Lower Harbor Confined Aquatic Disposal Cell (LHCC) Technical Working Group Meeting March 1, 2012

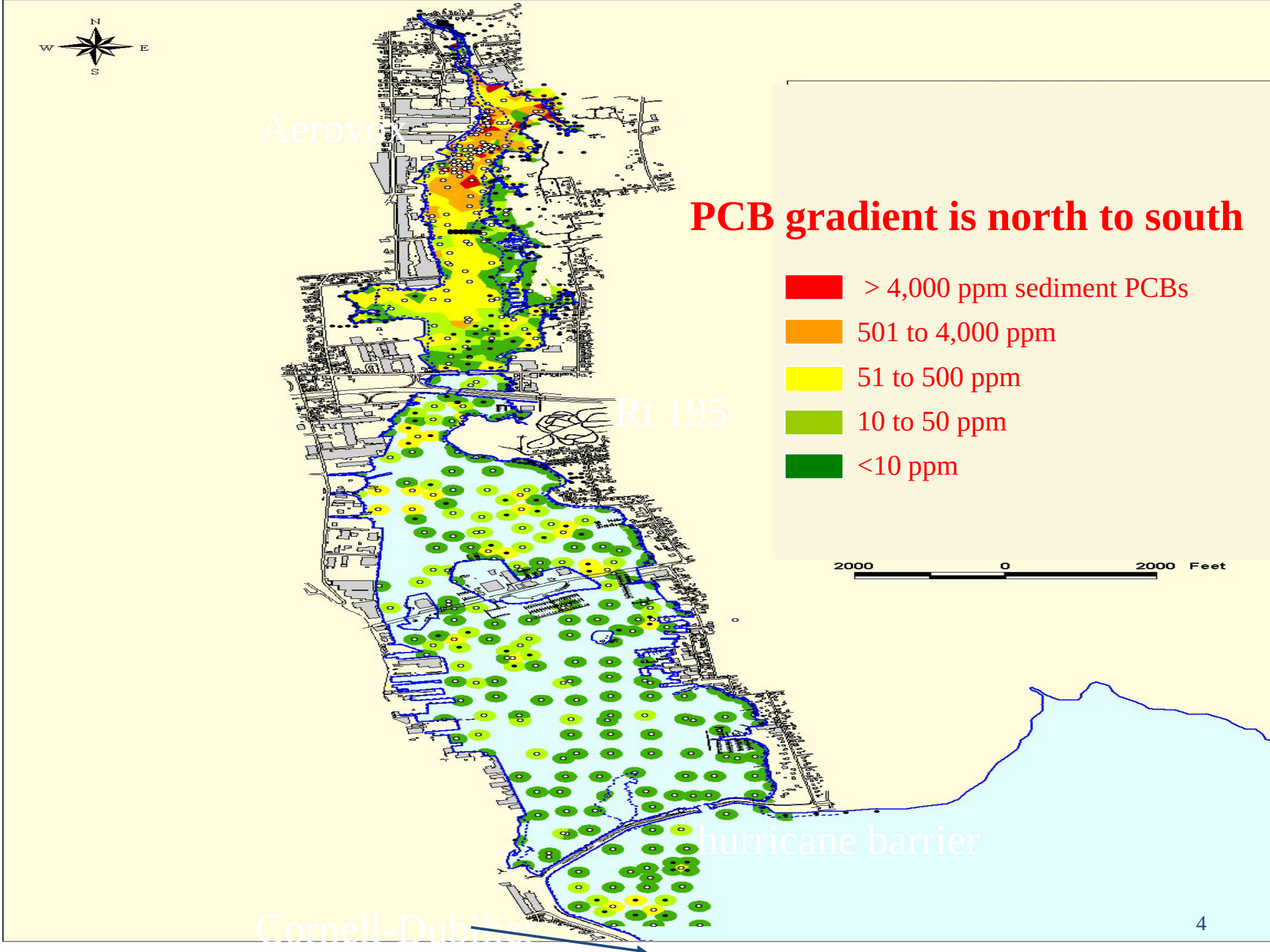
Today's Topics

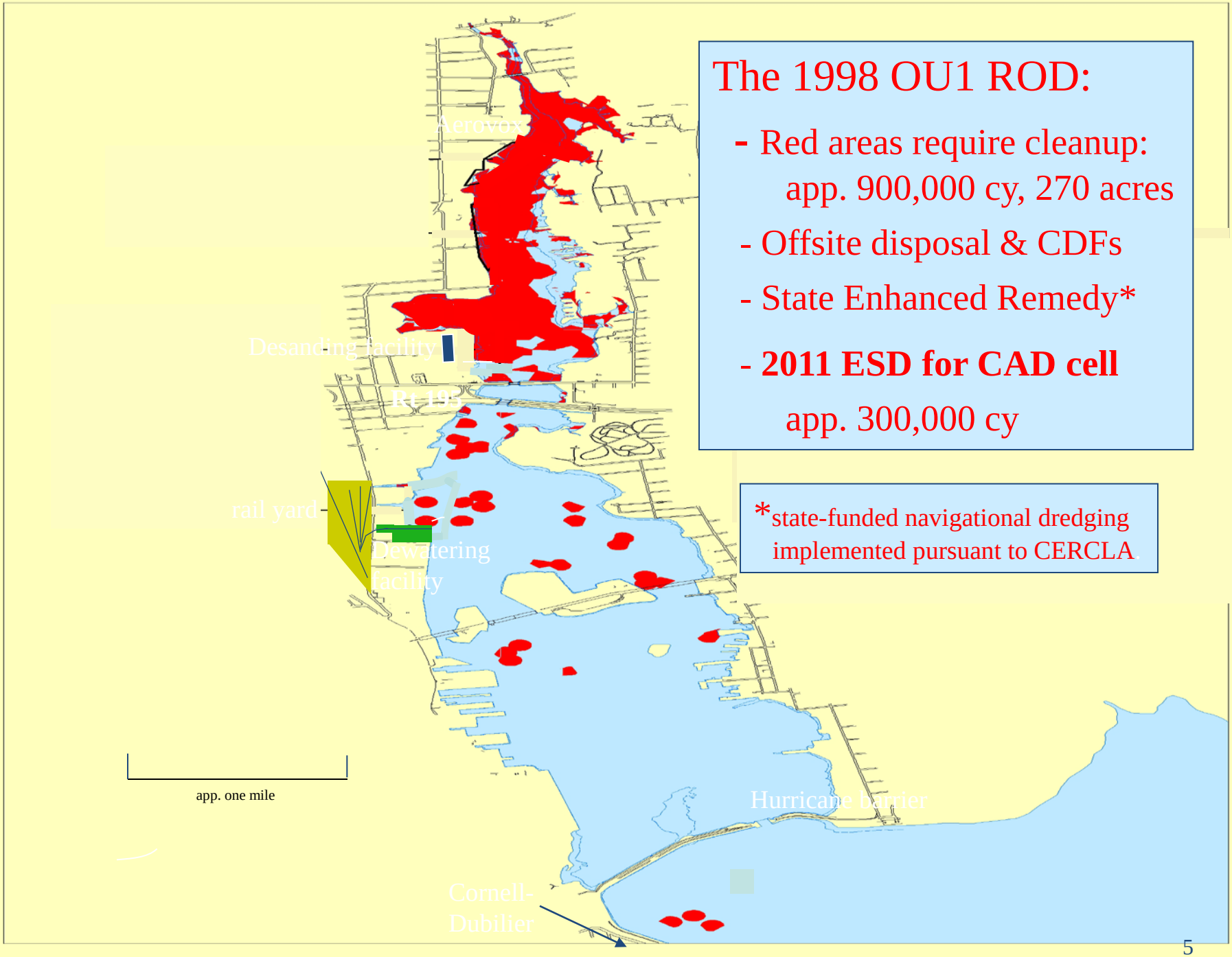
- Dave Lederer, EPA
  - Overview
  - Planning Process:
  - Management
- Edward Anthes-Washburn, HDC
  - Harbor Development Commission Role
- Chet Myers, Apex
  - Technical Considerations for the Design
- Tom Fredette & Ken Heim, USACE
  - Potential migration of contaminants from the CAD cell
- Chet Myers, Apex
  - Status of Technical Design
- Dave Lederer, US EPA
  - Permitting/Compliance
  - Air Monitoring Discussion

Overview : Dave Lederer, US EPA

New Bedford Harbor Website:

http://www.epa.gov/nbh

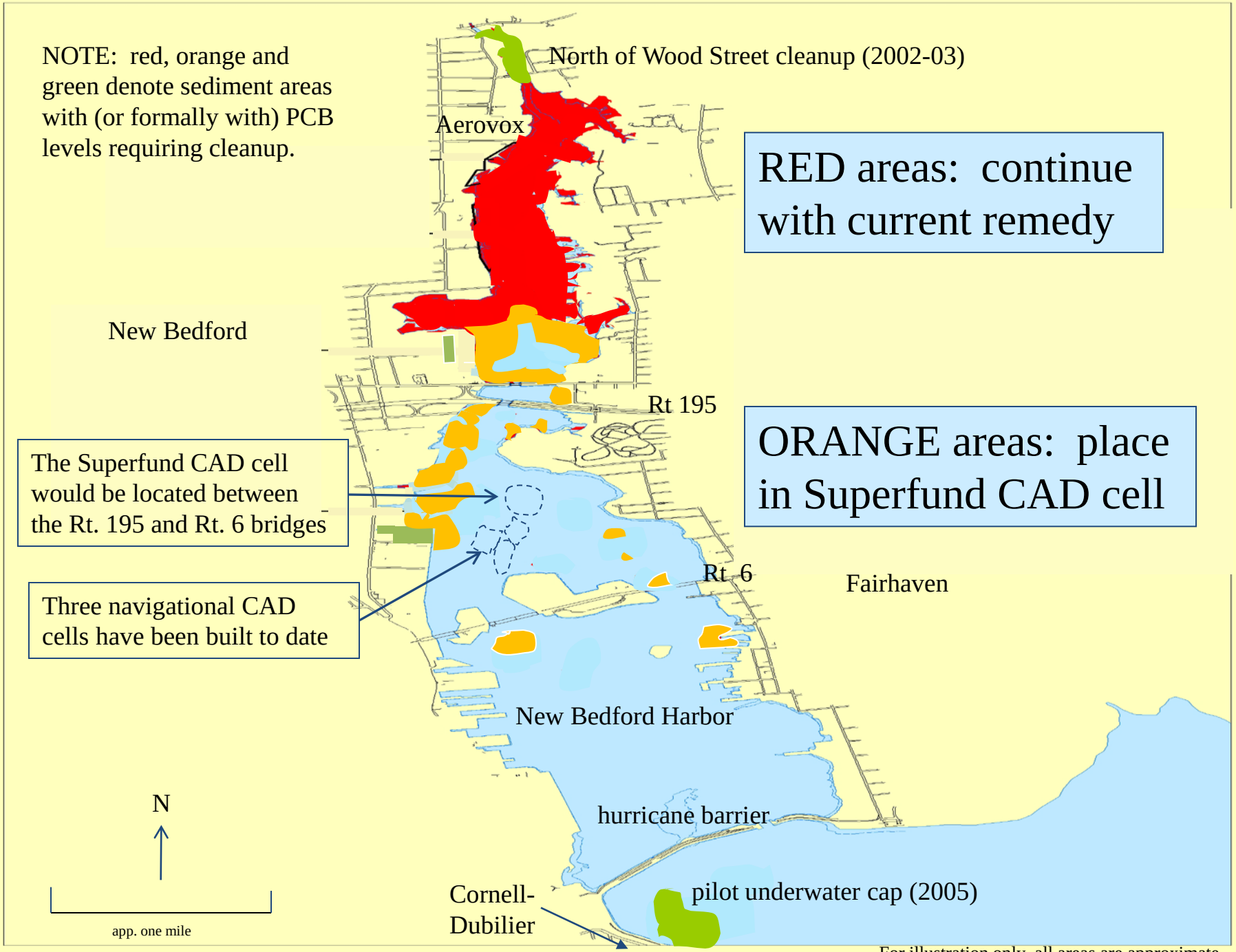

N
W
E
S
Aerovox
Rt 195
hurricane barrier
Cornell-Dubilier
PCB gradient is north to south
> 4,000 ppm sediment PCBs
501 to 4,000 ppm
51 to 500 ppm
10 to 50 ppm
<10 ppm
2000
0
2000 Feet



The 1998 OU1 ROD:

- Red areas require cleanup:
  app. 900,000 cy, 270 acres
- Offsite disposal & CDFs
- State Enhanced Remedy*
- **2011 ESD for CAD cell**
  app. 300,000 cy

*state-funded navigational dredging implemented pursuant to CERCLA.

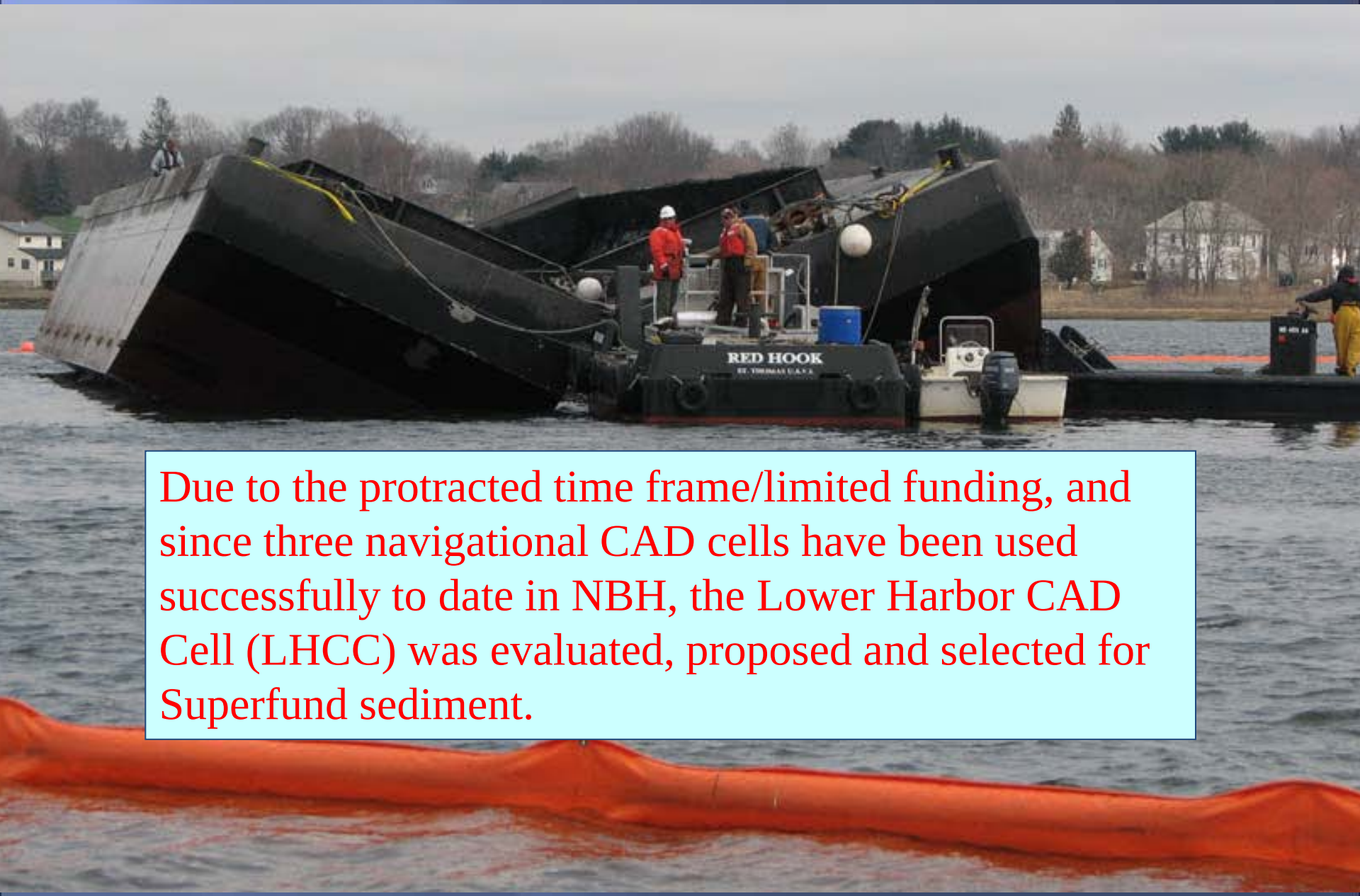

NOTE: red, orange and green denote sediment areas with (or formally with) PCB levels requiring cleanup.
North of Wood Street cleanup (2002-03)
Aerovox
RED areas: continue with current remedy
New Bedford
Rt 195
ORANGE areas: place in Superfund CAD cell
The Superfund CAD cell would be located between the Rt. 195 and Rt. 6 bridges
Rt 6
Fairhaven
Three navigational CAD cells have been built to date
New Bedford Harbor
hurricane barrier
N
app. one mile
Cornell-Dubilier
pilot underwater cap (2005)
For illustration only, all areas are approximate

A Great Deal of Progress Has Already Been Made….

Phase of Work	Year(s)	Cubic Yards	Pounds of PCBs Removed
Pilot Study, North of Wood Street, Hot Spot	1988-2003	40,000 (approx)	>134,000*
Annual Dredging Program	Since 2004	210,000 (approx)	102,000 (approx)
State Enhanced Remedy (SER)	Since 2005	167,000 (approx)	9,000 (approx)
Lower Harbor CAD Cell	Future	300,000 (estimated)	14,600 (estimated)
*conservative estimate			

Low Mass of PCB vs. High Volumes of Sediment in Lower Harbor

- The lower harbor contains large volumes of sediment at relatively low PCB concentrations.
- Mass of PCBs For Lower Harbor CAD Cell: 14,600 lbs (has been estimated to be less than 5% of total mass of PCBs in the harbor)
- However, this has been estimated at less than 40% (300k cy) of the remaining estimated total volume of impacted sediment EPA must address.
- Currently estimated 98 pounds of PCBs being discharged to the Bay yearly.



