

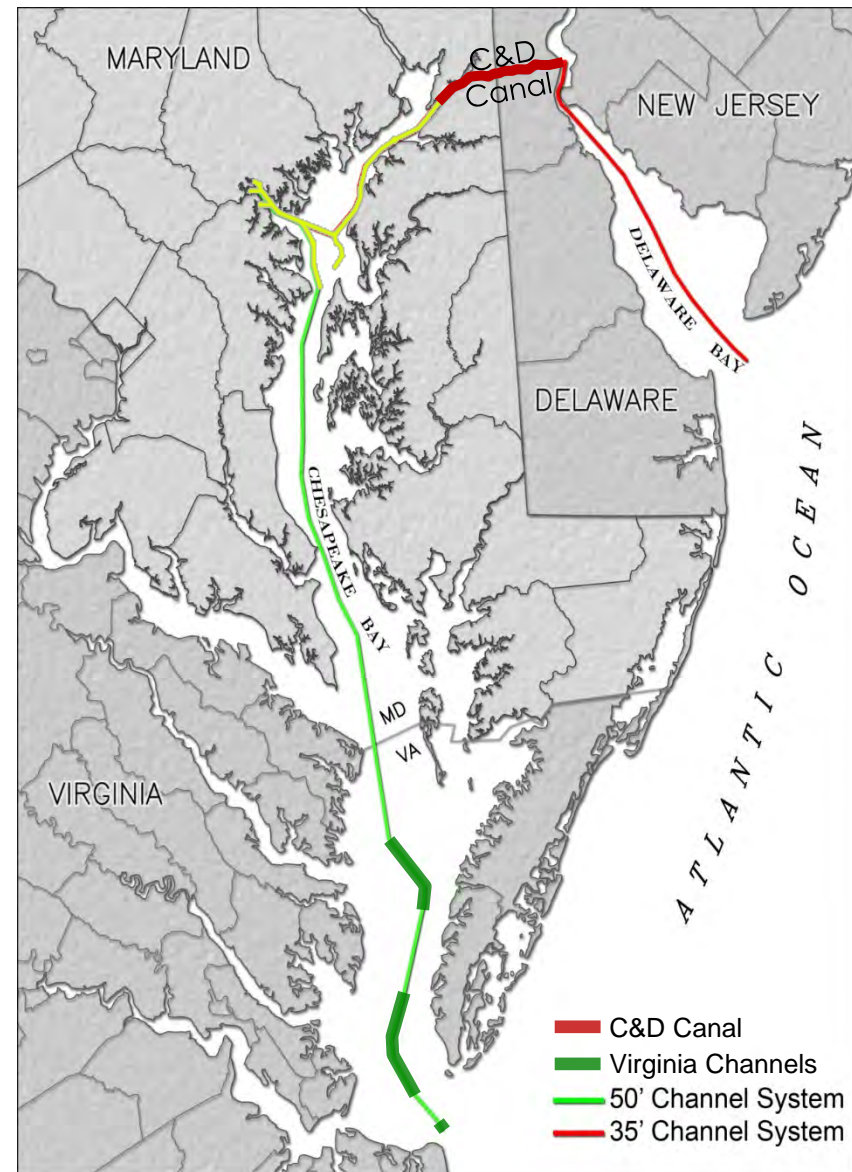
Baltimore Harbor Confined Aquatic Disposal (CAD) Pilot Project

