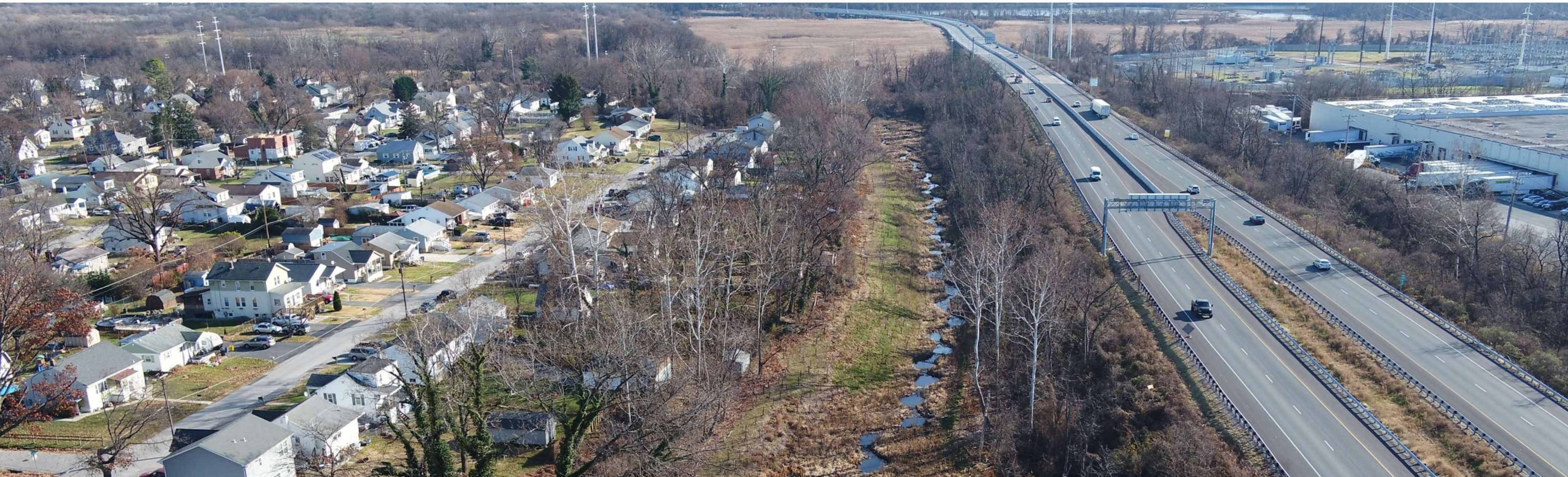

March 11, 2026

Restoring Natural Systems to Solve Infrastructure Challenges

Presented to: The 2026 New Jersey Coastal and Climate Resilience Conference

Restoring Natural Systems to Solve Infrastructure Challenges

- Case Study: I-895 Stream Restoration in Lansdowne, MD
- Ultra-urban watershed, aging culvert, critical rail crossing
- Nature-based retrofit for infrastructure protection
- Climate Resilience & Asset Management

