiple species were observed, indicating active mussel recruitment is occurring within the study area (Table 12).

Mussel assemblages differed among transects and quadrats (Tables 11, 13-15). Individual mussels collected along the transect lines ranged from four at T6 to 101 at T8 and T9. The number of mussel species collected along the transect lines ranged from two at T6 to seven at T8. The transects with the highest number of individual mussels collected in their respective quadrats was T8 (25 mussels), while the lowest was T6 with only four mussels (Table 14). The transects with the highest number of mussel species collected in their respective quadrats was T2 (5 species), while the lowest was T5 and T7 (2 species). Eleven total species and 436 total individuals were collected along the transect lines. Excluding T2 since it was only a partial transect, the mean number of species observed along each transect line was 4.8, while the mean number of individual mussels observed along each transect line was 54.

Mussels collected in each individual quadrat significantly varied. Mussels were found in 45 quadrats and mussels were absent from 45 quadrats (Table 15). The highest number of individual mussels found in a single quadrat was 11. Of the 140 mussels found in quadrats, 55 were in those that were excavated, leading to a mean of 1.8 mussels per excavated quadrat. Eighty-five (85) mussels were found in the non-excavated quadrats, leading to a mean of 1.4 mussels per non-excavated quadrat. On average, 1.55 mussels were collected per quadrat.

Particular attention was given to the left descending bank of French Creek in the immediate vicinity of the discharge. On August 6, when mussel sampling occurred at the transects above and immediately below the discharge, the outfall pipe was measured to be twelve meters from the left descending bank. To further elucidate any potential impacts from the discharge, mussels collected from transects and quadrats in the final twenty meters of the left descending bank below the discharge were documented. These twenty-meter reaches were further broken down into five-meter segments. This study found only nine mussels (2.3% of transect mussels below discharge) on the left descending bank in transect line searches of T2 – T9, with one being in the plume (Table 16, Figure 7). Of these nine, five were found in the silty, vegetated substrate close to the bank. From the quadrats in the final twenty meters of the left descending bank below the discharge (Table 17, Figure 8), fourteen mussels were collected (11.7% of quadrat mussels below discharge). None of the quadrats fell directly within the plume, though two were near the plume edge. No mussels were collected from these two quadrats. Of note, mussels were completely absent, in and out of the plume, from the quadrats in the final twenty meters of the left descending bank at T3. In the final twenty meters of the left descending bank, at and downstream of the discharge, only 23 mussels were found collectively from the quadrats and transect lines. These 23 mussels comprised only 4.6% of the mussels caught below the discharge, despite making up 39.3% of the total area searched. Though detailed transect line collection wasn't determined, detailed quadrat collection was determined for the rest of French Creek. In the fifteen meters closest to the right descending bank nineteen mussels were collected for 13.6% of total mussel collection, despite the quadrats comprising 30% of the total area surveyed during quadrat sampling. Mussels collected from the middle of the stream comprised 75.1% of the total quadrat mussel collection, despite making up only 33.2% of the quadrat area searched. Pictures of some mussel collection efforts are provided below (Figures 9-12).

Habitat

Habitat was similar among macroinvertebrate stations (Table 18). Each station scored at the upper threshold of the suboptimal category with only three points separating habitat scores. The station upstream of the discharge (1FRC) scored slightly lower in the "Channel Flow Status" and "Grazing/Disruptive Pressures" categories compared to the stations downstream of the discharge, largely due to the presence of the US Route 6 bridge just above the sampling station. As described in the general site description, 1FRC, above the discharge, was essentially a run with predominantly cobble and gravel substrate, while the stations downstream of the discharge were in heavy riffles with substrate composed of boulders, cobble, and gravel. While all three stations provided suitable habitat, the downstream stations had notably better instream habitat for macroinvertebrate assemblages.

Mussel habitat varied among transects and quadrants (Table 19). For mussel quadrats, depth and substrate composition were recorded. Generally, transects 1-3 were located in the run upstream of a pool that was formed from Woodcock Creek entering French Creek. About halfway through Transect 4, the pool was encountered. Transect 5 was sampled at the bottom of the pool, while Transects 6-7 were conducted in a heavy riffle downstream of the pool. Transects 8-9 were conducted downstream of the riffle in a shallow run where French Creek widened. The entirety of the right descending bank was shallow with tightly compacted cobble and gravel. With the exception of the transects sampled in the heavy riffle, the middle of French Creek was largely composed of loosely compacted cobble and gravel, which appeared optimal for mussel colonization. The left descending bank varied significantly, with Transects 1-4 composed primarily of gravel, sand, and silt. Through the heavy riffle, substrate was primarily cobble, limiting mussel colonization. At the stations downstream of the riffle, substrate changed to a mix of cobble and gravel, though again, it appeared tightly compacted, which appeared to limit the mussel assemblages. Of note, substrate immediately below the discharge varied among boulder, cobble, gravel, sand, and silt, though it could largely be considered depositional. The pool at the confluence of Woodcock Creek, just below the discharge, appeared to add a significant fine sediment load limiting mussel colonization.

CONCLUSIONS

The objective of this study was to determine the impacts, if any, the joint discharge between the Saegertown Sewage Treatment Plant and the Lord Corporation is having on water quality and aquatic life in French Creek, particularly regarding the mussel population. Saegertown operates under NPDES Permit No. PA0101923 and Lord operates under NPDES Permit No. PA0101800. They have a joint discharge to French Creek, where effluent flows from a pipe situated in French Creek approximately 35’ from the left descending bank. The discharge is located in a partly depositional area, approximately 35’ upstream of French Creek’s confluence with Woodcock Creek.

On the dates of this survey, the discharge appeared to be in good condition. The discharge was clear and did not emit any odor. While there was a fair amount of sand below the discharge, likely due to its depositional location, there was no accumulation of solids or sludge. No excessive algal growth was found in the vicinity of the discharge. Macroinvertebrates commonly observed in organically enriched waters, such as bloodworms or sludge worms, were notably absent.

Results found in the plume delineation and grab water samples suggested a modest amount of nutrients were added to French Creek in the immediate vicinity of the discharge. Effluent collected directly from the pipe was consistent with wastewater treatment discharges as total nitrogen doubled and total phosphorus rose from 0.022 to 0.106 mg/L. Ammonia concentration, which can be highly toxic to aquatic organisms, was low and similar to samples collected upstream and outside of the plume. Specific conductance at the pipe was a little higher than twice the recording from ambient conditions. Specific conductance and most nutrient concentrations dropped quickly as the plume mixed with French Creek and flow from Woodcock Creek. Any differences in water quality below the confluence of Woodcock Creek were difficult to ascertain due to the presence of confounding flows and factors. None of the measurements or concentrations exceeded water quality standards or precluded the potential for a diverse aquatic biological community throughout the study area.

Macroinvertebrate assemblages supported the designated aquatic life use of WWF with IBI scores greater than the 43.0 impairment threshold upstream and downstream of the discharge. Populations were each dominated by the same collector/filter feeding taxa – *Isonychia*, *Hydropsyche*, and Chironomidae – commonly observed in healthy, large river systems. Each station had at least ten EPT taxa, including some considered organically sensitive. The station most likely to be impacted by the discharge, 5FRC – LDB had the highest IBI score and most diverse assemblage. The reference station, 1FRC, had the lowest IBI score and least diverse assemblage. Instream habitat was moderately different upstream (run – cobble / gravel substrate) compared to downstream (heavy riffle – boulder / cobble / gravel substrate), which appeared to facilitate differences in macroinvertebrate assemblages more than inputs from the discharge or Woodcock Creek.

A previous mussel survey was conducted on French Creek above and below the discharge by EnviroScience, Inc. on behalf of the Department in 1997. The survey found a robust mussel assemblage through the study area, though mussels were most densely concentrated mid-channel. Mussel densities were highest in the run upstream of the pool created by the confluence of Woodcock Creek and highest in the run following a heavy riffle below the Woodcock Creek pool. Mussel densities were much lower in the transects covering the pool and the heavy riffle just downstream of the pool.

Results from the Department's study was consistent with the EnviroScience study findings (Table 20). The Department collected 576 total mussels comprising 14 species, while EnviroScience found 541 total mussels comprising 18 species. The four species the Department failed to observe comprised 2.3% of EnviroScience's total mussel contribution. None of the four species totaled greater than 0.7% of the total mussel population and less than four individuals were collected of each of these species. The most commonly observed taxa in each study were the mucket, kidneyshell, and spike. Each study observed the same four endangered or threatened mussels, the Northern riffleshell, snuffbox, rabbitsfoot, and rayed bean. In the Department's study, endangered/threatened species totaled 12 individuals (2.1% of total mussel collection) while EnviroScience observed 29 individuals (5.4% of total mussel collection). The most common endangered/threatened species collected by the Department was the rabbitsfoot, while for EnviroScience it was the rayed bean. Transects yielding the highest mussel collections – the run upstream of the confluence of Woodcock Creek and the run 1000-2000' below the discharge – were similar in both surveys. Few mussels were collected in either survey in the pool created by Woodcock Creek or in the heavy riffle just downstream of the confluence of Woodcock Creek. Additionally, when comparing quadrats between surveys, EnviroScience collected only 22 mussels (of 114; 19.3%) from quadrats in the left descending half of French Creek (Table 21). These data, similar to the Department's results, indicate the left descending bank lacks good mussel habitat for colonization.

Habitat appeared to be the limiting factor in mussel colonization through the study area. Mussels most densely populated the center of French Creek where habitat mostly consisted of loosely compacted cobble and gravel. Along the right descending bank, embeddedness was notably higher. Mussel habitat along the left descending bank was variable, with largely depositional substrate just above Woodcock Creek, very fine sediment at the confluence with Woodcock Creek, large boulders in the heavy riffle below Woodcock Creek, and high embeddedness in the run 1000-2000' downstream of the discharge and Woodcock Creek.

