Monitoring Effectiveness of Pilot-Scale Sediment Caps in a Dynamic Sand Riverbed

WEDA 2019 Dredging Summit and Expo

June 4-7, 2019

Chicago, Illinois

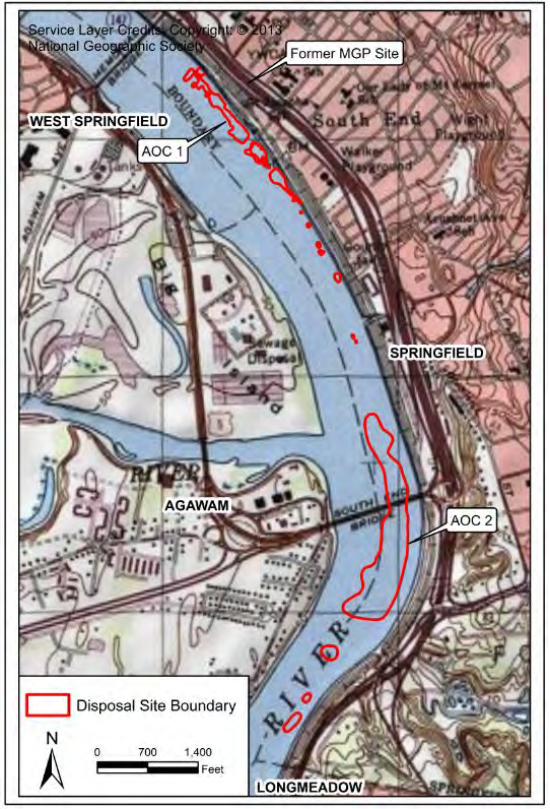
woodplc.com

Columbia Gas of Massachusetts
A NiSource Company

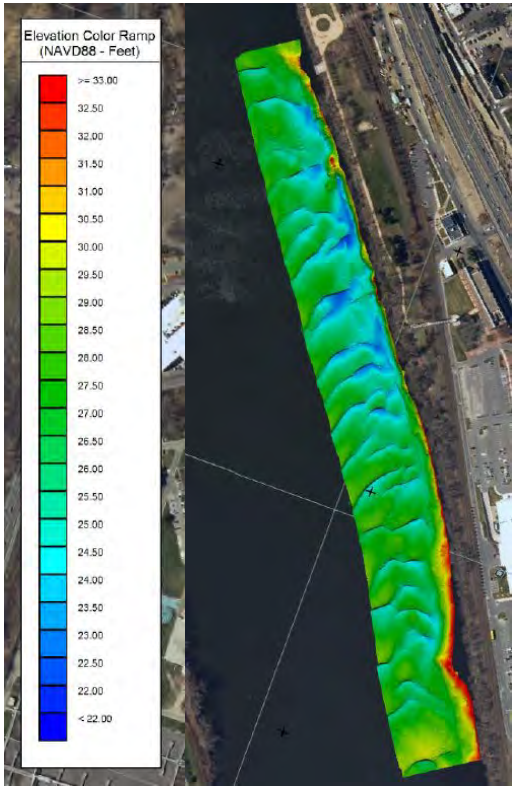
ANCHOR QEA

Site overview

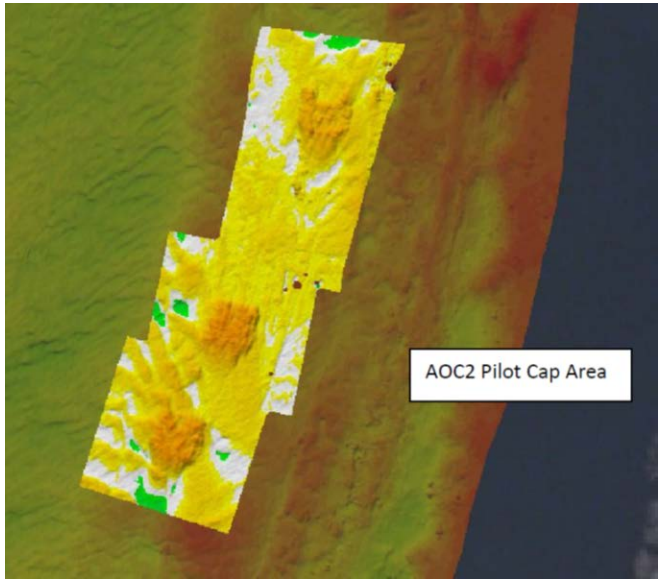
- Tar-infused sandy sediment at surface:
  - Very weathered
  - Firm
  - Resists erosion
- Tar at depth is less weathered
