

Prepared for:

Lehigh Cement Company

7660 Imperial Way
Allentown, Pennsylvania 18195

Washington Department of Ecology

4601 North Monroe Street
Spokane, Washington 99205

**Mixing Zone Study Results Report
for the Closed Cement Kiln Dust Pile
Site Groundwater Treatment System
Metaline Falls, Washington**

Prepared by:

Geosyntec 
consultants

engineers | scientists | innovators

520 Pike Street, Suite 1375
Seattle, WA 98101
Telephone: (206) 496-1450
www.geosyntec.com

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1. INTRODUCTION

Geosyntec Consultants (Geosyntec) has prepared this report to document the results of a mixing zone study completed on behalf of the Lehigh Cement Company (Lehigh). The groundwater treatment system at the Lehigh Closed Cement Kiln Dust (CKD) Pile site (Site; **Figure 1**) in Metaline Falls, Washington has been permitted to discharge treated groundwater into Sullivan Creek under National Pollutant Discharge Elimination System (NPDES) Discharge Permit No. WA-004558-6 (Washington Department of Ecology [Ecology], 2006b). The NPDES permit contains effluent limitations for pH, arsenic, chromium, lead and manganese. A copy of the permit is included in **Appendix A**. These effluent limitations have also been established in the Site Consent Decree No. 06-2-00034-6 (CD) (Ecology, 2006a).

Despite significant progress at treating the groundwater and efforts to improve performance since construction of the groundwater treatment system in 2007, the system effluent arsenic discharge concentration of 5 micrograms per liter ($\mu\text{g/L}$) has not been consistently met. The target arsenic cleanup level was set in the CD based on surface water quality standards and adjusted upward to 5 $\mu\text{g/L}$ in recognition of background conditions and technology limitations. Based on conversations between Geosyntec, Lehigh, and Ecology in 2016, a modeling study was proposed to understand effluent mixing within Sullivan Creek.

Geosyntec, on behalf of Lehigh, has completed the mixing zone study using a computer model to approximate total arsenic effluent dilution within the creek. Other discharge criteria monitored (pH, lead, manganese and chromium) have historically been in general compliance at the outfalls and were therefore excluded from this study. The assumptions, inputs and methodologies used in this mixing zone modeling study are discussed in Section 4. Results and recommendations are presented in Section 5.

Lehigh is requesting that Ecology consider evaluating the issuance of a mixing zone in accordance with Washington Administrative Code (WAC) 173-201A based on the results of this study and evaluation by Ecology.

2. BACKGROUND

Buried funnel-and-gate barrier walls capture highly alkaline CKD-impacted groundwater and divert it to the subsurface treatment zone. The groundwater is treated by using carbon dioxide diffusion to neutralize pH and stimulate metals precipitation and removal reactions. Treated groundwater is discharged into Sullivan Creek through three outfall locations, TZOutlet-1, TZOutlet-2 and TZOutlet-3, which are also the current effluent compliance monitoring points (**Figure 2**). As shown in **Figure 3**, when the outfall valves are open, treated groundwater flows out of the treatment system through 2-inch horizontal Schedule 80 polyvinyl chloride (PVC) pipes.

The approximate locations of the physical outfalls are shown below:

Outfall	Location Coordinates (NAD83HARN)
TZOutlet-1	48.86113275°N, -117.3668416°W
TZOutlet-2	48.86107543°N, -117.3668013°W
TZOutlet-3	48.86100716°N, -117.3667533°W

Notes:

1. Coordinates were retrieved from Ecology's Environmental Information Management System (EIM) Map with a horizontal accuracy of ± 40 feet
2. NAD83HARN – North American Datum of 1983 High Accuracy Reference Network

The valves are operated independently, so discharge may also be isolated to just one, two or all three outfalls at a given time. This study evaluated the conditions where the three outlet valves were fully open to allow maximum discharge from the treatment system. The outfall pipes are buried within the streambank stabilization structure (gabion baskets and soil pillows) along the bank of Sullivan Creek. Treated effluent flows through the streambank structure and into the creek via gravity.

3. APPLICATION OF AKART

WAC 173-201A states that a discharger is required to fully apply All Known and Reasonable Technologies (AKART) prior to being authorized the use of a mixing zone. According to WAC 173-201A, AKART is described as “represent[ing] the most current methodology that can be reasonably required for preventing, controlling or abating the pollutants associated with a discharge.”

The Site Engineering Design Report (EDR) addressed WAC 173-240-130(2)(c) through 2(j), which required characterization of the influent groundwater and a description of the treatment prior to discharge (Geosyntec, 2006). Under the MTCA process, Ecology previously performed an extensive analysis of alternatives, including no discharge options. Therefore, the AKART analysis is not repeated here. Because the treatment system meets the requirements of AKART, a mixing zone may be considered.

4. MIXING ZONE STUDY METHODOLOGY

This study was based on the scope of work outlined within the Work Plan to Support Mixing Zone and Zone of Initial Dilution Studies (Geosyntec, 2016b) submitted to Ecology in August 2016.

4.1 Model Selection

Geosyntec used the Cornell Mixing Zone Model (CORMIX; Doneker and Jirka, 2007) to simulate mixing of the treatment system effluent in the creek. This was an EPA-supported mixing zone model when it was developed and is also referenced in Ecology's Water Quality Program Permit Writer's Manual (Permit Writer's Manual; Ecology, 2015). CORMIX was selected because it can simulate mixing in all three dimensions, is capable of predicting centerline dilution, and can be used to evaluate the thickness and width of the plume. CORMIX also has a long history of applications throughout the United States for similar evaluations.

4.2 CORMIX Model Inputs

Geosyntec used available discharge and receiving water data and information to parameterize the CORMIX model. The modeling data and inputs are described in the following sections and are also summarized in **Tables 1** and **2**.

4.2.1 Sullivan Creek Characterization

CORMIX requires inputs of flow (velocity), geometry (width and depth), temperature and background total arsenic concentration for receiving water characterization.

4.2.1.1 Sullivan Creek Critical Flow Conditions

The degree of mixing was determined during critical conditions, as defined in WAC 173-201A-020. The selected critical flow condition in Sullivan Creek was the average minimum seven-day flow value which occurs once in 10 years (7Q10 flow). Daily average flow data for United States Geological Survey (USGS) gauge #12398000, located upstream of the Site in Sullivan Creek, was available for the years 1954 through 2005, intermittently. The 7Q10 value for Sullivan Creek was estimated to be 35.6 cubic feet per second (cfs). This value was determined using the US Environmental Protection Agency (EPA) DFLOW program for analyzing low flow statistics (see **Appendix B**).

Geosyntec is aware that the Mill Pond Dam, located upstream of the Site in Sullivan Creek, is currently undergoing decommissioning and the removal of the dam may alter creek flow conditions at the Site. However, Geosyntec assumes that decommissioning of the overflow concrete dam will result in increased winter flow in Sullivan Creek and effluent is expected to only be discharged in the winter under normal operations. Therefore, the critical conditions modeled in

this study are more conservative than the expected flow conditions that will occur after dam removal.

4.2.1.2 Receiving Water Geometry

The modeling framework used for the far-field model was the Environmental Fluid Dynamics Code (EFDC; Hamrick, 1992). EFDC is a multifunctional numerical surface water modeling system, which includes hydrodynamic, sediment-contaminant, and eutrophication components. The EFDC model was initially developed to support the Lehigh treatment bank stabilization and enhancement design project in 2015 (Geosyntec, 2016a). The model included alternative assessments of water surface elevations, and velocity and bed shear stress. The Dynamic Solutions International LLC version of EFDC was used along with the EFDC Explorer preprocessor (Craig, 2013) following additional bathymetric data collection to evaluate relative water levels under low-flow design conditions, and estimate design parameters needed for the CORMIX model.

Existing topography and initial channel cross-section data used in the development of the EFDC model grids were derived from Light Detection and Ranging (LiDAR) data collected by Seattle City Light in 2012. These data and the resulting model grid were augmented with 2015 site observations to account for below waterline characteristics not captured in the LiDAR data and used to support the streambank stabilization project conducted for Lehigh in 2015. As a result of on-going system morphology above and below the Lehigh site and the need to more accurately account for system geometries at low design flows (7Q10), a follow-up field survey was conducted in May 2017 to update the channel cross-section data.

Following collection of the additional geometric data up and down stream of the site and treatment discharge locations, the existing EFDC model grid was refined accordingly within the model cells where new data were available. Once refined, the model grid was run via the EFDC interface under low-flow design conditions and used to estimate the relative depths across representative cross-section locations determined appropriate for the CORMIX application. This iterative process was needed as the 7Q10 conditions (35.6 cfs) were unable to be observed in the field and required numerical estimation.

An aerial view of Sullivan Creek is shown in **Figure 4**, which shows that under critical flow the creek is bifurcated by the vegetated island adjacent to the treatment system. In order to account for the reduced flow near the treatment discharge location, the CORMIX modeling was completed in two parts: a side channel and a main channel analysis.

The first step modeled the effluent discharge from the treatment system directly into the side channel. The model simulates that only about 4.55 cfs of flow goes through the side channel during the 7Q10 flow condition. The simulated depth near the treatment discharge in the side channel ranges from 0.6 to 1.2 ft. For conservative purposes, a depth of 0.61 ft and width of 15.3 ft were

used as inputs for the receiving water channel geometry for side channel CORMIX modeling. The second CORMIX model step simulated the side channel discharge into the main channel. The EFDC model simulated a depth of 1.0 ft and width of 32.8 ft in the main channel, and these values were used for the main channel CORMIX modeling. The CORMIX model input parameters are described in **Table 1** for the side channel, and in **Table 2** for the main channel.

4.2.1.3 Receiving Water Temperature

Since the treatment system effluent is expected only to discharge in the winter, a water temperature of 6.5°C was selected for Sullivan Creek. This temperature was measured in Sullivan Creek below Mill Pond Dam on 15 November 2009, which was the last known measurement of a multi-month temperature monitoring program in this watershed (EES Consulting, 2010).

4.2.1.4 Background Arsenic Concentrations in Sullivan Creek

Background arsenic concentrations could not be located in the publically available USGS water quality data for Sullivan Creek. Geosyntec collected four grab samples from the creek to identify background arsenic concentrations. Three rounds of sampling were conducted during regular monthly site visits in September, October and November 2016. One additional sample was collected in September 2017 as part of the permit renewal sampling requested by Ecology.

The average total arsenic concentrations were evaluated from the four sampling events (see **Appendix C**) using the protocol outlined in Table 12 in Chapter 6 of the Permit Writer's Manual (Ecology, 2015). The background total arsenic concentration for the CORMIX model was selected to be 0.39 µg/L.

4.2.2 Effluent Discharge Characterization

CORMIX required inputs of effluent flow, total arsenic discharge concentration, and temperature for effluent discharge characterization.

4.2.2.1 Flowrate

As stated in WAC 173-201A-400, mixing zone studies shall consider critical discharge conditions. To model mixing under critical conditions, the maximum daily flow was used as the modeled effluent flow. As stated in Lehigh's 2018 Site NPDES permit renewal application, this value was estimated to be 86,000 gallons per day (gpd).

4.2.2.2 Arsenic Concentration

Three effluent samples were collected in January, February and March 2017 when the system was discharging. An additional effluent sample was collected in September 2017 as part of the Priority Pollutant List permit renewal sampling requested by Ecology. Results from these four samples

were analyzed to project a maximum total arsenic concentration in the effluent (see **Appendix D**) in accordance with procedures outlined in the EPA Technical Support Document for Water Quality-based Toxics Control (TSD; EPA, 1991). The highest observed total arsenic concentration was determined to be 0.015 mg/L from the data set. This value was then multiplied by a multiplying factor of 2.6 selected from Table 3-2 in the TSD (based on a sample size of 4, with a 95% confidence level and 95% probability). The calculated maximum total arsenic effluent concentration of 39 µg/L was selected for the CORMIX modeling.

4.2.2.3 Temperature

Because the discharge of treated groundwater to the creek is expected to only occur during winter months during standard operations, three temperature measurements collected in January, February and March 2017 (when the system was discharging) were analyzed. The values ranged between 4.27°C and 4.64°C (**Appendix D**). The maximum temperature, 4.64°C was selected as the modeled effluent temperature.

