CEDAR LAKE AQUATIC ECOSYSTEM RESTORATION FEASIBILITY STUDY

CEDAR LAKE, INDIANA

APPENDIX J
VALUE ENGINEERING STUDY

U.S. Army Corps of Engineers
Chicago District

July 2016

Memo

To:	USACE, Chicago District		
From:	Peter Berrini	Project:	Cedar Lake Ecosystem Restoration Feasibility Study
CC:	Cedar Lake Project Team		
Date:	July 19, 2013	Job No	214268

RE: Cedar Lake Ecosystem Restoration Feasibility Study

Sediment Placement VE Evaluation

A request was made by the USACE Chicago District for HDR to evaluate specific components of the Cedar Lake Ecosystem Restoration Feasibility Study for the purpose of verifying project costs related to dredging and effluent treatment. The specific components that have been prioritized for this Value Engineering effort include sediment placement and dewatering assumptions and alternatives; and to provide other recommendations as appropriate. The results of the 2007 Modified Sediment Elutriate Test indicated that effluent water quality compliance would require extensive water treatment. Therefore, estimated sediment storage, dewatering and treatment costs represented an unacceptably large percentage of the overall project costs.

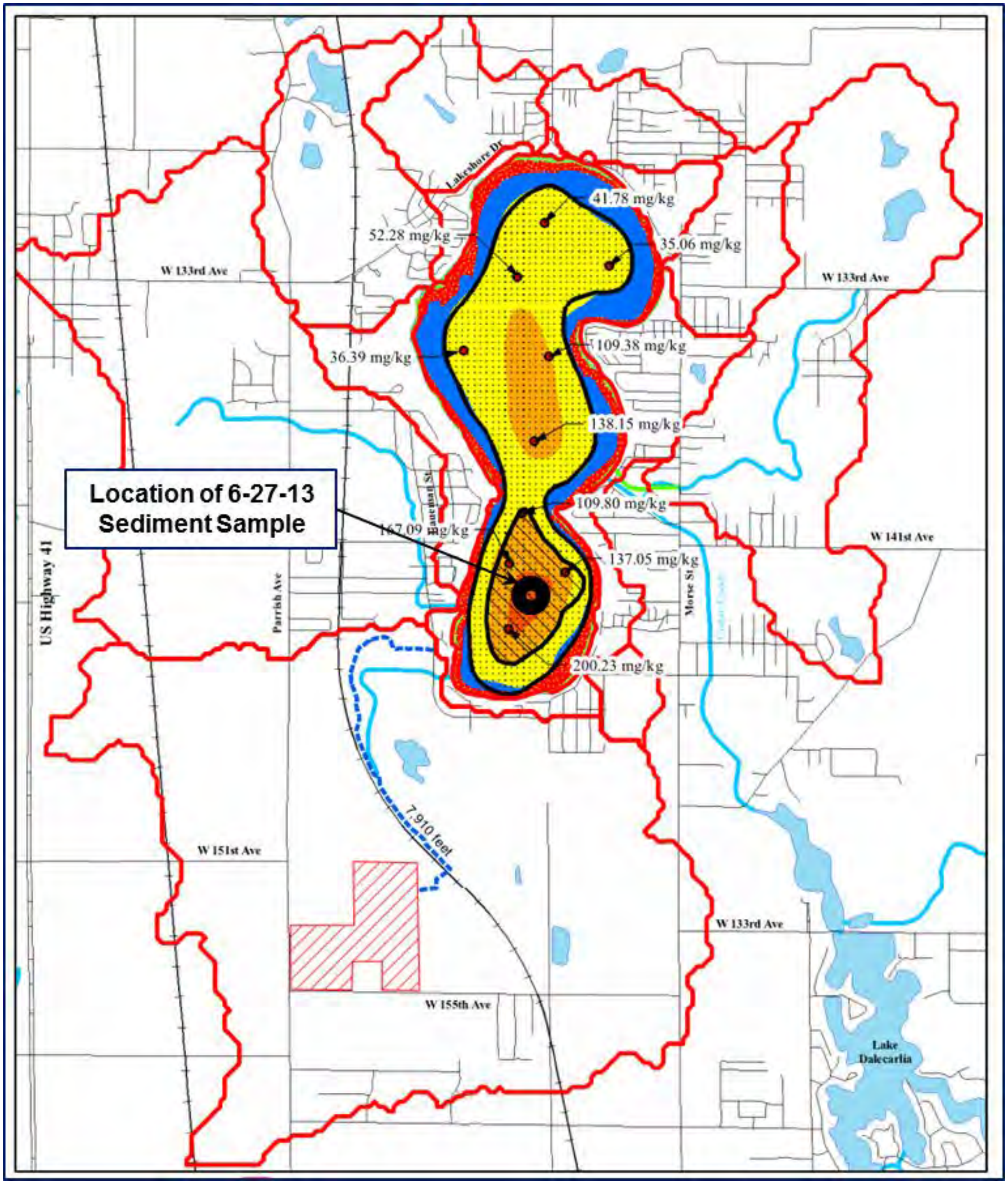
The USACE Project Team had proposed a cost reduction alternative that included removing the Dewatering portion, which consists of a package waste water treatment plant, deepen the existing Sediment Dewatering Facility (SDF) by approximately five (5) ft. to contain all the dredge water, then gradually land apply the excess water over a period of years to an adjacent farm. However, the Project team is looking at other ways to refine costs and requested that HDR assist with the following Scope of Work:

1. Evaluate assumptions for the sediment elutriate test, solids ratio.
2. Evaluate requirements for dam, environmental, and land application permitting.
3. Evaluate the feasibility of operating the facility ponded with gradual decanting of water to be applied to an adjacent site.
4. Provide additional recommendations as appropriate.

1. Evaluate Assumptions for the Sediment Elutriate Test, Solids Ratio

After reviewing the documents provided and discussing preliminary observations with members of the Project Team, HDR determined that a site visit was necessary in order to proceed with the evaluation. The results of the 2007 Elutriate test indicated that after 24 hours of settling, the supernatant water exhibited extremely high concentrations of total suspended solids (TSS), total phosphorus (TP) and ammonia nitrogen (NH_3) for the samples analyzed, particularly for the composited MU-4 samples located in the south end of the lake where the NER dredging area is located. The reported MU-4 elutriate concentrations were 89,200 mg/l for TSS, 18.6 mg/l for TP and 84.9 mg/l for NH_3, which are uncharacteristically high for supernatant analyses of similar lake sediment after 24 hours of settling. Therefore, the site visit included obtaining a sample of sediment and lake background water from the proposed NER dredging area for visual characterization and additional evaluation. HDR (Peter Berrini) met a USACE Project Team member (Joe Schulenberg) at Cedar Lake on June 27, 2013 and navigated via jon boat and GPS out to the approximate center point of the NER dredging area located at the south end of the lake (see Figure 1).