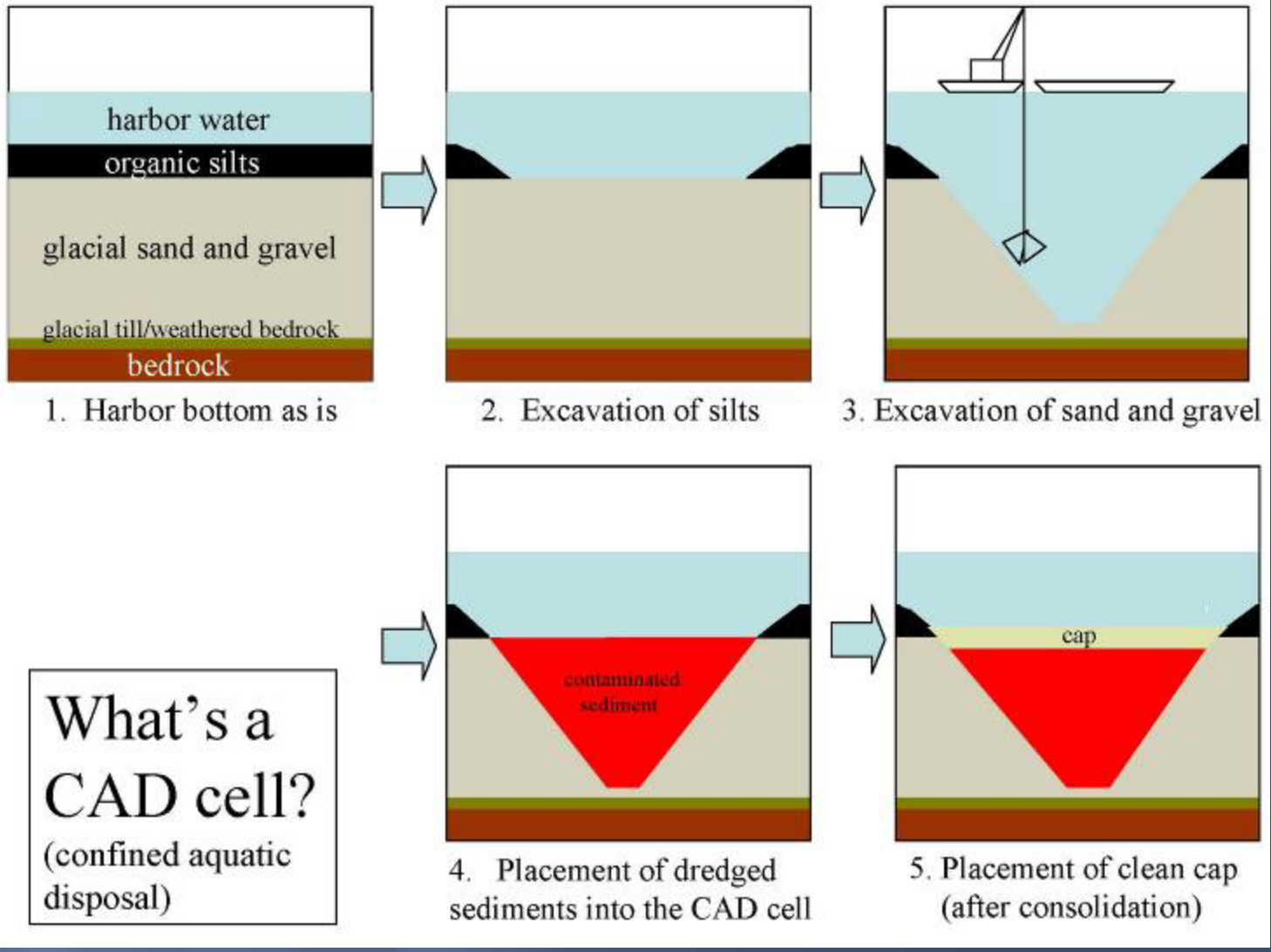
Due to the protracted time frame/limited funding, and since three navigational CAD cells have been used successfully to date in NBH, the Lower Harbor CAD Cell (LHCC) was evaluated, proposed and selected for Superfund sediment.

Lower Harbor CAD Cell Project

- Dredge 300,000 cubic yards of PCB contaminated sediment (mostly) from Lower Harbor;
- Contaminated at levels between 50 ppm and 190 ppm;
- Disposal in Confined Aquatic Disposal Cell (CAD) in Lower Harbor, allowed to consolidate.
- Three foot thick sand cap to cover consolidated material.

ESD Findings

- Can be safely implemented (four separate site-specific lines of evidence demonstrate this:
  - Lower Harbor's ecological quality significantly improved since navigational CAD cells implemented
  - State-of-the-science real-time water quality monitoring water quality performed showing protective results
  - Air and water quality modeling supports safe and effective implementation
  - 2005 underwater pilot cap outside the hurricane barrier continues to be protective


harbor water
organic silts
glacial sand and gravel
glacial till/weathered bedrock
bedrock
1. Harbor bottom as is
2. Excavation of silts
3. Excavation of sand and gravel
What's a CAD cell?
(confined aquatic disposal)
contaminated sediment
cap
4. Placement of dredged sediments into the CAD cell
5. Placement of clean cap (after consolidation)

Benefits to New Bedford Harbor of the Lower Harbor CAD Cell

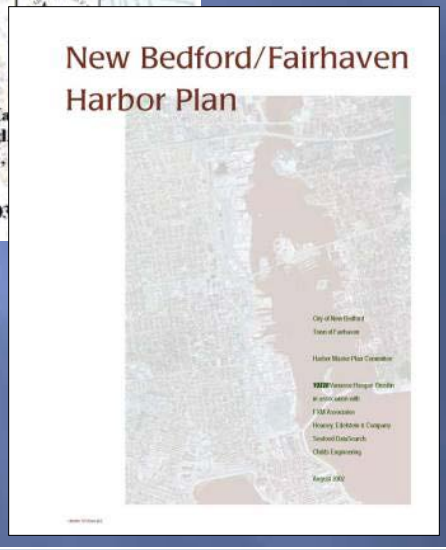
- The Superfund cleanup of sediment (non-navigational) will be complete in the 80% of the Harbor comprising the lower harbor.
- Continued improvements in ecology.
- Lower flux of contaminated sediment to Buzzard's Bay.

Planning: Dave Lederer

EPA has signed a cooperative agreement with the City of New Bedford Harbor Development Commission to design and oversee the construction of the CAD cell.

Navigational Dredging

Public Process To Determine How/Where to Handle Contaminated Sediment

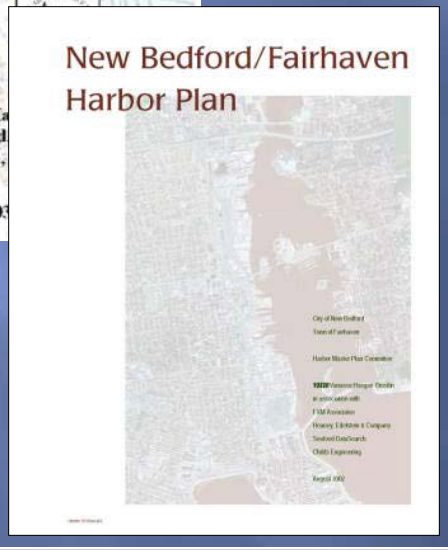


Public Notification/Public Meetings

1998- EPA Record of Decision:

Commonwealth of Massachusetts requests an enhancement to the EPA remedy allowing for streamlined navigational dredging of sediments from New Bedford Harbor

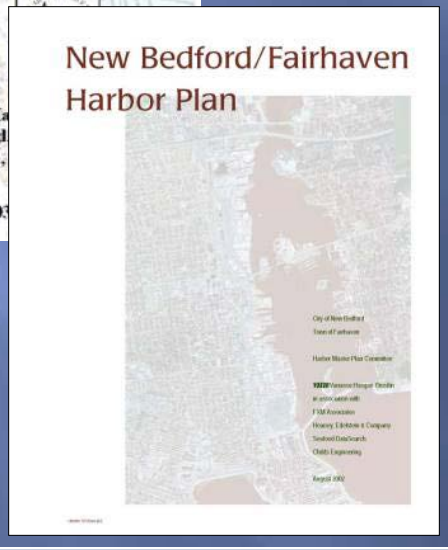
Public Process To Determine How/Where to Handle Contaminated Sediment



Public Notification/Public Meetings

- 2002 – New Bedford/Fairhaven Harbor Plan
- 2003 - Dredged Material Management Plan
- 2004 – Project Change to DMMP
- 2008 – Project Change to DMMP
- 2010 – New Bedford/Fairhaven Harbor Plan

Public Process To Determine How/Where to Handle Contaminated Sediment



Public Notification/Public Meetings

2011 CAD Cell Explanation of Significant Differences (ESD #4)

- Dredging (primarily) of lower harbor
- Disposal in CAD cells in DMMP selected area north of Pope's Island

Dredged Material Management Plan Area

Management

NEW BEDFORD HARBOR
USEPA LOWER HARBOR CAD CELL

USEPA
David Lederer
Remedial Project Manager

Jay Borkland
Apex Program Manager
Design/Resident Engineer

NBHDC
Edward Anthes-Washburn
Acting Executive Director

Pamela Lafreniere
NBHDC Legal Counsel

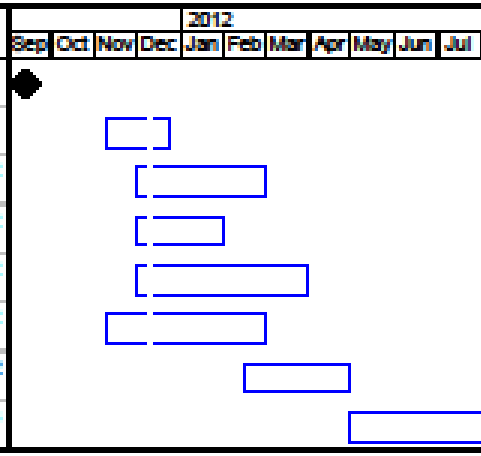
NBHDC
Facility/Harbor Operations
Tommy Vital – Assistant Harbor Master
Capt. Victor Fonseca - Assistant Harbor Master
John Anderson – Harbor Attendant
Robert Boulay – Harbor Attendant

NBHDC
Office + Administration
Roxanne Simoes – Financial Manager
Shelly Miranda – Office Manager
Debra Yuille – Facilities Manager
Adam Hart – Office Aide

Contractor
(To Be Determined)

USEPA LOWER HARBOR CAD CELL
PROJECT TIMELINE

ID	Task Name	Duration	Start	Finish
1	Cooperative Agreement signed by EPA	1 day	Tue 9/13/11	Tue 9/13/11
2	Task 1: Project Plans and CAD Cell Area Bathymetric Survey	32 days	Thu 11/10/11	Fri 12/23/11
3	Task 2: CAD Cell Geotechnical Borings and Vibracores	65 days	Thu 12/1/11	Wed 2/29/12
4	Task 3: CAD Cell Sub-bottom Survey	44 days	Thu 12/1/11	Tue 1/31/12
5	Task 4: CAD Cell Design	87 days	Thu 12/1/11	Fri 3/30/12
6	Task 5: Offshore Disposal Permitting/ Suitability Determination	80 days	Thu 11/10/11	Wed 2/29/12
7	Task 6: Prepare Dredge Contractor Procurement Package	54 days	Wed 2/15/12	Mon 4/30/12
8	Task 7: Construction Oversight/ Resident Engineer	239 days	Tue 5/1/12	Fri 3/29/13



ROLE OF NBHDC: Ed Anthes – Washburn

EPA Lower Harbor CAD Cell

What is role of NBHDC?

Why are we involved?

CAD Cell Management

- HDC has constructed three existing CAD Cells.
- In order for CAD Cell program to continue, prudent management of space and operation must take place.

- LHCC could interfere with future or existing CAD Cell construction or existing marine traffic.
- Therefore, it is in HDC's and City of New Bedford's interest to control where and how the LHCC is constructed.

NBHDC Role in CAD Construction

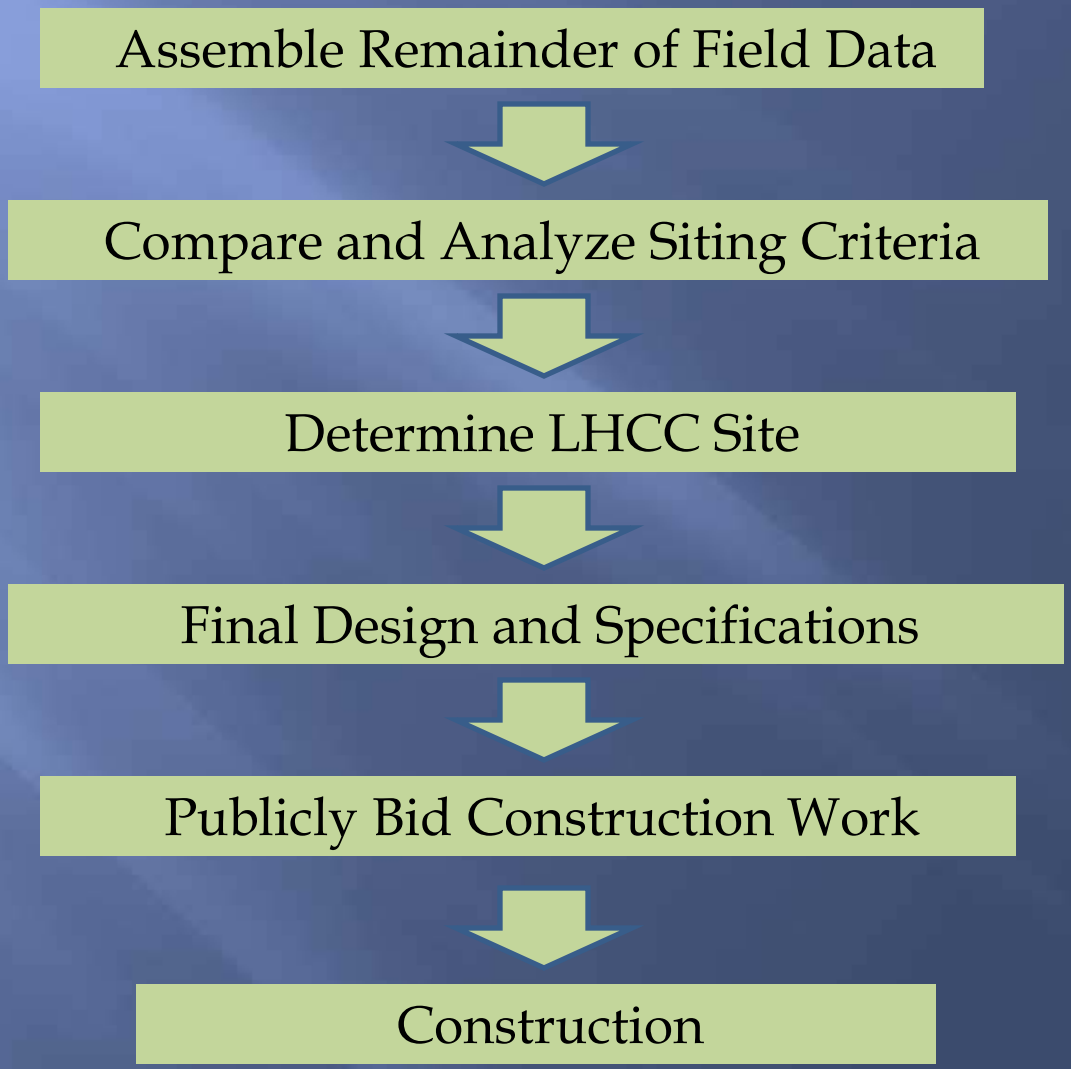
- EPA has granted NBHDC funds to design and construct LHCC.
- Once constructed, EPA will take ownership and operate and close LHCC.
- At some point in the future, Commonwealth of Massachusetts will take over operation from EPA.
- NBHDC will not operate or maintain LHCC. Once the LHCC is constructed, NBHDC's involvement will end.

Technical Considerations

Technical Considerations
LHCC Siting

- Siting Criteria:
  - Geotechnical properties of site location.
  - Potential for interference with existing navigation and harbor uses.
  - Interaction with existing and planned CAD Cells.
  - Depth to bedrock.
  - Proximity to existing navigational channels.
  - Thickness of mud layer that must be placed in CAD Cell #2
  - Need for Transitional CAD Cell.
  - Need for channel to access CAD Cell location.

