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To:
Bill Martin, AECOM

CC:
Jordan Smith, State Water Board

Project name:
Fordyce Dam Seepage Mitigation Project

Project ref:

From:
Phil Mineart, Jason Zhou

Date:
August 13, 2020

Memo

Subject: Estimation of Turbidity During Dewatering

To conduct the Fordyce Dam Seepage Mitigation Project, a work area upstream of the dam would be dewatered. To limit the area that needs to be dewatered, a cofferdam would be constructed approximately 700 feet upstream from the dam. The work area between the cofferdam and Fordyce Dam would then be dewatered. Initial dewatering would be through the low-level outlet (LLO). However, as the water level in the work area decreases, the turbidity in the discharge could increase. If the turbidity of the discharge nears an agreed upon criteria, water would be pumped from the work area to an embayment in the reservoir that has been isolated from the reservoir with a turbidity curtain. To maintain the instream flow requirement (IFR), PG&E would release water from the reservoir upstream of the cofferdam using a pumped bypass system with water flowing over the Fordyce Dam spillway. The purpose of this analysis is to provide an estimate of the turbidity in the discharge from the reservoir to Fordyce Creek due to potential migration of turbid water through the turbidity curtain mitigation measure.

Table 1 from the Fordyce Dam Seepage Mitigation Project Dewatering/Removal of Water Plan (Black & Veatch, 2020) provides a schedule for dewatering. Initially, water would be removed

Table 1. Plan for Dewatering of the Work Area

System	Quantity	Beginning WSEL	Ending WSEL	Volume (acre-feet)	Flow Range	Drawdown Time
Existing LLO	1	6,245.4	6,236	110	100 cfs (High El.) 25 cfs (Low El.)	24 hours
Trailer-Mount Pumps (8-inch)	3 to 4	6,236	6,220	90	25 cfs (High El.) 20 cfs (Low El.)	48 hours
Submersible Pumps (3-inch)	2 to 8	6,220	6,212	3.5	5 cfs (High El.) 1 cfs (Low El.)	24 hours

Source: Black & Veatch, 2020

from the reservoir through the LLO down to the Lake Fordyce minimum pool elevation, as is typically done each year during normal reservoir drawdown operations. During the initial construction year, a cofferdam would be constructed with reservoir at approximately minimum pool elevation. The next phase of dewatering includes complete dewatering of the work area between the cofferdam and Fordyce Dam. Dewatering of the work area would initially use the Fordyce Dam LLO until the water level falls to a level at or near the LLO elevation. Dewatering of the remaining water in the work area would be accomplished using three to four trailer mounted pumps to lower the lake 16 feet from elevation 6,236 to 6,220 feet. These pumps would withdraw water though floating intakes located about 100 feet from the cofferdam at an expected rate of 20 to 25 cubic feet per second (cfs). The use of floating intakes results in maximum water velocities near the surface close to the pumps and lesser and more uniform velocities far from the pumps. Below elevation 6,220 feet, submersible pumps would be installed in the low points in the reservoir. Withdrawal rates would be 1 to 5 cfs. These pumps would withdraw water near the bottom and pump to a nearshore area of the lake, upstream of the cofferdam, separated by a turbidity curtain.

This memo consists of the following sections:

1. The amount of fine sediment in the reservoir that could potentially be entrained during the dewatering.

2. The relationship between pumping rate, depth of water, and turbidity.
3. Calculation of the transport of sediment from the turbidity curtain area to the location where water is pumped for IFR.

1. Sediment in the Reservoir that could Potentially be Entrained

Based on the available boring data and surrounding topography at each location, the lakebed soil material was characterized with the following available data from Sage Engineering's Seepage Mitigation Improvement Plan (Final 90% Submittal Package):

- Surface data provided in AutoCAD format as part of 2014 bathymetry and topographic surface which covers the entire extents of Lake Fordyce.
- The 1911 bedrock surface was approximated from historic survey contours at 10-foot intervals. The surface covers roughly 500 feet upstream and downstream of the existing Fordyce Dam.
- Boring investigations performed within Lake Fordyce for the purposes of the Seepage Mitigation Project and design of the proposed upstream cofferdam. The borings were drilled in August 2019 and are located primarily at either the upstream toe of Fordyce Dam or near the proposed cofferdam alignment.

The original 1911 bedrock surface contours were extended 500 feet further upstream in order to fully cover the extents of the dewatered work area. The extended contours were approximated based on the general topography of the work area and considering the sediment depths reported at the applicable boreholes. A surface comparison between the approximate rock surface and the 2014 bathymetry surface was the basis for estimating the total volume of sediment that has deposited within the study area; where the 1911 bedrock surface was used as a base "datum" surface and the relative increase in ground elevation from the 2014 bathymetry surface was presumed as areas of sediment deposition.

As shown in Figure 1, the resulting sediment deposition area was divided into three representative fill groups (Channel; Terrace; Hillside) in order to approximate a spatial distribution of sediment classifications. The sediment fill groups were delineated based on the overall topography of the study area and the available boring log data. The deposited sediments above bedrock consists primarily of three classifications as indicated by the available boring logs:

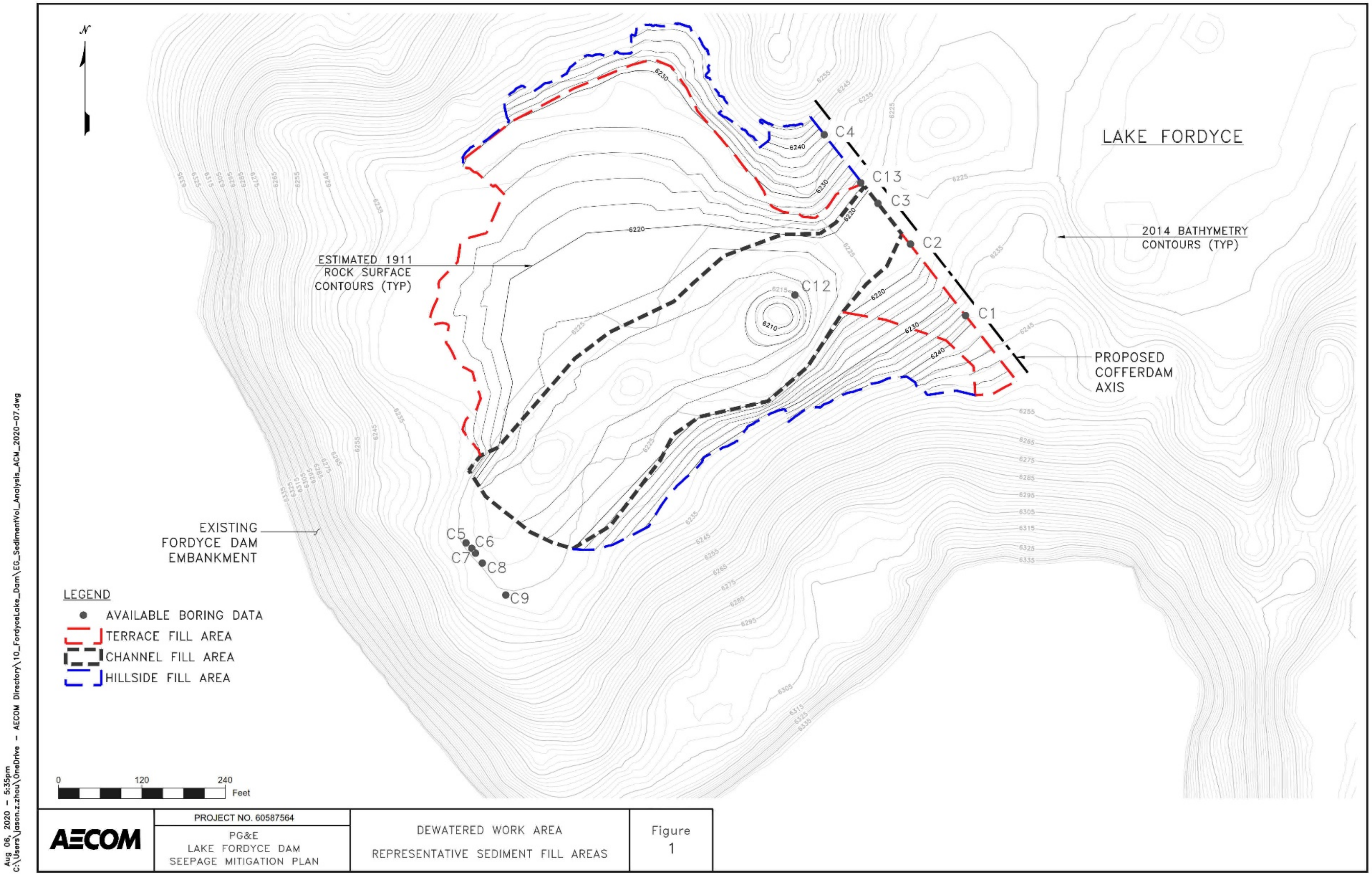


Figure 1. Locations of Representative Sediment Types

- Lake bottom Silt with Organics (Lake Muck)
- Silty Sand/Sandy Silt (SM/ML)
- Silty Gravel/Sandy Gravel (GM/GP)

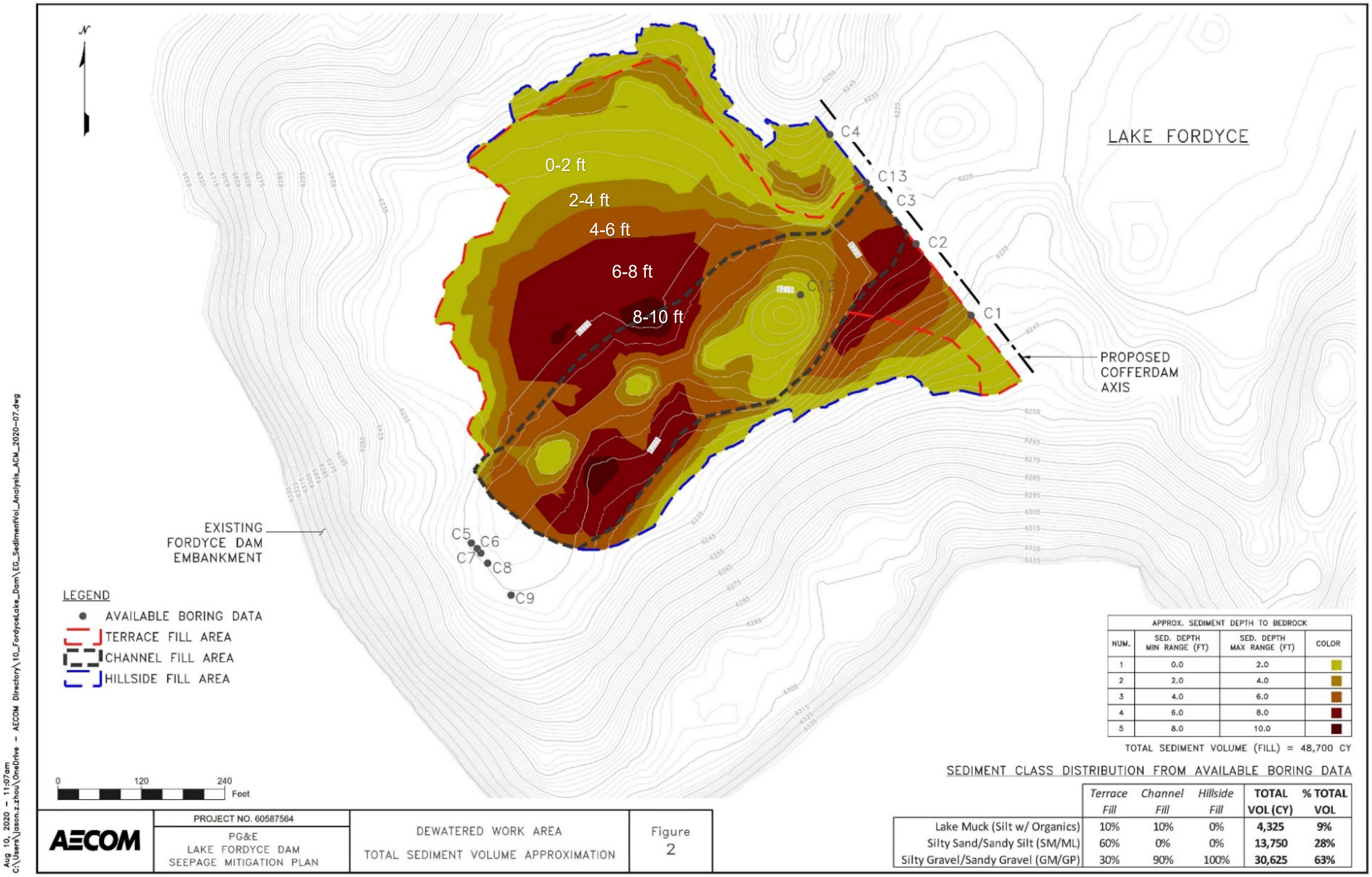
Within each fill group, a representative distribution of the primary soil classification was determined from the boring log data. The relative depths recorded at each borehole served as the basis for determining a representative distribution of sediment classifications for each sediment fill group.

