Planning and Implementing a Lake Dredging Project

by Peter Berrini, PG, CLP

Planning and implementing a lake dredging project is a significant management effort

- It is important to gather the information necessary to make informed planning decisions (with assistance), such as:

1) The extent of the sediment impaired area(s) of the lake,
2) The quantity of sediment to be removed (cu. yds.),
3) The physical & chemical characteristics of the sediment,
4) The optimum method of sediment removal,
5) Where sediment can be placed (storage, dewatering,) etc
6) How much the potential project is likely to cost, and
7) If dredging is needed, how can the project be paid for…

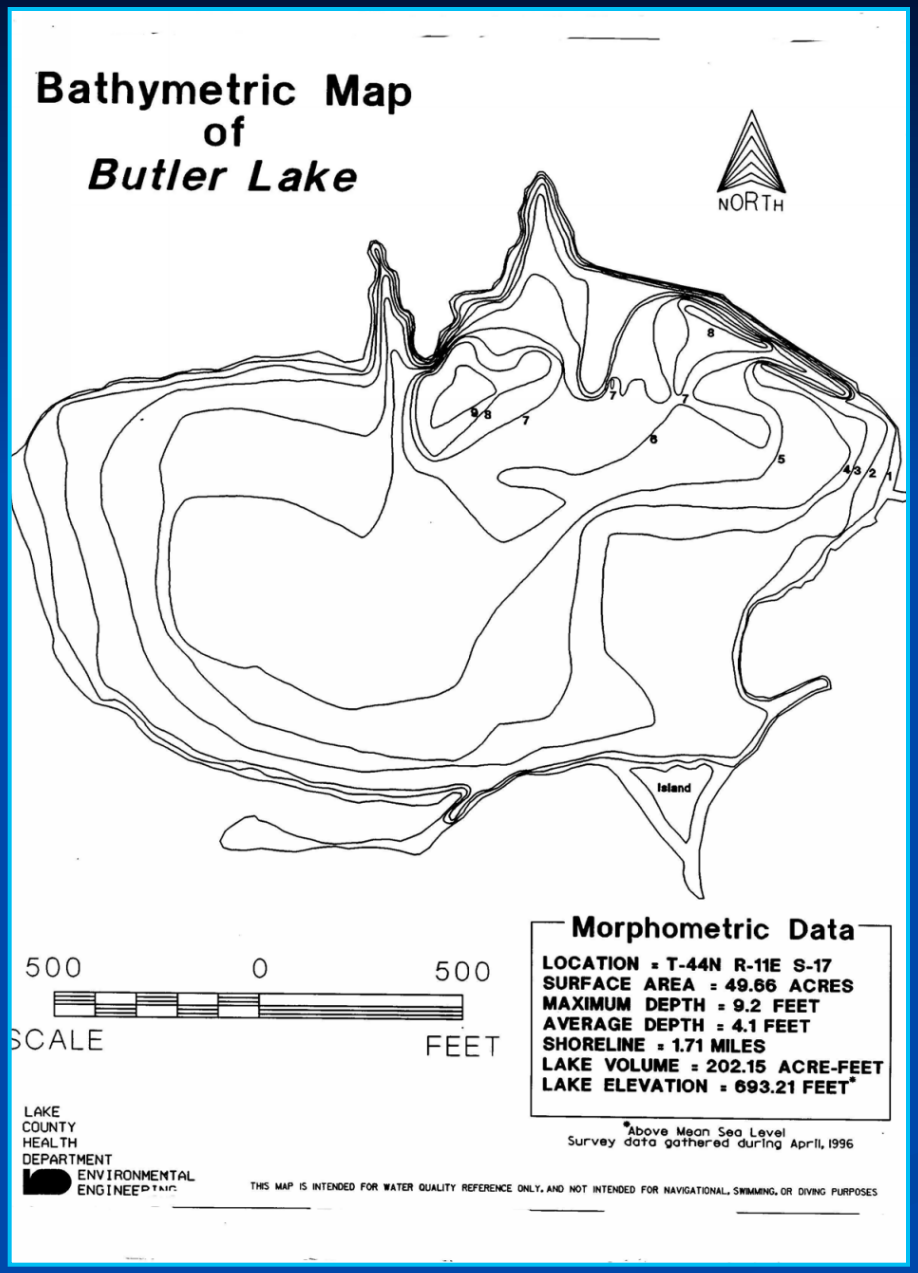
The Benefits of Sediment Removal as a Restoration Alternative