Results from mussel collection at the discharge suggests effluent does not appear to be impacting mussel assemblages, but instead habitat is the limiting factor. The pipe extends into French Creek through a concrete pad which also runs to the left descending bank. Where the pipe exits the concrete pad, an 18-24" drop-off occurs. This drop-off creates a depositional area which accumulated some sand and silt within the 1-2 meters below the pipe. In quadrats bracketing the discharge (T2-Q8, T2-Q9), along T2, mussels were observed (Figure 8). Quadrats 8 and 9 were out of the drop-off, with little to no depositional substrate. In the two 5-meter transects along T2 closest to the left descending bank, mussels were collected on the concrete pad in substrate consisting of heavily vegetated fine sediment (Figure 7). At T3, approximately 20' downstream of the discharge, no mussels were collected in the quadrats, including the quadrats out of the discharge plume. This substrate contained some fine sediment, likely due to the influence of Woodcock Creek. A single mussel, the threeridge (*Amblema plicata*) was collected along the T3 transect line in the last 20 meters of the left descending bank and this mussel was directly within the discharge plume. This species is generally known to inhabit depositional areas. At the transects and quadrats along the left descending bank 100' and greater below the discharge plume, mussel habitat was not favorable. Some transects had predominantly silt substrate, likely from Woodcock Creek, some had predominantly boulder and cobble substrate due to the heavy riffle below Woodcock Creek, and others contained tightly compacted cobble and gravel. Clearly, habitat was the driving factor for mussel colonization through the study area.

The objective of this study was to determine the impacts, if any, the Saegertown/Lord Corporation discharge may be having on water quality and aquatic life, particularly regarding state and federally endangered/threatened mussel colonization. Results from this study indicate water quality is not being significantly impacted by the discharge. No water quality standards were exceeded. Macroinvertebrates had better assemblages in the heavy riffles below the discharge as compared to the run upstream of the discharge. The mussel community, including state and federally listed species, appeared diverse and healthy through the study area, though were most densely populated mid-channel in the most favorable habitat consisting of loosely compact cobble and gravel. Aquatic communities appeared to be driven by habitat throughout the study area. The Department's study found no evidence the discharge was impacting water quality or aquatic life.

Cc: Stream File – French Creek (SC 51591)

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Table 1. List of known threatened and endangered mussel species in French Creek.

Common Name	Scientific Name	State Listing	Federal Listing
Northern Riffleshell	*Epioblasma rangiana*	Endangered	Endangered
Snuffbox	*Epioblasma triqueta*	Endangered	Endangered
Clubshell	*Pleurobema clava*	Endangered	Endangered
Salamander Mussel	*Simpsonaias ambigua*	Endangered	-
Rabbitsfoot	*Theliderma cylindrica*	Endangered	Threatened
Rayed Bean	*Villosa fabalis*	Endangered	Endangered

Table 2. Flows from sampling dates.

USGS Flow Gage (Cubic Feet per Second)	August 5, 2019	August 6, 2019	August 12, 2019	August 29, 2019
French Creek at Meadville (Recorded)	275	270	475	415
French Creek at Meadville (Average)	270	275	215	220
Woodcock Creek below Reservoir Outfall (Recorded)	23	24	30	33
Woodcock Creek below Reservoir Outfall (Average)	15	16	19	16

Table 3. Grab water sample locations.

Station Locations	
Station	**General Location Description**
1FRC	French Creek, ~75 Meters Upstream of Discharge, Mid-Channel
2FRC	French Creek, Adjacent to Discharge, Right Descending Bank
3FRC	French Creek, At Discharge Pipe, Left Descending Bank
4FRC	French Creek, ~25' Downstream of Discharge, Within Plume
1WCC	Woodcock Creek, ~40 Meters Upstream of Confluence with French Creek
5FRC	French Creek, ~100 Meters Downstream of Discharge

Table 4. Mussel transect locations on French Creek.

Station Locations	
Station	**General Location Description**
T1	Mussel Transect 1, ~20' Upstream of Discharge
T2	Mussel Transect 2, At Discharge
T3	Mussel Transect 3, ~20' Downstream of Discharge
T4	Mussel Transect 4, ~100 Downstream of Discharge
T5	Mussel Transect 5, ~200' Downstream of Discharge
T6	Mussel Transect 6, ~300' Downstream of Discharge
T7	Mussel Transect 7, ~500' Downstream of Discharge
T8	Mussel Transect 8, ~1000' Downstream of Discharge
T9	Mussel Transect 9, ~2000' Downstream of Discharge

Table 5. Plume delineation conducted on French Creek in the vicinity of the Saegertown STP / Lord Corporation outfalls.

Parameter	Above Discharge	At Discharge	5'	10'	15'	20'	25'	30'	35'	Woodcock Creek	300'
Temperature (°C)	22.0	18.0	19.6	20.0	21.6	21.6	21.6	21.6	21.7	20.1	21.5
Dissolved Oxygen (mg/L)	8.14	7.47	7.65	7.79	8.20	8.20	8.15	8.25	8.36	7.67	7.70
Dissolved Oxygen (% Sat.)	93.2	79.1	83.7	86.3	91.3	93.3	92.4	93.8	95.1	84.5	87.3
Specific Conductance (µS/cm)	271.2	607.0	571.0	492.1	339.1	334.0	340.1	329.1	315.9	177.0	258.0
pH (Units)	8.02	7.52	7.63	7.65	7.91	7.91	7.87	7.92	7.95	7.64	7.91
Width of Plume (Feet)	-	4.5	5.0	7.0	7.5	7.0	8.0	7.0	8.0	-	-

Table 6. Basic water quality measurements recorded at grab water sample locations.

Parameter	1FRC	2FRC	3FRC	4FRC	1WCC	5FRC
Temperature (ºC)	22.90	23.50	18.00	21.60	20.10	21.50
Dissolved Oxygen (mg/L)	10.52	11.15	7.47	8.15	7.67	7.70
Dissolved Oxygen (% Sat.)	122.20	131.10	79.10	92.40	84.50	87.30
Specific Conductance (µS/cm)	269.30	266.30	607.00	340.10	177.00	258.00
pH (Units)	8.51	8.61	7.52	7.87	7.64	7.91

Table 7. Basic water quality measurements recorded at macroinvertebrate sampling locations. LDB refers to left descending bank, while RDB refers to right descending bank. Discharge was located ~35' off left descending bank.

Parameters	1FRC	5FRC – LDB	5FRC – RDB
Temperature (ºC)	23.5	23.1	24.0
pH (Units)	8.73	8.60	8.66
Specific Conductivity (µS/cm)	266.8	262.4	266.6
Dissolved Oxygen (mg/L)	11.69	10.92	11.02

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Table 8. Grab sampling water results.

Parameter	1FRC	2FRC	3FRC	4FRC	1WCC	5FRC
Dissolved Ammonia (mg/L)	<0.02	<0.02	<0.02	0.03	0.04	<0.02
Total Ammonia (mg/L)	0.03	<0.02	0.03	0.04	0.04	0.06
Dissolved Nitrites and Nitrates (mg/L)	0.20	0.19	2.80	1.04	0.36	0.33
Total Nitrites and Nitrates (mg/L)	0.20	0.18	1.02	1.02	0.34	0.32
Dissolved Orthophosphorus (mg/L)	<0.010	<0.010	0.045	0.017	0.014	<0.010
Total Orthophosphorus (mg/L)	<0.010	<0.010	0.031	0.031	0.013	<0.010
Dissolved Nitrogen (mg/L)	0.576	0.529	3.455	1.447	0.876	0.816
Total Nitrogen (mg/L)	0.59	0.57	1.26	1.43	0.73	0.79
Dissolved Phosphorus (mg/L)	<0.010	<0.010	0.032	0.020	0.300	0.010
Total Phosphorus (mg/L)	0.022	0.019	0.106	0.065	0.048	0.031
Dissolved Aluminum (µg/L)	<10.0	10.8	18.4	12.0	<10.0	<10.0
Total Aluminum (µg/L)	88.0	64.9	80.1	96.6	78.8	88.2
Dissolved Copper (µg/L)	<4.00	<4.00	4.03	<4.00	<4.00	<4.00
Total Copper (µg/L)	<4.00	<4.00	5.79	<4.00	<4.00	<4.00
Dissolved Iron (µg/L)	<100	<100	<100	<100	757	132
Total Iron (µg/L)	265	235	277	244	1030	431
Dissolved Lead (µg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Lead (µg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Lithium (µg/L)	<25.0	<25.0	<25.0	<25.0	<25.0	<25.0
Total Lithium (µg/L)	<25.0	<25.0	<25.0	<25.0	<25.0	<25.0
Dissolved Manganese (µg/L)	18	15	17	18	61	23
Total Manganese (µg/L)	37	30	52	39	106	54
Dissolved Nickel (µg/L)	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
Total Nickel (µg/L)	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
Dissolved Zinc (µg/L)	<30.0	<30.0	<30.0	<30.0	<30.0	<30.0
Total Zinc (µg/L)	<30.0	<30.0	<30.0	<30.0	<30.0	<30.0
Total Barium (µg/L)	32.0	31.0	71.0	41.0	19.0	31.0
Total Boron (µg/L)	<200	<200	<200	<200	<200	<200
Total Cadmium (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Calcium (mg/L)	35.25	36.30	53.20	40.52	23.40	34.40
Total Magnesium (mg/L)	6.39	6.58	9.41	7.33	4.28	6.23
Total Potassium (mg/L)	1.64	1.67	2.07	2.04	1.57	1.70
Total Selenium (µg/L)	<7.0	<7.0	<7.0	<7.0	<7.0	<7.0
Total Sodium (mg/L)	9.51	9.64	27.7	18.56	5.52	9.88
Total Strontium (µg/L)	72	74	98	82	49	70
Bromides (µg/L)	34.07	34.60	33.56	39.66	27.81	32.77
Chlorides (mg/L)	16.00	15.47	48.98	34.95	8.54	15.71
Sulfates (mg/L)	7.96	8.00	18.28	13.57	5.70	8.01
Total Organic Carbon (mg/L)	3.58	3.63	2.12	3.30	4.67	3.73
Total Dissolved Solids (mg/L)	166	166	282	230	120	162
Total Suspended Solids (mg/L)	14.0	<5.0	<5.0	<5.0	6.0	<5.0
Hardness (mg/L)	114	118	172	132	76	112
Alkalinity (mg/L)	115.4	112.2	152.2	125.4	75.8	109.2
pH (Units)	8.0	8.2	7.9	7.8	7.5	7.8
Specific Conductivity (µS/cm)	282.0	279.0	475.0	377.0	182.9	266.0
Osmotic Pressure (mos/kg)	-	4	7	6	3	10

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Table 9. Macroinvertebrates collected from three stations on French Creek.

