Amanda L Minks, NR Program Manager
Waterway Management Specialist, Racine County
Wisconsin Department of Natural Resources
PO Box 7921, Madison, WI 53707-7921
Amanda.Minks@wisconsin.gov

Subject: **Preliminary Permit Information for the Proposed Browns Lake Sediment Removal Project in Burlington WI**

Dear Amanda, the Preliminary Permit Information for the proposed Browns Lake Sediment Removal Project is provided below as required by Wisconsin Administrative Code, Chapter NR 347. It is understood that prior to submission of a complete, signed Individual Permit Application form, anyone seeking to remove material from the beds of waterways is required to provide the following preliminary information that includes:

a. Name of waterbody and location of project,

Browns Lake is a 397-acre lake located in Racine County and is one of the most popular lakes in southeastern Wisconsin. It has a maximum depth of 44 feet and with a boat landing on the south side for public access (see Figure 1). Because the lake was formed by a melting ice block buried in glacial drift, it has both a deep kettle area as well as extensive shallow water and littoral zone areas. The lake’s watershed area is approximately 914 acres, which means it has a very low watershed-to-lake size area ratio. A low head structure on the outlet impounds spring runoff. An island, a narrow peninsula and extensive channels increase the shore length relative to the water area. Most of the watershed consists of residential land uses. The predominant fish species include Panfish, Largemouth Bass, Northern Pike and Walleye. The lake's water transparency is moderately clear and generally becomes more turbid during and after weekends during the summer boating season.

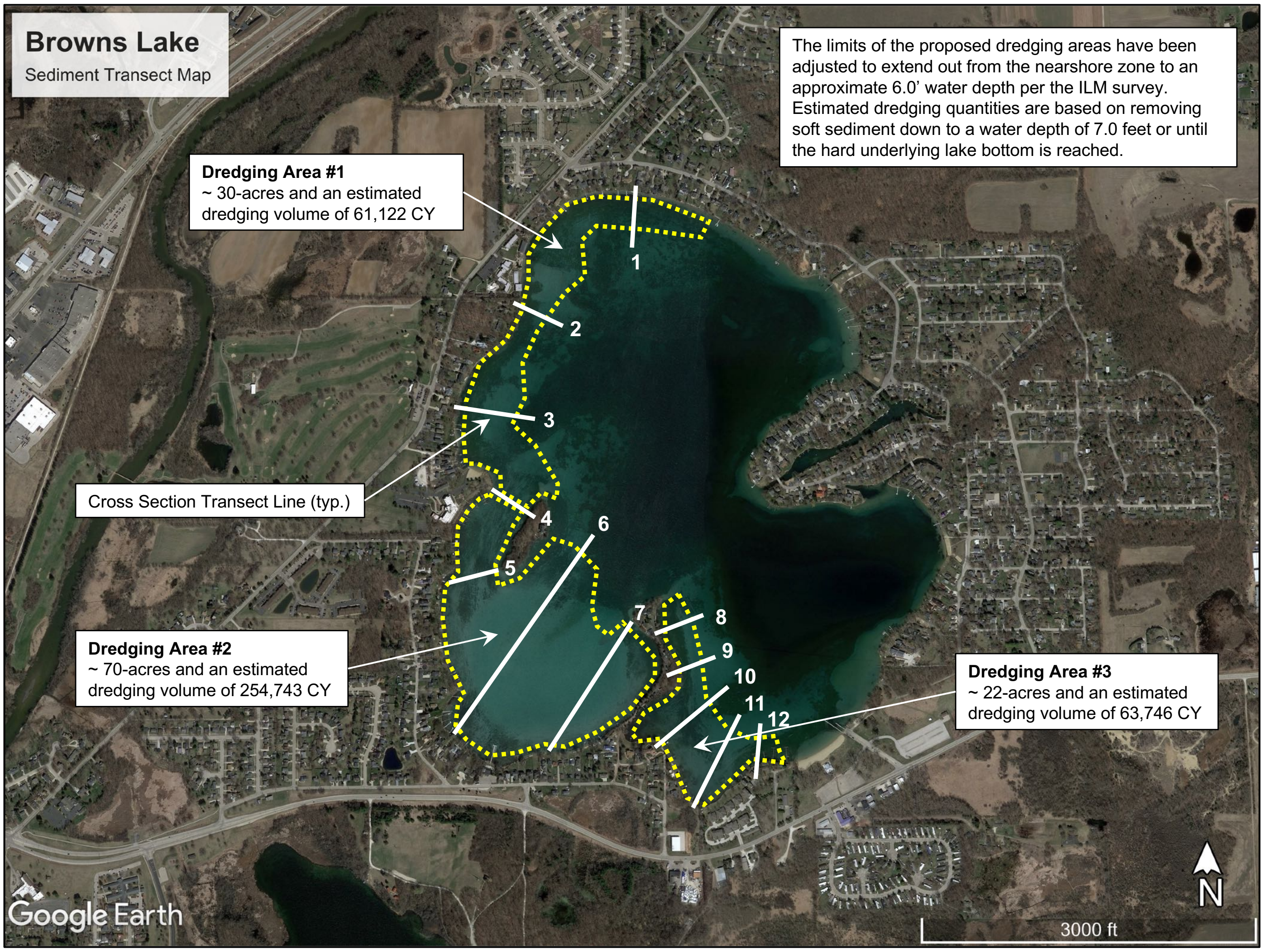
The Browns Lake Sanitary District (BLSD) was created in response to septic system and water quality concerns in 1970. Following intensive study and analysis, a sewer system was installed in the Browns Lake area in 1975. The lake was experiencing nuisance levels of aquatic plants and algae and the BLSD purchased aquatic plant harvesting equipment and began harvesting in 1970. The harvesting program continues to have the support and appreciation of local citizens and is considered essential to maintaining a reasonable level of recreational use by the community. Significant concerns about soft, easily resuspended sediment located throughout the shallower areas of the northwest, southwest and southern portions of the lake have been discussed with the intent of removing the most problematic sediment via hydraulic suction dredging. This sediment becomes even more problematic seasonally when lake water levels drop as much as a foot or more due to reduced rainfall and lower groundwater levels that often occur in late summer. Preliminary efforts were initiated that included obtaining sediment core samples for analysis and discussion with WDNR about the feasibility and permit requirements for this potentially significant restoration project.

Figure 1. Browns Lake Location Map

b. Volume of material to be dredged,

In an effort to identify and quantify the total volume of sediment that would realistically be targeted for removal as part of the developing Dredging Plan, Berrini & Associates, LLC worked with the Browns Lake Sanitary District to more accurately define and revise the preliminary Priority Areas (Figure 2). By utilizing the water and sediment depth information that became available by the ILM survey completed in May of 2021, the limits of the Preliminary Dredging Plan were adjusted to reflect actual conditions. Lake cross sections were developed to graphically evaluate and quantify anticipated dredging requirements, particularly since total cost and the feasibility of cost-effectively storing and dewatering the dredged sediment is of critical importance. A copy of the ILM Survey is available for reference.

Figure 2. Browns Lake Dredging Areas and Cross Section Transects



Bathymetric and Sediment Depth maps from the 2021 ILM Survey were utilized to evaluate and refine the Preliminary Dredging Plan and are provided in **Section g.** below in Figures 4 and 5 for reference. The lake-side limits of dredging were adjusted to approximately correspond with the current 6.0 ft. depth contour. The maximum dredging depth is proposed to be 7.0 feet, or until a hard, underlying lake bottom layer is reached. This depth was determined to be a suitable and achievable target depth since the soft, low-density, high water-content "marl" sediment from adjacent areas would likely flow horizontally back into a dredged area after completion.

Representative cross sections have also been developed and are included in **Section g.** to provide a clear graphical representation of the horizontal and vertical dredging limits. No dredging will occur within 20 feet of the shoreline and no closer than 10 feet from any existing pier or dock pending final WDNR recommendations. In addition, per WDNR recommendations from initial discussions, the Final Restoration Plan will include various aquatic habitat enhancements to provide improved fish habitat and spawning conditions due to the extensive habitat and water quality impacts that have resulted from the extensive layer of soft marl sediment. These enhancements may include diver-assisted suction removal of thin, soft sediment layers impacting spawning habitat in addition to fish attractor and habitat structures.

The goal of this restoration effort is to remove a sufficient layer of the soft sediment down to a depth that minimizes sediment resuspension by boats (in low wake areas) while being cognizant of total project costs and sediment storage space limitations. Figure 2 shows the limits of the three preliminary dredging areas along with transect locations where cross section views of the lake were plotted for additional analysis and volume estimation. Based on the amount of sediment removed for each dredging area, a summary of the proposed in-lake dredging volumes are shown in Table 1.

Table 1. Estimated Dredging Requirements for Browns Lake

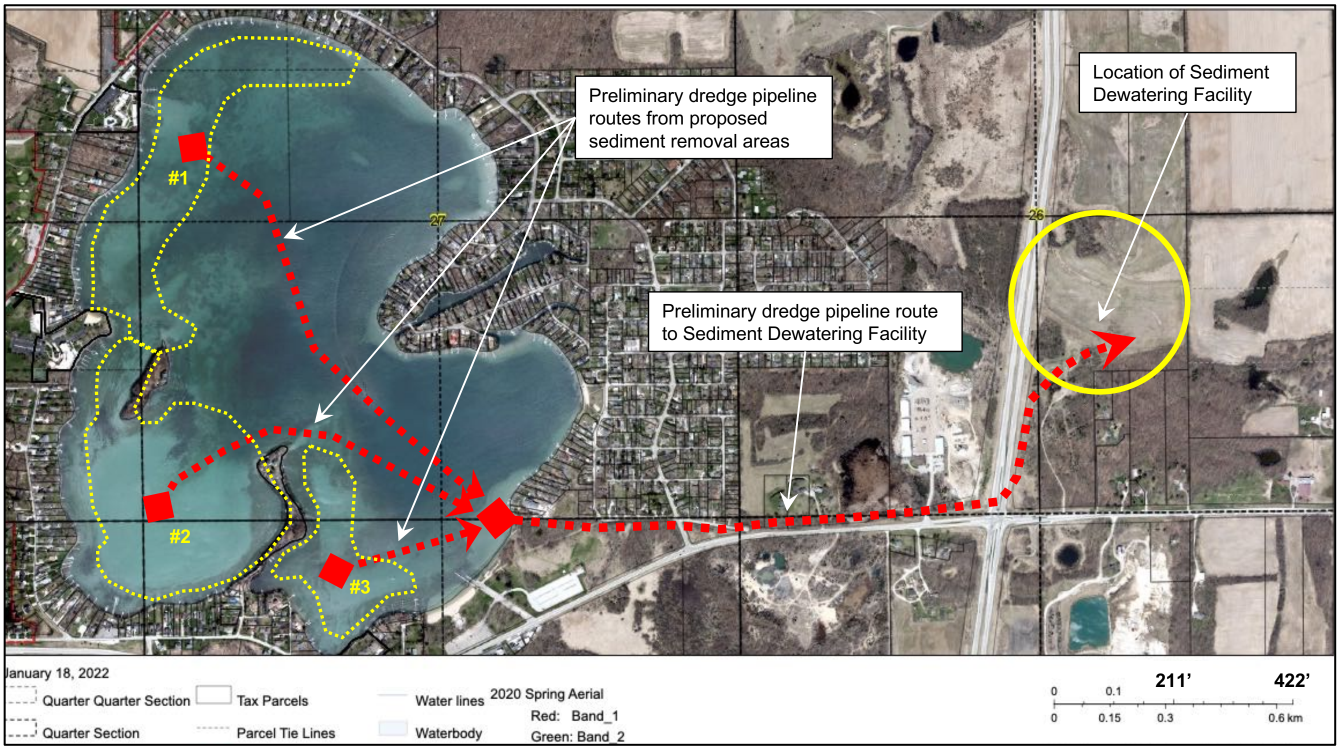
Location	Dredging Volume (CY)
Area #1 NW	61,122
Area #2 SW	254,743
Area #3 South	63,746
Total	**379,611**

c. Brief description of dredging method and equipment, including any containment BMPs to be used.

