NAPL in the East Branch

Agenda

- NAPL Introductory Information
- Sources of NAPL
- Current NAPL-related data in the East Branch
  - Methodology for Characterizing NAPL
  - Summary of NAPL Investigations
- How NAPL will be addressed moving forward in the East Branch

NAPL Introductory Information

NAPL Definition

- What is NAPL?
  - Non-aqueous phase liquid
    - Liquids that are separate from and immiscible with water
    - Does not always = contamination (vegetable oil is a NAPL)
  - LNAPL – NAPL that is lighter than water (floats)
  - DNAPL – NAPL that is denser than water (sinks)
- How do we describe NAPL in sediment?
  - Visual observations - sheen, bleb, coated, saturated, oil-wetted, oil-stained, etc.
  - Mobile NAPL vs. Immobile/Residual NAPL
    - Mobile NAPL may move by advection within the connected void spaces of the sediment
    - Immobile/residual NAPL does not move by advection within the connected void spaces of the sediment

NAPL in Newtown Creek

- What types of NAPL do we see in Newtown Creek?
  - Site-related or other sources (e.g., vessel spills, overland flow, etc)
- Why is considering NAPL important for the site?
  - NAPL can serve as a continuing source of contamination (potential for recontamination post-remedy)
  - Potential indicator of principal threat waste
  - Complexities in evaluating it (e.g., different transportation pathways and characteristics)

Sources of NAPL

Sources of NAPL to the Creek

- Upland spills (potential continuing source through overland runoff, NAPL dissolution into groundwater and subsequent migration, and/or NAPL seeps)
- Historical spills directly into the Creek/on surface water
- Mobile and immobile point sources (e.g., vessels, outfalls)
- Ebullition-facilitated NAPL transport from sediments to surface water
- Dissolution of NAPL and subsequent dissolved phase transport
- Potential NAPL advection (e.g., mobility resulting from changes to in situ conditions and/or anthropogenic changes)
- Mixing of NAPL-contaminated sediments with surface water at sediment-surface water interface

NAPL Fate and Transport Processes

- Ebullition-facilitated NAPL transport from sediments to surface water
- Dissolution of NAPL
  - Subsequent migration of contamination in porewater to surface water or sorption to sediments
- Potential NAPL advection
  - NAPL Mobility Evaluation Conclusion – RI findings suggest NAPL in sediment and native material at the locations tested has been interpreted to be immobile via advection under the testing conditions.
  - Uncertainties regarding NAPL transport mechanisms

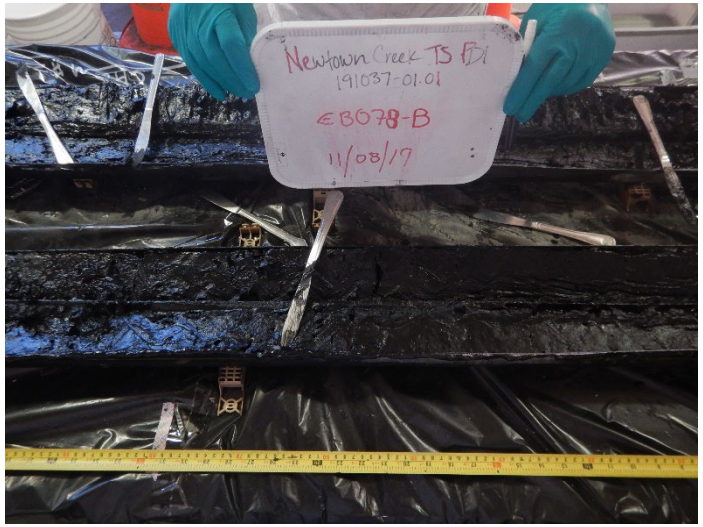
NAPL Investigation Methods

How Do We Identify NAPL in Sediment?

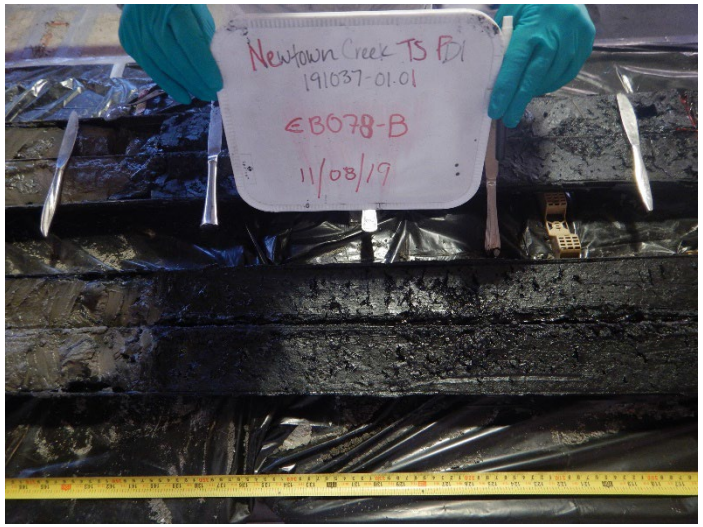
- Cores/samples
  - Visual observations – developed and utilized a standardized process based on NYSDEC procedures for visually inspecting sediment for signs of NAPL.
    - Descriptive categories include - sheen, blebs, oil coated, and oil saturated
  - Shake Testing – standard procedure to field test select intervals (based on visual observations) for confirmation of the presence of NAPL
  - Analytical Testing – samples of the contaminated sediment were collected and analyzed at off-site laboratories
- Screening – Laser Induced Fluorescence (LIF) probe

Example Core Observations

Sheen in surface soil sample collected from turning basin during 2024 FS SDC.

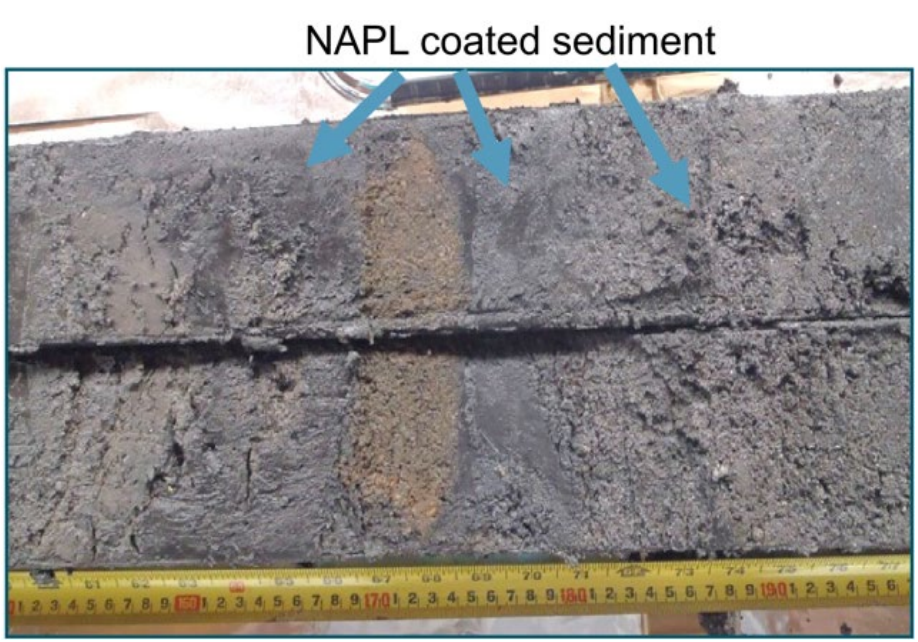


Sheen observed on core from 2019 Treatability Study in the East Branch

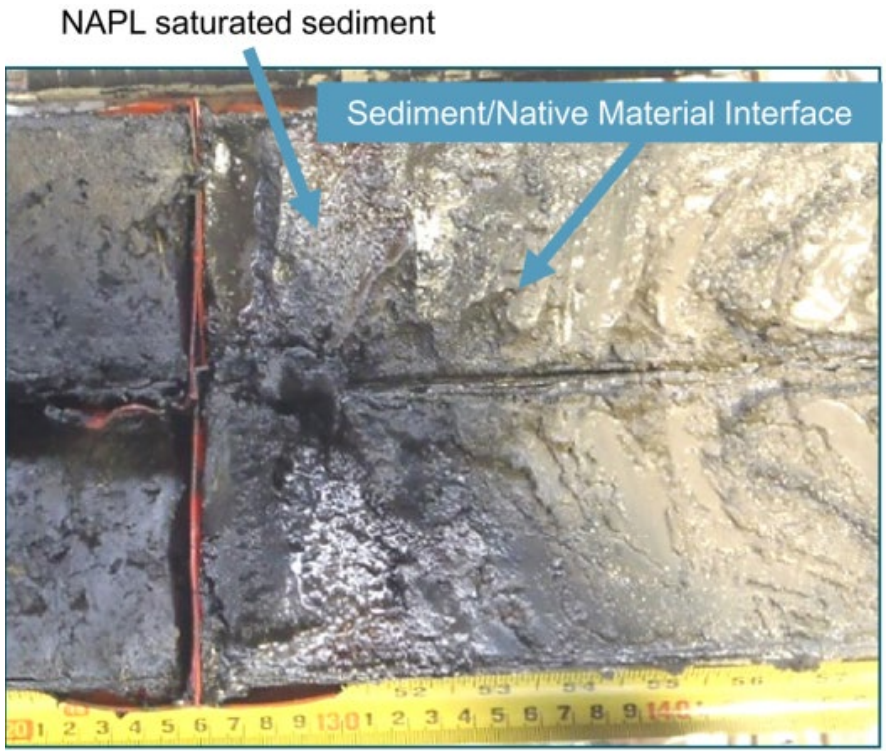


NAPL blebs observed on core from 2019 Treatability Study in the East Branch. Blebs typically not visible in photos and are confirmed with shake test.