Table 2 summarizes the resulting distribution of sediment material assumed for each deposition area for the purposes of this analysis. Figure 2 shows the resulting depths of total sediment estimated for the study area and summarizes corresponding the volume of deposits for each sediment classification.

An overall conservative approach was taken in estimating the amount of sediment, particularly in quantifying the finer "Lake Muck" sediment that is most likely to erode from the dewatering process. Figure 3 shows the resulting depths of the Lake Muck sediments estimated for the study area.

Table 2. Approximate Sediment Volume and Classification Distribution for the Dewatered Work Area

Sediment Classification	Terrace Fill Distribution	Channel Fill Distribution	Hillside Fill Distribution	Total Volume (CY)	% Total Volume
Lake Muck (Silt w/ Organics)	10%	10%	0%	4,280	9%
Silty Sand/Sandy Silt (SM/ML)	60%	0%	0%	13,800	28%
Silty Gravel/Sandy Gravel (GM/GP)	30%	90%	100%	30,620	63%



APPROX. SEDIMENT DEPTH TO BEDROCK

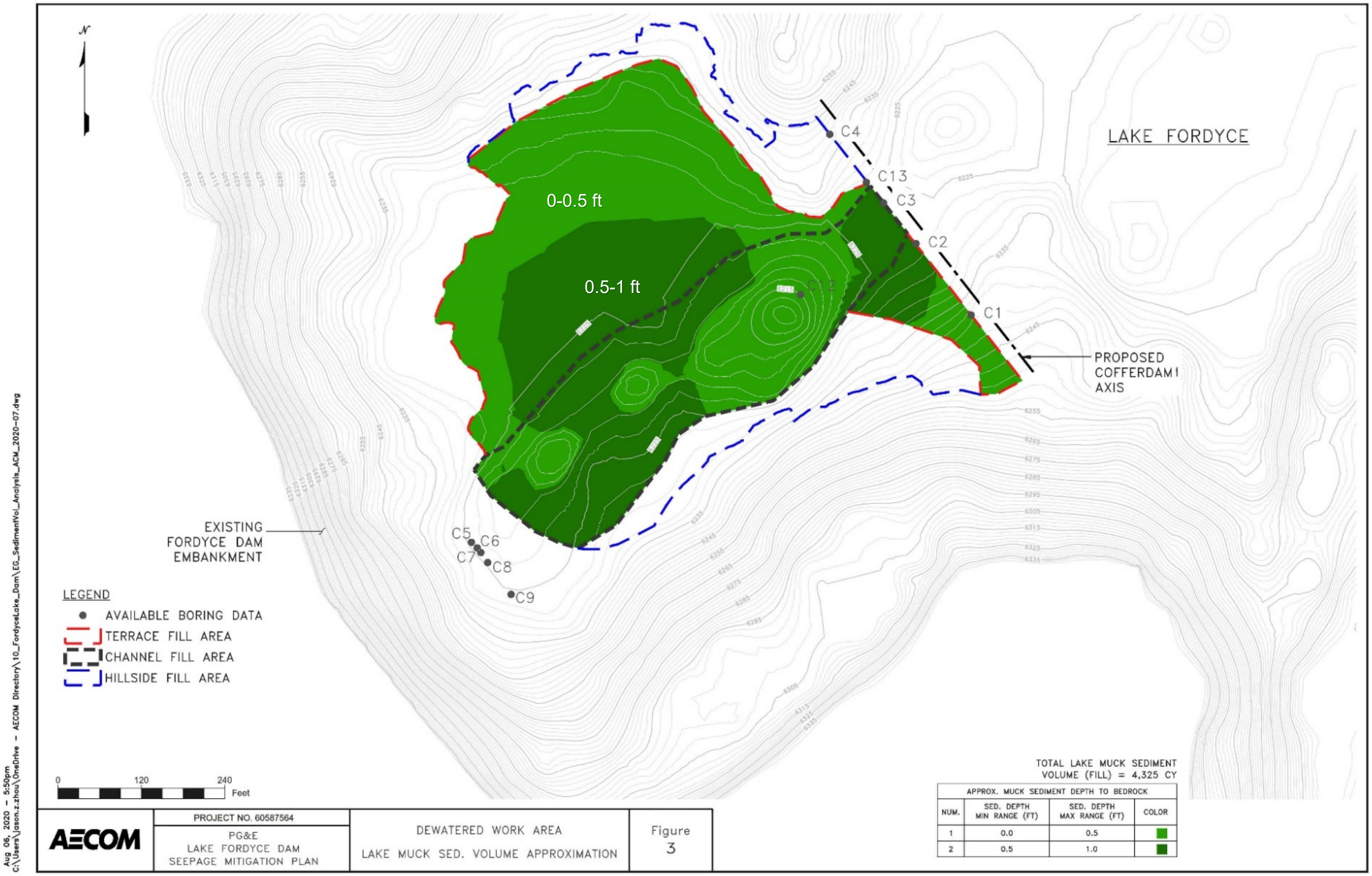
NUM.	SED. DEPTH MIN RANGE (FT)	SED. DEPTH MAX RANGE (FT)	COLOR
1	0.0	2.0	🟨
2	2.0	4.0	🟫
3	4.0	6.0	🟧
4	6.0	8.0	🟥
5	8.0	10.0	🟥