The proposed dredging method includes the use of a small, portable hydraulic suction dredge that will pump the soft marl-derived sediment and water via temporary HDPE dredge pipeline to the designated storage and dewatering location. The exact size and pumping capability of the dredge is being evaluated and will likely range from a 10” to 12” diameter discharge, which would pump a sediment and water slurry at a rate ranging from 4,000 to 6,000 GPM. The dredge must be capable of accurately dredging to the proposed depth while minimizing on turbidity to the greatest extent possible, either by utilizing a low-turbidity shroud or by controlling cutterhead velocity.

The current dredging plan includes pumping the soft sediment and water slurry into an upland, multi-cell containment and dewatering area that will be located approximately one mile east of the lake (see Figure 3 below).

Figure 3. Location of Dredging Areas and Pipeline Routes to Sediment Dewatering Site

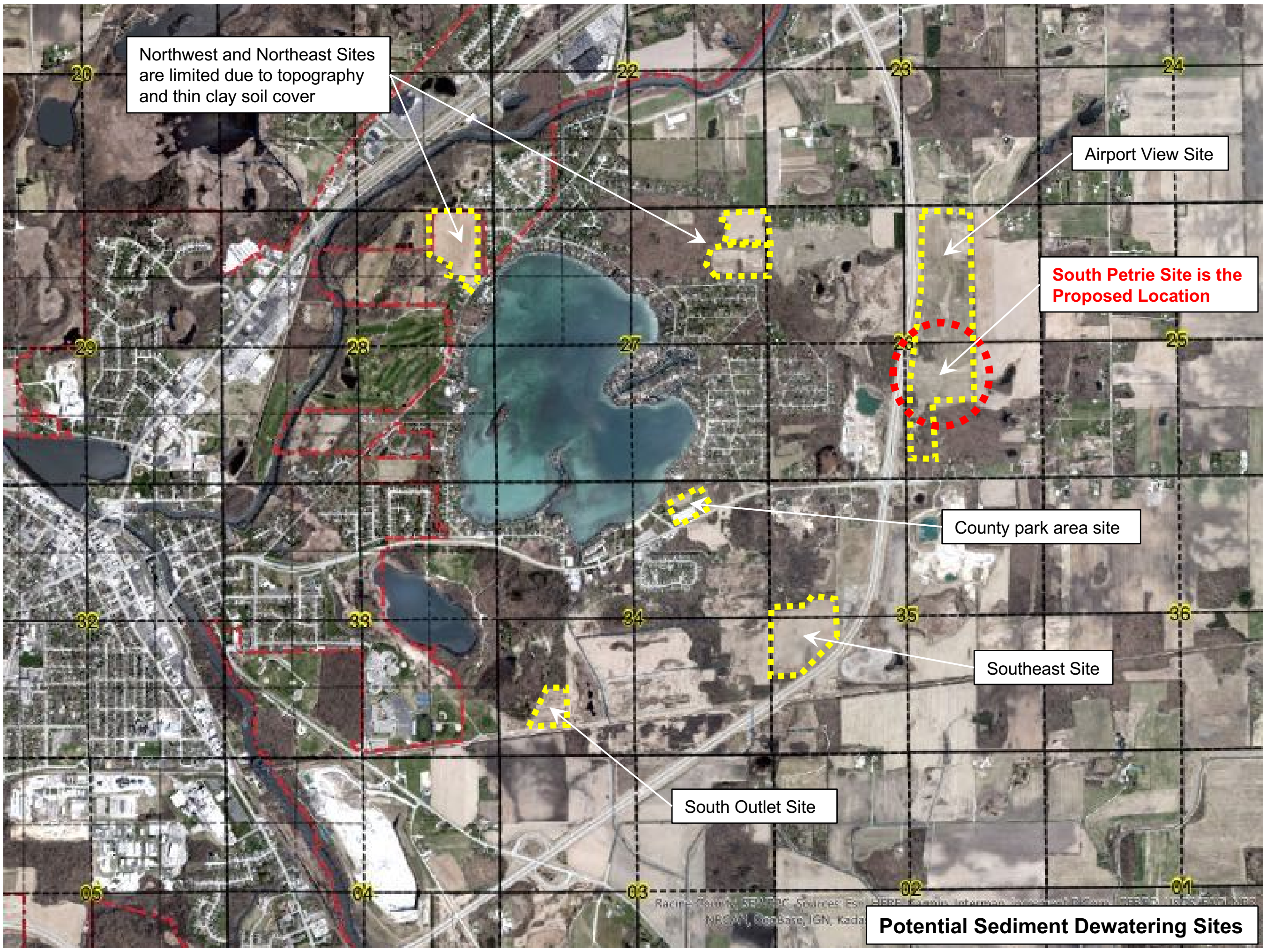


d. Brief description of proposed disposal method and location,

Hydraulic dredging operations will produce large quantities of a wet sediment slurry, which must be dewatered for efficient storage and eventual reuse or disposal. Dewatering is often accomplished by allowing solid material (silt) to either settle out of the slurry within a containment basin or to be retained within geotextile tubes. The clear water discharged from the containment area, known as “effluent return water,” is then released back to the adjacent waterway that preferably drains back to the lake to replenish water pumped out during the dredging process.

The dewatering facility should be located within close enough proximity to the dredging operations to allow for efficient pumping to the dewatering location. When the pumping distance extends beyond the capability of the dredge, a booster pump is required to maintain effective operations. Per discussions with the BLSD combined with a site visit and a review of available aerial and topographic maps, several potential upland sediment dewatering locations were identified and evaluated, and a preferred site was determined (see Figure 4 below).

Figure 4. Potential Sediment Dewatering Sites



As part of the preliminary development of a suitable Dredging Plan for Browns Lake, several potential sediment storage and dewatering sites were identified for further evaluation. These sites included: 1) the Northwest Site, 2) the Northeast Site, 3) the Petrie Airport View Site, 4) the South Petrie Site, 5) the Southeast Site, 6) the South Outlet Site and 7) the County Park Site.

A simple site evaluation table provides a comparison of key features that include estimated storage capacity, distance from the lake and pumping elevation (see Table 2). A key consideration for each site assumes that the dewatered sediment can be graded and stabilized on site without having to haul the material to another site for final placement. Additional sediment capacity could be restored by periodically moving the dewatered sediment to adjacent areas to accommodate additional dredging requirements.

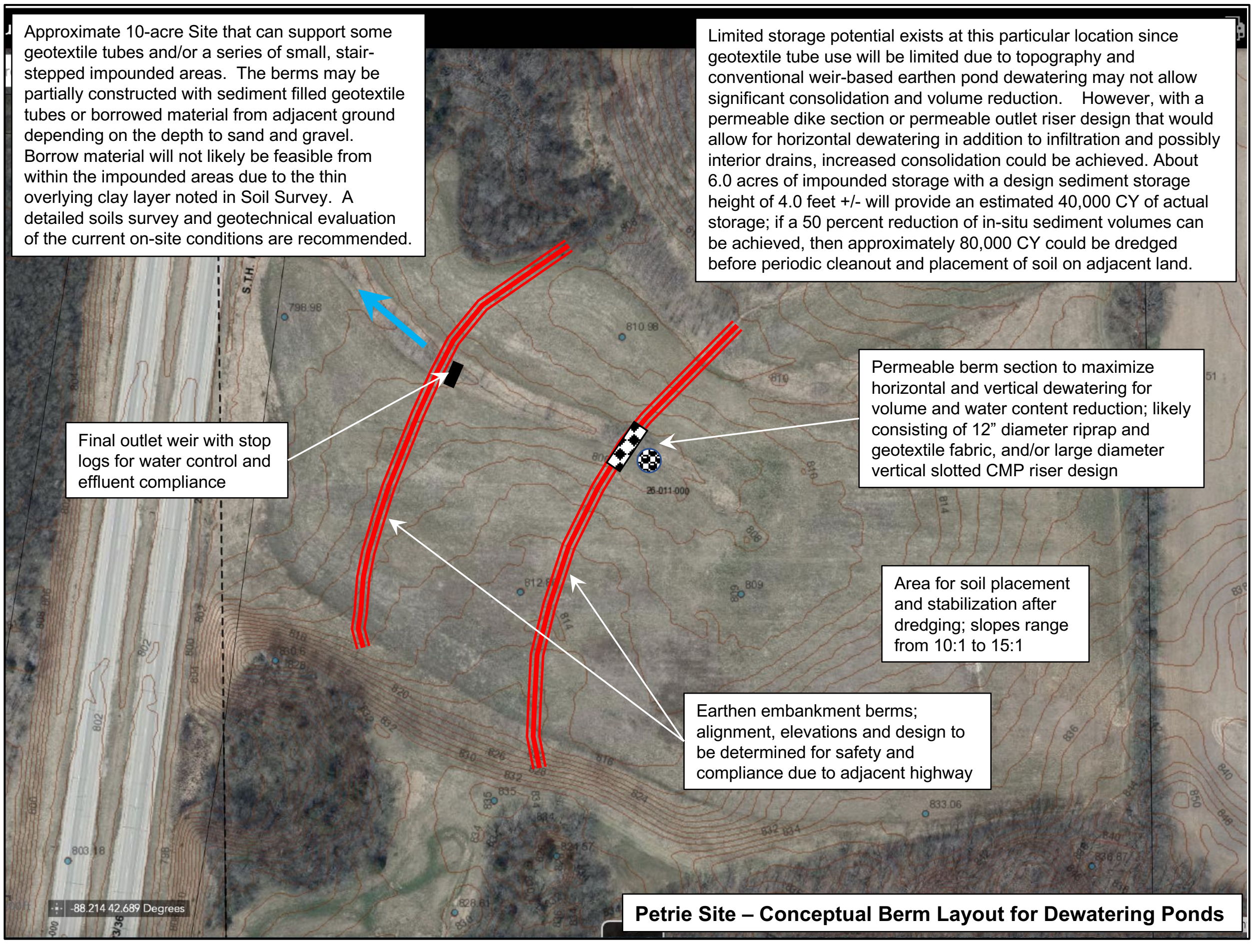
Table 2. Browns Lake Sediment Storage Site Evaluation Matrix

Site Evaluation Criteria	#1 Northwest Site	#2 Northeast Site	#3 Petrie (Airport View)	#4 Petrie (South)	#5 Southeast Site	#6 South Outlet	#7 County Park Site
Total Site Acreage	20.0	22.0	16.0	20.0	10.0	10.0	4.0
Usable Acreage (assume 60% to 80% of site)	12.0	13.2	8.0	16.0	8.0	6.0	3.2
Type of Storage Site	Upland Dikes	Upland Dikes	Geotubes	Upland Dikes	Geotubes	Geotubes	Geotubes
Storage Capacity in CY **	116,160	127,776	250,000	80,000	230,000	150,000	41,301
Min. Dredging Dist. (ft.)	700	2,400	9,000	7,000	4,200	3,200	600
Max. Dredging Dist. (ft.)	5,600	7,500	14,000	12,000	9,600	8,800	5,800
Avg. Dredging Dist. (ft.)	3,150	4,950	11,500	9,500	6,900	6,000	3,200
Average Site Elevation	774.0	808.0	798.0	820.0	782.0	772.0	780.0
Lake Surface Elevation (avg.)	769.0	769.0	769.0	769.0	769.0	769.0	769.0
Avg. Elev. above Lake	5.0	39.0	29.0	51.0	13.0	3.0	11.0
Booster Pump (s) for dredged sediment	Yes	Yes	Yes	Yes	Yes	Yes	No
Return Water back to Lake	Pump	Gravity	Gravity	Gravity	Pump	Pump	Gravity
Road or RR Crossings for Pipeline	1	1	3	3	1	1	0
Suitability of Topography	Fair	Good	Good	Good	Good	Fair	Good
Suitability of Soils	Fair	Fair	Good	Fair	Fair	Fair	Fair
Impact to Habitat	Low	Low	Low	Low	Low	Low	Low
Aesthetic Impact	Low	Low	Low	Low	Low	Low	Moderate
Amt. of Timber to Clear	None	None	None	None	None	None	None

Generally, the most cost-effective approach to dredge and dewater the volume of sediment in a large water body such as Browns Lake is to hydraulically pump the sediment and water slurry into an earthen dewatering pond. However, this scenario is dependent on securing or leasing a sufficiently sized parcel of open land that is nearly level or gently sloping and is located outside of any floodplains, with no wetlands on the site. It is also desirable to be within proximity to the targeted dredging area with pipeline access, a minimum number of road crossings and drainage back to the lake to replenish water pumped out while dredging. The use of an earthen dewatering impoundment for large scale sediment storage and dewatering via weir-based water control structures was evaluated. However, according to available Soil Surveys, most upland areas are only covered by thin layers of silty clay loam soils and are underlain by significantly more permeable sand and gravel deposits. An additional storage and dewatering option is the IMS GeoPool, which is an innovative dewatering solution that is cost effective, reusable, scalable, and easy to operate according to the manufacturer.