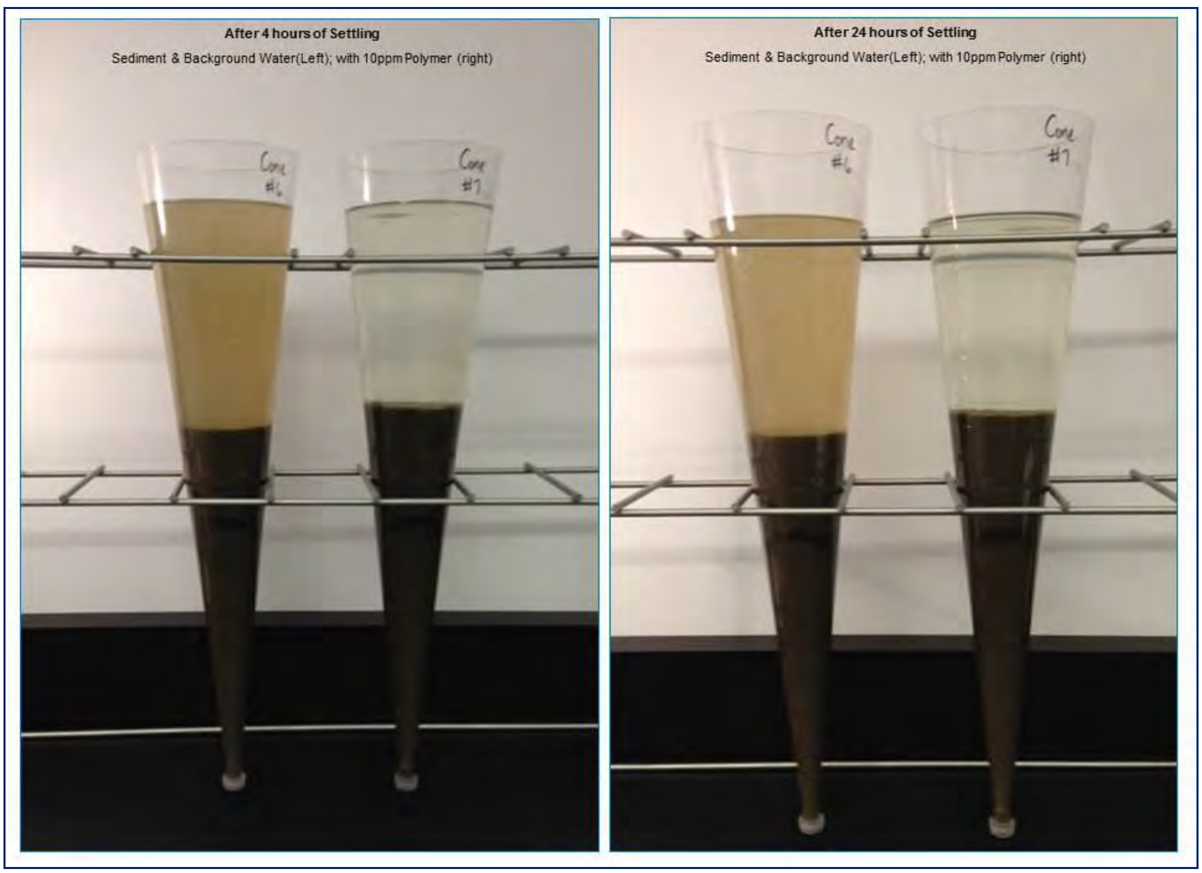
Figure 1. Location of 2013 Sediment Sample



A composite sediment sample was obtained from the upper 1.0 feet of the underlying sediment along with lake background water for the purpose of completing additional testing. The water depth at the sampling location was approximately 13.0 feet and the Secchi depth was 2.7 ft. at approximately 11:00 a.m. The upper two feet of in-situ lake sediment exhibited high water contents and extremely low bulk density, which corresponded with historical sediment core data indicating water contents in the 75 percent range. The sediment sample was immediately placed into glass jars and stored in a cooler for transport back to the HDR office in Springfield, IL for analysis.

HDR prepared a mixture or sediment and lake background water that approximated a of 15 to 20 percent solids slurry for placement into 1,000 ml Imhoff cones to complete a supernatant test for settleable solids (Standard Method 2540F; *note: this supernatant test is the standard material analysis method currently required by Illinois EPA for dredging permits*). The sediment water mixture was thoroughly mixed and aerated prior to subsequent placement into the Imhoff settling cone. Since it was anticipated that the supernatant water above the sediment water interface may remain somewhat elevated after 24 hours, a second 1,000 ml sediment-water slurry mixture was prepared with the addition of approximately 10 ppm of AquaMark AQ200 polymer, which is an environmentally acceptable cationic polymine that has been successfully used on past dredging projects. Once the mixtures were placed into the adjacent Imhoff cones (see Figure 2 below), supernatant samples were obtained after 4-hours and 24-hours by extracting a sufficient volume from the approximate mid-point between the top of the water and the sediment-water interface using a pipette without agitating the sediment.

Figure 2. Supernatant Settling Test Images



It was observed that a distinct sediment-water interface formed within the first 10 minutes of settling and that after 4 hours, the sediment had self consolidated such that the sediment-water interface was at the 300 ml level for sediment and lake water only, and 340 ml for the mixture with polymer. After 24 hours, the sediment-water interface had dropped to 290 ml and 320 ml respectively. The results of the supernatant analyses are listed below in Table 1. After 4 hours of settling, total suspended solids (TSS) was 132 mg/l for sediment and lake water only and 10 mg/l with polymer added; total phosphorus (TP) was 0.31 mg/l and 0.07 mg/l respectively; and ammonia-N (NH3) was observed to be approximately 14 mg/l and 10 mg/l respectively. After 24 hours of settling, total suspended solids (TSS) was 73 mg/l for sediment and lake water only and 7 mg/l with polymer added; total phosphorus (TP) was 0.22 mg/l and 0.06 mg/l respectively; and ammonia-N (NH3) was observed to be approximately 10 mg/l and 13 mg/l respectively.

Table 1. Solids Settling Test and Supernatant Analysis Results

Cedar Lake Sediment		Laboratory Analyst: Meghan Oh		
Solids Settling Test/ Supernatant Analysis		Samples Collected: 6/27/13		
Certificate of Analysis				
Sample 1 - Lake Water and Sediment				
Analyte	**Result (mg/L)**	**Reporting Limit**	**Method**	**Date Analyzed**
Sediment/ Water Interface- 4 hours	300 mL	200 mL	SM 2540 F	7/1/2013
Sediment/ Water Interface- 24 hours	290 mL	200 mL	SM 2540 F	7/2/2013
TSS- 4 hours	132	2.0 mg/L	SM 2540 D	7/1/2013
TSS- 24 hours	73	2.0 mg/L	SM 2540 D	7/2/2013
NH_3-N- 4 hours	14*	0.06 mg/L	Hach 8038	7/1/2013
NH_3-N- 24 hours	14*	0.06 mg/L	Hach 8038	7/2/2013
Total Phosphorus- 4 hours	0.31	0.01 mg/L as P	365.2	7/1/2013
Total Phosphorus- 24 hours	0.22	0.01 mg/L as P	365.2	7/2/2013
Sample 2 - Lake Water and Sediment with Polymer Added				
Analyte	**Result (mg/L)**	**Reporting Limit**	**Method**	**Date Analyzed**
Sediment/ Water Interface- 4 hours	340 mL	200 mL	SM 2540 F	7/1/2013
Sediment/ Water Interface- 24 hours	320 mL	200 mL	SM 2540 F	7/2/2013
TSS- 4 hours	10	2.0 mg/L	SM 2540 D	7/1/2013
TSS- 24 hours	7	2.0 mg/L	SM 2540 D	7/2/2013
NH_3-N- 4 hours	10*	0.06 mg/L	Hach 8038	7/1/2013
NH_3-N- 24 hours	13*	0.06 mg/L	Hach 8038	7/2/2013
Total Phosphorus- 4 hours	0.07	0.01 mg/L as P	365.2	7/1/2013
Total Phosphorus- 24 hours	0.06	0.01 mg/L as P	365.2	7/2/2013
*Results were estimated using expired reagents due to time constraints				
Hach NH3 test strips were used and ~15 mg/l result was observed				
Sediment and lake background water was obtained from center of south lake dredging area (NER Plan)				

Although ammonia-N was relatively high compared to results for TSS and TP, all observed results were significantly lower than the values presented in the 2007 Elutriate Test results. The lake sediment targeted for dredging appears to settle at a predictable rate within a quiescent water column and the sediment-water interface develops rapidly and self consolidated to approximately 30 percent of the overall slurry volume within four hours of gravity based settling. The addition of a cationic polymer accelerates the settling process and appears to precipitate phosphorus out of the water column, which is typical. Ammonia-N remains somewhat elevated and will require some level of treatment and subsequent conversion to non-toxic forms of nitrogen.