TOTAL SEDIMENT VOLUME (FILL) = 48,700 CY

SEDIMENT CLASS DISTRIBUTION FROM AVAILABLE BORING DATA

	Terrace Fill	*Channel Fill*	*Hillside Fill*	**TOTAL VOL (CY)**	**% TOTAL VOL**
Lake Muck (Silt w/ Organics)	10%	10%	0%	**4,325**	**9%**
Silty Sand/Sandy Silt (SM/ML)	60%	0%	0%	**13,750**	**28%**
Silty Gravel/Sandy Gravel (GM/GP)	30%	90%	100%	**30,625**	**63%**

Figure 2. Estimated Depth of Sediment in Lake Fordyce



APPROX. MUCK SEDIMENT DEPTH TO BEDROCK			
NUM.	SED. DEPTH MIN RANGE (FT)	SED. DEPTH MAX RANGE (FT)	COLOR
1	0.0	0.5	🟩
2	0.5	1.0	🟩

Figure 3. Estimated Depth of Lake Muck in Lake Fordyce.

2. Relationship between Pumping Rate, Depth of Water, and Turbidity

The erosion rate of sediment from the lake bottom is dependent on the velocity and depth of water. The turbidity is dependent upon the erosion rate and water pumping rate.

2.1 Velocity

The velocity was estimated using two methods. Assuming the flow is frictionless with no rotation and calculating the 3-D flow field for a source near the surface. The second method assumes that the velocity is uniform with depth and the flow is approximately radial towards the pump intakes. Assuming a uniform flow with depth over-estimates the velocity near the bottom but is approximately correct farther from the intakes. In this case the velocity can be estimated as the flow through a cylinder with a radius equal to the distance from the pump intakes and the height equal to the depth of water.

Table 3 shows the estimated velocities assuming radial flow through a cylinder for 25 cfs withdraw rate and Table 4 assuming 20 cfs withdraw rate. The velocity using frictionless flow theory at a distance 0.5 foot above the bottom is estimated to be less than 0.5 foot per second (ft/s) within 10 feet of the discharge for even shallow depths of water. This is consistent with the results shown in Tables 3 and 4. Both methods indicate that the velocities drop off quickly with depth and distance from the pumps.

Table 3. Estimated Velocities during Dewatering assuming Flow through Cylinder, 25 cfs Withdraw Rate

Distance (feet)	1-foot Depth	1.5-foot Depth	2-foot Depth	3-foot Depth	5-foot Depth	10-foot Depth
2 feet	1.99	1.33	0.99	0.66	0.40	0.20
5 feet	0.80	0.53	0.40	0.27	0.16	0.08
10 feet	0.40	0.27	0.20	0.13	0.08	0.04
15 feet	0.27	0.18	0.13	0.09	0.05	0.03
20 feet	0.20	0.13	0.10	0.07	0.04	0.02
50 feet	0.08	0.05	0.04	0.03	0.02	0.01
100 feet	0.04	0.03	0.02	0.01	0.01	0.00

Note: Withdraw Rate 25 cfs

Table 4. Estimated Velocities during Dewatering assuming Flow through Cylinder, 20 cfs Withdraw Rate

Distance (feet)	1-foot Depth	1.5-foot Depth	2-foot Depth	3-foot Depth	5-foot Depth	10-foot Depth
2 feet	1.59	1.06	0.80	0.53	0.32	0.16
5 feet	0.64	0.42	0.32	0.21	0.13	0.06
10 feet	0.32	0.21	0.16	0.11	0.06	0.03
15 feet	0.21	0.14	0.11	0.07	0.04	0.02
20 feet	0.16	0.11	0.08	0.05	0.03	0.02
50 feet	0.06	0.04	0.03	0.02	0.01	0.01
100 feet	0.03	0.02	0.02	0.01	0.01	0.00

Note: Withdraw Rate 20 cfs

2.2 Erosion Rate

The erosion rate was calculated using procedures described in Van Rijn (1984). The method consists of calculating erosion based on excess shear stress and assumed velocity and concentration profiles. The excess shear stress is the amount of shear stress generated by flow on the lakebed that is greater than the critical shear stress. The critical shear stress is the shear stress required to mobilize the representative sediment particle. The velocity profile is assumed to have a logarithmic shape which is determined by the shear stress and roughness of the bottom. This assumption isn't strictly true in the case where water is drawn off the surface rather than over the entire depth. However, it overestimates the actual shear stress at the bottom.

Van Rijn (1984) calculated bottom shear stress assuming uniform flow in the water body. Since this does not apply to the case of pumping water from the surface of Lake Fordyce the calculation of bottom shear stress was calculated using procedures presented in Berenbrock and Tranmer (2008). Berenbrock and Tranmer provide a relationship for bottom shear stress based on near bottom velocity.