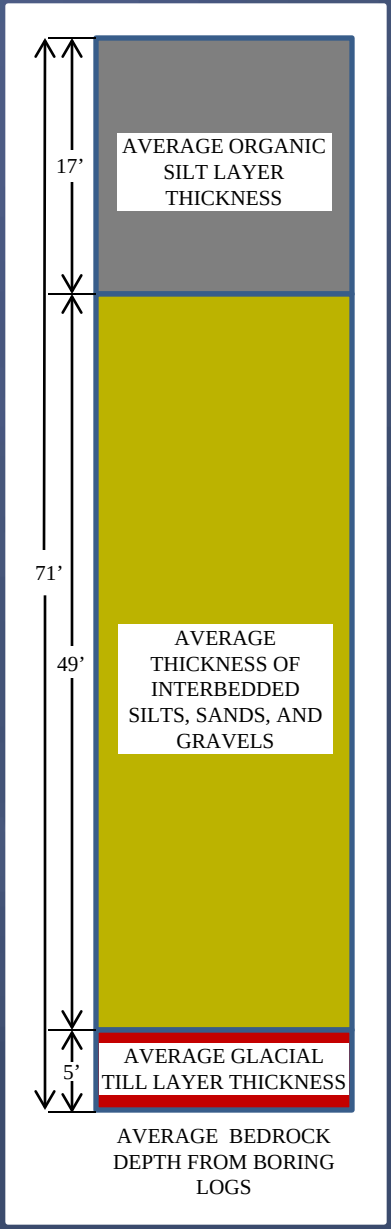
Process Flow Chart Moving Forward

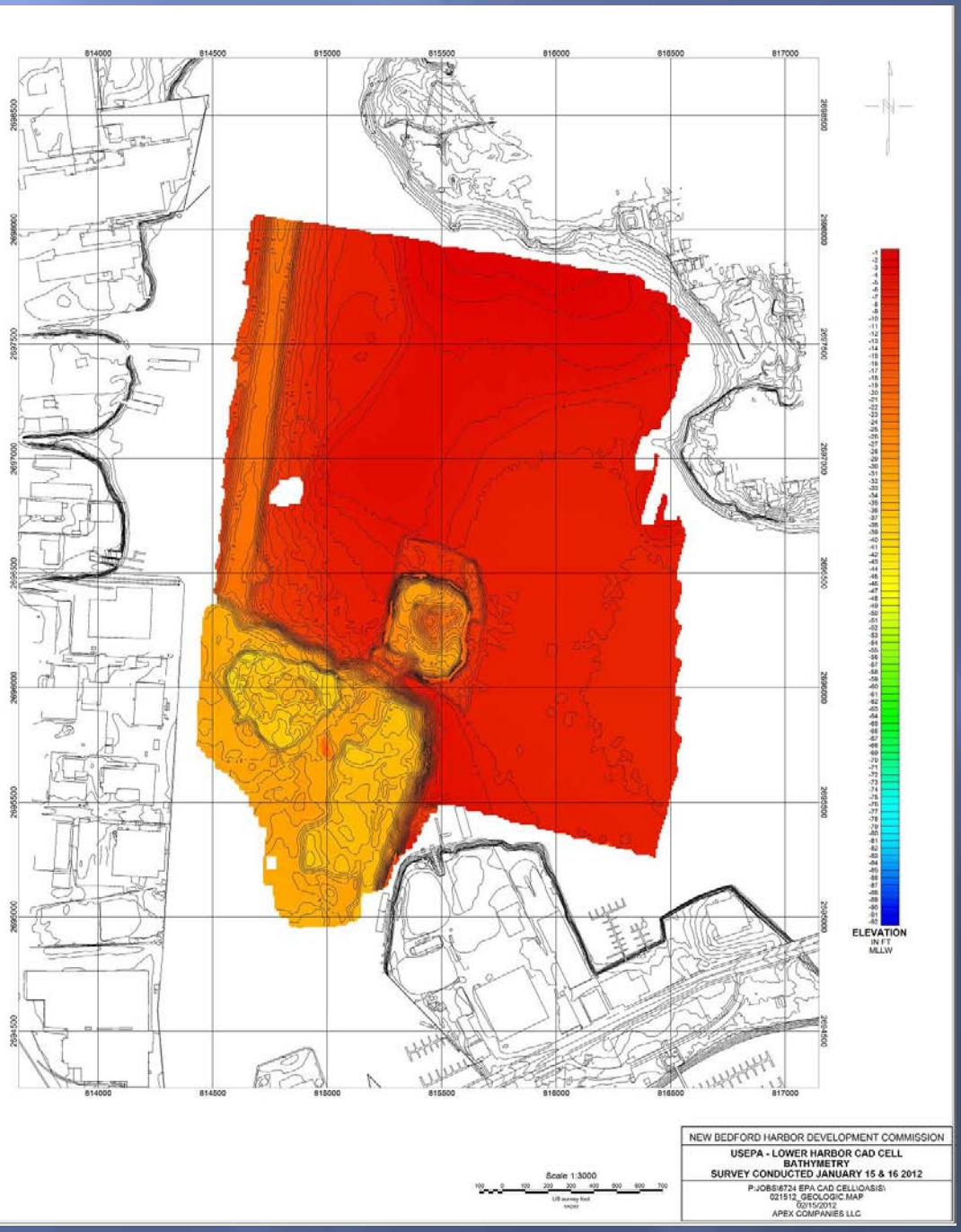


Characterization of Material at the Proposed Site

Geologic Model Summary

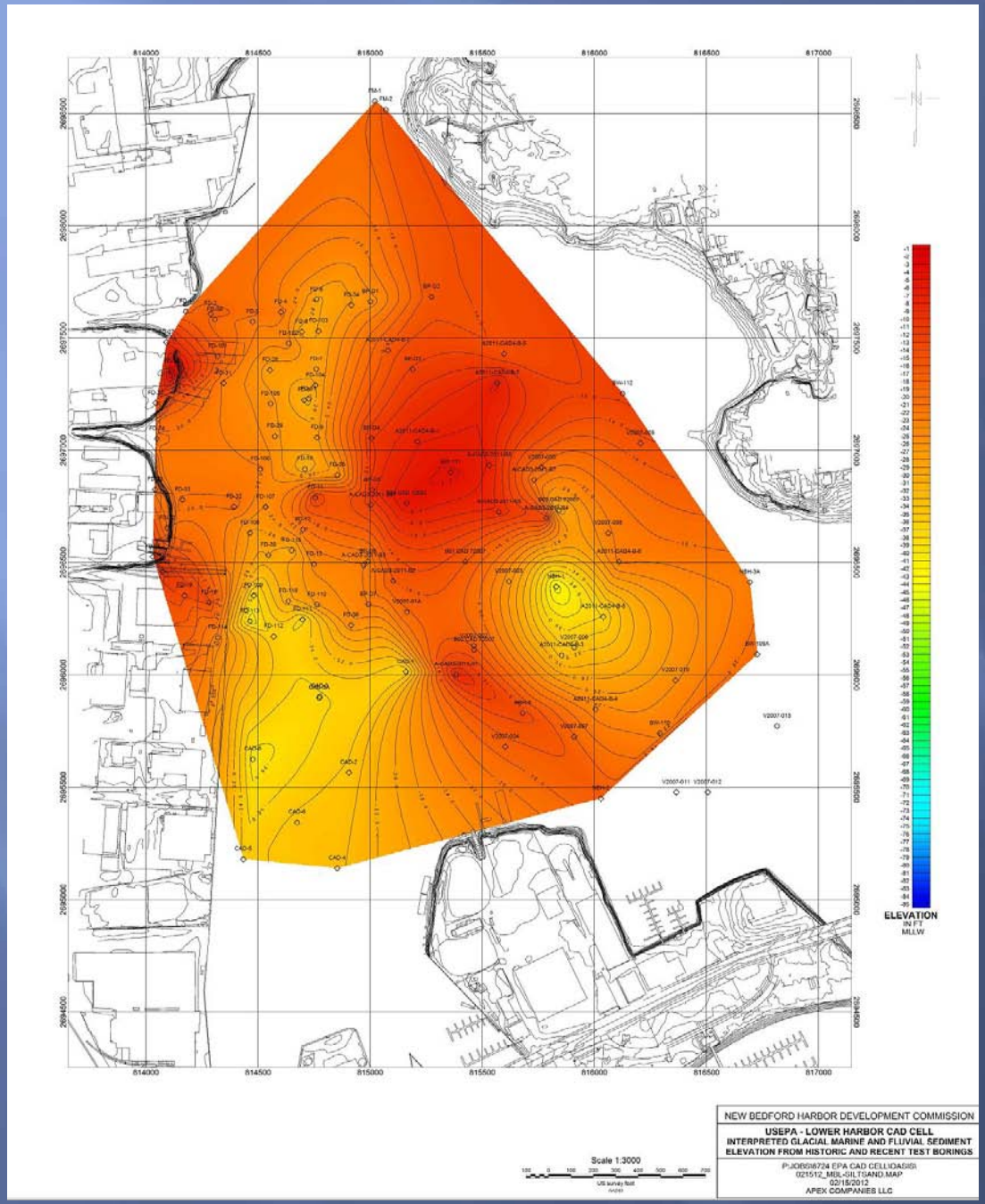
- Local Geology:
  - Recent Marine Sediments (Organic Silt/Clay Layer)
  - Glacial Marine and Glaciofluvial Sediments (Interbedded silts, sands, and gravels)
  - Glacial Till
  - Bedrock





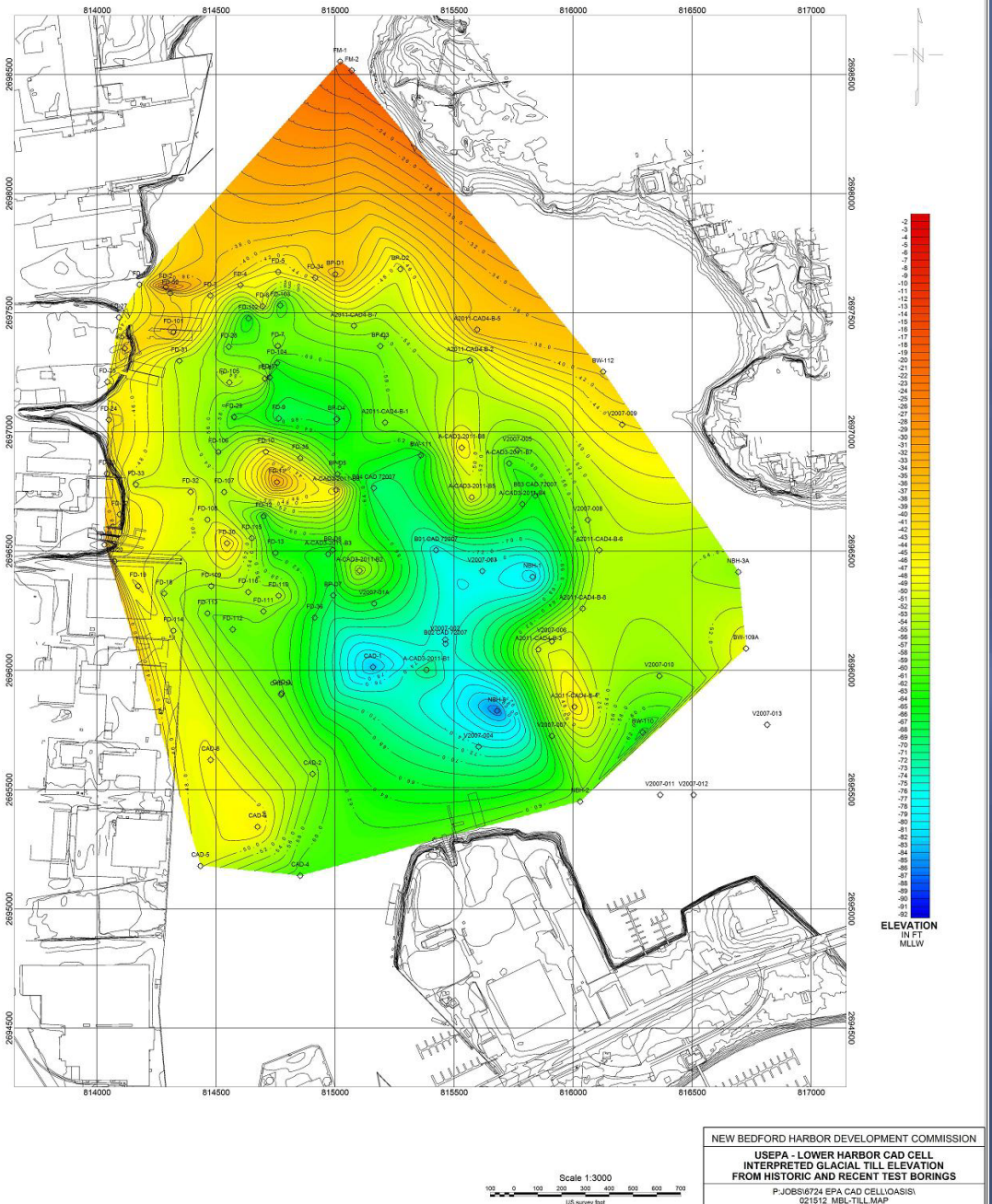
Geologic Model

Recent Marine Sediments (Organic Silt/Clay)