2. Evaluate Requirements for Dam, Environmental, and Land Application Permitting

Based on the information provided regarding the proposed sediment dewatering facility location and the geotechnical borings completed, there appears to be ample space available to provide sediment storage and associated dewatering and water treatment options necessary to achieve regulatory compliance. The approximate 100 acre upland agricultural site contains in excess of 10 feet of cohesive silty clay loam soils throughout most of the site, which are excellent for earthen embankment construction. The layout of the available land and the gently sloping to level topography is ideal for a multi-cell configuration that would optimize solids storage and on-site water treatment alternatives. Land application alternatives were determined to be unnecessary based on additional discussion. However, beneficial uses for the dewatered sediment after dewatering may be a viable alternative to evaluate further, particularly for spreading in thin layers on existing agricultural ground. Soil fertility tests of the lake sediment are recommended to confirm beneficial use potential based on the high nutrient content and visible organic matter present in the sampled sediment.

3. Evaluate the Feasibility of Operating the Facility Ponded with Gradual Decanting of Water to be Applied to an Adjacent Site

It was previously assumed that effluent water could not be discharged from the site based on the 2007 Elutriate Test results, which exhibited extremely high concentrations of suspended solids, phosphorus and ammonia nitrogen. This task appears a closer look based on observations made during the supernatant settling test, which demonstrate that suspended solids and phosphorus can be effectively removing by gravity settling and the introduction of a cationic polymer. It is my opinion that elevated levels of ammonia-N (NH3) can be removed or reduced to regulatory compliance levels by implementing various onsite alternatives implemented into the SDF design and should be further evaluated during the project design phase.

4. Provide any Other Recommendations to meet the Requirements of Reducing the Overall Project Cost

Additional sediment testing has demonstrated that suspended solids and phosphorus can be removed by gravity settling and the introduction of low concentrations of polymer into the sediment and water slurry being pumped into the SDF. The introduction of 10 to 20 ppm of cationic polymer into the influent dredge slurry being pumped into the SDF would cost approximately $40,000 to $60,000 based on dredging 140,000 cubic yards of sediment from Cedar Lake. Designing a multi-cell configuration for the SDF will allow for the effective removal of suspended solids and phosphorus by incorporating long weir crest length(s) (> 12 ft.) into the water control structure(s) that are capable of skimming the top one or two inches of the supernatant water from the initial primary solids storage cell and subsequent secondary treatment cells. In addition to the multi-cell flow through cell configuration, interior baffle or diversion dikes should be implemented to minimize short circuiting and to increase hydraulic retention time prior to eventual discharge.

The observed ammonia-N concentrations were elevated (~15 mg/l) after 24 hours. However, the observed concentrations were significantly lower than the ammonia-N concentration documented in the 2007 Elutriate Test (~84.9 mg/l). Therefore, it appears highly feasible to incorporate a combination of ammonia removal and or reduction alternatives into the SDF design since sufficient land area is available for a multi-cell configuration. Once suspended solids and phosphorus are removed and isolated within the initial primary storage cell (~50 acres +/-), the initial decant water would be routed into a series of 10 to 20 acre “treatment” cells that would utilize a combination of ammonia reduction alternatives to achieve IDEM regulatory compliance for discharging the effluent water from the final treatment cell of the SDF in lieu of the water treatment methods proposed in the NER plan. These alternatives could include, but would not be limited to, compressed air and/or fountain aeration; constructed wetland components utilizing vegetation and biological productivity for nutrient removal; rock and earthen riffles with alternating pools; sand and rock (gravel) filtration; dilution; etc. and would be specifically determined during the design phase.

USACE investigated various wastewater treatment methods used for ammonia removal. The most common technologies used for this application included ammonia air stripping, selective ion exchange, biological treatment via nitrification-denitrification, constructed wetlands, and breakpoint chlorination.

The calculations generated by USACE in the Draft Report provided appear to be appropriate and correct for the assumptions that were made based on available data. However, based on the recent observations of how the targeted lake sediment will behave during a gravity based settling test scenario, it is certain that a significant percentage of the cost estimate for “Dewatering” can be reduced due to the significantly lower concentrations anticipated to require treatment. As summarized above, a significant percentage of the solids and phosphorus contained with the dredged slurry can be effectively removed within the initial storage cell of the SDF. The remaining elevated levels of ammonia-N can be effectively removed within the remainder of the multi-cell sediment storage and dewatering facility (SDF) by incorporating a combination of physical and biological alternatives designed to remove and/or convert ammonia-N into non-toxic forms of nitrogen prior to discharge as effluent return water. During the design phase and prior to final design and permitting, additional sediment testing and characterization should be completed and direct communication with Indiana DEM regarding effluent testing and compliance requirements should ensue, particularly with regards to the sediment settling observations and supernatant analytical results obtained during this evaluation.

If you have any questions or need additional information regarding the above summary, please feel free to contact me.

Sincerely,

Peter Berrini, P.G., CLP

peter.berrini@hdrinc.com

DoD SERVICE: USACE
CONTROL NO: CELRC-VE-2009-001-CW
VALUE PROGRAM MANAGER: Leslie C Bush

Value Engineering Study on the

Cedar Lake, Indiana Aquatic Ecosystem Restoration Feasibility Study

Held at: U.S. Army Engineering District, Chicago Chicago, Illinois

27 through 28 January 2009

VALUE ENGINEERING STUDY TEAM LEADER: Jeffrey Zuercher
Civil Engineer, U.S. Army Corps of Engineers (USACE), Chicago District

	VALUE ENGINEERING STUDY TEAM MEMBER
Kay Whitlock	Project Manager, Christopher B. Burke Engineering Limited (CBBEL)
Patrick Kelsey	Soil Scientist, CBBEL West
Sarah Wright	Environmental Resource Specialist, CBBEL
Barry Bunch	Research Civil Engineer, USACE, Engineer Research Development Center (ERDC)
Paul Schroeder	Research Civil Engineer, USACE, ERDC
Satch Damaraju	Cost Engineer, USACE, Chicago District

VALUE ENGINEERING TEAM STUDY

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VALUE ENGINEERING TEAM STUDY

PROJECT DESCRIPTION AND BACKGROUND

PROJECT TITLE: Cedar Lake, Indiana, Aquatic Ecosystem Restoration Feasibility Study

PROJECT LOCATION: Northwestern Indiana

Cedar Lake is a 781-acre, glacially formed lake located in the Town of Cedar Lake, in Lake County, Indiana as shown on the Project Map. The study area is located in west central Lake County, Township 34 Range 9 West, Sections 22, 23, 26, 27, 34 and 35. It lays 4.5-miles southwest of Crown Point and forty miles southeast of Chicago. (United States) U.S. Route 41 (Wicker Street), Lake Shore Drive and Parrish Street, 133rd Avenue, Morse Street and Cline Avenue are the main streets surrounding the lake. Historically, Cedar Lake supported a biologically diverse ecosystem with native flora and fauna characteristic of glacial lakes. Since the late nineteenth century, alterations within the Cedar Lake watershed have caused major adverse impacts to Cedar Lakes' fringe wetland habitat, littoral zone habitat, lake-bottom substrate, and water quality. In the past 100 years, these changes have accelerated lacustrine succession, resulting in a shallower, more turbid, and less diverse lake ecosystem. Currently, the lake does not provide the ecosystem services it historically did, and restoration efforts are needed to improve and enhance habitat availability and diversity, improve substrate conditions, and protect water quality. These improvements will allow the lake to support a diverse aquatic community of native plants and fish species.