The suspended sediment concentration profile is based on the balance between turbulence (generated by bottom shear) which keeps sediment in suspension and settling velocity (determined by particle size) which removes sediment from suspension.

Data needed and the values used in the analysis are provided in Table 5.

Table 5. Input Data Used to Estimate Sediment Erosion Rate

Parameter	Value	Units	Source
Particle Size, D_{50}	0.035	mm	Particle size distribution from boring C-2
Particle Size, D_{90}	0.15	mm	Particle size distribution from boring C-2, provided in Attachment A
Water Density	999.921	kg/m^3	10°C
Particle Density	2650	kg/m^3	assumed
Kinematic Viscosity	1.31e-6	m^2/s	10°C
Water Depth	Variable	m	
Velocity	Variable	m/s	
Flow Rate	20 and 25	cfs	Lake Fordyce Dam Seepage Mitigation Project, Dewatering/Removal of Water Plan (Black and Veatch 2020)

3. Results

The erosion rate was calculated at different distances from the intake for depths of water from 0.5 to 3 feet. The velocity used in the analysis was estimated using frictionless flow at 0.1 foot off the bottom. This results in a slightly higher velocity than calculated assuming flow through a cylinder (uniform with depth as shown in Tables 3 and 4). Withdrawing water at 25 cfs resulted in no erosion for depths greater than 3 feet. For depths between 3 and 1.5 feet, concentrations were less than 10 milligrams per liter (mg/L). If there is no decreases in the flow rate (from 20 or 25 cfs),a sharp increase in concentration is possible to greater than 100 mg/L as the depth decreases to less than 1.5 feet. However, the dewatering plan calls for decreasing the flow rate from 25 cfs to 20 cfs as the water level gets below elevation 6,220 feet, at which point the water is restricted to just the lowest points in the reservoir. Submersible pumps would then be used with a flow rate of between 1 and 5 cfs. By controlling the flow to 5 cfs or less, the concentration should be able to be maintained at less than 30 mg/L.

The turbid water would be discharged into an isolated area of Lake Fordyce. A silt curtain would keep the area isolated from the Lake. A silt curtain would reduce sediment discharges to the main body of the lake. The concentration behind the silt curtain can increase above the concentration in the discharge to the lake, because the mass of sediment leaving the isolation area is less than the mass of sediment being added, until the sediment behind the curtain settles and diffuses through the curtain at the same rate as it is being discharged from the lake to the isolation area (under steady state conditions). The mass settling rate depends upon surface area behind the silt curtain. The exact size of the area has yet to be determined but preliminary drawings indicate it will be about 7,000 square feet (ft^2). The settling rate for a D_{50} particle size of 0.035 mm (from Table 5) is about 1.017e-4 ft/s (see van Rijn 1984 for settling velocity relationship). The concentration increase in the isolation area can be calculated by balancing the three fluxes listed below.

1. Inflow of sediment = $Q^* C_i$, the inflow rate to isolation area times the concentration in the discharge.
2. Settling of sediment = A^*Vs^*C, the area of isolation area times the settling velocity times the concentration in isolation area.
3. Diffusion of sediment through curtain = $Q^*C^*(1-\varepsilon)$, the inflow rate times the concentration in isolation area times the leakage rate (equal to 1 minus curtain efficiency). This assumes steady-state flow (i.e., discharge into the isolation area equals flow out of isolation area).

Steady-state concentration will be reached when the inflow of sediment equals the sediment settling in the isolation area plus diffusion of sediment through the curtain. If the curtain was 100 percent efficient, the increase in concentration behind the silt curtain would be between 1.5 times to over 25 times the input concentration(see Table 6). If, however, the silt curtain is 90 percent efficient at retaining sediment, in this case, the increase in concentration above the inflow concentration is expected to vary from between 1.2 and 7 to 8 times the inflow concentration. The variation depends primarily upon the rate of pumping (e.g., 1 cfs to 25 cfs). For low flow rates, much of the sediment can either settle or leak through the curtain, so the increase in concentration behind the curtain will be small. For large flow rates only a small percentage of the sediment can settle or leak through the curtain so the increase in concentration behind the curtain will be larger. Under the existing plan (see Table 1), when the water gets shallow so that concentrations (turbidity) could increase small flow rates are proposed (5 cfs or less).

Table 6. Ratio of Steady-State Concentration in the Isolation Area to Inflow Concentration for Different Constant Inflow Rates and Silt Curtain Efficiencies

Scenario	Ratio for 1 cfs Inflow	Ratio for 3 cfs Inflow	Ratio for 5 cfs Inflow	Ratio for 10 cfs Inflow	Ratio for 15 cfs Inflow	Ratio for 18 cfs Inflow	Ratio for 20 cfs Inflow	Ratio for 25 cfs Inflow
Silt curtain efficiency = 100%; Isolation Area = 7,000 ft^2	1.4	4.2	7.0	14	21	25	28	35
Silt curtain efficiency = 90%; Isolation Area = 7,000 ft^2	1.2	3.0	4.1	5.8	6.8	7.2	7.3	7.8
Silt curtain efficiency = 80%; Isolation Area = 7,000 ft^2	1.1	2.3	2.9	3.7	4.0	4.2	4.2	4.4
Silt curtain efficiency = 90%; Isolation Area = 14,000 ft^2	0.66	0.95	2.6	4.1	5.1	5.6	5.8	6.3
Silt curtain efficiency = 90%; Isolation Area = 3,000 ft^2	2.5	3.3	6.2	7.7	8.3	8.6	8.7	8.9

Notes: Ratio = $C/Ci = Q/((1-\varepsilon)*Q+VsA)$*, Setting velocity = 0.0001017 ft/s*