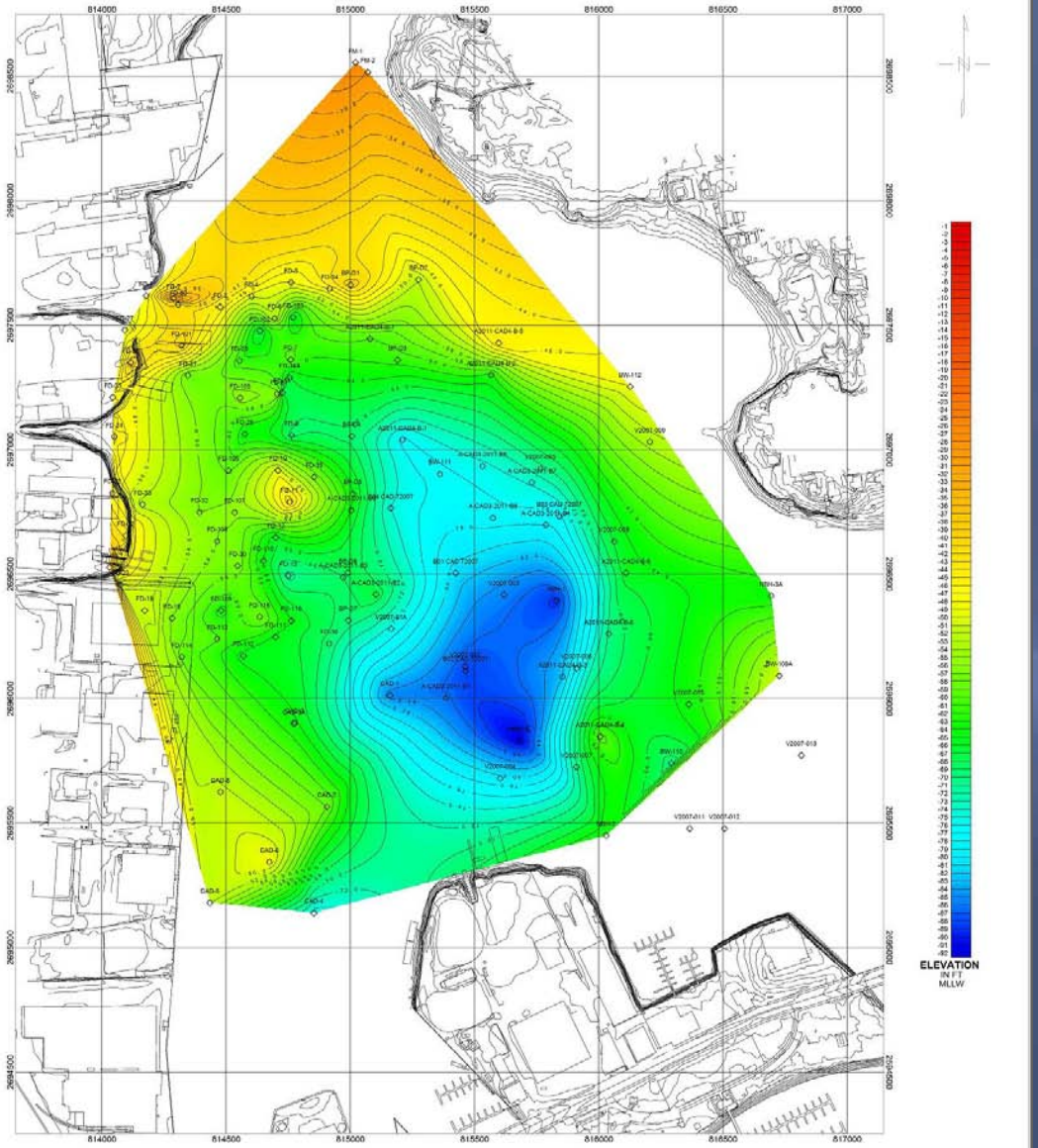
Geologic Model

Glacial Marine and Glaciofluvial Sediments



Geologic Model

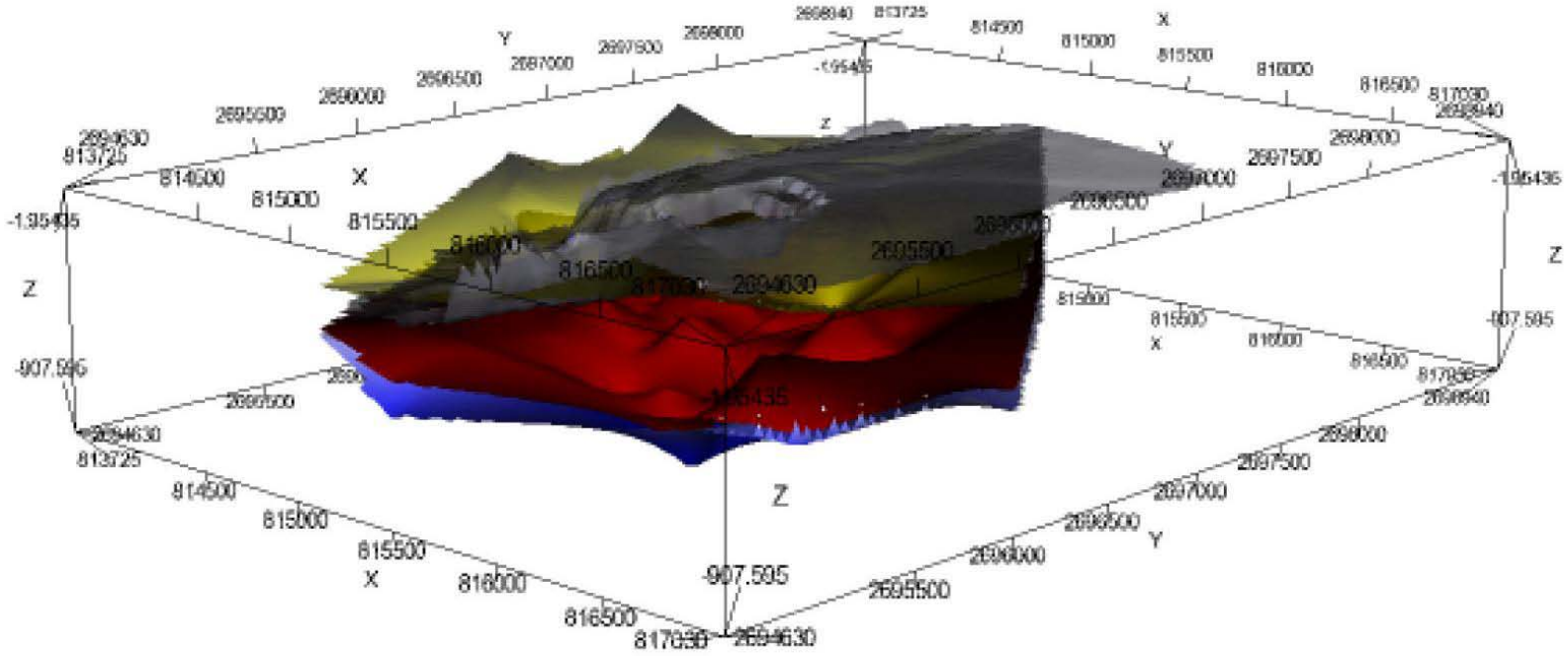
Glacial Till



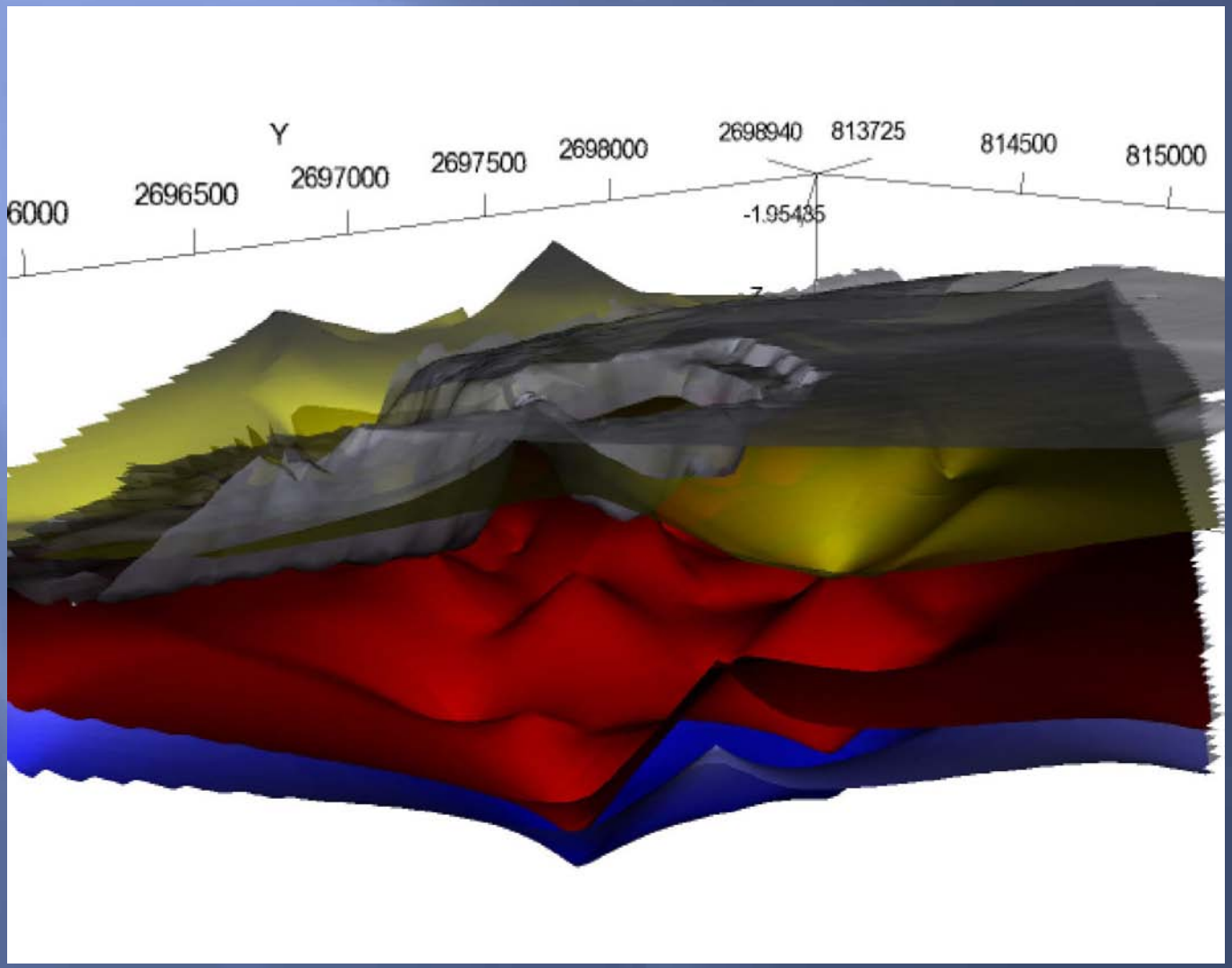
Geologic Model

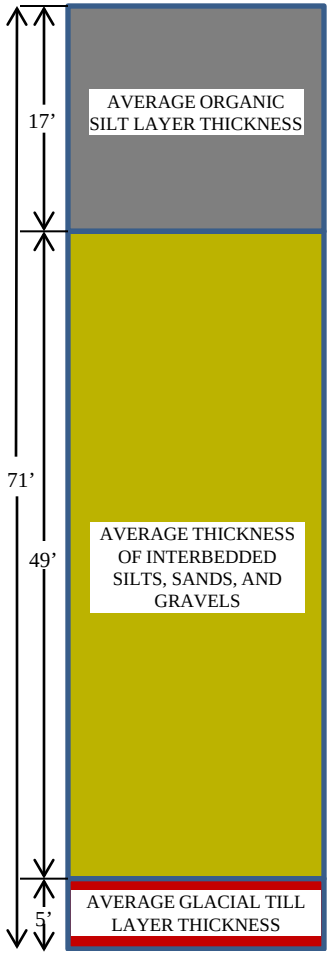
Bedrock

Geologic Model
3-D Image of Layers



Geologic Model
Slice of 3-D Image





AVERAGE BEDROCK DEPTH FROM BORING LOGS

New Bedford Harbor CAD Cell Modeling

Thomas J. Fredette, PhD
Engineer Research and Development Center

1 March 2012

US Army Corps of Engineers
BUILDING STRONG®

May 2010

US Army Corps of Engineers
Engineer Research and Development Center

Assessment of Contaminant Loss and Sizing for Proposed Lower Harbor Confined Aquatic Disposal (CAD) Cell

New Bedford Harbor Superfund Site Massachusetts

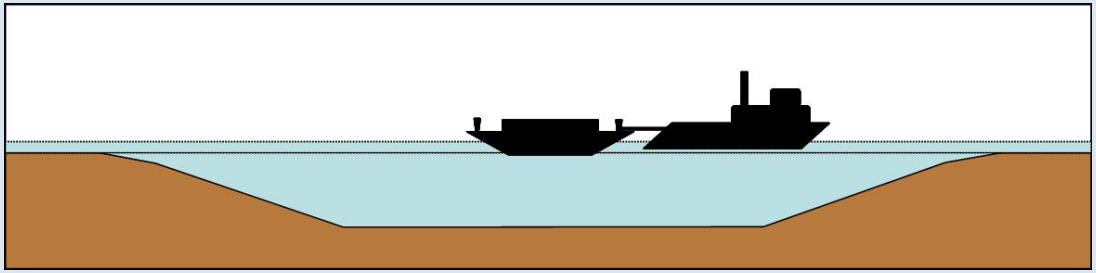
Paul R. Schroeder, Carlos E. Ruiz, Thomas J. Fredette and Earl Hayter

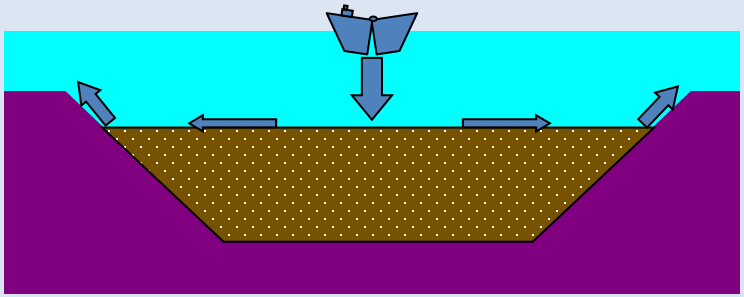
Environmental Laboratory
US Army Engineer Research and Development Center
3909 Halls Ferry Rd
Vicksburg, MS 39180-6199

Prepared for U.S. Environmental Protection Agency, Region 1

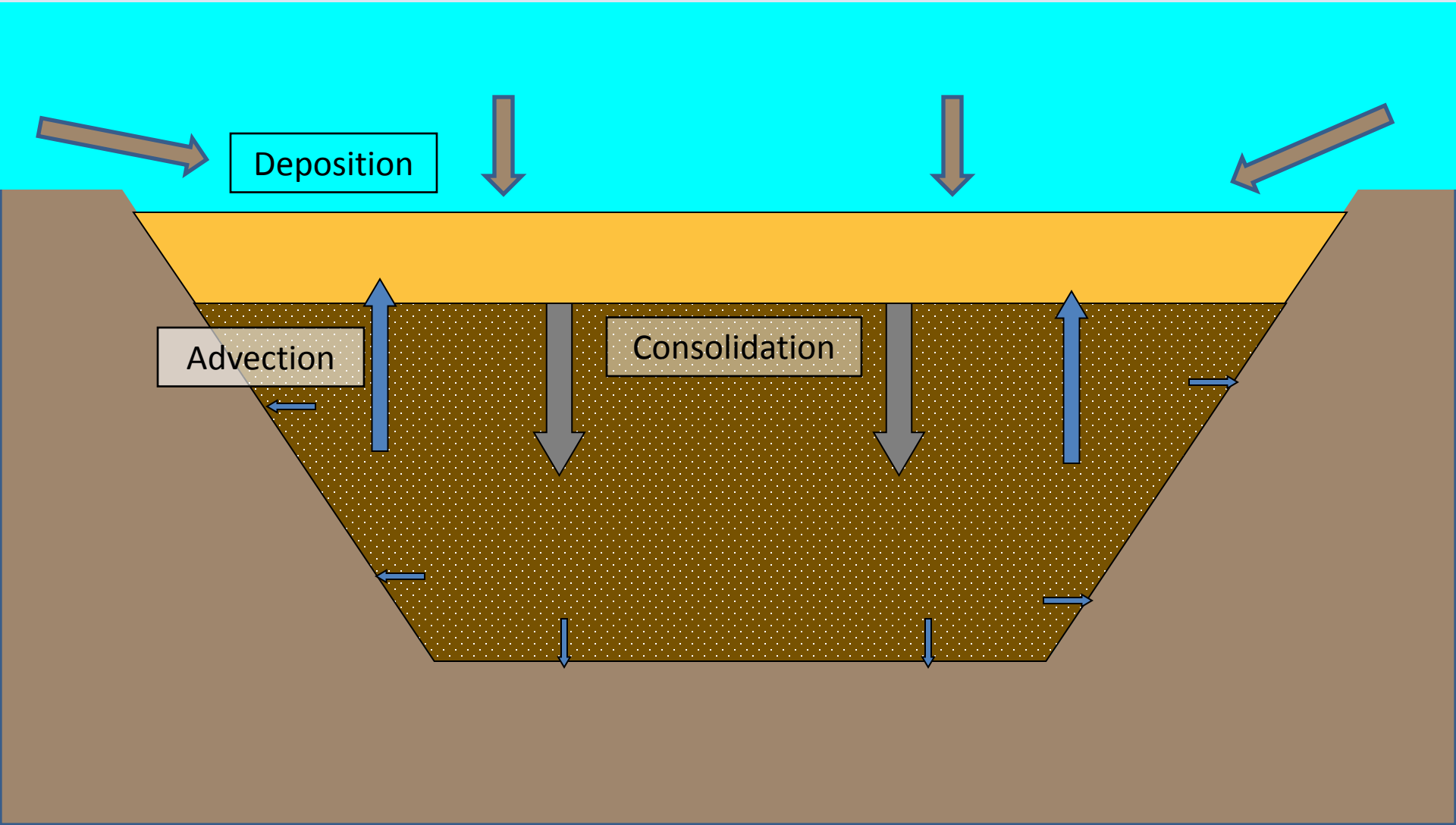
What was Modeled?

- Losses during filling/between seasons
- Lateral surge from filling
- Consolidation
- Long-term losses

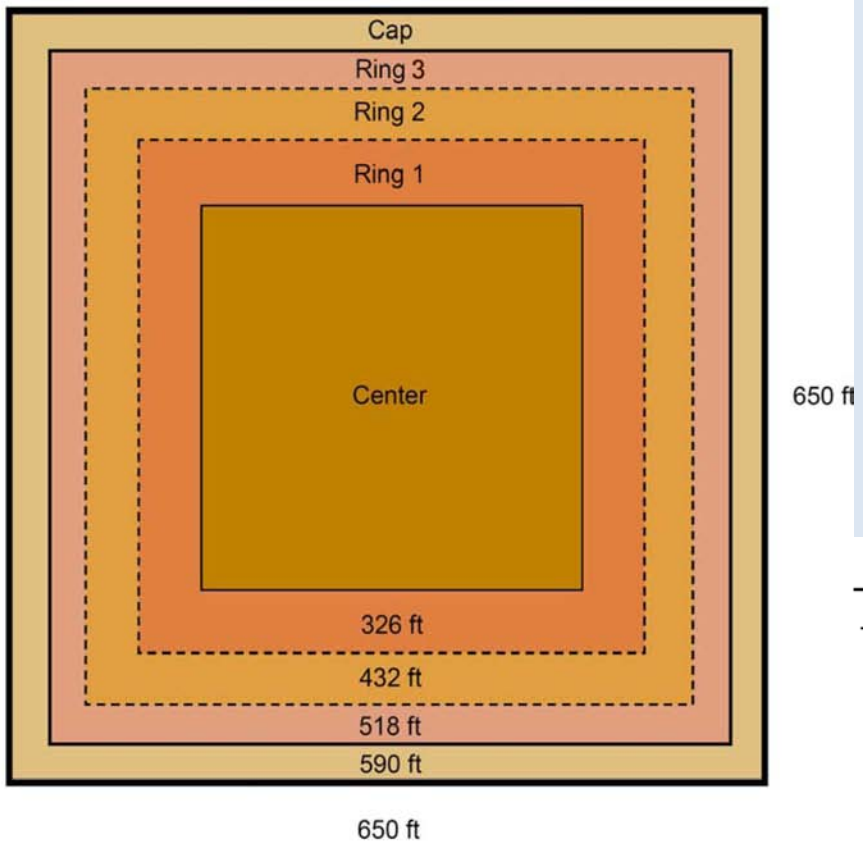


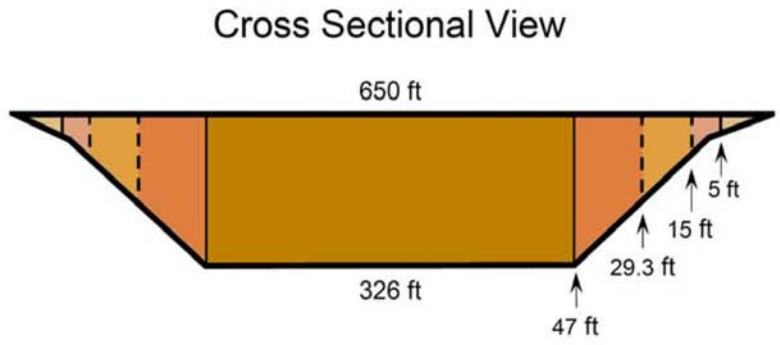


NBH CAD Cell Long-term Conceptual Model



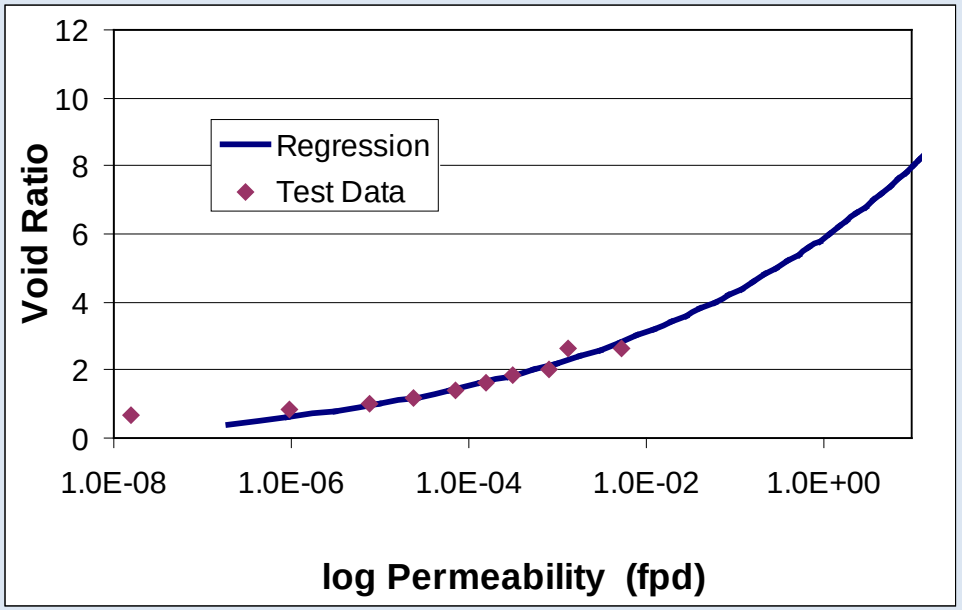
Model Set-up



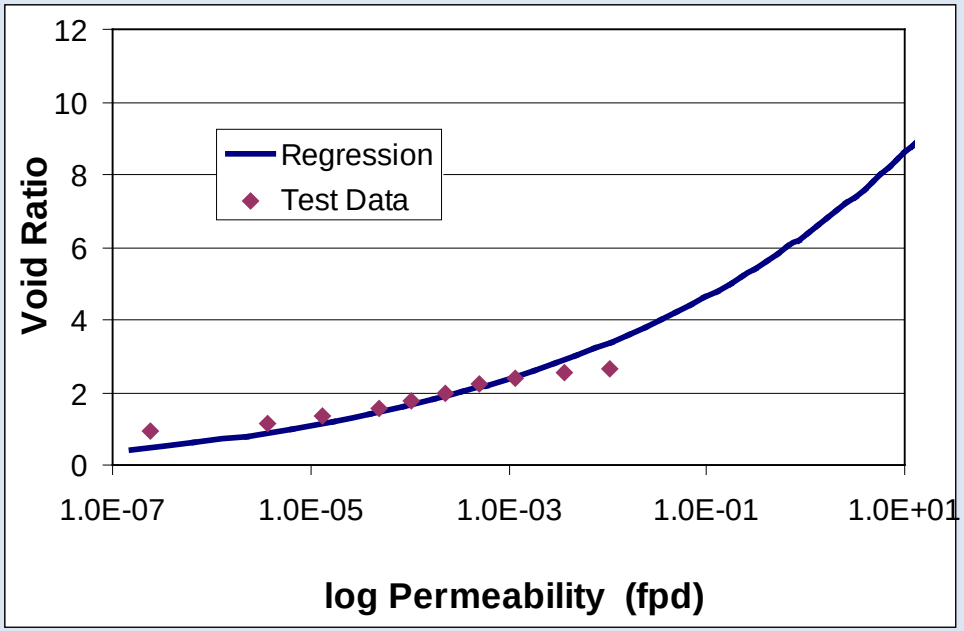


Properties				Concentration (mg/kg)			
				PCBs			
SG	Porosity	foc		1242	1248	1254	Cu
2.7	0.4989	0.003	Mixed 0.33 ft	0	0	0	0
2.7	0.4899	0.003	Cap 2.96 ft	0	0	0	0
2.46	0.7773	0.071	Composite 5 12.89 ft	17	3.86	11	2030
2.6	0.7126	0.066	Composite 4 20.56 ft	16	6.3	8	836
2.47	0.6896	0.087	Composite 3 8.27 ft	47	37.7	21	1110
			Clean Sediments				

