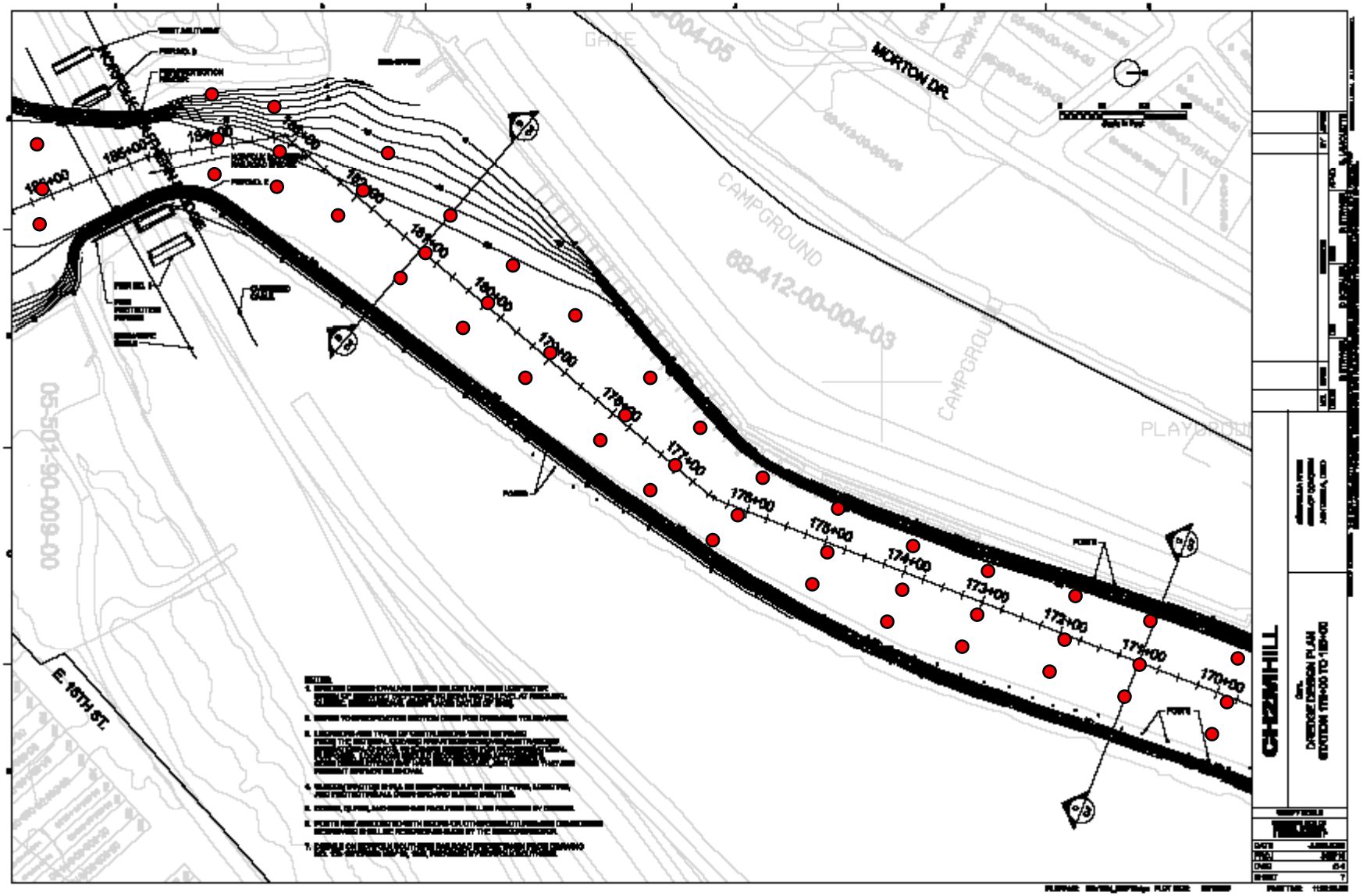
The U.S. EPA's Great Lakes Legacy Act Ashtabula River Clean-Up