Maryland Department of Transportation
Maryland Port Administration
June 2019

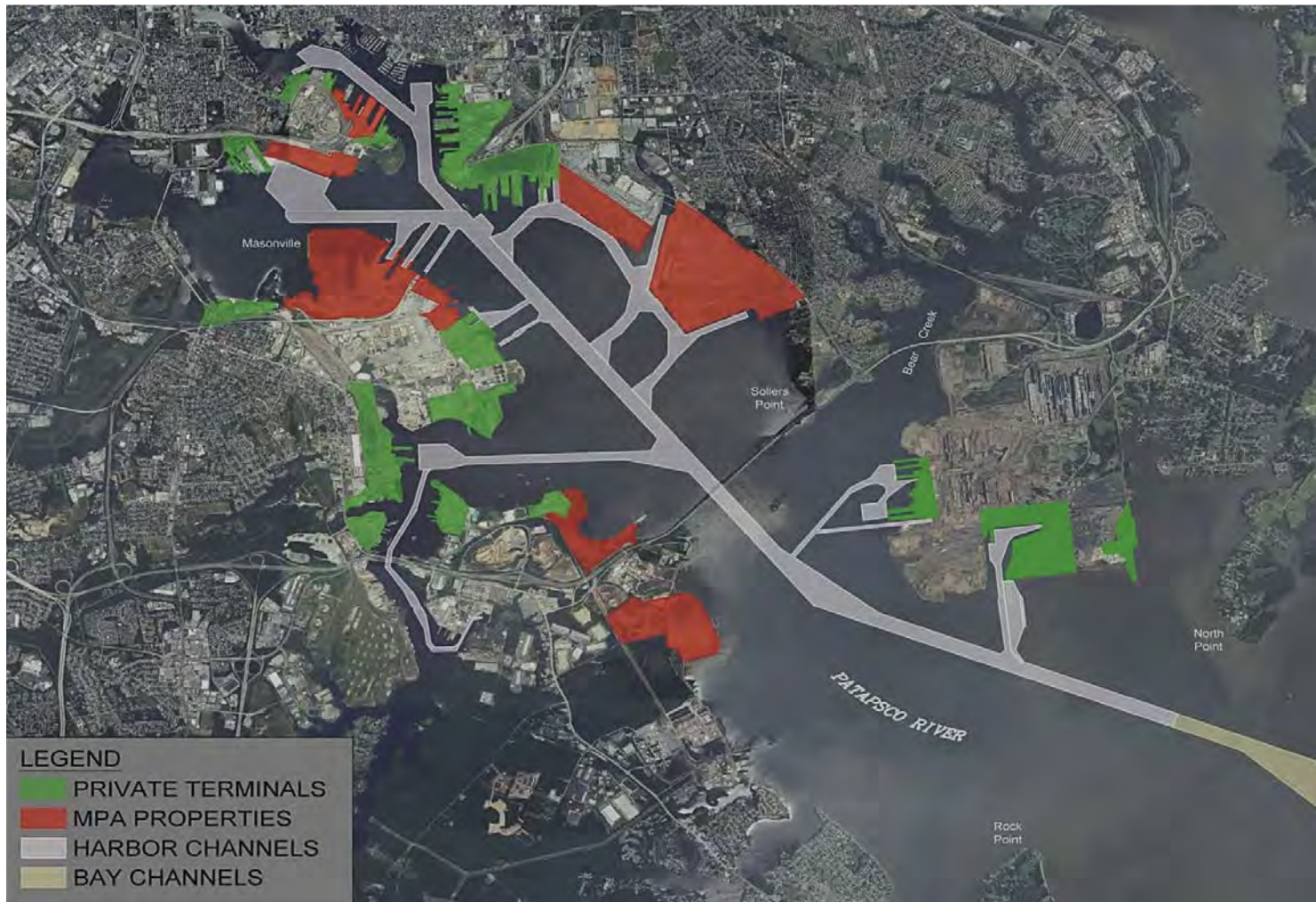


Port of Baltimore Channel System

- ▶ Annual Baltimore Harbor maintenance dredging about 1.5 mcy
- ▶ Legislation requires Baltimore Harbor material be *confined* or *beneficially / innovatively reused*
- ▶ Maintaining cost-effective, environmentally sensitive, and community-supported dredging program is ongoing challenge:
 - Less expensive options are exhausted
 - Future placement sites limited
 - Existing placement sites have limited capacity
 - Obstacles to implementing the beneficial use / innovative use program

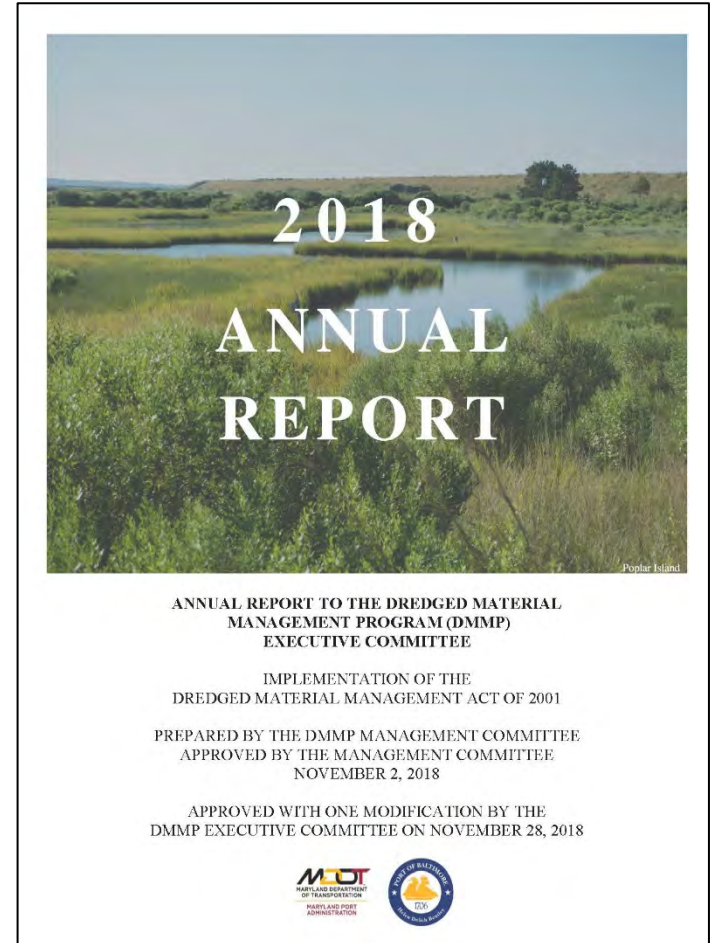


Port of Baltimore Terminals



Baltimore Harbor Dredged Material Management Program

- ▶ 20-year plan for managing dredged material capacity
- ▶ Harbor dredged material is managed using two dredged material containment facilities (DMCFs)
- ▶ Confined aquatic disposal (CAD) is an additional option for dredged material management within the Harbor
- ▶ Would provide flexibility in the program → maximize DMCF capacity and life cycle



Baltimore Harbor CAD Site

- ▶ Pilot project evaluated potential to implement CAD as part of the overall DMMP
- ▶ Constructed between Pier 3 and Pier 4 within an active berth at the Masonville/Fairfield Marine Terminal
- ▶ Coordinated with USACE's annual maintenance dredging
- ▶ Two simultaneous goals:
 - Beneficial use of sandy material removed during construction
 - Placement site for maintenance material from Federal navigation channels