Taxa		Pollution Tolerance Value	1FRC	5FRC - LDB	5FRC - RDB
EPHEMEROPTERA (MAYFLIES)					
Polymitarcyidae	*Ephoron*	2		1	
Baetidae	*Baetis*	6		2	3
	Heterocloeon	2	1	2	2
Ephemerellidae	*Teloganopsis*	2	8	17	15
Heptageniidae	*Leucrocuta*	1			1
	Maccaffertium	3	6	8	12
Leptohyphidae	*Tricorythodes*	4	4	1	
Isonychiidae	*Isonychia*	3	57	78	62
Caenidae	*Caenis*	7	1	1	
PLECOPTERA (STONEFLIES)					
Pteronarcyidae	*Pteronarcys*	0		1	
Perlidae	*Agnetina*	2	1	3	6
TRICHOPTERA (CADDISFLIES)					
Hydroptilidae	*Hydroptila*	6	3		2
Hydropsychidae	*Hydropsyche*	5	32	46	43
	Macrostemum	3		1	2
	Cheumatopsyche	6	9	13	5
Philopotamidae	*Chimarra*	4		2	1
MEGALOPTERA (DOBSONFLIES)					
Corydalidae	*Corydalus*	4		1	2
COLEOPTERA (BEETLES)					
Psephenidae	*Psephenus*	4	3	1	1
Elmidae	*Dubiraphia*	6	2		
	Optioservus	4	8	3	7
	Macronychus	2		1	
	Stenelmis	5	41	6	13
Gyrinidae	*Dineutus*	4	1		
DIPTERA (TRUE FLIES)					
Chironomidae		6	28	21	26
Simuliidae	*Simulium*	6		1	
Athericidae	*Atherix*	2	1		3
NON-INSECT TAXA					
Gammaridae	*Gammarus*	4		1	

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Table 10. Index of Biotic Integrity (IBI) scores from macroinvertebrate stations.

Metric	1FRC	5FRC - LDB	5FRC - RDB
Taxa Richness	17	22	18
EPT Richness (PTV 0-4)	6	10	8
Beck's Index	4	8	6
Hilsenhoff Biotic Index	4.36	3.95	3.99
% Sensitive Individuals (PTV 0-3)	35.9	53.1	50.0
Shannon Diversity	2.10	2.04	2.17
IBI Score	53.2	68.0	62.1

Table 11. Quadrat and transect mussels collected from French Creek.

Mussel Species Collected		Stations																		Total	% of Total	Global Ranking	State Ranking
Common Name	Scientific Name	T1		T2*		T3		T4		T5		T6		T7		T8		T9					
		Quad	Line	Quad	Line	Quad	Line	Quad	Line	Quad	Line	Quad	Line	Quad	Line	Quad	Line	Quad	Line				
Mucket	*Actinonaias ligamentina*	11	36	9	3	9	42	12	61	4	6	2	3	4	8	13	60	14	59	**356**	**61.8**	G5	S4
Elktoe	*Alasmidonta marginata*						2		1								1		2	**6**	**1.0**	G4/G5	S3/S4
Threeridge	*Amblema plicata*						1													1	**0.2**	G5	S2/S3
Northern Riffleshell[1]	*Epioblasma rangiana*					1														1	**0.2**	G2	S2
Snuffbox[1]	*Epioblasma triquetra*																1			1	**0.2**	G3/G4	S2
Spike	*Eurynia dilatata*	3		3		1		3	7		2	1			3	1		2	8	**34**	**5.9**	G5	S4
Wavyrayed Lampmussel	*Lampsilis fasciola*			1																1	**0.2**	G5	S3/S4
Fatmucket	*Lampsilis siliquoidea*			1	1		1		1							1	1			**6**	**1.0**	G5	S4
Flutedshell	*Lasmigona costata*		1														2			**3**	**0.5**	G5	S4
Round Pigtoe	*Pleurobema sintoxia*																	1		1	**0.2**	G4/G5	S3/S4
Kidneyshell	*Ptychobranchus fasciolaris*	6	14	8		4	13	5	11	3	4	1	1	2	2	10	35	4	31	**154**	**26.7**	G4/G5	S4
Creeper	*Strophitus undulatus*		1																1	**2**	**0.3**	G5	S5
Rabbitsfoot[2]	*Theliderma cylindrica*		2				1		5								1			**9**	**1.6**	G3/G4	S1/S2
Rayed Bean[1]	*Villosa fabalis*														1					1	**0.2**	G2	S1/S2
Species Richness		**6**		**5**		**8**		**6**		**3**		**3**		**4**		**9**		**5**		**14**			
Number of Individuals		**74**		**26**		**75**		**106**		**19**		**8**		**20**		**126**		**122**		**576**			

Global and State Rankings Summary:
- G1/S1 - Critically Impaired
- G2/S2 - Imperiled
- G3/S3 - Vulnerable
- G4/S4 - Apparently Secure
- G5/S5 - Secure

[1]Listed as Federal and Pennsylvania Endangered Species

[2]Listed as Federal Threatened and Pennsylvania Endangered Species

*Only Final 20m On Left Descending Bank Were Examined During Transect

Table 12. Size and weight profile of mussels collected from French Creek.

Mussel Species Collected		Length (mm)			Height (mm)			Width (mm)			Weight (g)		
Common Name	Scientific Name	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
Mucket (n=356)	*Actinonaias ligamentina*	229	11	98	55	1	36	90	6	63	570	1	190
Elktoe (n=6)	*Alasmidonta marginata*	70	47	59	27	19	22	36	23	29	40	13	24
Threeridge (n=1)	*Amblema plicata*	32	32	32	13	13	13	27	27	27	8	8	8
Northern Riffleshell (n=1)	*Epioblasma rangiana*	40	40	40	20	20	20	27	27	27	14	14	14
Snuffbox (n=1)	*Epioblasma triquetra*	42	42	42	20	20	20	25	25	25	16	16	16
Spike (n=34)	*Eurynia dilatata*	95	40	68	26	11	18	48	20	33	86	5	34
Wavyrayed Lampmussel (n=1)	*Lampsilis fasciola*	60	60	60	22	22	22	41	41	41	44	44	44
Fatmucket (n=6)	*Lampsilis siliquoidea*	92	54	77	46	25	34	57	36	47	115	45	89
Flutedshell (n=3)	*Lasmigona costata*	109	81	92	25	20	22	52	44	49	83	45	65
Round Pigtoe (n=1)	*Pleurobema sintoxia*	66	66	66	24	24	24	52	52	52	57	57	57
Kidneyshell (n=154)	*Ptychobranchus fasciolaris*	114	22	80	39	5	24	67	10	44	265	1	83
Creeper (n=2)	*Strophitus undulatus*	51	46	49	17	14	16	30	23	27	13	10	12
Rabbitsfoot (n=9)	*Theliderma cylindrica*	108	52	91	32	18	27	46	31	42	144	24	95
Rayed Bean (n=1)	*Villosa fabalis*	25	25	25	10	10	10	15	15	15	3	3	3

Table 13. Mussels collected from transect lines in French Creek.

Mussel Species Collected		Stations									Total	Global Ranking	State Ranking
Common Name	**Scientific Name**	**T1**	**T2***	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**			
Mucket	*Actinonaias ligamentina*	36	3	42	61	6	3	8	60	59	278	G5	S4
Elktoe	*Alasmidonta marginata*			2	1				1	2	6	G4/G5	S3/S4
Threeridge	*Amblema plicata*			1							1	G5	S2/S3
Snuffbox[1]	*Epioblasma triquetra*								1		1	G3/G4	S2
Spike	*Eurynia dilatata*				7	2		3		8	20	G5	S4
Fatmucket	*Lampsilis siliquoidea*		1	1	1				1		4	G5	S4
Flutedshell	*Lasmigona costata*	1							2		3	G5	S4
Kidneyshell	*Ptychobranchus fasciolaris*	14		13	11	4	1	2	35	31	111	G4/G5	S4
Creeper	*Strophitus undulatus*	1								1	2	G5	S5
Rabbitsfoot[2]	*Theliderma cylindrica*	2		1	5				1		9	G3/G4	S1/S2
Rayed Bean[1]	*Villosa fabalis*							1			1	G2	S1/S2
Species Richness		**5**	**2**	**6**	**6**	**3**	**2**	**4**	**7**	**5**	**11**		
Number of Individuals		**54**	**4**	**60**	**86**	**12**	**4**	**14**	**101**	**101**	**436**		

Global and State Rankings Summary:
- G1/S1 - Critically Impaired
- G2/S2 - Imperiled
- G3/S3 - Vulnerable
- G4/S4 - Apparently Secure
- G5/S5 - Secure

[1]Listed as Federal and Pennsylvania Endangered Species
[2]Listed as Federal Threatened and Pennsylvania Endangered Species
*Only Final 20 Meters on Left Descending Bank Were Examined

Table 14. Mussels collected from quadrats in French Creek.