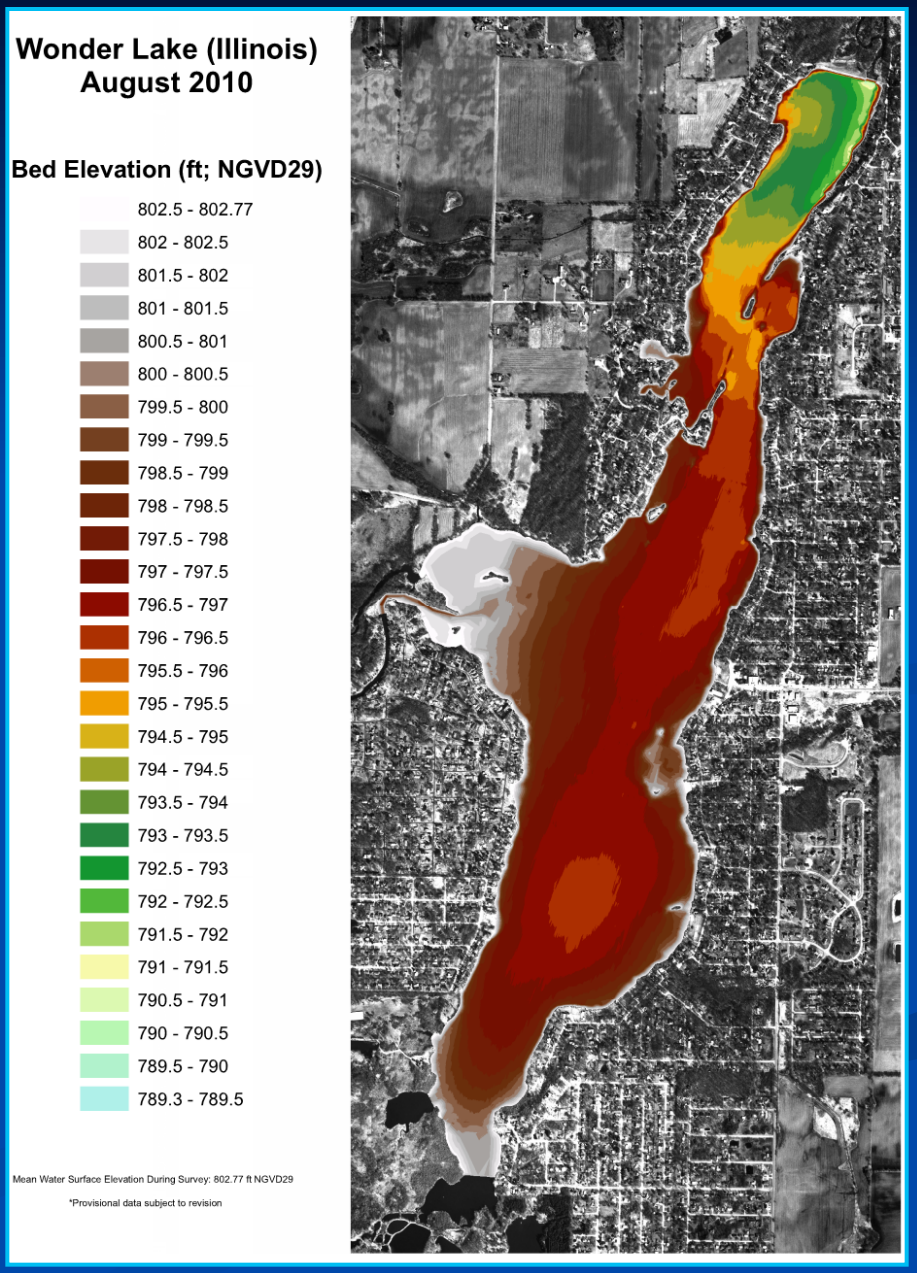
1) Increased water depths and overall storage capacity that has been lost to sediment deposition;
2) Improved and expanded recreational opportunities for safe boating and access;
3) Expanded aquatic habitat and deeper overwintering conditions
4) Improved water quality and clarity, and reduced internal nutrient recycling from re-suspension
5) Water supply reservoirs can increase storage volume to help prevent shortages during drought

Preliminary Project Requirements

- Complete a Sedimentation Survey that includes water depth and sediment thickness measurements (*methods*)