How Confined Aquatic Disposal Works

PATAPSCO RIVER

SOFT HARBOR
MUD

CHANNEL BOTTOM

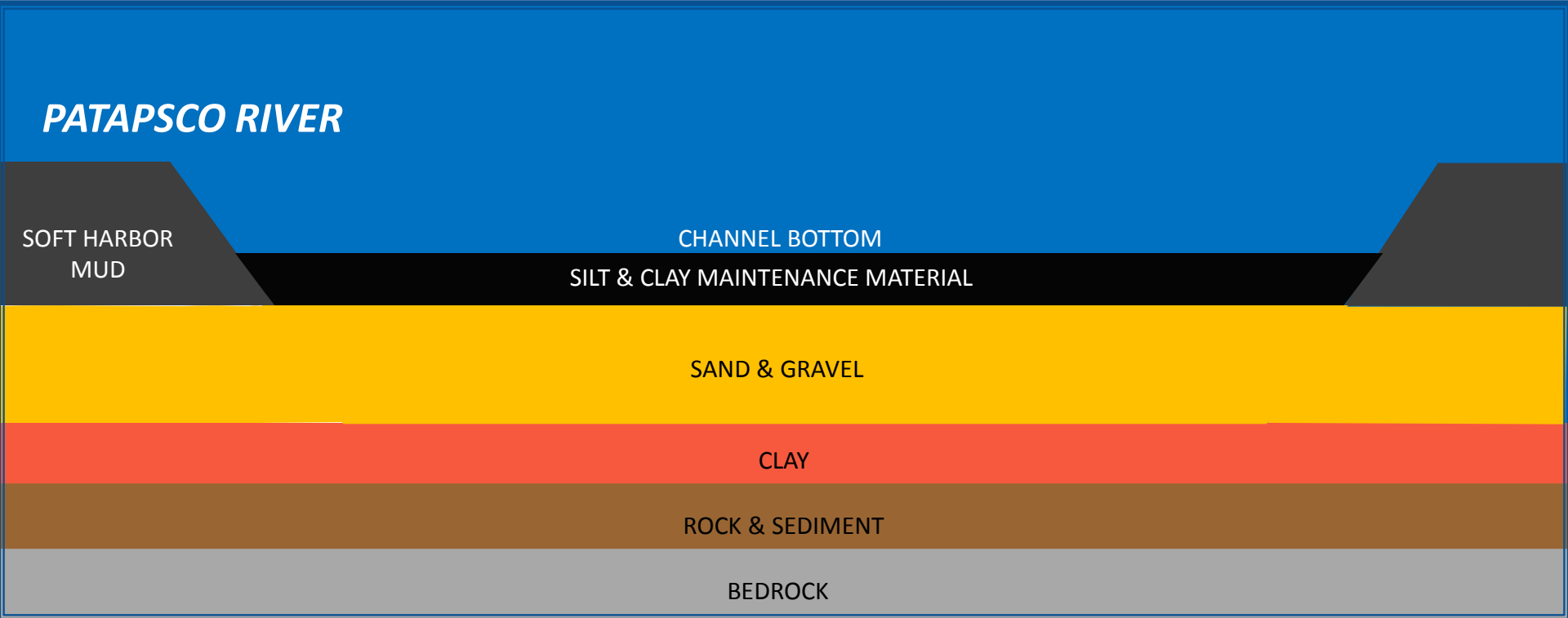
SILT & CLAY MAINTENANCE MATERIAL

SAND & GRAVEL

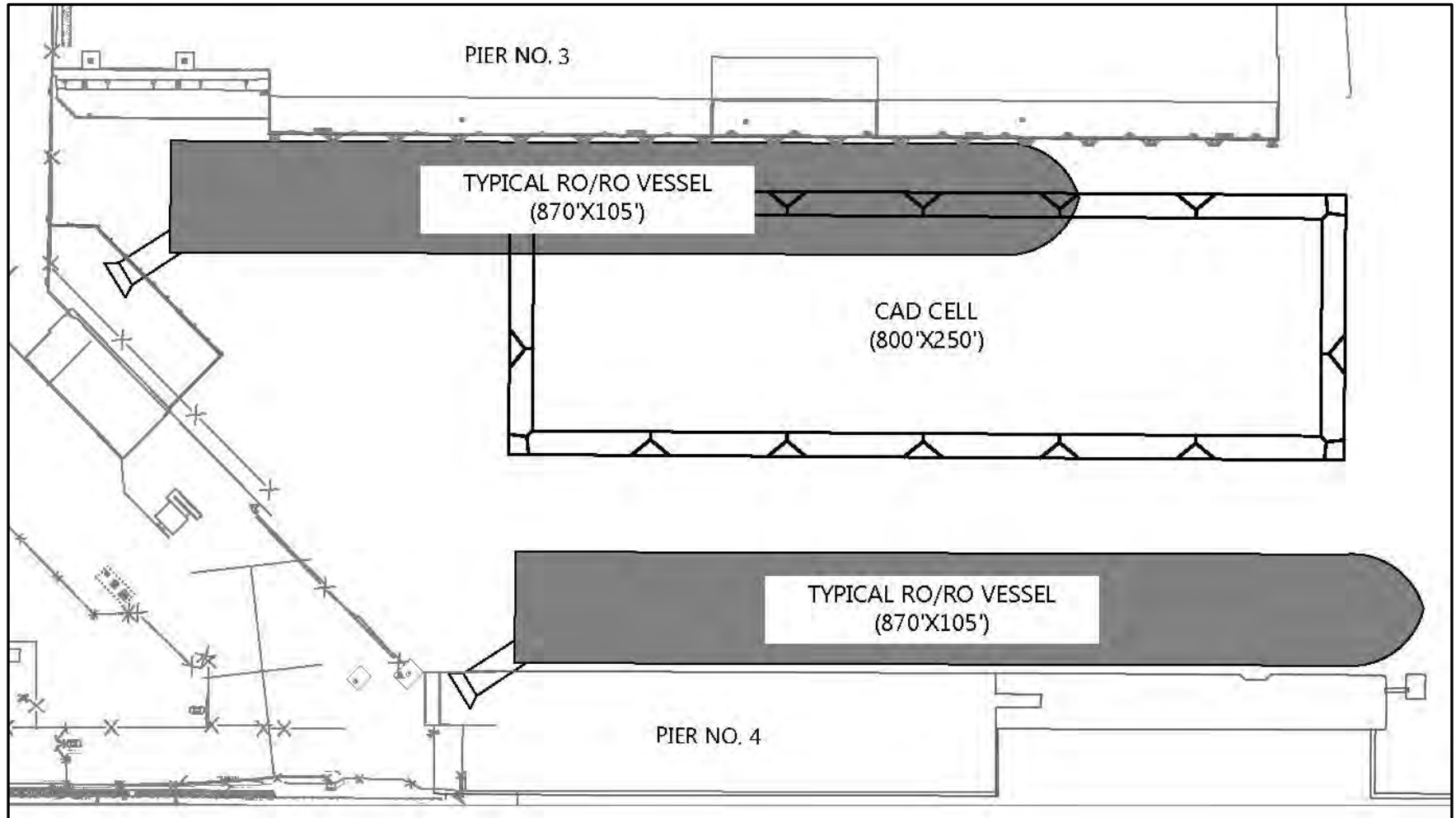
CLAY

ROCK & SEDIMENT

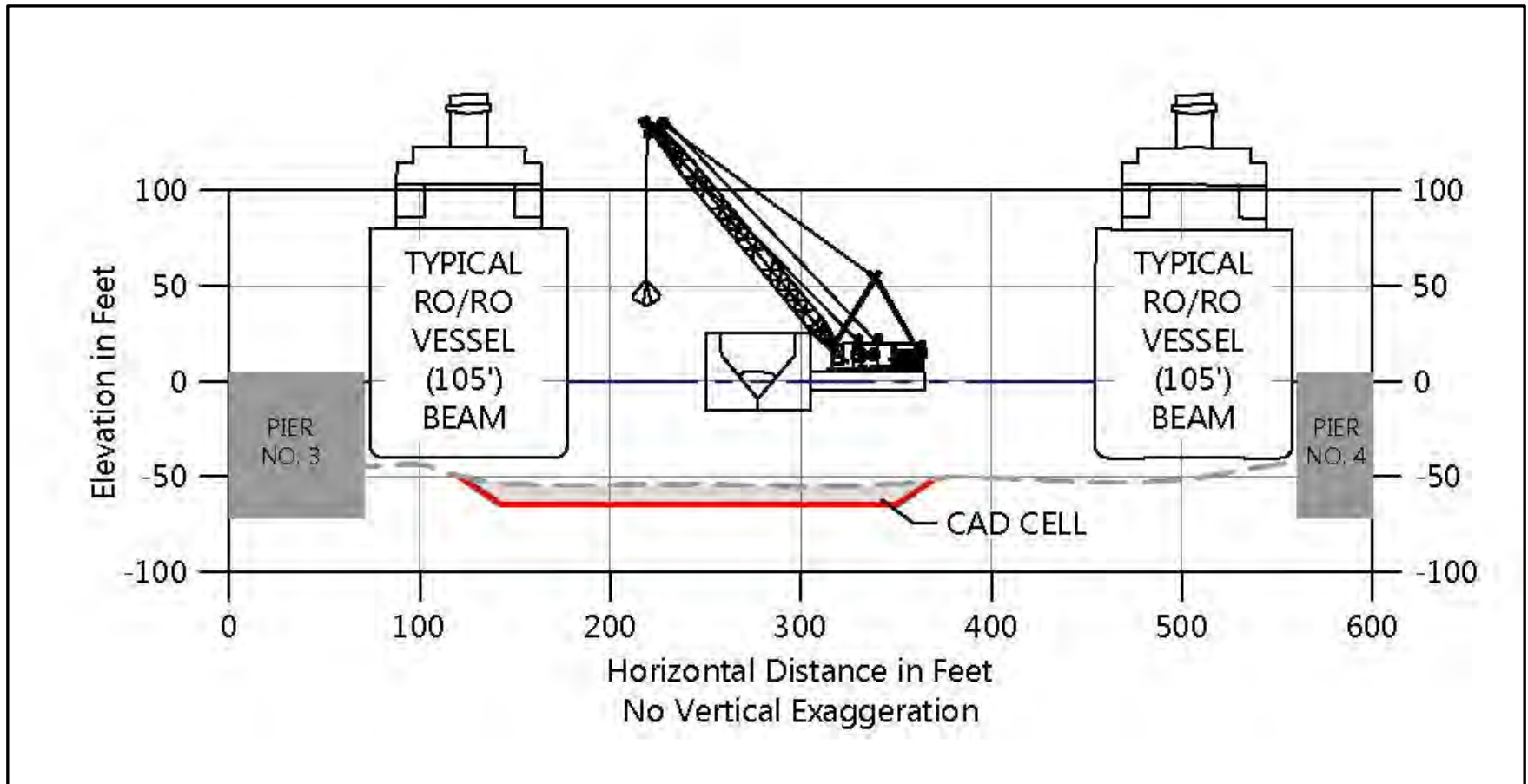
BEDROCK



CAD Site Location – Plan View



CAD Site Location – Section View



CAD Site Construction

- ▶ CAD constructed in September and October 2016
- ▶ Approximately 130,000 cy of sandy material placed at Masonville
- ▶ CAD placement occurred in February 2017
- ▶ Approximately 62,000 cy of maintenance material from the Ferry Bar channel placed into the CAD.
- ▶ Developed a multi-phased monitoring plan for the project.