The approximate 10-acre South Petrie Site was selected due to overall land owner cooperation and the ability to store dewatered sediment on-site without requiring off-site hauling for final placement. It can support a series of small, stair-stepped impounded areas (see Figure 5). The two earthen berms will be constructed with borrowed material from adjacent ground depending on the depth to more permeable material, but excavation will likely be limited from within the impounded areas due to the thin overlying clay layer noted in the Soil Survey. A detailed soils survey and geotechnical evaluation of the current on-site conditions is proposed and will be completed as part of the final Project design. If the construction of earthen berms is not determined to be feasible after completion of soil borings to evaluate detailed site conditions, then the IMS GeoPool system will be further evaluated prior to submitting a Final Permit Application.

Figure 5. Preliminary South Petrie Site Plan



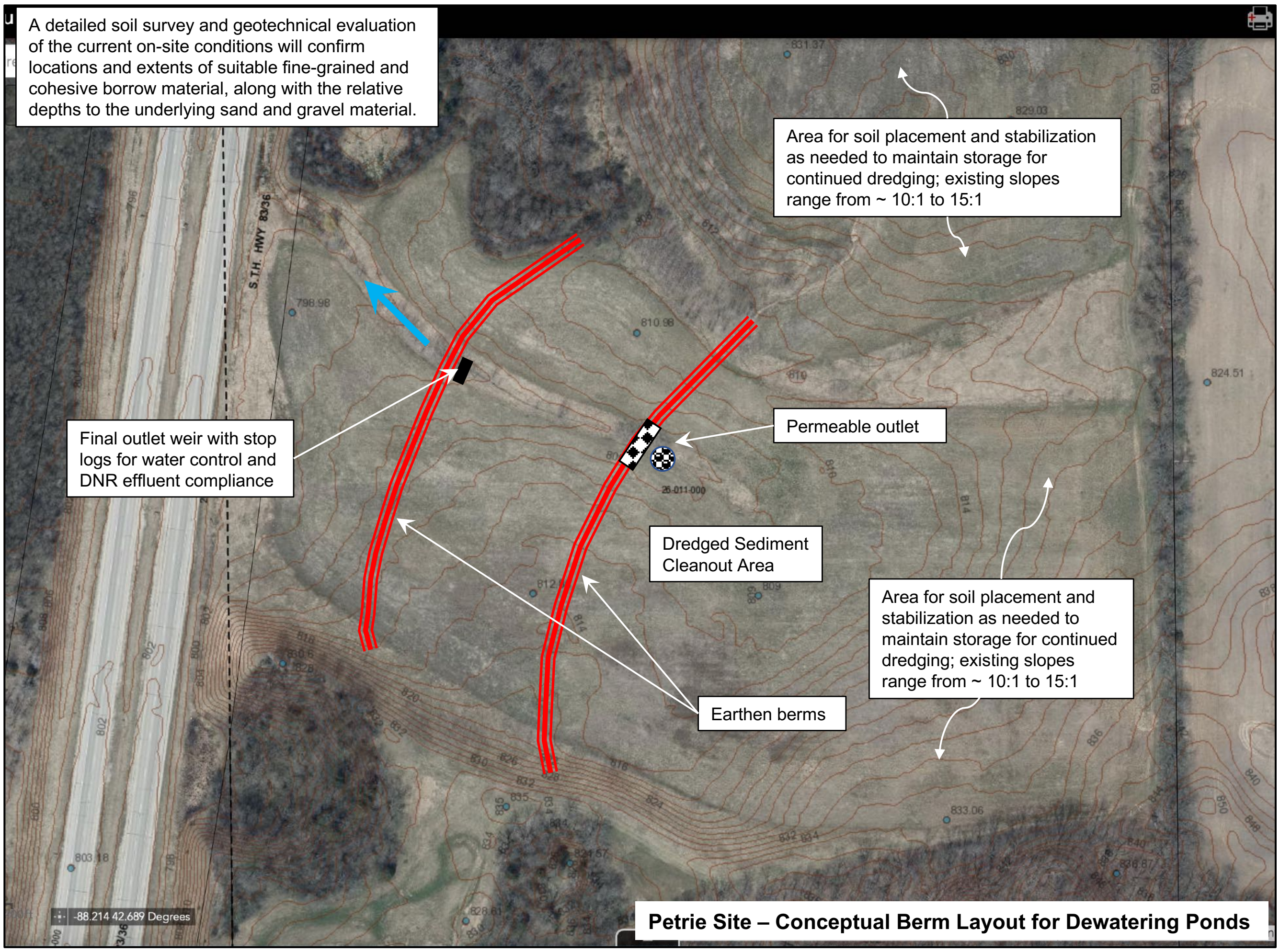
The dredge pipeline will be routed along Durand Ave. and will pass under Highway 83 to the proposed sediment dewatering site. Several road crossings will be required for the dredge pipeline in addition to crossing Highway 83 and will be accomplished by directional boring and/or road cuts to allow uninterrupted access. Highway 83 will be crossed either by utilizing an existing culvert or via directional boring methods and will be determined during the final engineering design process.

Limited storage potential exists at this location due to topography and because a conventional weir-based earthen pond may not allow significant consolidation and volume reduction to occur because of the low specific gravity marl-sediment. However, a permeable or perforated outlet riser design would allow horizontal dewatering and increased self-consolidation to be achieved. About 6.0 to 8.0 acres of impounded storage with a design sediment storage height of 4.0 feet (+/-) will provide an estimated 40,000 to 50,000 CY of actual storage. If a 50 percent reduction of in-situ sediment volumes can be achieved, then approximately 80,000 to 100,000 CY (measured in-situ) could be dredged before periodic cleanout and placement of soil on adjacent land would be needed in order to provide sufficient space for continued dredging (see Figure 6).

e. If a disposal facility is to be used, size of the disposal facility,

The size of this proposed upland dewatering facility is approximately 10.0 acres in total area and appropriate erosion and sediment control practices will be utilized during all phases of the proposed maintenance activities as required. As shown in the figure below, there is also adjacent land that can be utilized for spreading the dewatered sediment for final placement and stabilization, while providing ongoing dewatering space for continued dredging and completion of the project.

Figure 6. Preliminary South Petrie Site Plan (Additional Detail)

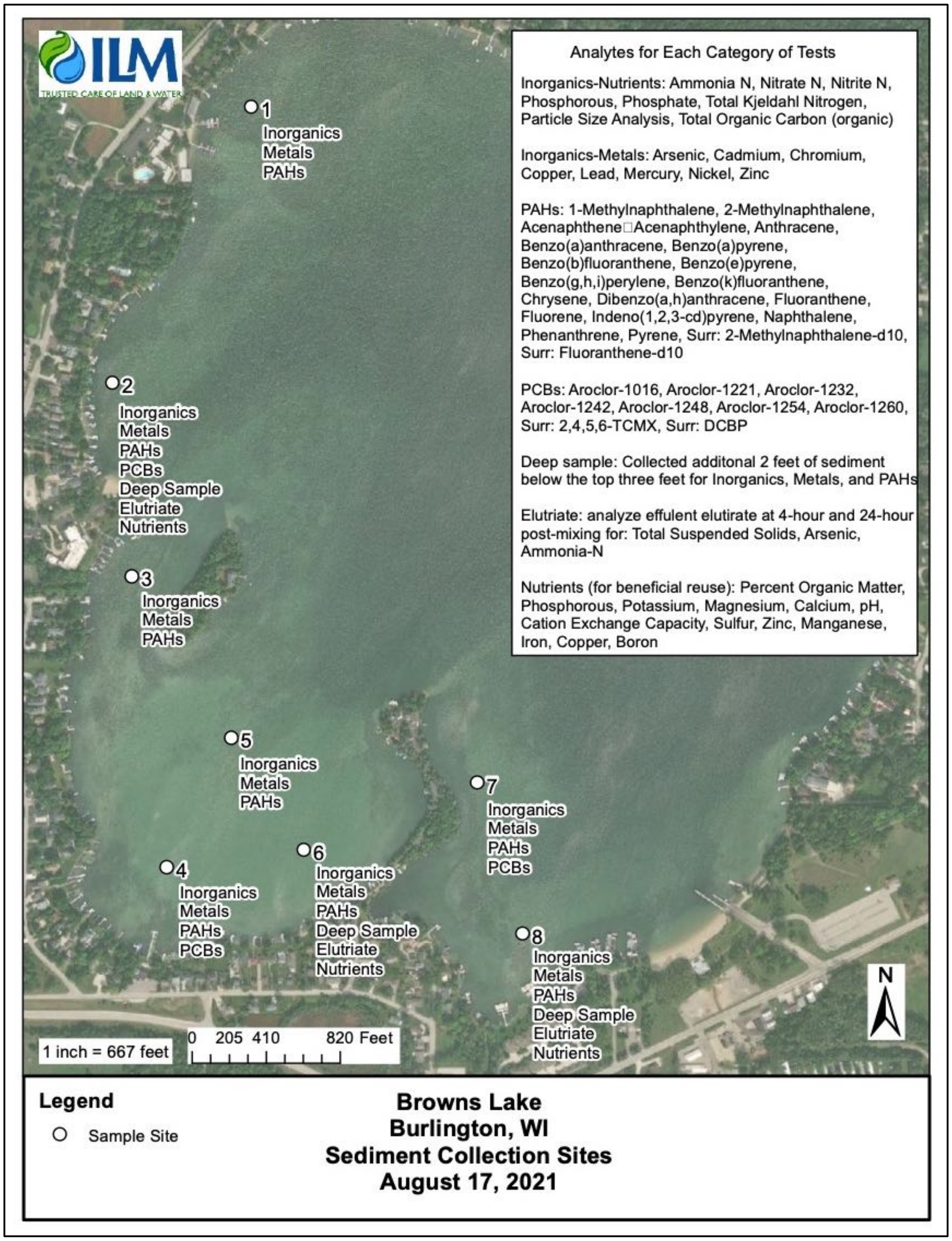


Since maximum volume reductions of the sediment while dredging and dewatering is an important component of the project, a small Pilot Project may be considered. A Hanging Bag test and/or other small scale dewatering methods would provide valuable volume reduction information. It will also be important to confirm how the lake sediment being dredged will behave and how it could be best measured for eventual payment, particularly since the marl sediment has a very low specific gravity and would likely be flowable in-situ. Further discussion is needed to confirm whether a suitable and cost-effective Pilot Project could be implemented.

f. Any previous sediment sampling (including field observations) and analysis data from the area to be dredged or from the proposed disposal site,

Sediment core samples were collected on August 18, 2021, at eight sampling locations that were pre-determined and submitted to WDNR for approval. The types of tests completed for each site were determined by WDNR. Figure 8 shows the locations as well as the types of analyses completed for each site.