March 2008

1995 PCB Sampling Locations

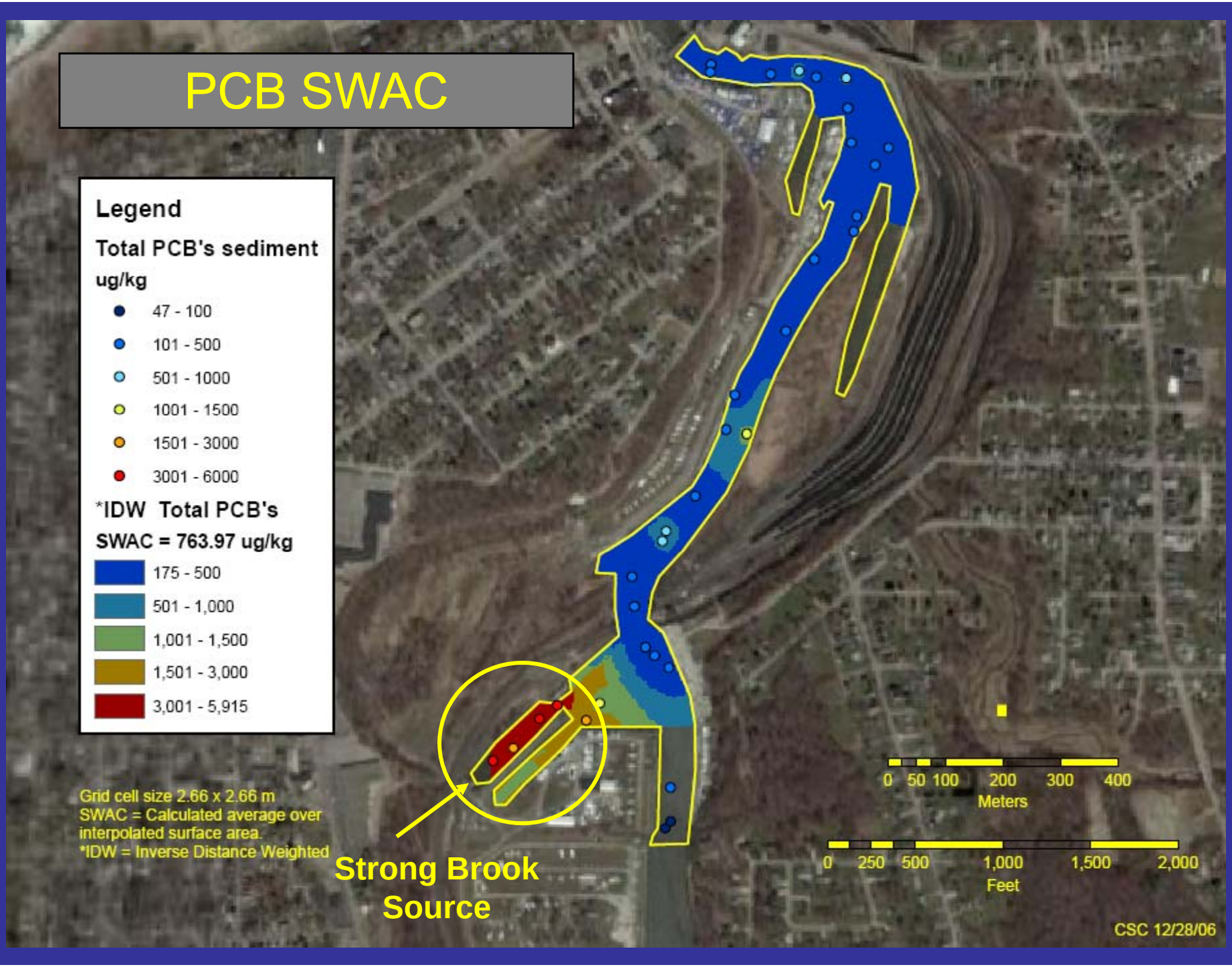


Summary of Sampling Results

- 545,000 cubic yards of impacted sediments
- Maximum PCB Concentration 660 ppm
- Average PCB Concentration: 7.5 ppm (throughout entire sediment column)
- 25,000 pounds of PCBs present in sediments

Baseline Sampling Program

- **Sediment Chemistry**
  - PCBs, HCB, HCBD, TOC
- **Sediment Toxicity**
  - 20-day for *C. dilutus* Survival and Growth
  - 28-days for *H. azteca* Survival and Growth
- **Water Chemistry**
  - PCBs, TOC
- **Whole Sediment Bioaccumulation**
  - 28-day exposure of *Lumbriculus variegatus*;
  - Analyzed for: PCBs, % Lipids, % Moisture
- **Caged Fish**
  - 28-day exposure of young of the year catfish
  - Analyzed for: PCBs, % Lipids, % Moisture


PCB SWAC
Legend
Total PCB's sediment
ug/kg
47 - 100
101 - 500
501 - 1000
1001 - 1500
1501 - 3000
3001 - 6000
*IDW Total PCB's
SWAC = 763.97 ug/kg
175 - 500
501 - 1,000
1,001 - 1,500
1,501 - 3,000
3,001 - 5,915
Grid cell size 2.66 x 2.66 m
SWAC = Calculated average over interpolated surface area.
*IDW = Inverse Distance Weighted
Strong Brook Source
0 50 100 200 300 400
Meters
0 250 500 1,000 1,500 2,000
Feet
CSC 12/28/06