Mussel Species Collected		Stations									Total	Global Ranking	State Ranking
Common Name	**Scientific Name**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**			
Mucket	*Actinonaias ligamentina*	11	9	9	12	4	2	4	13	14	78	G5	S4
Northern Riffleshell[1]	*Epioblasma rangiana*			1							1	G2	S2
Spike	*Eurynia dilatata*	3	3	1	3		1		1	2	14	G5	S4
Wavyrayed Lampmussel	*Lampsilis fasciola*		1								1	G5	S3/S4
Fatmucket	*Lampsilis siliquoidea*		1						1		2	G5	S4
Round Pigtoe	*Pleurobema sintoxia*									1	1	G4/G5	S3/S4
Kidneyshell	*Ptychobranchus fasciolaris*	6	8	4	5	3	1	2	10	4	43	G4/G5	S4
Species Richness		**3**	**5**	**4**	**3**	**2**	**3**	**2**	**4**	**4**	**7**		
Number of Individuals		**20**	**22**	**15**	**20**	**7**	**4**	**6**	**25**	**21**	**140**		

Global and State Rankings Summar

G1/S1 - Critically Impaired

G2/S2 - Imperiled

G3/S3 - Vulnerable

G4/S4 - Apparently Secure

G5/S5 - Secure

[1]Listed as Federal and Pennsylvania Endangered Species

Table 15. Number of mussels collected by the Department from individual quadrats in French Creek. Excavated quadrats are shaded gray.

	Length (m)	Spacing (m)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total
Transect 1	55	5.0	-	-	1	-	11	1	-	-	1	6	20
Transect 2	55	5.0	-	1	1	2	7	3	-	3	4	1	22
Transect 3	55	5.0	-	2	-	5	7	1	-	-	-	-	15
Transect 4	54	5.0	-	1	-	8	9	1	1	-	-	-	20
Transect 5	44	4.0	-	1	-	1	2	-	3	-	-	-	7
Transect 6	39	3.5	-	-	1	2	1	-	-	-	-	-	4
Transect 7	44	4.0	1	3	1	1	-	-	-	-	-	-	6
Transect 8	60	5.5	1	-	3	8	6	4	2	1	-	-	25
Transect 9	56	5.0	-	-	-	5	9	3	3	-	1	-	21

Table 16. Mussels collected in transect lines from the final 20 meters of the left descending bank.

Transects	20 - 15 m	15 - 10 m	10 - 5 m	5 - 0 m	Total
Transect 2	-	-	1	3	4
Transect 3	-	1	-	1	2
Transect 4	-	-	-	1	1
Transect 5	1	-	-	-	1
Transect 6	-	-	-	-	0
Transect 7	-	1	-	-	1
Transect 8	-	-	-	-	0
Transect 9	-	-	-	-	0

Table 17. Mussels collected in quadrats from the final 20 meters of the left descending bank.

Quadrats	20 - 15 m	15 - 10 m	10 - 5 m	5 - 0 m	Total
Transect 2	-	3	4	1	8
Transect 3	-	-	-	-	0
Transect 4	1	-	-	-	1
Transect 5	3	-	-	-	3
Transect 6	-	-	-	-	0
Transect 7	-	-	-	-	0
Transect 8	1	-	-	-	1
Transect 9	-	1	-	-	1

Table 18. Habitat scores from the three macroinvertebrate sampling locations.

Parameter	Score Range	1FRC	5FRC - LDB	5FRC - RDB
1. Instream Cover	0-20	16	16	16
2. Epifaunal Substrate	0-20	12	12	12
3. Embeddedness	0-20	17	17	17
4. Velocity/Depth Regimes	0-20	13	13	13
5. Channel Alteration	0-20	16	16	16
6. Sediment Deposition	0-20	15	15	15
7. Frequency of Riffles	0-20	16	16	16
8. Channel Flow Status	0-20	13	14	14
9. Condition of Banks	0-20	15	15	15
10. Bank Vegetative Protection	0-20	16	16	16
11. Grazing/Disruptive Pressures	0-20	13	15	15
12. Riparian Vegetation Zone Width	0-20	16	16	16
Total Score	0-240	178	181	181
Rating		Sub-Optimal	Sub-Optimal	Sub-Optimal

Table 19. Habitat data collected from quadrat mussel sampling.

Station	Dive #	Depth (Feet)	SAV Score	Substrate Composition					
				Bedrock	Boulder	Cobble	Gravel	Sand	Silt
T1	Q1	1.5	0	0	0	60	40	0	0
T1	Q2	2.0	0	0	0	70	25	5	0
T1	Q3	2.0	0	0	0	60	40	0	0
T1	Q4	1.5	0	0	0	70	30	0	0
T1	Q5	1.0	0	0	0	80	15	5	0
T1	Q6	0.5	0	0	0	60	35	5	0
T1	Q7	1.5	0	0	0	50	40	10	0
T1	Q8	1.5	0	0	40	30	20	10	0
T1	Q9	1.0	0	0	10	50	40	0	0
T1	Q10	1.5	0	0	0	0	30	0	70
T2	Q1	1.5	0	0	0	65	30	5	0
T2	Q2	1.0	0	0	0	70	25	5	0
T2	Q3	1.75	0	0	0	50	40	10	0
T2	Q4	1.0	0	0	0	50	25	25	0
T2	Q5	1.5	0	0	0	60	20	20	0
T2	Q6	1.5	0	0	0	70	25	5	0
T2	Q7	2.0	0	0	0	70	25	5	0
T2	Q8	2.5	0	0	0	60	30	10	0
T2	Q9	3.0	0	0	0	65	30	5	0
T2	Q10	2.5	0	90	0	0	10	0	0
T3	Q1	1.0	0	0	0	75	15	10	0
T3	Q2	2.0	0	0	0	60	30	10	0
T3	Q3	1.75	0	0	0	70	20	10	0
T3	Q4	2.0	0	0	0	75	20	5	0
T3	Q5	1.5	1	0	0	60	35	5	0
T3	Q6	1.5	0	0	0	70	25	5	0
T3	Q7	3.0	0	0	0	60	30	10	0
T3	Q8	2.0	0	0	0	40	20	40	0
T3	Q9	4.0	0	0	30	40	20	0	10
T3	Q10	2.0	3	0	0	0	0	0	100

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Table 19. Habitat data collected from quadrat mussel sampling. (Cont.)

Station	Dive #	Depth (Feet)	SAV Score	Substrate Composition					
				Bedrock	Boulder	Cobble	Gravel	Sand	Silt
T4	Q1	1.5	0	0	0	50	25	15	10
T4	Q2	2.0	0	0	0	60	25	10	5
T4	Q3	4.0	0	0	0	60	30	10	0
T4	Q4	3.5	0	0	0	60	25	10	5
T4	Q5	3.5	0	0	0	55	35	10	0
T4	Q6	4.0	0	0	0	20	20	60	0
T4	Q7	5.0	0	0	0	50	30	20	0
T4	Q8	9.0	0	0	0	20	20	60	0
T4	Q9	6.0	0	0	0	0	10	0	90
T4	Q10	3.0	0	90	0	0	0	0	10
T5	Q1	1.0	0	0	0	50	40	10	0
T5	Q2	2.5	0	0	10	60	25	5	0
T5	Q3	4.0	0	0	75	20	5	0	0
T5	Q4	3.5	0	0	20	50	20	10	0
T5	Q5	4.0	0	0	0	50	20	30	0
T5	Q6	4.0	0	0	0	50	30	20	0
T5	Q7	2.5	0	0	10	40	25	20	5
T5	Q8	1.5	0	0	0	10	40	35	25
T5	Q9	2.0	0	0	0	80	15	5	0
T5	Q10	0.75	0	0	0	70	25	5	0
T6	Q1	0.5	0	0	0	90	5	5	0
T6	Q2	0.5	0	0	0	90	5	5	0
T6	Q3	1.5	0	0	0	60	35	5	0
T6	Q4	2.0	0	0	5	70	10	10	5
T6	Q5	2.0	0	0	0	60	35	5	0
T6	Q6	2.0	0	0	30	50	15	5	0
T6	Q7	1.5	0	0	0	70	25	5	0
T6	Q8	2.0	0	0	30	50	15	5	0
T6	Q9	0.5	0	0	30	30	20	20	0
T6	Q10	1.0	0	0	5	70	10	10	0

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Table 19. Habitat data collected from quadrat mussel sampling. (Cont.)

Station	Dive #	Depth (Feet)	SAV Score	Substrate Composition					
				Bedrock	Boulder	Cobble	Gravel	Sand	Silt
T7	Q1	0.5	0	0	0	20	75	5	0
T7	Q2	1.0	0	0	0	15	60	20	5
T7	Q3	1.0	0	0	0	70	10	10	10
T7	Q4	1.0	0	0	10	60	10	10	10
T7	Q5	1.5	0	0	30	40	15	10	5
T7	Q6	2.5	0	0	20	50	20	10	0
T7	Q7	1.0	0	0	10	45	35	10	0
T7	Q8	1.0	0	0	10	45	35	10	0
T7	Q9	1.5	0	0	10	60	15	15	0
T7	Q10	2.0	0	0	0	80	10	5	5
T8	Q1	0.5	0	0	0	20	70	10	0
T8	Q2	0.5	0	0	0	20	70	10	0
T8	Q3	1.0	0	0	0	40	50	10	0
T8	Q4	1.5	0	0	0	60	35	5	0
T8	Q5	1.5	0	0	0	65	30	5	0
T8	Q6	1.5	0	0	0	65	30	5	0
T8	Q7	2.0	0	0	0	65	30	5	0
T8	Q8	2.0	0	0	0	65	30	5	0
T8	Q9	1.0	0	0	0	45	45	10	0
T8	Q10	1.0	0	0	0	40	50	10	0
T9	Q1	2.5	0	100	0	0	0	0	0
T9	Q2	2.5	0	100	0	0	0	0	0
T9	Q3	2.0	0	20	0	35	20	20	5
T9	Q4	2.0	0	0	0	40	45	15	0
T9	Q5	2.5	0	0	20	50	20	10	0
T9	Q6	2.0	0	0	0	40	30	25	5
T9	Q7	2.0	0	0	0	40	30	25	5
T9	Q8	2.5	0	0	0	45	45	10	0
T9	Q9	2.0	0	0	0	50	35	10	5
T9	Q10	1.5	0	0	0	30	50	15	5

Table 20. Department and EnviroScience, Inc. mussel collection comparison.