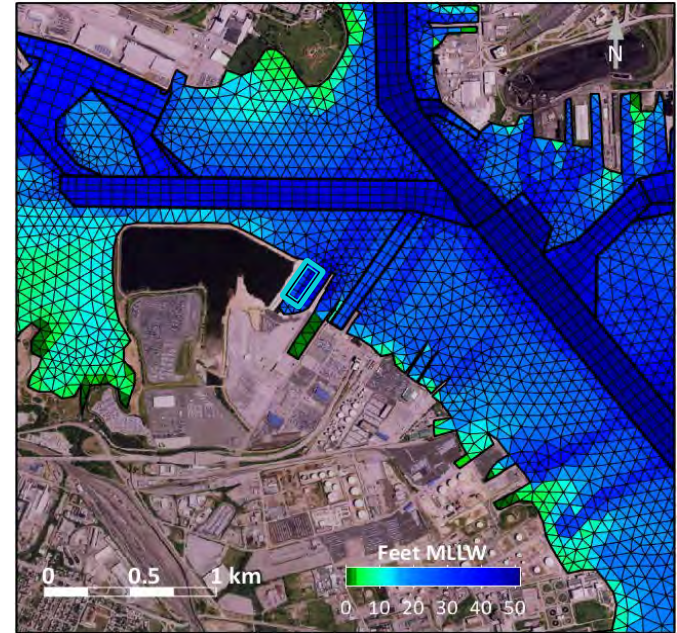
Inflow at Masonville DMCF
(2016)



Maintenance Dredging in
Ferry Bar Channel (2017)

Regulatory and Stakeholder Coordination

- ▶ Nutrient monitoring (total nitrogen and total phosphorus) during dredged material placement because of the Chesapeake Bay TMDL
 - Conducted a baseline nutrient study to establish existing conditions so the influence of the project, if any, could be identified
 - Performed 3-D hydrodynamic modeling to predict nutrient concentrations over time
- ▶ Stakeholder questions about the dredged material quality and potential for remobilization
 - Sediment testing to confirm material quality
 - Post-placement surveys to evaluate dredged material consolidation