Baseline Sampling: Results and Lessons Learned

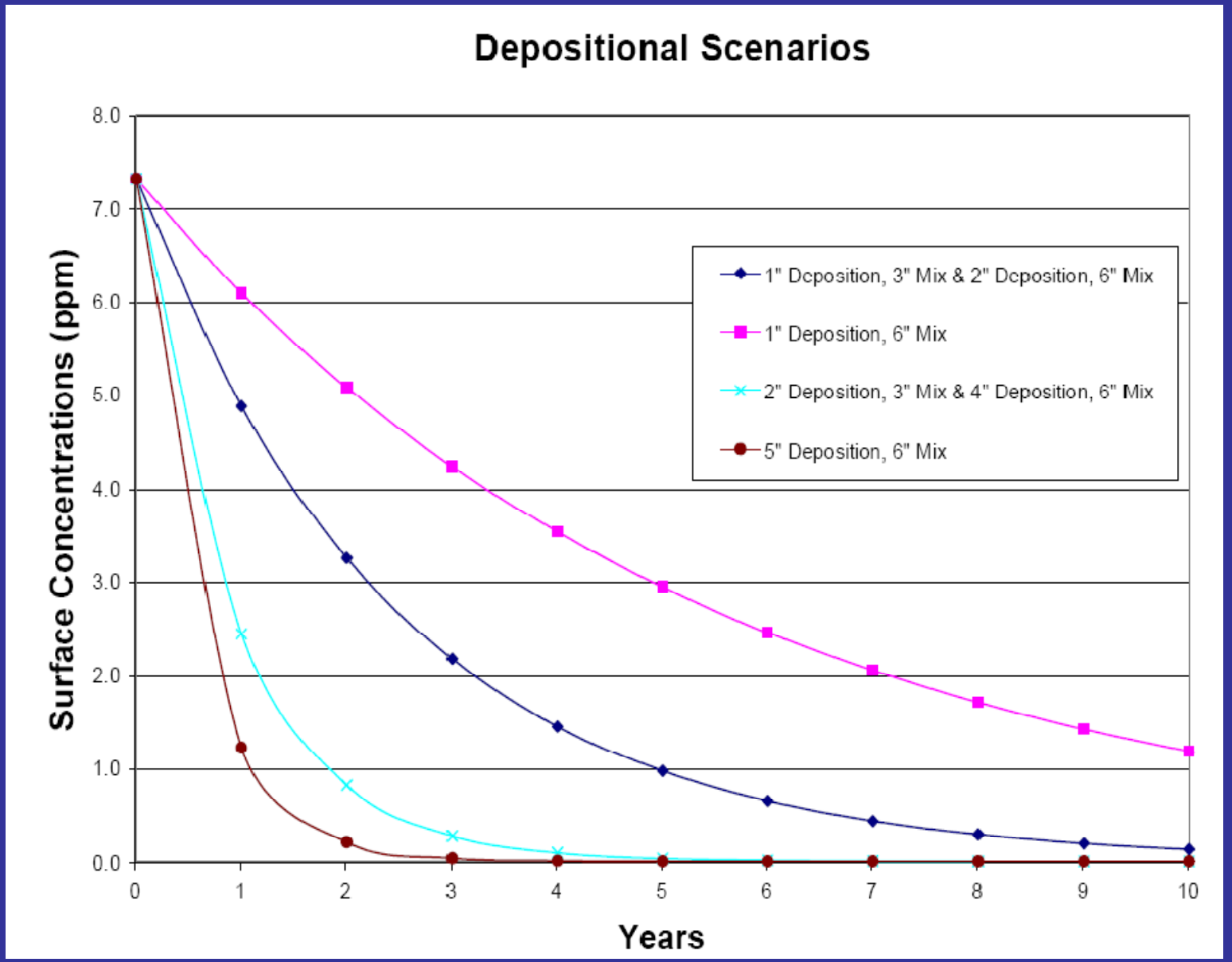
- Lessons Learned
  - Always do a baseline assessment
  - Always collect recent data to assess potential sources
  - It's 2008 and there are still violators out there (intentional and/or unintentional)
- **Results**
  - **Pre-Dredging PCB SWAC: 0.5 mg/kg**