Mussel Species Collected		DEP Total	DEP % of Total	EnviroScience Total	EnviroScience % of Total
Common Name	Scientific Name				
Mucket	*Actinonaias ligamentina*	356	61.8	296	54.7
Elktoe	*Alasmidonta marginata*	6	1.0	17	3.1
Threeridge	*Amblema plicata*	1	0.2	1	0.2
Northern Riffleshell	*Epioblasma rangiana*	1	0.2	3	0.6
Snuffbox	*Epioblasma triquetra*	1	0.2	4	0.7
Spike	*Eurynia dilatata*	34	5.9	46	8.5
Plain Pocketbook	*Lampsilis cardium*	-	-	3	0.6
Wavyrayed Lampmussel	*Lampsilis fasciola*	1	0.2	5	0.9
Pocketbook	*Lampsilis ovata*	-	-	4	0.7
Fatmucket	*Lampsilis siliquoidea*	6	1.0	12	2.2
Flutedshell	*Lasmigona costata*	3	0.5	5	0.9
Black Sandshell	*Ligumia recta*	-	-	4	0.7
Round Pigtoe	*Pleurobema sintoxia*	1	0.2	2	0.4
Kidneyshell	*Ptychobranchus fasciolaris*	154	26.7	99	18.3
Giant Floater	*Pyganadon grandis*	-	-	1	0.2
Creeper	*Strophitus undulatus*	2	0.3	17	3.1
Rabbitsfoot	*Theliderma cylindrica*	9	1.6	4	0.7
Rayed Bean	*Villosa fabalis*	1	0.2	18	3.3
Species Richness		**14**		**18**	
Number of Individuals		**576**		**541**	

Table 21. Number of mussels collected by EnviroScience from individual quadrats in French Creek.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total
Transect 1	5	2	3	9	4	-	-	3	-	-	26
Transect 3	2	2	-	8	12	-	-	-	-	-	24
Transect 4	3	1	-	2	1	-	-	-	-	-	7
Transect 5	2	-	-	1	-	-	-	-	-	-	3
Transect 6	-	-	-	-	-	-	-	-	1	-	1
Transect 7	-	2	5	1	1	-	-	-	-	-	9
Transect 8	2	7	3	3	1	1	2	2	2	-	23
Transect 9	2	1	-	2	5	-	-	2	5	4	21

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Figure 1. French Creek study area with Saegertown/Lord discharge location.

Figure 2. Plume delineation and grab water sample locations on French Creek.

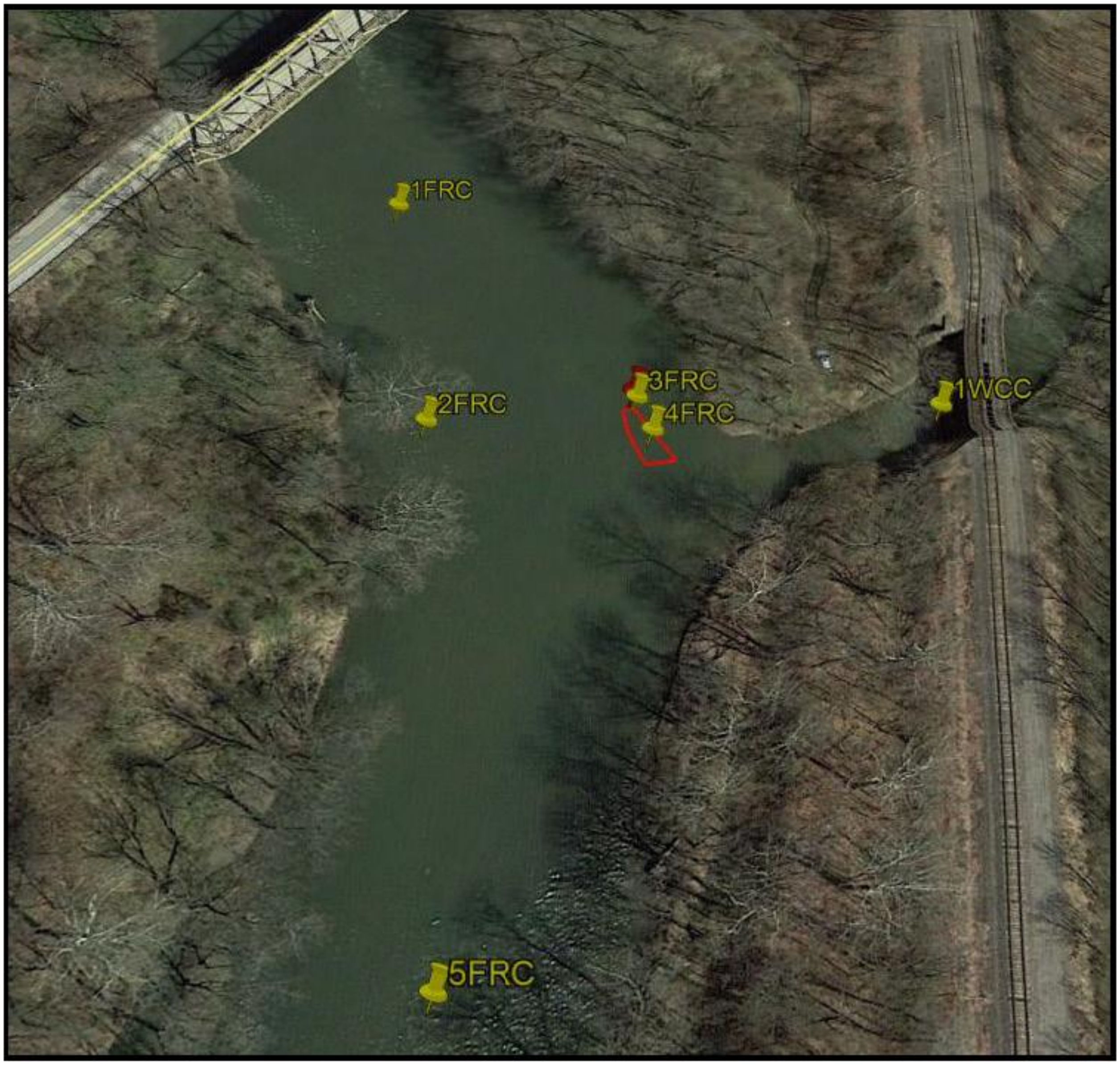

Figure 3. Macroinvertebrate sampling locations on French Creek.

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Figure 4. Mussel transect locations on French Creek.

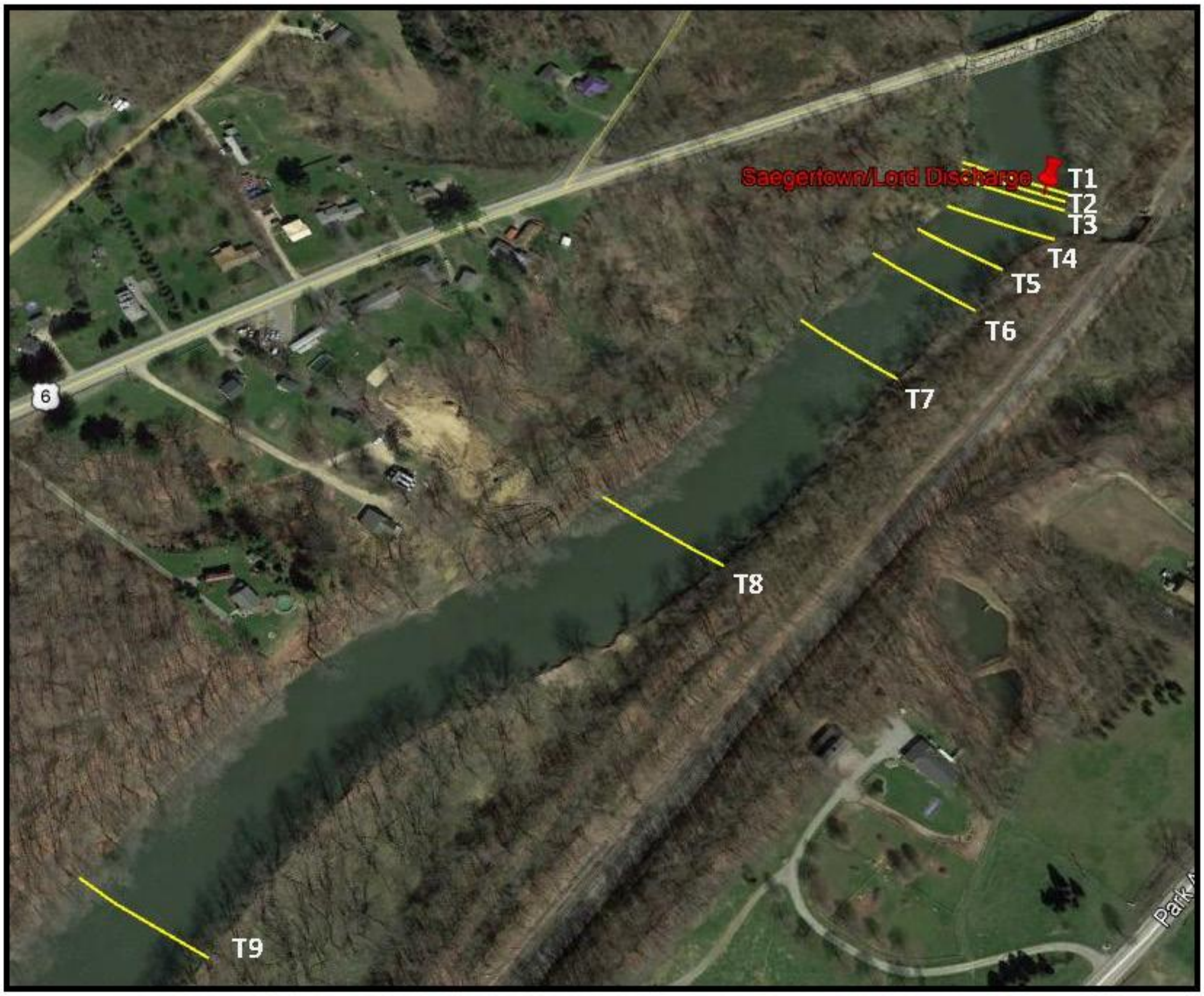

Figure 5. Last 20 meters of left descending bank transect lines.

