AECOM
300 Lakeside Drive
Suite 400
Oakland, CA 94612
aecom.com

To:
Mr. Jordan Smith
State Water Resources Control Board
Division of Water Rights – Water Quality Certification Program
P.O. Box 2000 Sacramento, CA 95812-2000

Project name:
Lake Fordyce Seepage Mitigation Project

Project ref:

From:
AECOM

Date:
September 21, 2020

Memo

Subject: Hydrology and Water Quality Technical Memorandum

This technical memorandum summarizes the results of the sediment and water quality sampling at Lake Fordyce collected in 2019 as part of the Lake Fordyce Seepage Mitigation Project.

1.1 Sediment Quality

AECOM reviewed the results from two reservoir sediment samples collected from borings advanced in Lake Fordyce in August 2019 as part of the Lake Fordyce Seepage Mitigation Project. Samples were selected from soil borings C-1, C-2, and C-3 located near the proposed cofferdam alignment (see Figure 1) and material from soil borings C-1 and C-2 were combined prior to sediment quality analysis. These borings were collected as part of a larger a geotechnical assessment associated with the cofferdam.

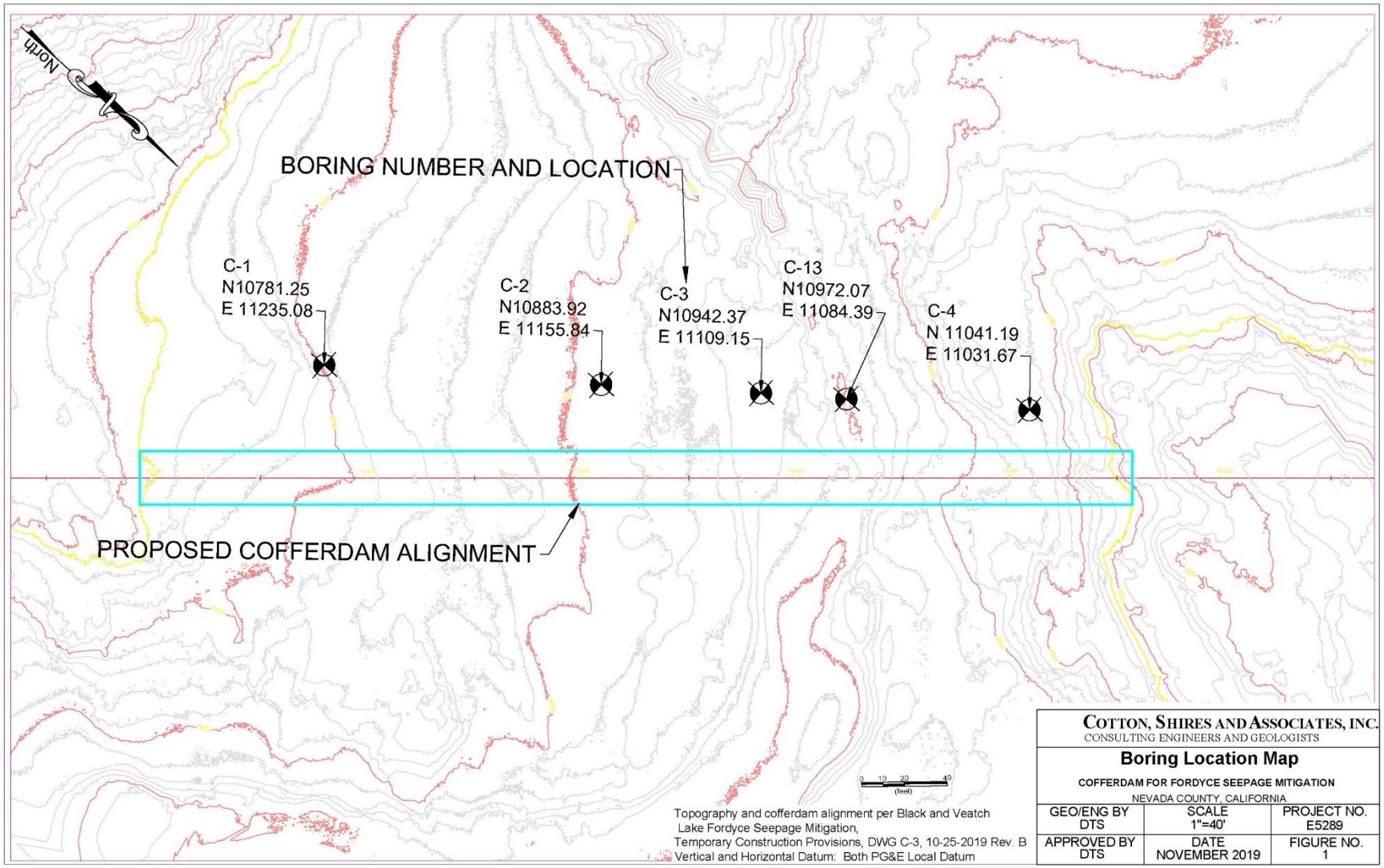

Figure 1. Boring Location Map

Sediment samples collected from the borings were analyzed for metals and mercury, petroleum hydrocarbons (i.e., gasoline, diesel, motor oil), and volatile organic compounds. Motor oil and toluene were found one sample (C-1/C-2), but at concentrations below sediment screening levels (toluene at 22 µg/kg and motor oil at 8.9 mg/kg). The metal and mercury results for C-1/C-2 and C-3 are provided in Table 1. Sediment screening levels are also provided to provide context for interpreting the metals and mercury concentrations in the reservoir sediments. These sediment screening levels are not regulatory values.