- Determine optimum dredging limits, target depths and total quantity of sediment to be removed (*alternatives*)
- Characterize and analyze physical and chemical properties of sediment to be removed (*contaminants?*)
- Determine dredging method(s) (Hydraulic or Mechanical)
- Locate site(s) for Sediment Storage and/or Dewatering
- If implemented, obtain Regulatory Permits from Army Corps of Engineers, State and Local Agencies

Bathymetric Maps Have Limitations

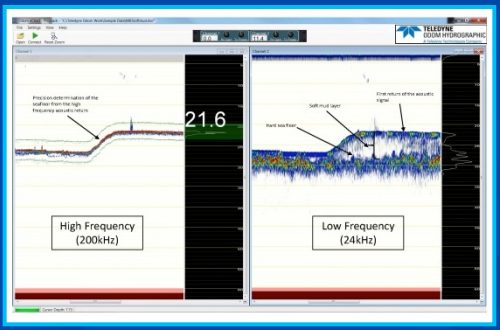




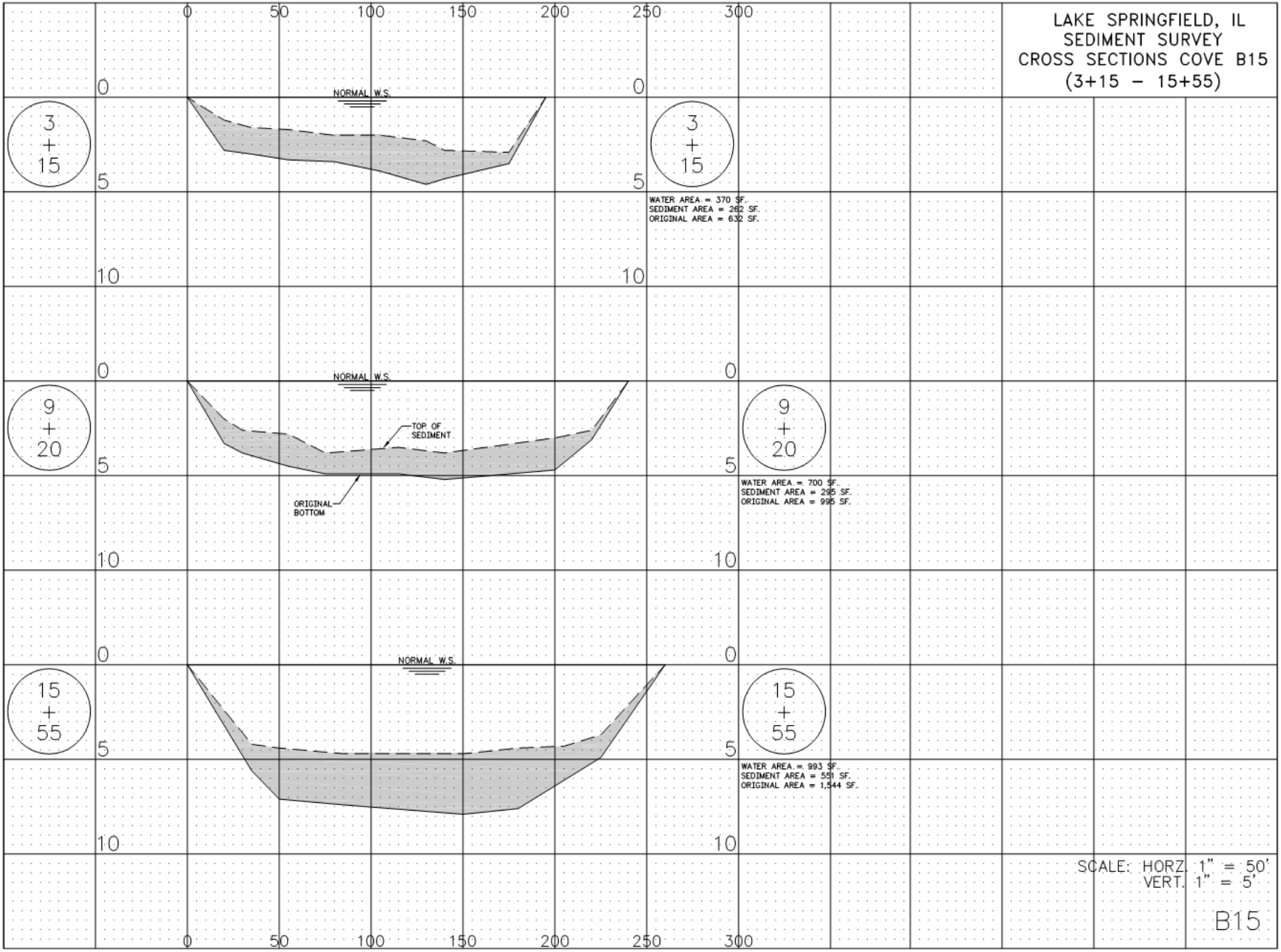
The Sedimentation Survey should include water depth and sediment thickness measurements along predetermined transects in order to develop cross sectional views of the lake