Figure 8. Sediment Core Sample Locations and Analyses



To collect each sample, a 5-foot acrylic tube was placed into a coring device and lowered into the sediment to collect the top 3 feet. A cap was placed on the tube upon retrieval and the water at the top of tube was carefully dumped out to leave the loose top layer at the sediment-water interface intact. The sediment was then released into a stainless-steel mixing pan. This process was repeated until enough sample was collected to fill the sample jars, with the appropriate sample containers chosen for each test. The sediment was then homogenized and scooped into the jars with a stainless-steel spoon. All sampling equipment was thoroughly washed before moving to the next site. A new acrylic tube and cap was used for each site to reduce cross-contamination.

For sites 2, 6 and 8, the corer was lowered 5 feet into the sediment. The collected core was split so the top 3 feet was analyzed separately from the bottom 2 feet. At sites 2, 6, and 8, additional water was collected so effluent elutriate testing could be done on collected sediment at those locations. Photos were taken to document the appearance of the cores and total sediment depth was recorded at each site. Samples were stored in coolers on ice and transported within 24 hours to CT Laboratories – a Wisconsin Certified laboratory. CT Laboratories performed the analysis according to the methods indicated in the analytical report. Additional samples were collected and sent to A & L Great Lakes Laboratories to gather nutrient data to preliminarily evaluate for the potential beneficial reuse of the dredged material.

All cores were composed of marl, which is typically a mixture of clay and calcium carbonate and is often found in post-glacial lake-bed sediments, particularly in areas with limestone bedrock. The marl near the surface of the lake was very loose and when disturbed by boaters, the resuspended sediment was slow to resettle and consolidate. Deeper in the sediment, the marl was denser, appearing to have a higher clay-content. The cores had a similar general profile, which consisted of fine, unconsolidated material in the first foot or two, which then transitioned into decomposing shells and more consolidated material. The “fluffy” top layer led to a high water-content in the samples.

The ILM Report noted that Chara was also abundant in the lake. Chara is a macroalgae with a hard, calcified stem that grows in lakes with high alkalinity. When the Chara dies, the breakdown of the calcified stem helps form marl. Skeletons of freshwater mollusks are also common in marl and were present in the samples collected.

The results of the laboratory analyses did not show any elevated levels of contaminants, except for sample #3 contained a slightly elevated level of Arsenic at 11.2 mg/kg, which is slightly above the TEC or Threshold Effects Concentration of 9.8 mg/kg (see Table 3). However, the other 7 samples were all below the detection level or well below the TEC, and the overall average Arsenic concentration was approximately 5.0 mg/kg. Therefore, we believe that the Self-Certification Exemption Criteria Flow Chart for a Dredge Material Disposal Facility can be satisfied. A preliminary analysis of soil nutrients showed high concentrations of calcium as expected of the marl sediment. Phosphorus was low and organic contents were moderately high, probably from aquatic plant and algae enrichment after seasonal die-off and decomposition.

Table 3. Laboratory Results for Browns Lake Sediment

Analyte	Units	Core #1	Core #2	#2 (Deep)	Core #3	Core #4	Core #5	Core #6	#6 (Deep)	Core #7	Core #8	#8 (Deep)	Mean Conc.	* WDNR Sed. Qual. TEC (Threshhold Effect Conc.)	* WDNR Sed. Qual. MEC (Midpoint Effect Conc.)	* WDNR Sed. Qual. PEC (Probable Effect Conc.)
Inorganics- Nutrients																
Nitrogen Kjeldahl	mg/kg	3,090	3,830	2,360	3,990	3,500	4,180	5,270	1,470	7,790	7,580	4,090				
Phosphorus	mg/kg	102	<99	95.9	<180	<110	<130	<160	<81	<200	<220	<140				
Nitrate Nitrogen	mg/kg	4.87	<1.6	<1.1	<2.6	<1.6	<2.0	<2.5	3.42	<3.0	<3.5	<2.1				
Nitrite Nitrogen	mg/kg	<6.2	<6.0	<4.3	<9.8	<6.0	<7.5	<9.2	<4.3	<11	<13	<7.7				
Phosphate, ortho	mg/kg	<4.2	<4.0	<2.8	8.34	<4.0	5.3	<6.2	<2.9	<7.6	<8.7	<5.2				
Total Organic Carbon	mg/kg	48,200	57,500	68,100	68,800	53,700	68,200	65,500	53,000	109,000	104,000	74,600				
Ammonia Nitrogen	mg/kg	13.6	23.6	17.4	17	12.6	22.9	15.4	22.8	29.1	29.8	44.4				
Solids, percent	%	24.1	25.1	35.2	15.2	25.2	19.9	16.2	34.7	13.2	11.5	19.4				
Inorganics-Metals																
Arsenic	mg/kg	5.0	6.5	<2.2	**11.2**	<2.8	<3.8	<4.4	<2.1	<5.3	7.9	<3.6	**5.0**	9.8	21.4	33.0
Cadmium	mg/kg	<0.18	<0.17	<0.13	<0.29	<0.17	<0.23	<0.27	<0.13	<0.32	<0.40	<0.22		0.99	3.0	5.0
Chromium	mg/kg	3.4	2.7	2.2	4.9	2.2	<2.5	<2.9	2.5	4	5.7	3.1		43.0	76.5	110.0
Copper	mg/kg	5	3.6	3.8	9.5	3.8	3.4	3.6	2.7	7.2	11.4	4.7		32	91	150
Lead	mg/kg	4.3	1.2	<0.75	17.7	3.1	<1.3	<1.5	1.2	4.9	12.2	2.8		36.0	83.0	130.0
Nickel	mg/kg	1.9	<1.9	1.8	3.1	2	<2.5	<2.8	1.8	4.4	7.2	2.8		23.0	36.0	49.0
Zinc	mg/kg	11.5	8.5	8.7	27.7	11.3	<5.6	<6.4	8.8	20.8	34.2	11.4		120.0	290.0	460.0
Mercury	mg/kg	<0.012	<0.011	<0.0081	0.02	<0.011	<0.014	<0.017	<0.0078	<0.021	<0.023	<0.014		0.18	0.64	1.10
Organics - PAHs																
1-Methylnaphthalene	ug/kg	<5.0	<4.8	<3.4	<7.9	<4.8	<6.0	<7.4	<3.5	<9.1	<10	8.44		20.2	111.0	201.0
2-Methylnaphthalene	ug/kg	<4.1	<4.0	<2.8	<6.6	<4.0	<5.0	<6.2	7.51	<7.6	<8.7	14.5		20.2	111.0	201.0
Acenaphthene	ug/kg	<4.1	<4.0	<2.8	<6.6	<4.0	<5.0	<6.2	<2.9	<7.6	<8.7	<5.2		6.7	48.0	89.0
Acenaphthylene	ug/kg	4.44	<4.0	<2.8	<6.6	<4.0	<5.0	<6.2	<2.9	<7.6	<8.7	9.6		5.9	67.0	128.0
Anthracene	ug/kg	<4.6	<4.4	<3.1	<7.2	<4.4	<5.5	<6.8	7.81	<8.3	<9.6	14.9		57.2	451.0	845.0
Benzo(a)anthracene	ug/kg	10.6	14.1	<2.8	26.1	<4.0	<5.0	<6.2	<2.9	12.7	36.7	<5.2		108.0	579.0	1,050.0
Benzo(a)pyrene	ug/kg	8.51	9.16	<2.6	19.8	<3.6	7.98	<5.6	<2.6	<6.8	28	<4.6		150.0	800.0	1,450.0
Benzo(b)fluoranthene	ug/kg	22.4	25.4	<2.8	43.6	8.85	15.7	14.1	7.97	30.6	86.8	21.3		240.0	6,820.0	13,400.0
Benzo(e)pyrene	ug/kg	12.4	12	<2.6	21.9	<3.6	9.43	8.14	<2.6	39.5	39.8	21.1		240.0	6,820.0	13,400.0
Benzo(g,h,i)perylene	ug/kg	12.7	13.2	<3.4	20.2	<4.8	<6.0	<7.4	<3.5	<9.1	36.4	<6.2		170.0	1,685.0	3,200.0
Benzo(k)fluoranthene	ug/kg	9.28	8.62	<2.8	12.8	<4.0	5.6	<6.2	<2.9	<7.6	31.8	<5.2		240.0	6,820.0	13,400.0
Chrysene	ug/kg	18.1	20.7	<2.8	35.8	8.38	14	13	7.66	26.5	58.7	16.5		166.0	728.0	1,290.0
Dibenzo(a,h)anthracene	ug/kg	<5.0	<4.8	<3.4	<7.9	<4.8	<6.0	<7.4	<3.5	<9.1	43.5	<6.2		33.0	84.0	135.0
Fluoranthene	ug/kg	64.2	38.9	<2.8	81.5	34.7	43.8	46.9	40.3	97.6	120	75.6		423.0	1,327.0	2,230.0
Fluorene	ug/kg	42	21.7	4.15	30.9	32.6	26.1	40.2	51.1	<6.8	56.8	79.8		77.4	307.0	536.0
Indeno(1,2,3-cd)pyrene	ug/kg	15.3	15.6	<3.4	20.8	<4.8	<6.0	<7.4	<3.5	<9.1	42	<6.2		200.0	1,700.0	3,200.0
Naphthalene	ug/kg	29	15.9	<2.8	22.8	18.3	19.5	31.4	26.8	68.4	48.1	63		176.0	369.0	561.0
Phenanthrene	ug/kg	65.8	35.4	4.77	63.7	44.8	41.6	56.2	63.6	115	95.3	105		204.0	687.0	1,170.0
Pyrene	ug/kg	33.7	28.6	<2.6	51.5	16.3	27.7	20	17.5	44.2	67.4	32.7		195.0	858.0	1,520.0
PCBs																
Aroclor-1016	mg/kg		<0.068			<0.067				<0.13						
Aroclor-1221	mg/kg		<0.11			<0.11				<0.21						
Aroclor-1232	mg/kg		<0.044			<0.043				<0.083						
Aroclor-1242	mg/kg		<0.040			<0.040				<0.076						
Aroclor-1248	mg/kg		<0.056			<0.055				<0.11						
Aroclor-1254	mg/kg		<0.072			<0.071				<0.14						
Aroclor-1260	mg/kg		<0.044			<0.043				<0.083						
												Total PCBs		60.0	368.0	676.0
Effluent Elutriate Test																
(after 4 hours)																
Total Arsenic	ug/L		62.9					26.4			42.0					
Total Suspended Solids (TSS)	mg/L		1,300					600			950					
Ammonia Nitrogen Total	mg/L		0.45					0.24			0.6			1.0		
(after 24 hours)																
Total Arsenic	ug/L		58.4					25.6			39.7					
Total Suspended Solids (TSS)	mg/L		460					230			460					
Ammonia Nitrogen Total	mg/L		0.51					0.23			0.68			1.0		

g. Copy of a map showing the area to be dredged, the depth of cut, the specific location of the proposed sediment sampling sites and the bathymetry of the area to be dredged,

Various maps are provided below in figures 9 through 13 that show bathymetry, sediment thickness and completed sediment core sampling sites, and representative cross sections that show the area to be dredged and the proposed dredge cut depth. The completed sediment sampling sites were based on the DNR approved core sampling plan and specific analysis requirements as described in Section f. The maximum dredging depth is proposed to be 7.0 feet, or until a hard, underlying lake bottom layer is reached. No dredging will occur within 20 feet of the shoreline and no closer than 10 feet from any existing pier or dock. In addition, per WDNR recommendations during initial discussions, the Final Restoration Plan will include various aquatic habitat enhancements to provide improved fish habitat and spawning conditions due to the significant habitat and water quality impacts from the extensive layer of soft marl sediment that has been re-mobilized and re-distributed throughout Browns Lake.