4.2.3 Outlet Structure Configuration

The study assumed that the three outlet valves were open, and the combined effluent discharge was modeled as a single discharge. Because the outfall structures are buried within the streambank stabilization structure and effluent flows through the streambank structure and into the creek via gravity, it was assumed that the sheet flow of effluent over the bank into the creek imparted no horizontal momentum to the creek. Due to the unique nature of the effluent flow discharge, an alternating diffuser configuration parallel to the bank was used to simulate the sheet flow of effluent discharge into the creek. This type of diffuser configuration imparts no net horizontal momentum to the receiving water (Doneker and Jirka, 2007). A total of 50 ports with a diameter of 0.1 feet each were assumed on the diffuser along the 54 foot length of treatment bank.

4.2.4 Additional CORMIX Inputs and Considerations

A Manning's roughness coefficient of 0.07 was used for the creek based on Table 5-2 of the "Mill Pond Decommissioning Plan" prepared by Seattle City Light (2010, Seattle City Light).

An average wind speed of 7 miles per hour was used as an input into the CORMIX model, based on the Meteoblue historical climate information for Metaline Falls, Washington (https://www.meteoblue.com/en/weather/forecast/modelclimate/metaline-falls_united-states-of-america_5803199).

Because of the unique features of the outlets in which effluent flows through the streambank structure before entering Sullivan Creek, the diffusers do not actually discharge directly into the creek. Therefore, three different diffuser depths were assessed in CORMIX for modeling effluent flow into the side channel: shallow, middle and deep (0.61, 0.92 and 1.2 feet below the surface of

the water). A sensitivity analysis determined that the shallow case showed the most conservative dilution. Therefore this configuration was selected for the CORMIX model.

5. CORMIX RESULTS

Results from the steady state model CORMIX, used to simulate the mixing of effluent from the treatment system at 7Q10 flow conditions in the Sullivan Creek, are discussed below. Three dimensional plots of effluent mixing within the side and main channels are shown in **Figures 5 and 6**. A graph demonstrating the centerline total arsenic concentrations with downstream distance from the outfalls is shown in **Figure 7**. Combined simulated centerline dilution factors for the effluent plume are tabulated in **Table 3**.

5.1 Side Channel

The first step in the CORMIX modeling simulated the effluent plume discharging directly from the treatment system into the side channel. The silver tube in **Figure 6** represents the diffuser used to model the treatment system outflow, and the colored area represents arsenic concentrations in the plume. Brown shading indicates the banks and bottom of the Sullivan Creek side channel. Water outside of the effluent plume is not shown. It should be noted that the distance label units in the CORMIX figure are in meters.

The CORMIX analysis predicted an initial centerline dilution factor of 1.4 along the treatment bank length. The simulated plume clung close to the bank shoreline with little lateral spreading due to the absence of horizontal flux of effluent discharge into the side channel. The plume becomes fully vertically mixed at the downstream end of the treatment bank and continues so downstream. The simulated plume width at the end of side channel is 2.1 ft (0.63 m). At the end of the side channel, the simulated arsenic concentration of the centerline of the treatment zone discharge, which is immediately next to the river bank, is 12.3 µg/L. This represents a dilution factor of 3.2 and equivalent mixing flow of 0.6 cfs. These simulated plume characteristics at the end of side channel were used as inputs into the CORMIX model for the main channel.

5.2 Main Channel

The second step in the CORMIX modeling simulated the discharge of the side channel (and effluent plume) into the main channel. As shown in **Figure 7**, CORMIX predicted rapid substantial mixing and dilution of the plume in the main channel. It should be noted that the distance label units in the CORMIX figure are in meters. The simulated plume centerline concentration meets the NPDES discharge criteria at a distance of 5.2 ft (1.6 m) from the end of side channel with a concentration of 4.9 µg/L. This represents dilution factors of 2.7 and 8.7 relative to the plumes entering the main channel (from the side channel) and the side channel (from the treatment system), respectively. It represents an equivalent mixing flow of 2.1 cfs.

5.3 Summary

The model results demonstrated rapid initial mixing within the side channel downstream of the treatment system, then additional substantial and rapid mixing after the side channel entered into the main channel of Sullivan Creek.

The water quality criteria of 5 µg/L was met at a distance of 58.1 ft (17.7 m) downstream of the center of the treatment bank, or at a distance of 31.1 ft (9.5 m) from the downstream edge of the treatment bank. Dilution in the first 100 feet downstream from the middle of the remedy outfall reaches a dilution factor of 25.6 under critical conditions (**Table 3**).

Electronic CORMIX files can be provided to Ecology staff upon request.

6. CONCLUSIONS

6.1 Proposed Mixing Zone Boundary

The CORMIX model demonstrated significant initial dilution of the effluent plume within the side channel, and rapid subsequent dilution within the main channel. As shown in **Figure 7**, the NPDES concentration limit for total arsenic (5 µg/L) was met approximately 31.1 ft (9.5 m) downstream from the edge of the treatment bank under critical conditions. To limit the size of the requested mixing zone, Lehigh is requesting that the mixing zone boundary, and revised total arsenic compliance point, be located at an accessible point approximately 100 ft (9.5 m) downstream from the downstream edge of the treatment zone bank, or 120 ft (17.7 m) from the center of the treatment bank (**Figure 8**). The location is proposed for several reasons, including:

- The location is adjacent to Lehigh's property.
- The streambank is steep, uneven, and heavily vegetated in general, but the proposed location is accessible unless snow depth or icy conditions are present..
- The location meets the numerical criteria listed in WAC 173-201A as described in the following section.

6.2 Mixing Zone Size Restrictions

As stated in WAC 173-201A-400(7), the maximum size of the mixing zone shall comply with the following size restrictions:

1. Extend less than 300 feet downstream of the discharge ports;
2. Extend less than 100 feet upstream of the discharge ports;
3. Utilize less than 25% of the creek flow; and
4. Occupy less than 25% of the creek width.

A discussion of how the requested mixing zone would meet the size restrictions is presented below:

1. The proposed mixing zone would extend approximately 120 ft downstream from the center of the treatment bank, which is less than 300 ft. **Criteria satisfied.**
2. Because of the unidirectional downstream flow in the creek at the discharge location the mixing zone is not expected to significantly extend upstream of the discharge outfalls. **Criteria satisfied.**
3. At 58 feet downstream from the center of the treatment bank, the total creek flow is 35.6 cfs and the mixing zone flow is 2.1 cfs. As estimated by CORMIX, under critical conditions the effluent is expected to occupy a maximum of 5.9% of the total creek flow at 58 ft downstream of the outfalls, and thus at 120 ft the percentage is expected to be even lower. **Criteria satisfied.**
4. The mixing zone is expected to occupy a maximum width of 2.1 feet in the side channel, which is a maximum of 13.7% of the side channel width. At 58 feet downstream the mixing zone is expected to occupy 1.4 ft of the width of the main channel, which is 4.2% of the main channel creek width, and thus at 120 ft the percentage is expected to be even lower. **Criteria satisfied.**

The proposed mixing zone would meet the size restrictions outlined in WAC 173-201A-400(7), based on the results of this study.

7. SUMMARY

Lehigh has completed a mixing zone study to evaluate the mixing of total arsenic in effluent within Sullivan Creek under critical conditions. The results of the study demonstrated that the permitted total arsenic discharge limit of 5 µg/L could be met with the issuance of a mixing zone. The proposed mixing zone would meet the sizing requirements outlined in the Washington Administrative Code. The proposed mixing zone is shown in **Figure 8**. Based on the results of this study, Lehigh is requesting that Ecology consider granting a mixing zone as part of the NPDES permit No. WA-004558-6

8. REFERENCES

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TABLES

TABLE 1: CORMIX INPUTS - SIDE CHANNEL

Remedy effluent discharge from three outfalls (TZOutlet-1, TZOutlet-2, and TZOutlet-3) modeled as a single discharge.

Description	Values in U.S. Units		CORMIX Inputs in Metric Units		Notes
Discharge Geometry					
Nearest bank is on the	-	-	Left		
Diffuser length	54	feet	16.46	m	Length of treatment zone bank
Number of ports	-	-	50	-	Number of ports to ensure that port spacing is of same or less order of magnitude as compared to receiving water water depth
Height of ports	-	-	0.16	m	Openings of diffuser ports are slightly below the water surface.
Diameter of ports	0.10	feet	0.03048	m	Assumed value 0.1 feet
Distance of ports from bank	-	-	0	m	Representative of a slow momentum effluent discharge entering the creek from the creek bank
Type of diffuser	-	-	Alternating diffuser		Achieves zero net horizontal flux
Horizontal angle of diffuser line	-	-	0	degrees	Diffuser oriented parallel to creek flow
Vertical angle	-	-	90	degrees	Ports oriented vertically
Contraction ratio	-	-	1	-	
Direction of nozzles on each side	-	-	Same direction		
Effluent Flow into Side Channel					
Flow rate	86,000	gpd	0.0038	m³/sec	Maximum daily design flow in renewal application for NPDES Permit No. WA-004558-6
Temperature	-	-	4.64	°C	See Appendix D.
Total As concentration	-	-	39	µg/L	See Appendix D.
Excess total As concentration	-	-	38.61	µg/L	Effluent concentration - background concentration
Receiving Water (Sullivan Creek Side Channel)					
Flow rate	4.55	cfs	0.13	m³/sec	Bifurcated portion of 7Q10 flow in Sullivan Creek, as indicated by EFDC model
Background total As concentration	-	-	0.39	µg/L	See Appendix C.
Average depth	-	-	0.185	m	Simulated value from EFDC model, shallow case
Depth at discharge	-	-	0.185	m	Shallow case
Average width	-	-	4.67	m	Site geometry
Ambient velocity	-	-	0.149	m/sec	Flow velocity in fastest-moving portion of the side channel in the EFDC model
Ambient temperature	-	-	6.5	°C	From Sullivan Creek Cold Water Release Facility Plan
Manning's roughness coefficient		-	0.07	-	From Mill Pond Dam Decommissioning Plan
Wind speed	7	mph	3.13	m/sec	Nearest wind gauge: 7 mph
Appearance	-	-	Uniform		
Mixing Zone					
Concentration for WQ standard (excess)			5	ppb	
Region of interest			50	m	
Output steps per module			100		

TABLE 2: CORMIX INPUTS - MAIN CHANNEL

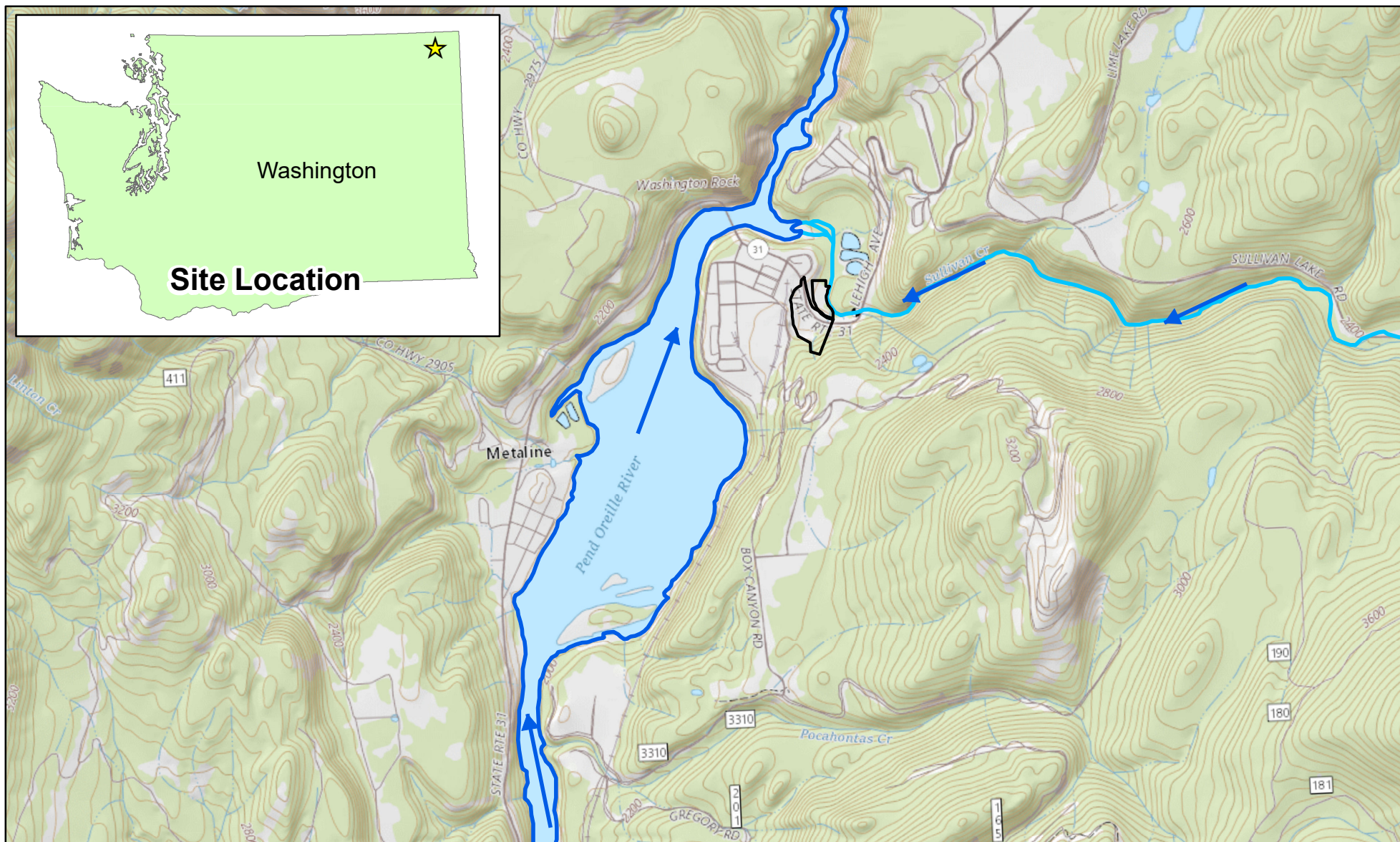
Remedy effluent discharge from three outfalls (TZOutlet-1, TZOutlet-2, and TZOutlet-3) modeled as a single discharge.