Consolidation Testing (used in modeling)

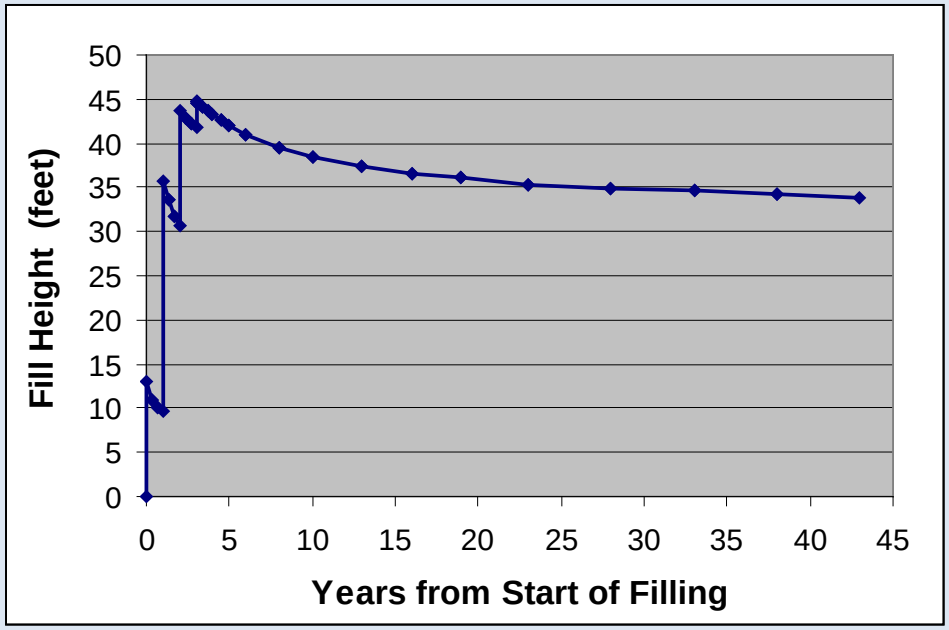


Composite 3

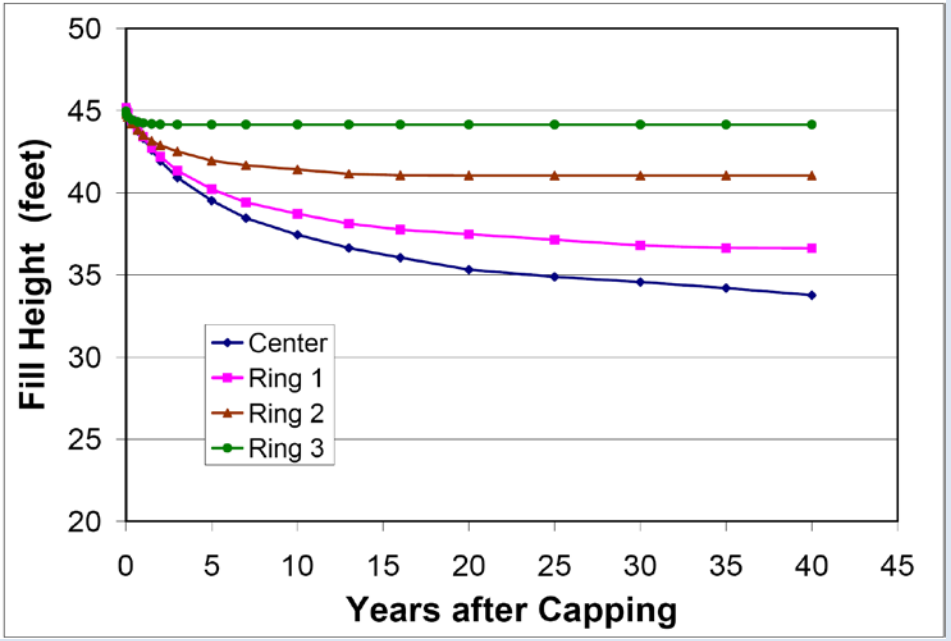


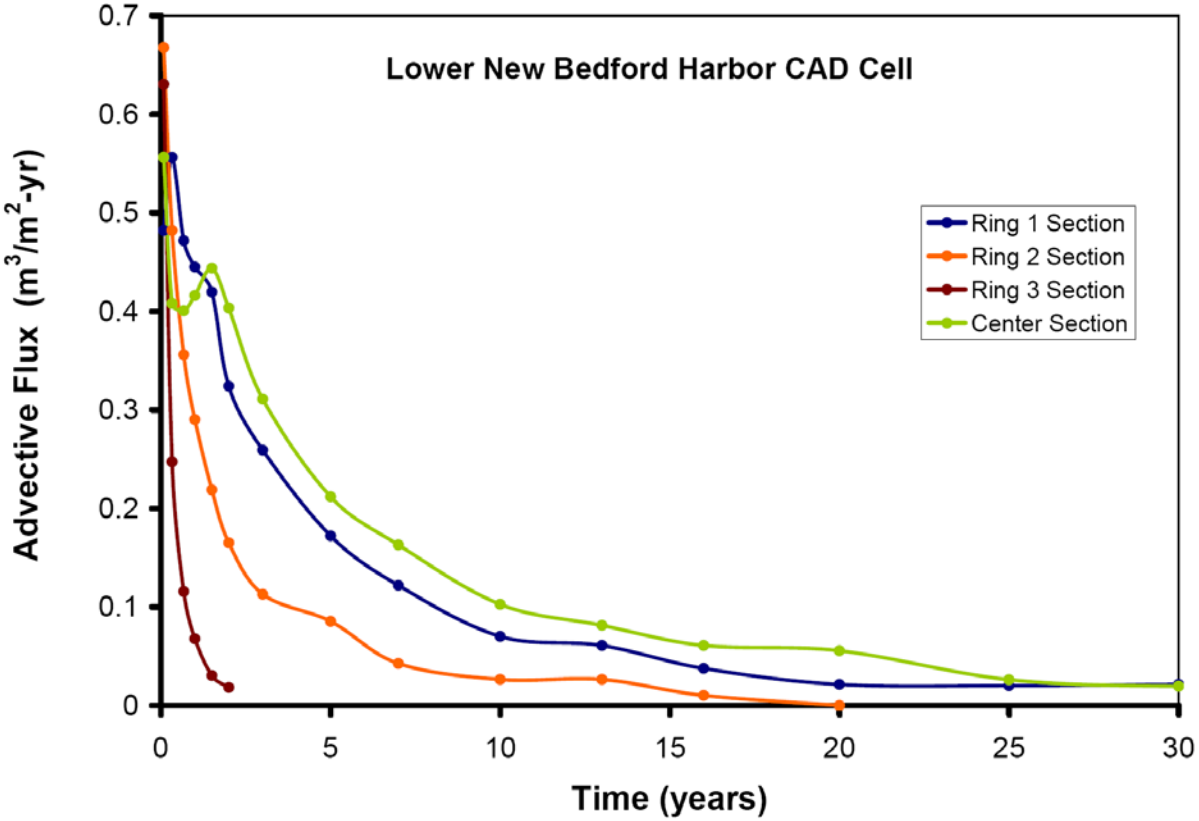
Composite 5

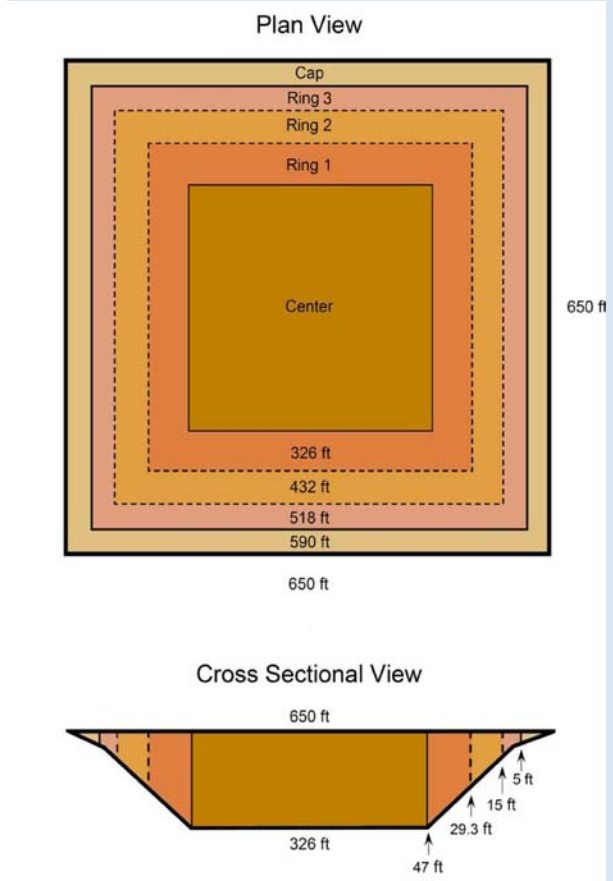
Fill Modeling



Long-term Consolidation







After capping, the contaminants expelled from the dredged material by *consolidation* would be contained in the lower foot of the cap. Organic carbon in sand is sufficient to trap the PCBs

Diffusion becomes the dominant process after consolidation.

Modeling Conclusions

- In all cases the discharged material is not predicted to run up the slope and out of the CAD cell.

- After capping, the *contaminants* expelled from the dredged material by consolidation would be contained in the lower foot of the cap as predicted by the modeling.

- Without consideration of deposition, contaminant breakthrough of the cap at a concentration of 0.01% of the pore water contaminant concentration (e.g., 0.01% of 7 ppb PCB or 0.0007 ppb PCB) will take more than 1800 years as predicted by modeling.

- With deposition, the transport of contaminants through the cap and deposition material will take tens of thousands of years.

Additional Reading (1)

Fredette, T. J., P. E. Jackson, C. J. Demos, D. A. Hadden, S. H. Wolf, T. A. Nowak Jr., and. E. DeAngelo. 2000. The Boston Harbor Navigation Improvement Project CAD Cells: Recommendations for Future Projects Based on Field Experience and Monitoring. Proceedings of the Western Dredging Association, Twentieth Technical Conference and Twenty-second Texas A&M Dredging Seminar, June 25-28, Warwick, RI. Pp. 291-302.

Myre, P., P. Walter, and M. Rollings. 2000. Geotechnical Evaluation of Sediment Data Collected in Boston Harbor Confined Aquatic Disposal Cells, *Proceedings of the Western Dredging Association -Twentieth Technical Conference Thirty-Second Texas A&M Dredging Seminar, No.372, pp. 303-316.*

Walter, P.J., R.M. Valente, and T.J. Fredette. 2002. Evaluating Sub-Channel Confined Aquatic Disposal Cells: Experience from the Boston Harbor Navigation Improvement Project. Proceedings of Dredging ’02: Third Specialty Conference on Dredging and Dredged Material Disposal, May 5-8, Orlando, Florida. American Society of Civil Engineers, Reston, VA. p. 44.

Palmerton, D.L. Jr., R.K. Mohan, and K.D. Elenbaas. 2002. Contained Aquatic Disposal (CAD) - An Analysis of their advantages, limitations, and costs. *Western Dredging Association 22nd Annual Meeting and Texas A&M's 34th Annual Dredging Seminar June 13-17, 2001 Denver, Colorado.*

SAIC. 2003. An Investigation of Sediment Dynamics in the Vicinity of Mystic River CAD Cells Utilizing Artificial Sediment Tracers. DAMOS Contribution No. 150. U.S. Army Corps of Engineers, New England District, Concord, MA, 54 pp.

Additional Reading (2)

Germano, JD. 2003. Designing borrow pit CAD sites: Remember Newton's third law! In: Randall RE, editor. Proceedings of the Western Dredging Association Twenty-Third Technical Conference; 10-13 June 2003; Chicago, IL. College Station (TX): Center for Dredging Studies. p 302-312.

Fredette, T.J. 2006. Why confined aquatic disposal cells often make sense. Integrated Environ. Assess. Man. 2(1): 1-4.

Wolf, S., M. Greenblatt, T.J. Fredette, D.A. Carey, S. Kelly, R.J. Diaz, P. Neubert, I. Williams, and J.H. Ryther. 2006. Stability and Recovery of Capped in-Channel CAD Cells: Boston Harbor, Massachusetts. Proceedings of the Western Dredging Association Twenty-Sixth Technical Conference and Thirty-Eighth Texas A&M Dredging Seminar, 26-28 June 2006, San Diego, CA. Center for Dredging Studies , Ocean Engineering Program, Civil Engineering Department, Texas A&M University, College Station, TX. Pp. 451-460.

ENSR. 2007. Monitoring Survey at Boston Harbor CAD Cells, August 2004. DAMOS Contribution No. 168. U.S. Army Corps of Engineers, New England District, Concord, MA, 112 pp.

ENSR. 2008. Providence River and Harbor Maintenance Dredging Project Synthesis Report. DAMOS Contribution No. 178. U.S. Army Corps of Engineers, New England District, Concord, MA, 133 pp.

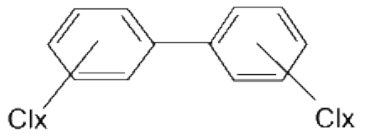
Potential For Migration of Contaminants

Why Contaminants Won't Migrate

Contaminants Will Be Trapped

1. PCBs bind tightly to sediment.
2. Sediment movement is restricted.
3. PCB Impacted Sediment Is Highly Impermeable
4. As consolidation progresses, groundwater Will Prefer to Go Around LHCC

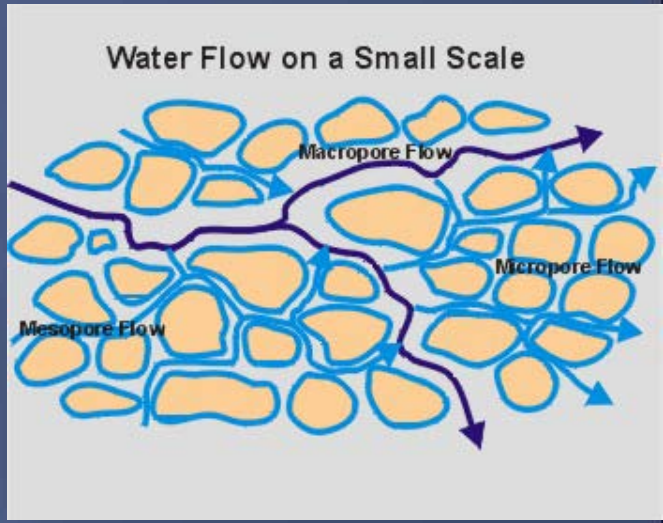
Will Contaminants Migrate? PCB Chemistry

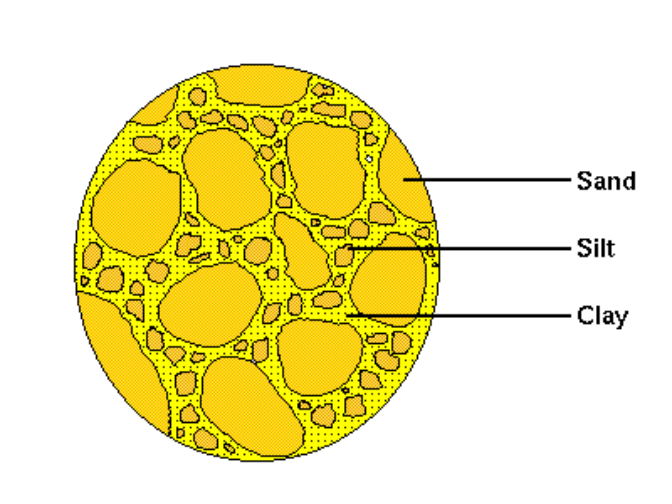


- PCBs are tightly bound to the impacted sediment.
- PCBs do not dissolve into water easily.
- Most PCB transport within New Bedford Harbor is via PCB attached to sediment particulates.

Will Contaminants Migrate?

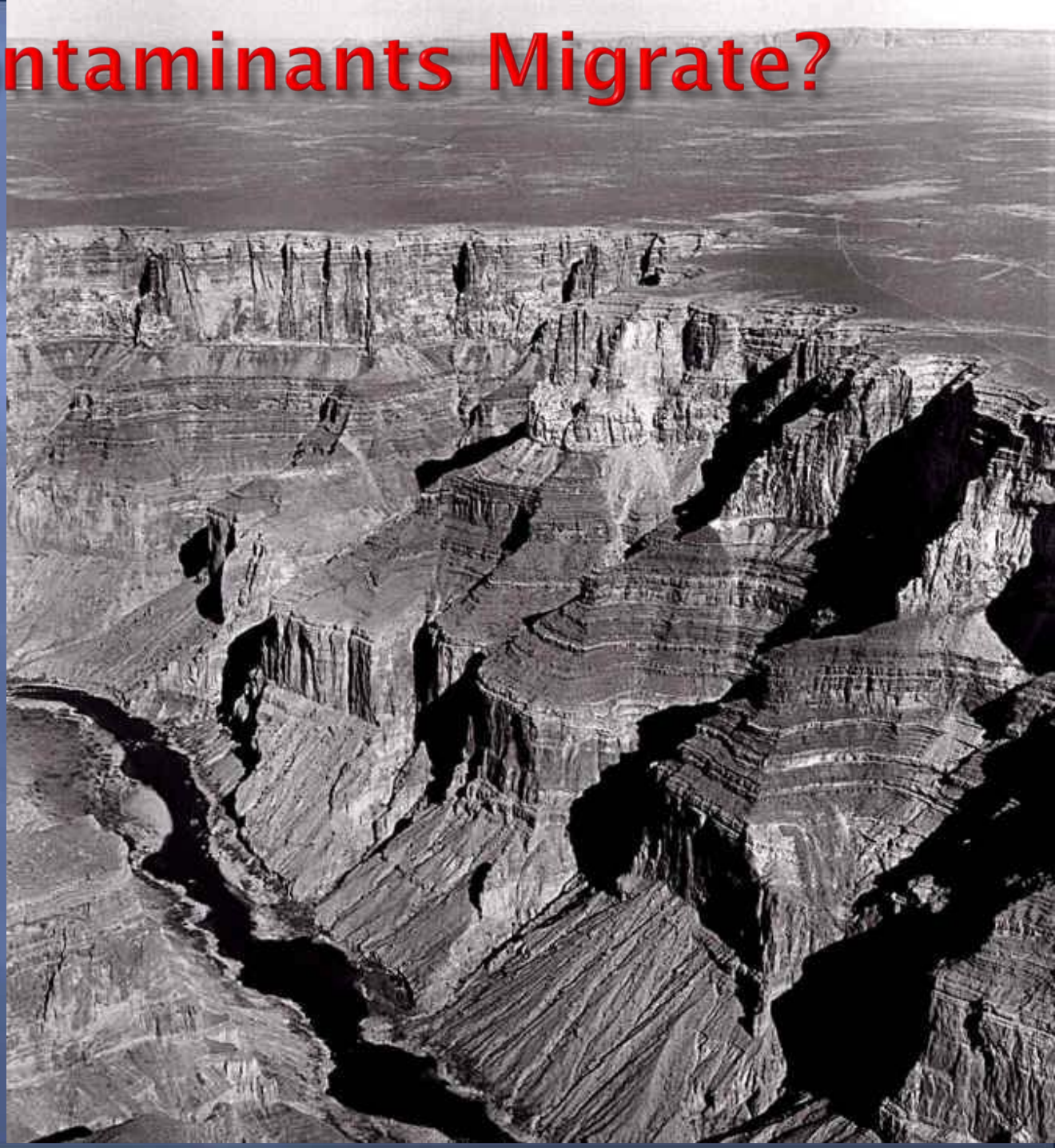
- In order for contaminants below the sediment/water interface to move, pore water must navigate the twisting paths between sediment particles.
- Glacial deposits (like those within which the LHCC will be built) contain varying degrees of particle sizes and permeability making it even more difficult to navigate.