Figure 9. Proposed Dredging Areas and Cross Section Transects

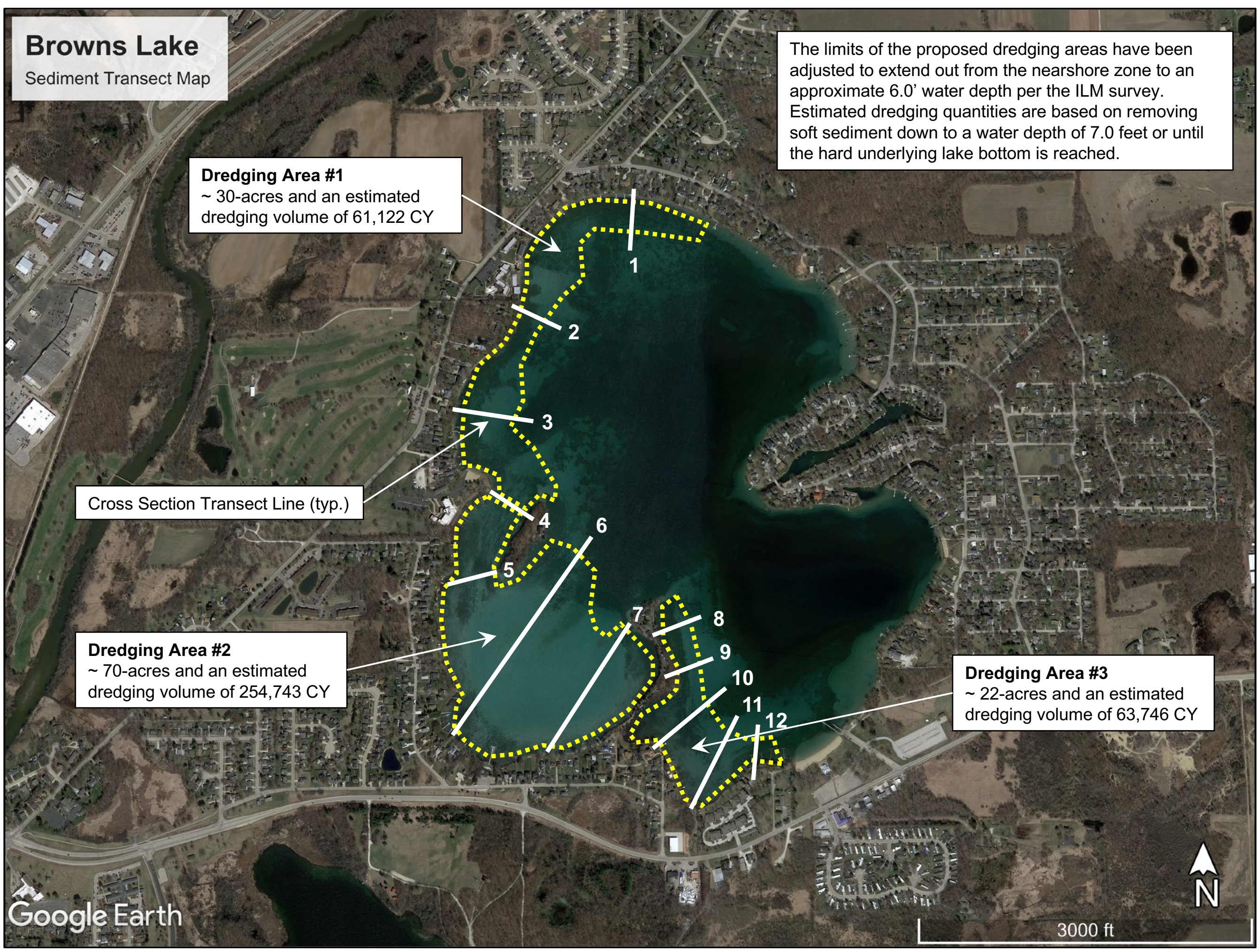


Figure 10. Sediment Core Sample Location Map

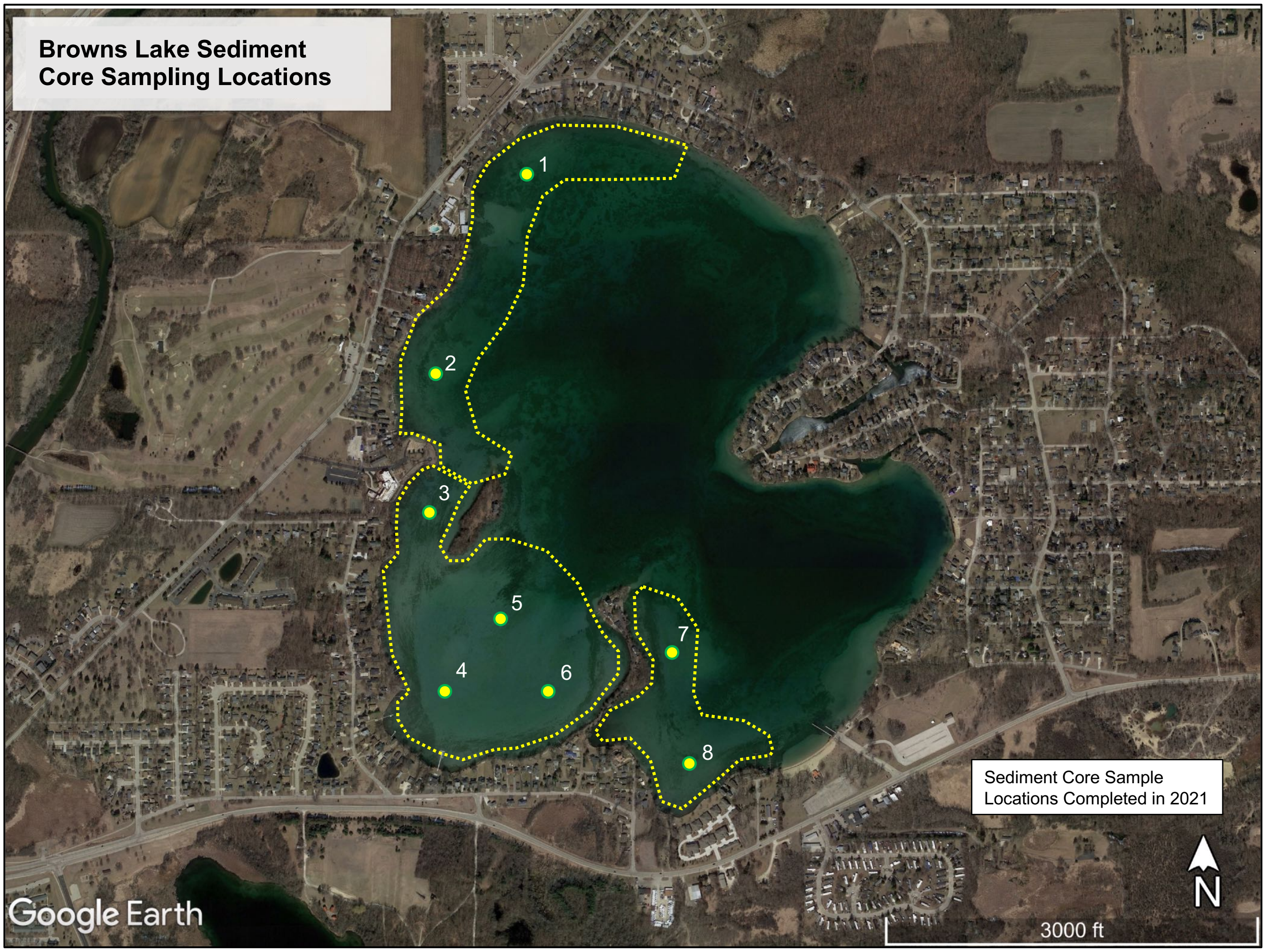


Figure 11. Browns Lake Bathymetric Map (ILM, 2021)

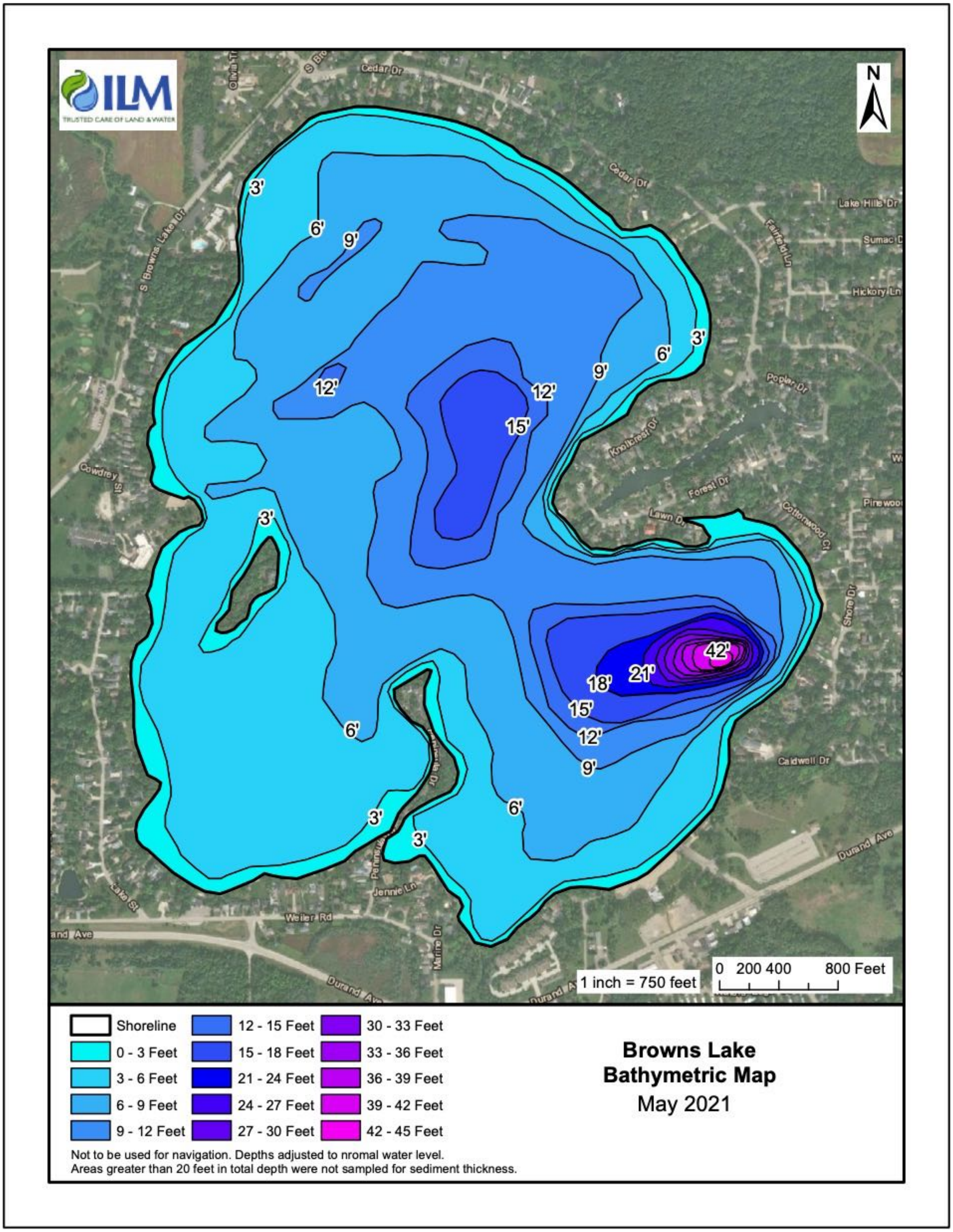


Figure 12. Browns Lake Sediment Thickness Map (ILM, 2021)