Description	Values in U.S. Units		CORMIX Inputs (Metric Units)		Notes
Side Channel Discharge Geometry					
Discharge located on the	-	-	Left bank		
Plume width	-	-	0.63	m	Equal to plume width at the end of side channel
Depth of discharge channel	-	-	0.19	m	Depth in side channel
Area of channel	-	-	0.12	m ²	Calculated from above values
Receiving water depth at channel entry (i.e., local depth at discharge outlet)	-	-	0.30	m	Equal to average depth
Receiving water slope in vicinity of discharge	-	-	1.490	%	
Type of discharge	-	-	Flush		Discharge is flush with the bank
Horizontal angle between the discharge and and current direction of the main channel	-	-	20	degrees	Site geometry
Discharge Flow into Main Channel					
Flow rate	0.5958	cfs	0.017	m ³ /sec	Mixing flow, calculated from side channel model results
Temperature	-	-	6.5	°C	From Sullivan Creek Cold Water Release Facility Plan
Total As concentration in side channel mouth	-	-	12.29	µg/L	Side channel model output at 16.17 m (53.05 ft)
Excess total As concentration in side channel mouth	-	-	11.90	µg/L	Calculated from above value - background concentration
Receiving Water (Sullivan Creek Side Channel)					
Flow rate	35.6	cfs	1.01	m ³ /sec	7Q10 flow
Background total As concentration	-	-	0.39	µg/L	See Appendix C.
Average depth	-	-	0.30	m	Simulated value from EFDC model
Depth at discharge	-	-	0.30	m	Simulated value from EFDC model
Average width	-	-	10.0	m	Site geometry
Ambient velocity	-	-	0.34	m/sec	Calculated from flow rate.
Ambient temperature	-	-	6.5	°C	From Sullivan Creek Cold Water Release Facility Plan
Manning's roughness coefficient		-	0.07	-	From Mill Pond Dam Decommissioning Plan
Wind speed	7	mph	3.13	m/sec	Nearest wind gauge: 7 mph
Appearance	-	-	Slight meander		
Mixing Zone					
Concentration for WQ standard (excess)			5	ppb	
Region of interest			50	m	
Output steps per module			100		

TABLE 3: CENTERLINE DILUTION FACTORS

Distance Downstream of Middle of Treatment Bank (feet)	Distance Downstream of Middle of Treatment Bank (meters)	Dilution Factor
0.0	0.0	1.4
5.0	1.5	1.4
10.0	3.0	1.4
15.0	4.6	1.4
20.0	6.1	1.4
25.0	7.6	1.4
30.0	9.1	1.8
35.0	10.7	2.2
40.0	12.2	2.6
45.0	13.7	2.9
50.0	15.2	3.1
55.0	16.8	5.1
60.0	18.3	6.9
65.0	19.8	11.3
70.0	21.3	14.4
75.0	22.9	16.7
80.0	24.4	18.8
85.0	25.9	20.7
90.0	27.4	22.4
95.0	29.0	24.1
100.0	30.5	25.6

FIGURES



Legend

- Sullivan Creek
- Pend Oreille River
- Site Boundary
- ➔ Flow Direction

Notes:



0 2,500 Feet

Site Location Mixing Zone Study

Lehigh Cement Company
Closed CKD Pile Site
Metaline Falls, WA

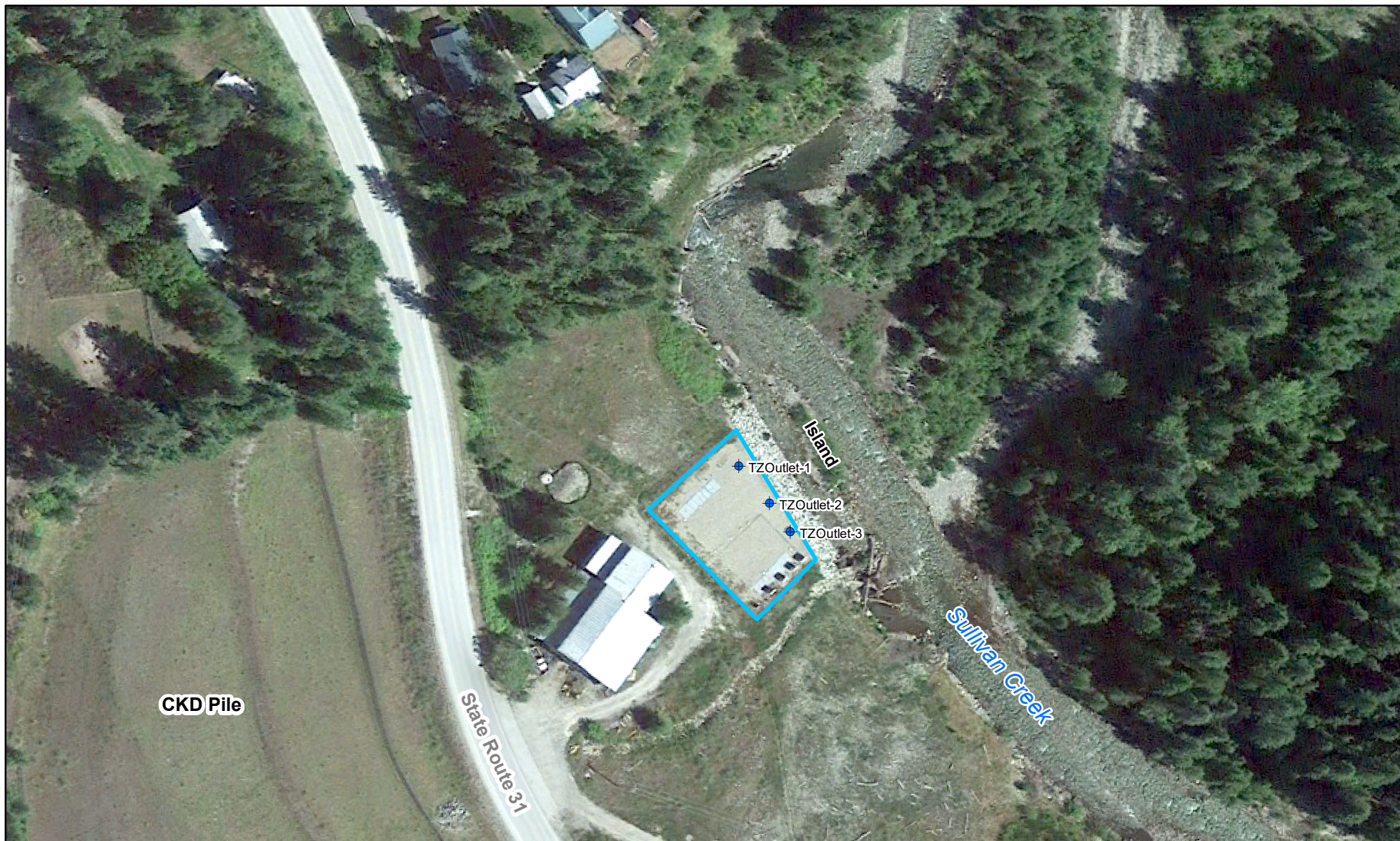
Geosyntec
consultants



HR0996C

January 2018

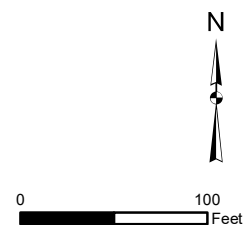
Figure

1



- Legend**
-  Discharge Outlet
 -  Treatment Zone

Notes:



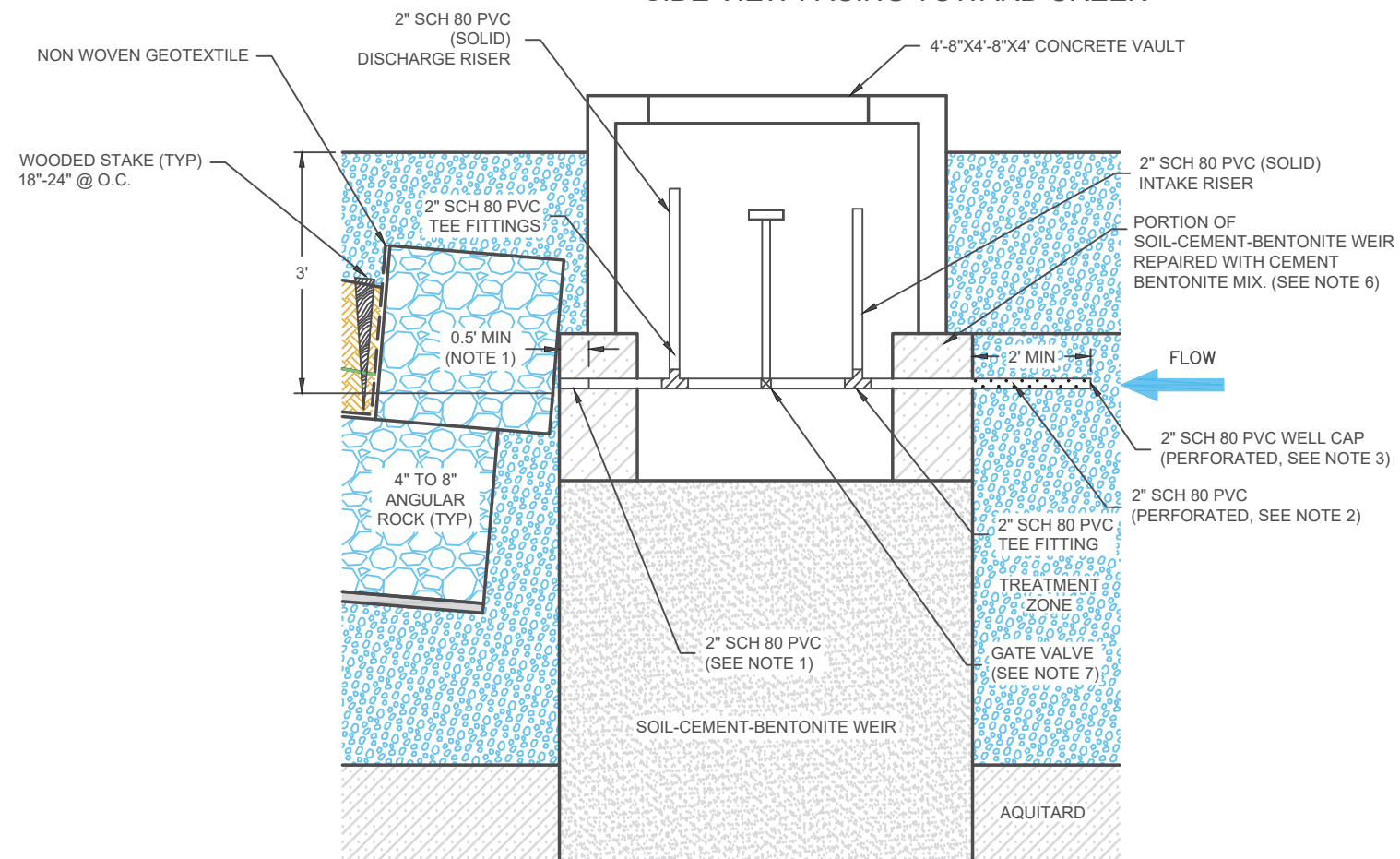
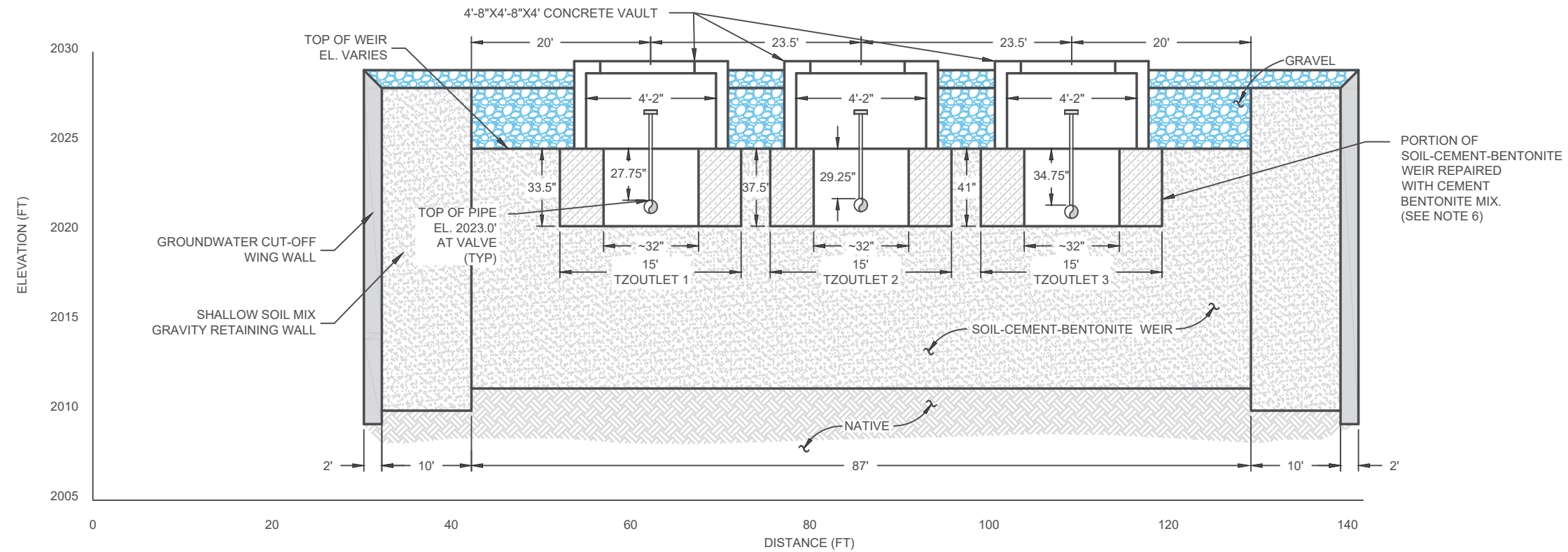
Site Map
Mixing Zone Study
 Lehigh Cement Company
 Closed CKD Pile Site
 Metaline Falls, WA