Figure 3. Sedimentation Survey Location Map
Lake Holiday, LaSalle County, Illinois

Sediment Measurement Options

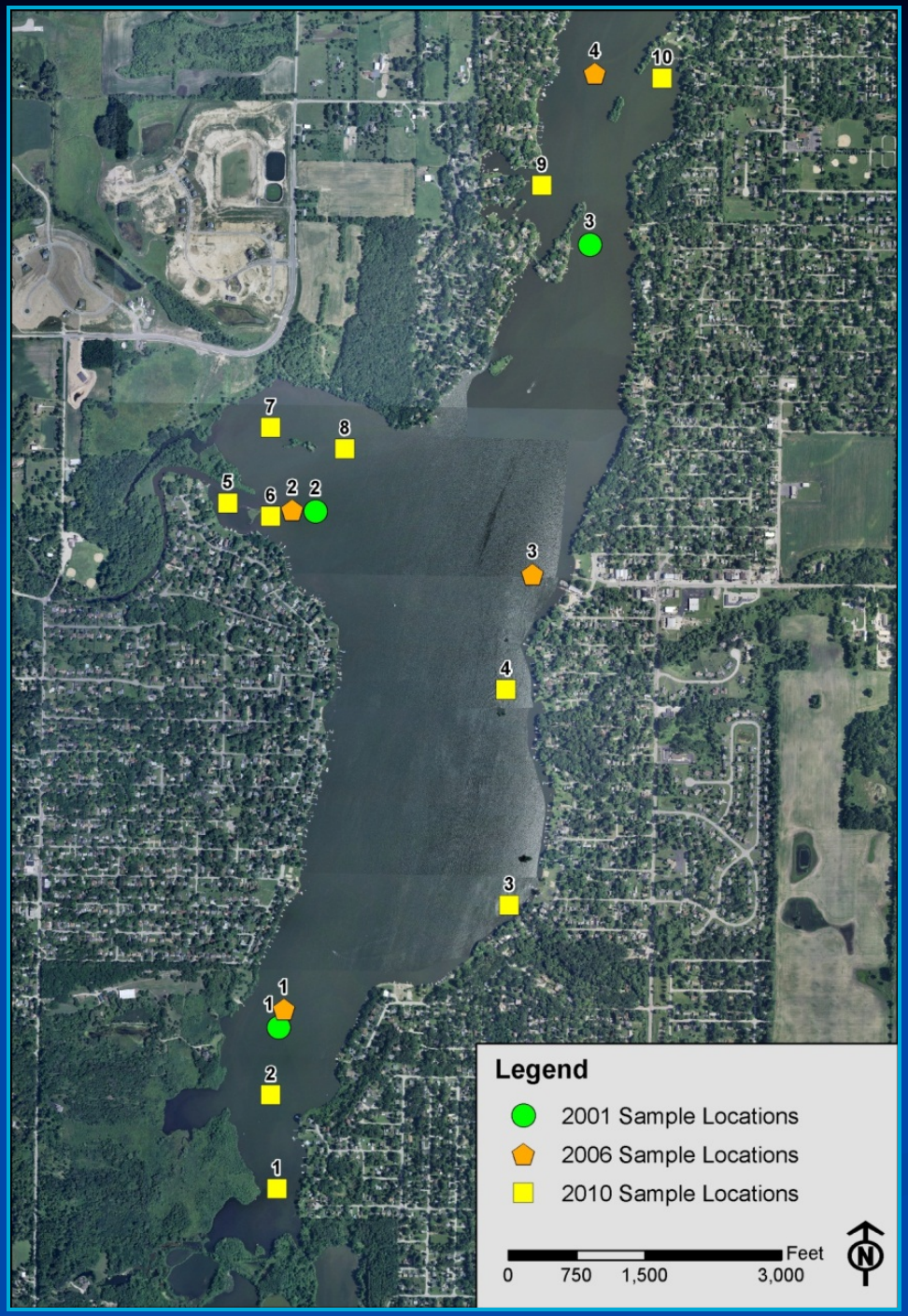


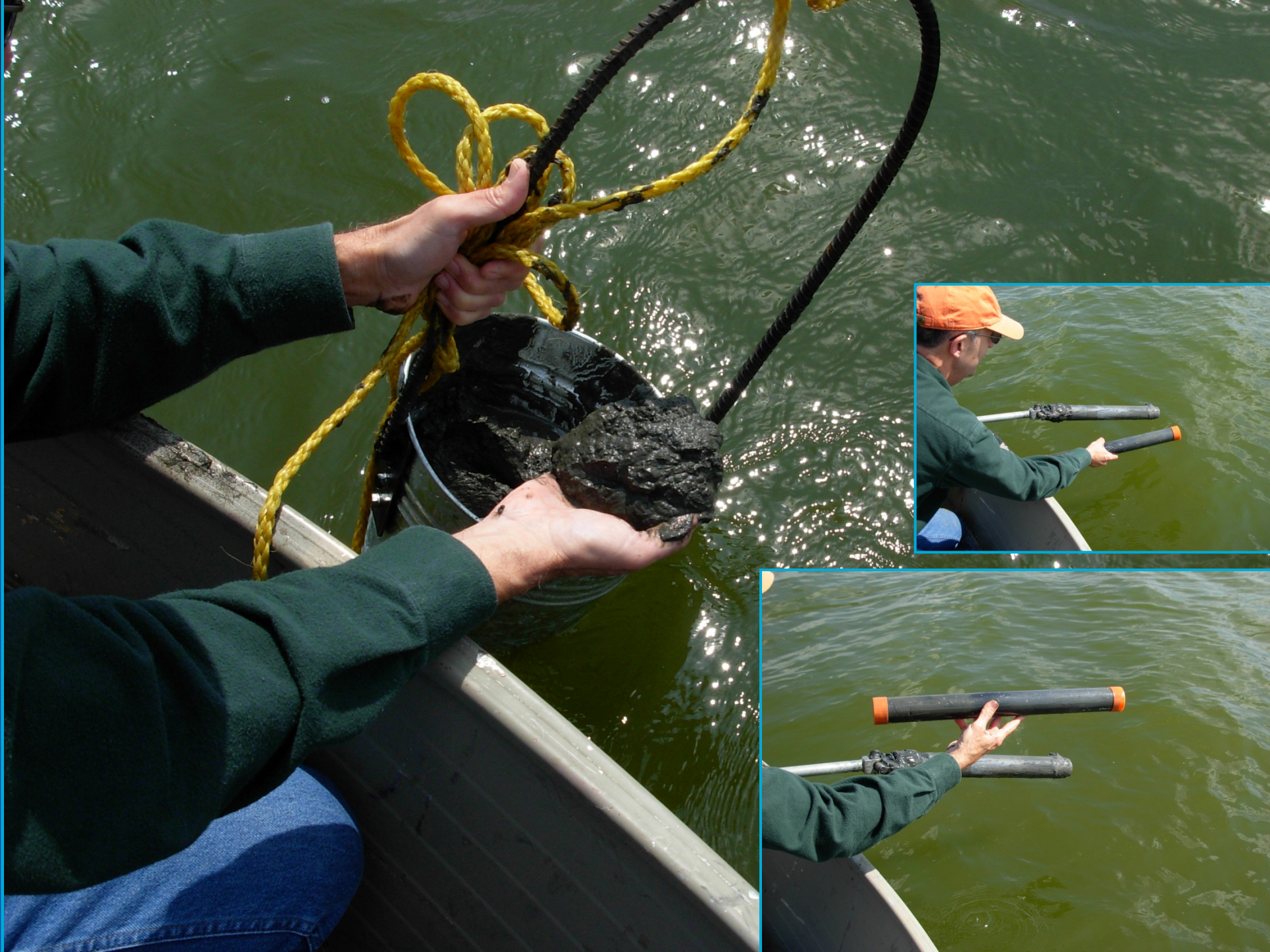
LAKE SPRINGFIELD, IL
SEDIMENT SURVEY
CROSS SECTIONS COVE B15
(3+15 – 15+55)

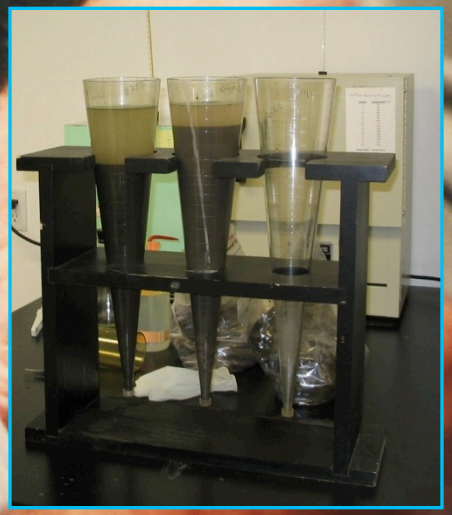


SCALE: HORZ. 1" = 50'
VERT. 1" = 5'