To be conservative a scenario of an increase of 25 times a concentration of 30 mg/L was assumed. This means that the isolation area behind the silt curtain could have a concentration of 750 mg/L, assuming steady-state conditions are reached. This should be considered a very high estimate since the flow rate will be reduced to 5 cfs or less when the water level in the Lake gets shallow and erosion increases. Assuming a 90 percent efficiency for the silt curtain and an 5 cfs inflow rate, in this case, the increase would be closer to 4 times (rather than 25 times) for a steady-state concentration of 120 mg/L (see Table 6 to see how the increase in concentration varies with pumping, efficiency, and isolation size). Under actual field conditions the high concentrations in the discharge from the Lake will likely last only 1 to 2 days, so it is unlikely that steady-state conditions will be reached

The steady-state turbidity concentration in the isolation area is proportional to the flow rate and inversely proportional to the area behind the silt curtain (i.e., increasing the flow rate increases the concentration, increasing the area decreases the concentration). It is unknown at this time if it is possible to substantially increase the size of the isolation zone (a bigger area would require a longer curtain and would be in deeper water). However, as an example, if the isolation area was increased to 14,000 square feet (double the proposed size), the expected maximum concentration in the isolation area would decrease between 20 to 50 percent, depending on inflow rate (see Table 6)

It was conservatively assumed that the silt curtain would reduce sediment concentrations by 90 percent (USACE 1978). Residual turbid water could seep into the lake and possibly diffuse to the intake for IFR water over a distance of approximately 600 feet. The concentration in the lake due to diffusion was estimated assuming 2-dimensional diffusion with a uniform concentration with depth (i.e., line source). The source was assumed to be steady-state, that is a continuous release at a constant rate over the depth of the curtain (see Socolofsky and Jirka, 2005 Attachment A for diffusion relationships). The concentration is sensitive to the diffusion coefficient value selected. Figure 4 from Shanahan (2000) provides a relationship between diffusion coefficient and length scale. The length scale is proportional to the size of the plume. The intake to the IFR is about 500 to 600 feet (150 to 180 m) from the silt curtain. This results in a diffusion coefficient of 0.08 square meter per second (m^2/s).

Figure 5 shows the concentration in the lake assuming a continuous sediment release from the silt curtain with a concentration behind the curtain of 750 mg/L. This would be due to pumping at 20 cfs at 30 mg/L into a 7,000 ft^2 isolation area with no leakage. After the maximum concentration was reached, it was assumed that the curtain starts to release at a concentration of 75 mg/L, assuming the curtain was 90 percent efficient. If the curtain was assumed to release sediment as sediment is pumped into the isolation area, the release concentration would be about 20 mg/L (approximately 200 mg/L behind the curtain, based on an inflow rate of 20 cfs at 30 mg/L with a 90 percent efficient curtain, see Table 6). A more likely release concentration would be closer to 12 mg/L (approximately 120 mg/L behind the curtain, based on an inflow of 5 cfs at 30 mg/L with a 90 percent efficient curtain). However, to account for the simple analysis and uncertainties in the inputs, a more conservative value for concentration was considered appropriate.

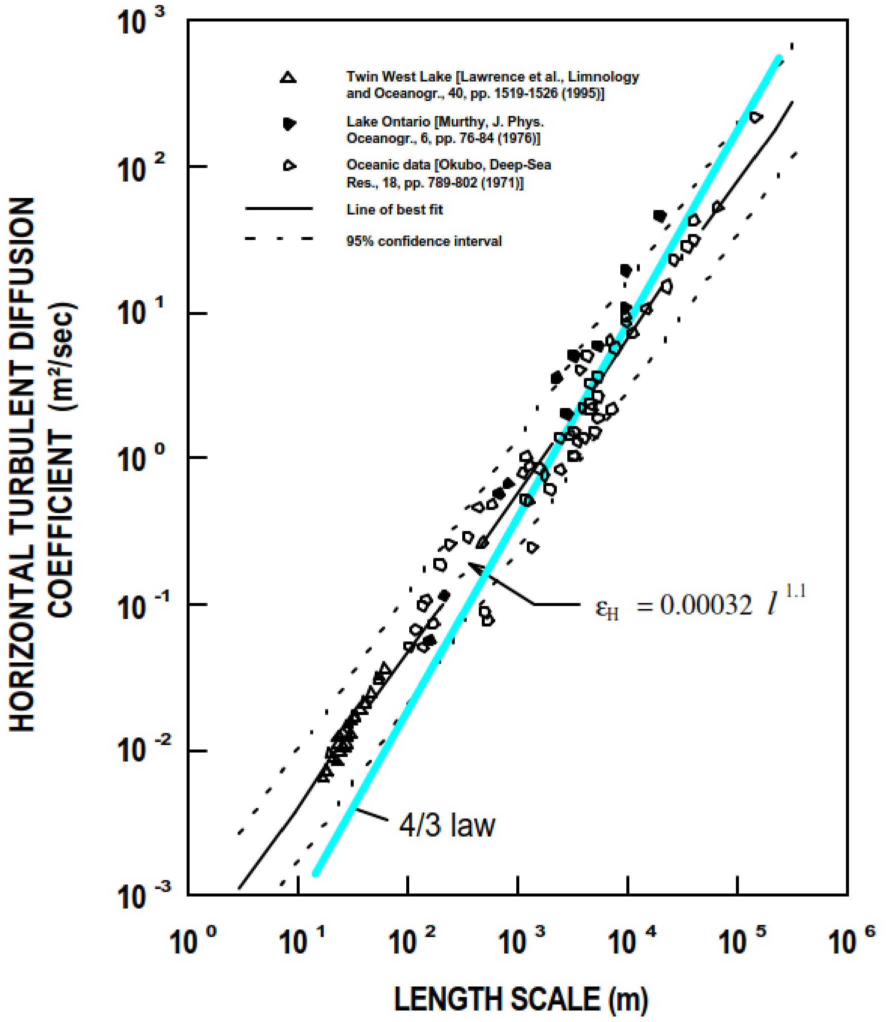


Figure 5B-2
Horizontal Turbulent Diffusivity in Oceans and Large Lakes as a Function of Length Scale
[based on Lawrence et al., Limnology and Oceanogr., 40, pp. 1519-1526 (1995),
reproduced with permission]