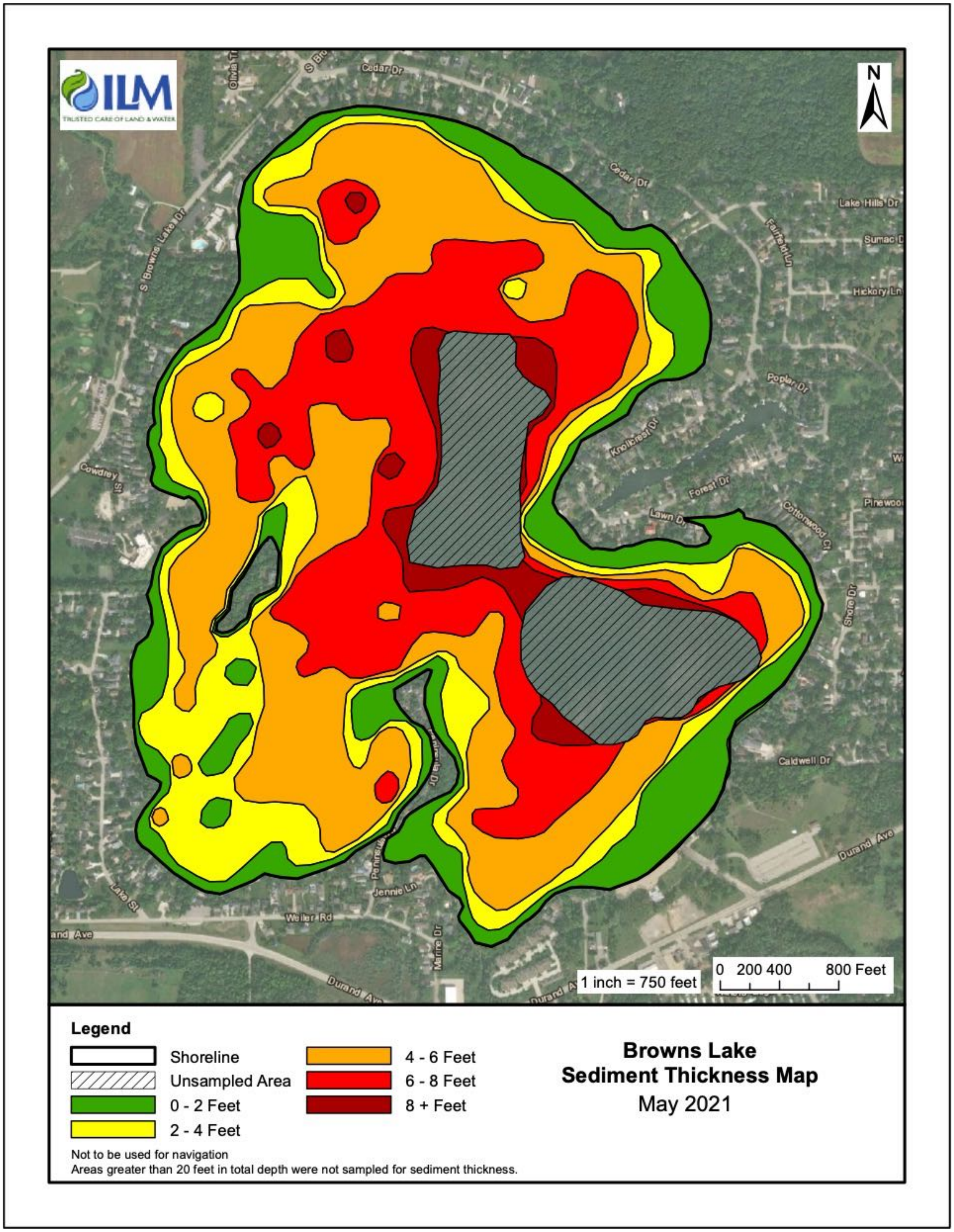
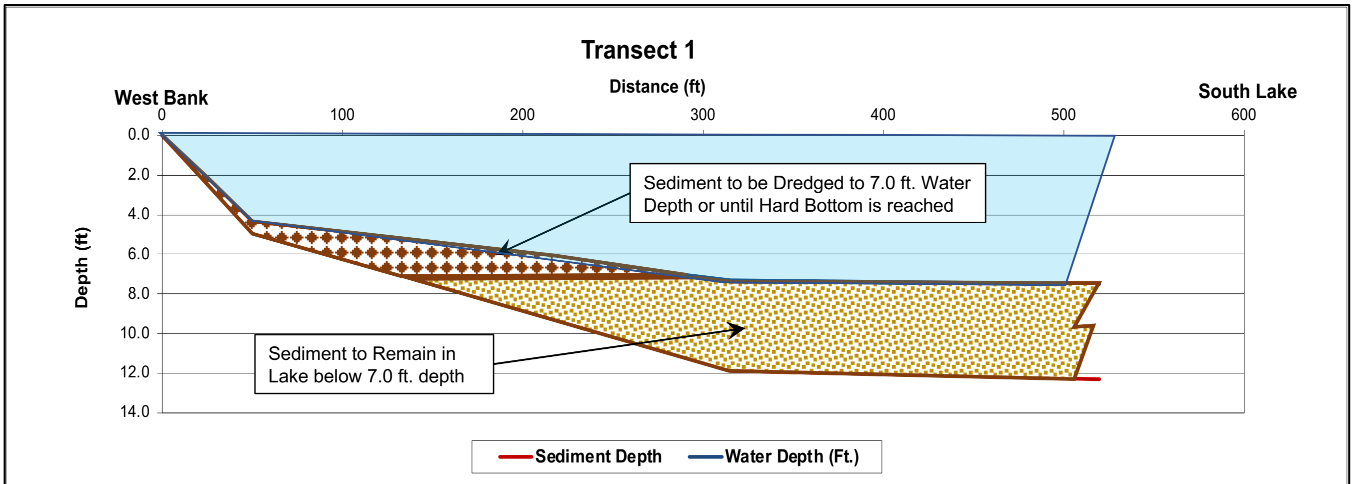
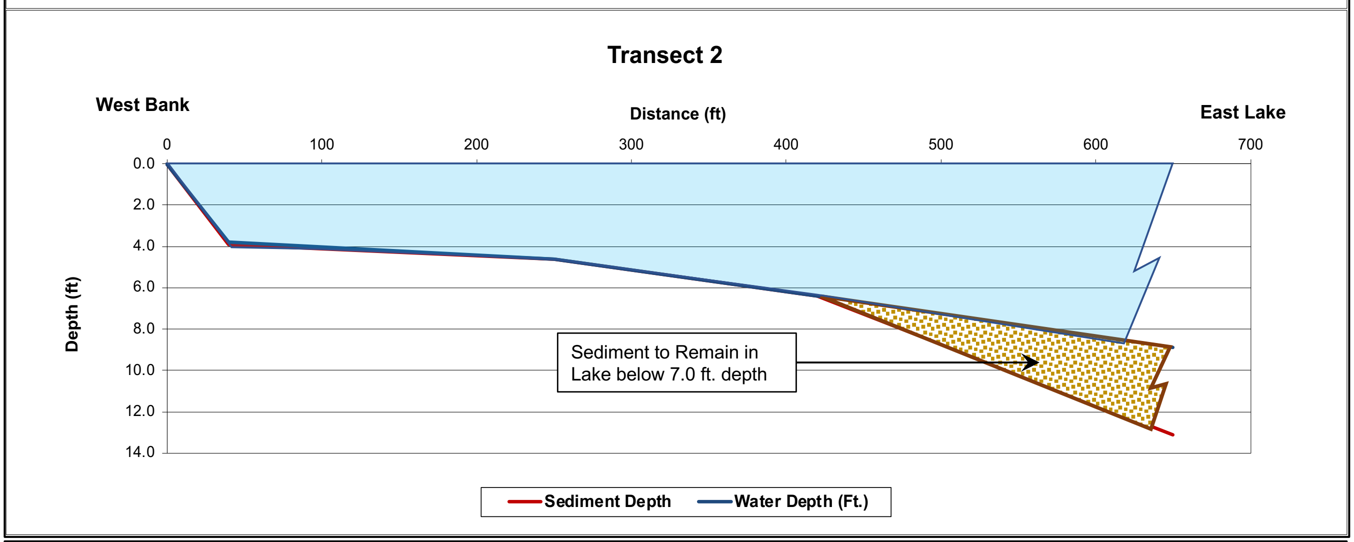
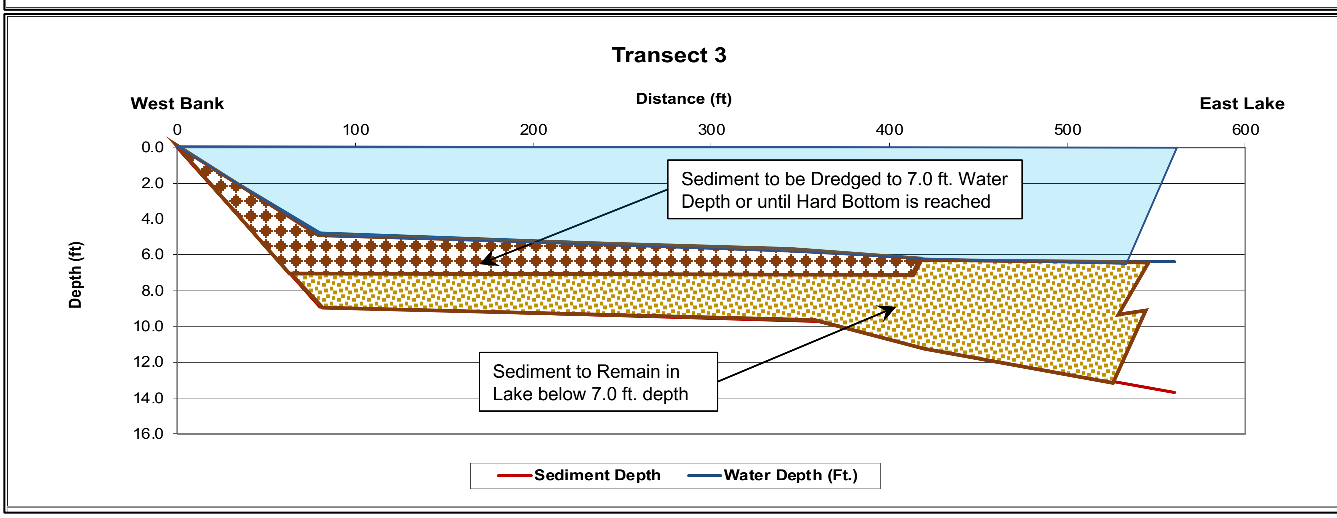
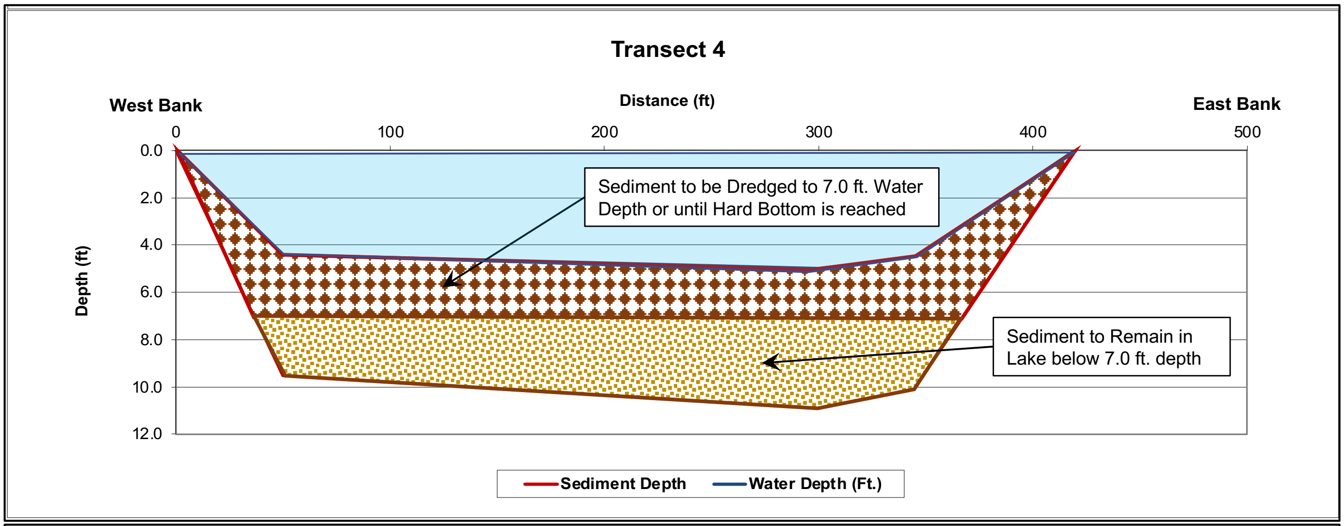