Project Details

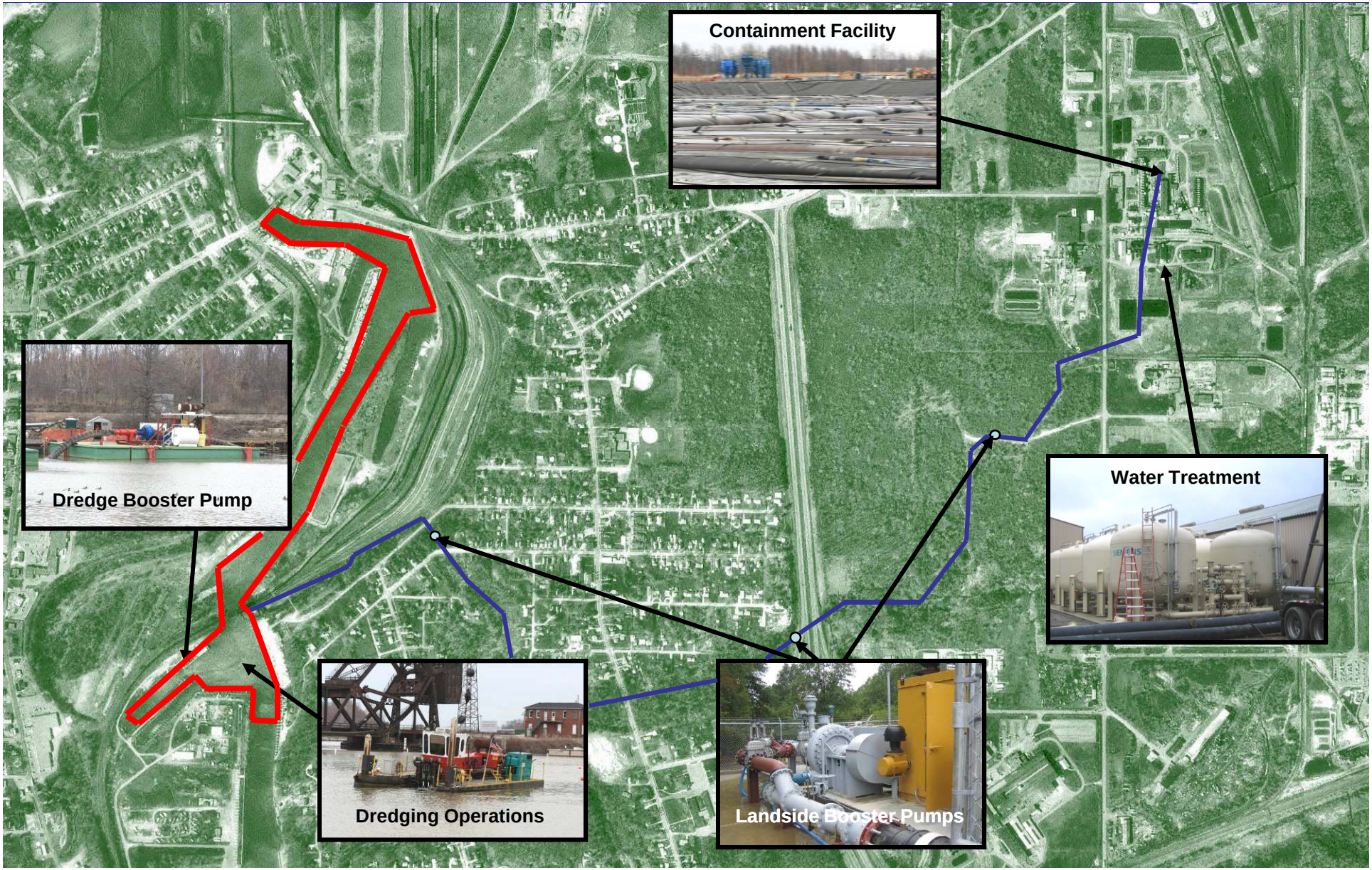
Project Goals

- **Overarching Goals**
  - **Reduce contaminant levels in fish**
  - **Restore use of river by boats**
    - **20% of boats damaged due to shallow depths in 2005**
  - **Reduce number of tumors in fish**
  - **Restore valuable habitat**
- **Specific Remedial Goal**
  - **0.25 ppm PCBs Surface Weighted Average Concentration (SWAC) 10 years after the completion of dredging**
  - **7.5 ppm PCB SWAC immediately following dredging**
  - **Dredge navigation channel below the federally authorized depth**

Re-Sedimentation and Recovery

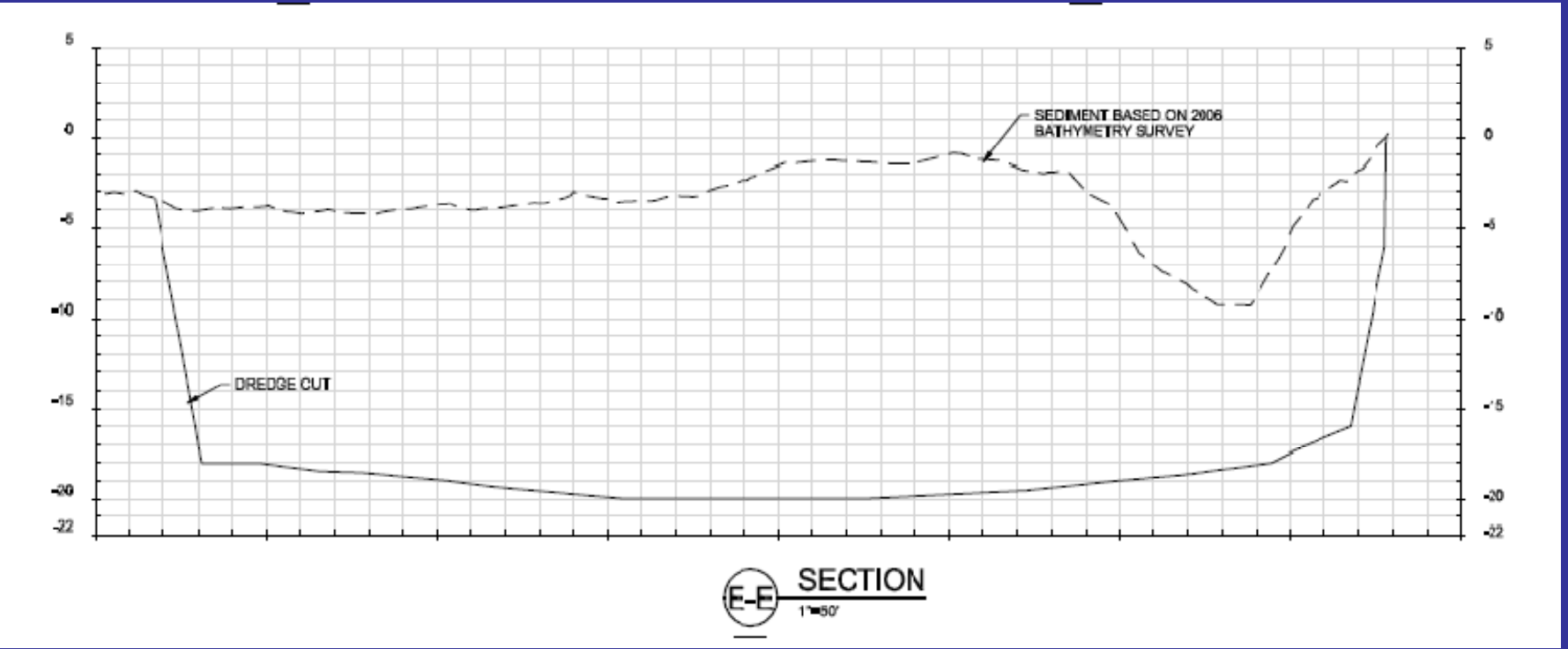


Operations Overview



Dredging

Dredging Cross Section



Summary of Dredging Process

- Required cut depths
  - Average total cut = 11 feet
  - Range of cut depths = 2-18 feet
  - Target depth: 20 feet or Bedrock
  - 545,000 cubic yards targeted for removal
- Two Hydraulic Cutterhead Dredges
  - 12” Dredge for Production
  - 8” Dredge for Clean Up Passes
    - VicVac™ Suction attachment utilized for last pass above bedrock in Upper Turning Basin
  - Operated Concurrently