- The ecological effects-based screening levels shown in Table 1 are freshwater sediment quality guidelines categorized as either threshold effects or probable effect levels, corresponding to thresholds below which effects to aquatic species are unlikely and thresholds above which effects to aquatic species are likely (Corps 2007). The threshold effect levels are described in scientific literature under a variety of names including "threshold effects levels" or TELs, "effects range low" or ER-L, and "threshold effect concentrations" or TECs. The probable effect levels include "probable effects levels" or PELs, "range effects median" or ER-M, "probable effect concentrations" or PECs, and "upper effects thresholds" or UETs (EPA 2002, NOAA 2008). These screening levels are based on the potential effects to more sensitive aquatic species.

- EPA regional screening levels are also shown in Table 1. These screening levels address human health endpoints, not ecological impacts. The EPA regional screening level for soil to groundwater considers the groundwater-soil system and is designed to be protective of groundwater MCLs. The resident soil screening level is recommended for residential soils. The composite worker soil screening level is protective of outdoor workers.

- The environmental screening levels shown on Table 1 were developed for by the SF Bay RWQCB for a variety of endpoints. The Tier 1 screening level is the threshold for unrestricted exposure to soils. The shallow soil exposure threshold for nonresidential areas applies where contamination is only found in the first few inches of the soil. The threshold for exposure of construction workers to "any land use/any soil depth" is applicable to construction work with deep excavations.

- The hazardous waste characterization criteria shown in Table 1 provide a general indication of whether additional waste characterization would be needed prior to any offsite disposal of the reservoir sediments. Wet leachate procedures (TCLP and STLC) are recommended when soil/sediment concentrations are greater than the decision factors shown in Table 1. (As shown in Table 1, reservoir sediments are found below hazardous waste criteria.)