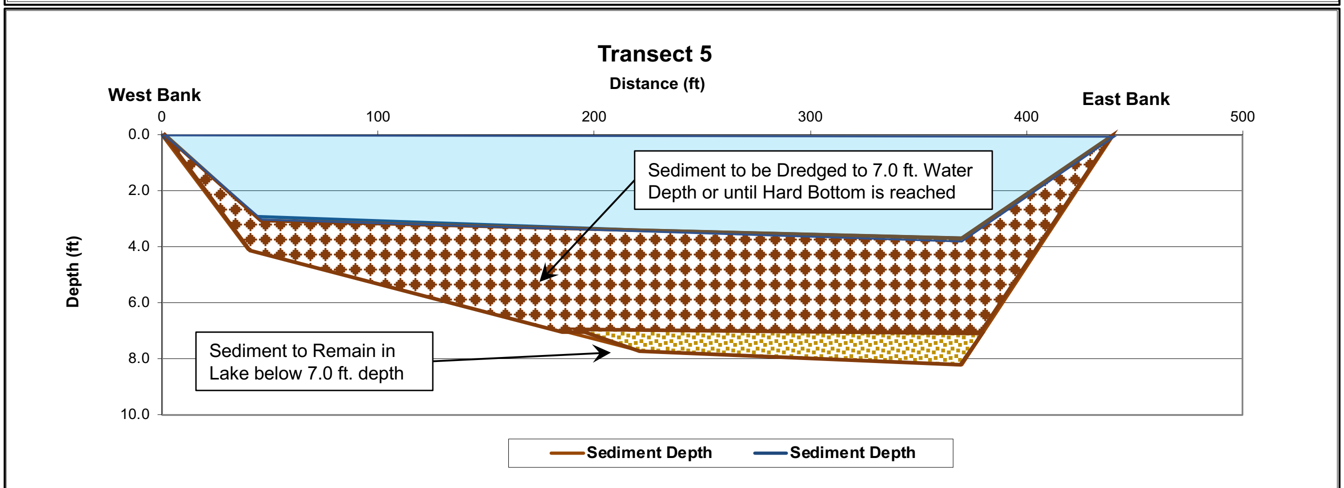
Figure 13. Representative Lake Cross Sections (Transects 1 through 12)

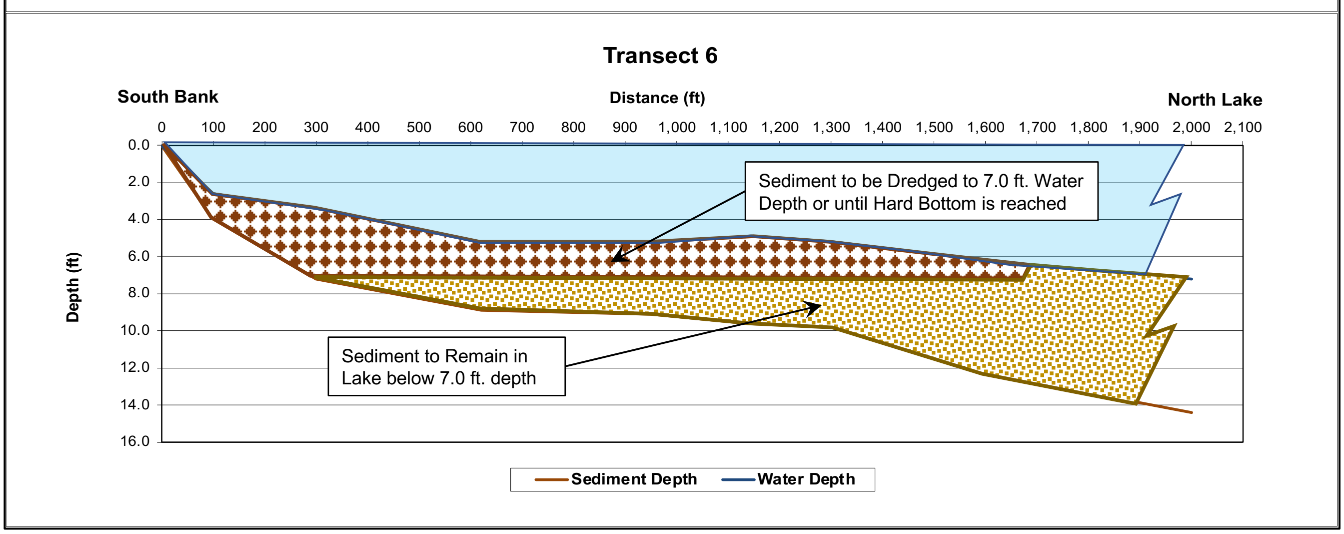


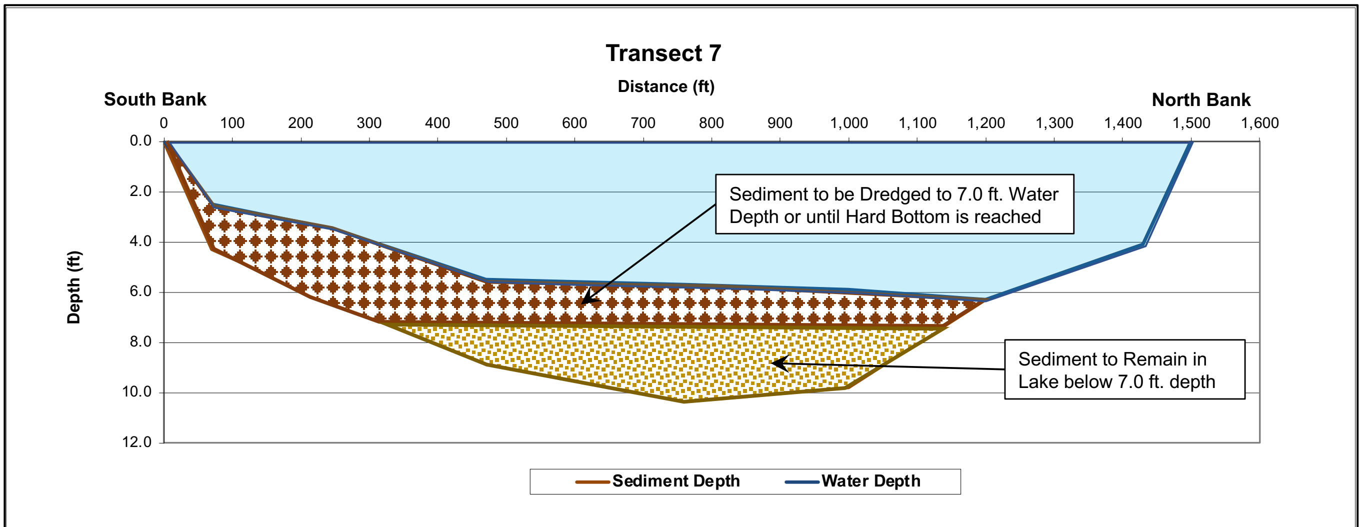


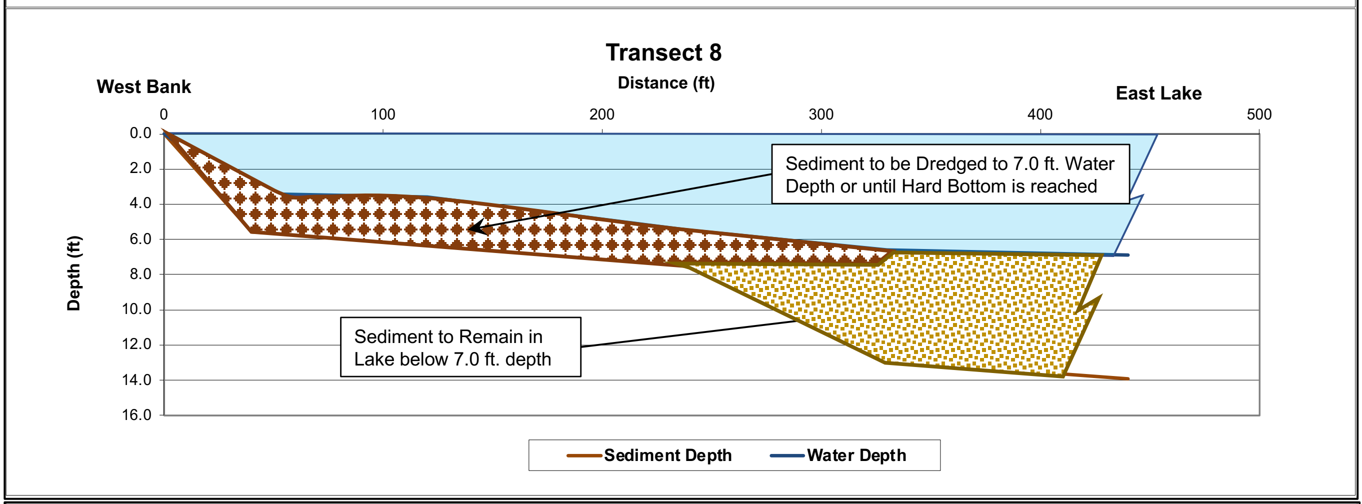


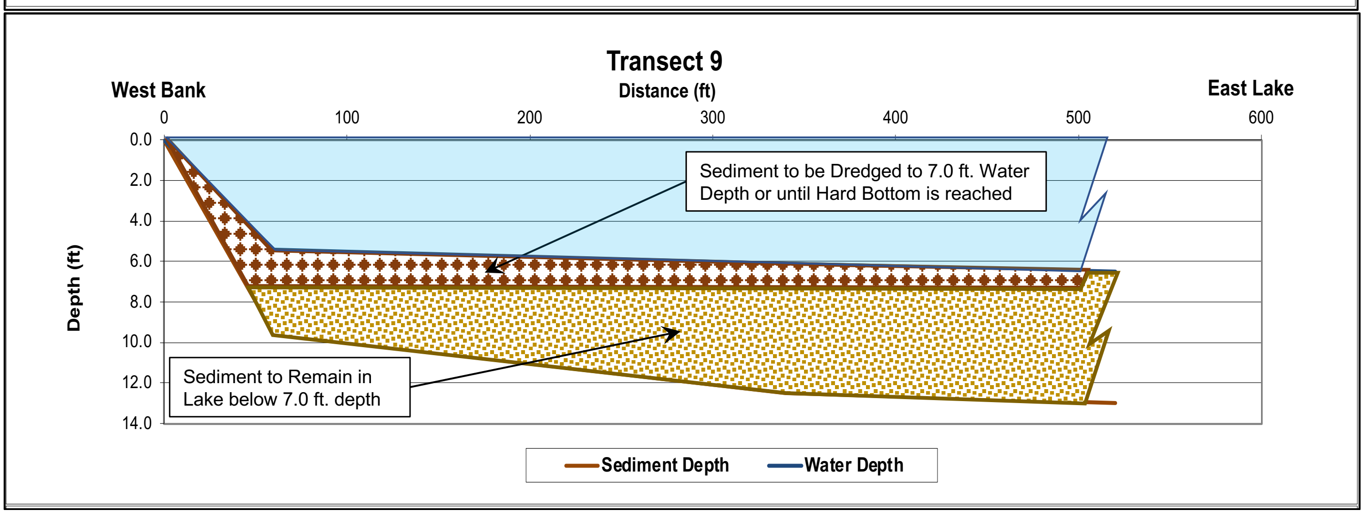

Transect 4
West Bank
Distance (ft)
East Bank
0
100
200
300
400
500
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Depth (ft)
Sediment to be Dredged to 7.0 ft. Water Depth or until Hard Bottom is reached
Sediment to Remain in Lake below 7.0 ft. depth
Sediment Depth
Water Depth (Ft.)