Example Core Observations



In NAPL coated sediments, the grains are coated with NAPL, but there isn't enough NAPL present to saturate pore spaces. Core NC265SC-B from RI Phase 2 (2014)

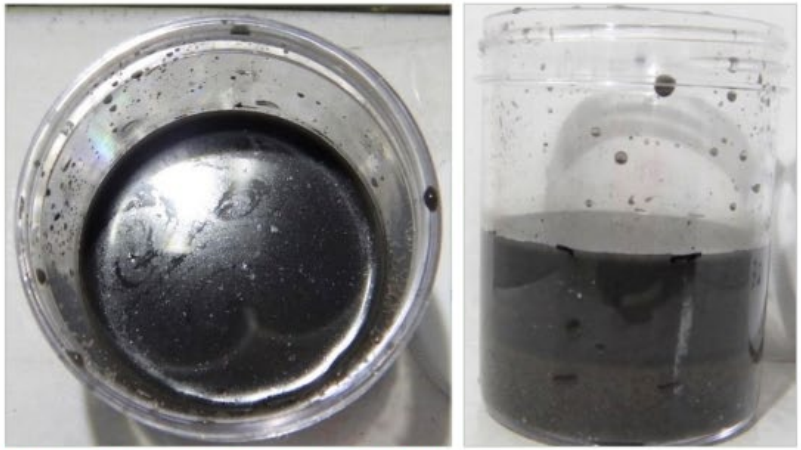


In NAPL saturated sediments, the sediment pore spaces are filled with NAPL. Core EK104SC-A from RI Phase 2 (2014)

Core Processing and Shake Testing

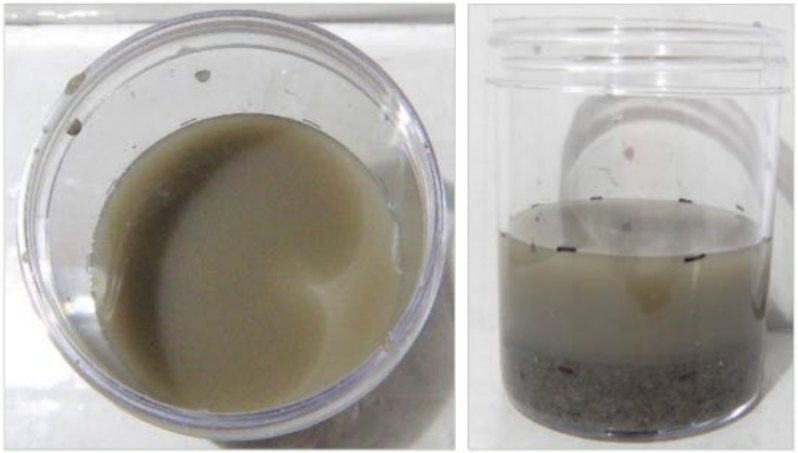
EK145SC-H, 500 to 630 cm

EK145SC-H, 50 cm



Shake test result: Sheen (no NAPL)

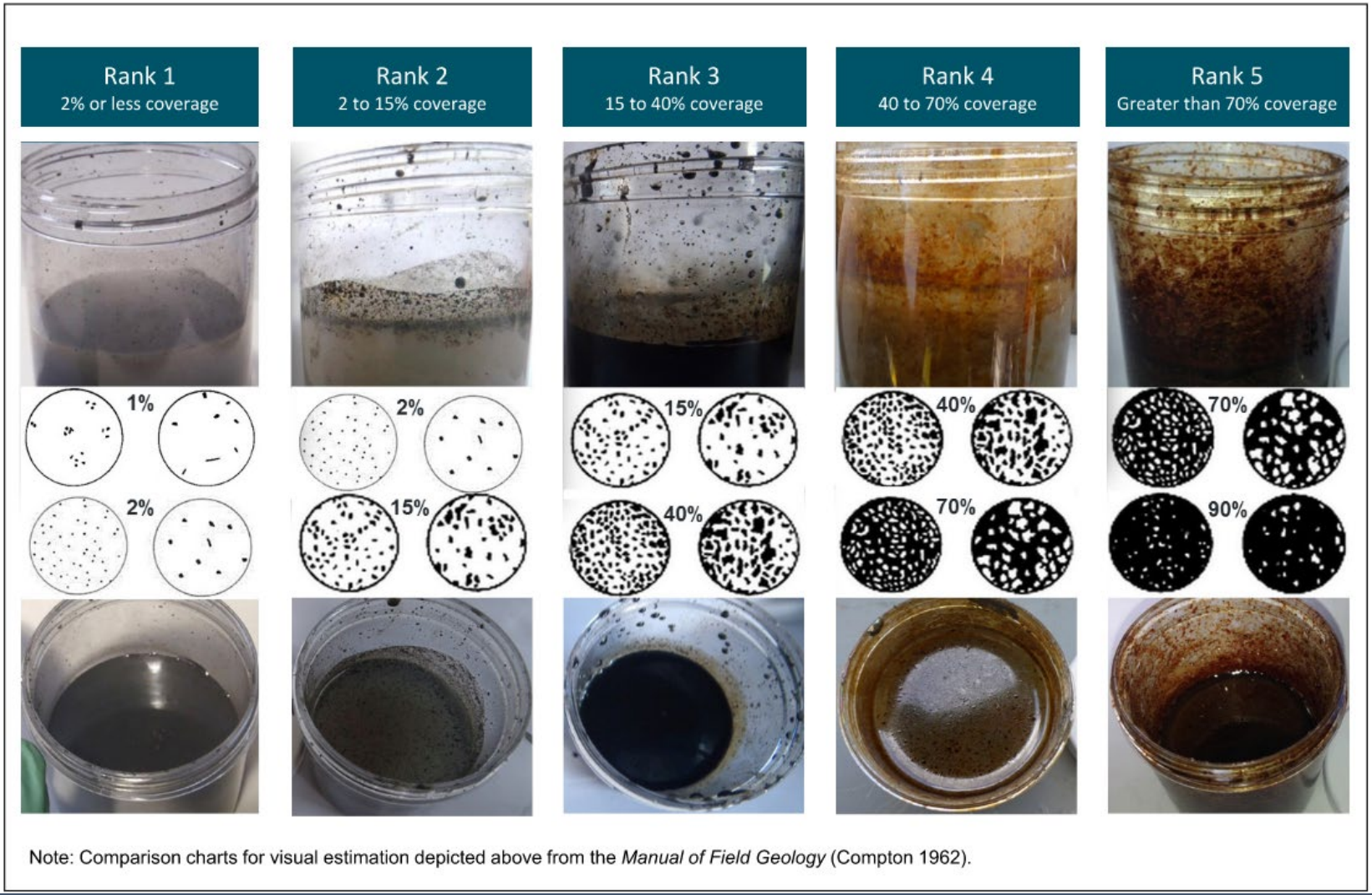
EK145SC-H, 118 cm



Shake test result: Negative (no sheen or NAPL)

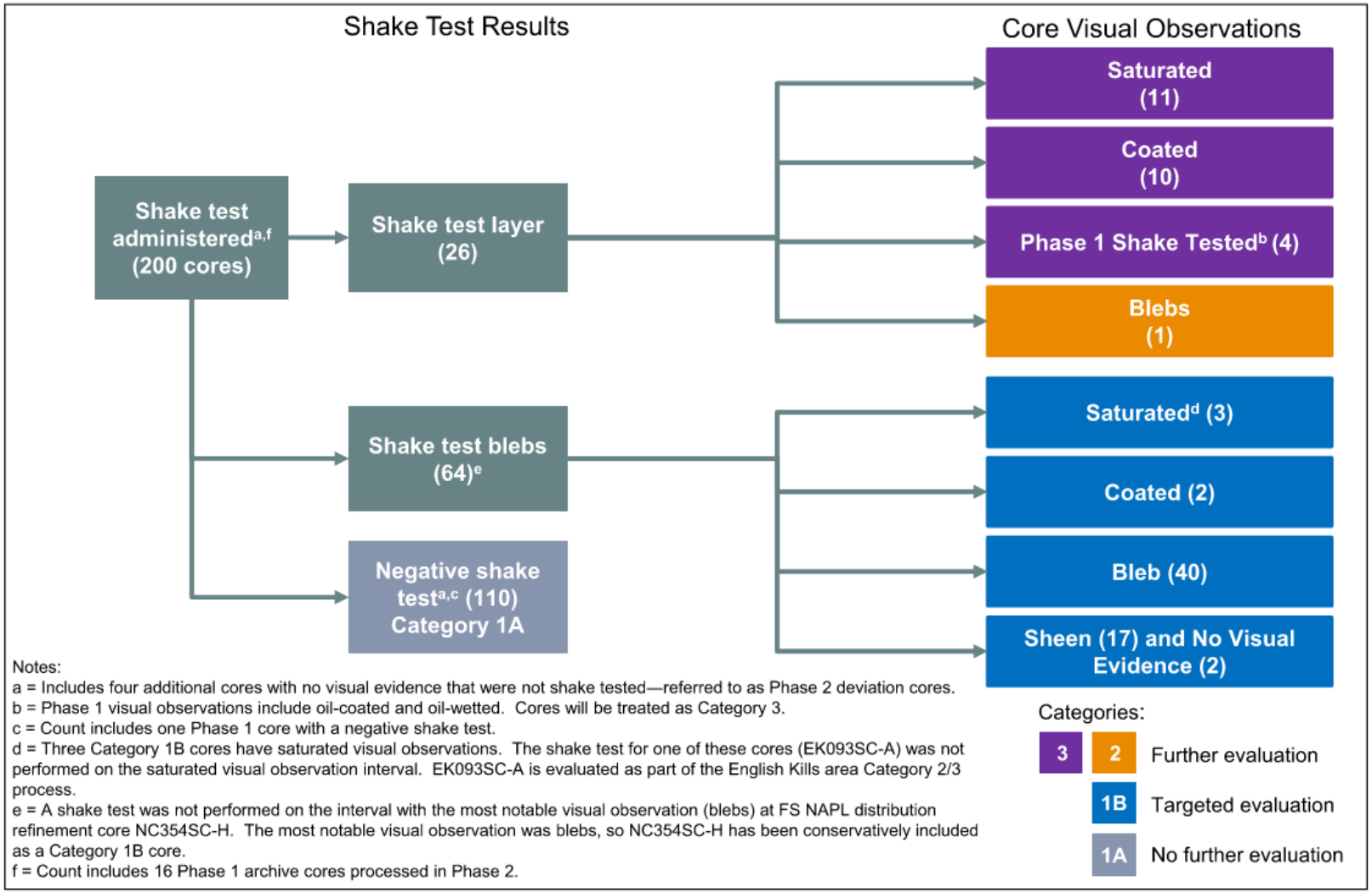
10

Shake Test Bleb Rank Scale



Note: Comparison charts for visual estimation depicted above from the *Manual of Field Geology* (Compton 1962).

