



Lessons Learned for Sediment Remediation Design in the Great Lakes from Recently Constructed Remedies

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Great Lakes Sediment Remediation Projects

- Lessons learned from two recent sediment remedies under Great Lakes Legacy Act
- Feasibility study through remedy construction
- EPA contracting (Design, Bid to pre-qualified contractors, Construct with engineer/EPA oversight)
- Key lessons learned regarding:
 - ◆ Approach to means and methods
 - ◆ In situ stabilization
 - ◆ Dewatering & disposal
 - ◆ Team coordination
 - ◆ Changing site conditions
 - ◆ Landowner coordination



Great Lakes Sediment Remediation Projects

Lincoln Park and Milwaukee River Channels, Phase II – Milwaukee, WI

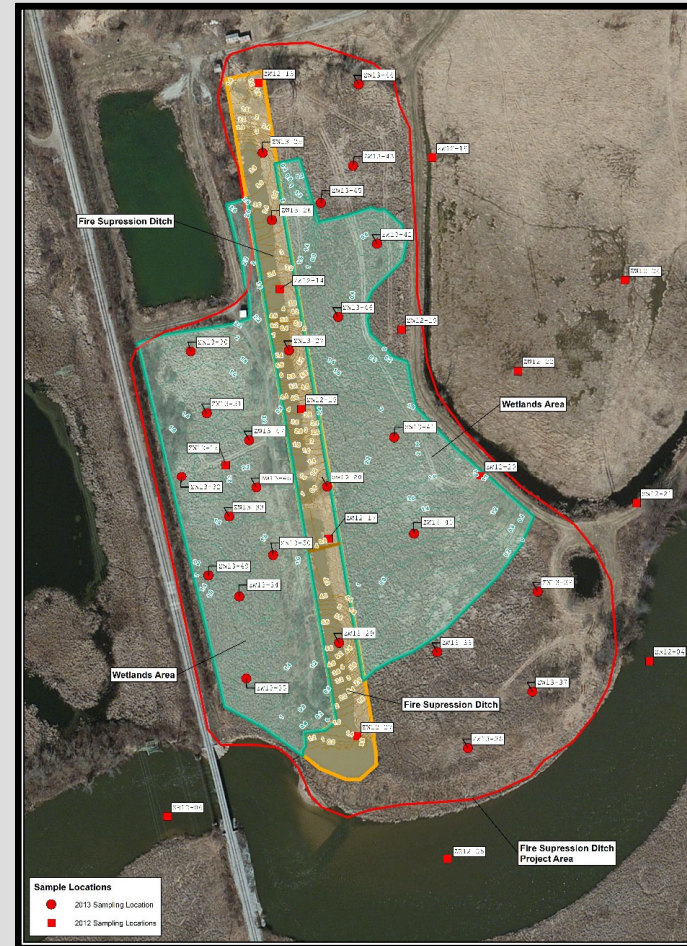
- ◆ PCBs, PAHs, NAPL
- ◆ 7 removal areas along 1.7 miles
- ◆ Relatively in-dry removal of 50,000 CY
- ◆ City park with adjacent property owners
- ◆ Spillway and dam



Great Lakes Sediment Remediation Projects

■ Former Zephyr Oil Refinery Fire Suppression Ditch Area - Muskegon, MI

- ◆ TPH and metals
- ◆ Characteristically hazardous lead area
- ◆ Large wetland area with deep ditch area
- ◆ Relatively in-dry removal of 50,000 CY
- ◆ Adjacent to Muskegon River



Contractor Means and Methods

Leave Means and Methods up to Contractor

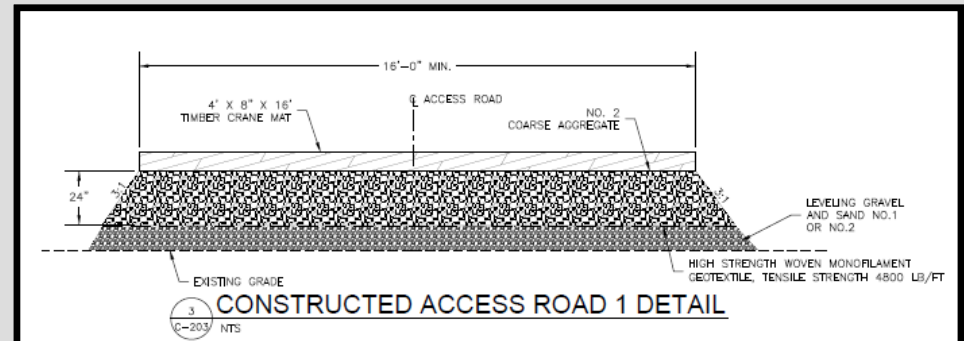
- Pre-qualified GLNPO contractors
 - ◆ Innovative ideas
 - ◆ Cost and schedule savings