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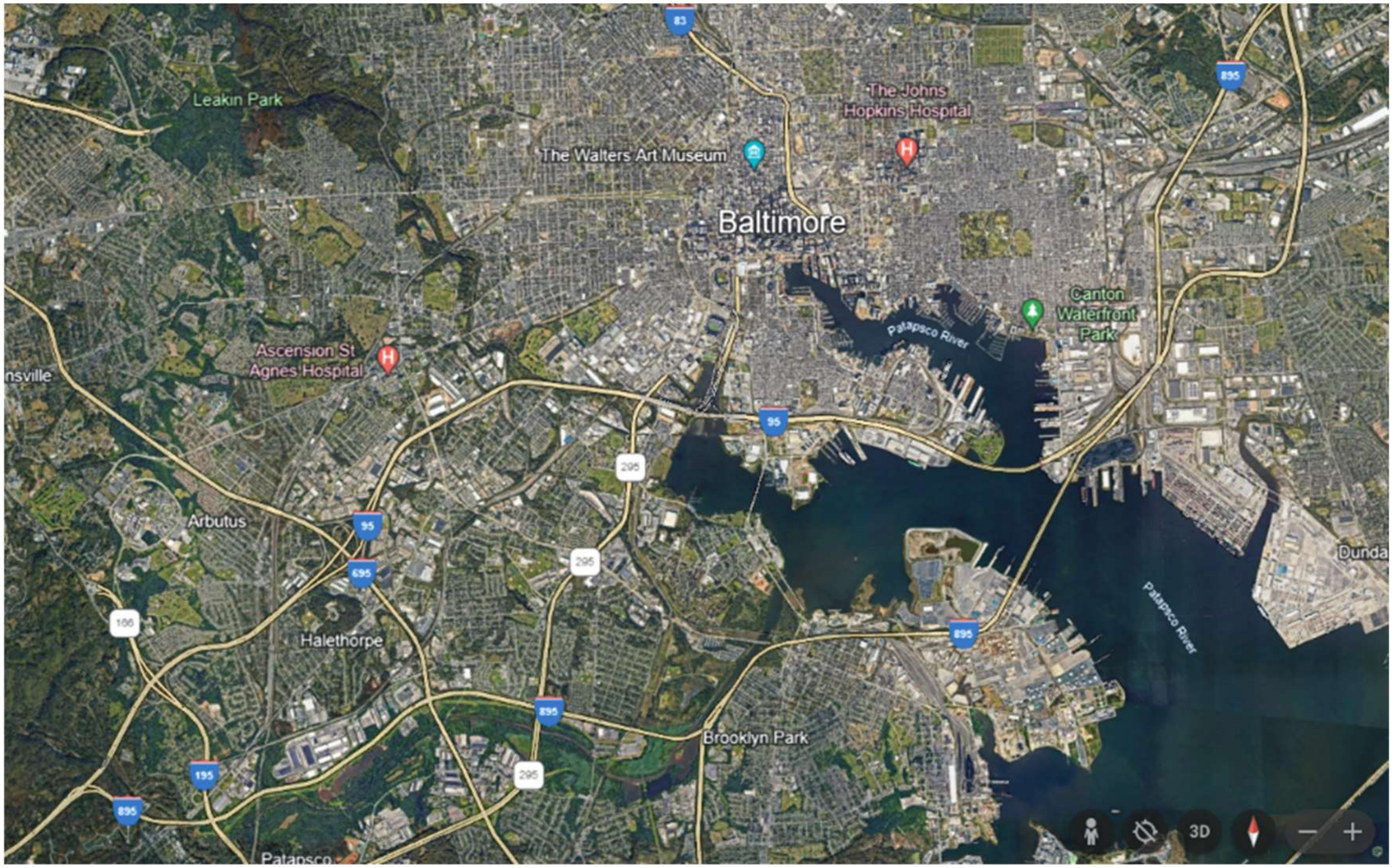
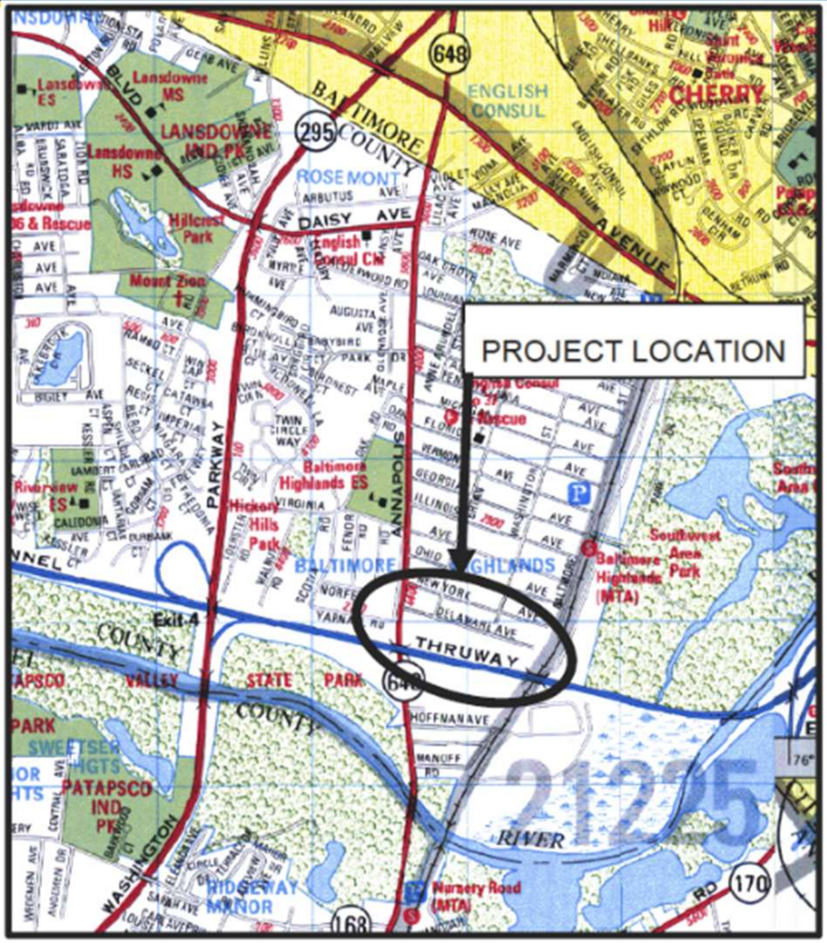
Location