Hydraulic Dredge

Dredging Equipment

Biggest Challenge: *Debris*

Solution: *Gatling Plate and Shear Bar*

Solution: *Root Knife Installed in Pumps*

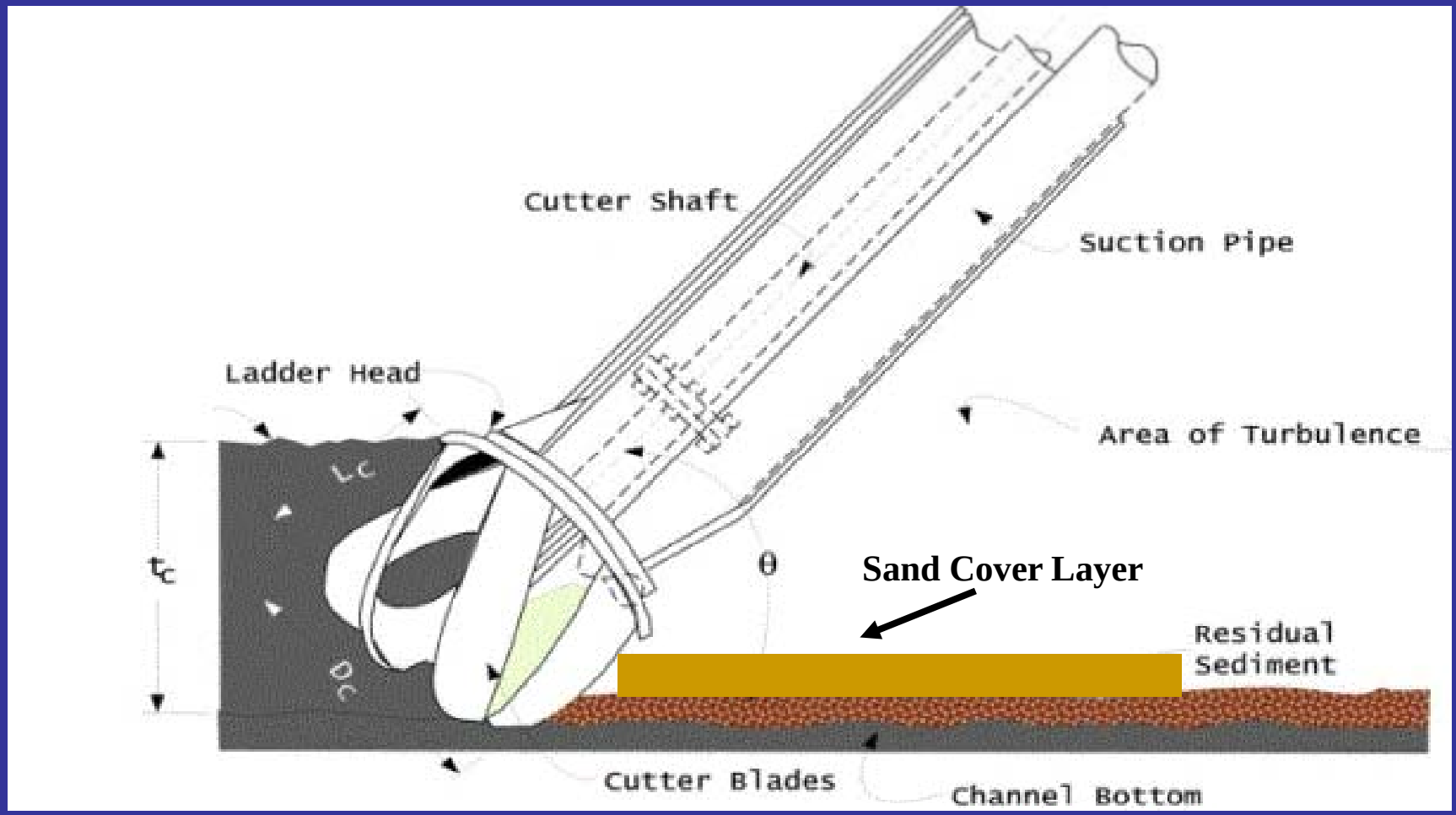
Dredging and Debris

- Debris related shutdowns
  - 2006: 19% project downtime throughout the entire system, with the worst day averaging 4 shutdowns per hour
    - installed revised gatling plate, and root knife in dredge pump led to 7% project downtime, and 1 cleanout every 2 hours.
  - 2007: Installed wiper blade along with gatling plate, added root knives to all boosters
    - 3% project downtime.