Process for Identifying Magnitude of NAPL Observations

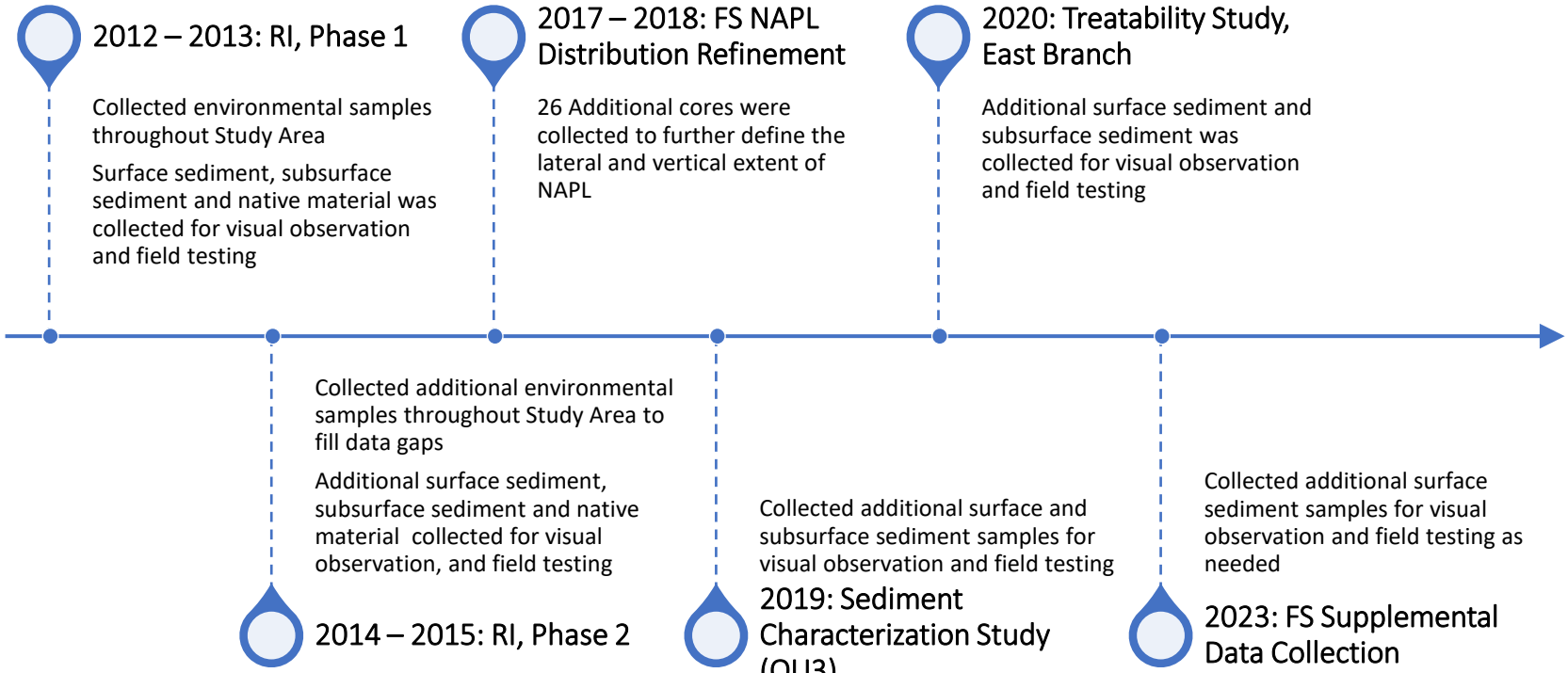


Current NAPL-related data in the East Branch

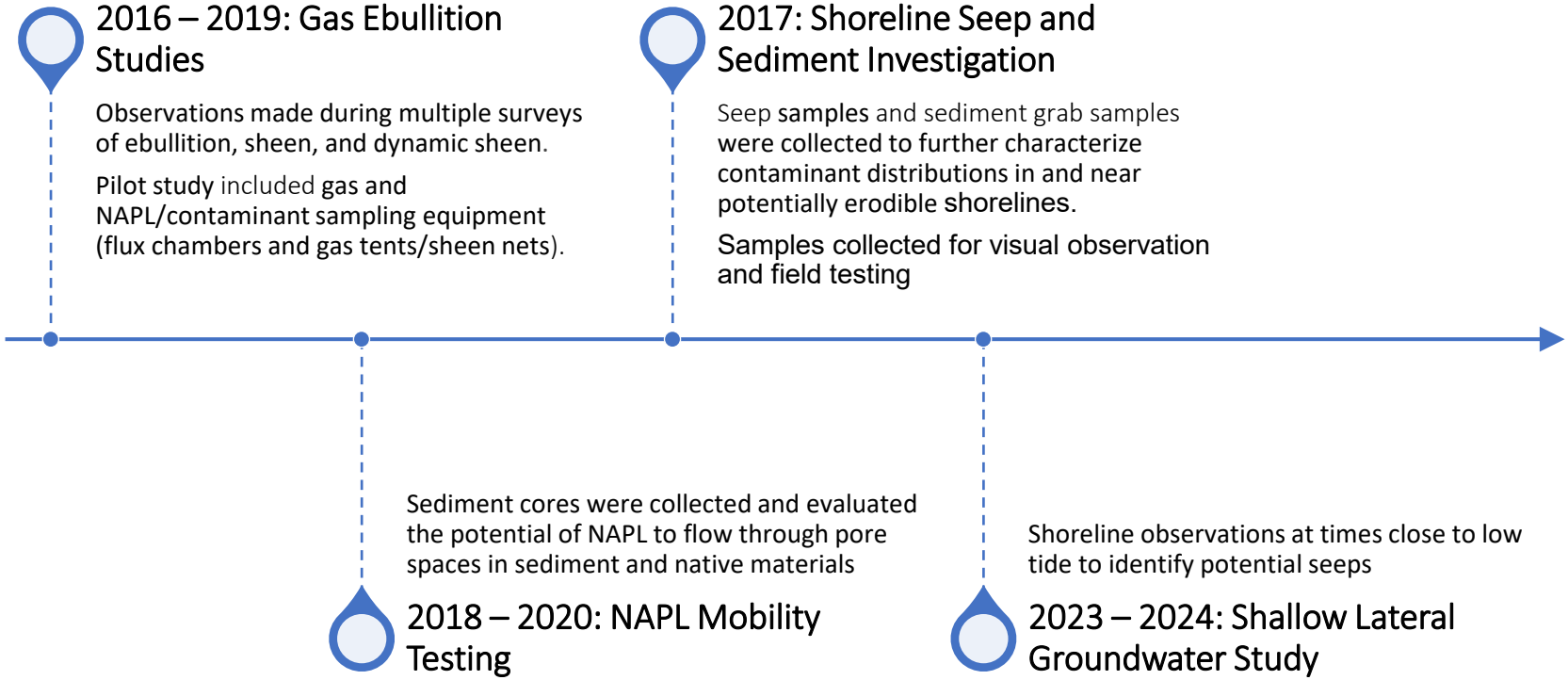
EPA NAPL Investigations

- In general, NAPL has been and is being assessed in all phases of the investigation at the Newtown Creek Superfund Site (RI, FS, PDI, etc.)
- Primary Investigations
  - Conducted sampling to identify the presence of NAPL and other environmental impacts in the Study Area media
  - Included direct collection of surface sediment, subsurface sediment and native material from the Study Area for discrete visual observation and field testing
  - Included additional sampling to further refine the lateral and vertical extent of NAPL impacts
- Secondary Investigations
  - Conducted sampling to better understand the nature of the NAPL in the Study Area and the processes that impact its environmental fate and transport within the system
  - Included mobility studies, ebullition studies, upland studies, etc.