Table 1. Metals in Freshwater Sediment at Lake Fordyce

Metals in mg/kg	C-1/C-2	C-3	Threshold Effect Conc (TEC) [1,2]	Threshold Effect Level (TEL) [1,2]	Effects Range Low (ER-L) [1,2]	Probable Effect Level (PEL) [1,2]	Probable Effect Conc (PEC) [1,2]	Effects Range Median (ER-M) [1,2]	Upper Effects Threshold (UET) [1,2]	Soil to Ground-water (MCL) [3]	Resident Soil[3]	Composite Worker Soil[3]	Tier 1 Screening Level[4]	Construc-tion Worker Exposure[4]	Commercial Industrial Shallow Soil[4]	Decision Factor for STLC, State[5]	Decision Factor for TCLP, Federal[5]	TTLC, State (wet weight)[5]
Antimony	< 5	< 5	—	—	—	—	—	—	3	0.27	3.1	47	11	50	164	150	—	500
Arsenic	4.5	5.9	9.8	5.9	33	17	33	85	17	0.29	0.68	3.0	0.07	0.98	0.31	50	100	500
Barium	30	32	—	—	—	—	—	—	—	82	1,500	22K	390	3K	220K	1K	2K	10K
Beryllium	< 1	< 1	—	—	—	—	—	—	—	3.2	16	230	5	27	232	7.5	—	75
Cadmium	< 1	< 1	0.99	0.596	5	3.53	4.98	9	3	0.38	—	—	1.9	51	1,100	10	20	100
Chromium	8.1	5.5	43.4	37.3	80	90	111	145	95	180K	12K	180K	160	—	—	50	100	2,500
Cobalt	4.2	3.2	—	—	—	—	—	—	—	—	2.3	35	23	28	350	800	—	8K
Copper	23	10	31.6	35.7	70	197	149	390	86	46	310	4,700	180	14K	47K	250	—	2,500
Lead	< 5	< 5	35.8	35	35	91.3	128	110	127	14	400	800	32	160	320	50	100	1K
Mercury	0.23	< 0.1	0.18	0.174	0.15	0.486	1.06	1.3	0.56	0.1	1.1	4.6	13	44	190	2	4	20
Molybdenum	< 2	< 2	—	—	—	—	—	—	—	—	39	580	6.9	1,800	5,800	3,500	—	3,500
Nickel	5	4.1	22.7	18	30	36	48.6	50	43	—	150	2,200	86	86	11K	200	—	2K
Selenium	< 5	< 5	—	—	—	—	—	—	—	0.26	39	580	2.4	1,700	5,800	10	20	100
Silver	< 2	< 2	—	—	—	—	—	—	4.5	—	39	580	25	1,800	5,800	50	100	500
Thallium	< 2	< 2	—	—	—	—	—	—	—	0.14	0.08	1.2	0.78	3.5	12	70	—	700
Vanadium	27	38	—	—	—	—	—	—	—	—	39	580	18	470	5,800	240	—	2,400
Zinc	19	22	121	123	120	315	459	270	520	—	2,300	35K	340	106K	350K	2,500	—	5K

Source:

[1] EPA (United States Environmental Protection Agency). 2002. *A Guidance Manual to Support the Assessment of Contaminated Sediments in Freshwater Ecosystems. Volume III.* Prepared by DD MacDonald and CG Ingersoll. EPA 905 B02 001 A. December.

[2] NOAA (National Oceanic and Atmospheric Administration). 2008. *NOAA Screening Quick Reference Tables, NOAA OR&R Report 08 01*. Prepared by M.F. Buchman, Office of Response and Restoration Division.

[3] EPA (United States Environmental Protection Agency). 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites. November.

[4] SF Bay RWQCB (San Francisco Bay Regional Water Quality Control Board). 2019. *Environmental Screening Levels.* Rev. 1. January.

[5] 22 CCR § 66261.24

The samples tested had concentrations above screening levels for certain metals. Arsenic and mercury were found in at least one of the two samples at concentrations at or greater than human health regional screening levels and ecological-based threshold effect concentrations for freshwater sediments (EPA 2002, 2019). Cobalt and vanadium were also detected at concentrations above the resident soil screening level and the Tier 1 screening level, respectively, but these criteria are not directly applicable to work at Lake Fordyce.