8” Dredge for
Cleanup Operations

VicVac™ Attachment

Residual Contamination and Cover Layer



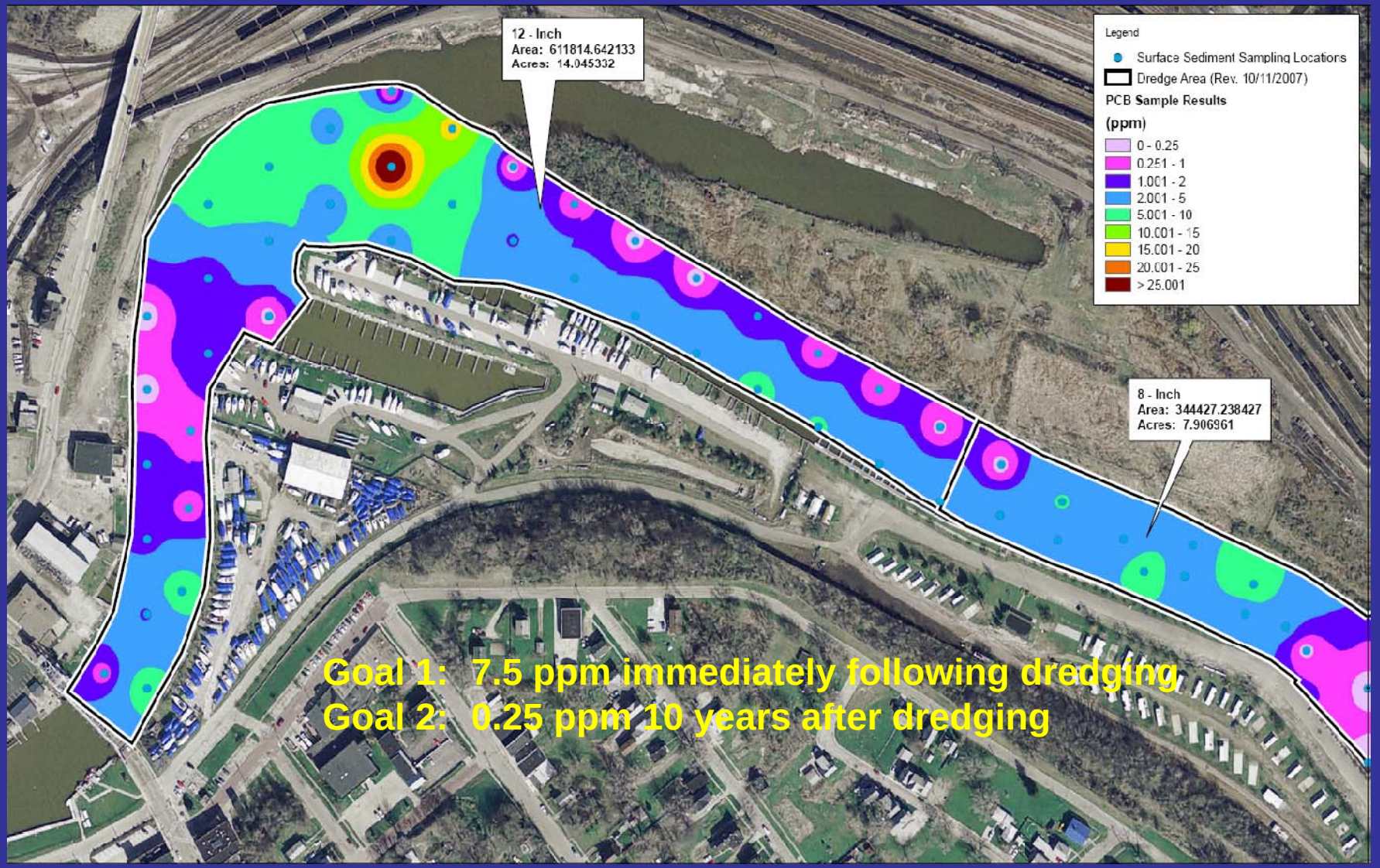
Dredging Operation Details

- 12” Dredge Operating Independently
  - GPM = 4,000
  - Average % Solids = 8%-10%
  - Cy/day = 1,200 to 5,000 (dependent on system uptime)
  - Average cut depth per pass = 5 ft face
- 12” Dredge and 8” Dredge in Tandem
  - GPM = 3,500 + 1,000 = 4,500
  - Average % Solids = 8%
  - Cy/day = 1,200 to 5,000 (dependent on system uptime)