Figure 6. Plume delineation of Saegertown/Lord Corporation discharge.

Figure 7. Last 20 meters of left descending bank transect lines. Green lines indicate 5-meter transect lines where mussels were collected. Transects 8 and 9 are not pictured since mussels were not observed in the last 20 meters of these transects. Additionally, some transects appear to begin in the channel. Flow when the aerial was taken (April 15, 2016) was 2,750 cubic feet per second, which was ten times greater than when this study occurred. Banks were dewatered in some areas during the Department's study period.

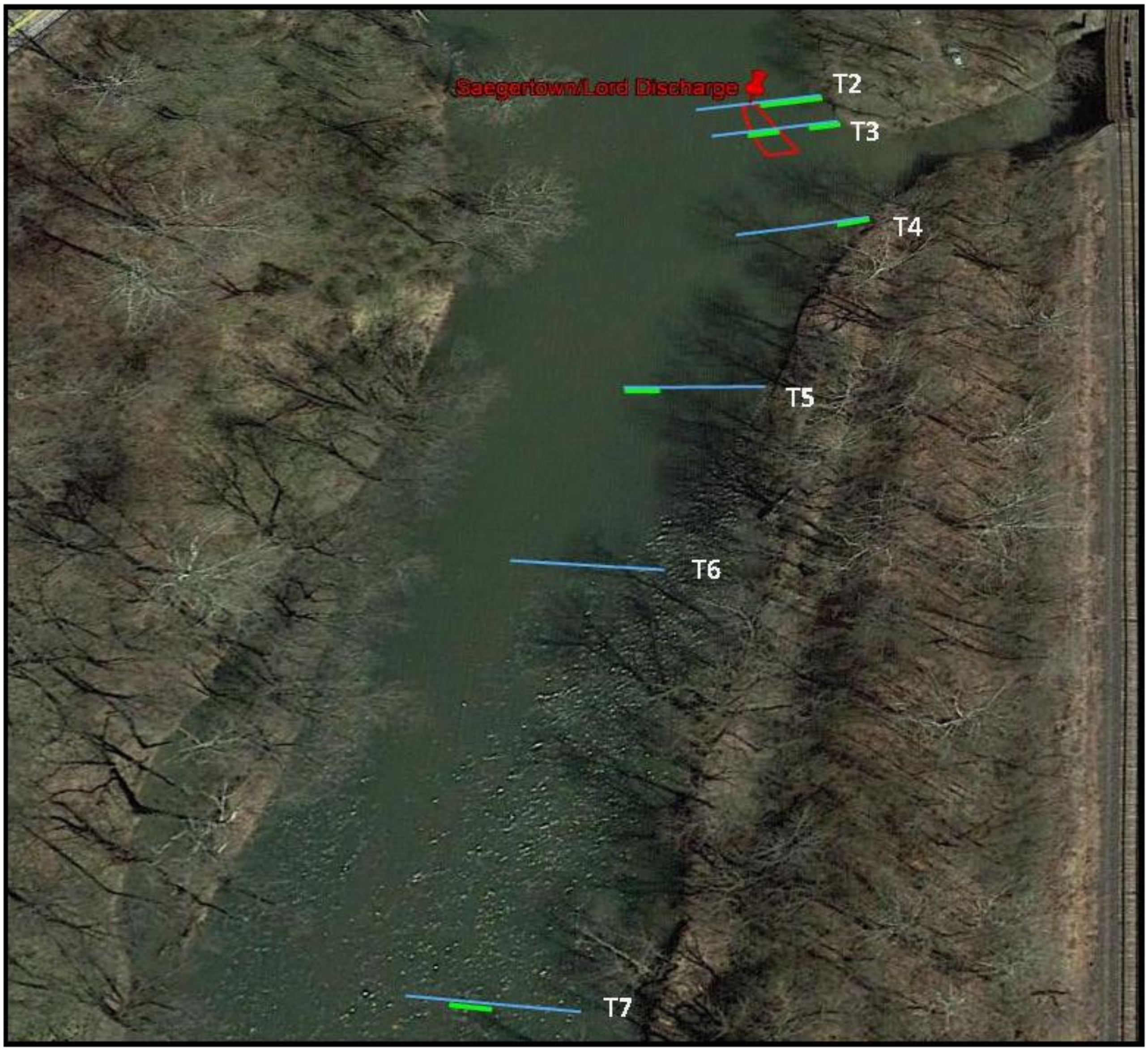

Figure 8. Quadrats from the last 20 meters of the left descending bank in Transects 1-3. Green pins indicate mussels were found in the quadrat, while yellow pins indicate mussels were absent in the quadrat. Below Transect 3, mussels were only collected from four quadrats in Transects 4-9. These included T4-Q7, T5-Q7, T8-Q8, and T9-Q9.

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Figure 9. Mussels collected from Transect 1, Quadrat 10.

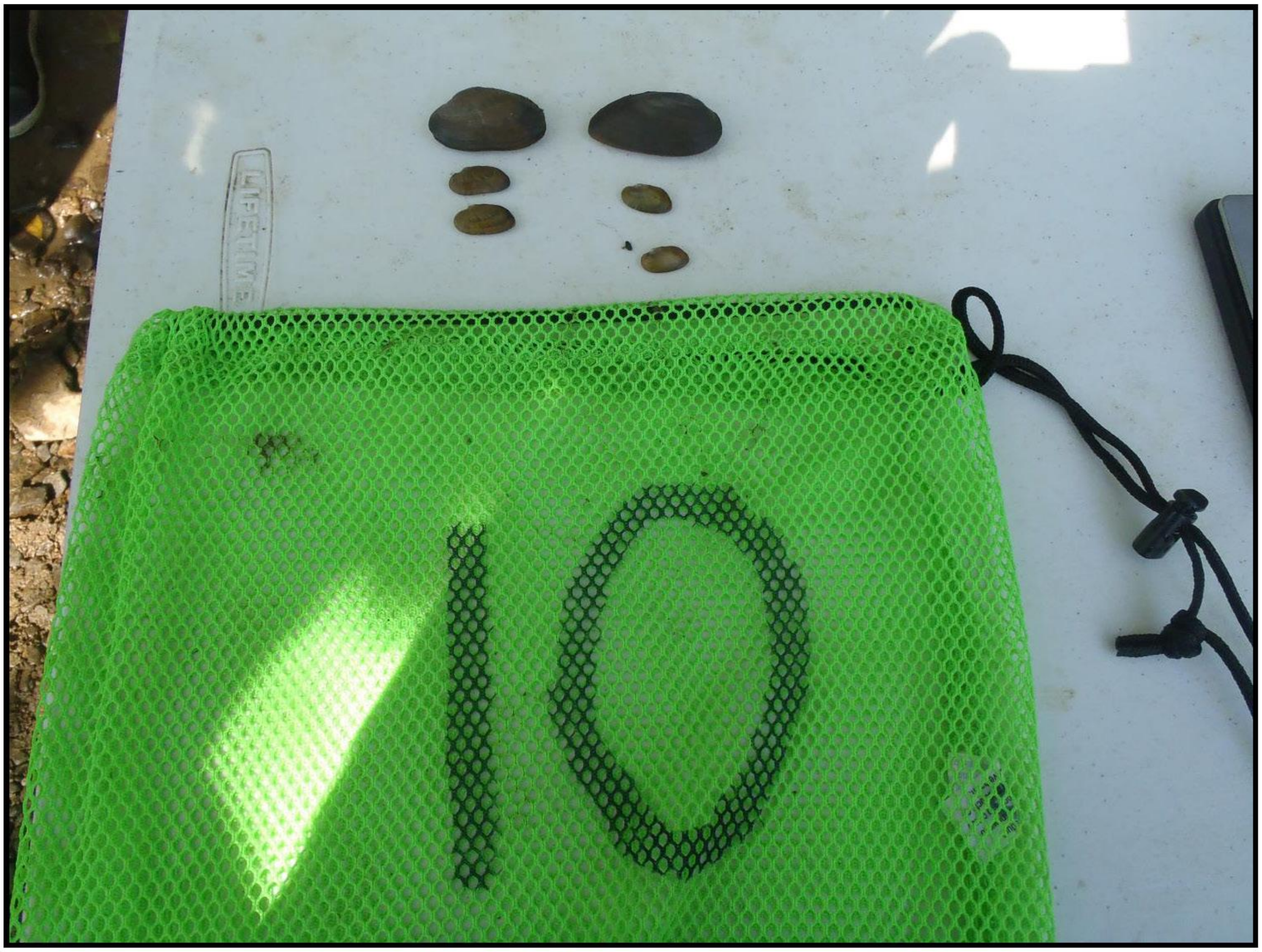

Figure 10. Mussels collected from Transect 2, Quadrat 9.

Figure 11. Mussels collected from the last 20 meters of the left descending bank of Transect 3.

Figure 12. Mussels collected from Transect 8.