- Sand constantly in motion
- Low PAHs in sand reflect background



Sand bed river

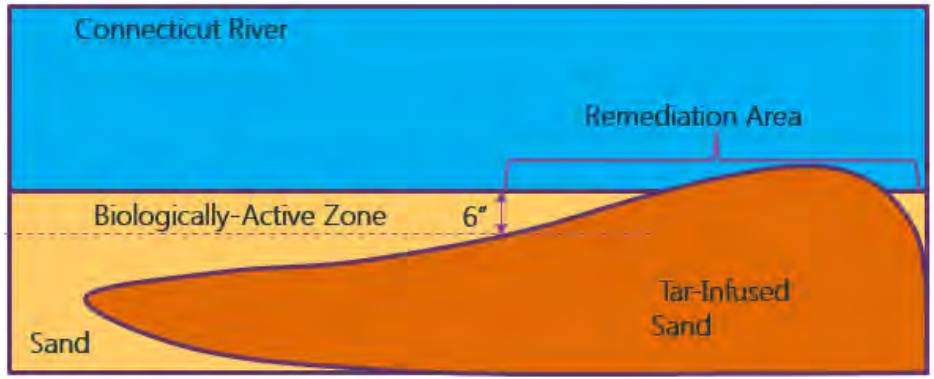


- Primarily medium sand
- Eroded, transported and replenished
- Sand waves and ripples evident from bathymetry



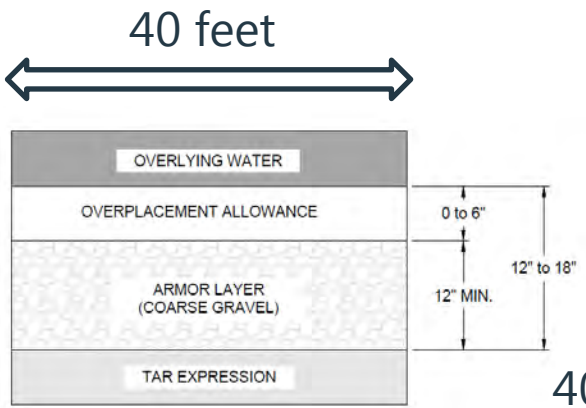
Remediation Goal and Design Objectives

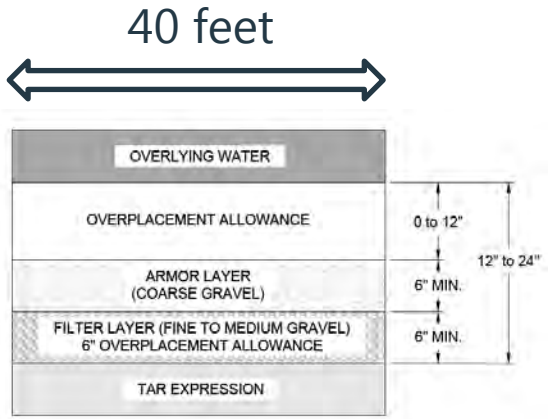
- Cap exposed tar & tar in upper 6 inches
  - Challenge - target footprint constantly changing
  - Benefit - abundance of natural cover material