Primary - Remedial investigation (RI) and Feasibility Study (FS) NAPL Investigations



Secondary- Remedial investigation (RI) and Feasibility Study (FS) NAPL Investigations



Other Investigations

- Data use
  - EPA did not review or approve the plans developed to guide these programs or provide oversite during the implementation.
  - Data from these programs was used by EPA in the RI/FS program to target RI/FS sampling efforts/locations.
  - Data will be used to design the PDI and during RD development
- Investigations targeting the presence of NAPL
  - NYCDEP Laser Induced Fluorescence (LIF) Study - performed to identify potential NAPL areas
  - NYCDEP Ebullition Surveys – performed during lower low tides and led to additional RI/FS ebullition surveys
- Investigations targeting NAPL discharges from upland properties
  - NYCDEP Shoreline Seep Sampling – performed to collect samples of seeps discharging from upland properties
  - NYCDEC Upland and Seeps Investigations - performed to collect samples of seeps discharging from upland properties

East Branch – Most Notable NAPL Observations in Surface Sediment

Source: East Branch Early Action Focused Feasibility Study – Draft Final, Appendix A Figure A2-10a

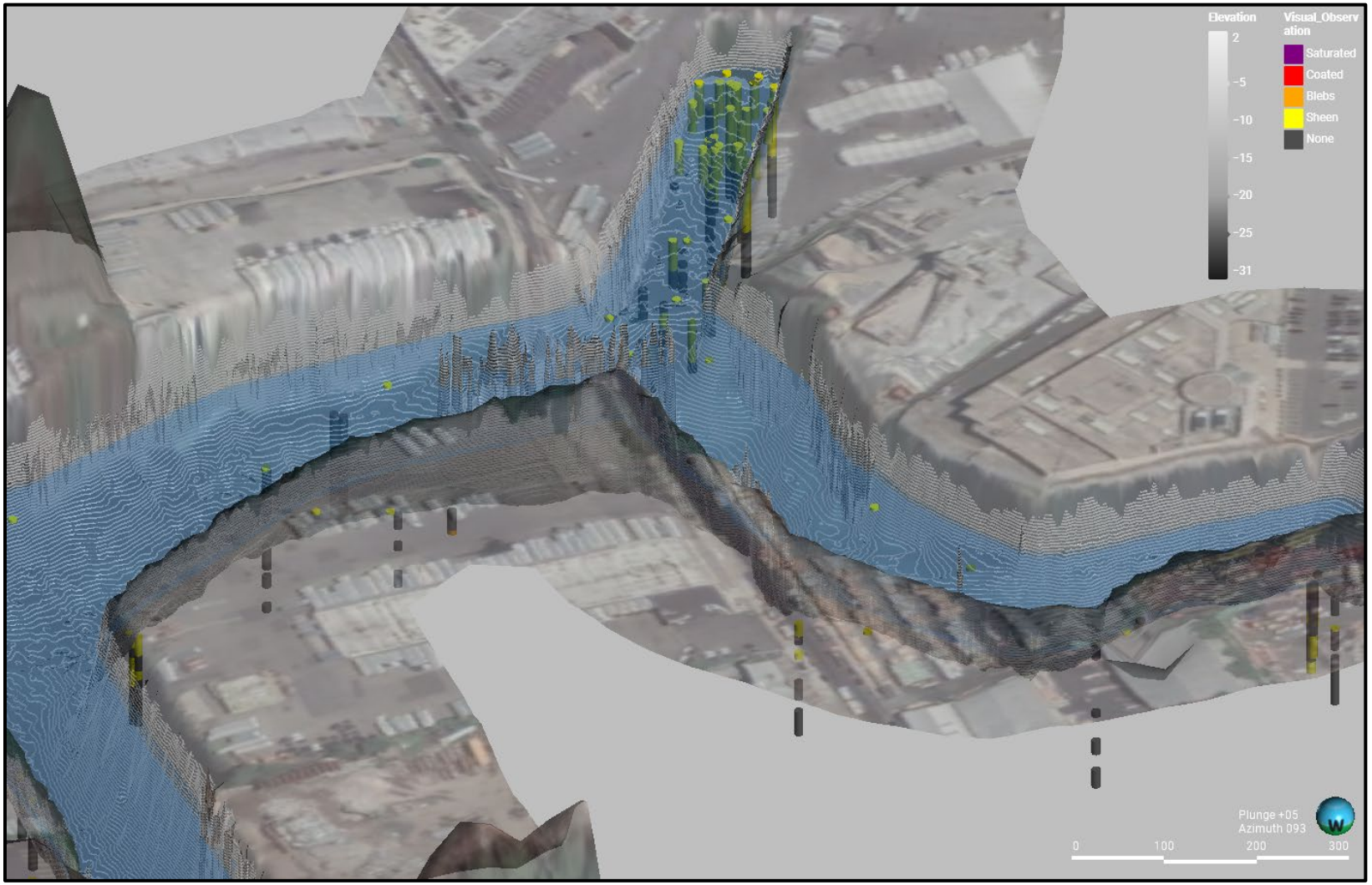
East Branch – Most Notable NAPL Observations in Subsurface Sediment

Source: East Branch Early Action Focused Feasibility Study – Draft Final, Appendix A Figure A2-10b

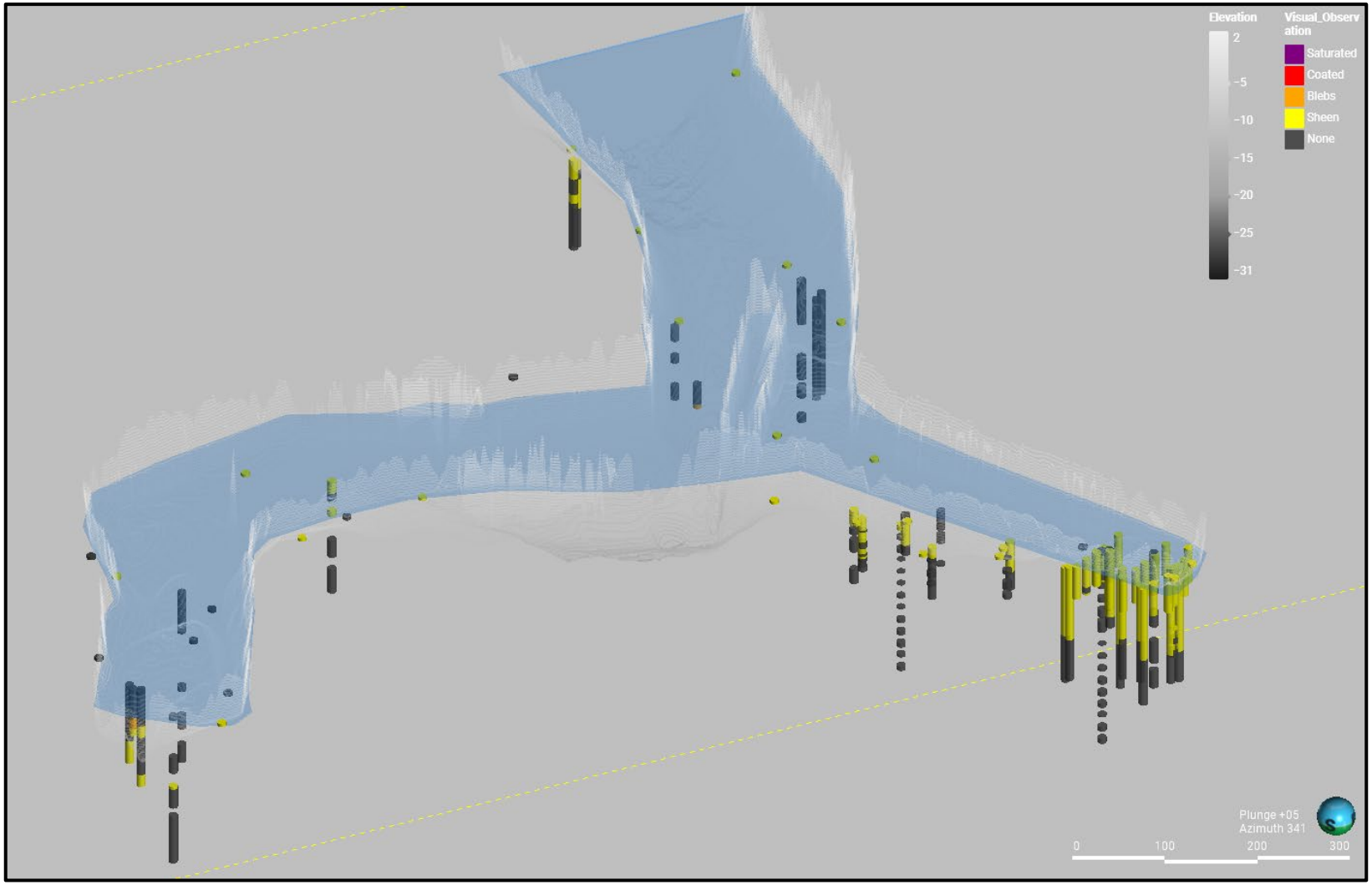
East Branch – Most Notable NAPL Observations in Native Material

Source: East Branch Early Action Focused Feasibility Study – Draft Final, Appendix A Figure A2-10c