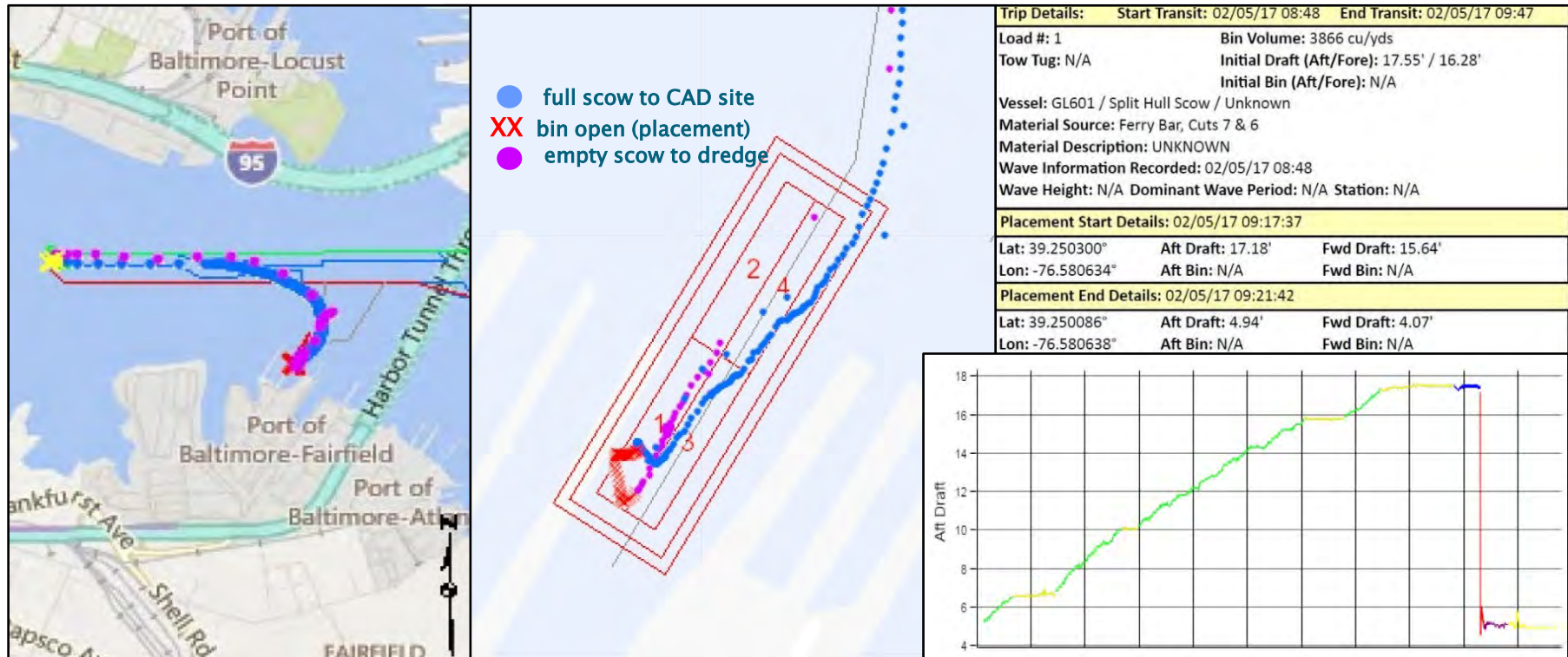


Water Quality Monitoring



Dredged Material Placement

- Each scow and placement event tracked: timing, placement location, draft, estimated quantity
- Monitoring started right after scow emptied



Water Quality Monitoring Locations



Water Quality Monitoring Program

- ▶ Conducted during dredged material placement
- ▶ Daily monitoring → 7 events total
- ▶ 7 locations sampled during each sampling event
 - 4 near field
 - 2 far field
 - 1 background
- ▶ Turbidity measured at 5-ft depth increments
- ▶ Nutrient data collected at surface and mid-depth