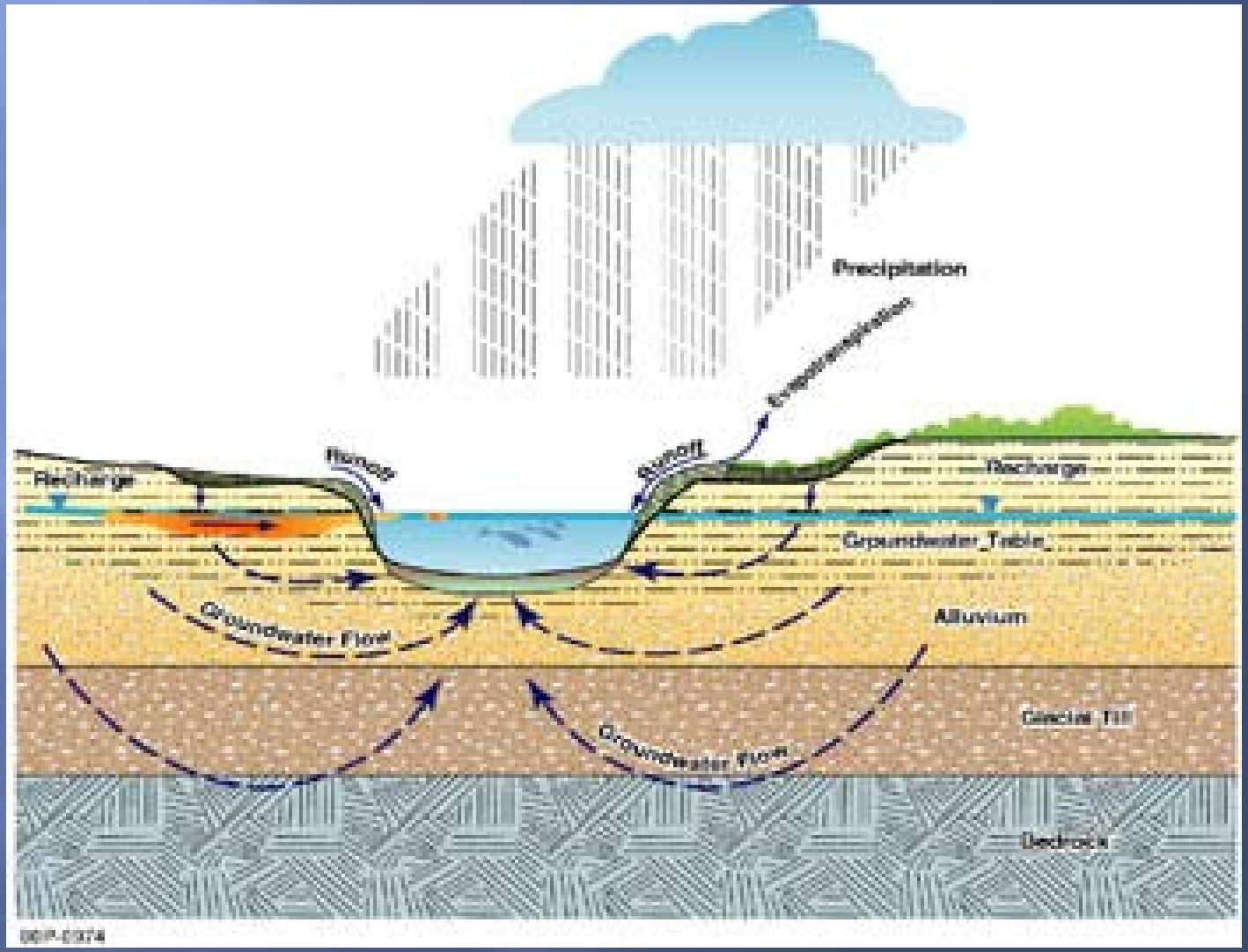


Will Contaminants Migrate?

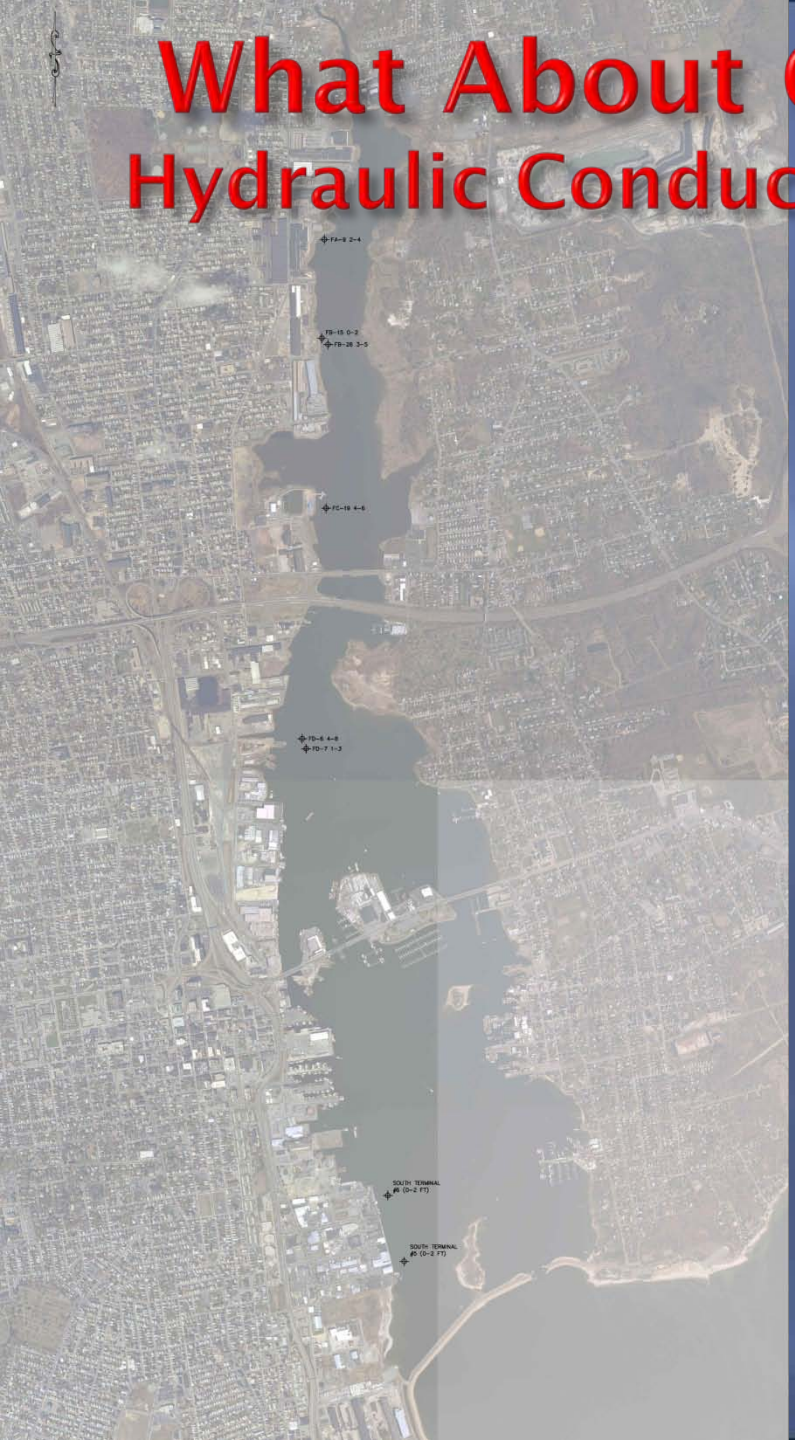
- Sediment deposits form distinct layers.
- You can see layering during geologic investigations.
- Those layers are generally very distinct.



What About Groundwater Flow?

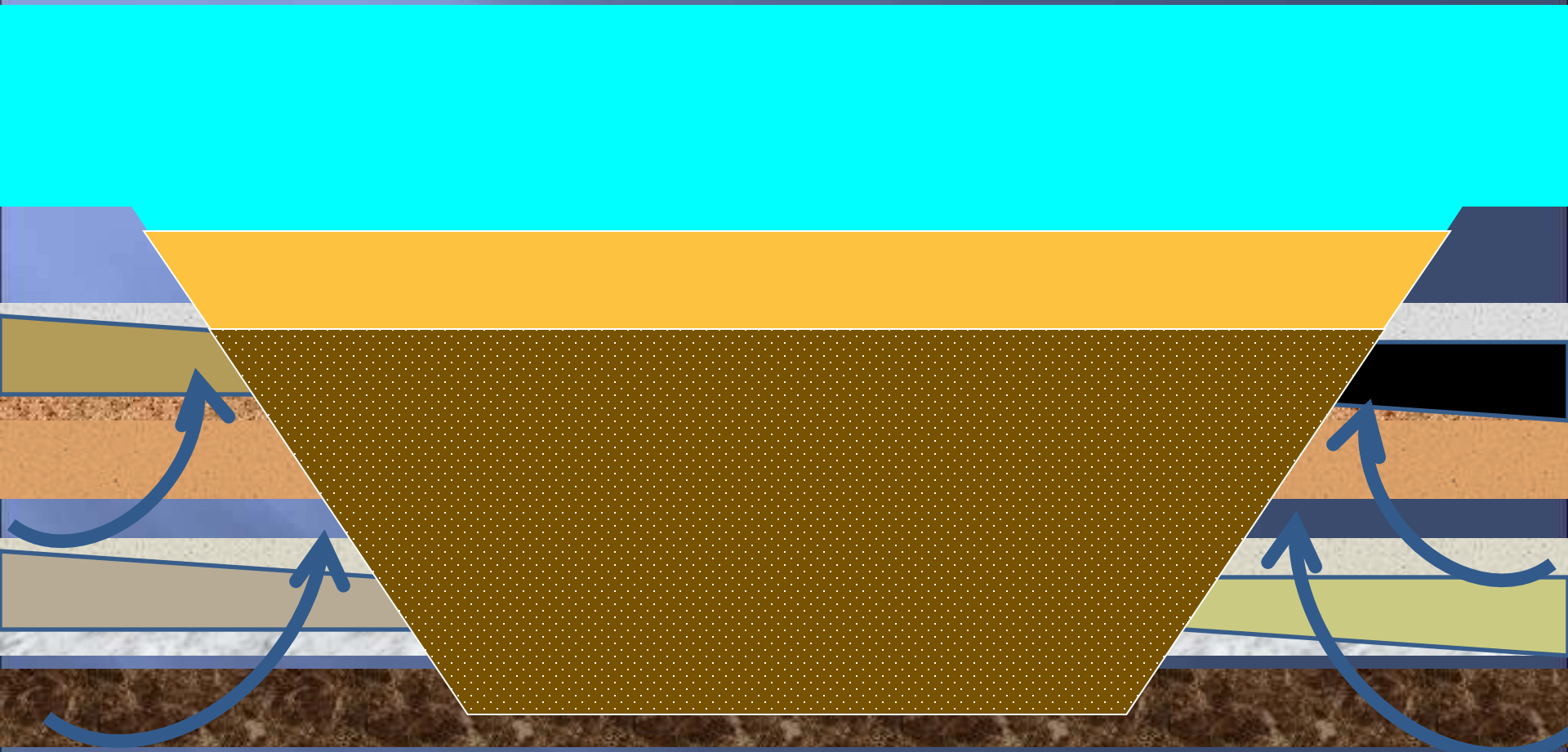


What About Groundwater Flow?
Hydraulic Conductivity of Dredged Material



- Contaminated layer is generally a uniform, black, organic silt.
- Historic samples of this material have been collected and tested for hydraulic conductivity.
- Average hydraulic conductivity is approximately 4×10^{-7} cm/sec.
- For comparison, landfill liner hydraulic conductivity is 1×10^{-7} cm/sec.
- The low conductivity of the disposed material will severely restrict groundwater flow through the LHCC.

Expected Groundwater Flow Response



Flow Seeks Path of Least Resistance

Potential for Migration of Contaminants

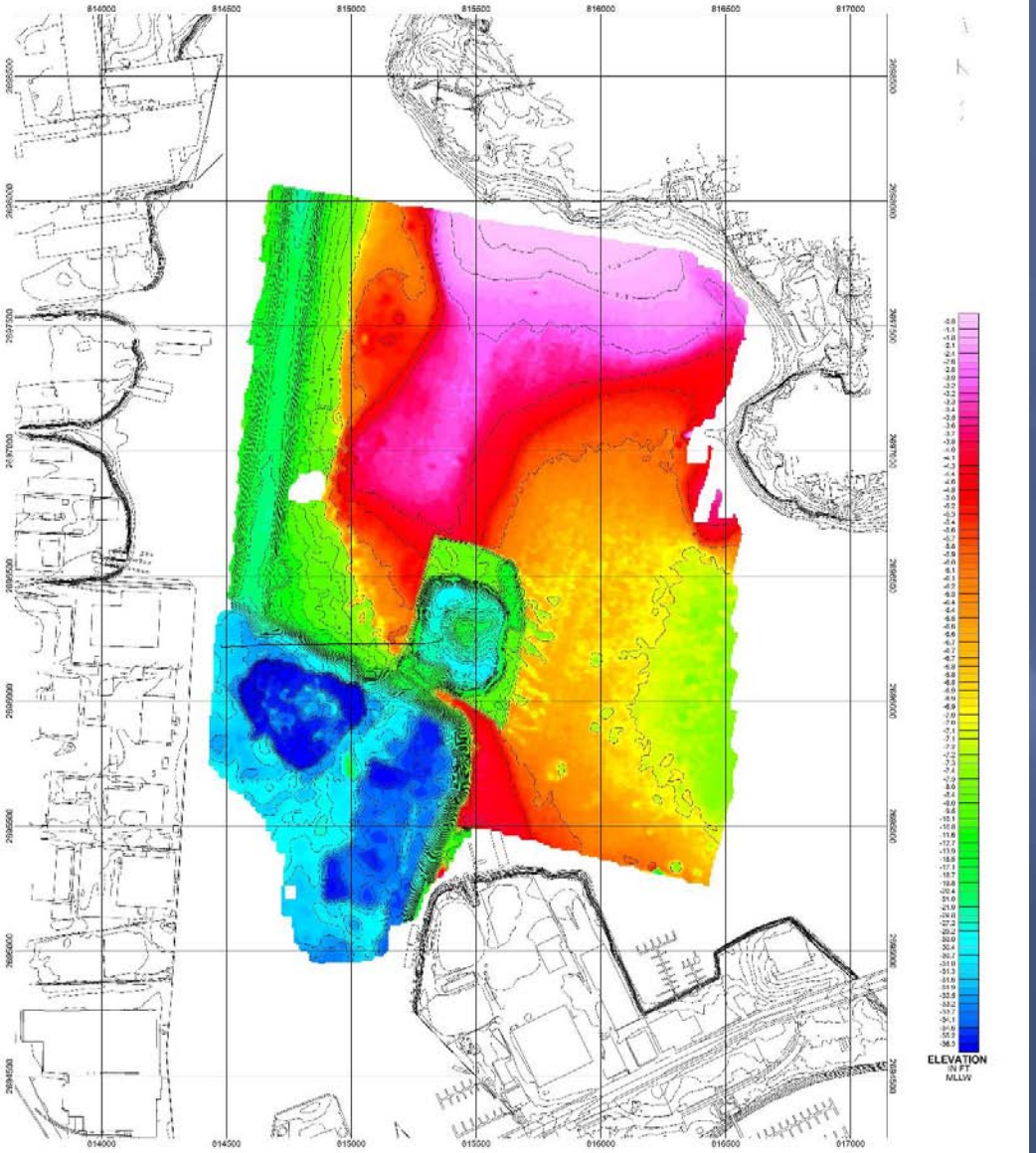
Summary

- PCBs are tightly bound to sediments.
- Sediment particles will be immobile.
- CAD Cell contents will be nearly impermeable after consolidation.