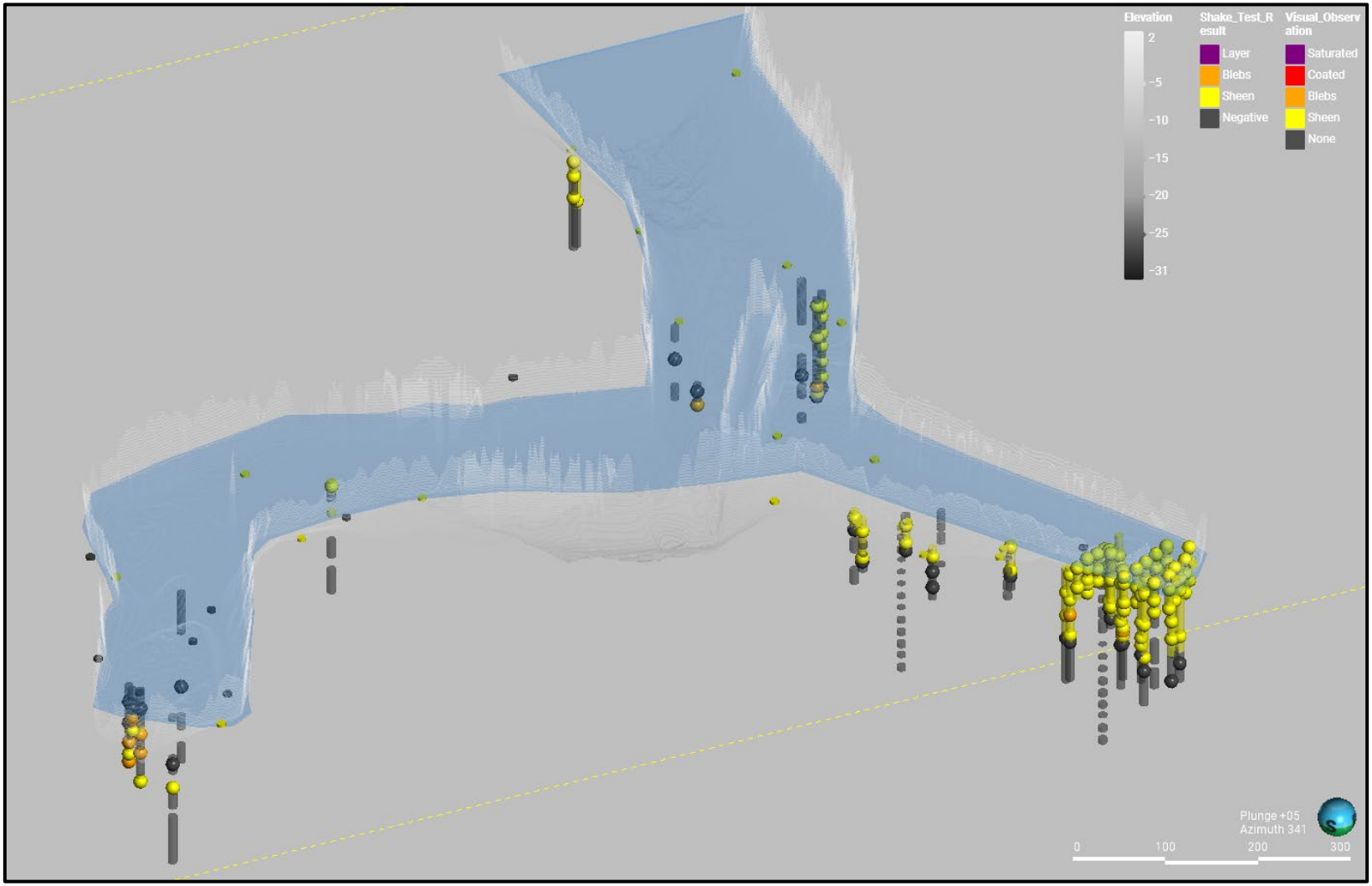
Overview of the East Branch in 3D Model



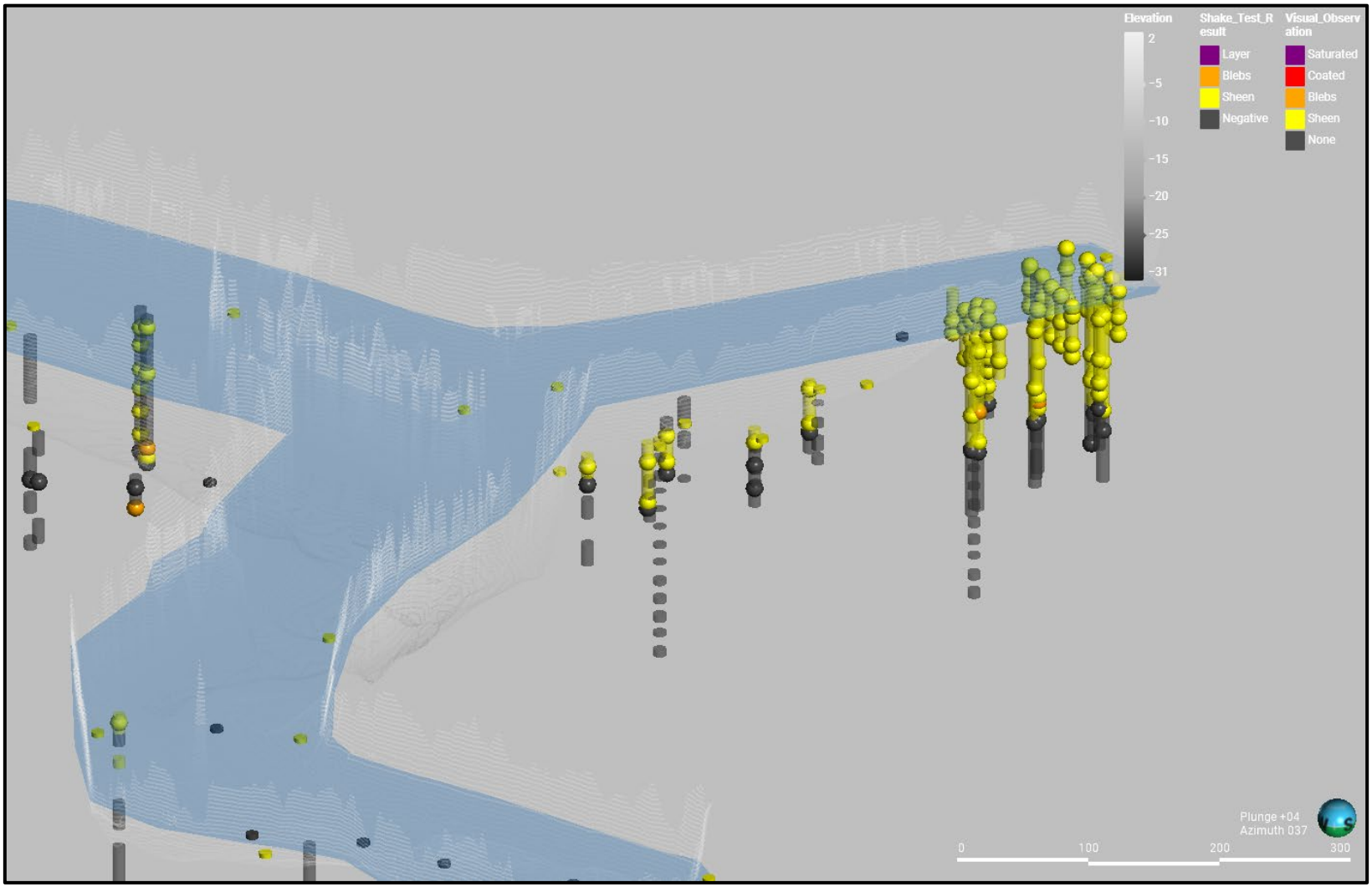
Visual Observations in Cores



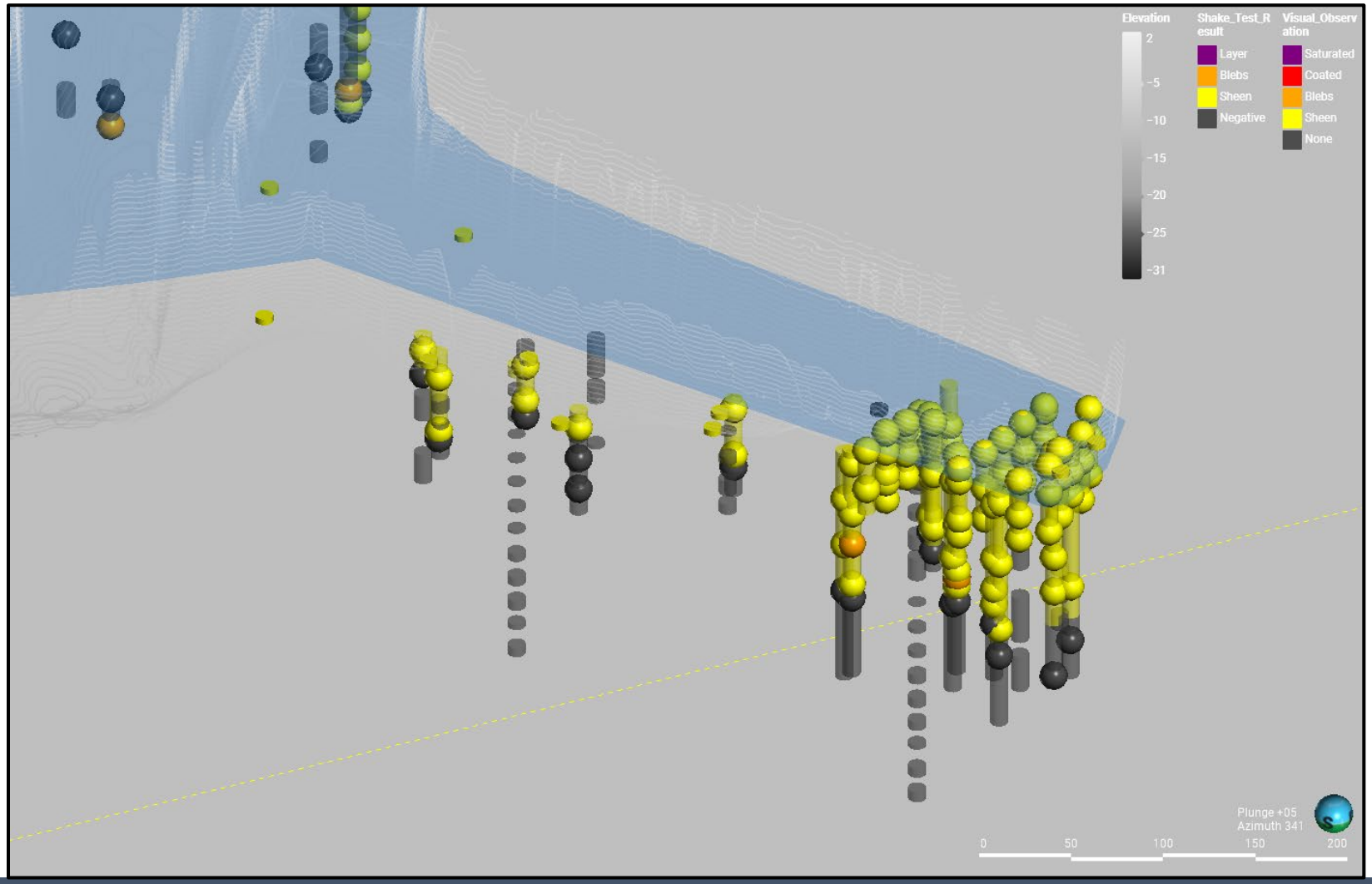
Shake Tests Results with Visual Observations