Access Roads

- Typical design factors
 - ◆ Commonly used equipment/loaded weights
 - ◆ Geotechnical data
- Zephyr access roads
 - ◆ High strength geotextile
 - ◆ Minimum 2 feet of gravel
 - ◆ Timber mats

Lessons Learned

- Balance between need for minimum design to account for project cost estimates and allowing flexibility to contractors
- Access roads design is an area we are evaluating



In-situ Treatment of Characteristically Hazardous Lead

Zephyr Characteristically Hazardous Lead Area

- Very wet, highly organic sediment and peat-like soil (almost sponge-like materials)
- Heavy vegetation (cattails)
- Very dense root mass
- Irregular area of removal
- 2-3 foot contamination depth

Specified Approach

- Required use of power mixing tool
- Required removal of top vegetation
 - ◆ Changed during construction due to dead vegetation
- Used Enviroblend dry reagent
 - ◆ 14% by wet weight of sediment, based on factor-of-safety for treatability testing, expecting wet conditions



In-situ Treatment of Characteristically Hazardous Lead

Implementation

- Excavator mounted power mixer
- 3 days of mixing time
- Resulted in well mixed sediment
- All confirmation samples passed



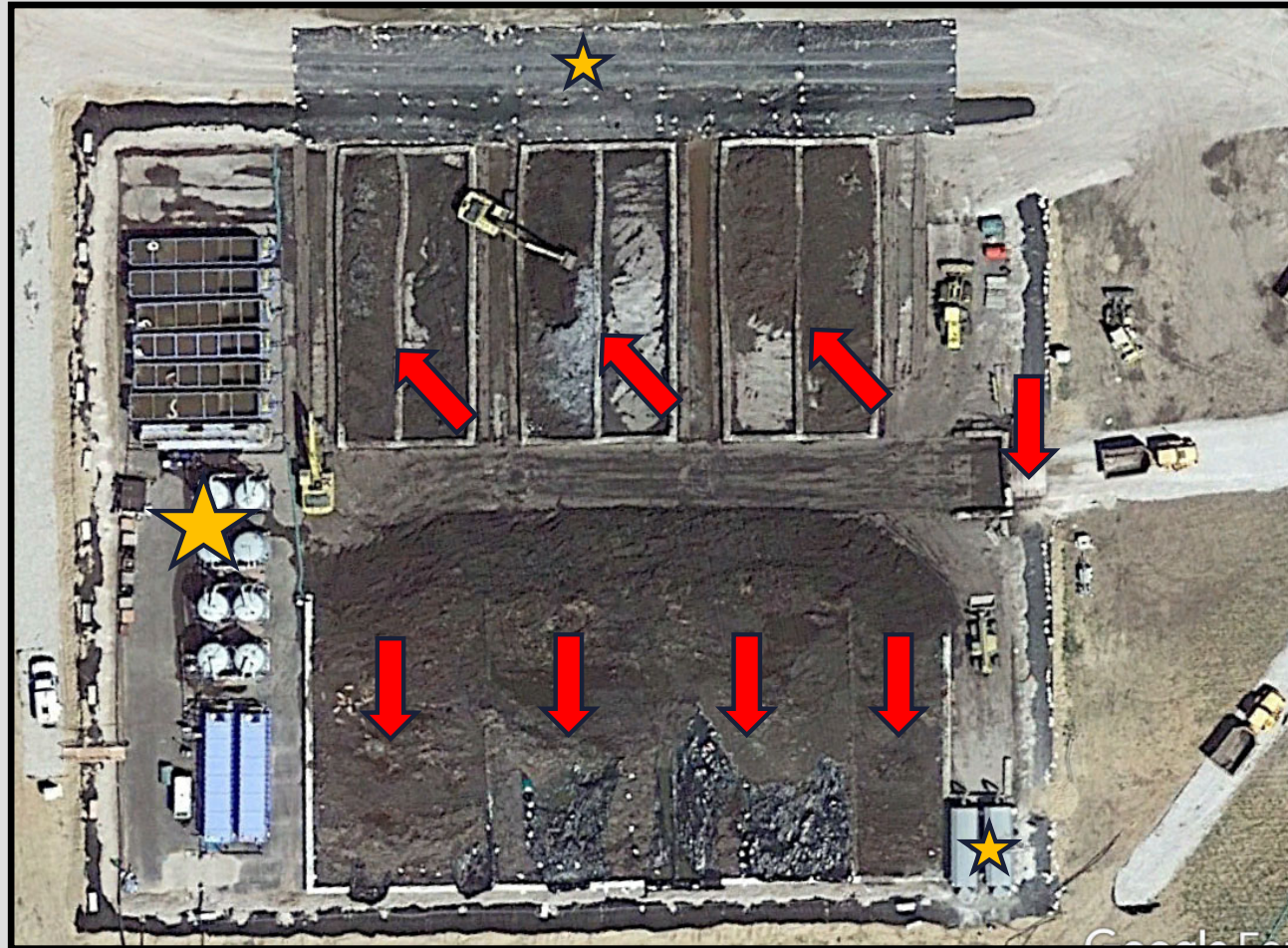
Lessons Learned

- Sometimes dictating means & methods is necessary
- Method was very effective even in wet environment