In addition to the sediment quality analyses described above, particle size distribution/sieve tests were conducted for sediments collected from boring C-1, C-2, C-3, and C-13 and strength tests, hydraulic conductivity, and plasticity tests were conducted on select borings as part of the geotechnical investigation. The engineering geologic cross section developed for this area (Figure 2) was based on this data.

1.2 Water Quality

A sensor system was installed in October 2019 to continuously monitor turbidity and temperature at the existing stream gauging station on Fordyce Creek downstream of Fordyce Dam (Figure 3). Data were collected in October and November 2019 prior to winterization of the site: the turbidity and temperature data are shown in Figures 4 and 5. A short-term increase in turbidity occurred when the flows were increased from 8 to 14 cubic feet per second at the end of October (Figure 6).

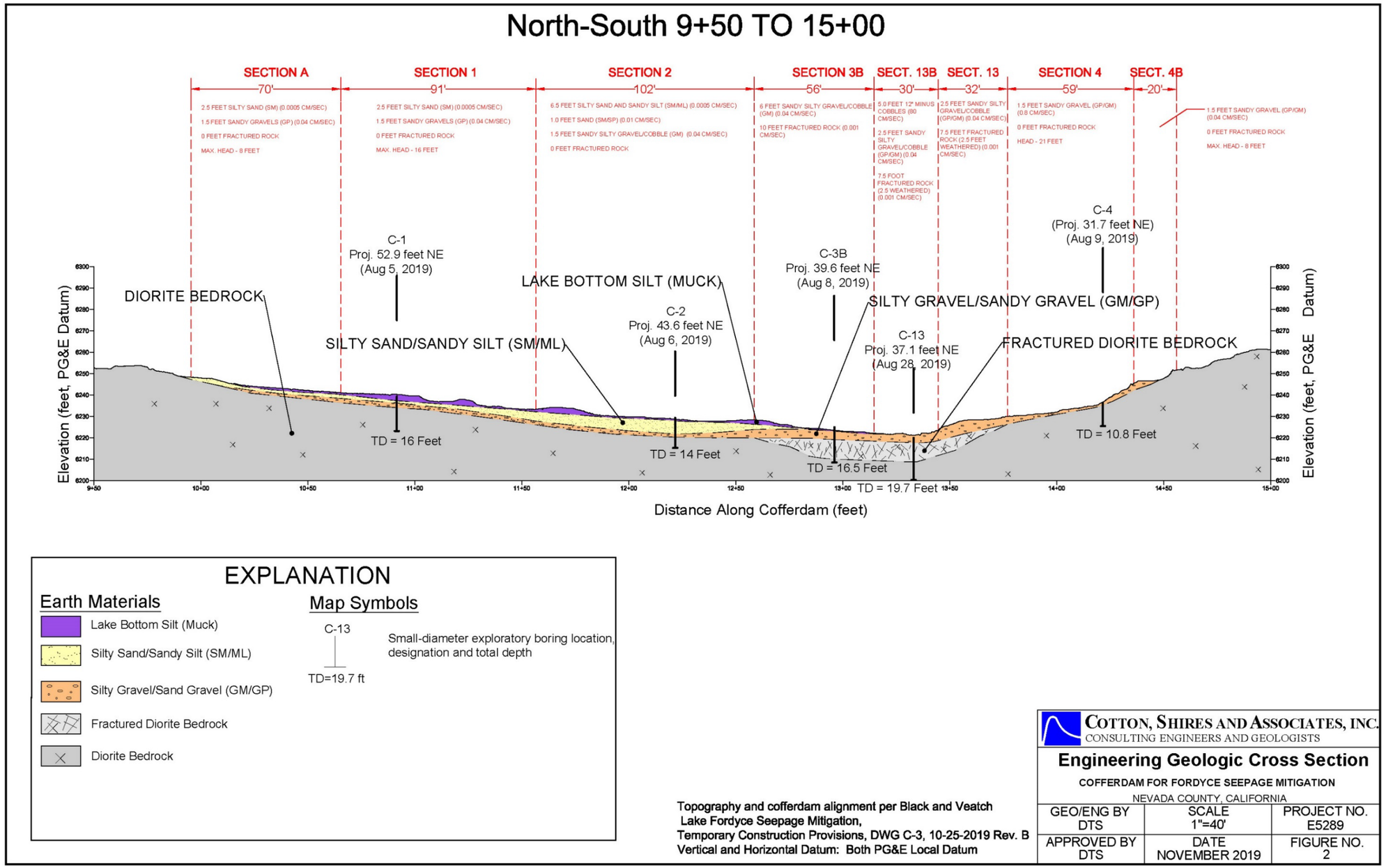

Figure 2. Engineering Geologic Cross Section

AECOM

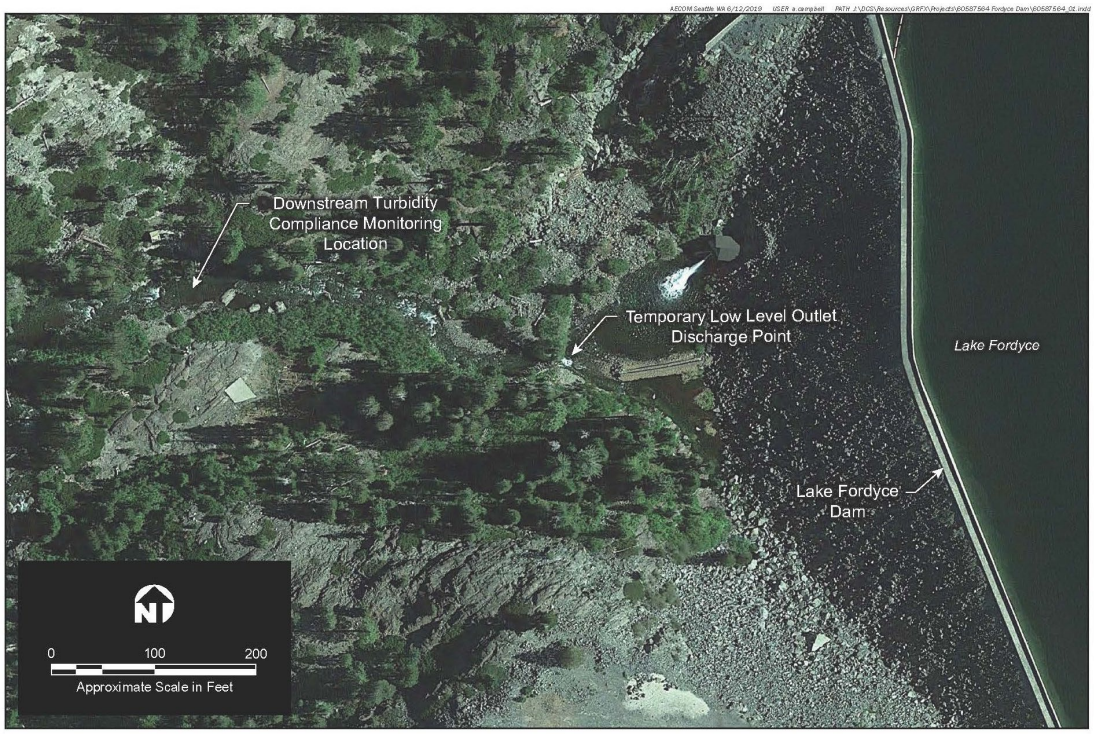

Figure 3. Downstream Monitoring Location

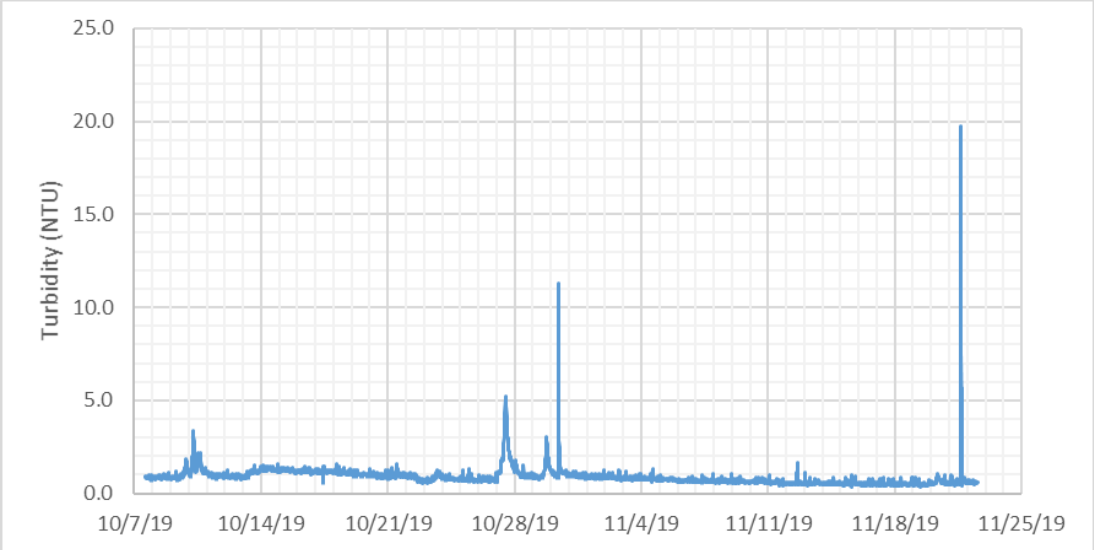