Fully Loaded Scow

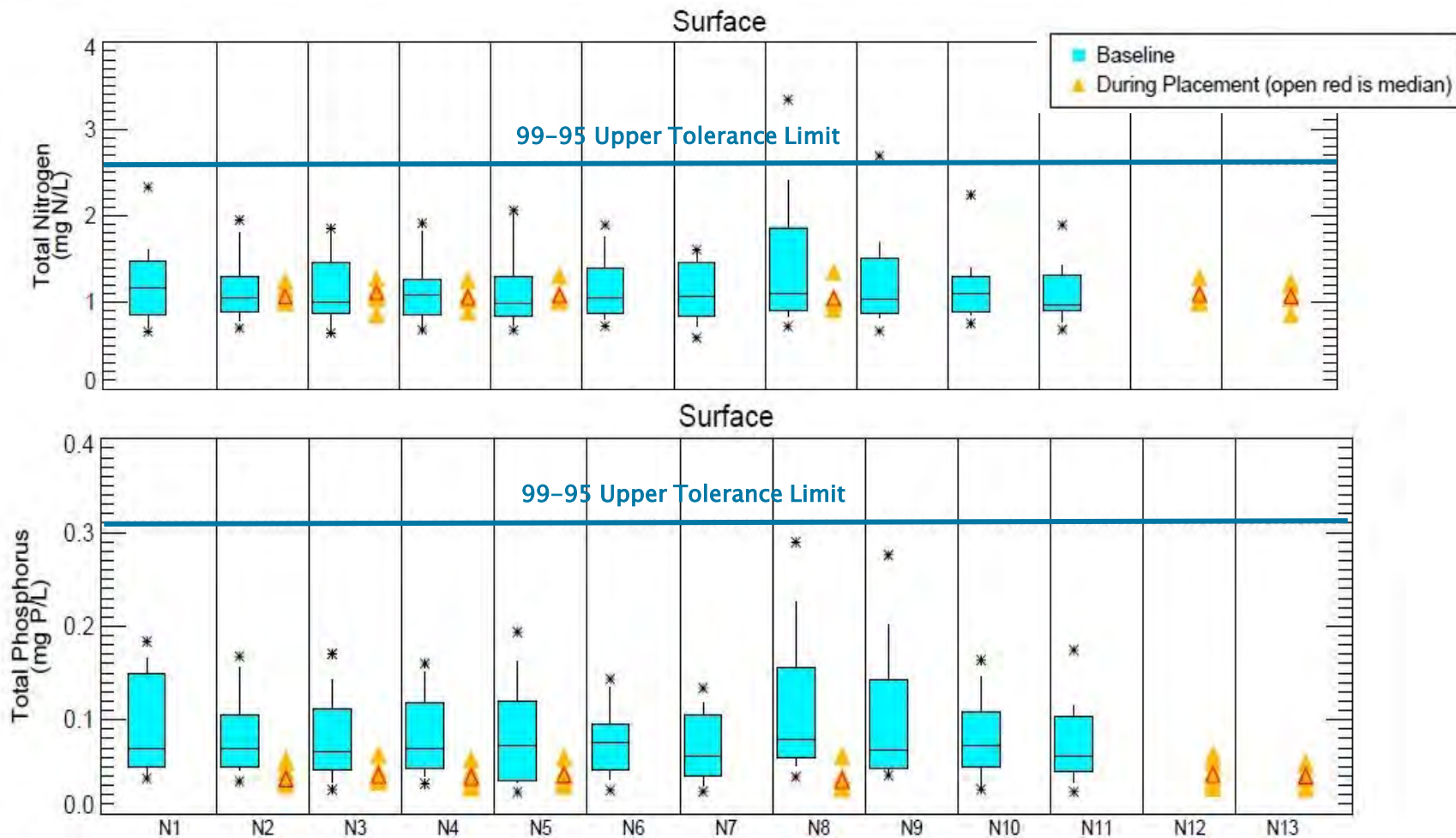


Dredged Material Placement



Empty Scow

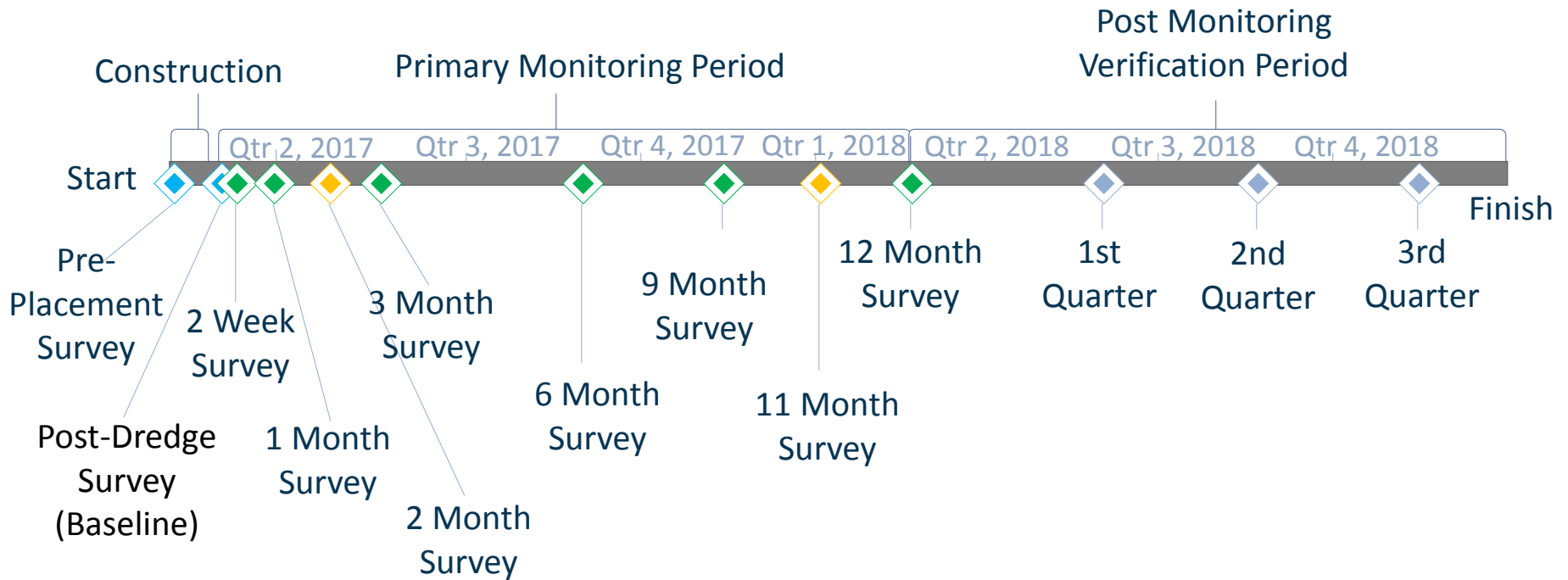
Nutrient Monitoring Results



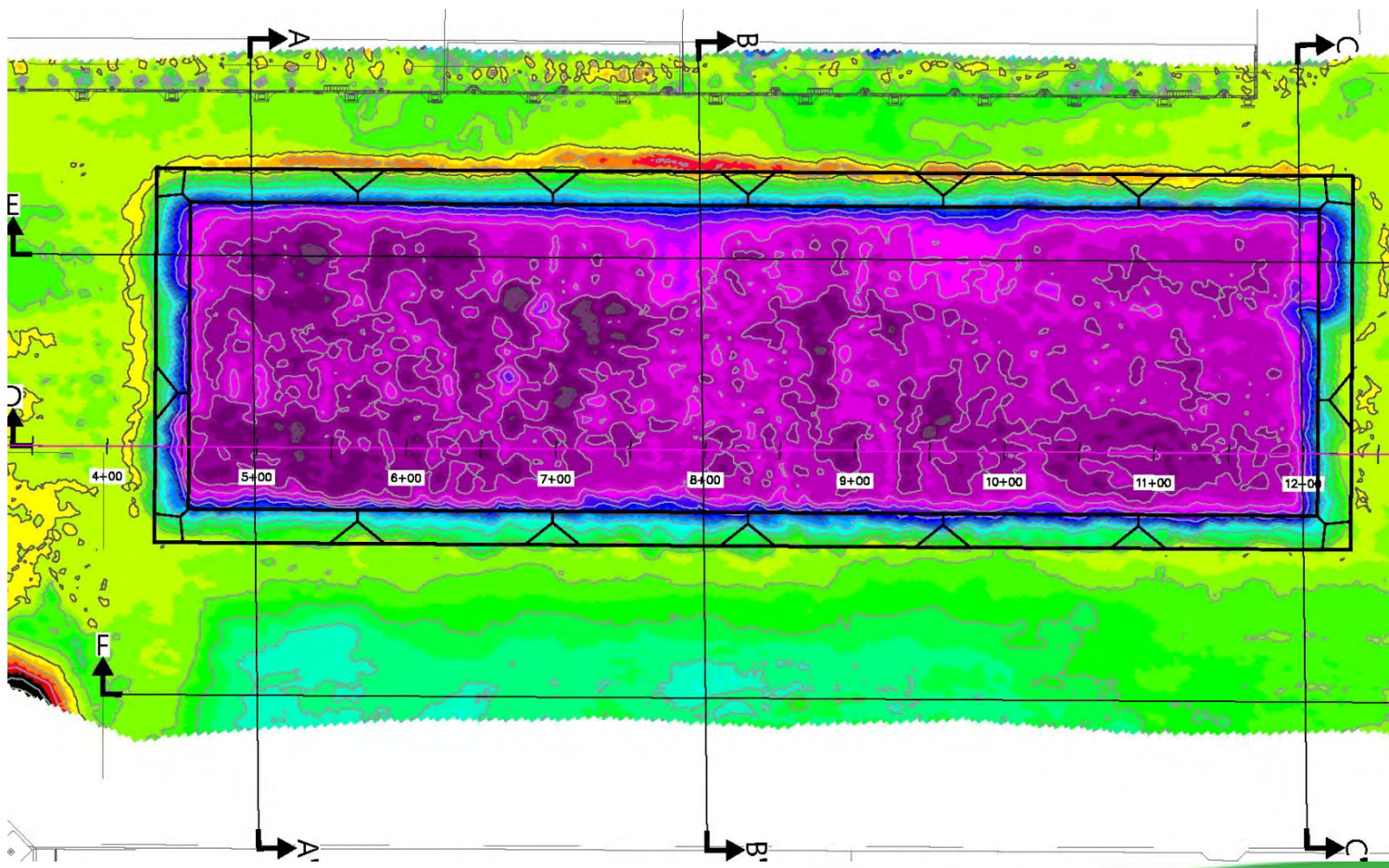
- Horizontal green lines indicate 99-95 Upper Tolerance Limits from baseline data
- Boxes show median (horizontal central line) and outliers (stars)
- Baseline and "During Placement" data consist of 14 and 7 points, respectively

Post-Placement Bathymetric Monitoring

Post Placement Monitoring Schedule and Additional Monitoring



Change in Elevations (Pre-Placement to Post-Placement)