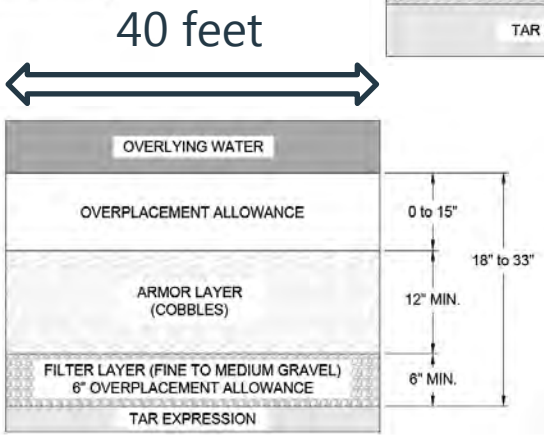


- High dilution – armoring only
- Isolate tar with minimum 1 foot of armoring
- Resist scour from 100-year storm event
- Minimize cap-induced scour at margins
- Enhance deposition
- Prevent tar intrusion into cap

Full-thickness cap designs





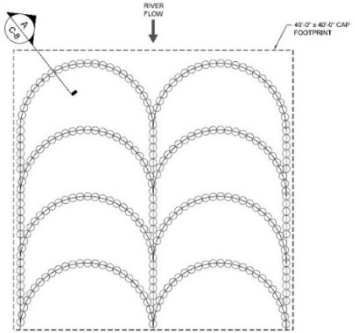


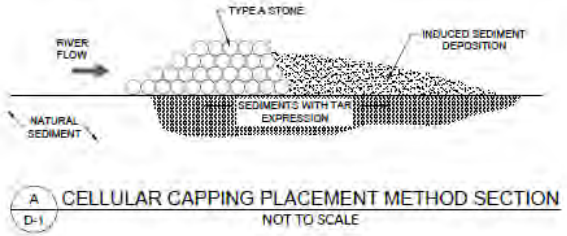
All cap types sloped to sediment surface (1:5 to 1:2.5).