Figure 4. Turbidity in Fordyce Creek, October and November 2019

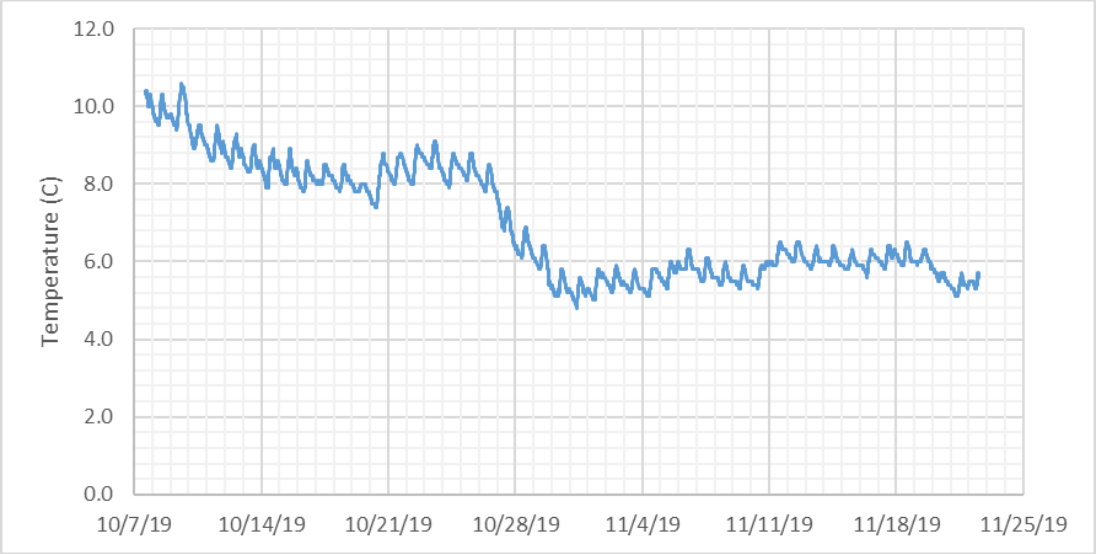

Figure 5. Temperature in Fordyce Creek, October and November 2019

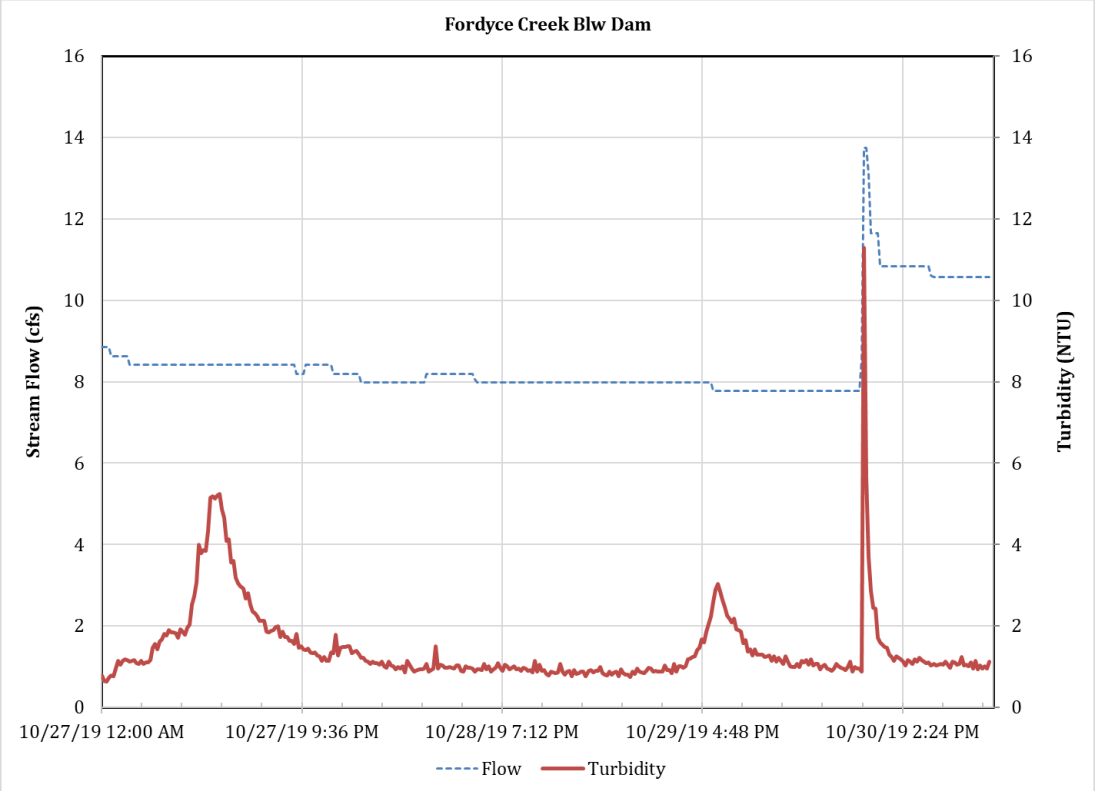

Figure 6. Flow and Turbidity, October 30, 2019

1.3 References

Corps (United States Army Corps of Engineers). 2007. Summary of Available Guidance and Best Practices for Determining Suitability of Dredged Material for Beneficial Uses. Dredging Operations and Environmental Research Program. ERDC/EL TR-07 27. November.

EPA (United States Environmental Protection Agency). 2002. A Guidance Manual to Support the Assessment of Contaminated Sediments in Freshwater Ecosystems. Volume III. Prepared by DD MacDonald and CG Ingersoll. EPA 905 B02 001 A. December.

———. 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites. November.

NOAA (National Oceanic and Atmospheric Administration). 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08 01. Prepared by M.F. Buchman, Office of Response and Restoration Division.

SF Bay RWQCB (San Francisco Bay Regional Water Quality Control Board). 2019. Environmental Screening Levels. Rev. 1. January.