1/9/2025

Outfall 001

Facility:	Saegertown		
Permit Number:	PA0101923	Effective:	Expiration:
Outfall No:	001		
Location:	Saegertown, Crawford County		
Discharge to:	French Creek		
Site Specific Mussel Survey Completed:	Yes		

Discharge and Stream Characteristics			Comments
Q_S	Stream Flow	31 MGD / 47.325 cfs	
Q_D	Discharge Flow	0.491 MGD / 0.7598 cfs	
$C_{S(Cl^-)}$	Instream chloride Concentration	16 mg/L	Mussel Survey - 1FRC Station Grab Sample
$C_{E(Cl^-)}$	Discharge chloride (existing)	238 mg/L	Maximum in past 3-years
$C_{P(Cl^-)}$	Discharge chloride (proposed)	238 mg/L	Maximum in past 3-years
$C_{S(Ni)}$	Instream nickel Concentration	0 µg/L	Mussel Survey - 1FRC Station Grab Sample had a non-detect value of <50
$C_{E(Ni)}$	Discharge nickel (existing)	60 µg/L	Maximum in past 3-years
$C_{P(Ni)}$	Discharge nickel (proposed)	60 µg/L	Maximum in past 3-years
$C_{S(Zn)}$	Instream zinc Concentration	0 µg/L	Mussel Survey - 1FRC Station Grab Sample had a non-detect value of <30
$C_{E(Zn)}$	Discharge zinc (existing)	51 µg/L	Application Sampling - 1 sample
$Zn_{P(Zn)}$	Discharge zinc (proposed)	51 µg/L	Application Sampling - 1 sample
$C_{S(Cu)}$	Instream copper Concentration	4 µg/L	Mussel Survey - 1FRC Station Grab Sample
$C_{E(Cu)}$	Discharge copper (existing)	25 µg/L	Application Sampling - 1 sample
$Zn_{P(Cu)}$	Discharge copper (proposed)	25 µg/L	Application Sampling - 1 sample
$C_{S(NH3-N)}$	Instream NH^3-N	0.03 mg/L	Mussel Survey - 1FRC Station Grab Sample
$C_{E(NH3-N)}$	Discharge NH^3-N (existing)	13.8 mg/L	Maximum in past 3-years
$C_{P(NH3-N)}$	Discharge NH^3-N (proposed)	13.8 mg/L	Maximum in past 3-years
pH_S	Instream pH	8 S.U.	Mussel Survey - 1FRC Station Grab Sample
T_S	Instream Temp.	25 °C	Default value for a WWF
$C_{C(NH3-N)}$	Ammonia criteria	0.563 mg/L	From ammonia criteria comparison spreadsheet -using instream pH and Temp
$C_{C(Cl^-)}$	Chloride criteria	78 mg/L	USFWS criteria
$C_{C(Ni)}$	Nickel criteria	7.3 µg/L	USFWS criteria
$C_{C(Zn)}$	Zinc criteria	13.18 µg/L	USFWS criteria
$C_{C(Cu)}$	Copper criteria	10 µg/L	USFWS criteria
W_S	Stream width	30.5 meters	Google Earth (Approximate)

Ammonia Criteria Calculations:

pH_S	8	S.U.	*(Default value is 7.0)*
T_S	25	°C	*(Default value is 20° for a CWF and 25° for a WWF)*

Acute Criteria

	METHOD and UNITS	CRITERIA	Comments	
	Old CMC (mg TAN/L) =	1.859		
	EPA 2013 CMC (mg TAN/L) =	2.580	Oncorhynchus present	* formula on pg. 41 (plateaus at 15.7 C)
		2.580	Oncorhynchus absent	* formula on pg. 42 (plateaus at 10.2 C)

Chronic Criteria

	METHOD and UNITS	CRITERIA	COMMENTS
	Old CMC (mg TAN/L) =	0.464	
$C_{C(NH3-N)}$	EPA 2013 CMC (mg TAN/L) =	0.563	* formula on pg. 46 (plateaus at 7 C)

Endangered Mussel Species Impact Area Calculations:

Existing Area of Impact

☑ N/A - No Site Specific Mussel Survey Completed for this Discharger

Approximate Area of Impact Determined from Survey =	N/A	m^2
Existing Mussel Density within Area of Impact =		
Rabbitsfoot *(Quadrula cylindrical)*		per m^2
Northern Riffleshell *(Epioblasma torulosa rangiana)*		per m^2
Rayed Bean *(Villosa fabalis)*		per m^2
Clubshell *(Pleurobema clava)*		per m^2
Sheepnose *(Plethobasus cyphyus)*		per m^2
Snuffbox *(Epioblasma triquetra)*		per m^2
TOTAL	0	per m^2

(Enter N/A if no site specific survey has been completed)

Method 1 - Utilizing Site Specific Mussel Survey Information

☑ N/A - No Site Specific Mussel Survey Completed for this Discharger

This method utilizes a simple comparison of the size of the existing area of impact as determined from a site specific mussel survey and the chlorides in the existing discharge compared to the chlorides in the proposed discharge after the facility upgrades treatment technologies. This method is only applicable to where the stream impairment is caused by TDS and/or chlorides as the plume has been delineated through conductivity measurements.

A.	Area of Impact Determined from Survey:	N/A	m^2
B.	Chlorides in Existing Discharge:	238	mg/L
C.	Chlorides in Proposed Discharge after Treatment Facility Upgrades:	238	mg/L
D.	Approximate Area of Impact after Treatment Facility Upgrades:	N/A	m^2

$A/B = D/C$ Therefore, $D = (A*C)/B$

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1/9/2025

Outfall 001

Facility:	Saegertown		
Permit Number:	PA0101923	Effective:	Expiration:
Outfall No:	001		
Location:	Saegertown, Crawford County		
Discharge to:	French Creek		
Site Specific Mussel Survey Completed:	Yes		

Endangered Mussel Species Impact Area Calculations: (continued...)

Method 2 - Mass Balance Relationship of Loading and Assimilative Capacity of Stream

Chloride (Cl^-)	$L_{S(Cl^-)}$ = Available Chloride Loading in Stream = $C_{C(Cl^-)}$ - $C_{S(Cl^-)}$ X Q_S(MGD) X 8.34 =	16,029 lbs/Day
	$L_{D\text{-}MAX(Cl^-)}$ = Current Maximium Discharge Chloride Loading exceeding criteria = ($C_{E(CL^-)}$ - $C_{E(CL^-)}$) X Q_D(MGD) X 8.34 =	655 lbs/Day
	$\%_{E(Cl^-)}$ = Percent of Stream Capacity for Current Loading = $L_{D\text{-}MAX(Cl^-)}$ / $L_{S(Cl^-)}$ =	4% of Stream Capacity
	$L_{D(Cl^-)}$ = Proposed Discharge Cl^- Loading exceeding criteria after Treatment Facility Upgrades = ($C_{P(Cl^-)}$ - $C_{P(Cl^-)}$) X Q_D(MGD) X 8.34 =	655.1904 lbs/Day
	$\%_{P(Cl^-)}$ = Percent of Stream Capacity for Proposed Loading = $L_{D(Cl^-)}$ / $L_{S(Cl^-)}$ =	4.09% of Stream Capacity
	Proposed Area of Impact due to Chloride * = $(\%_{P(Cl^-)} X W_S)^2$ X 0.5 = * assuming equal flow across transect and 90° spread at discharge	0.78 m^2
Nickel(Ni)	$L_{S(Ni)}$ = Available Nickel Loading in Stream = $C_{C(Ni)}$ - $C_{S(Ni)}$ X Q_S(MGD) X 8.34 =	1,887 lbs/Day
	$L_{D\text{-}MAX(Ni)}$ = Current Maximium Discharge Nickel Loading exceeding criteria = ($C_{E(Ni)}$ - $C_{E(Ni)}$) X Q_D(MGD) X 8.34 =	216 lbs/Day
	$\%_{E(Ni)}$ = Percent of Stream Capacity for Current Loading = $L_{D\text{-}MAX(Ni)}$ / $L_{S(Ni)}$ =	11% of Stream Capacity
	$L_{D(Ni)}$ = Proposed Discharge Ni Loading exceeding criteria after Treatment Facility Upgrades = ($C_{P(Ni)}$ - $C_{P(Ni)}$) X Q_D(MGD) X 8.34 =	215.803338 lbs/Day
	$\%_{P(Ni)}$ = Percent of Stream Capacity for Proposed Loading = $L_{D(Ni)}$ / $L_{S(Ni)}$ =	11.44% of Stream Capacity
	Proposed Area of Impact due to Nickel * = $(\%_{P(Ni)} X W_S)^2$ X 0.5 = * assuming equal flow across transect and 90° spread at discharge	6.08 m^2
Zinc (Zn)	$L_{S(Zn)}$ = Available Zinc Loading in Stream = $C_{C(Zn)}$ - $C_{S(Zn)}$ X Q_S(MGD) X 8.34 =	3,408 lbs/Day
	$L_{D\text{-}MAX(Zn)}$ = Current Maximium Discharge Zinc Loading exceeding criteria = ($C_{E(Zn)}$ - $C_{E(Zn)}$) X Q_D(MGD) X 8.34 =	155 lbs/Day
	$\%_{E(Zn)}$ = Percent of Stream Capacity for Current Loading = $L_{D\text{-}MAX(Zn)}$ / $L_{S(Zn)}$ =	5% of Stream Capacity
	$L_{D(Zn)}$ = Proposed Discharge Zn Loading exceeding criteria after Treatment Facility Upgrades = ($C_{P(Zn)}$ - $C_{PZn)}$) X Q_D(MGD) X 8.34 =	154.870631 lbs/Day
	$\%_{P(Zn)}$ = Percent of Stream Capacity for Proposed Loading = $L_{D(Zn)}$ / $L_{S(Zn)}$ =	4.54% of Stream Capacity
	Proposed Area of Impact due to Zinc * = $(\%_{P(Zn)} X W_S)^2$ X 0.5 = * assuming equal flow across transect and 90° spread at discharge	0.96 m^2
Copper (Cu)	$L_{S(Cu)}$ = Available Copper Loading in Stream = $C_{C(Cu)}$ - $C_{S(Cu)}$ X Q_S(MGD) X 8.34 =	1,551 lbs/Day
	$L_{D\text{-}MAX(Cu)}$ = Current Maximium Discharge Copper Loading exceeding criteria = ($C_{E(Cu)}$ - $C_{E(Cu)}$) X Q_D(MGD) X 8.34 =	61 lbs/Day
	$\%_{E(Cu)}$ = Percent of Stream Capacity for Current Loading = $L_{D\text{-}MAX(Cu)}$ / $L_{S(Cu)}$ =	4% of Stream Capacity
	$L_{D(Cu)}$ = Proposed Discharge Cu Loading exceeding criteria after Treatment Facility Upgrades = ($C_{P(Cu)}$ - $C_{P Cu)}$) X Q_D(MGD) X 8.34 =	61.4241 lbs/Day
	$\%_{P(Cu)}$ = Percent of Stream Capacity for Proposed Loading = $L_{D(Cu)}$ / $L_{S(Cu)}$ =	3.96% of Stream Capacity
	Proposed Area of Impact due to Copper* = $(\%_{P(Cu)} X W_S)^2$ X 0.5 = * assuming equal flow across transect and 90° spread at discharge	0.73 m^2
Ammonia-Nitrogen (NH3-N)	$L_{S(NH3\text{-}N)}$ = Available NH3-N Loading in Stream = $C_{C(NH3\text{-}N)}$ - $C_{S(NH3\text{-}N)}$ X Q_S(MGD) X 8.34 =	138 lbs/Day
	$L_{D\text{-}MAX(NH3\text{-}N)}$ = Current Maximium Discharge NH3-N Loading = $C_{E(NH3\text{-}N)}$ X Q_D(MGD) X 8.34 =	57 lbs/Day
	$\%_{E(NH3\text{-}N)}$ = Percent of Stream Capacity for Current Loading = $L_{D\text{-}MAX(NH3\text{-}N)}$ / $L_{S(NH3\text{-}N)}$ =	41% of Stream Capacity
	$L_{D(NH3\text{-}N)}$ = Proposed Discharge NH3-N Loading after Treatment Facility Upgrades = $C_{P(NH3\text{-}N)}$ - $C_{C(NH3\text{-}N)}$ X Q_D(MGD) X 8.34 =	54 lbs/Day
	$\%_{P(NH3\text{-}N)}$ = Percent of Stream Capacity for Proposed Loading = $L_{D(NH3\text{-}N)}$ / $L_{S(NH3\text{-}N)}$ =	39.13% of Stream Capacity
	Proposed Area of Impact due to NH3-N * = $(\%_{P(NH3\text{-}N)} X W_S)^2$ X 0.5 = * assuming equal flow across transect and 90° spread at discharge	71.22 m^2