Figure 4. Diffusivity Values for Diffusion Calculation of Sediment Released from Isolation Area

Results for two other values for diffusion coefficient are included to show sensitivity. Note that the concentration behind the silt curtain could be much less than 750 mg/L if the pumping rate is controlled to keep the concentration low, as is planned. Results for a case with the concentration equal to 375 mg/L (one-half 750 mg/L) within the isolation area and results in a concentration within the lake adjacent to the silt curtain of 37 mg/L are shown on Figure 5 as dashed lines. For the two cases shown, the concentration 600 feet from the silt curtain varies from about 2 mg/L to approximately 19 mg/L. This represents the expected increase in concentration at the intake and is representative of what could be expected within Fordyce Creek. Similar to the analysis above, these results assume that the silt curtain leaks over its entire depth. If the release occurs over only a portion of the silt curtain, concentrations at 600 feet would be lower.

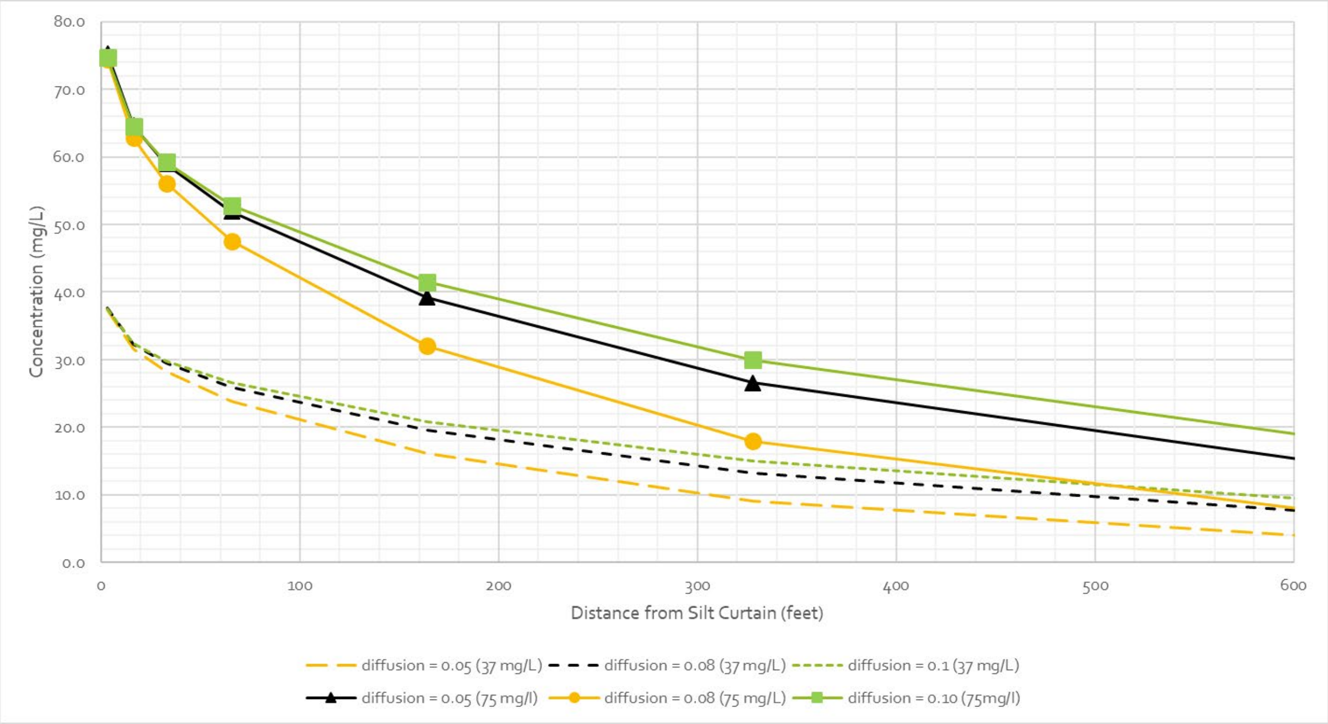


Figure 5. Estimated Concentration in Lake Fordyce due to Release from Silt Curtain

The above results are provided in mg/L; however, field monitoring is typically measured in units of Nephelometric Turbidity units (NTUs). The conversion between NTU and mg/L is site specific due to differences in particle type and size; however, is often found to be close to 1:1.

These results indicate that additional mitigation measures, such as Baker tanks, are unlikely be needed. Any short-term spikes in concentrations that do occur, would be reduced when mixed with water in the turbidity isolation area.

4. Limitations

No field work was conducted for this study. Background information and other data used by AECOM in preparing this report have been furnished by third parties. AECOM has relied on this information as furnished, and is neither responsible for nor has confirmed the accuracy of this information.

The calculations presented in this memorandum apply to the dewatering of the work area and pumping of cofferdam seepage to Lake Fordyce upstream of the cofferdam to an area behind a silt curtain. These results do not apply to turbidity generated specifically during the small dredging operation or construction of the cofferdam (surrounded by a silt curtain).

This sediment study was conducted with limited sediment data. Reasonable assumptions on the properties of the erodible sediment (i.e., muck) based on the available data were made, but it is possible that actual field conditions would vary.