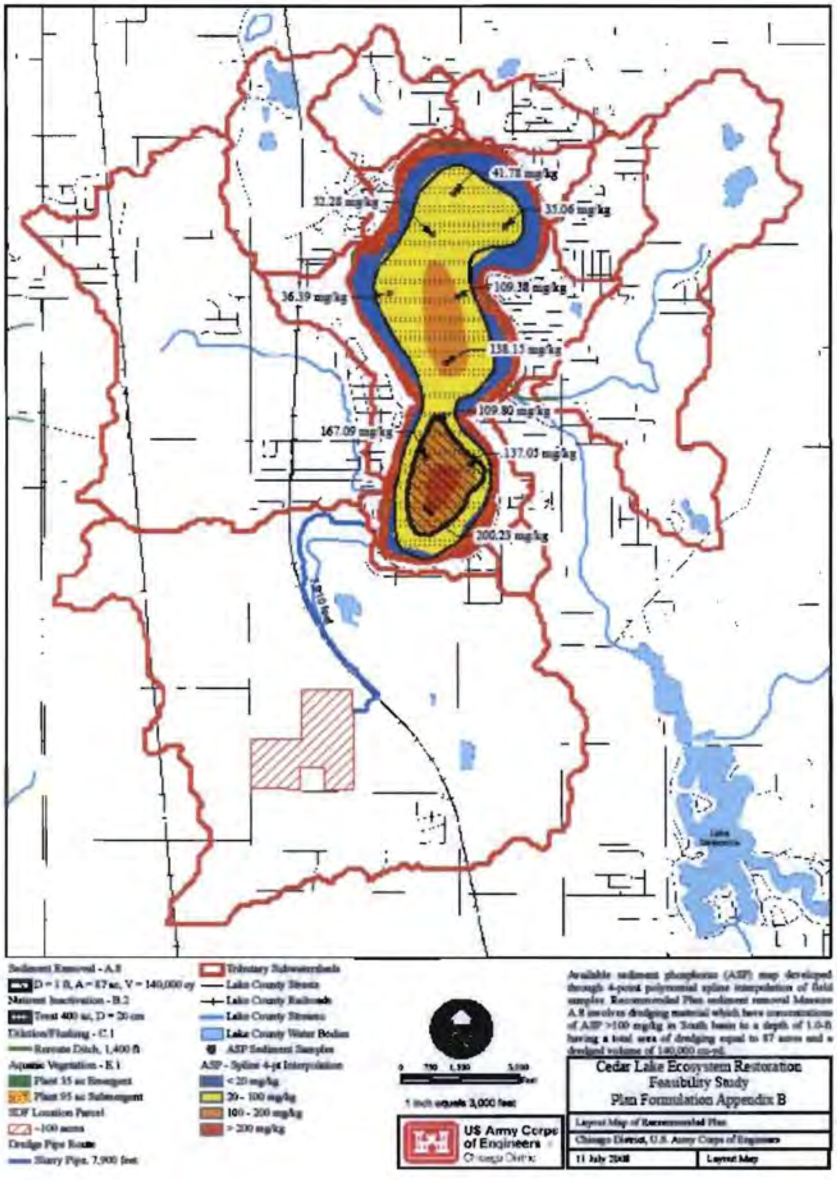
The Cedar Lake watershed is located within the Valparaiso Moraine and is characterized by distinct morainal topography. Since the 1800s, Cedar Lake has been described in numerous accounts, including reports of early surveyors, settlers, and explorers for natural resources (Large 1897, Indiana Academy of Science 1896, Blatchey 1900). Early accounts indicate that Cedar Lake was formed when the melt-water of retreating glaciers collected on clay deposits in a narrow valley. Processes that formed the lake created a relatively small and limited watershed covering about 7.6 square miles or 4,864 acres, with all but the southern portions of the lake confined by steep slopes. One significant exception to the steep slopes of the surrounding basin is the 400-acre Cedar Lake Marsh on the south end of the lake. Cedar Lake Marsh is the largest contiguous marsh in Indiana (Goodwin and Neiring 1975). Slightly less than half the entire Cedar Lake watershed drains into this marsh before reaching the lake (SPEA 1984). In addition to the marsh, two small riparian wetlands are associated with intermittent tributaries on the north end of the lake.

VALUE ENGINEERING TEAM STUDY

PROJECT MAP

PROJECT TITLE: Cedar Lake, Indiana, Aquatic Ecosystem Restoration Feasibility Study

PROJECT LOCATION: Northwestern Indiana

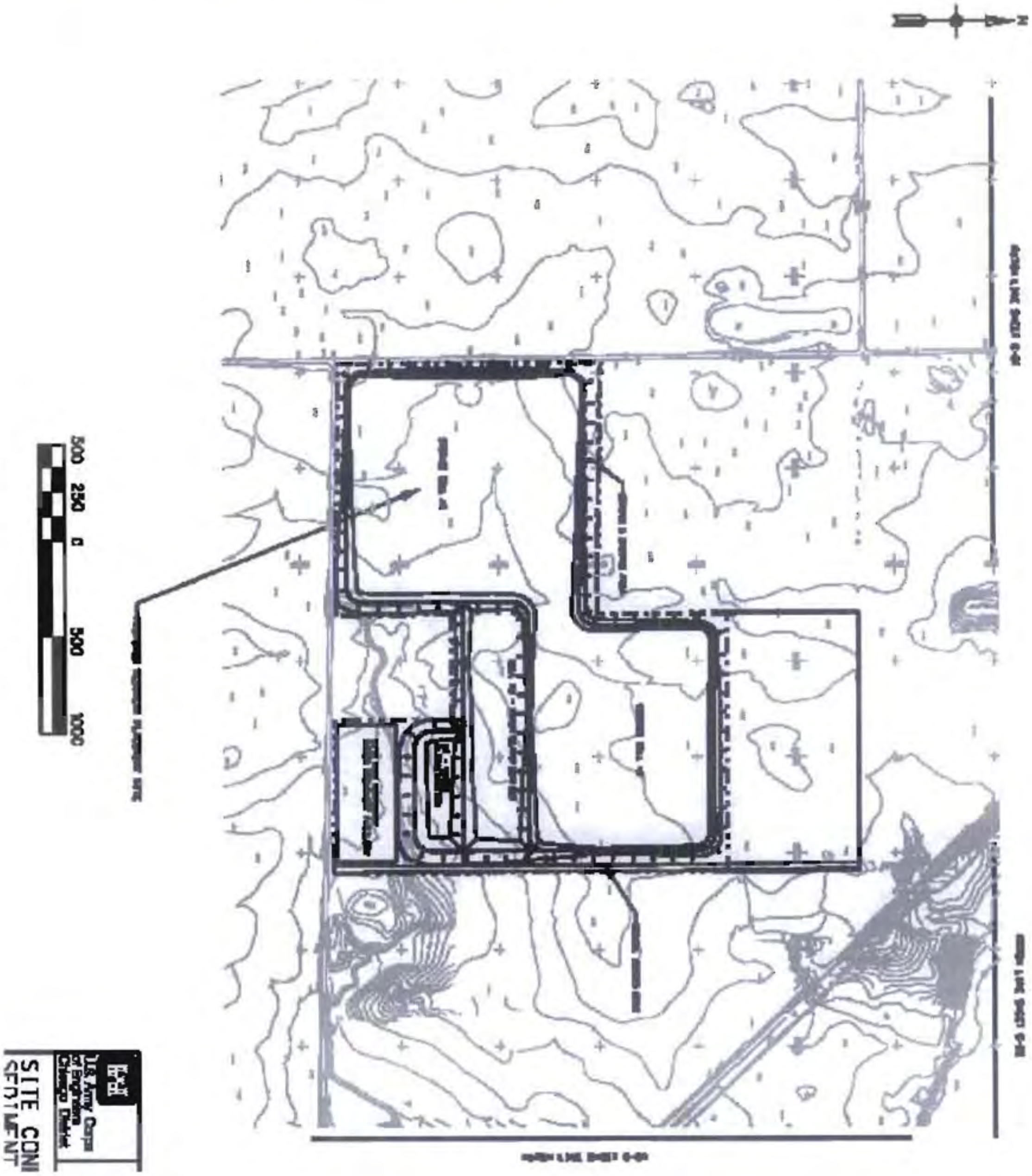


VALUE ENGINEERING TEAM STUDY

PROJECT SITE PLAN

PROJECT TITLE: Cedar Lake, Indiana, Aquatic Ecosystem Restoration Feasibility Study