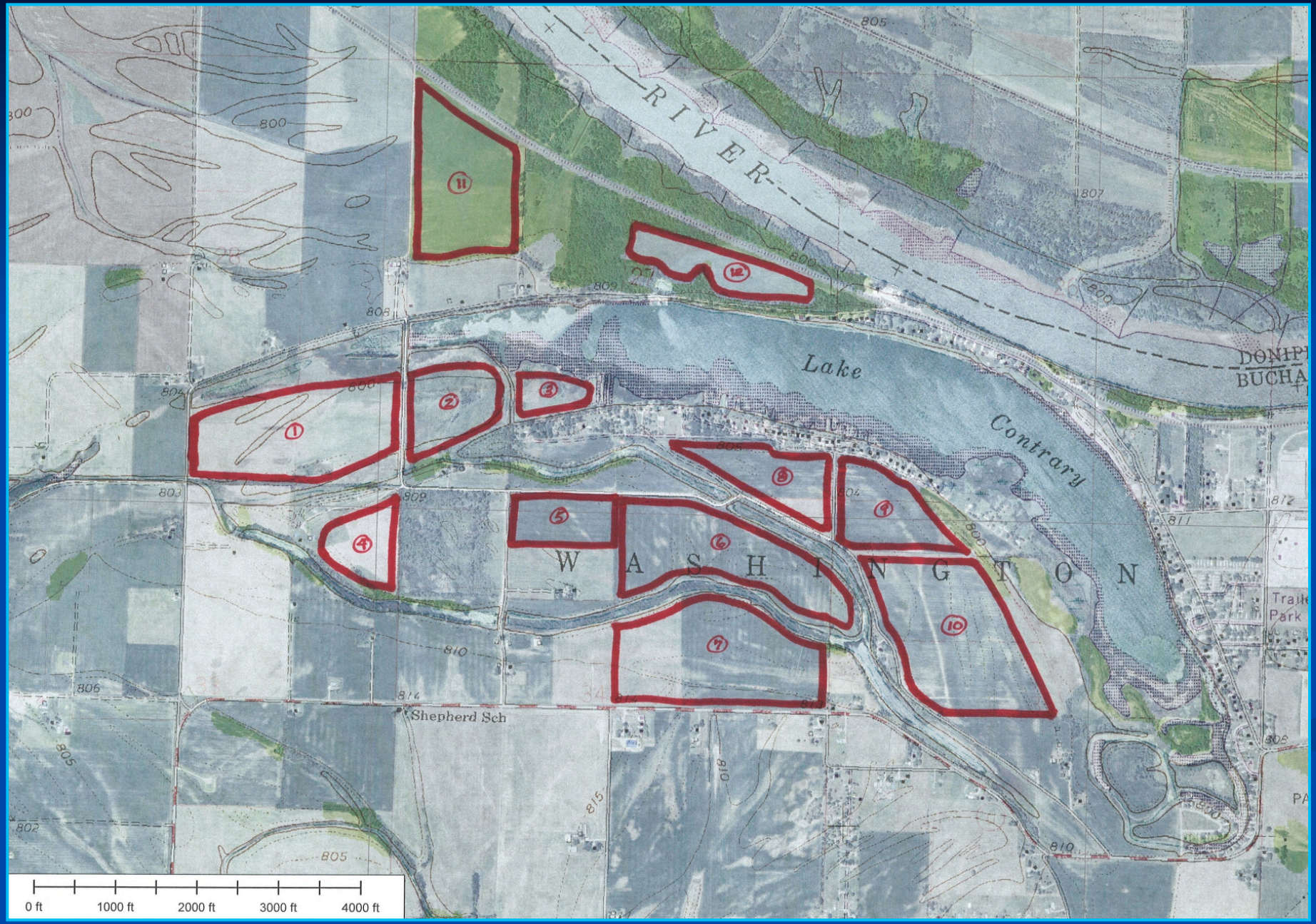
B15


4
10
9
3
7
8
5
6
2
2
3
4
3
1
1
2
1
Legend
2001 Sample Locations
2006 Sample Locations
2010 Sample Locations
Feet
0
750
1,500
3,000
N





Potential Sediment Storage and Dewatering Sites



Site Evaluation Criteria	SW Nelson Rd. West	SW Nelson Rd. East	Christie Lane NW	SW Nelson Rd. SW	CR-201 NE	SW Nelson Rd. South	State Route U North	CR-199 West
Total Site Acreage	48.0	8.0	3.0	16.0	18.0	49.0	66.0	29.0
Usable Acreage (assume 80% of site)	38.4	6.4	2.4	12.8	14.4	39.2	52.8	23.2
Type of Storage Site	Upland Dikes	Geotubes	Geotubes	Upland Dikes	Upland Dikes	Upland Dikes	Upland Dikes	Upland Dikes
Storage Capacity in CY **	495,615	82,602	30,976	165,205	185,856	505,940	681,471	299,434
Total Length of Perimeter Embankment (ft.)								
Estimated Earthwork Quantity (cy)								
Dist. - Lake to Storage Site	800	700	300	2,300	2,400	2,300	3,500	800
Dist. - Lake to Farthest Pt.	11,000	10,000	9,000	9,000	9,000	5,500	5,500	5,500
Min. Dredging Dist. (ft.)	800	700	300	2,300	2,400	2,300	3,500	800
Max. Dredging Dist. (ft.)	11,800	10,700	9,300	11,300	11,400	7,800	9,000	6,300
Avg. Dredging Dist. (ft.)	5,900	5,350	4,650	5,650	5,700	3,900	4,500	3,150
Average Site Elevation	800.0	800.0	800.0	805.0	810.0	810.0	810.0	805.0
Lake Surface Elevation (avg.)	798.0	798.0	798.0	798.0	798.0	798.0	798.0	798.0
Avg. Elev. above Lake	2.0	2.0	2.0	7.0	12.0	12.0	12.0	7.0
Terminal (Pumping) Elev.	12.0	12.0	12.0	17.0	22.0	22.0	22.0	17.0
Booster Pump (s) for dredged sediment	Yes	Yes	Yes	Yes	Yes	No	No	No
Return Water back to Lake	Gravity	Gravity	Gravity	Gravity	Gravity	Gravity	Gravity	Gravity
Adj. Homes/Buildings	Low	Low	Low	Low	Low	Low	Low	Moderate
Land Cost (if applicable)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Road or RR Crossings for Pipeline	1	0	0	1	2	2	2	1
Suitability of Topography	Good	Partial Wetland	Partial Wetland	Good	Good	Good	Good	Good
Suitability of Soils	Good	Good	Good	Good	Good	Good	Good	Good
Impact to Habitat	None	Low	Low	None	None	None	None	None
Aesthetic Impact	Low	Low	Low	Low	Moderate	Moderate	Moderate	Moderate
Amt. of Timber to Clear	None	Low	Low	None	Low	None	None	None