Dewatering Pad Design

Zephyr Dewatering Pad

- WWTP and sediment
- Asphalt base (designed gravel)
- Bin blocks to separate areas
- Contractor developed layout



Dewatering Pad Design



Minimum Dewatering Pad Residence Times

Zephyr Sediments

- Design required stockpile mgmt. To provide up to 5 days dewatering, unless passing paint filter
- Testing indicated majority of gravity dewatering occurred within 5 days
- 10% Portland was estimated to meet landfill requirements based on laboratory testing
 - ◆ Wet weight of sediment
- Final project totals showed 7% Portland amendment
 - ◆ 30% savings in amendments
- Reduction in disposal tonnage

Lessons Learned

- Minimum dewatering times work
- Pre-design sediment testing is key



Landfills

Landfill Requirements

- What we hear during design:
 - ◆ “Just needs to pass paint filter.”
 - ◆ “I just need to be able to drive on it.”
 - ◆ “We can work with almost any sediment.”
- What we hear during construction:
 - ◆ “It’s too wet.”
 - ◆ “It needs to support ___ PSI.”

Lessons Learned

- Call landfills multiple times and provide as much sediment data during design as possible
- Consider putting multiple types of amendments in the specifications



Project Coordination Meetings

Lincoln Park Phase II

- Weekly calls
- Daily contractor progress reports
- Daily oversight reports

Zephyr Fire Suppression Ditch Area

- 3 Weekly meetings
 - ◆ 15 minute update calls Monday & Friday
 - Verbal discussions with basic agenda
 - ◆ 30 minute to 1 hour formal progress meeting on Wednesday
- Daily contractor progress reports
- Daily oversight reports



Lessons Learned

- 1 Meeting was good, but 3 was better.
- Created a cohesive group
- Meetings already on everyone's schedule
- RFI and design changes in real time

Unknown/Changed Site Conditions

Lincoln Park Phase II

- Cofferddam installation
 - ◆ Floodplain modeling used to set maximum wall height
 - ◆ $\frac{3}{4}$ Wall installation – normal flows approaching 20yr flood elevation
 - ◆ Contractor and oversight engineer recognized it immediately
 - ◆ Reworked removal schedule and redesigned cofferdam

Cause

- Old survey of bypass channel (7 years)
- Found an old low water crossing

Lessons Learned

- Current surveys of waterways are a must
- Design engineer leading construction oversight works



Unknown/Changed Site Conditions

Zephyr Fire Suppression Ditch Area

- Dewatering pad installation
 - ◆ ACM found in pad location
 - ◆ Contractor and engineer redesigned pad in 3 days

Lessons Learned

- Old refinery sites are unpredictable
- Can't always design for it - just be ready
 - ◆ For example: appropriate balance of performance requirements, bid form and payment specs. Allowing for timely negotiations, effective real time owner-construction oversight mgmt.-Contractor superintendent communications
- Progress meetings were crucial during redesign



Unknown/Changed Site Conditions

Zephyr Fire Suppression Ditch Area

- High water levels in the Great Lakes
 - ◆ WSE 578.5 during design survey (2016)
 - ◆ WSE 580.8 at start of construction (2017)
 - ◆ WSE 581.3 max height during construction (2018)
- Effect on project
 - ◆ Redesign of cofferdam
 - ◆ Dewatering volume
 - ◆ Redesign of habitat areas
 - ◆ Permitting issues

Lessons Learned

- Water always wins
- Can't always design for it - just be ready



Unknown/Changed Site Conditions

Zephyr Fire Suppression Ditch Area

- Orphaned oil well
 - ◆ Found under last access road
 - ◆ 25 feet from ditch
 - ◆ Located in deep marsh habitat area
- Effect on project
 - ◆ Schedule delay for capping
 - ◆ Redesign of habitat areas

Lessons Learned

- ◆ Regular group meetings allowed for development of plan quickly



Adjacent Property Owners

Site Access Issues

- Access agreements
 - ◆ We try to secure before bidding
 - ◆ Property owners don't always agree with project

Railroads

- Challenging to manage design around
 - ◆ TREL and offsets
- Many layers of reviews and approvals
- Zephyr example
 - ◆ Removal offsets
 - ◆ Placing sand bags



Lessons Learned

- Always have a plan B for access
- Involve Railroads early and often

Summary

- ✓ **Biggest challenges are unknown/changed site conditions**
- ✓ **Great working relationships between contractor, engineer, client is key**
- ✓ **Create flexible designs that allow for contractor innovation**



Thank You!

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