Footprint 50′ by 50′

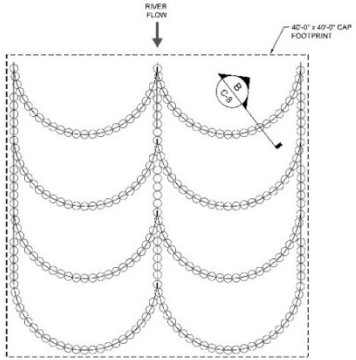
Cellular cap designs

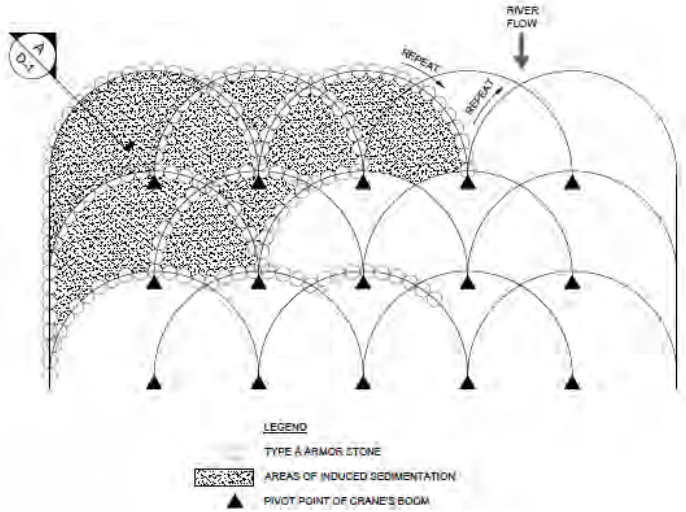
Cellular Cap Convex Placement Method





Cellular Cap Concave Placement Method





Permitting -2 years with many twists & turns

- MEPA – started with full-scale project, trigger EIR
- USACE suggested permit pilot project, falling below threshold
- Wetlands Protection Act
  - Holyoke – Negative Determination
  - Springfield – Order of Conditions
  - Chapter 91 and Section 401 – Exempt
- NHESP – Conservation Management Permit (CMP) for yellow lamp mussel and shortnose sturgeon
  - Required fish exclusion barrier and acoustic monitoring
- USACE – GP for Massachusetts (Section 404 of the Clean Water Act) with permit modification to change the staging area location one month before project implementation.
- Other agencies: US Fish and Wildlife Services, National Marine Fisheries Services:
  - shortnose and Atlantic sturgeon
  - CMP was adequate for these species
- Consultations required
  - Bureau of Underwater Archaeological Resources
  - Massachusetts Historical Commission (State Historic Preservation Office)

Staging Areas and Cap Placement

- Two staging areas obtained for loading and personnel movement
- Material placed via crane onto barges
- Hauled via barge up to 6 miles away to placement site
- Work conducted in late fall/early winter
- Work ceased when ice flows hinder material transport and diver surveys
- Material placed accurately using DredgePak software

Fish Barrier

Placement Operations in PT9

- Stopped using the barrier after the TOY restriction ended in December with permission

- Fish barrier required by CMP
- Ineffective and inefficient
- Not able to withstand river flows

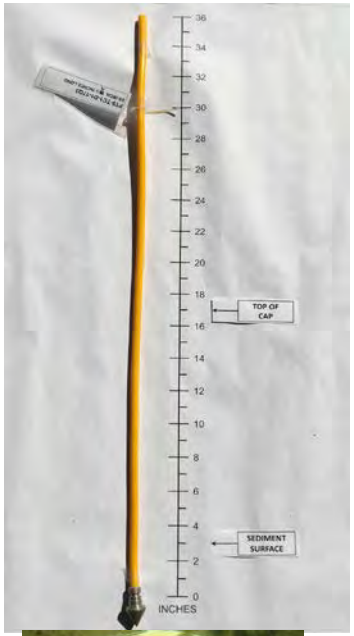
Armoring material

- Fine to medium gravel – filter layer
- Coarse gravel – armor layer
  - 4-inch minus
- Cobbles – armor layer between bridge piers
  - 8-inch minus