PROJECT LOCATION: Northwestern Indiana



EXECUTIVE SUMMARY

Value Engineering (VE) is a process to study the functions of a project. It takes a critical look at how these functions are met and develops alternative ways to achieve the same function while increasing the value of the project. In the end, it is hoped that the project will realize a reduction in cost, but adding value over reducing cost is the focus of VE.

The VE Study was initiated during a VE workshop conducted at the U.S. Army Corps of Engineers Chicago District (CELRC) Office in Chicago, Illinois, during 27 through 28 January 2009. The study evaluated the Cedar Lake, Indiana, Feasibility Report and cost estimate prepared by CELRC. The VE Study team limited its focus to the dredging and disposal components of the project. The entire project will be reviewed during a subsequent VE Study to be performed during at the 35 percent plans and specifications completion milestone. The project was studied using the Corps of Engineers standard VE methodology, consisting of five phases:

Information Phase: The VE Study Team studied drawings, figures, descriptions of project work, and cost estimates to fully understand the work to be performed and the functions to be achieved. Cost Models were evaluated to determine areas of relative high cost to ensure that the team focused on those parts of the project that offered the most potential for cost savings (see Appendix B).

Speculation Phase: The VE Study Team speculated by conducting brainstorming sessions to generate ideas for alternative designs. All team members contributed ideas and critical analysis of the ideas was discouraged (see Appendix C).

Analysis Phase: Evaluation, testing and critical analysis of all ideas generated during speculation was performed to determine feasibility, potential for savings and possibilities for risk. Ideas were ranked by priority for development. Ideas that did not survive critical analysis were deleted (see Appendix C).

Development Phase: VE Study Team members developed the priority ideas into written proposals during an intensive technical development session. Proposal descriptions, along with sketches, technical support documentation, and cost estimates were prepared to support implementation of ideas. Additional VE Study Team Comments were included for items of interest that were not developed as proposals, and these comments follow the study proposals.

Presentation Phase: The published VE Study Report shall be distributed for review by project designers and decision makers. Proposal implementation decisions shall be determined through coordination of Chicago District design team decision makers.

VALUE ENGINEERING TEAM STUDY
SUMMARY OF RECOMMENDATIONS

Forty-six (46) ideas for ways to improve the project or reduce costs were generated during the Speculation Phase. The Analysis Phase reduced the ideas to ***seven*** proposals and three comments. All the ideas are presented in this report.

The ideas that became proposals offer specific revisions to project design and construction. Savings that can be realized from these proposals are not additive for because implementation of the proposals is dependent on the combination of proposals to be implemented. The following table itemizes each proposal and respective estimated savings.

Cost estimates were determined using cost information provided by the Chicago District personnel, VE Study Team members, and vendors. The estimated savings and/or proposal descriptions are to be used to aid in decision-making. Approved proposals from this VE Study shall be incorporated during the development of the project's plans and specifications. Savings from approved and implemented proposals from this VE Study and the subsequent VE Study for the entire project will be verified after contract award.

PROPOSAL NUMBER	RECOMMENDATION	POTENTIAL SAVINGS
C-1	Use High Solids / High Density Hydraulic Dredging	[redacted]
C-2	Replace Package Water Treatment Plant with a Temporary (or Permanent) Treatment Wetland	[redacted]
C-3	Optimize Use of Sediment Disposal Facility (SDF) Real Estate for Sediment Storage and Effluent Treatment	[redacted]
C-4	Promote Accelerated Infiltration at SDF	
C-4A	Use Wick Drains	[redacted]
C-4B	Use Underdrains	
C-5	Use Alternative Management Options to Minimize or Eliminate Water Treatment - Use Water for Agriculture or Other Irrigation	[redacted]
C-6	Dredge Every Other Year	

NOTE: A minus sign (i.e., "-") indicates additional initial project cost.

The current baseline estimated project cost is [redacted]

PROPOSALS

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-1 PAGE NO: 1 OF 2
DESCRIPTION: Use High Solids / High Density Hydraulic Dredging

ORIGINAL DESIGN:

Use mechanical dredging with hydraulic offloading with recirculation

PROPOSED CHANGE:

Use high solids / high density hydraulic dredge to dredge and transport sediment to SDF without recirculation

Consider using opportunities to dredge from a deeper hole, promoting surrounding sediment to settle into the depression, to maintain high density and to reduce resuspension in the water column.

NOTE: Addition of water to the dredging stream should be minimal considering the low solids concentration of the in-situ sediments thereby minimizing the quantity of carrier water required to transport the sediment to the SDF.

ADVANTAGES:

- Cost effective
- Higher production rates
- Reduced operation demands
- Reduced permitting concerns
- Reduced pumping requirements
- Eliminates extra pipeline (i.e., no return required)
- Minimizes culvert and railroad issues
- Less suspension in the water column during dredging
- No silt curtain requirement
- Reduces bulking
- Reduces staging area and SDF storage requirements

DISADVANTAGES:

- Possibly more water to treat
- Smaller pool of bidders
- Using a deeper hole will require more sediment sampling

VALUE ENGINEERING PROPOSAL

DESCRIPTION: Use High Solids / High Density Hydraulic Dredging

JUSTIFICATIONS:

- Save money (approximately 50 percent of dredging cost)
- Saves time

COST ESTIMATE WORKSHEET

PROPOSAL NO: C-1 PAGE NO: 3 OF 3

DELETIONS

ITEM	U/M	QTY	UNIT COST ($)	TOTAL ($)
Mechanical Dredging w/ Hydraulic Offloading Measure A4 w/ SDF				
Mob and Demob	LS	1	[redacted]	[redacted]
Dredge	LS	1	[redacted]	[redacted]
Hydraulic Offloading A4 w/ SDF				
Mob and Demob	LS	1	[redacted]	[redacted]
Hydraulic Offloading	LS	1	[redacted]	[redacted]
Water Treatment *(Prorated Reduced Volume Demand)*	LS	1	[redacted]	[redacted]
			SUBTOTAL:	[redacted]

ADDITIONS

ITEM	U/M	QTY	UNIT COST ($)	TOTAL ($)
HS/HD Hydraulic Dredging w/ Hydraulic Offloading Measure A4 w/ SDF				
Mob and Demob	LS	1	[redacted]	[redacted]
Dredge *(Assumed no effluent)*	CY	140,000	[redacted]	[redacted]
Hydraulic Offloading A4 w/ SDF				
Mob and Demob	LS	1	[redacted]	[redacted]
Hydraulic Offloading *(Assumed addition of water, equal in volume to 30% of fluid that comes with Mechanical Dredging, to make this material flowable in the hydraulic offloading method)*	LS	1	[redacted]	[redacted]
Water Treatment	LS	1	[redacted]	[redacted]
			SUBTOTAL:	[redacted]
SAVINGS				[redacted]
CONTINGENCIES 0% [*Included in unit costs*]				[redacted]
TOTAL SAVINGS				[redacted]