Shake Tests Results with Visual Observations – Closer Look



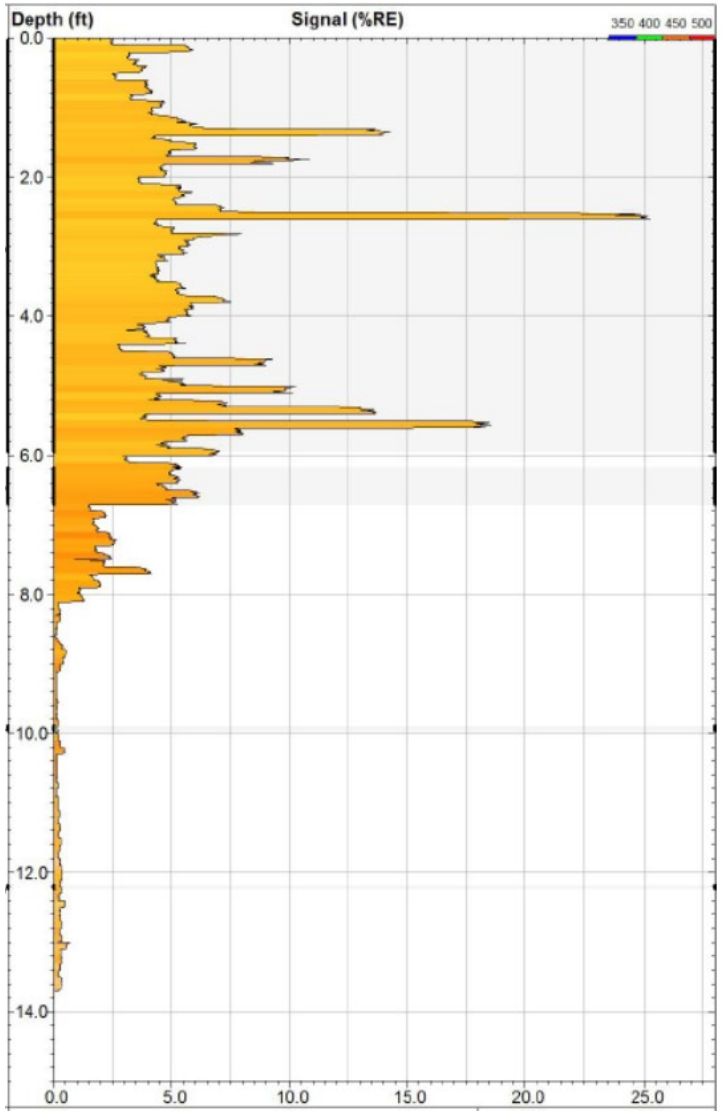
Shake Tests Results with Visual Observations – Closer Look



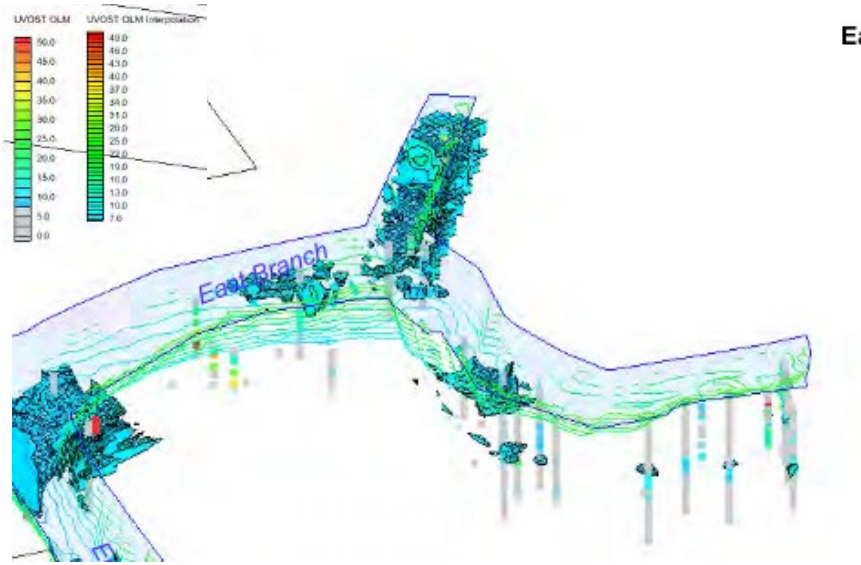
NYCDEP Laser Induced Fluorescence (LIF) Study

- Laser Induced Fluorescence (LIF) probes advanced throughout the creek.
- Probes sense the fluorescence from materials in the sediments.
- Confirmation borings were installed by NYC near the probe points to help correlate the LIF readings to visual core observations and shake tests

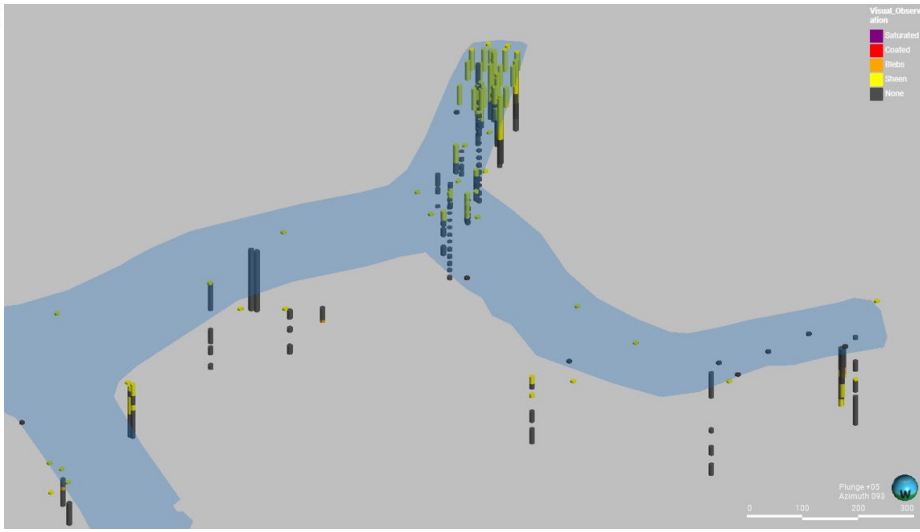
- Benefits and Limitations
  - Qualitative data/no contaminant concentration data
  - Used to efficiently identify potential areas of contamination
  - Informs further investigation



NYCDEP LIF Study - UVOST and Sheen/NAPL Core Observations

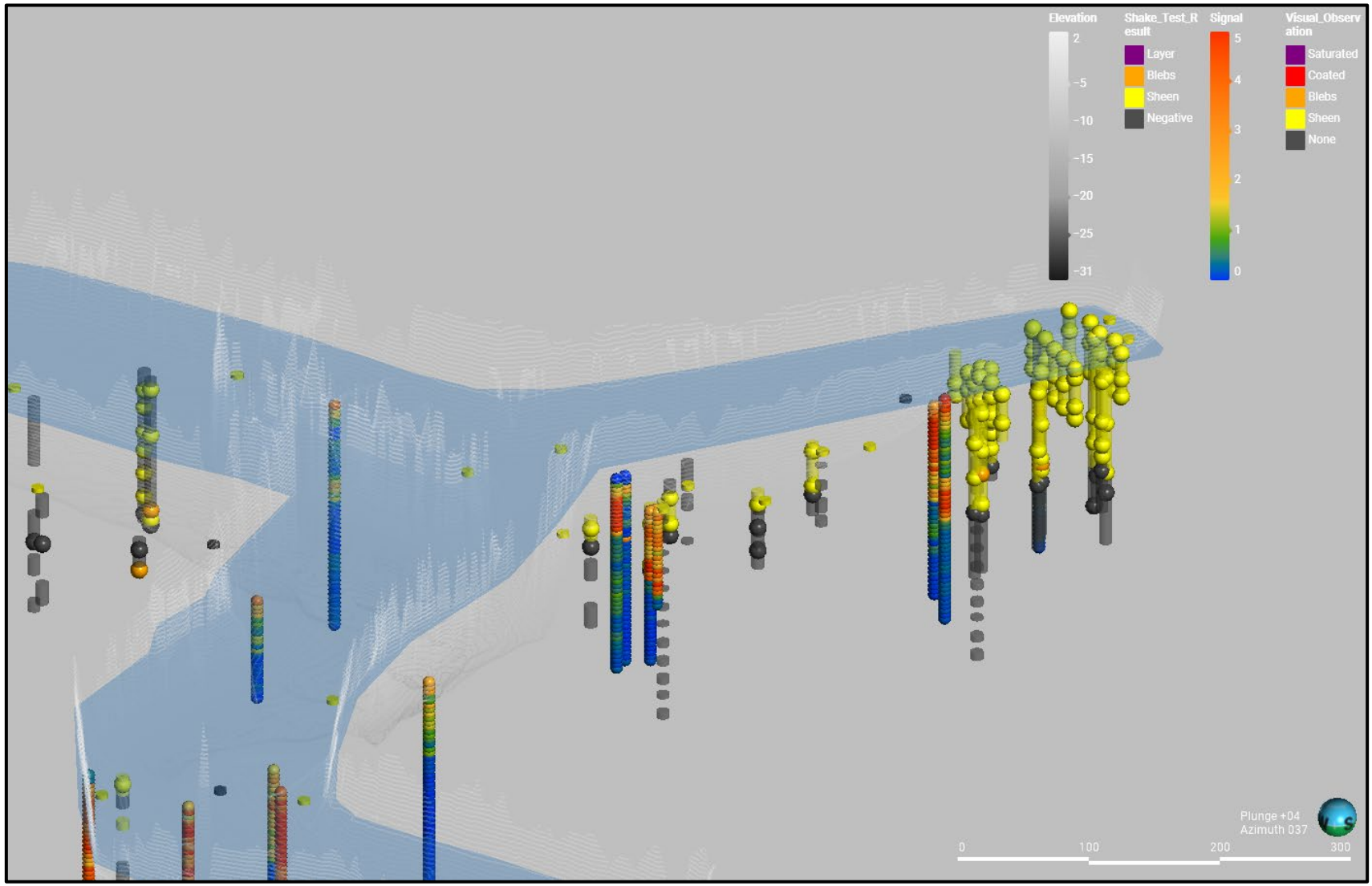


East



- LIF UVOST represents potential presence of oil-like materials
- Provided similar observations when compared to RI/FS NAPL and sheen observations from cores and the extent of impacted areas from ebullition studies