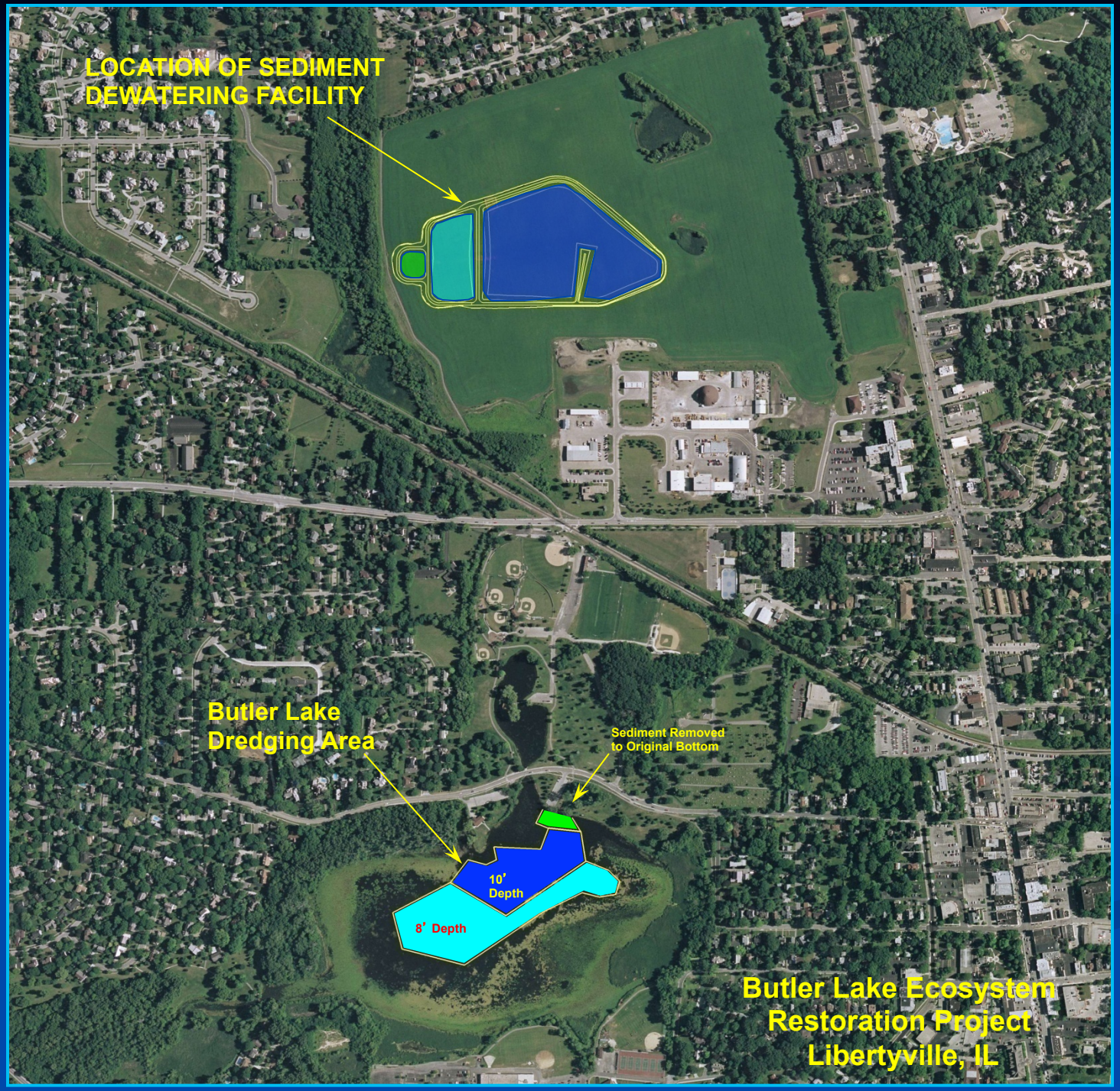
** Assume 10 ft. average sediment height for Upland Dike Sites; storage volume includes 1.2 sediment bulking factor

Types of Storage Sites:

Floodplain Sites - earthen SDF with pumped effluent back to lake

Upland Sites - earthen SDF with gravity flow efluent to lake

In-Lake or Adjacent Wetland Sites - Consists of limited in-lake storage created by filling geotextile tubes


LOCATION OF SEDIMENT
DEWATERING FACILITY
Butler Lake
Dredging Area
Sediment Removed
to Original Bottom
10'
Depth
8' Depth
Butler Lake Ecosystem
Restoration Project
Libertyville, IL

Various site characteristics and obstacles must be considered for the dredge pipeline access, sediment storage and dewatering requirements

Permitting Requirements

(depending on location and complexity of project)

- Joint Application Permit to be completed and submitted to USACE, EPA and DNR
- Section 401 Water Quality Certification (EPA)
- Anti-Degradation Assessment (EPA); Threatened or Endangered Species
- DNR Dam Permit may be required for storage and dewatering impoundment:
- EPA Storm Water Permit (NPDES ILR10)
- Historic Preservation Agency (Phase 1 Archeological Survey)
- Local and County Permits as Required

Corps determines IF, and what type of 404 permit is required

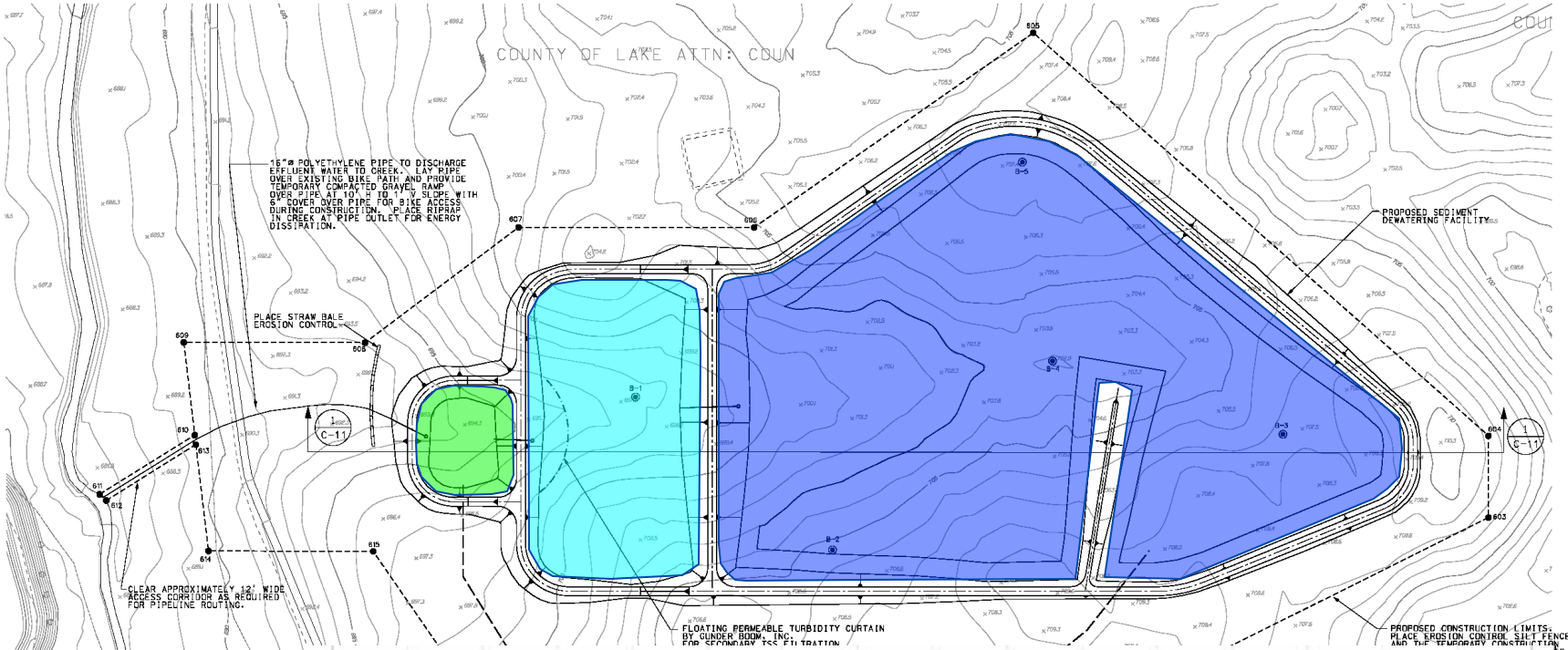
Nationwide Permits are a series of general permits issued by the Corps for minor projects in certain areas. All nationwide permits have special conditions which must be met in order for a project to qualify for nationwide permit status. Some nationwide permits also require pre-construction notification to the Corps prior to the initiation of any activities.