NOTE: The cost comparison is very preliminary and the final design would need to be submitted for quotes to truly determine the most cost effective alternative.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-2 PAGE NO: 1 OF 2
DESCRIPTION: Replace Package Water Treatment Plant with Temporary (or Permanent) Treatment Wetland

ORIGINAL DESIGN:

Use a Sediment Disposal Facility (SDF) with a package water treatment plant

PROPOSED CHANGE:

Construct a temporary (or permanent) wetland at the SDF to treat the dredge water

ADVANTAGES:

- Eliminates package treatment plant [redacted]
- Provides habitat enhancement
- Results in a more attractive alternative to permitting agencies
- Improves local social impact
- Provides a pilot treatment wetland

DISADVANTAGES:

- Requires more site preparation work (i.e., grading, plant establishment)
- Time is required for wetland plant establishment
- Increases need for insect management

JUSTIFICATIONS:

- The current effluent quality data is suspect.
- The real estate is available.

COST ESTIMATE WORKSHEET

PROPOSAL NO: C-2

DELETIONS

ITEM	U/M	QTY	UNIT COST ($)	TOTAL ($)
Water Treatment *(Prorated Reduced Volume Demand)*	LS	1	[redacted]	[redacted]
			SUBTOTAL:	[redacted]

ADDITIONS

ITEM	U/M	QTY	UNIT COST ($)	TOTAL ($)
Prepare Wetland Area for Water Treatment	AC	10	[redacted]	[redacted]
Plantings	AC	10	[redacted]	[redacted]
			SUBTOTAL:	[redacted]

SAVINGS	[redacted]
CONTINGENCIES 0% [*Included in unit costs*]	[redacted]
TOTAL SAVINGS	[redacted]

NOTE: The cost comparison is very preliminary and the final design would need to be submitted for quotes to truly determine the most cost effective alternative.

DESCRIPTION: Use same dredging procedure. Change layout of SDF, maximizing use of the area and using a portion of the SDF for a wetland to treat the water.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-3 PAGE NO: 1 OF 2
DESCRIPTION: Optimize Use of SDF Real Estate for Sediment Storage and Effluent Treatment

ORIGINAL DESIGN:

Use 40 acres of the SDF

PROPOSED CHANGE:

Utilize most or all of the entire available SDF acreage for storage, infiltration and evaporation to reduce or eliminate the water treatment requirement (i.e., use 100 acres versus current 40 acres)

Additional Feature: Incorporate the use of wick drains or a comparable underdrain system to maximize infiltration into and percolation through the foundation if the permeability of the site is less than 0.000005 centimeters per second.

ADVANTAGES:

- Maximizes use of available real estate
- May reduce berm height requirements
- May reduce water treatment demand
- Can improve odor control
- Eases site management
- Increases volatilization and evaporation rates
- Increases infiltration rates that reduces water treatment volume
- Promotes more rapid sediment desiccation and dewatering (i.e., quicker site closure)

DISADVANTAGES:

- Increases berm length requirements (offset by reduced height)
- More material handling at the SDF to prepare the site
- Disturbs the existing ground, therefore increases erosion control costs
- Results in a larger area for particulate emission and resultant dust control

JUSTIFICATION:

- The real estate is available

COST ESTIMATE WORKSHEET

PROPOSAL NO: C-3 PAGE NO: 2 OF 2

			DELETIONS	
ITEM	**U/M**	**QTY**	**UNIT COST ($)**	**TOTAL ($)**
Berm Material *(Reduced top elevation)*	CY	4,985	[redacted]	[redacted]
Water Treatment *(Prorated Reduced Volume Demand)*	LS	1	[redacted]	[redacted]
			SUBTOTAL:	[redacted]
			ADDITIONS	
ITEM	**U/M**	**QTY**	**UNIT COST ($)**	**TOTAL ($)**
Approximately 2628 feet of New Berm	CY	10,293	[redacted]	[redacted]
			SUBTOTAL:	[redacted]
SAVINGS				[redacted]
CONTINGENCIES 0% [*Included in unit costs*]				[redacted]
TOTAL SAVINGS				[redacted]

NOTE: The cost comparison is very preliminary and the final design would need to be submitted for quotes to truly determine the most cost effective alternative.

DESCRIPTION: Use same dredging procedure. Change layout of SDF, maximizing use of the area. Need new pool elevation to determine berm crest elevation requirement (i.e., CY required). There will likely be less water to treat due to increase evaporation and infiltration. Need approximation of reduced water treatment requirement.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-4A & 4B
DESCRIPTION: Promote Accelerated Infiltration at the SDF
C-4A Using Wick Drains
C-4B Using Underdrains

ORIGINAL DESIGN:

Use 40 acres of the SDF

PROPOSED CHANGE:

Use Proposal C-3 and maximize infiltration into and percolation through the foundation

C-4A Use wick drains
C-4B Use underdrains

ADVANTAGES:

- Maximizes use of available real estate
- May reduce berm height requirements
- May reduce water treatment demand
- Improves odor control
- Eases site management
- Increases volatilization and evaporation rates
- Increases infiltration rates that reduces water treatment volume
- Promotes more rapid sediment desiccation and dewatering (i.e., quicker site closure)

DISADVANTAGES:

- Increases berm length requirements
- More material handling at the SDF to prepare the site
- Disturbs the existing ground
- Results in a larger area for particulate emission and resultant dust control
- Additional site closure work may be required to remove and/or disable drainage system

JUSTIFICATION:

- The real estate is available

COST ESTIMATE WORKSHEET

PROPOSAL NO: C-4A

DELETIONS

ITEM	U/M	QTY	UNIT COST ($)	TOTAL ($)
Berm Material *(Reduced top elevation)*	CY	4,985	[redacted]	[redacted]
Water Treatment *(Prorated Reduced Volume Demand)*	LS	1	[redacted]	[redacted]
			SUBTOTAL:	[redacted]

ADDITIONS

ITEM	U/M	QTY	UNIT COST ($)	TOTAL ($)
Approximately 2628 feet of New Berm	CY	10,293	[redacted]	[redacted]
Wick Drain Installation (77 Acres)	LF	101,640	[redacted]	[redacted]
Wick Drain Removal	LF	101,640	[redacted]	[redacted]
			SUBTOTAL:	[redacted]

SAVINGS	[redacted]
CONTINGENCIES 0% [*Included in unit costs*]	[redacted]
TOTAL SAVINGS	[redacted]

NOTE: The cost comparison is very preliminary and the final design would need to be submitted for quotes to truly determine the most cost effective alternative.

DESCRIPTION: Use same dredging procedure. Change layout of SDF, maximizing use of the area. Need new pool elevation to determine berm crest elevation requirement (i.e., CY required). There will likely be less water to treat due to increase evaporation and infiltration. Install wick drains at beginning of project. Remove wick drains at completion of project (i.e., water is gone). Need approximation of reduced water treatment requirement.

COST ESTIMATE WORKSHEET

PROPOSAL NO: C-4B

DELETIONS

ITEM	U/M	QTY	UNIT COST ($)	TOTAL ($)
Berm Material *(Reduced top elevation)*	CY	4,985	[redacted]	[redacted]
Water Treatment *(Prorated Reduced Volume Demand)*	LS	1	[redacted]	[redacted]
			SUBTOTAL:	[redacted]

ADDITIONS

ITEM	U/M	QTY	UNIT COST ($)	TOTAL ($)
Approximately 2628 feet of New Berm	CY	10,293	[redacted]	[redacted]
Underdrain System Installation (77 Acres)	LF	95,835	[redacted]	[redacted]
Disable Underdrain System	LF	95,835	[redacted]	[redacted]
			SUBTOTAL:	[redacted]

SAVINGS	[redacted]
CONTINGENCIES 0% [*Included in unit costs*]	[redacted]
TOTAL SAVINGS	[redacted]

NOTE: The cost comparison is very preliminary and the final design would need to be submitted for quotes to truly determine the most cost effective alternative.