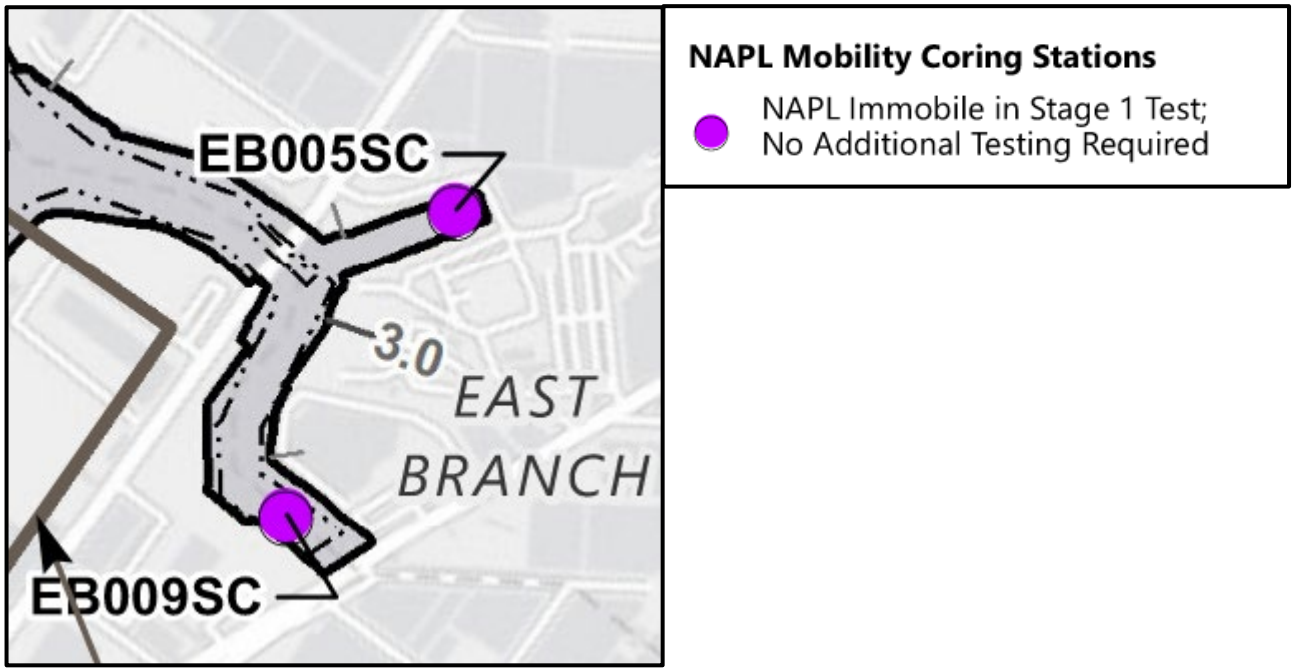
LIF Data in the Model



Secondary Investigation Methods and Results (Fate and Transport)

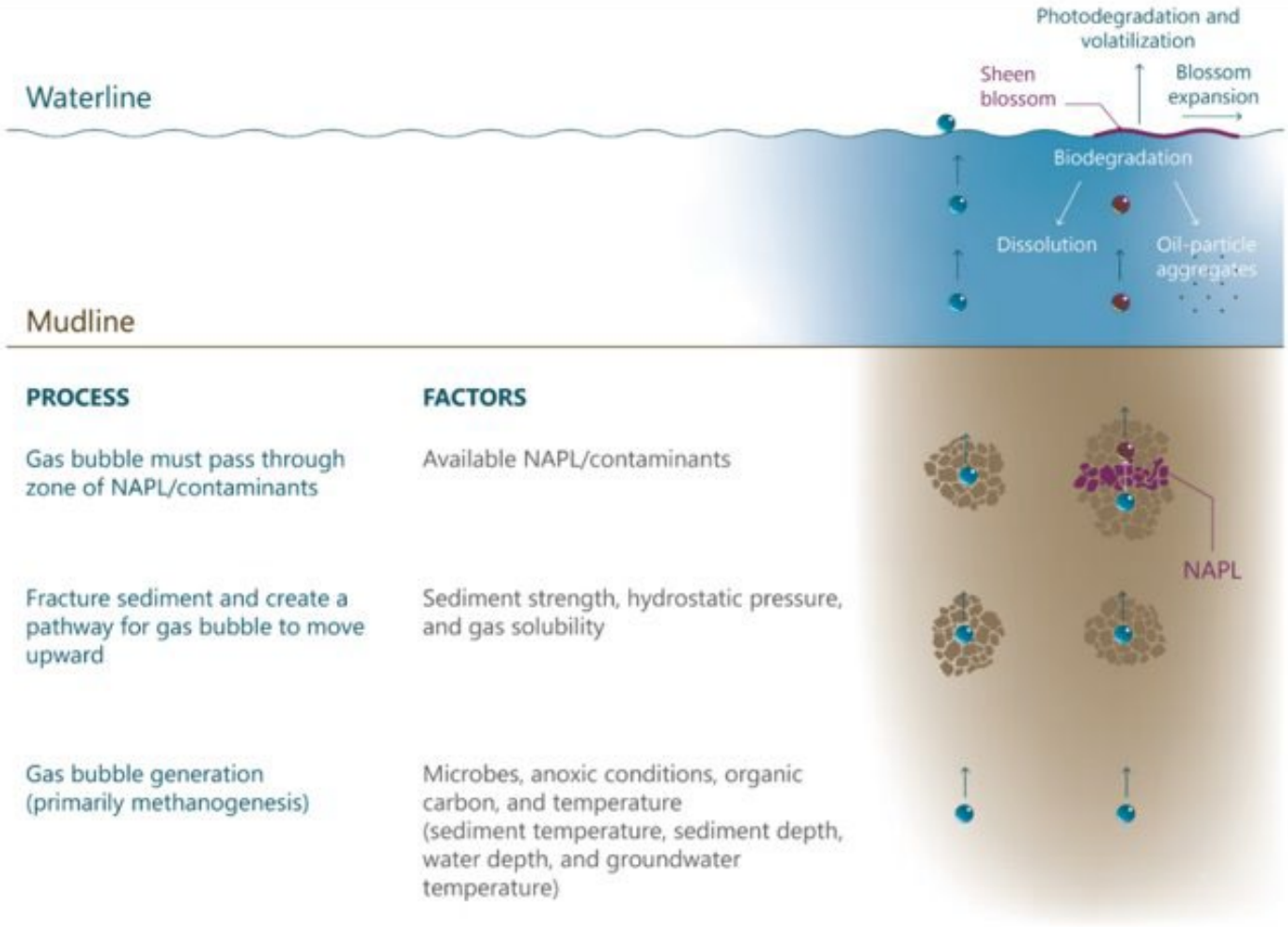
NAPL Mobility Evaluation and Results

- Evaluated NAPL transport by advection - potential of NAPL to flow through pore spaces in sediment and native materials



- Initial testing indicates NAPL migration via advection may be limited under current field conditions
- More testing necessary during pre-design investigation

RI/FS Gas Ebullition Studies

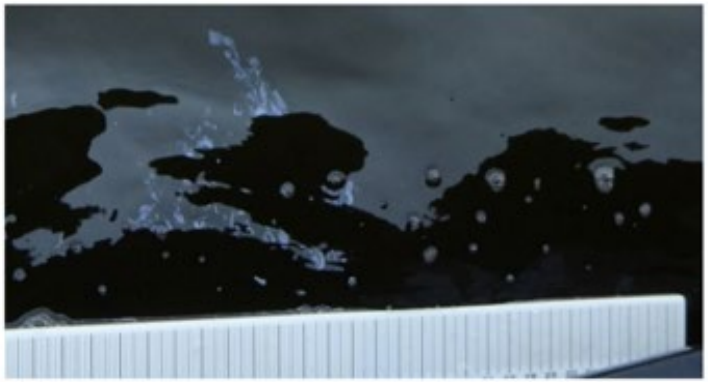


Notes:
The majority of methanogenesis is expected in shallower sediments where temperatures are warmest and sediment strengths are weakest.
The USEPA is still investigating the potential for ebullition sediment fractures to serve as preferential flow paths for contaminated groundwater into surface water.