Geosyntec
 consultants

HR0996C

January 2018

Figure
2



- NOTE:

1. DISCHARGE PIPE PLACED OPEN ENDED AGAINST GABION BASKET.
2. PERFORATIONS ARE $\frac{5}{16}$ " SPACED 3" O.C. ON FOUR SIDES.
3. 2" SCH 80 PVC WELL CAP INCLUDES THREE $\frac{5}{16}$ " HOLES.
4. PIPE PENETRATIONS AND VALVE BOX JOINTS SEALED WITH INSULATING FOAM SEALANT.
5. CEMENT BENTONITE MIX CONSISTED OF APPROXIMATELY 7.5% CEMENT, 2% BENTONITE, AND 90.5% SAND BY WEIGHT. CONSISTENCY OF CONCRETE WAS 4"-6" OF SLUMP.
6. VALVE ELEVATION TAKEN AT TOP OF HORIZONTAL PIPE, APPROXIMATELY EQUAL TO VALVE SEAT ELEVATION.

NOT TO SCALE

OUTLET STRUCTURES
LEHIGH CLOSED CKD PILE SITE
METALINE FALLS, WASHINGTON

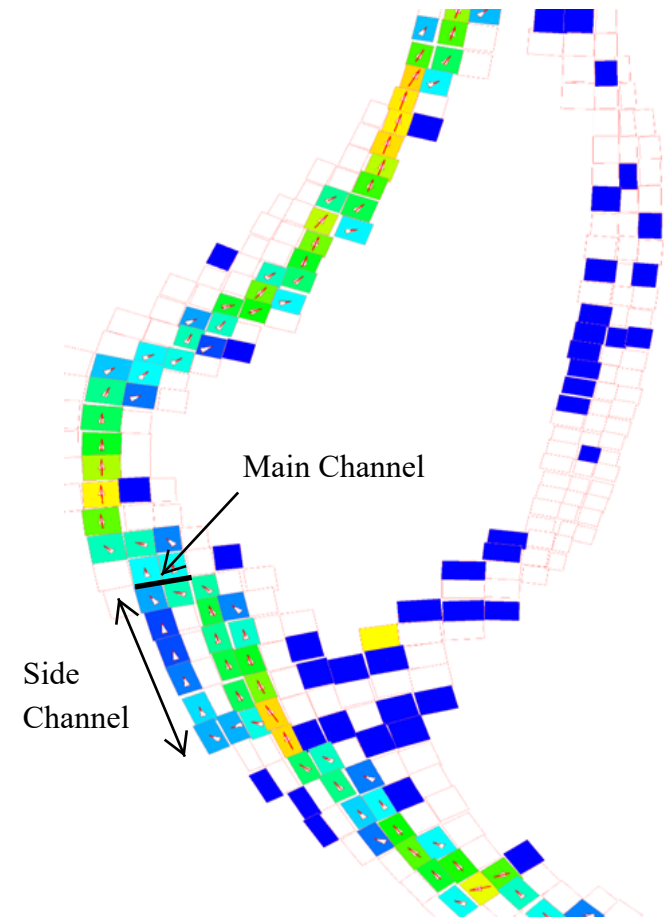
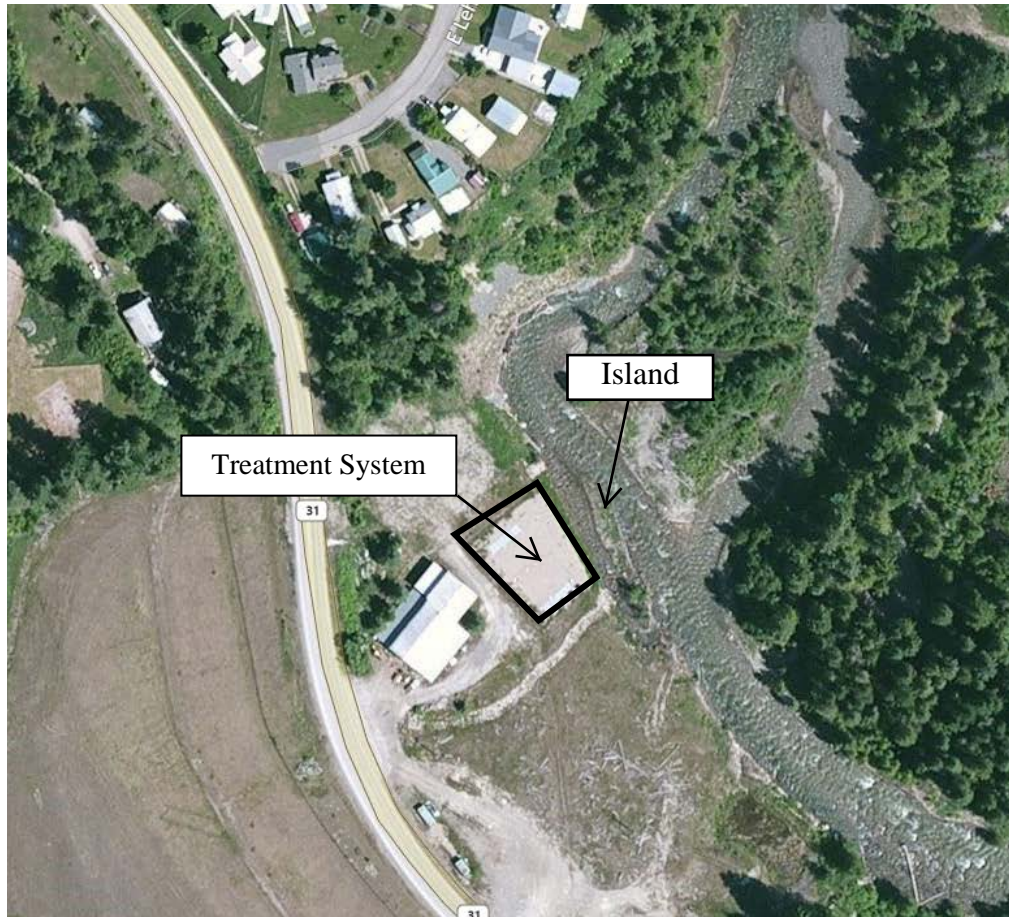
Geosyntec
consultants

FIGURE

3

PROJECT NO: HR0996C

DECEMBER 2017



Notes:

**Sullivan Creek – EFDC Model 7Q10 Flow
Mixing Zone Study**
Lehigh Cement Company Closed CKD Pile Site
Metaline Falls, Washington

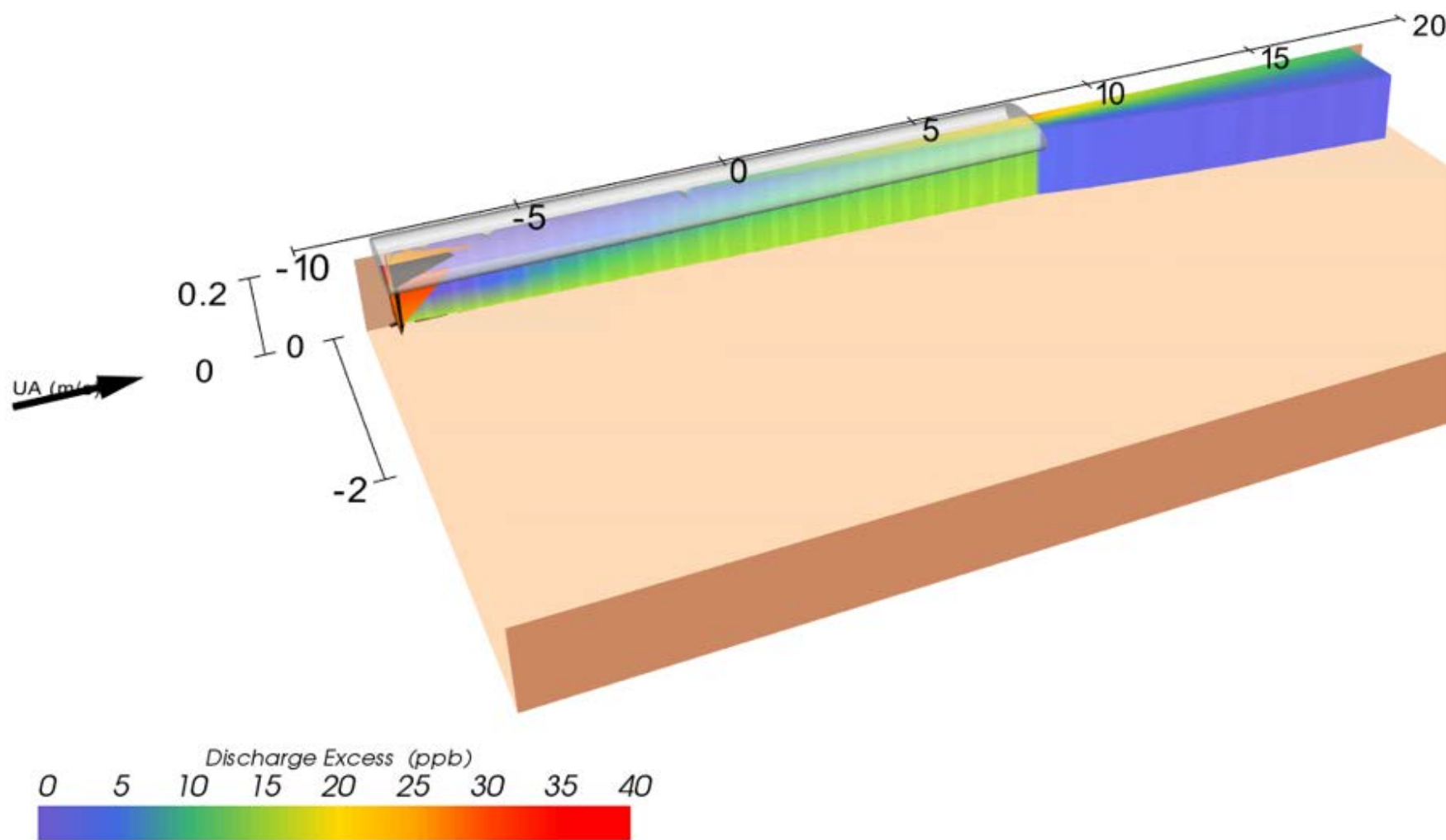
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Figure

4

Project No: HR0996C

January 2018



Notes:

1. The silver tube represents the diffuser.
2. The colored areas represent total arsenic concentrations in the plume in micrograms per liter ($\mu\text{g/L}$).
3. Brown shading indicates the banks and bottom of the Sullivan Creek channel.
4. Water outside the effluent plume is not shown in this plot.
5. Distances labels along the axes are in meters.