DESCRIPTION: Use same dredging procedure. Change layout of SDF, maximizing use of the area. Need new pool elevation to determine berm crest elevation requirement (i.e., CY required). There will likely be less water to treat due to increase evaporation and infiltration. Install underdrain system at beginning of project. The underdrain system will likely need to be disabled at completion of project (i.e., water is gone). Need approximation of reduced water treatment requirement.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-5 PAGE NO: 1 OF 2
DESCRIPTION: Use Alternative Management Options to Minimize or Eliminate Water Treatment - Use Water for Agriculture or Other Irrigation

ORIGINAL DESIGN:

Treat effluent water using a package water treatment plant at the SDF

PROPOSED CHANGE:

Create a SDF that can be maintained in a ponded condition that relies upon evaporation for water removal (i.e., consider with Proposals C-3 and C-4). Use the existing wetland for a discharge area

ADVANTAGES:

- Eliminates package treatment plant [redacted]
- Reduces permitting issues
- May reduce odors
- Maximizes use of SDF real estate

DISADVANTAGES:

- Requires more operation and maintenance (O&M)
- Increases need for insect management
- May increase permit requirements

JUSTIFICATION:

- Technically feasible

COST ESTIMATE WORKSHEET

PROPOSAL NO: C-5

			DELETIONS	
ITEM	**U/M**	**QTY**	**UNIT COST ($)**	**TOTAL ($)**
Berm Material *(Reduced top elevation)*	CY	4,985	[redacted]	[redacted]
Water Treatment Plant *(Prorated Reduced Volume Demand)*	LS	1	[redacted]	[redacted]
			SUBTOTAL:	[redacted]
			ADDITIONS	
ITEM	**U/M**	**QTY**	**UNIT COST ($)**	**TOTAL ($)**
Approximately 2628 feet of New Berm	CY	10,293	[redacted]	[redacted]
Transport offsite for alternative use (*Assumed 2.5 miles for Pumping thru Polyvinylchloride pipe for agriculture*)	LS	1	[redacted]	[redacted]
			SUBTOTAL:	[redacted]
SAVINGS				[redacted]
CONTINGENCIES 0% [*Included in unit costs*]				[redacted]
TOTAL SAVINGS				[redacted]

NOTE: The cost comparison is very preliminary and the final design would need to be submitted for quotes to truly determine the most cost effective alternative.

DESCRIPTION: Use same dredging procedure. Change layout of SDF, maximizing use of the area. Need new pool elevation to determine berm crest elevation requirement (i.e., CY required). Allow water remain until it has evaporated and/or infiltrated into the soil. Use water for agriculture or other irrigation.

VALUE ENGINEERING PROPOSAL

PROPOSAL NO: C-6 PAGE NO: 1 OF 2
DESCRIPTION: Dredge Every Other Year

ORIGINAL DESIGN:

Dredge continuously for two consecutive dredging seasons

PROPOSED CHANGE:

Dredge one year, do not dredge the second year and then dredge the third year (consider with Proposals C-3 and C-4)

ADVANTAGES:

- Reduces sediment storage volume (i.e., reduces aerial coverage and berm height requirements)
- Reduces or eliminates the need for water treatment
- Gives more time for infiltration and evaporation
- Reduces annual volume of effluent to be managed
- Allows for a review period to evaluate the effectiveness of the first year's dredging on achieving the overall improved water quality goal, the response of the system to the dredging process, and the ability to modify either the dredging approach or SDF operation, if needed

DISADVANTAGES:

- Increases mobilization and demobilization cost
- Extends the time the SDF is active (i.e., more O&M)
- Extends use of the staging pipeline and handling area, increasing real estate costs

JUSTIFICATIONS:

- Reduces the berm heights and effluent treatment costs
- Technically feasible

COST ESTIMATE WORKSHEET

PROPOSAL NO: C-6 PAGE NO: 2 OF 2

DELETIONS

ITEM	U/M	QTY	UNIT COST ($)	TOTAL ($)
Berm Material *(Reduced top elevation)*	CY	4,985	[redacted]	[redacted]
Water Treatment *(Prorated Reduced Volume Demand)*	LS	1	[redacted]	[redacted]
			SUBTOTAL:	[redacted]

ADDITIONS

ITEM	U/M	QTY	UNIT COST ($)	TOTAL ($)
Approximately 2628 feet of New Berm	CY	10,293	[redacted]	[redacted]
Additional Mob & Demob	LS	1	[redacted]	[redacted]
			SUBTOTAL:	[redacted]

SAVINGS	[redacted]
CONTINGENCIES 0% [*Included in unit costs*]	[redacted]
TOTAL SAVINGS	[redacted]

NOTE: The cost comparison is very preliminary and the final design would need to be submitted for quotes to truly determine the most cost effective alternative.

DESCRIPTION: Use same dredging procedure but dredge every other year. Change layout of SDF, maximizing use of the area. Need new pool elevation to determine berm crest elevation requirement (i.e., CY required). Need approximation of reduced water treatment requirement.

COMMENTS

VALUE ENGINEERING COMMENTS

DREDGE MANAGEMENT

Use suspended solids control during the dredging process (e.g., a silt fence).

Self-explanatory.

EFFLUENT TREATMENT

Use Polymer Addition for Polishing Pond.

If poor settling occurs, a flocculent could be added to treat the effluent from the storage basin as the effluent passes through to the water clarification cell.

SEDIMENT USE

Use Sediment for Soil Amendment Material.

If the sediment nutrient and mineral characteristics allow, promote using the dried sediment as a soil amendment.