Assumptions made for the analysis include:

- The D_{50} particle size used for the analysis was 0.035 mm. This is approximately the D_{50} size from the sediment sample collected in boring C2, the boring with the finest sediment. The other sediment samples had significantly coarser material. If coarser material is eroded during dewatering, the concentration in the isolation area would be smaller due to the higher settling rate of the coarser material.
- The silt curtain was assumed to be 90 percent effective in removing sediment. Operating according to manufactures specifications can result in higher efficiencies.
- It was assumed that flow ramping would occur during dewatering, that is, as the water depth gets shallow, the pumping rate will be reduced to prevent excessive concentrations in the discharge.
- A constant concentration was assumed to occur for a specified depth and pumping rate. In practice, the concentration in the discharge pipe may vary depending upon the type and mix of sediments encountered (fine, coarse, or mixture). However, the concentration behind the silt curtain should be more uniform due to mixing and dilution.

The services presented herein were conducted in a manner consistent with the standard of care ordinarily applied as the state of practice in the profession. No other warranties, expressed or implied, are included or intended in this document.

5. References

Berenbrock, Charles and Andrew W. Tranmer. 2008. Simulation of Flow, Sediment Transport and Sediment Mobility of the Lower Coeur d'Alene River, Idaho. United States Geological Survey, Scientific Investigations Report 2008-5093.

Black and Veatch, 2020. Lake Fordyce Dam Seepage Mitigation Project. Dewatering/Removal of Water Plan. Technical Memorandum – Draft. Prepared for Syblon Reid Contractors. January.

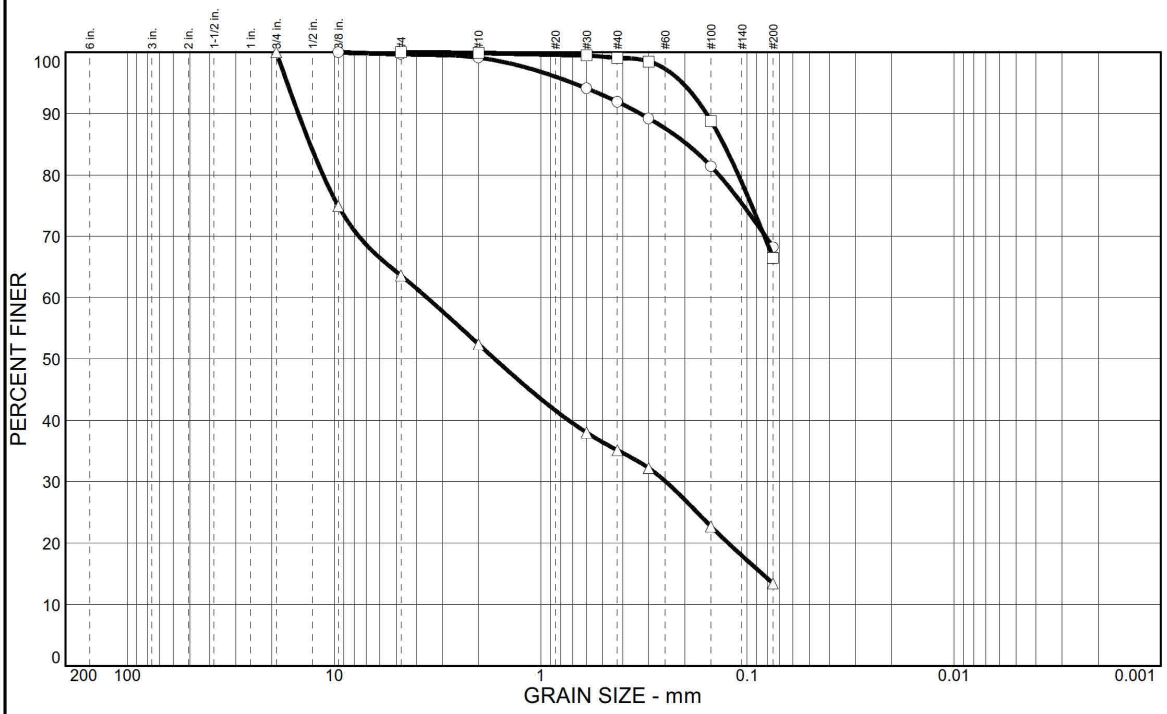
Socolofsky, Scott A., and Gerhard H. Jirka. 2005. CVEN 489-501: Special Topics in Mixing and Transport Processes in the Environment. Engineering – Lectures.

US Army Corp of Engineers (USACE). 1978. An Analysis of the functional Capabilities and Performance of Silt Curtains. Technical Report D-78-39. Dredged Material Research Program. July.

Van Rijn, Leo C. 1984. Sediment Transport, Part II: Suspended Load Transport. ASCE Journal of Hydraulic Engineering, Vol. 10, No. 11, November.

Attachment A Particle Size Distribution from Boring C-2

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		0.3	31.5	68.2					
□			33.5	66.5		ML		NP	
△		36.4	50.2	13.4					

SIEVE inches size	PERCENT FINER ○	□	△
3/4"			100.0
3/8"	100.0		74.9
	GRAIN SIZE		
D_{60}			3.55
D_{30}			0.248
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	99.7	100.0	63.6
#10	99.1	99.9	52.4
#30	94.1	99.5	38.0
#40	91.9	99.1	35.1
#50	89.2	98.5	32.2
#100	81.4	88.8	22.7
#200	68.2	66.5	13.4

SOIL DESCRIPTION

○ Gray Sandy SILT

□ Gray Sandy SILT

△ Gray Silty SAND w/ Gravel

REMARKS:

○

□

△

○ Source: C-2 Sample No.: T-4 Elev./Depth: 5.5'
□ Source: C-2 Sample No.: T-5 Elev./Depth: 6.5'
△ Source: C-2 Sample No.: T-6 Elev./Depth: 7'

COOPER TESTING LABORATORY

Client: Cotton, Shires & Associates
Project: Fordyce - E5289
Project No.: 026-705 Figure