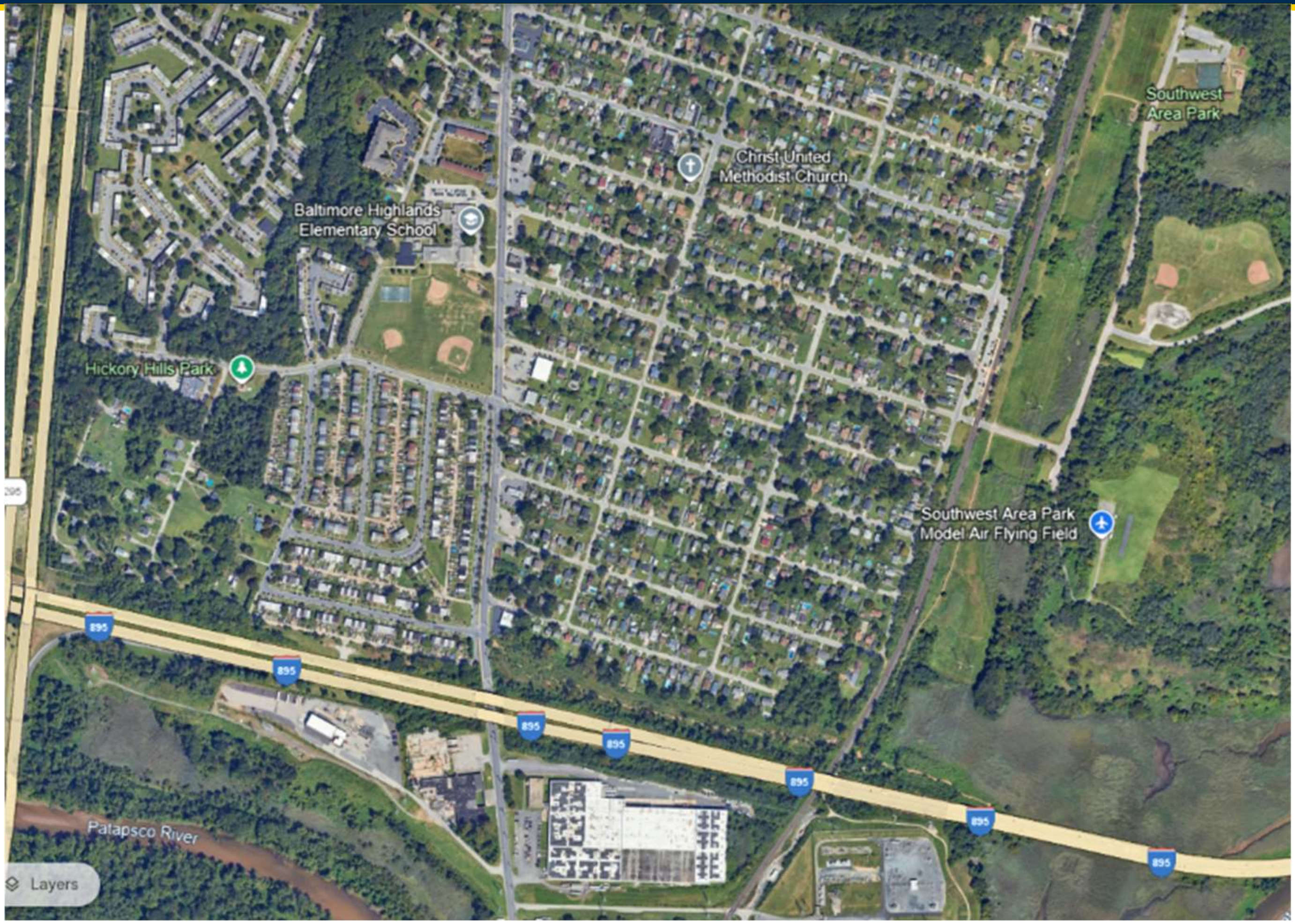
Leakin Park
The Johns Hopkins Hospital
The Walters Art Museum
Baltimore
Canton Waterfront Park
Patapsco River
Ascension St Agnes Hospital
nsville
Arbutus
Halethorpe
Dunda
Brooklyn Park
Patapsco
83
895
95
295
695
166
195
3D