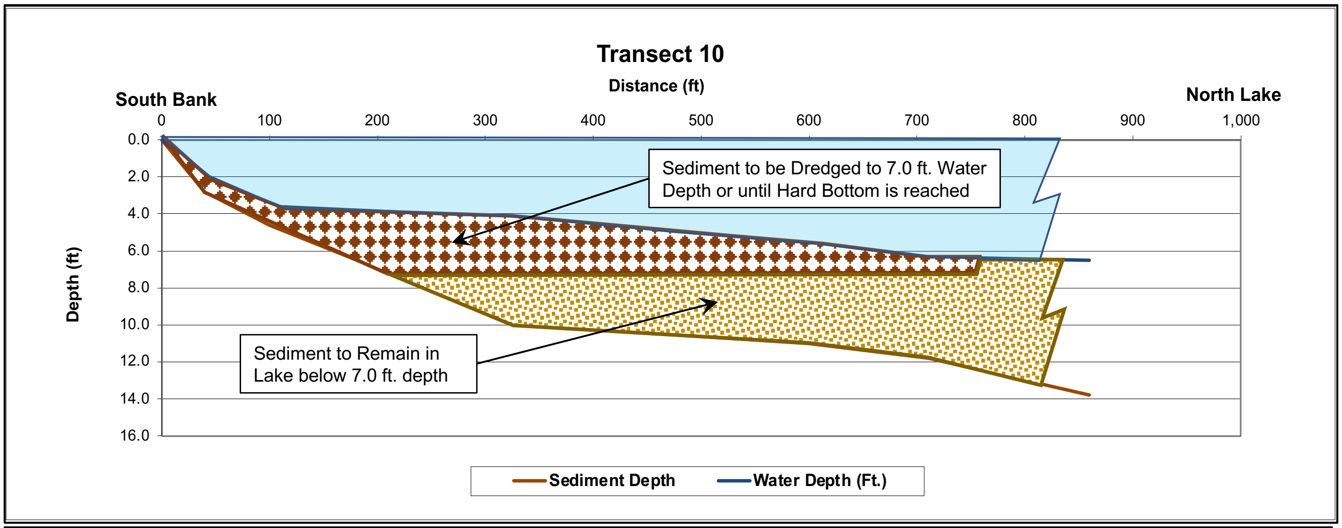

Transect 5
Distance (ft)
West Bank
East Bank
0
100
200
300
400
500
0.0
2.0
4.0
6.0
8.0
10.0
Depth (ft)
Sediment to be Dredged to 7.0 ft. Water Depth or until Hard Bottom is reached
Sediment to Remain in Lake below 7.0 ft. depth
Sediment Depth
Sediment Depth

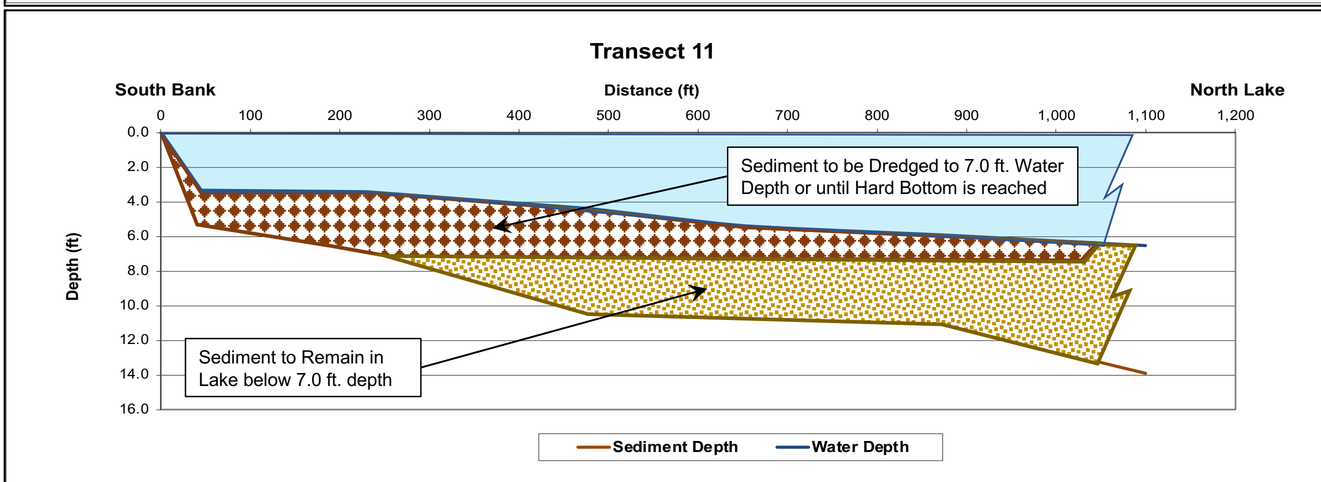

Transect 6
South Bank
Distance (ft)
North Lake
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
1,500
1,600
1,700
1,800
1,900
2,000
2,100
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Depth (ft)
Sediment to be Dredged to 7.0 ft. Water Depth or until Hard Bottom is reached
Sediment to Remain in Lake below 7.0 ft. depth
Sediment Depth
Water Depth

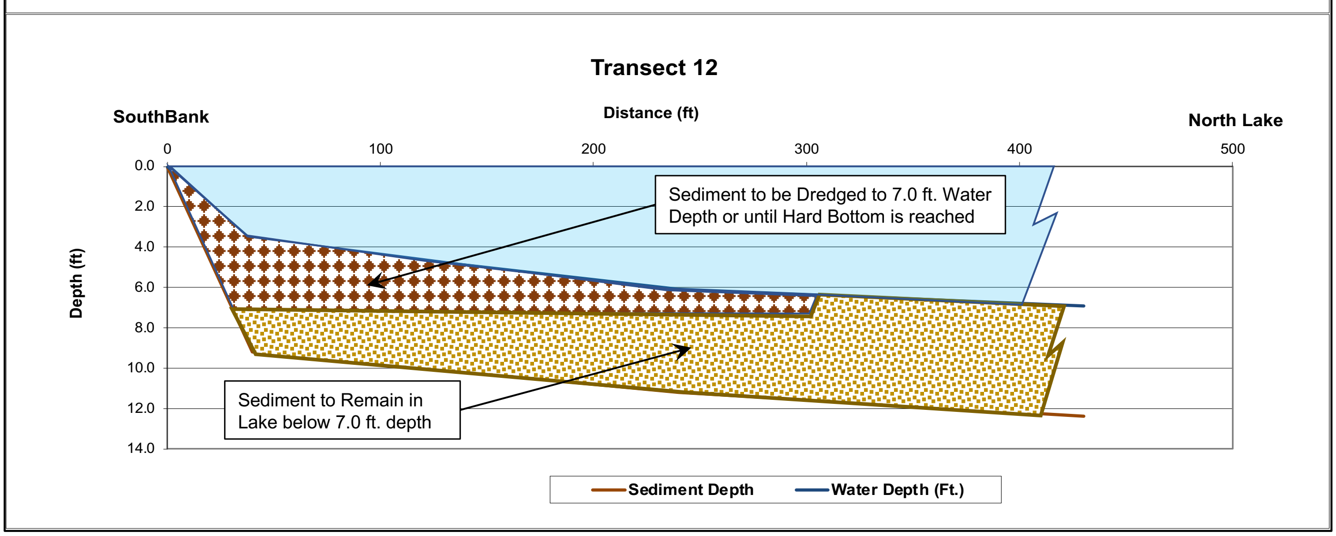

Transect 7
Distance (ft)
South Bank
North Bank
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
1,500
1,600
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Depth (ft)
Sediment to be Dredged to 7.0 ft. Water Depth or until Hard Bottom is reached
Sediment to Remain in Lake below 7.0 ft. depth
Sediment Depth
Water Depth


Transect 8
Distance (ft)
West Bank
East Lake
0
100
200
300
400
500
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Depth (ft)
Sediment to be Dredged to 7.0 ft. Water Depth or until Hard Bottom is reached
Sediment to Remain in Lake below 7.0 ft. depth
Sediment Depth
Water Depth


Transect 9
Distance (ft)
West Bank
East Lake
0
100
200
300
400
500
600
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Depth (ft)
Sediment to be Dredged to 7.0 ft. Water Depth or until Hard Bottom is reached
Sediment to Remain in Lake below 7.0 ft. depth
Sediment Depth
Water Depth


Transect 10
Distance (ft)
South Bank
North Lake
0
100
200
300
400
500
600
700
800
900
1,000
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Depth (ft)
Sediment to be Dredged to 7.0 ft. Water Depth or until Hard Bottom is reached
Sediment to Remain in Lake below 7.0 ft. depth
Sediment Depth
Water Depth (Ft.)


Transect 11
South Bank
Distance (ft)
North Lake
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Depth (ft)
Sediment to be Dredged to 7.0 ft. Water Depth or until Hard Bottom is reached
Sediment to Remain in Lake below 7.0 ft. depth
Sediment Depth
Water Depth


Transect 12
SouthBank
Distance (ft)
North Lake
0
100
200
300
400
500
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Depth (ft)
Sediment to be Dredged to 7.0 ft. Water Depth or until Hard Bottom is reached
Sediment to Remain in Lake below 7.0 ft. depth
Sediment Depth
Water Depth (Ft.)

h. Anticipated starting and completion dates of the proposed project.

The anticipated starting and completion dates would include initial sediment storage and dewatering site preparation during late summer/fall of 2023 with dredging beginning in Spring of 2024. Since the dewatered sediment-derived soil will have to be periodically moved to adjacent areas of the dewatering facility limits, the dredging work will likely be completed over a two-season period with completion anticipated by Fall 2025. Additionally, since regional groundwater levels seasonally become lower in late summer and directly coincide with lake levels, the dredging work may be affected if low lake levels become problematic for dredging equipment access and overall lake use.

If you have any questions or comments prior to submitting a response to the BLSD, please do not hesitate to contact me.

Sincerely,

Peter Berrini, P.G., CLP
Berrini & Associates, LLC
Pberrini@comcast.net
(217)-899-2153

Cc: Paul Naber, Browns Lake Sanitary District