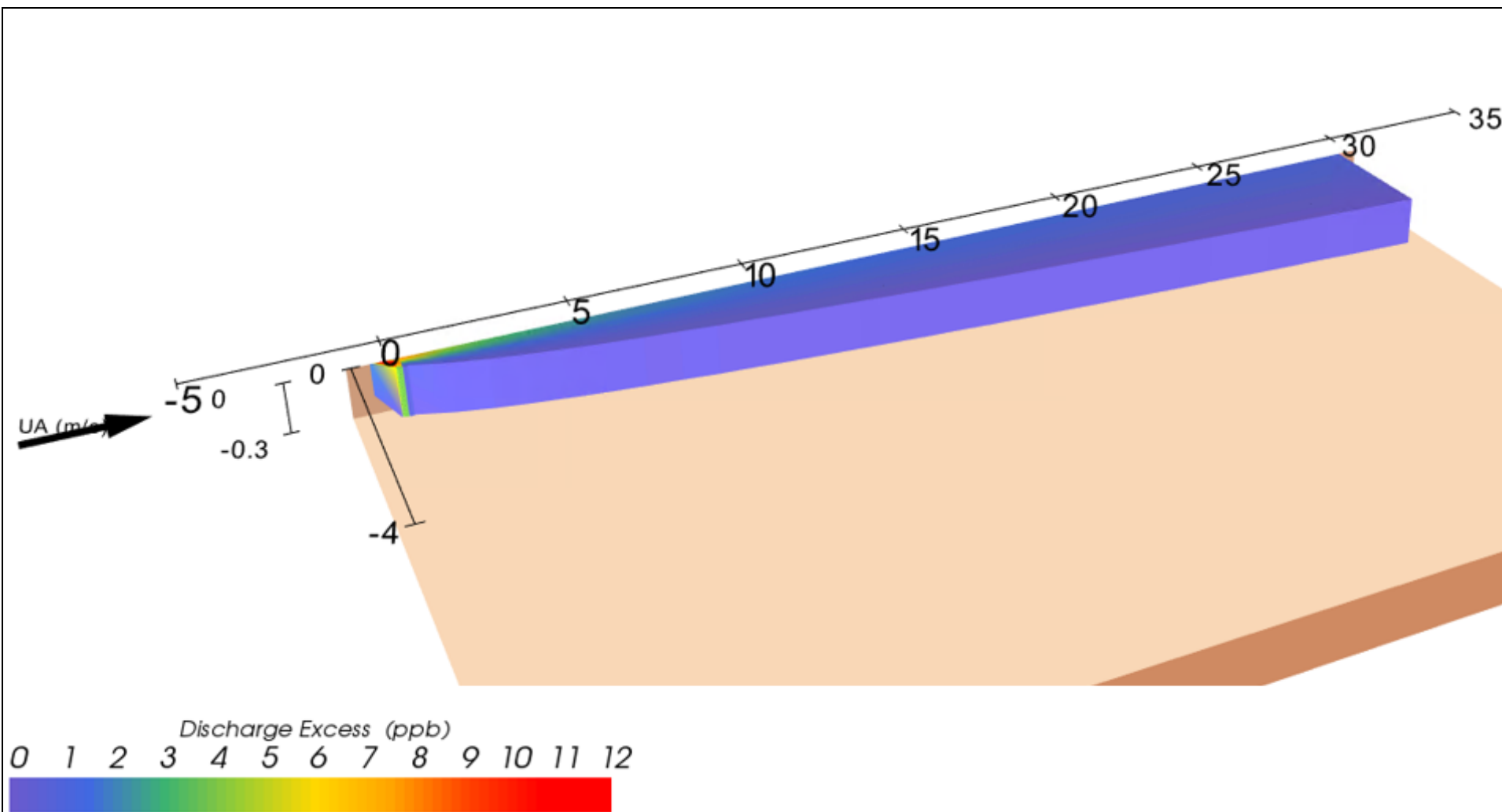
CORMIX 3D Plot – Simulated Arsenic Effluent Plume in Side Channel

Groundwater Treatment System Mixing Zone Study
Lehigh Cement Company Closed CKD Pile Site
Metaline Falls, Washington

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Figure 5



Notes:

1. The silver tube represents the diffuser.
2. The colored areas represent total arsenic concentrations in the plume in micrograms per liter ($\mu\text{g/L}$).
3. Brown shading indicates the banks and bottom of the Sullivan Creek channel.
4. Water outside the effluent plume is not shown in this plot.
5. Distances labels along the axes are in meters.

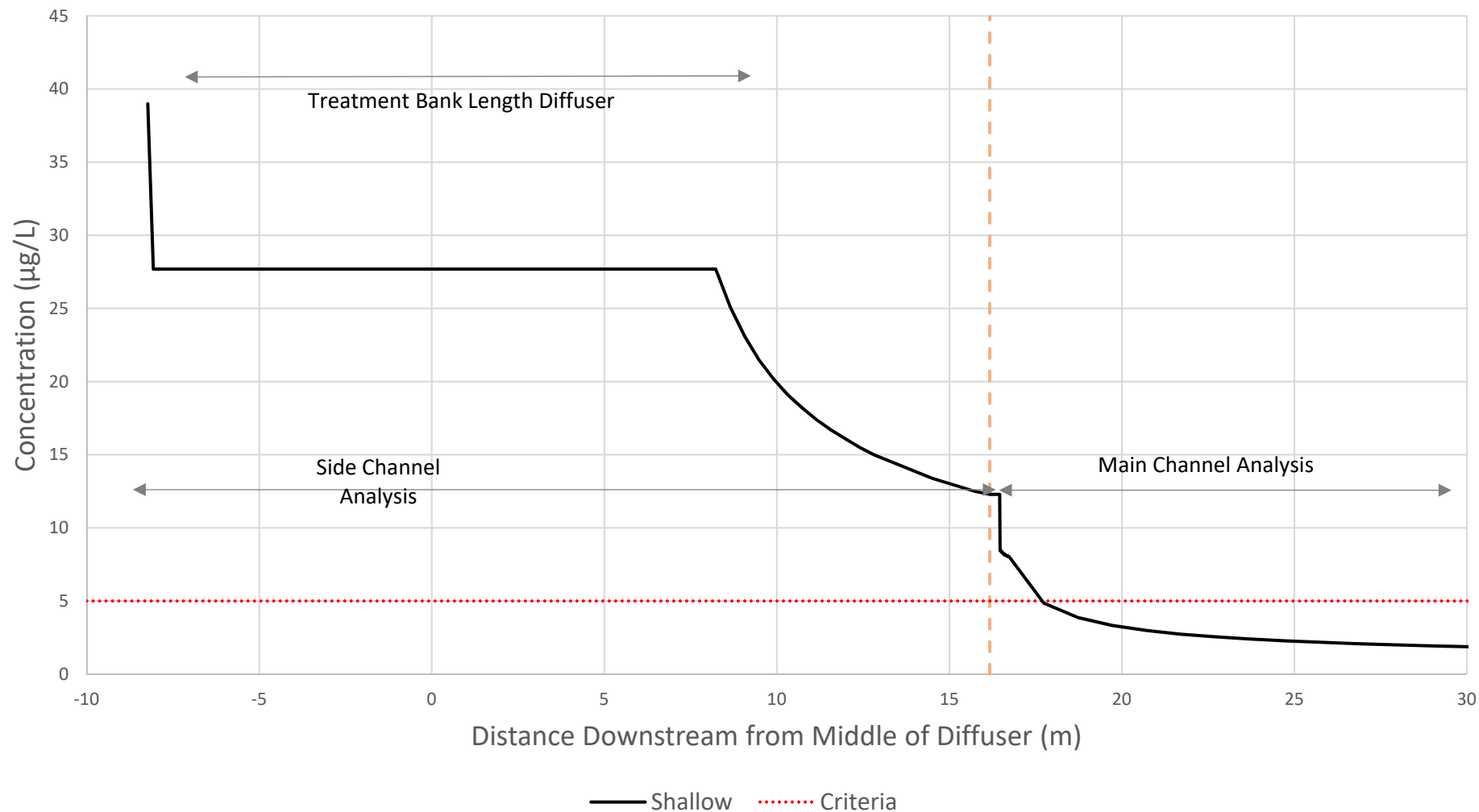
CORMIX 3D Plot – Simulated Arsenic Effluent Plume in Main Channel

Groundwater Treatment System Mixing Zone Study
Lehigh Cement Company Closed CKD Pile Site
Metaline Falls, Washington

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Figure 6



Notes:

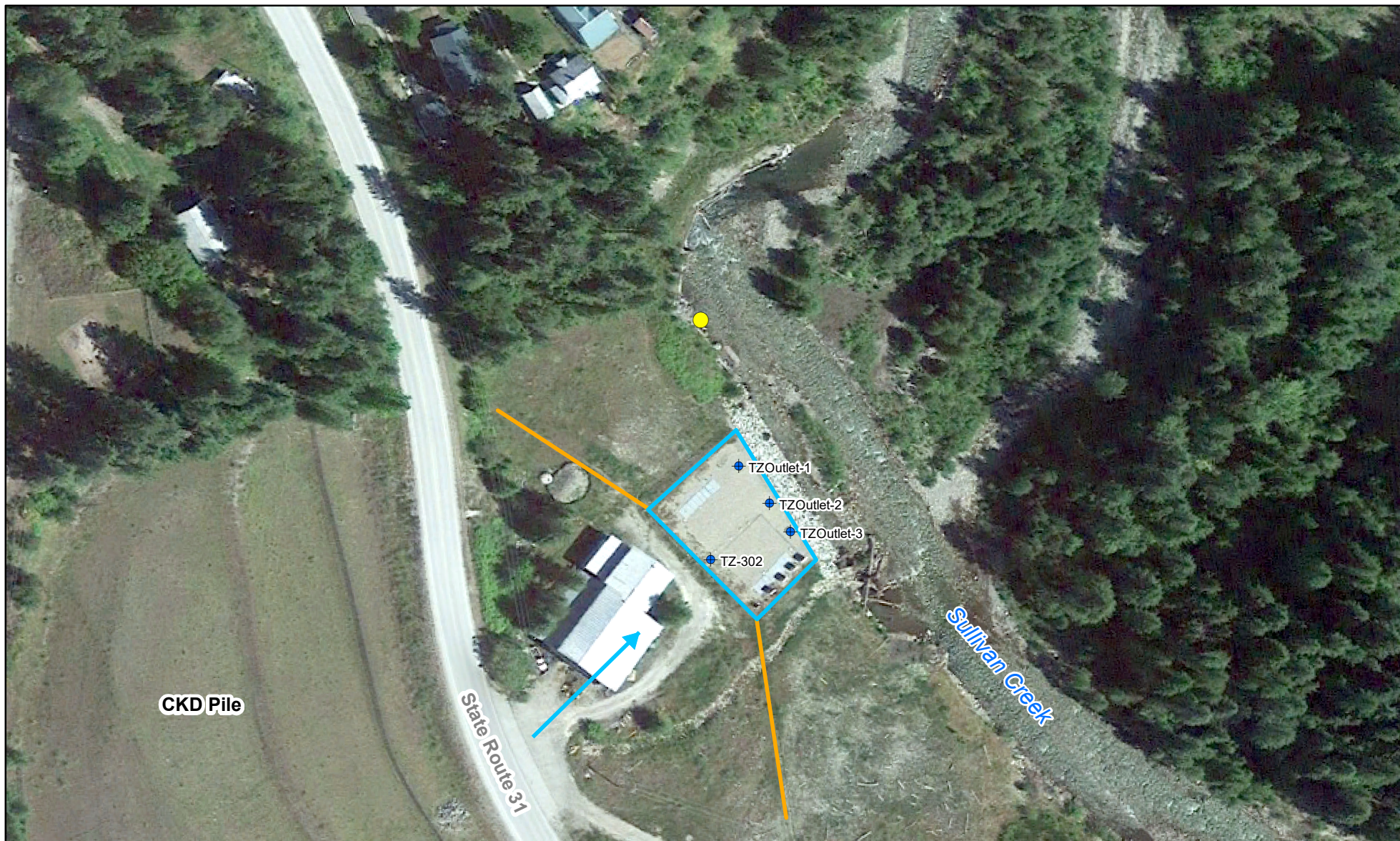
1. Arsenic concentrations shown are the total metals fraction.
2. As stated in NPDES Permit No. WA-004558-6, the current total arsenic discharge limit is 5 micrograms per Liter (µg/L).
3. The treatment bank was assessed as one diffuser with a length of 16.5 m (54 ft).
4. Three diffuser depths were assessed: shallow, middle and deep. The shallow case (0.61 ft below the surface of the water) was used, as this demonstrated the most conservative dilution.