Status of Technical Design

Status of Technical Design
Field Data Collection

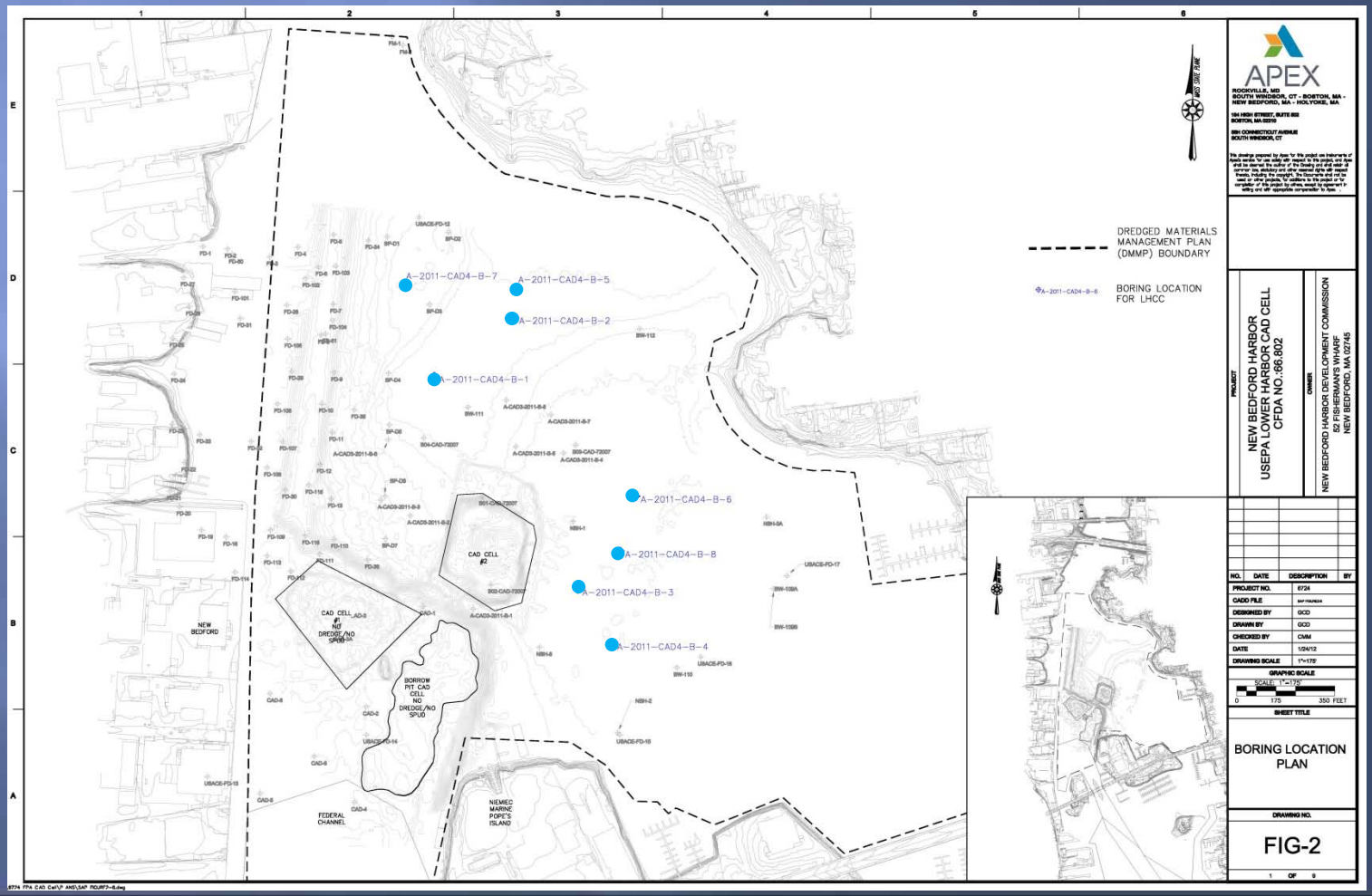
- Bathymetry Data Collected
- Boring Data Collected
- Geotechnical Data Collected (Partial)
- Historical Data Collected
- Seismic Data Collected (Partial)
- Vibracore Data Collected (Partial)
- Conceptual LHCC Siting Plans Completed



BATHYMETRIC DATA

BORING DATA

- Historic Boring Data
  - 8 Additional Supplemental Borings Advanced.



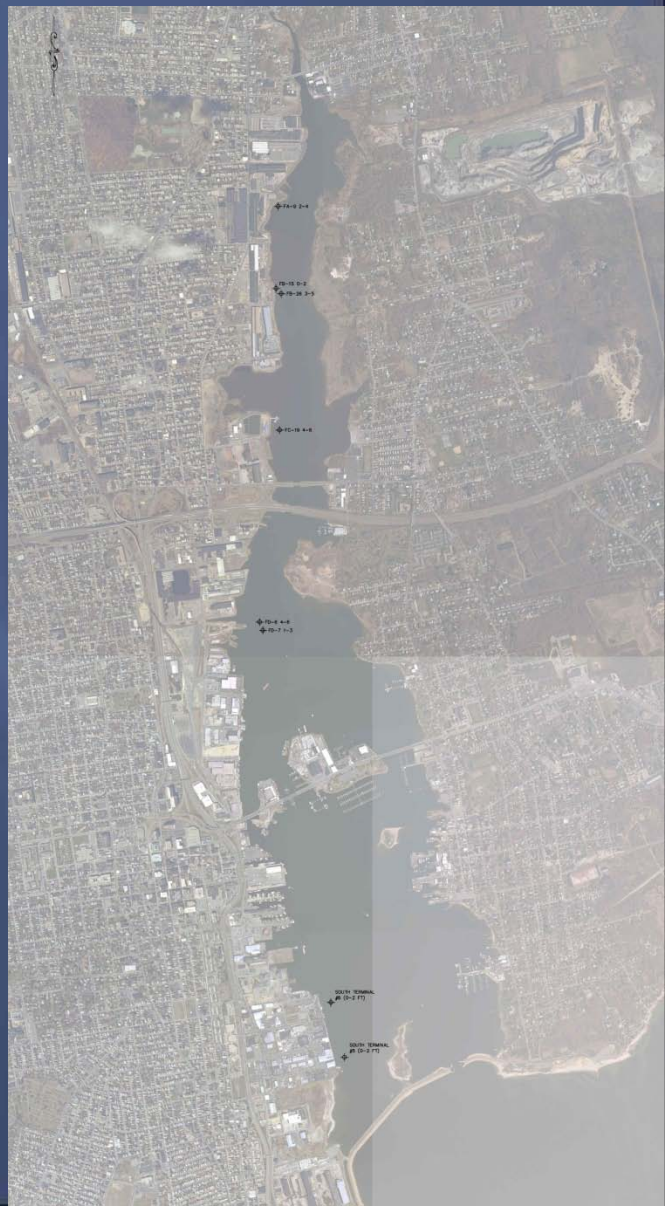
Status of Technical Design

Geotechnical Data (Partial)

- Geologic Material – Data shows wide range of hydraulic conductivities.
- Contaminated Material – Data shows very low hydraulic conductivity.

Average Hydraulic Conductivity of Organic Silt/Clay

Sample	Hydraulic Conductivity
S. Terminal #5 0-2	2.80E-07 cm/sec
S. Terminal #6 0-2	7.30E-08 cm/sec
FB-15 0-2	6.10E-07 cm/sec
FB-26 3-5	9.70E-07 cm/sec
FA-9 2-4	2.70E-07 cm/sec
FD-7 1-3	3.00E-07 cm/sec
FD-6 4-6	2.90E-07 cm/sec
FC-19 4-6	3.30E-07 cm/sec
Average Hydraulic Conductivity:	**3.9E-07 cm/sec**
Typically Landfill Liner Criteria:	**1.0E-07 cm/sec**

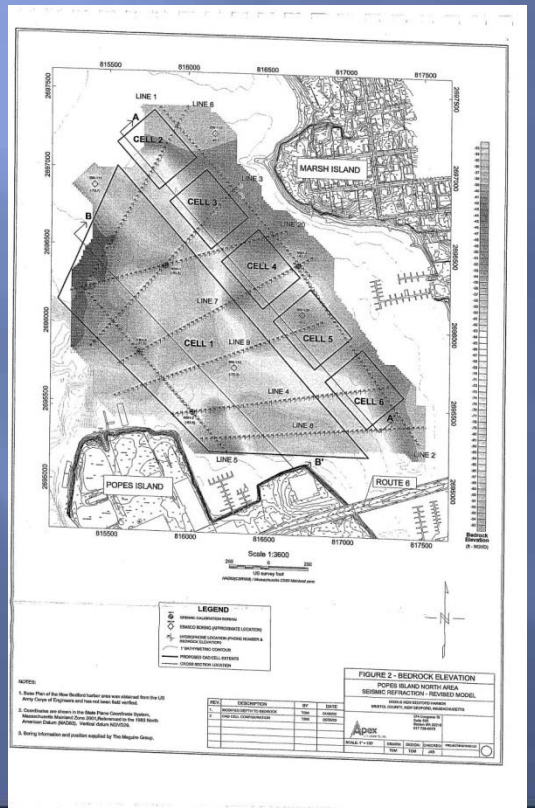


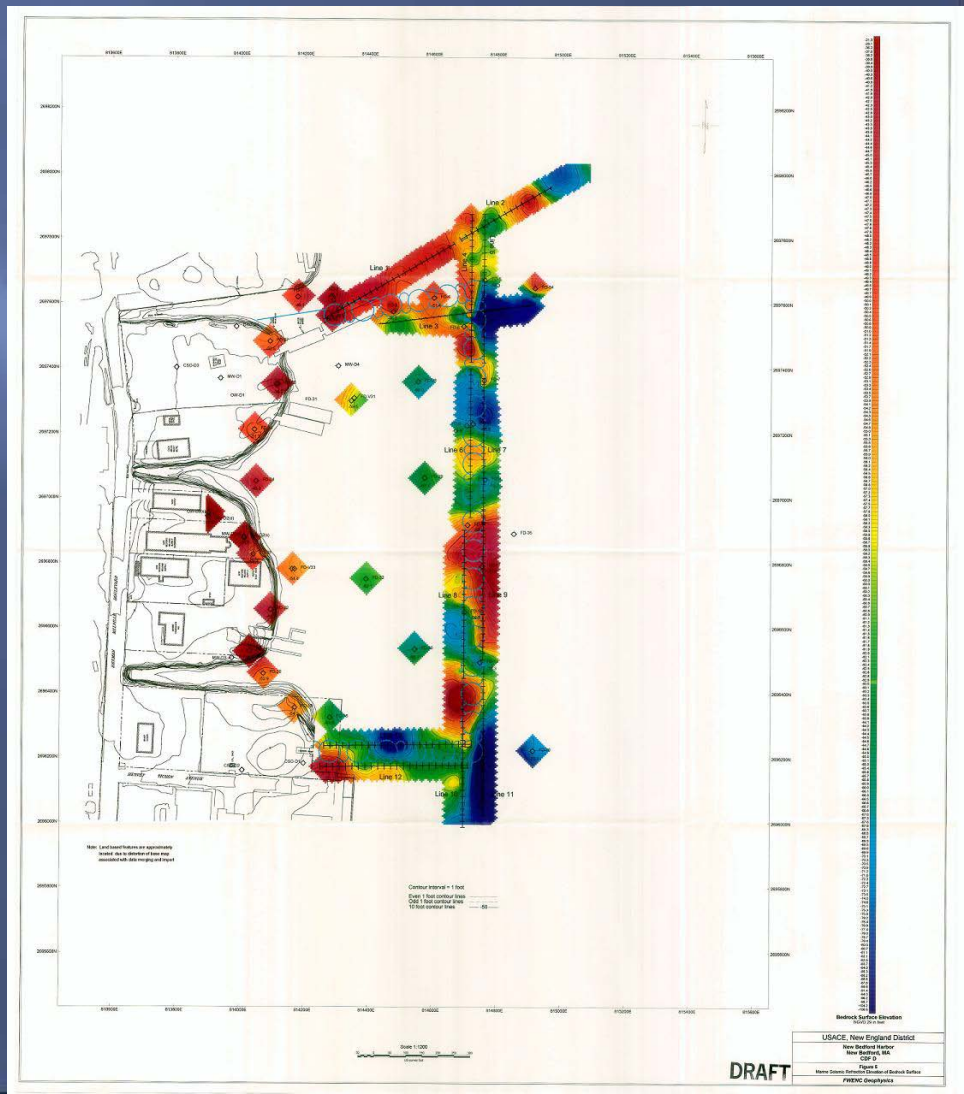
Status of Technical Design
Historic Data

- Generated From: Superfund Investigations, DMMP Process, Navigational Dredging Projects, Independent Papers/Analysis
  - Historic Air Evaluations
  - Historic New Bedford Harbor Superfund Site Risk Assessments
  - Historic USEPA LHCC Feasibility Assessments
  - Historic Background Material and Literature
  - Historic Remote Sensing Reports
  - Historic Navigational Dredging Water Quality Monitoring Measurements
  - Historic Suspended Sediment Transport Modeling and Measurement
  - Historic Toxicity Testing

Status of Technical Design
Seismic Data (Partial)

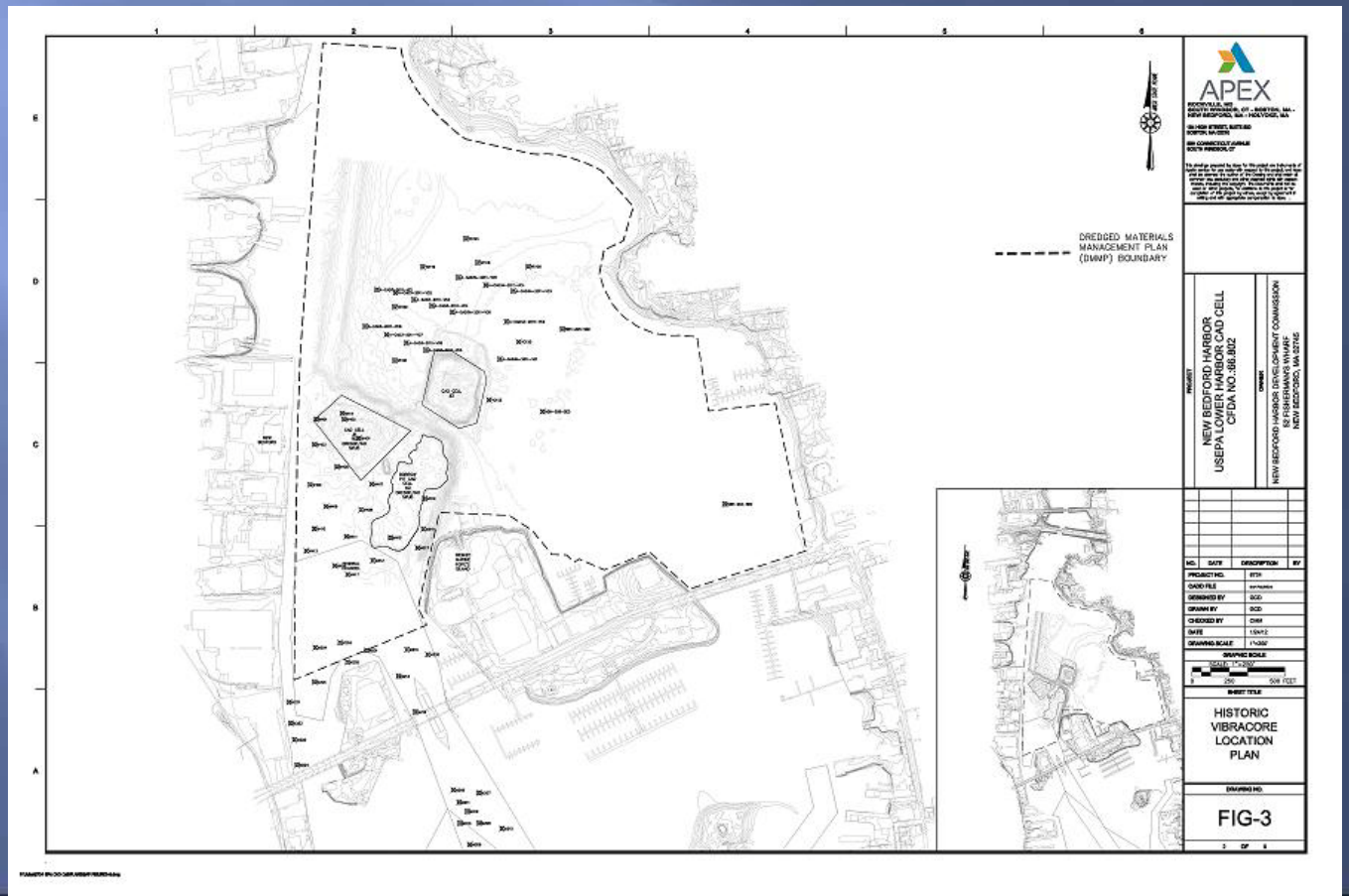
- Historic Seismic Data
  - USEPA Designs
  - DMMP Process





Status of Technical Design
Vibracore Data (Partial)

- Historic Vibracore Data
  - Additional vibracore data being collected.