Settlement plates and test cells

Armored
PT3 – SP3

Cellular
PT5 – SP2

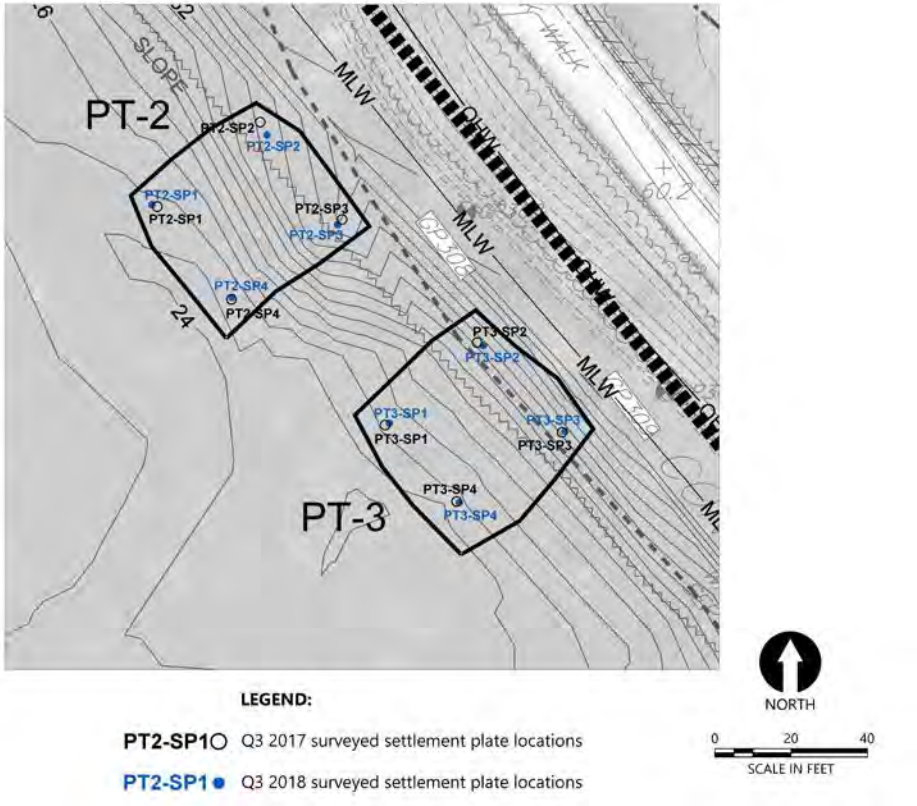


DART
PT9 – TC1

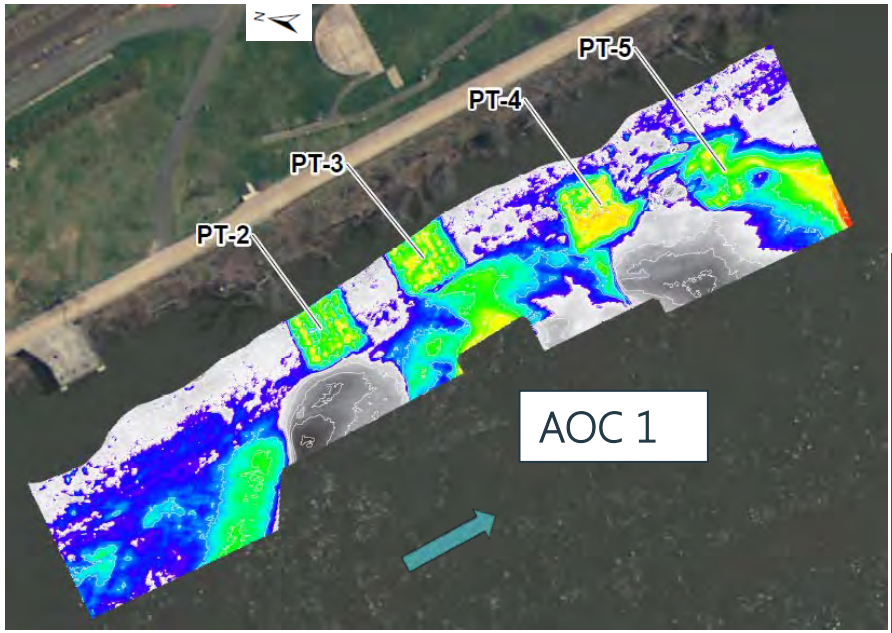
Closed Cell
PT6 – TC1

Open Cell
PT9 – TC2

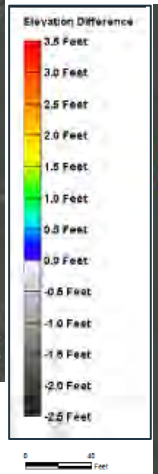
Lateral movement

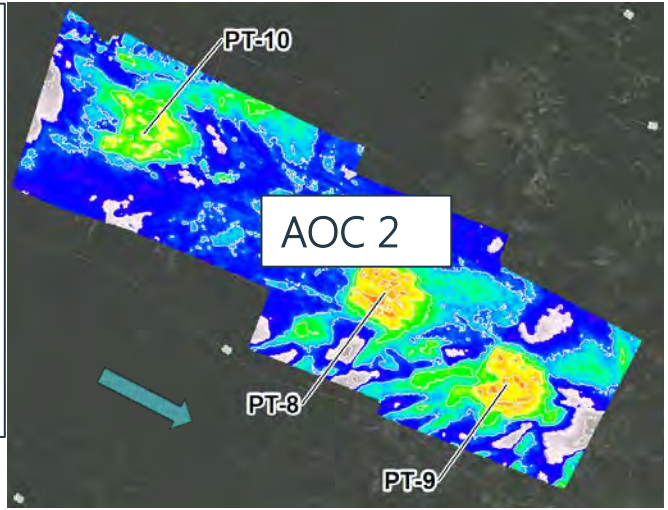


Pre-construction to July 2017

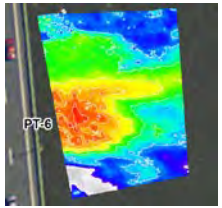


Gravel Caps