CORMIX Results – Centerline Total Arsenic Concentrations

Groundwater Treatment System Mixing Zone Study
Lehigh Cement Company Closed CKD Pile Site
Metaline Falls, Washington

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Figure 7



Legend

- ◆ Discharge Outlet
- Arsenic Compliance Monitoring Point
- Groundwater Flow
- Buried Funnel and Gate Barrier Walls
- Treatment Zone

Notes:



0 100 Feet

Proposed Revised Compliance Monitoring Point Mixing Zone Study

Lehigh Cement Company
Closed CKD Pile Site
Metaline Falls, WA

Geosyntec
consultants

HR0996C

February 2018

Figure

8

APPENDIX A

NPDES Permit No. WA-004558-6

Issuance Date: September 27, 2006

Effective Date: October 15, 2006

Expiration Date: October 14, 2011

**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT No. WA-004558-6**

State of Washington
DEPARTMENT OF ECOLOGY
Olympia, Washington 98504-7600

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1251 et seq.

Lehigh Cement Company
7660 Imperial Way
Allentown, Pennsylvania 18195

Facility Location:

Milepost 14.7 Washington State Route 31
Metaline Falls, Washington 99153

Water Body I.D. No.:

WA 62-SN79HL

Receiving Water:

Sullivan Creek

Discharge Location:

Latitude: 48° 51' 40" N

Longitude: 117° 22' 0" W

Industry Type: Closed Cement Kiln Dust Pile
Groundwater Remediation

is authorized to discharge in accordance with the special and general conditions which follow.

James M. Bellatty
Water Quality Section Manager
Eastern Regional Office
Washington State Department of Ecology

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SUMMARY OF PERMIT REPORT SUBMITTALS

Refer to the Special and General Conditions of this permit for additional submittal requirements.

Permit Section	Submittal	Frequency	First Submittal Date
S3.A	Discharge Monitoring Report	Monthly	December 15, 2006
S3.E	Noncompliance Notification	As necessary	
S4.A	Operations and Maintenance Manual Update or Review Confirmation Letter	Annually	
S4.A	Treatment System Operating Plan		
S4.B	Reporting Bypasses	As necessary	
S5.	Application for Permit Renewal	1/permit cycle	April 15, 2011
G1.	Notice of Change in Authorization	As necessary	
G4.	Permit Application for Substantive Changes to the Discharge	As necessary	
G5.	Engineering Report for Construction or Modification Activities	As necessary	
G7.	Application for Permit Renewal	1/permit cycle	April 15, 2011
G8	Notice of Permit Transfer	As necessary	
G21	Reporting Anticipated Non-compliance	As necessary	
G22.	Reporting Other Information	As necessary	

SPECIAL CONDITIONS

S1. DISCHARGE LIMITATIONS

A. Authorized Discharges

All discharges and activities authorized by this permit shall be consistent with the terms and conditions of this permit.

1. Wastewater from Groundwater Treatment System

Beginning on the effective date of this permit and lasting through the expiration date, the Permittee is authorized to discharge wastewater from the groundwater treatment system to Sullivan Creek via groundwater from the Lehigh Cement Company Closed Kiln Dust Pile Site (Site) in Metaline Falls, Washington.

	EFFLUENT LIMITATIONS: OUTFALL # 1		
	INTERIM EFFLUENT LIMITATIONS^a	FINAL EFFLUENT LIMITATIONS^b	
Parameter		Average Monthly^c	Maximum Daily^d
Arsenic (total)	Optimize Groundwater Treatment System Performance; ^e Monitor and Report	5 µg/l	5 µg/l
Chromium (total)	Optimize Groundwater Treatment System Performance; ^e Monitor and Report	10 µg/l	10 µg/l
Lead (total)	Optimize Groundwater Treatment System Performance; ^e Monitor and Report	5 µg/l	5 µg/l
Manganese (total)	Optimize Groundwater Treatment System Performance; ^e Monitor and Report	2,240 µg/l	2,240 µg/l
pH	Optimize Groundwater Treatment System Performance; ^e Monitor and Report	Not applicable.	Daily minimum is equal to or greater than 6.5 and the daily maximum is less than or equal to 8.5. ^f

- ^a The interim effluent limitations will be in effect during the Construction and Optimization Phases for the groundwater treatment system.
- ^b The final effluent limitations will take effect at the end of the Optimization Phase. Ecology may propose alternative final effluent limits based upon the results of the effluent mixing study required under Special Condition 7 (S7) and other factors.
- ^c The average monthly effluent limitation is defined as the highest allowable average of daily discharges over a calendar month, calculated as the sum of measured daily discharges during a calendar month divided by the number of daily discharges measured during that month.
- ^d The maximum daily effluent limitation is defined as the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For other units of measurement, the daily discharge is the average measurement of the pollutant over the day. The pH shall not be averaged.
- ^e During the Construction Phase (which is defined as the period from the effective date of this permit to the beginning of the Optimization Phase) and the Optimization Phase (which is defined as the period from October 28, 2007 to October 28, 2009, or a period of two years beginning on the date on which groundwater treatment system operations commence, whichever is earlier), interim effluent limitations will be in effect and are established at the current groundwater discharge concentrations not to exceed 275 micrograms per liter for total arsenic, 10.6 micrograms per liter for total chromium, 200 micrograms per liter for total lead, and 3,500 micrograms per liter for total manganese. During the Optimization Phase, the Permittee shall monitor the system operation, adjust treatment variables to tune system operation, and improve the treatment system operation with the objective of meeting the final effluent limitations at the earliest opportunity. A compliance schedule of two years from October 28, 2007, or two years from the date on which groundwater treatment system operations commence, whichever is earlier, is allowed for complying with the final effluent limitations during the Optimization Phase. Since a compliance schedule is provided, an annual report is required
- ^f Indicates the range of permitted values. Any excursions below 5.5 and above 9.5 at any time are violations. The instantaneous maximum and minimum pH shall be reported monthly. When pH is continuously monitored, excursions between 5.5 and 6.5, or 8.5 and 9.5 shall not be considered violations provided no single excursion exceeds 60 minutes in length and total excursions do not exceed 7 hours and 30 minutes per month. pH readings from continuous monitoring devices that are out of the permitted range will not be violations if the Permittee demonstrates that the pH monitoring device was having technical difficulties that caused the pH readings to be in error.

2. Construction Stormwater and Dewatering Water

Beginning on the effective date of this permit and lasting through completion of construction of the Groundwater Remedy described in the Cleanup Action Plan for the Site, the Permittee is authorized to discharge stormwater and dewatering water associated with construction activities at the Site.

	EFFLUENT LIMITATIONS
Parameter	Maximum Daily^a
Turbidity	50 NTU
pH	Daily minimum is equal to or greater than 6.5 and the daily maximum is less than or equal to 8.5.
^a The maximum daily effluent limitation is defined as the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For other units of measurement, the daily discharge is the average measurement of the pollutant over the day. The pH shall not be averaged. Discharges shall not cause a visible change in turbidity or color or cause a visible oil sheen.	

S2. MONITORING REQUIREMENTS

A. The Permittee shall monitor in accordance with the following schedule:

1. Monitoring Schedule for Wastewater from Groundwater Treatment System

Category	Parameter	Units	Sample Point	Minimum Sampling Frequency	Sample Type
Effluent	pH	Standard Units	Point of Compliance as defined by WAC 173-340-730(6)(a)	Continuous ^a	Metered
	Arsenic	ug/L	Point of Compliance as defined by WAC 173-340-730(6)(a)	Every two weeks	Grab ICP-MS
	Chromium	ug/L	Point of Compliance as defined by WAC 173-340-730(6)(a)	Every two weeks	Grab ICP-MS

Category	Parameter	Units	Sample Point	Minimum Sampling Frequency	Sample Type
Effluent	Lead	ug/L	Point of Compliance as defined by WAC 173-340-730(6)(a)	Every two weeks	Grab ICP-MS
	Manganese	ug/L mg/L	Point of Compliance as defined by WAC 173-340-730(6)(a)	Every two weeks	Grab ICP-MS
^a Continuous means uninterrupted, except for brief lengths of time for calibration, power failure, or for unanticipated equipment repair or maintenance. For facilities which continuously monitor and record pH values, the number of minutes the pH value was below or above the permitted range shall be recorded for each day and the total minutes for the month reported, the durations when values were above and below the permitted range shall be reported separately. The instantaneous maximum and minimum pH shall be reported monthly. Sampling frequency for the metal parameters may be decreased after six months to monthly and after one year to quarterly after Ecology's review and approval.					

2. Monitoring Schedule for Construction Stormwater and Dewatering Water

Category	Parameter	Units	Sample Point	Minimum Sampling Frequency	Sample Type
Construction Stormwater	Turbidity	NTU Visual Inspection	Discharge Location	Weekly during construction	Visual
Construction Stormwater	Erosion	Visual Inspection	Discharge Location	Weekly during construction	Visual
Construction Stormwater	Total petroleum hydrocarbons	mg/L	Discharge location	When sheen visible	Grab
Dewatering Water	Arsenic	ug/L	Discharge location	Weekly during discharge	Grab
Dewatering Water	Chromium	ug/L	Discharge location	Weekly during discharge	Grab
Dewatering Water	Lead	ug/L	Discharge location	Weekly during discharge	Grab
Dewatering Water	Manganese	ug/L	Discharge location	Weekly during discharge	Grab

Category	Parameter	Units	Sample Point	Minimum Sampling Frequency	Sample Type
Dewatering Water	Turbidity	NTU	Discharge location	Weekly during discharge	Grab
Dewatering Water	pH	Standard Units	Discharge location	Weekly during discharge	Grab

B. Sampling and Analytical Procedures

Samples and measurements taken to meet the requirements of this permit shall be representative of the volume and nature of the monitored parameters, including representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions affecting effluent quality.

Sampling and analytical methods used to meet the monitoring requirements specified in this permit shall conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136.

C. Laboratory Accreditation

All monitoring data required by the Department shall be prepared by a laboratory registered or accredited under the provisions of, *Accreditation of Environmental Laboratories*, Chapter 173-50 WAC. Temperature, settleable solids, conductivity, pH, turbidity, and internal process control parameters are exempt from this requirement. Conductivity and pH shall be accredited if the laboratory must otherwise be registered or accredited. The Department exempts crops, soils, and hazardous waste data from this requirement pending accreditation of laboratories for analysis of these media.

S3. REPORTING AND RECORDKEEPING REQUIREMENTS

The Permittee shall monitor and report in accordance with the following conditions. The falsification of information submitted to the Department shall constitute a violation of the terms and conditions of this permit.

A. Reporting

The first monitoring period begins on the effective date of the permit. Monitoring results shall be submitted monthly. Monitoring data obtained during each monitoring period shall be summarized, reported, and submitted on a Discharge Monitoring Report (DMR) form provided, or otherwise approved, by the Department. DMR forms shall be postmarked or received no later than the 15th day of the month following the completed monitoring period, unless otherwise specified in this permit. Priority pollutant analysis data shall be submitted no later than forty-five (45) days following the monitoring period. Unless otherwise specified, all toxicity test data shall be submitted within sixty (60) days after the sample date. The report(s) shall be sent to the Department of Ecology, 4610 North Monroe, Spokane, Washington 99205.

All laboratory reports providing data for organic and metal parameters shall include the following information: sampling date, sample location, date of analysis, parameter name, CAS number, analytical method/ number, method detection limit (MDL), laboratory practical quantitation limit (PQL), reporting units, and concentration detected. Analytical results from samples sent to a contract laboratory must have information on the chain of custody, the analytical method, QA/QC results, and documentation of accreditation for the parameter.