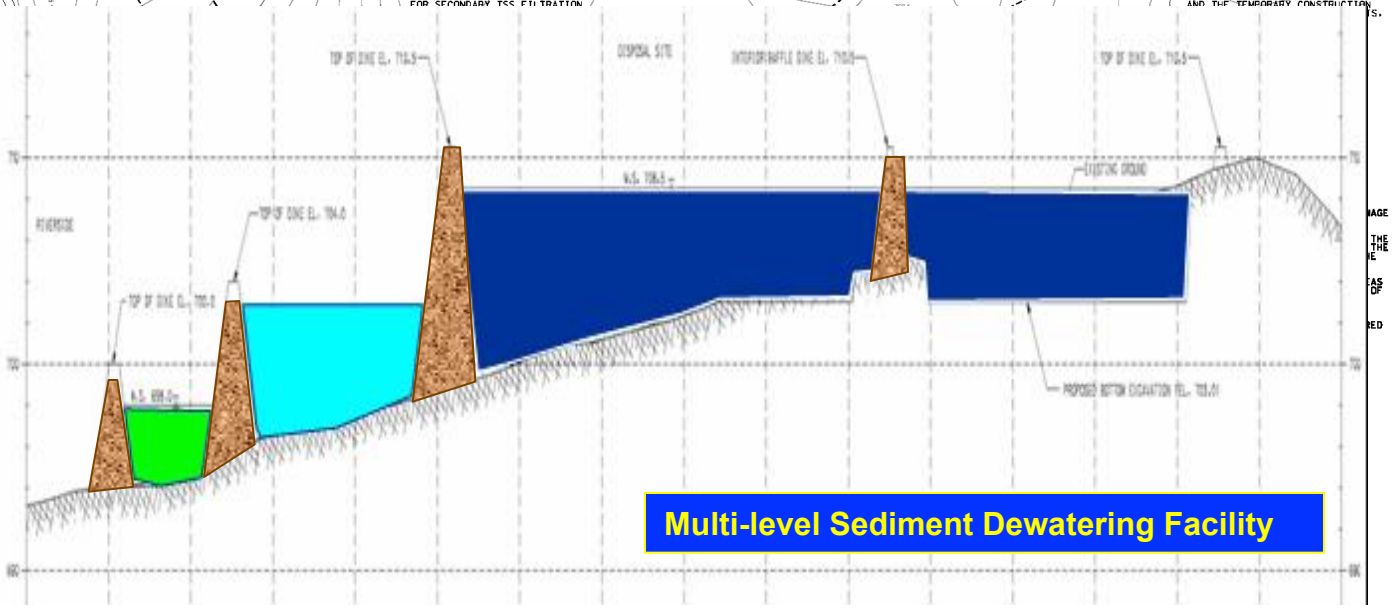
Regional Permits are a type of general permit that may be issued by a division or district engineer after compliance with the other procedures of this regulation. After a regional permit has been issued, individual activities falling within those categories that are authorized by such regional permits do not have to be further authorized by the procedures of this regulation.

Individual Permits are required if your project does not fall under the criteria for a general permit or letter of permission. If your project requires an individual permit, the Corps issues a Public Notice advising all interested parties of the proposed activity. This Public Notice process helps the Corps to evaluate the probable impact of the project as part of the public interest review. Illinois EPA and DNR may also issue separate Public Notices for individual Permits, which generally require substantial additional information and documentation.

Dredging & Dewatering Options

- Hydraulic Cutterhead, Swinging Ladder, Horizontal Auger, Low Turbidity, High Solids, Diver Operated
- Mechanical Excavation: Wet and Dry
- Conventional Upland Containment Area Designs based on retention and gravity settling of solids
- Geotextile Tubes (Geotubes) both in-lake and upland
- Treatment Options such as Polymers, Flocculants, etc.
- On-Site Mechanical Dewatering Systems





Multi-level Sediment Dewatering Facility

US Army Corps of Engineers Chicago District

SYMBOL	AMENDMENT DESCRIPTION	DATE APPROVED	APPROVED BY/DATE	DESCRIPTION	DATE APPROVED

DESIGNED BY: P.J.B. DATE: OCTOBER, 2003
DRAWN BY: K.A.H. SCALE: AS SHOWN
CHECKED BY: J.T. DRAWING CODE:
REVIEWED BY: J.J.S. SOLICITATION NUMBER:

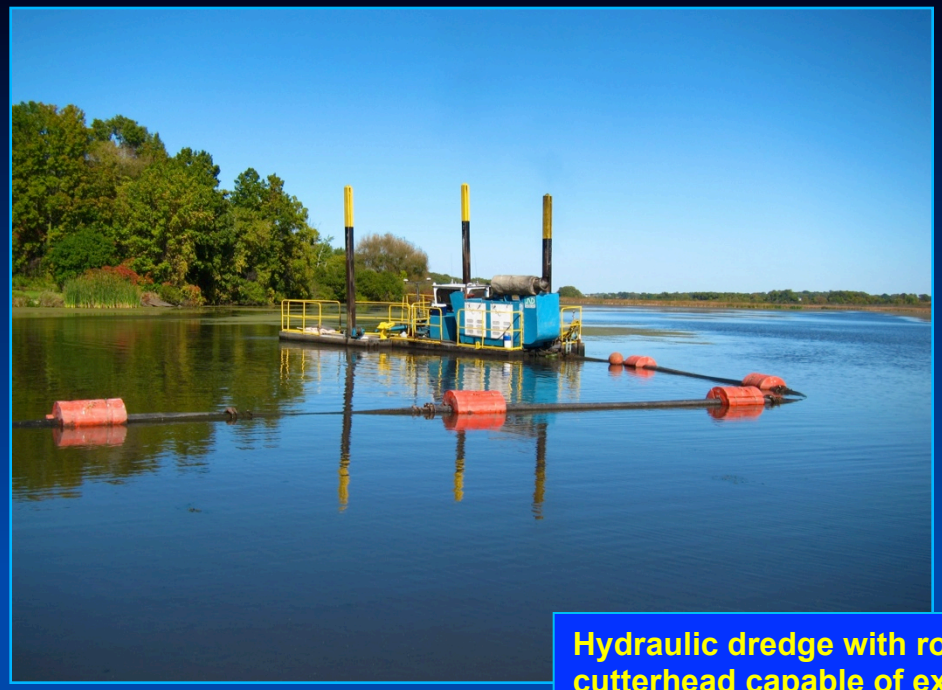
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
CHICAGO, ILLINOIS

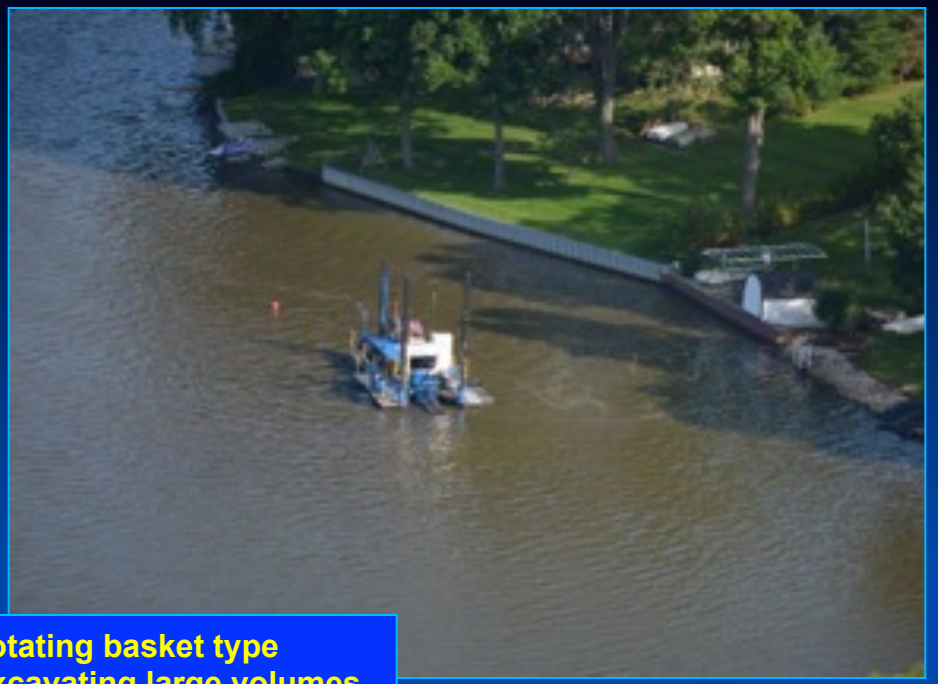
HDR Engineering, Inc.

BUTLER LAKE
LIBERTYVILLE, ILLINOIS
DREDGING AND ENVIRONMENTAL RESTORATION

SDF SITE

SHEET REFERENCE NUMBER:
C-05
SHEET OF XX





Hydraulic dredge with rotating basket type cutterhead capable of excavating large volumes sediment and transporting a slurry via pipeline.

Hydraulic dredge equipment with both horizontal auger type cutterhead for soft sediment and swinging ladder with basket type cutterhead for maneuverability and versatility.

Hydraulic dredge equipment with conventional upland sediment storage and dewatering facilities.

Hydraulic dredge mobilization and pipeline assembly.

Hydraulic dredge slurry discharge from pipeline and water control structures at dewatering facilities.

Clarified effluent return water being discharged from sediment dewatering facilities must be compliant with State permit requirements.

Fine grained sediment that does not settle within a 24 hour period may require a polymer or flocculent to achieve necessary return water clarity.

Geotextile tubes can provide an effective sediment dewatering option depending on specific project conditions

Mobile Mechanical Dewatering Systems can provide an effective dewatering option for small spaces

From Wet Lake Sediment to Stackable Soil

Coarse Material Separator and Hydrocyclone

Clarifier, Polymers and Clear Return Water

Loading Trucks for Transport to Placement Site

Recovered Soil for Future Beneficial Use

A high solids “Dry Dredge” can excavate material and pump a thickened slurry of “lava” consistency, which reduces dewatering and is efficient at filling geotextile tubes

Wet Mechanical Dredging with Barge Mounted Excavators

Dry Mechanical Dredging with Long Reach Excavators


Upland sediment storage and dewatering impoundments are often permitted dams and must be decommissioned by breaching to eliminate impounding capability

Sediment drying and consolidation allows for rapid establishment of vegetation due to soil fertility. Extensive agronomic testing at Univ. of Illinois has confirmed that most lake and river sediment has excellent agricultural potential. The options for Beneficial Reuse vary depending on the type of sediment dredged ….

A restored lake can provide increased water storage capacity, enhanced recreational opportunities and improved habitat.

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Peter is a Geologist and Certified Lake Professional with significant project experience in all aspects of lake and reservoir restoration and has specialized in planning and implementing lake dredging projects throughout the United States for more than 25 years. He has planned, designed, permitted and completed more than 50 dredging and dewatering projects ranging in size from 300 cubic yards to 3,000,000 cubic yards.