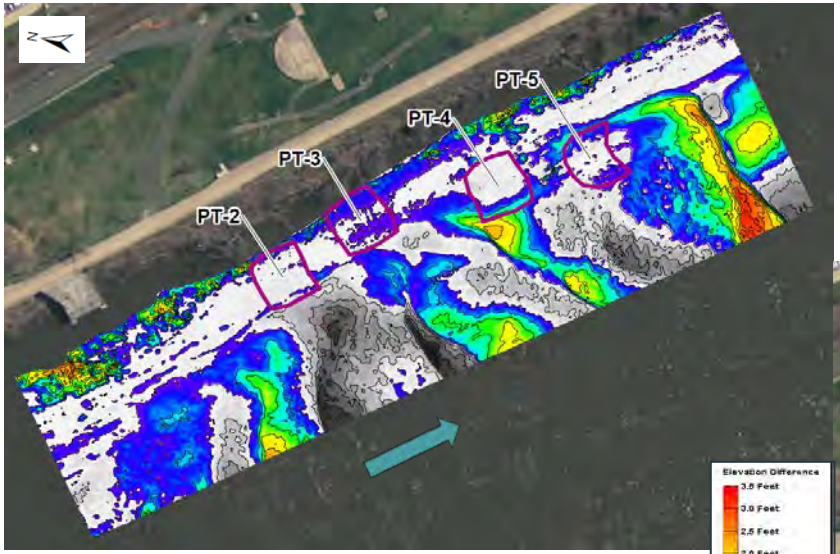




Cobble Cap
AOC2-PT6

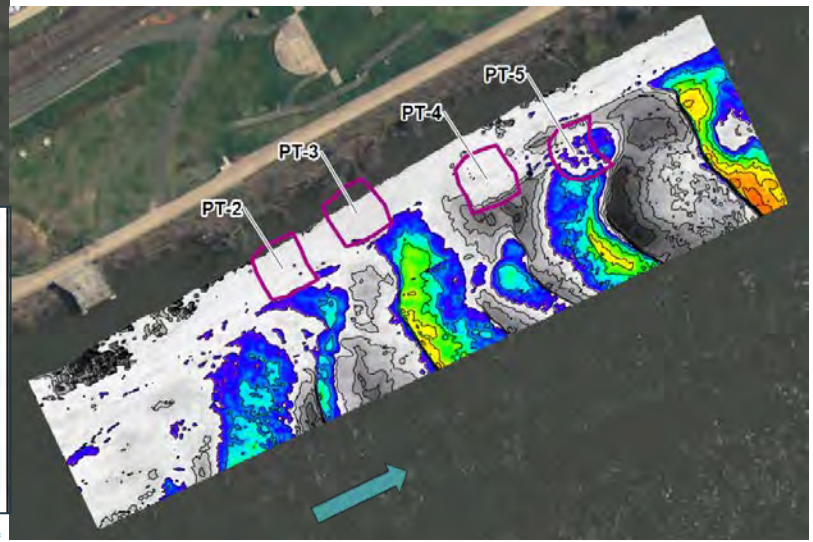


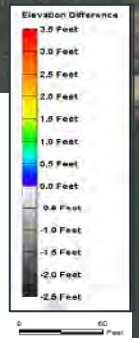
AOC 1 difference maps



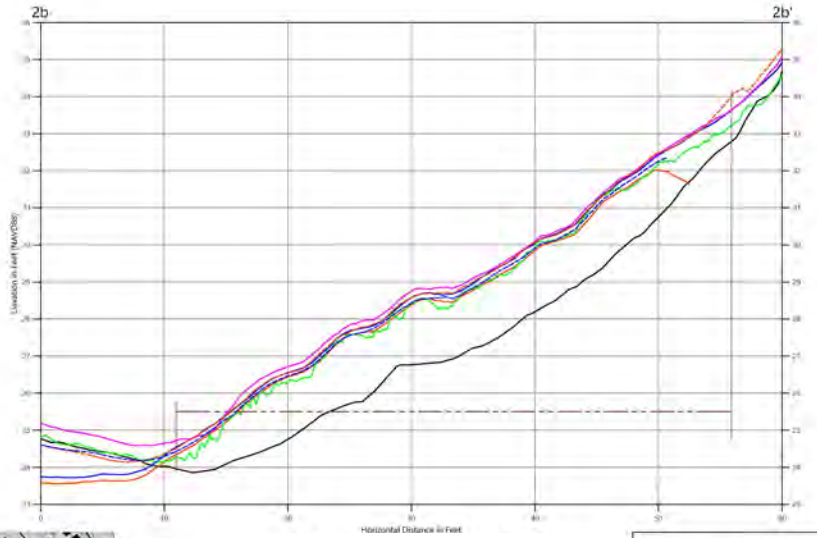
May to August 2018

August to November 2018

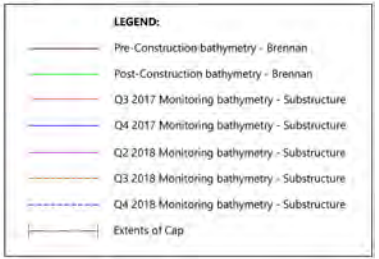




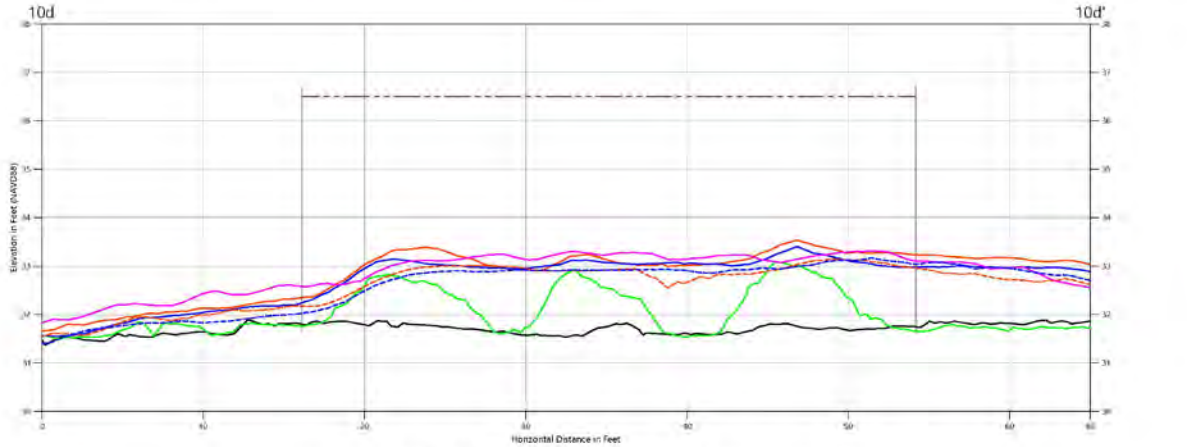
AOC 1 event summary



Full Thickness Cap PT-2



AOC 2 event summary



Conclusions and Next Steps

- Cap design causes sediment accumulation
- Low-profile cap does not cause margin effects
- Cap margins withstand passing sand waves
- No evidence of tar intrusion
- Cap types appear to perform equally well
- Cap designed for 100-year storm event, but
  - Flows only approached two-year recurrence interval
  - Targeting 10-year event to assess scour resistance
- Monitor less frequently until 10-year event occurs

woodplc.com