Discharge Monitoring Report forms must be submitted monthly whether or not the facility was discharging. If there was no discharge during a given monitoring period, submit the form as required with the words "no discharge" entered in place of the monitoring results.

B. Records Retention

The Permittee shall retain records of all monitoring information for a minimum of ten (10) years, which is in keeping with Section XII Records Retention provision of the Consent Decree. Such information shall include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by the Director.

C. Recording of Results

For each measurement or sample taken, the Permittee shall record the following information: (1) the date, exact place, method, and time of sampling or measurement; (2) the individual who performed the sampling or measurement; (3) the dates the analyses were performed; (4) the individual who performed the analyses; (5) the analytical techniques or methods used; and (6) the results of all analyses.

D. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by this permit using test procedures specified by Condition S2. of this permit, then the results of this monitoring shall be included in the calculation and reporting of the data submitted in the Permittee's DMR.

E. Twenty-four Hour Notice of Noncompliance Reporting

1. The permittee must report the following occurrences of noncompliance by telephone, to Ecology at (509) 329-3589, within 24 hours from the time the Permittee becomes aware of any of the following circumstances:
 - a. any noncompliance that may endanger health or the environment;
 - b. any unanticipated **bypass** that exceeds any effluent limitation in the permit (See Part S4.B., "Bypass Procedures");

- c. any **upset** that exceeds any effluent limitation in the permit (See G.15, “Upset”);
 - d. any violation of a maximum daily or instantaneous maximum discharge limitation for any of the pollutants in S1.A.; or
 - e. any overflow prior to the treatment works, whether or not such overflow endangers health or the environment or exceeds any effluent limitation in the permit.
2. The Permittee must also provide a written submission within five days of the time that the Permittee becomes aware of any event required to be reported under subpart 1, above. The written submission must contain:
- a. a description of the noncompliance and its cause;
 - b. the period of noncompliance, including exact dates and times;
 - c. the estimated time noncompliance is expected to continue if it has not been corrected;
 - d. steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance; and
 - e. if the non compliance involves an overflow prior to the treatment works, an estimate of the quantity (in gallons) of untreated overflow.
3. Ecology may waive the written report on a case-by-case basis if the oral report has been received within 24 hours of the noncompliance.
4. Reports must be submitted to the address in S3.(“REPORTING AND RECORDKEEPING REQUIREMENTS”).

F. Other Noncompliance Reporting.

The Permittee must report all instances of noncompliance, not required to be reported immediately or within 24 hours, at the time that monitoring reports for S3.A ("Reporting") are submitted. The reports must contain the information listed in paragraph E above, (“Twenty-four Hour Notice of Noncompliance Reporting”). Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

G. Maintaining a Copy of This Permit

A copy of this permit must be kept at the permitted facility and be made available upon request to Department of Ecology inspectors.

S4. OPERATION AND MAINTENANCE

The Permittee shall, at all times, properly operate and maintain all facilities or systems of treatment and control (and related appurtenances) which are installed to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems, which are installed by a Permittee only when the operation is necessary to achieve compliance with the conditions of this permit.

A. Operations and Maintenance Manual

An Operations and Maintenance (O&M) Manual shall be prepared by the Permittee in accordance with WAC 173-240-150 and be submitted to the Department for approval. This O&M Manual will be incorporated into the O&M Plan that is to be prepared in accordance with the Consent Decree and submitted according to the schedule included in the Consent Decree. The O&M Manual shall be reviewed by the Permittee at least annually and the Permittee shall confirm this review by letter to the Department. Substantial changes or updates to the O&M Manual shall be submitted to the Department for review and approval whenever they are incorporated into the manual.

The approved Operations and Maintenance Manual shall be kept available at the permitted facility and all operators shall follow the instructions and procedures of this manual.

In addition to the requirements of WAC 173-240-150(1) and (2), the O&M Manual shall include:

1. Emergency procedures for plant shutdown and cleanup in event of wastewater system upset or failure.
2. Wastewater system maintenance procedures that contribute to the generation of process wastewater
3. Any directions to maintenance staff when cleaning, or maintaining other equipment or performing other tasks which are necessary to protect the operation of the wastewater system (e.g. defining maximum allowable discharge rate for draining a tank, blocking all floor drains before beginning the overhaul of a stationary engine.)
4. The treatment process control monitoring schedule.
5. Replacement components to the treatment system.

B. Bypass Procedures

Bypass, which is the intentional diversion of waste streams from any portion of a treatment facility, is prohibited, and the Department may take enforcement action against a Permittee for bypass unless one of the following circumstances (1, 2, or 3) is applicable.

1. Bypass for Essential Maintenance without the Potential to Cause Violation of Permit Limits or Conditions.

Bypass is authorized if it is for essential maintenance and does not have the potential to cause violations of limitations or other conditions of this permit, or adversely impact public health as determined by the Department prior to the bypass. The Permittee shall submit prior notice, if possible, at least ten (10) days before the date of the bypass.

2. Bypass Which is Unavoidable, Unanticipated, and Results in Noncompliance of this Permit.

This bypass is permitted only if:

- a. Bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.
 - b. There are no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, stopping production, maintenance during normal periods of equipment downtime (but not if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance), or transport of untreated wastes to another treatment facility.
 - c. The Department is properly notified of the bypass as required in condition S3E of this permit.
3. Bypass which is Anticipated and has the Potential to Result in Noncompliance of this Permit.

The Permittee shall notify the Department at least thirty (30) days before the planned date of bypass. The notice shall contain (1) a description of the bypass and its cause; (2) an analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing; (3) a cost-effectiveness analysis of alternatives including comparative resource damage assessment; (4) the minimum and maximum duration of bypass under each alternative; (5) a recommendation as to the preferred alternative for conducting the bypass; (6) the projected date of bypass initiation; (7) a statement of compliance with SEPA; (8) a request for modification

of water quality standards as provided for in WAC 173-201A-110, if an exceedance of any water quality standard is anticipated; and (9) steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

For probable construction bypasses, the need to bypass is to be identified as early in the planning process as possible. The analysis required above shall be considered during preparation of the engineering report or facilities plan and plans and specifications and shall be included to the extent practical. In cases where the probable need to bypass is determined early, continued analysis is necessary up to and including the construction period in an effort to minimize or eliminate the bypass.

The Department will consider the following prior to issuing an administrative order for this type bypass:

- a. If the bypass is necessary to perform construction or maintenance-related activities essential to meet the requirements of this permit.
- b. If there are feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, stopping production, maintenance during normal periods of equipment down time, or transport of untreated wastes to another treatment facility.
- c. If the bypass is planned and scheduled to minimize adverse effects on the public and the environment.

After consideration of the above and the adverse effects of the proposed bypass and any other relevant factors, the Department will approve or deny the request. The public shall be notified and given an opportunity to comment on bypass incidents of significant duration, to the extent feasible. Approval of a request to bypass will be by administrative order issued by the Department under RCW 90.48.120.

C. Duty to Mitigate

The Permittee is required to take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

S5. APPLICATION FOR PERMIT RENEWAL

The Permittee shall submit an application for renewal of this permit by February 23, 2011.

S6. STORMWATER POLLUTION PREVENTION PLAN (SWPPP) FOR CONSTRUCTION ACTIVITIES

The Permittee shall prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) for construction activity, beginning with initial soil disturbance and until final stabilization.

A. The SWPPP shall be prepared with the following objectives:

1. To implement Best Management Practices (BMPs) to prevent erosion and sedimentation, and to identify, reduce, eliminate or prevent stormwater contamination and water pollution from construction activity.
2. To prevent violations of surface water quality, ground water quality, or sediment management standards.
3. To control peak volumetric flow rates and velocities of stormwater discharges.

B. General Requirements

The SWPPP shall include a narrative and drawings. BMPs shall be clearly referenced in the narrative and marked on the drawings. BMPs shall be consistent with the Stormwater Management Manual for Eastern Washington (September 2004 edition). The SWPPP narrative shall include documentation to explain and justify the pollution prevention decisions made for the project.

C. SWPPP – Narrative Contents and Requirements

The Permittee shall include each of the 12 elements below in S6.C.1-12 in the narrative of the SWPPP and ensure that they are implemented unless site conditions render the element unnecessary and the exemption from that element is clearly justified in the SWPPP.

1. Preserve Vegetation/Mark Clearing Limits
2. Establish Construction Access
3. Control Flow Rates
4. Install Sediment Controls
5. Stabilize Soils
6. Protect Slopes
7. Protect Drain Inlets
8. Stabilize Channels and Outlets
9. Control Pollutants
10. Control DeWatering
11. Maintain BMPs
12. Manage the Project

S7. EFFLUENT MIXING STUDY

No later than two years following the completion of construction as defined in the Consent Decree, the Permittee will notify the Department of its intent to conduct the effluent mixing study described under this condition. If the Permittee does not so notify the Department, then it need not comply with this special condition and the Department will not consider setting revised final effluent limitations. If the Permittee does so notify the Department, the Permittee will comply with this special condition and the Department may propose revised final effluent limits if it approves the Study Plan and Final Effluent Mixing Report described below.

A. General Requirements

The Permittee shall determine the degree of effluent and receiving water mixing that occurs within the proposed mixing zone. The degree of mixing shall be determined during critical conditions, as defined in WAC 173-201A-020 Definitions-“Critical Condition,” or as close to critical conditions as reasonably possible. The critical condition scenarios shall be established in accordance with *Guidance for Conducting Mixing Zone Analyses* (Ecology, 1996).

A Plan of Study and schedule shall be submitted to the Department for review and approval 30 days prior to the initiation of the effluent mixing study.

B. Specific Requirements

The purpose of the effluent mixing study is to establish a dilution factor so that Ecology can calculate alternative, final effluent limitations to meet water quality standards in accordance with Ch. 173-201A WAC. The effluent mixing study will conform to Ecology guidance for establishing mixing zones in rivers and streams. Critical conditions will be as described in Ecology Guidance.

C. Reporting Requirements

The results of the effluent mixing study shall be included in an Effluent Mixing Report, which shall be submitted to the Department for approval. The Permittee shall submit a draft report to Ecology and Ecology may provide comments on the draft report or may terminate the effluent mixing study. If the effluent study is continued, the Permittee shall, within 30 days after receipt of Ecology’s comments, address comments from the Department and submit a final report

The Permittee shall use some method of fixing and reporting the location of the outfall and mixing zone boundaries (i.e., triangulation off the shore, microwave navigation system, or using Loran or Global Positioning System (GPS) coordinates). The method of fixing station location and the actual station locations shall be identified in the report.

GENERAL CONDITIONS

G1. SIGNATORY REQUIREMENTS

All applications, reports, or information submitted to the Department shall be signed and certified.

- A. All permit applications shall be signed by either a responsible corporate officer of at least the level of vice president of a corporation, a general partner of a partnership, or the proprietor of a sole proprietorship.
- B. All reports required by this permit and other information requested by the Department shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:
 - 1. The authorization is made in writing by a person described above and submitted to the Department.
 - 2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)
- C. Changes to authorization. If an authorization under paragraph B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph B.2 above must be submitted to the Department prior to or together with any reports, information, or applications to be signed by an authorized representative.
- D. Certification. Any person signing a document under this section shall make the following certification:

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

G2. RIGHT OF INSPECTION AND ENTRY

The Permittee shall allow an authorized representative of the Department, upon the presentation of credentials and such other documents as may be required by law:

- A. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit.
- B. To have access to and copy - at reasonable times and at reasonable cost - any records required to be kept under the terms and conditions of this permit.
- C. To inspect - at reasonable times - any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.
- D. To sample or monitor - at reasonable times - any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G3. PERMIT ACTIONS

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person (including the permittee) or upon the Department's initiative. However, the permit may only be modified, revoked and reissued, or terminated for the reasons specified in 40 CFR 122.62, 122.64 or WAC 173-220-150 according to the procedures of 40 CFR 124.5.

- A. The following are causes for terminating this permit during its term, or for denying a permit renewal application:
 - 1. Violation of any permit term or condition.
 - 2. Obtaining a permit by misrepresentation or failure to disclose all relevant facts.
 - 3. A material change in quantity or type of waste disposal.
 - 4. A determination that the permitted activity endangers human health or the environment or contributes to water quality standards violations and can only be regulated to acceptable levels by permit modification or termination [40 CFR part 122.64(3)].
 - 5. A change in any condition that requires either a temporary or permanent reduction or elimination of any discharge or sludge use or disposal practice controlled by the permit [40 CFR part 122.64(4)].
 - 6. Nonpayment of fees assessed pursuant to RCW 90.48.465.
 - 7. Failure or refusal of the permittee to allow entry as required in RCW 90.48.090.