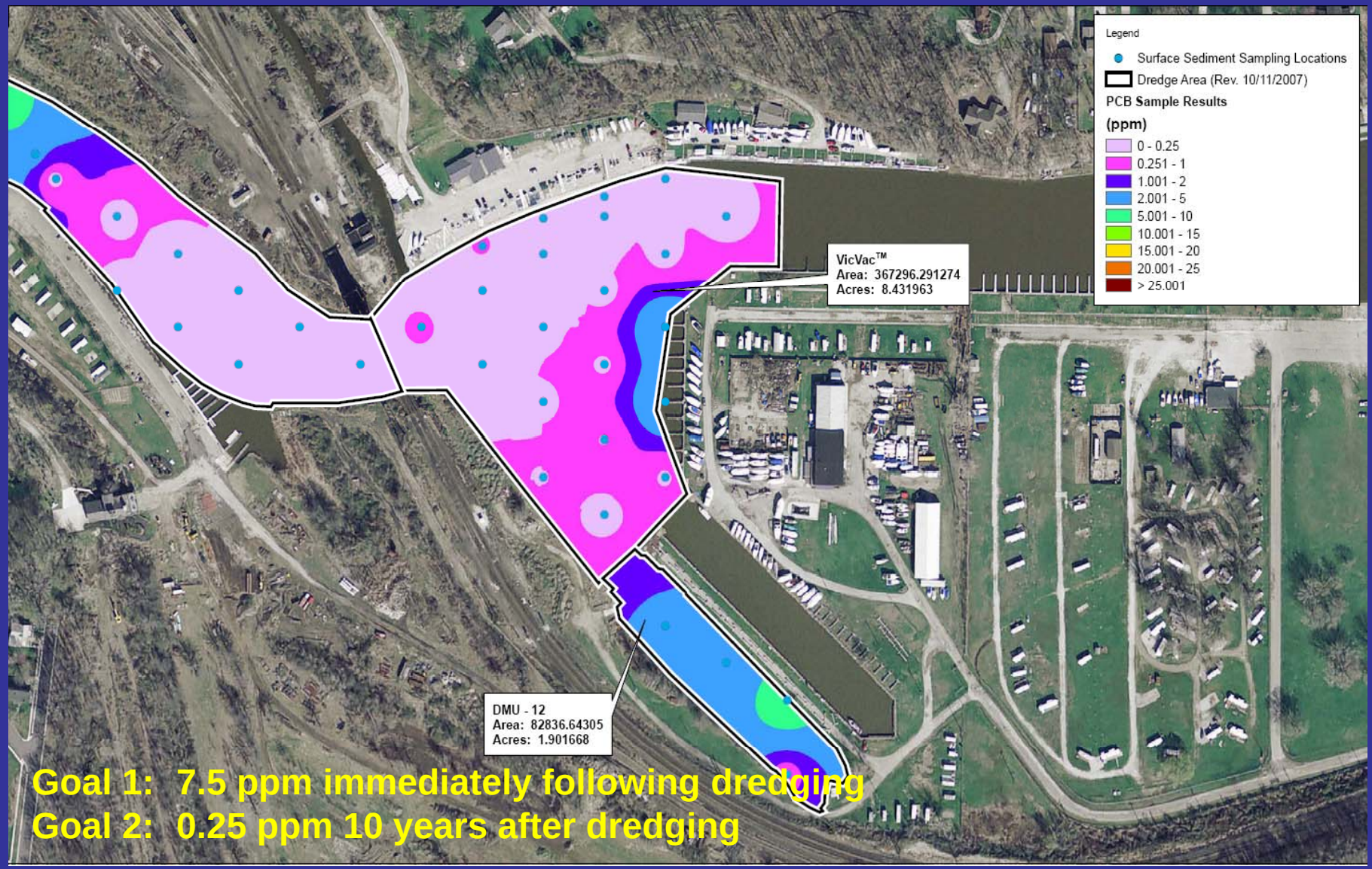
Dredging Operation Details

- 8” Dredge with VicVac™ Attachment
  - GPM = 1,000
  - Average % Solids = 2% to 4%
  - Coverage = ½ acre/day
  - Average cut depth per pass = 6”-12”