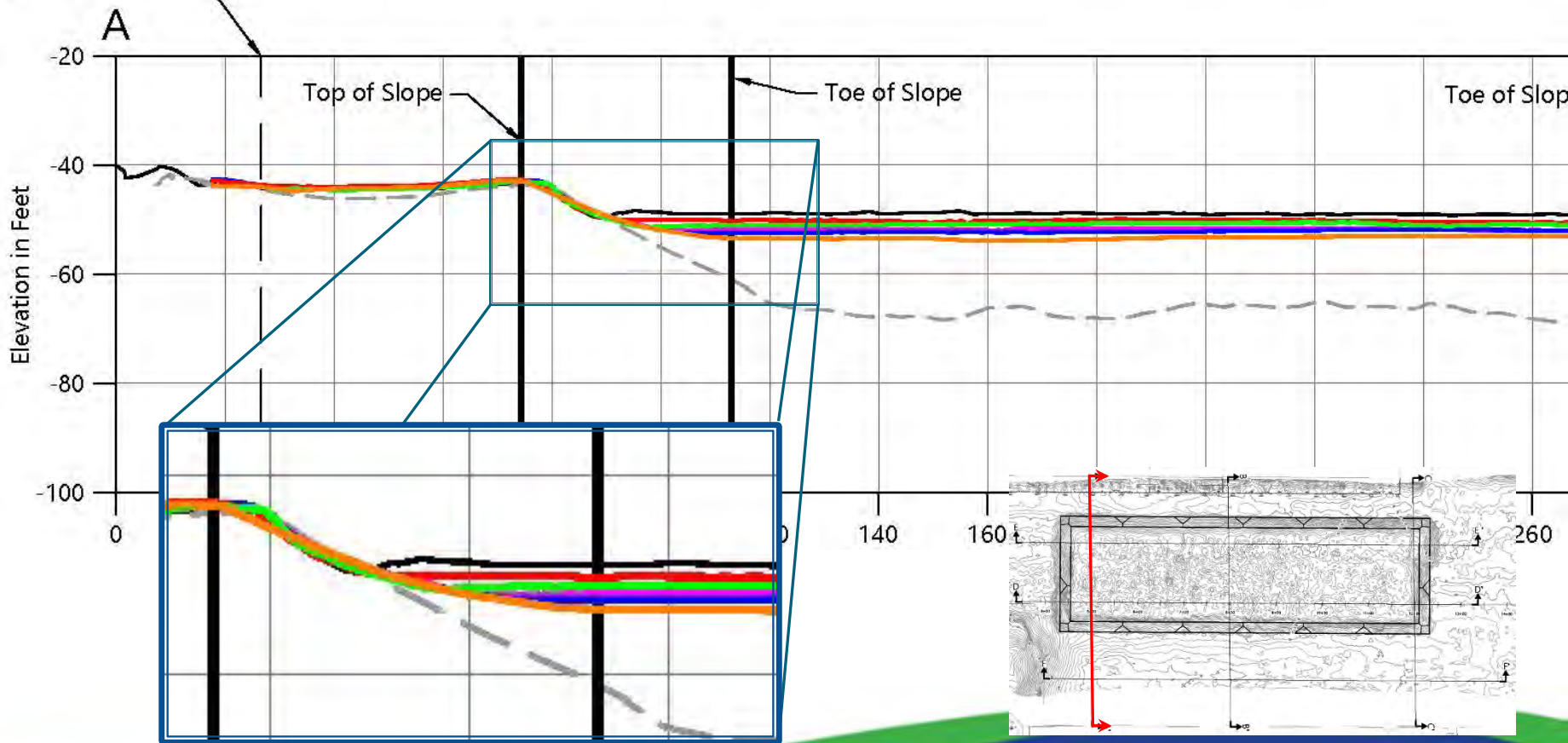


DIFFERENCE BETWEEN PRE-PLACEMENT AND POST-PLACEMENT ELEVATION		
ELEVATION DIFFERENCE (FT)	COLOR	AREA (SF)
-5.00 to -4.00	Red	191
-4.00 to -3.00	Red	771
-3.00 to -2.00	Orange	2990
-2.00 to -1.00	Orange	5227
-1.00 to 0.00	Yellow	51468
0.00 to 1.00	Light Green	238798
1.00 to 2.00	Light Green	84201
2.00 to 3.00	Light Green	56161
3.00 to 4.00	Light Green	25700
4.00 to 5.00	Light Green	19847
5.00 to 6.00	Light Green	25507
6.00 to 7.00	Light Green	11376
7.00 to 8.00	Light Green	4316
8.00 to 9.00	Light Green	4138
9.00 to 10.00	Light Green	4114
10.00 to 11.00	Light Green	4088
11.00 to 12.00	Light Green	4040
12.00 to 13.00	Light Green	4021
13.00 to 14.00	Light Green	4548
14.00 to 15.00	Light Green	5948
15.00 to 16.00	Light Green	10675
16.00 to 17.00	Light Green	25587
17.00 to 18.00	Light Green	54203
18.00 to 19.00	Light Green	35100
19.00 to 20.00	Light Green	11574
20.00 to 21.00	Light Green	911

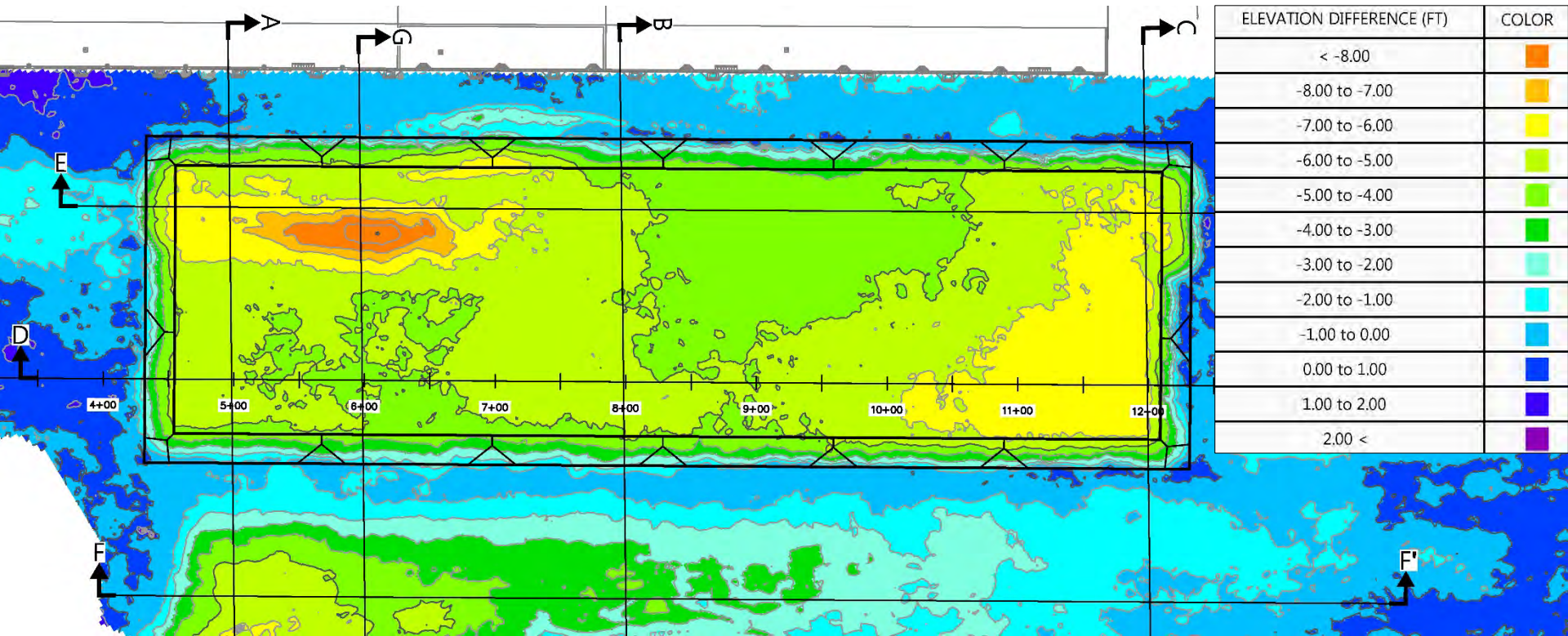
Section A-A' (5+00 South of Cell)