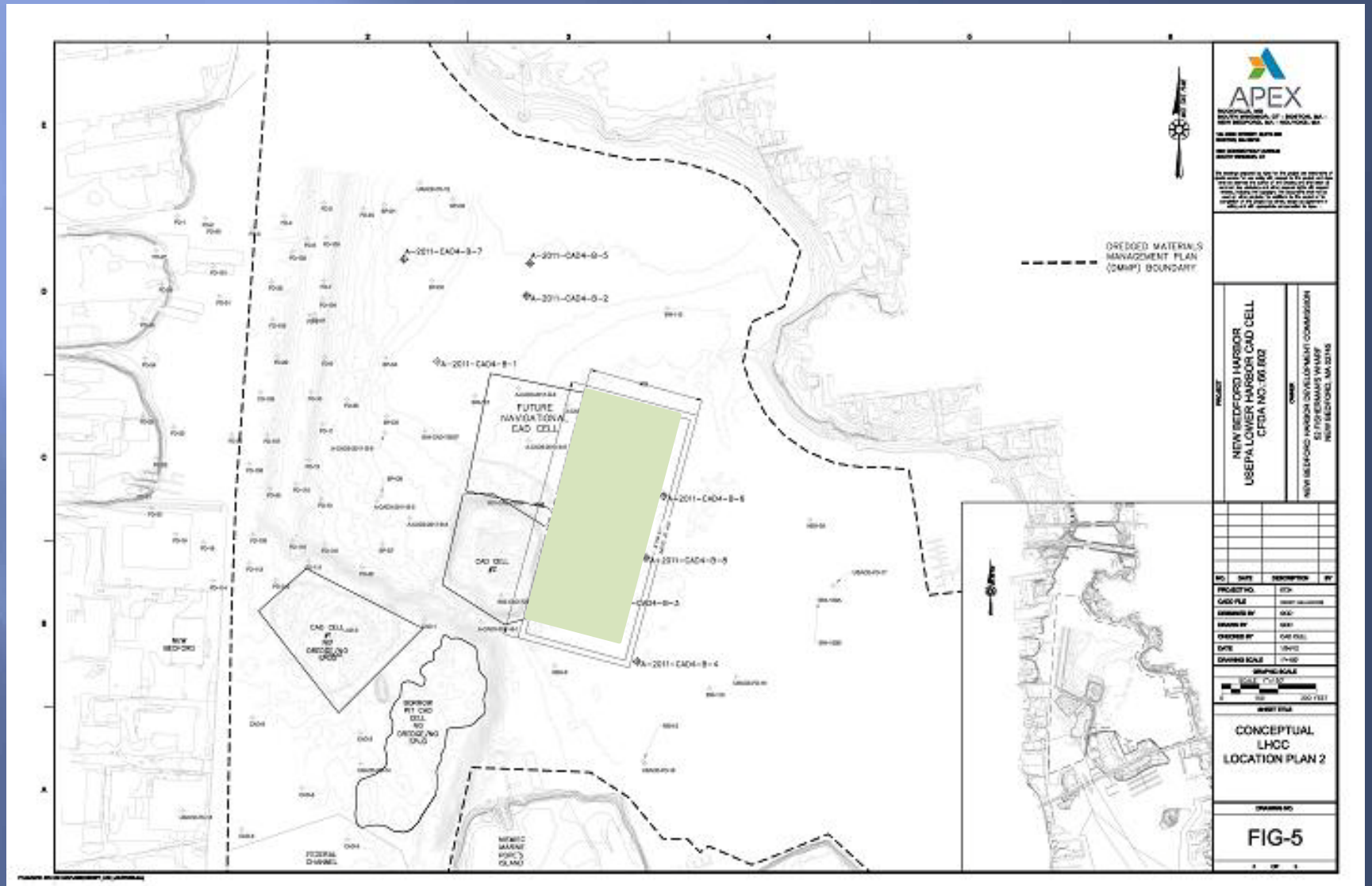
Status of Technical Design

Conceptual LHCC Siting Plans

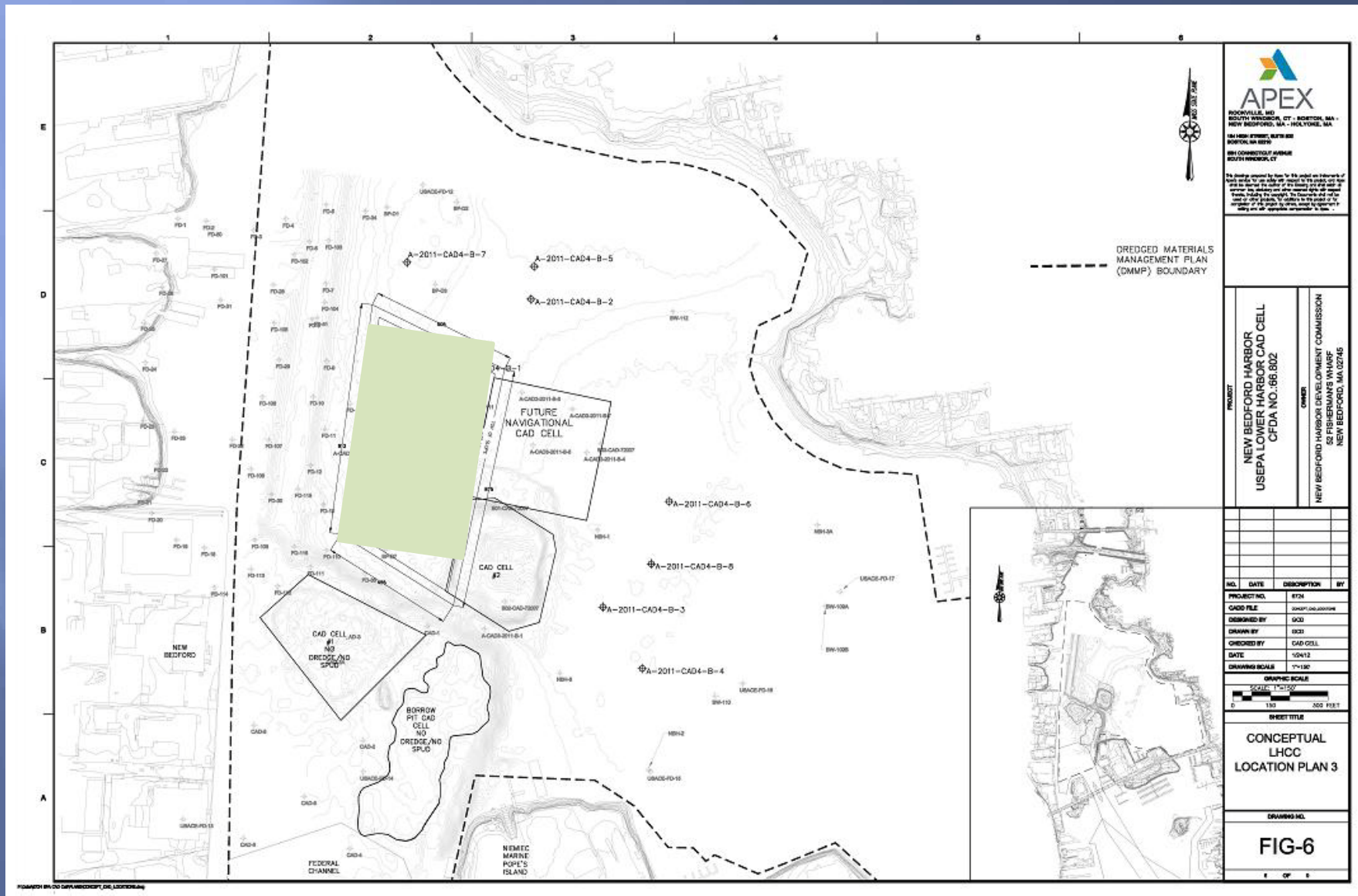
- Six different potential siting locations proposed.
- Five of six are EPA only options.
- Sixth option is a combined EPA/Navigational Dredging CAD Cell.
- All siting plans are currently conceptual pending full analysis of data.

CONCEPT LHCC LOCATION 1

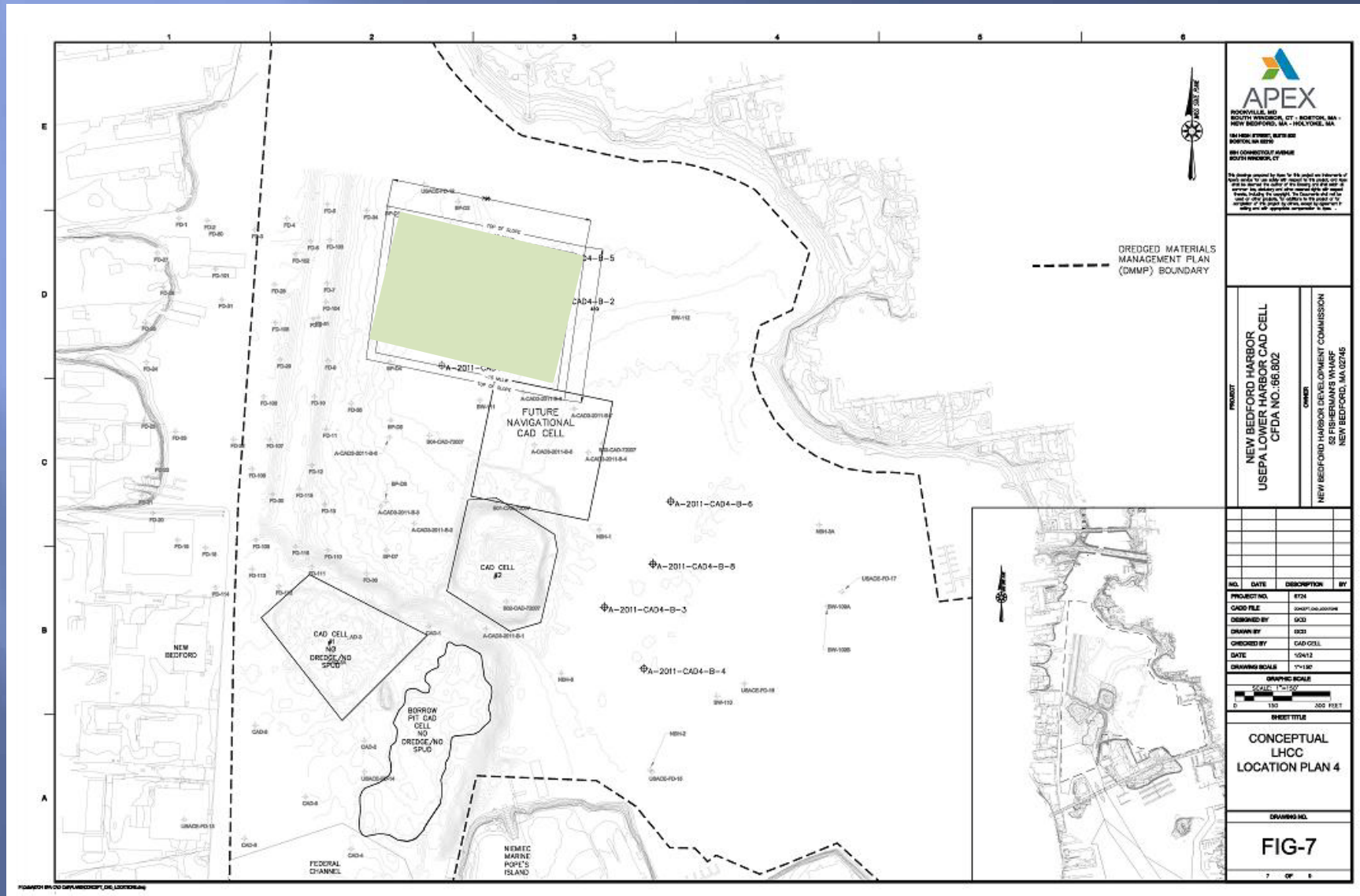
CONCEPT LHCC LOCATION 2



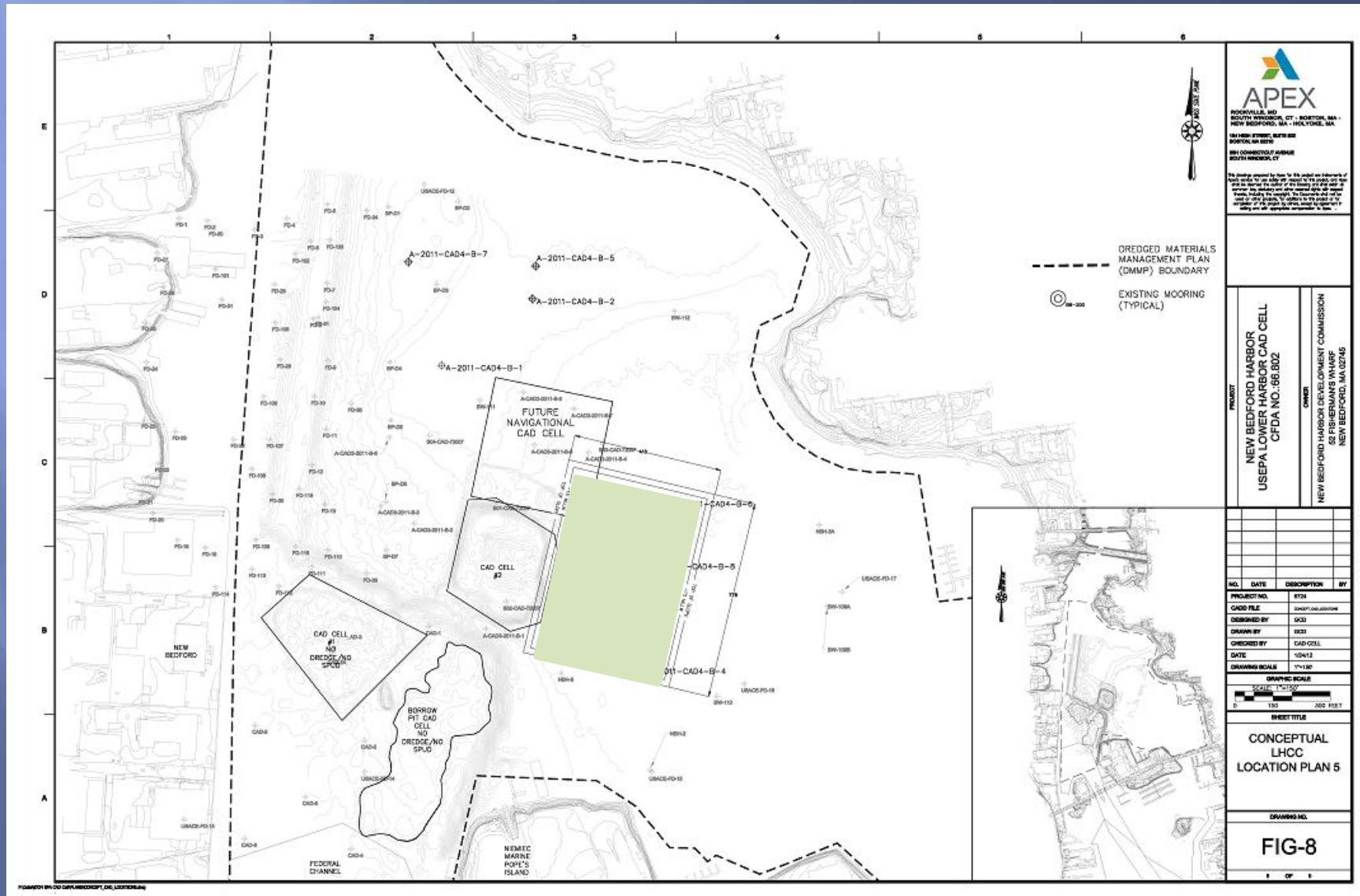
CONCEPT LHCC LOCATION 3



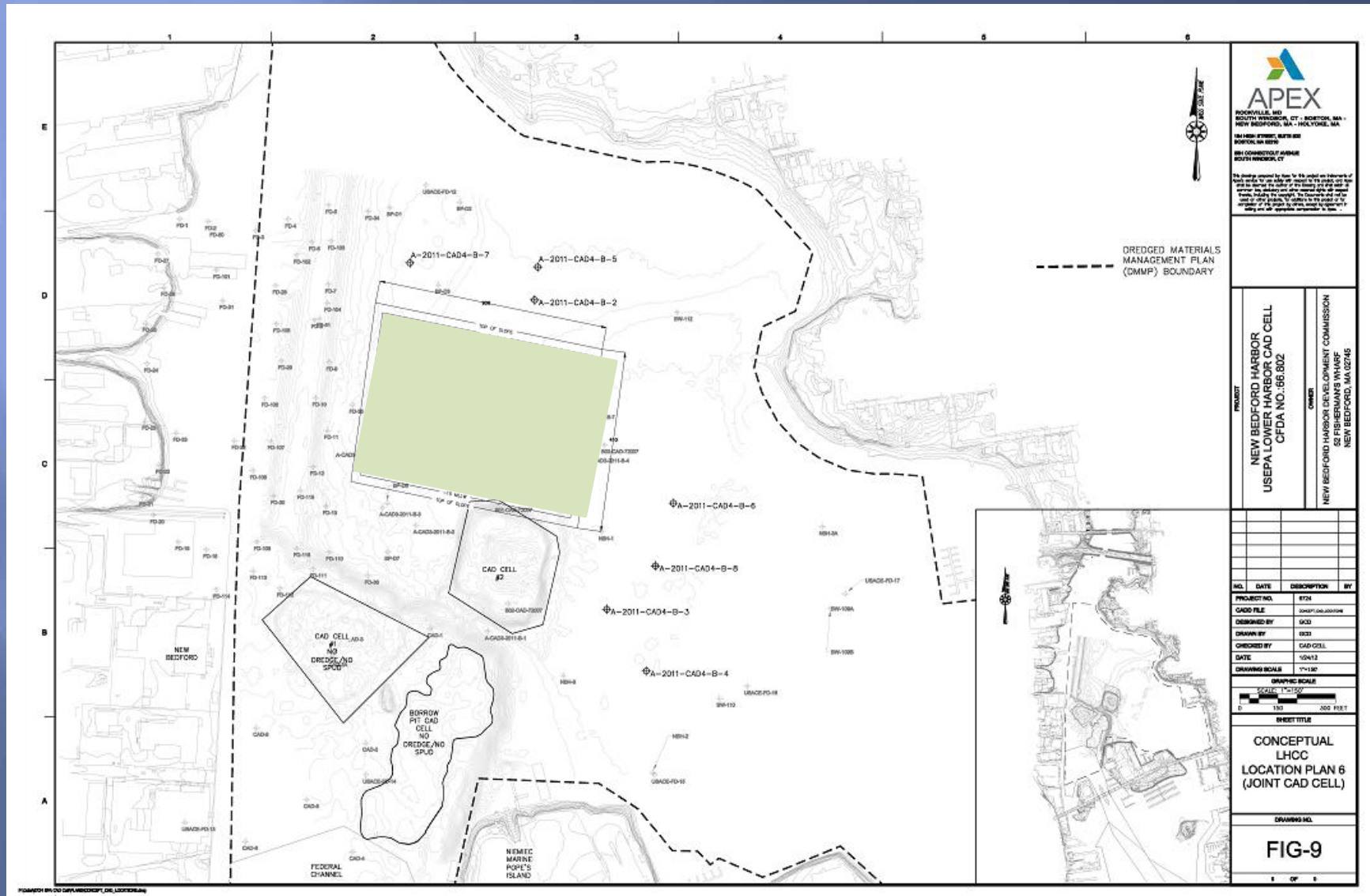
CONCEPT LHCC LOCATION 4



CONCEPT LHCC LOCATION 5



CONCEPT LHCC LOCATION 6



Permiting /Compliance

Permiting/Compliance

- ESD Outlines performance standards to be used during construction
- Sediment/Water
  - Silt curtain around LHCC perimeter w/oil absorbent boom
  - 100 NTU turbidity standard down-current
  - Treatment of free-standing water on scow
  - Prior to capping, monitoring of TSS, PCB, copper will be measured within the CAD cell to ensure its within predicted levels.

Permiting /Compliance

- Suitability Determination-is needed from the Corps of Engineers for clean material to be disposed in off-shore disposal site, such as the Cape Cod Bay Disposal Site. Sampling has been performed.

Permiting/Compliance

- Institutional Controls
  - EPA coordinates with the Coast Guard and NOAA to establish regulated navigation area to ensure that the cap is not damaged.

Air Quality

- Based on the CAD monitoring performed during the filling of the navigational cells, EPA does not anticipate any harmful impacts during our CAD project.
- Modelling of potential impacts of dredging and filling the CAD cell was completed in June 2010.

Air Quality

- Results of the air dispersion modeling of the proposed dredging and CAD activities indicate that the maximum annual impacts from the planned operations, even with background sources included, would remain far below these risk-based ambient air concentrations developed for the NBH Site at any of the locations evaluated, even given the large areas planned for dredging. The two CAD cell disposal options will have minimal impact on airborne PCB levels.

Air Quality

- Site specific air quality monitoring program will be continued for dredging and placement activities.