Post-Dredging PCB Concentrations



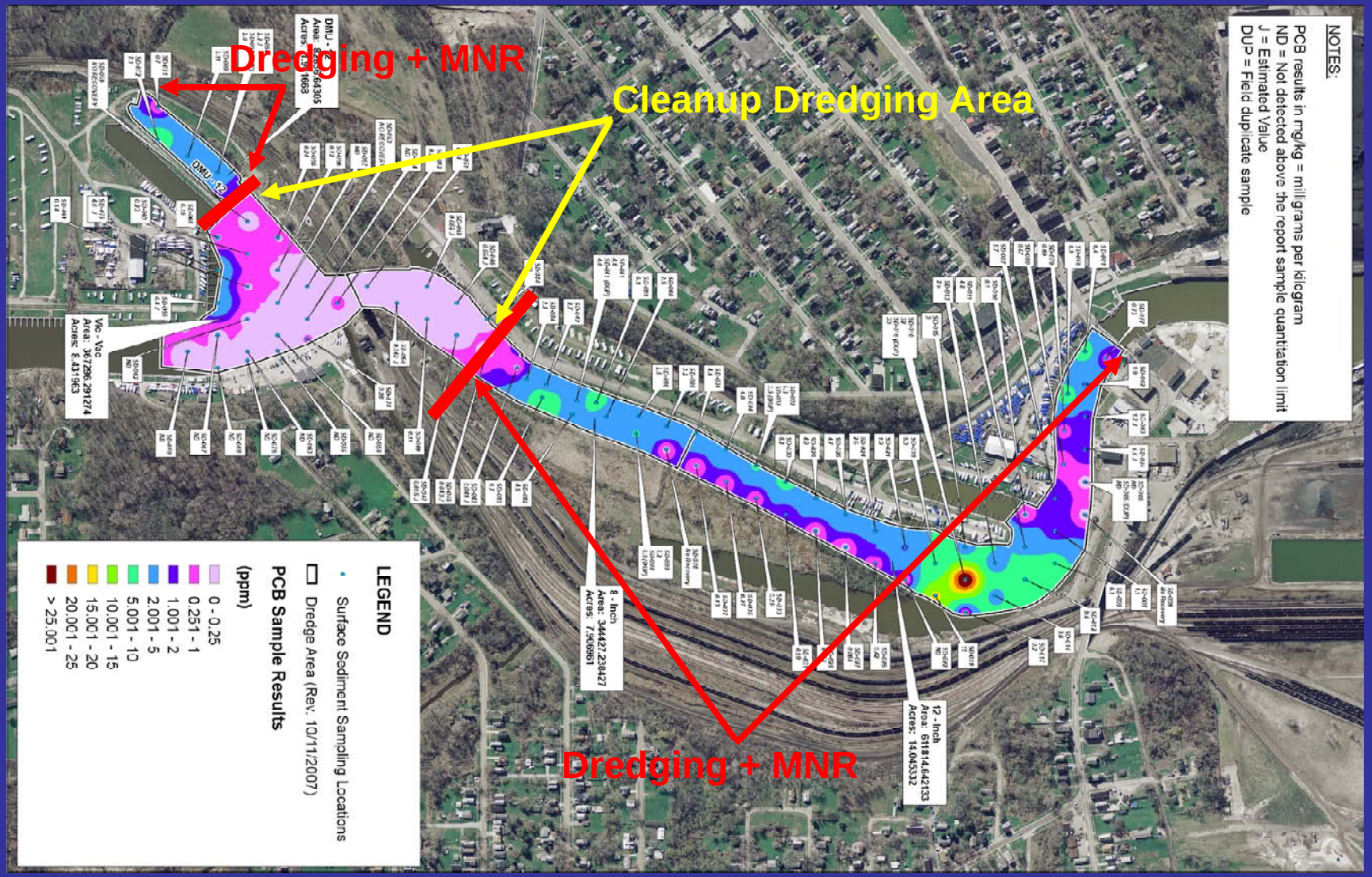
Post-Dredging PCB Concentrations



Post Dredging SWAC

- Goal: 7.5 ppm PCBs
  - Max. Concentration of 40 ppm
- Results: 2.5 ppm PCBs
  - Max. Concentration 33 ppm

Post-Dredging PCB Concentrations



SWAC Comparison

Cleanup Dredging Areas vs. MNR Areas

- MNR Areas
  - Goal: Dredge to prescribed depth, natural sedimentation to complete remediation
  - Approximate Area = 18 acres
  - # of Samples = 50
  - Post-Dredge PCB SWAC = 3.7 ppm
- Cleanup Dredging Areas with 8” Dredge
  - Goal: Remove all sediment to bedrock
  - Approximate Area = 10 acres
  - # of Samples = 21
  - Post-Dredge PCB SWAC = 0.1 ppm

Dredging: Lessons Learned

- Innovations are improving results of environmental dredging
- “Necessity is the mother of invention”
- Use of wiper blades, gatling plate, and root knives reduced impact of debris
- Need top notch team/Listen to the dredging experts
- Prescribe objectives, not methods
- Continuous improvement
- Proper sampling leads to accurate volume estimates
- Set realistic cleanup goals

Transport, Dewatering, Disposal, Water Treatment

Double-Walled Pipeline

CF with geotube bags laid out in preparation for sediment dewatering

Summary of Dewatering & Water Treatment

- Equipment
  - Primary Treatment
    - Geotubes (primary removal)
      - Anionic and cationic polymers
  - Secondary Treatment
    - Lamella Settlers/Polishing Bag Field
      - Poly Aluminum Chloride (PAC)
  - Polishing Treatment
    - Sand Filters
    - Carbon Filters
- Capacity
  - Designed for 5,000 gpm

Summary of Water Treatment

- Discharge Limits
  - PCBs = 0.0001 ug/L (monthly average)
  - Hg = ND (at 0.16 ng/L)
    - Difficulty meeting this limit
    - Discharge concentration significantly less than river water concentrations
  - TSS = 10 mg/L (monthly average)
    - Daily maximum = 20 mg/L

Sediment Dewatering

Mountains of Bags

Polymer Quality Control

Sand and Carbon Filter Units

Clarification System
(installed winter shutdown)

Polishing Bag Field

Dewatering: Lessons Learned

- Chemistry, Chemistry, Chemistry
- Accurate chemistry = better performance
  - Not enough polymer = Poor solids removal
  - Too much polymer = Plugged bags & Unhappy WTP
  - Heterogeneity of Sediment Slurry (% solids)
  - Oil and Grease
- Minimal Breakages (9 bag failures)
  - Watch flow rates and pressures
- Adequate man power, lighting, training, and conditioning
- Safety/Managing bags for stability

Water Treatment: Lessons Learned

- Getting the Chemistry Right
  - Substantial problems if chemistry and dose of polymer not accurately matched to sediment chemistry
  - Sediments are not a homogeneous matrix
- Impacts from Oxidation of Iron
  - Before and/or after treatment plant
- Need enough flexibility to incorporate changes to WTP as required
  - Equipment
  - Size
- Oil Grease Impacts

Progress, Issues, and Modifications

2006 Progress

- **Dredging Commenced on September 9, 2006**
  - **Average production <800 cy per day**
  - **62,000 cubic yards dredged**
  - **Winter shutdown on November 27, 2006**
- **Barrier to Construction**
  - **Polymer chemistry/dosing**
  - **Water treatment plant performance**
    - **Exceedances of TSS limit**
  - **Debris**

Winter 2006/2007 Modifications

- Root knives installed on dredge and at each booster pump
- Installed Wipers on Gatling Plate
- Secondary treatment component added to WTP
  - Lamella settlers
  - Polish bag field
- Modifications to dewatering/water treatment chemistry
  - Cationic polymer added prior to dewatering
  - ACH added to control soluble iron before primary treatment process
- 2nd 8” Dredge mobilized for cleanup operations
  - Articulating dredge head
  - VicVac™ Attachment
  - 12” Dredge and 8” Dredge feed into single 12” transport line

2007 Progress

- **Full-scale dredging commenced April 6, 2007**
  - **Average production ~2,400 cy per day (including cleanup passes) at ~63% project uptime**
  - **435,000 cubic yards dredged in 2007**
  - **Dredging end date: October 14, 2007**
- **Residual Cover Placement**
  - **2+ acres covered in 7 days**
- **Remedial work complete**

Lessons Learned

- Initial production ≠ Ultimate Production
- 2007 performance improvements was possible because of lessons learned during 3 month production-scale “pilot” dredging in 2006
- Adapt and improve
- Dredging and disposal is not cheap ($125 per cubic yard)
- Dredging and disposal is not easy, but it can be accomplished

Questions?