1/9/2025

Outfall 001

Facility:	Saegertown		
Permit Number:	PA0101923	Effective:	Expiration:
Outfall No:	001		
Location:	Saegertown, Crawford County		
Discharge to:	French Creek		
Site Specific Mussel Survey Completed:	Yes		

Endangered Mussel Species Impact Area Calculations: (continued...)

Method 3 - Mass Balance Relationship of Stream Flow, Proposed Effluent Quality, and Mussel Protection Criteria

Chloride (Cl^-)	$Q_{A(Cl^-)}C_{S(Cl^-)} + Q_DC_{P(Cl^-)} = Q_TC_{C(Cl^-)}$	
	$Q_{A(Cl^-)}$ = Assimilative Stream Flow Required to Achieve Criteria (cfs)	
	$Q_T = Q_S + Q_D$ (cfs)	
	$Q_{A(Cl^-)}C_{S(Cl^-)} + Q_DC_{P(Cl^-)} = (Q_D+Q_S)C_{C(Cl^-))}$	
	SOLVING FOR $Q_{A(Cl^-)} = [(Q_DC_{P(Cl^-)} / C_{C(Cl^-)}) - Q_D)] / (1 - C_{S(Cl^-)}/C_{C(Cl^-)}) =$	1.96077419 cfs
	$\%_{P(Cl^-)}$ = Percent of Stream Width Required to Assimilate Chlorides to Criteria Concentration $= Q_{A(Cl^-)} / Q_S$ (cfs) =	4.1432%
	$W_{I(Cl^-)}$ = Proposed Width of Stream required to Assimilate Chlorides to Criteria Concentration $= W_S \times \%_{P(Cl^-)}$	1.263679 meters
	Proposed Area of Impact due to Chloride * $= (W_{I(Cl^-)})^2 \times 0.5 =$ * assuming equal flow across transect and 90° spread at discharge	0.80 m^2
Nickel (Ni)	$Q_{A(Ni)}C_{S(Ni)} + Q_DC_{P(Ni)} = Q_TC_{C(Ni)}$	
	$Q_{A(Ni)}$ = Assimilative Stream Flow Required to Achieve Criteria (cfs)	
	$Q_T = Q_S + Q_D$ (cfs)	
	$Q_{A(Ni)}C_{S(Ni)} + Q_DC_{P(Ni)} = (Q_D+Q_S)C_{C(Ni))}$	
	SOLVING FOR $Q_{A(Ni)} = [(Q_DC_{P(Ni)} / C_{C(Ni)}) - Q_D)] / (1 - C_{S(Ni)}/C_{C(Ni)}) =$	5.48513151 cfs
	$\%_{P(Cl^-)}$ = Percent of Stream Width Required to Assimilate Nickel to Criteria Concentration $= Q_{A(Ni)} / Q_S$ (cfs) =	11.5903%
	$W_{I(Ni)}$ = Proposed Width of Stream required to Assimilate Nickel to Criteria Concentration $= W_S \times \%_{P(Ni)}$	3.535056 meters
	Proposed Area of Impact due to Nickel * $= (W_{I(Ni)})^2 \times 0.5 =$ * assuming equal flow across transect and 90° spread at discharge	6.25 m^2
Zinc (Zn)	$Q_{A(Zn)}C_{S(Zn)} + Q_DC_{P(Zn)} = Q_TC_{C(Zn)}$	
	$Q_{A(Zn)}$ = Assimilative Stream Flow Required to Achieve Criteria (cfs)	
	$Q_T = Q_S + Q_D$ (cfs)	
	$Q_{A(Zn)}C_{S(Zn)} + Q_DC_{P(Zn)} = (Q_D+Q_S)C_{C(Zn))}$	
	SOLVING FOR $Q_{A(Zn)} = [(Q_DC_{PZn)} / C_{C(Zn)}) - Q_D)] / (1 - C_{S(Zn)}/C_{C(Zn)}) =$	2.18024552 cfs
	$\%_{P(Cl^-)}$ = Percent of Stream Width Required to Assimilate Zinc to Criteria Concentration $= Q_{A(Zn)} / Q_S$ (cfs) =	4.6070%
	$W_{I(Zn)}$ = Proposed Width of Stream required to Assimilate Zinc to Criteria Concentration $= W_S \times \%_{PZn)}$	1.405124 meters
	Proposed Area of Impact due to Zinc * $= (W_{I(Zn)})^2 \times 0.5 =$ * assuming equal flow across transect and 90° spread at discharge	0.99 m^2
Copper (Cu)	$Q_{A(Cu)}C_{S(Cu)} + Q_DC_{P(Cu)} = Q_TC_{C(Cu)}$	
	$Q_{A(Cu)}$ = Assimilative Stream Flow Required to Achieve Criteria (cfs)	
	$Q_T = Q_S + Q_D$ (cfs)	
	$Q_{A(Cu)}C_{S(Cu)} + Q_DC_{P(Cu)} = (Q_D+Q_S)C_{C(Cu))}$	
	SOLVING FOR $Q_{A(Cu)} = [(Q_DC_{PCu)} / C_{C(Cu)}) - Q_D)] / (1 - C_{S(Cu)}/C_{C(Cu)}) =$	1.8995 cfs
	$\%_{P(Cu)}$ = Percent of Stream Width Required to Assimilate Copper to Criteria Concentration $= Q_{A(Cu)} / Q_S$ (cfs) =	4.0137%
	$W_{I(Cu)}$ = Proposed Width of Stream required to Assimilate Copper to Criteria Concentration $= W_S \times \%_{PCu)}$	1.224189 meters
	Proposed Area of Impact due to Copper * $= (W_{I(Cu)})^2 \times 0.5 =$ * assuming equal flow across transect and 90° spread at discharge	0.75 m^2
Ammonia-Nitrogen (NH3-N)	$Q_{A(NH3\text{-}N)}C_{S(NH3\text{-}N)} + Q_DC_{P(NH3\text{-}N)} = Q_TC_{C(NH3\text{-}N)}$	
	$Q_{A(NH3\text{-}N)}$ = Assimilative Stream Flow Required to Achieve Criteria (cfs)	
	$Q_T = Q_S + Q_D$ (cfs)	
	$Q_{A(NH3\text{-}N)}C_{S(NH3\text{-}N)} + Q_DC_{P(NH3\text{-}N)} = (Q_D+Q_S)C_{C(NH3\text{-}N))}$	
	SOLVING FOR $Q_{A(NH3\text{-}N)} = [(Q_DC_{P(NH3\text{-}N)} / C_{C(NH3\text{-}N)}) - Q_D)] / (1 - C_{S(NH3\text{-}N)}/C_{C(NH3\text{-}N)}) =$	18.869555 cfs
	$\%_{P(NH3\text{-}N)}$ = Percent of Stream Width Required to Assimilate NH3-N to Criteria Concentration $= Q_{A(NH3\text{-}N)} / Q_S$ (cfs) =	39.8723%
	$W_{I(NH3\text{-}N)}$ = Proposed Width of Stream required to Assimilate NH3-N to Criteria Concentration $= W_S \times \%_{P(NH3\text{-}N)}$	12.161044 meters
	Proposed Area of Impact due to NH3-N * $= (W_{I(NH3\text{-}N)})^2 \times 0.5 =$ * assuming equal flow across transect and 90° spread at discharge	73.95 m^2