East Branch Survey Area
Dynamic Sheen: Silvery, non-brittle

Whale Creek Survey Area
Dynamic Sheen: Silvery, non-brittle

CM 1.6 to 1.94 Survey Area
Static Sheen: Silvery, non-brittle, contiguous



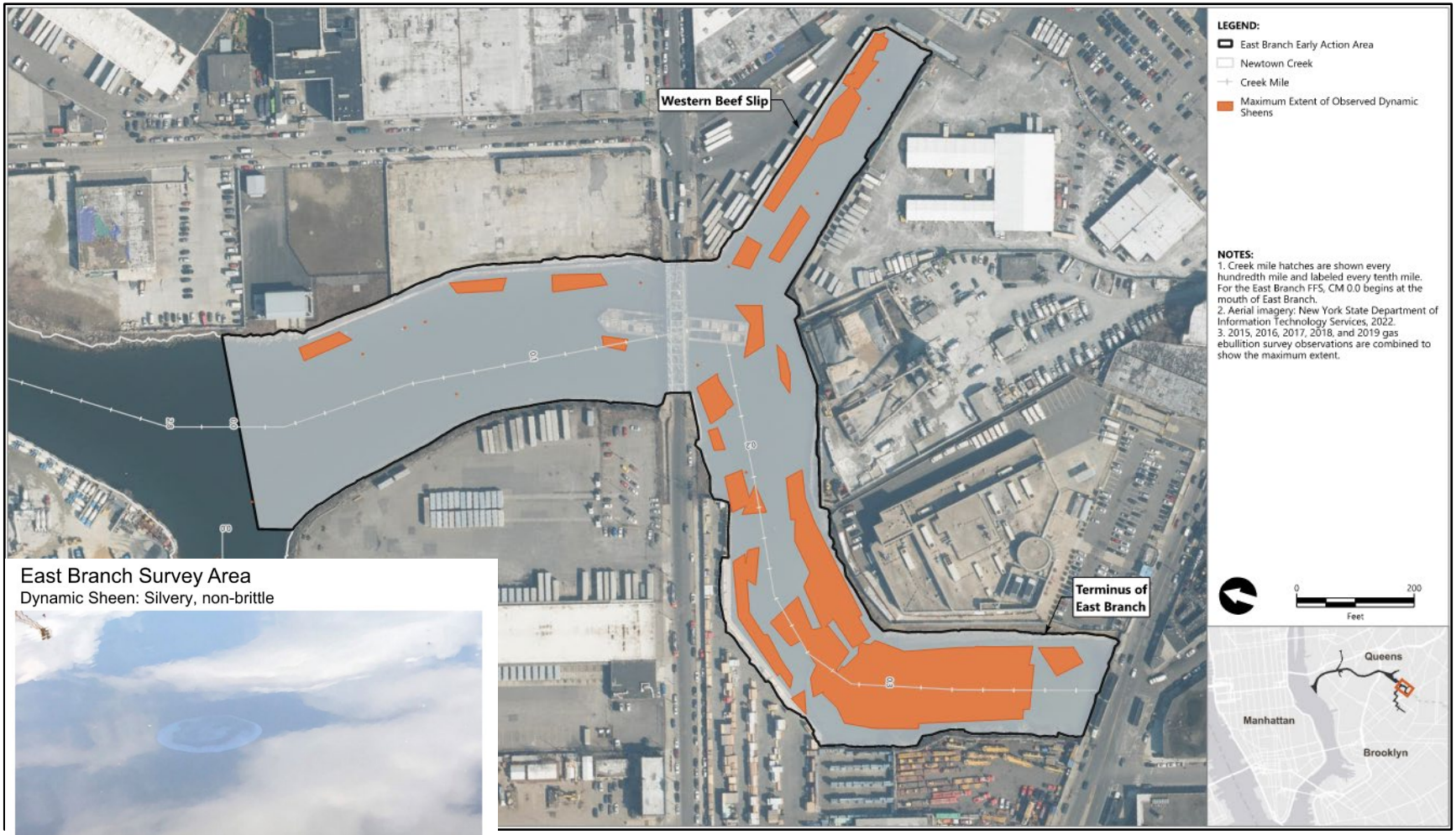
Turning Basin Survey Area
Static Sheen: Rainbow, brittle, spotty

Note: Sheens that develop on the water surface are classified as dynamic sheens (with or without a breaking gas bubble), whereas static sheens float on the water surface into the observation area.

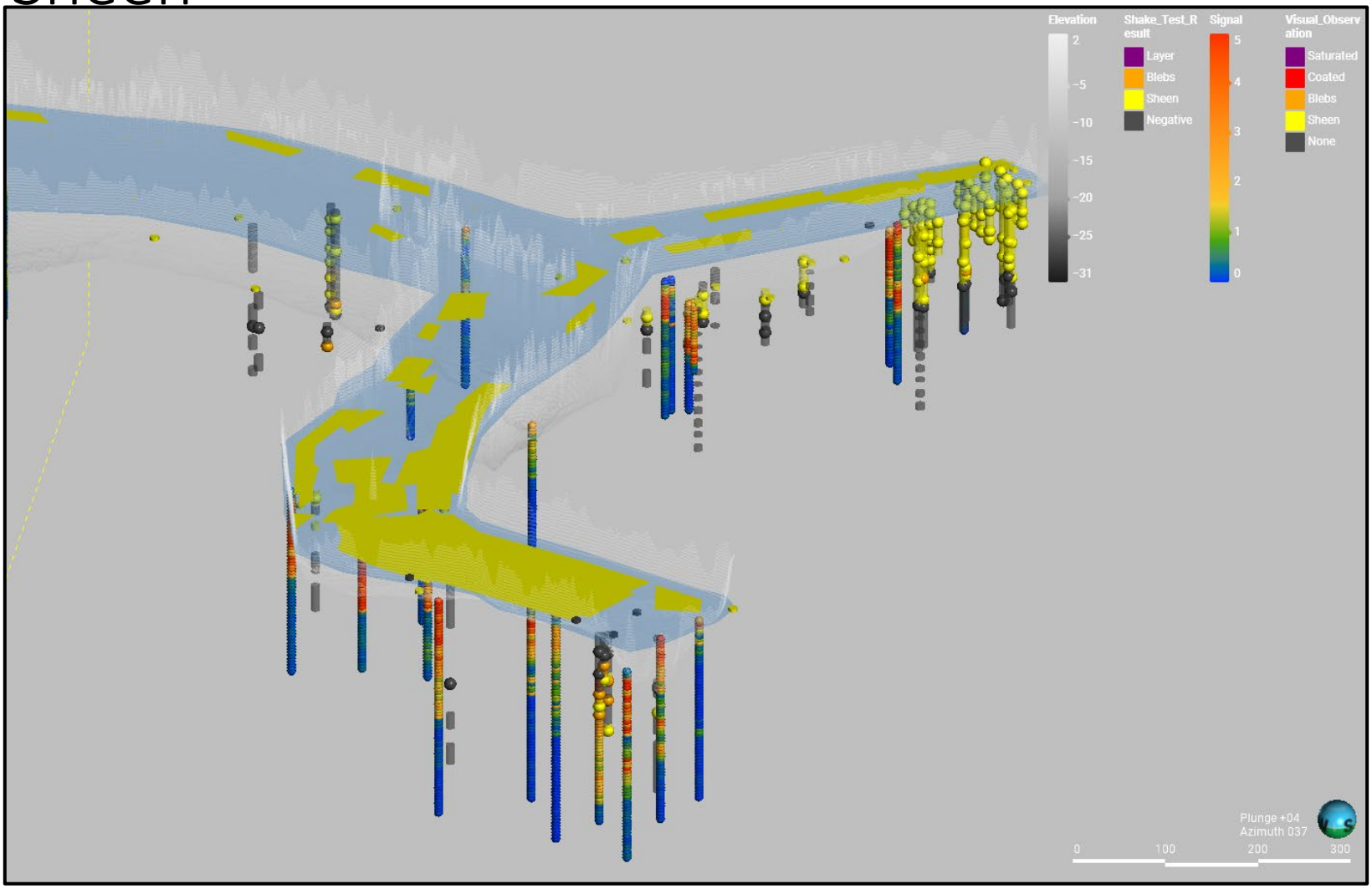
RI/FS Gas Ebullition Studies - Conclusions

- Visual mapping of the spatial extent of gas ebullition made during multiple surveys (over 5 years) of ebullition, sheen, and dynamic sheen.
- Data utilized to help identify areas where NAPL is present and may have transport mechanisms to mobilize into the water column
- Pilot Study – attempted to Quantitatively measure gas ebullition-facilitated NAPL/ contaminant transport in a sitewide study
- Additional Ebullition surveys recommended for PDI

Spatial Extent of Gas Ebullition Associated Dynamic Sheens



Gas Ebullition Associated with Dynamic Sheen



Current NAPL-related data in the East Branch

- Sediment cores – Observations and shake tests
- NAPL mobility testing
- Ebullition data
- Laser Induced Fluorescence (LIF) study data
- Shoreline seep sampling
- Upland and seep investigation data

How NAPL will be addressed moving forward in the East Branch

Record of Decision – NAPL in the Remedy

- Conduct a preliminary design investigation (PDI) to help fill data gaps, further refine East Branch CSM, and inform decisions on the need for ongoing source control measures.
- Dredging deeper in certain areas (TBD during the design remedy) based on the following considerations:
  - Potential for NAPL migration from deeper soft and/or native material
  - Potential for human and/or ecological exposure to PTW
  - Depth to uncontaminated material
  - Comparatively high COC concentrations in remaining sediment
- ISS where needed to reduce migration of and/or for treating NAPL or PTW
- NAPL sorption layer in the cap where determined to be required
- Sealed bulkheads where determined to be needed and as a preliminary measure to address shoreline seeps (which may include NAPL seeps)

Pre-Design Investigation for NAPL

- The PDI sampling will include the following to inform the remedial design:
  - Collection of data to further delineate non-aqueous phase liquid
  - Investigation of NAPL mobility, and
  - Determination of the constituents present in NAPL;
- All existing NAPL information previously described will be used to help develop the PDI

Questions