B. The following are causes for modification but not revocation and reissuance except when the permittee requests or agrees:

1. A material change in the condition of the waters of the state.
2. New information not available at the time of permit issuance that would have justified the application of different permit conditions.
3. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.
4. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions, or requiring permit revision.
5. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR Part 122.62.
6. The Department has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.
7. Incorporation of an approved local pretreatment program into a municipality's permit.

C. The following are causes for modification or alternatively revocation and reissuance:

1. Cause exists for termination for reasons listed in A1 through A7, of this section, and the Department determines that modification or revocation and reissuance is appropriate.
2. The Department has received notification of a proposed transfer of the permit. A permit may also be modified to reflect a transfer after the effective date of an automatic transfer (General Condition G8) but will not be revoked and reissued after the effective date of the transfer except upon the request of the new permittee.

G4. REPORTING PLANNED CHANGES

The Permittee shall, as soon as possible, but no later than sixty (60) days prior to the proposed changes, give notice to the Department of planned physical alterations or additions to the permitted facility, production increases, or process modification which will result in: 1) the permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b); 2) a significant change in the nature or an increase in quantity of pollutants discharged; or 3) a significant change in the Permittee's sludge use or disposal practices. Following such notice, and the submittal of a new application or supplement to the existing application, along with required engineering plans and reports, this permit may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G5. PLAN REVIEW REQUIRED

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications shall be submitted to the Department for approval in accordance with Chapter 173-240 WAC. Engineering reports, plans, and specifications shall be submitted at least one hundred eighty (180) days prior to the planned start of construction unless a shorter time is approved by Ecology. Facilities shall be constructed and operated in accordance with the approved plans.

G6. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in this permit shall be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. TRANSFER OF THIS PERMIT

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the Permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to the Department.

A. Transfers by Modification

Except as provided in paragraph B below, this permit may be transferred by the Permittee to a new owner or operator only if this permit has been modified or revoked and reissued under 40 CFR 122.62(b)(2), or a minor modification made under 40 CFR 122.63(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

B. Automatic Transfers

This permit may be automatically transferred to a new Permittee if:

1. The Permittee notifies the Department at least 30 days in advance of the proposed transfer date.
2. The notice includes a written agreement between the existing and new Permittee's containing a specific date transfer of permit responsibility, coverage, and liability between them.
3. The Department does not notify the existing Permittee and the proposed new Permittee of its intent to modify or revoke and reissue this permit. A modification under the subparagraph may also be minor modification under 40 CFR 122.63. If this notice is not received, the transfer is effective on the date specified in the written agreement.

G8. REDUCED PRODUCTION FOR COMPLIANCE

The Permittee, in order to maintain compliance with its permit, shall, within the design limits of the groundwater treatment system, control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G9. REMOVED SUBSTANCES

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G10. DUTY TO PROVIDE INFORMATION

The Permittee shall submit to the Department, within a reasonable time, all information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee shall also submit to the Department upon request, copies of records required to be kept by this permit.

G11. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G12. ADDITIONAL MONITORING

The Department may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G13. PAYMENT OF FEES

The Permittee shall submit payment of fees associated with this permit as assessed by the Department.

G14. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars (\$10,000) and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars (\$10,000) for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be deemed to be a separate and distinct violation.

G15. UPSET

Definition – “Upset” means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that: 1) an upset occurred and that the Permittee can identify the cause(s) of the upset; 2) the permitted facility was being properly operated at the time of the upset; 3) the Permittee submitted notice of the upset as required in condition S3.E; and 4) the Permittee complied with any remedial measures required under S4.C of this permit.

In any enforcement proceedings the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G16. PROPERTY RIGHTS

This permit does not convey any property rights of any sort, or any exclusive privilege.

G17. DUTY TO COMPLY

The Permittee shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G18. TOXIC POLLUTANTS

The Permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G19. PENALTIES FOR TAMPERING

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than two years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this Condition, punishment shall be a fine of not more than \$20,000 per day of violation, or by imprisonment of not more than four (4) years, or by both.

G20. REPORTING ANTICIPATED NON-COMPLIANCE

The Permittee shall give advance notice to the Department by submission of a new application or supplement thereto at least one hundred and eighty (180) days prior to commencement of such discharges, of any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility or activity which may result in noncompliance with permit limits or conditions. Any maintenance of facilities, which might necessitate unavoidable interruption of operation and degradation of effluent quality, shall be scheduled during non-critical water quality periods and carried out in a manner approved by the Department.

G21. REPORTING OTHER INFORMATION

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.

G22. REPORTING REQUIREMENTS APPLICABLE TO EXISTING MANUFACTURING, COMMERCIAL, MINING, AND SILVICULTURAL DISCHARGERS

The Permittee belonging to the categories of existing manufacturing, commercial, mining, or silviculture must notify the Department as soon as they know or have reason to believe:

- A. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in this permit, if that discharge will exceed the highest of the following “notification levels:”
 - 1. One hundred micrograms per liter (100 µg/L).
 - 2. Two hundred micrograms per liter (200 µg/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 µg/L) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony.
 - 3. Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7).
 - 4. The level established by the Director in accordance with 40 CFR 122.44(f).

- B. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in this permit, if that discharge will exceed the highest of the following “notification levels:”
1. Five hundred micrograms per liter (500µg/L).
 2. One milligram per liter (1 mg/L) for antimony.
 3. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7).
 4. The level established by the Director in accordance with 40 CFR 122.44(f).

G23.COMPLIANCE SCHEDULES

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than fourteen (14) days following each schedule date.

APPENDIX B

7Q10 Flow Determination Using USGS Flow Gauge #12398000 Data

APPENDIX B: 7Q10 FLOW CALCULATIONS FOR SULLIVAN CREEK

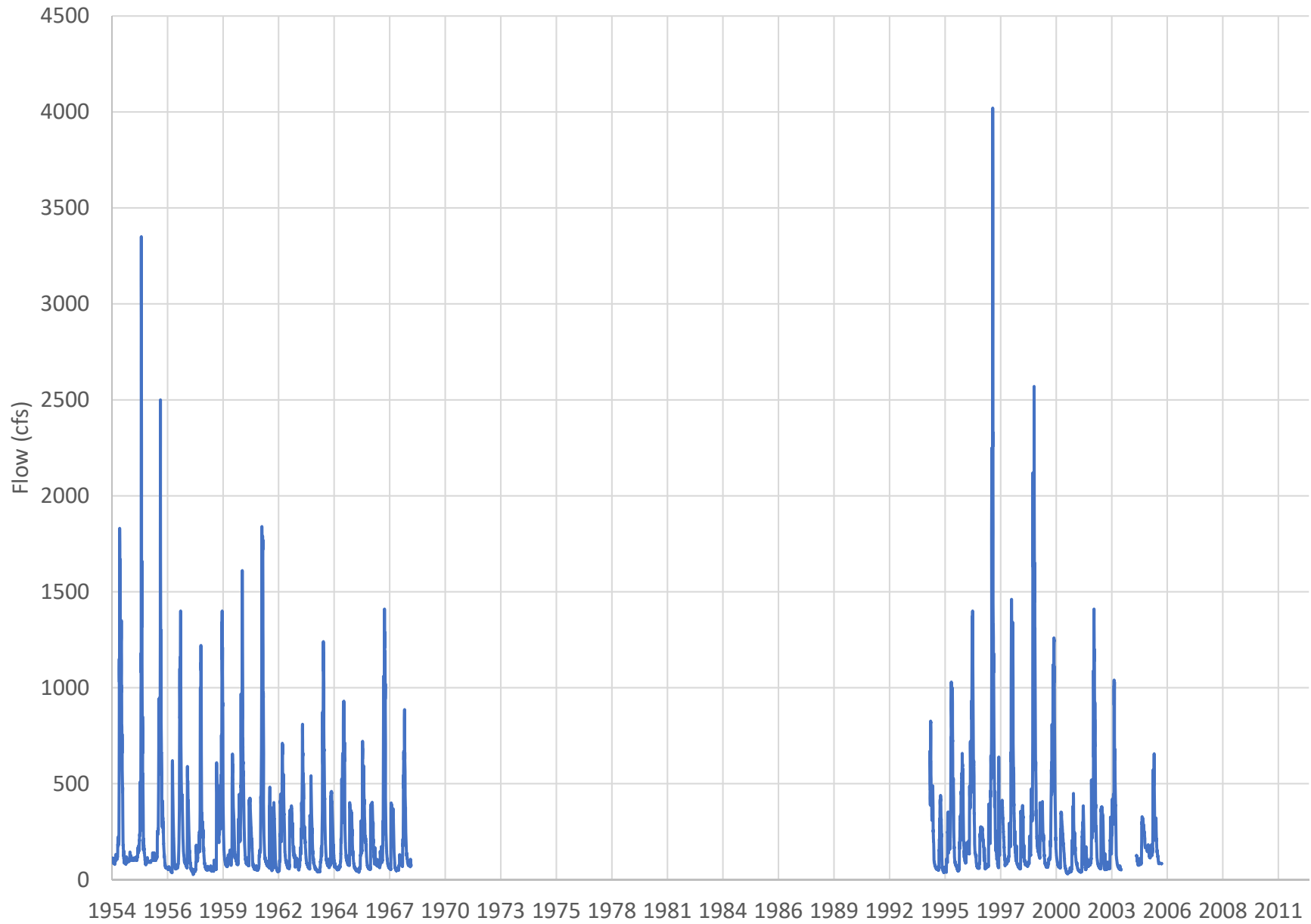
USGS FLOW GAUGE #12398000 DATA

Period record : 1953-10-01 to 9/30/1968 and 4/24/1994 to 9/30/2005

7Q10 flow estimates calculated using US EPA DFLOW tool for water year period from Oct 1 to Sept 30

Period	7Q10 flow
Whole record	35.9
WY 1954 to WY 1968	35.6
WY 1995 to WY 2005	35.9

Flow Time series at USGS 12398000 Sullivan Creek at Metallaine Falls



APPENDIX C

Background Sullivan Creek Water Quality Data

APPENDIX C: SULLIVAN CREEK WATER QUALITY DATA

Sample Name	Date	Lab Analysis	Reporting Limit (mg/L)	Detection Limit (mg/L)	Result (mg/L)	Corrected Results (mg/L)
MF-MZSBG1-20160916	9/16/2016	Total Arsenic	0.0010	0.00027	0.00039 J	0.00039
MF-MZSBG2-20161009	10/9/2016	Total Arsenic	0.0010	0.00027	0.00032 J	0.00032
MF-MZSBG3-20161110	11/10/2016	Total Arsenic	0.0010	0.00027	< 0.00027	0.000135
MFCREEK092817	9/28/2017	Total Arsenic	0.0050	0.0001	<0.0001	0.00005
Mean concentration						0.00022375
Multiplying factor						1.74
90th Percentile Value for CORMIX Model						0.00039

Notes:

MF-MZSBGD-20161110 was a duplicate sample of MF-MZSBG3-20161110.

The corrected total arsenic concentration for a sample without a detection above the method detection limit (MDL) was determined to be one-half of the MDL.

< - Analyte was not detected above the MDL.

J - Result is less than the reporting limit (RL) but greater than or equal to the MDL. The concentration is an approximate value.

mg/L - milligrams per Liter

APPENDIX D

Effluent Water Quality Data

APPENDIX D: EFFLUENT WATER QUALITY DATA

Sample Name	Date	Lab Analysis	Reporting Limit (mg/L)	Detection Limit (mg/L)	Result (mg/L)	Field Measurement	Result (°C)
TZOutlet1010417	1/4/2017	Total Arsenic	0.0010	0.00027	0.012	Temperature	4.52
TZOutlet1021517	2/15/2017	Total Arsenic	0.0010	0.00027	0.015	Temperature	4.64
TZOutlet1030817	3/8/2017	Total Arsenic	0.0010	0.00027	0.011	Temperature	4.27
TZCOMP092817	9/28/2017	Total Arsenic	0.0010	0.0001	0.0105	-	-
					Maximum value		4.64
					Multiplying factor		-
					Value for CORMIX model		4.64

Notes:

The multiplying factor for projecting the maximum total arsenic effluent concentration was based on a sample size of 4, with a 95% confidence level and 95% probability.

°C - Degrees Celsius.

mg/L - milligrams per Liter