- Pre-Placement
- Post-Placement
- 2-Weeks Post
- 1-Month Post
- 2-Month Post
- 3-Month Post
- 6-Month Post

Pier 3 Bulkhead Line



Post Placement Changes Over 9 Months



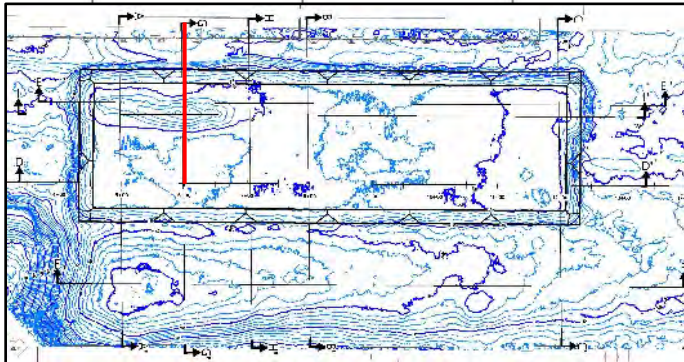
Cross Section B (Rear of CAD Cell)

Post Placement

9 Months

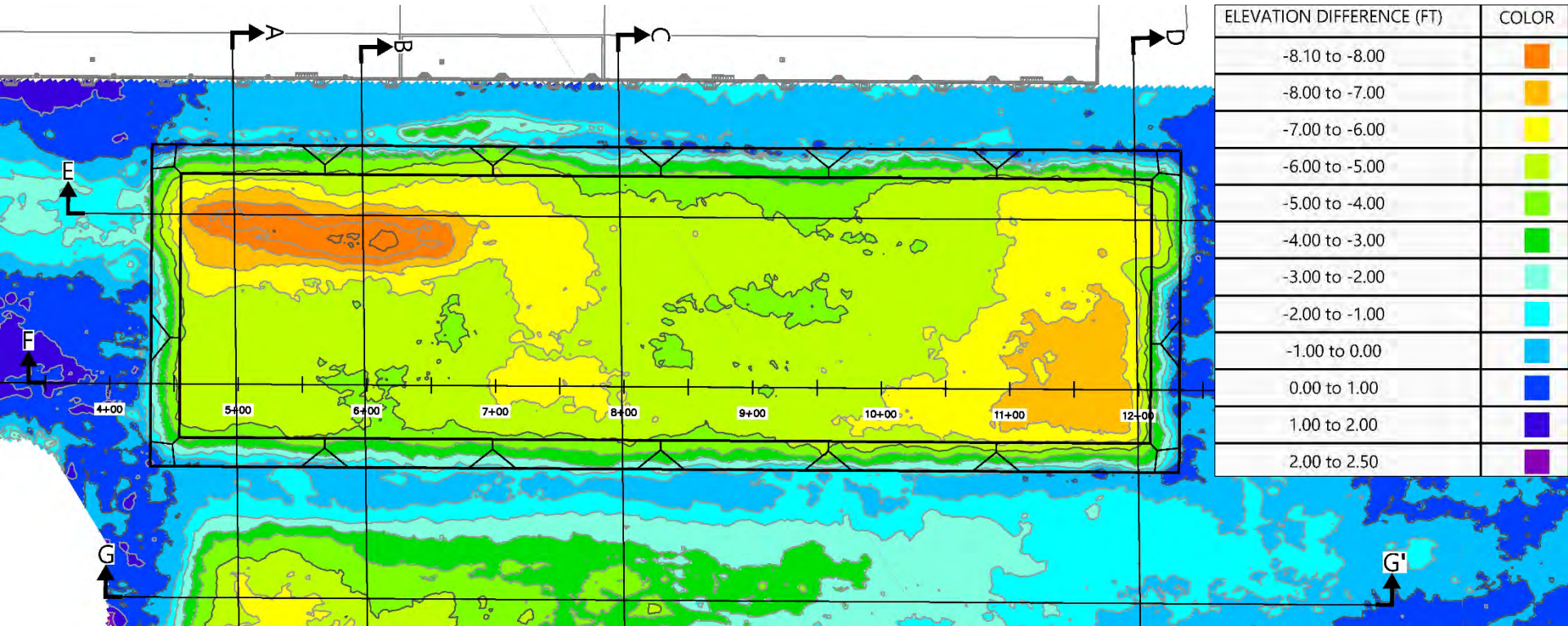
6 Months

12 Months



120 140 160 180 200 220

Post Placement Changes Over 21 Months



CAD Pilot Project Findings

- ▶ Construction and dredged material placement were successful
 - Collaboration with USACE to incorporate CAD into annual maintenance dredging program
- ▶ Challenges working in a busy, high traffic berth
 - Coordinating with the dredging contractors and Harbor Pilots, construction sequencing, and monitoring operations were all key
- ▶ Nutrient monitoring to evaluate project under Chesapeake Bay TMDL framework was successful
 - Developed site-specific approach so potential project impacts could be identified
- ▶ Localized scour was observed but area has stabilized
 - Importance of site selection criteria and planning studies



CAD is an effective strategy and may be an option for future dredged management in Baltimore Harbor

Questions?

For additional information:



Holly Miller
Maryland Port Administration
hmiller2@marylandports.com