CONTACT DIRECTORY

VALUE ENGINEERING TEAM STUDY
APPENDIX A: CONTACT DIRECTORY

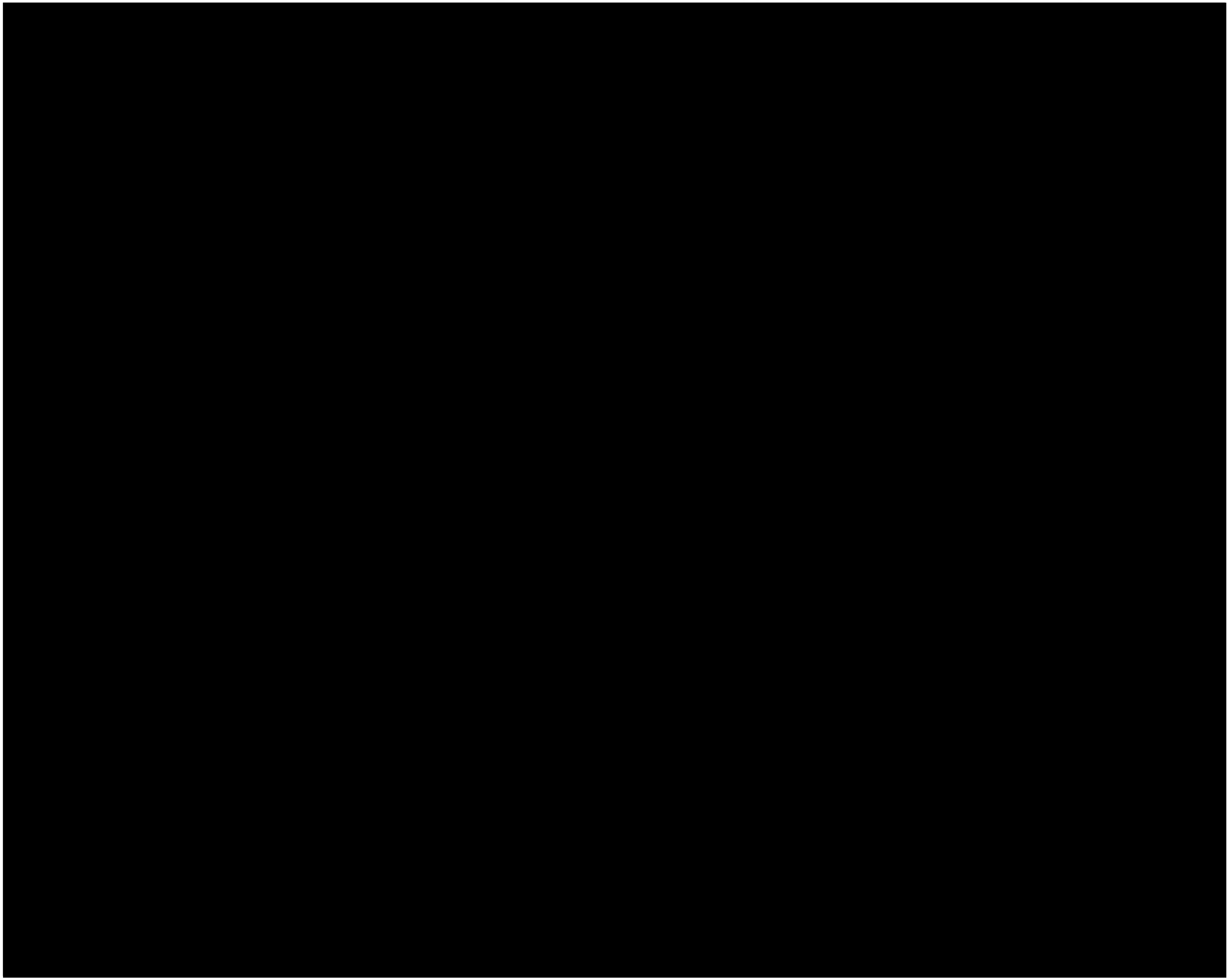
NAME	ORGANIZATION, TITLE	TELEPHONE AND ELECTRONIC MAIL ADDRESS
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

[redacted] from CBBEL serve as Town Engineers and Local Sponsor.

VALUE ENGINEERING TEAM STUDY
APPENDIX B

COST MODELS

CEDAR LAKE, INDIANA, AQUATIC ECOSYSTEM RESTORATION PROJECT



CEDAR LAKE, INDIANA, AQUATIC ECOSYSTEM RESTORATION PROJECT

[redacted]

CEDAR LAKE, INDIANA, AQUATICE ECOSYSTEM RESTORATION PROJECT

[redacted]

CEDAR LAKE, INDIANA, AQUATIC ECOSYSTEM RESTORATION PROJECT

[redacted]

CEDAR LAKE, INDIANA, AQUATIC ECOSYSTEM RESTORATION PROJECT

[redacted]

SPECULATION AND ANALYSIS LISTS

VALUE ENGINEERING TEAM STUDY
APPENDIX C: SPECULATION AND ANALYSIS LISTS
√ = Develop Idea CMT = Comment X = Delete I = In Progress (Being Done)

I 1. Use hydraulic dredge

√ 2. Use high solids/high density hydraulic dredge (see #9)

√ 3. Use geotubes for dewatering with either hydraulic or mechanical dredge

√ 4. Hold water in a pond and use evaporation

√ 5. Use water from pond (see #4) and use for agriculture irrigation water (see #20 & 21)

√ 6. Use water from pond (see #4) and use in existing wetland

√ 7. Create a wetland at the SDF to treat effluent water

X 8. Use conveyor belt to transport sediment to SDF

√ 9. Use recirculation dredge and lower berm height (e.g., 1 foot) (see #2)

√ 10. Use entire (optimize) SDF for sediment and effluent treatment

√ 11. Dredge one year and off one year to reduce sediment storage volume

√ 12. Dredge deeper hole in lake to let sediment move into the hole to reduce the aerial extent of the dredge area

CMT 13. Use sediment control during dredging (i.e., silt fence)

X 14. Use pipeline injection of polymer

CMT 15. Use polymer addition for polishing pond (see #1)

I 16. Use on-site soils to construct berms and subsequent cover at SDF (i.e., knock down berms)

X 17. Stabilize fly ash to treat sediment during recirculation process

X 18. Dewater using an absorbent (eliminate effluent)

√ 19. Promote infiltration in the SDF substrate (see #38 & 39)

VALUE ENGINEERING TEAM STUDY
APPENDIX C: SPECULATION AND ANALYSIS LISTS
√ = Develop Idea CMT = Comment X = Delete I = In Progress (Being Done)

√ 20. Promote evaporation (see #5 & 21)

√ 21. Use water for land application (see #5, 21 & 20)

X 22. Bottle water and sell for fertilizer

X 23. Drain lake and dredge in the dry

X 24. Do nothing

X 25. Stabilize soil in situ (e.g., seal in place)

X 26. Use geofabric to contain sediment in place

X 27. Use hydraulic dredge with geotubes on dredge barge and truck to SDF

√ 28. Use mechanical dredge with geotubes to dewater sediment before trucking to SDF

X 29. Use mechanical dredge with fly ash addition on barge and truck or conveyor belt to SDF

X 30. Drain lake and stabilize sediment in situ

X 31. Burn sediment for fuel

CMT 32. Use sediment for soil amendment material

X 33. Use dead fish to blend with sediment to make soil amendment material

X 34. Sell the lake to a third party

X 35. Require all lake users to take sediment home with them

I 36. Truck wet sediment from mechanical dredge to SDF

√ 37. Pond water and sediment at SDF with no treatment

√ 38. Use soil wicks in conjunction with sediment dewatering (see #19 & 39)

VALUE ENGINEERING TEAM STUDY
APPENDIX C: SPECULATION AND ANALYSIS LISTS
√ = Develop Idea   CMT = Comment   X = Delete   I = In Progress (Being Done)

√ 39. Use under drain beneath the SDF (see #19 & 38)

X 40. Use cofferdam to dewater dredge area and dredge in the dry and use geotube with trucking to SDF

X 41. Create an island in lake to develop it into a SDF

√ 42. Create an island using geotubes with stabilized sediment (hydraulic dredge)

√ 43. Use geotubes with stabilized sediment (hydraulic dredge) for shoreline erosion protection and reestablish with wetland vegetation

X 44. Put sediment into railcars and ship to coal mines for mine land reclamation

X 45. Ditto #44 but ship to Indiana Harbor and Canal Confined Disposal Facility

X 46. Ditto #44 but ship to other locations

LIST OF ACRONYMS

VALUE ENGINEERING TEAM STUDY
APPENDIX D: LIST OF ACRONYMS

AC	Acre
CBBEL	Christopher B. Burke Engineering Limited
CELRC	Corps of Engineers Chicago District
CMT	Comment
CW	Civil Works
CY	Cubic Yard
Demob	Demobilization
ERDC	Engineering Research and Development Center
Hydr	Hydraulic
LERRDS	Lands, Easements, Rights of Way, Relocations, Disposal Areas
LF	Linear Feet
LS	Lump Sum
Mech	Mechanical
Mob	Mobilization
O&M	Operation and Maintenance
SDF	Sediment Disposal Facility
Trt	Treatment
VE	Value Engineering
U.S.	United States
USACE	United States Army Corps of Engineers