Location



PROJECT LOCATION
THRUWAY
BALTIMORE HIGHLANDS
BALTIMORE COUNTY
BALTIMORE AVENUE
ANNAPOLIS
PARKWAY
DAISY AVE
ROSEMONT
ENGLISH CONSUL
CHERRY
LANSDOWNE IND PK
PATAPSCO VALLEY STATE PARK
RIDGEWAY MANOR
WASHINGTON
RIVER
21225
295
648
170
168

Location



Southwest Area Park
Christ United Methodist Church
Baltimore Highlands Elementary School
Hickory Hills Park
Southwest Area Park Model Air Flying Field
895
Patapsco River
Layers

Location

Figure 3: Map of Annapolis Road and the parcels at the project site circa 1878 (Hopkins).

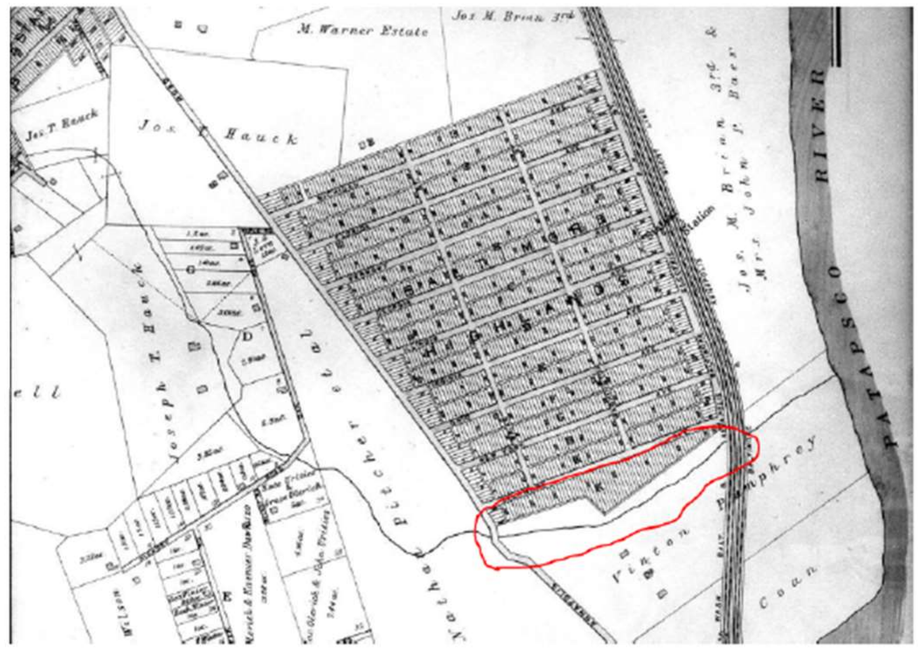


Figure 4: Map of completed Baltimore Highlands neighborhood circa 1915 (Bromley and Co).

Location

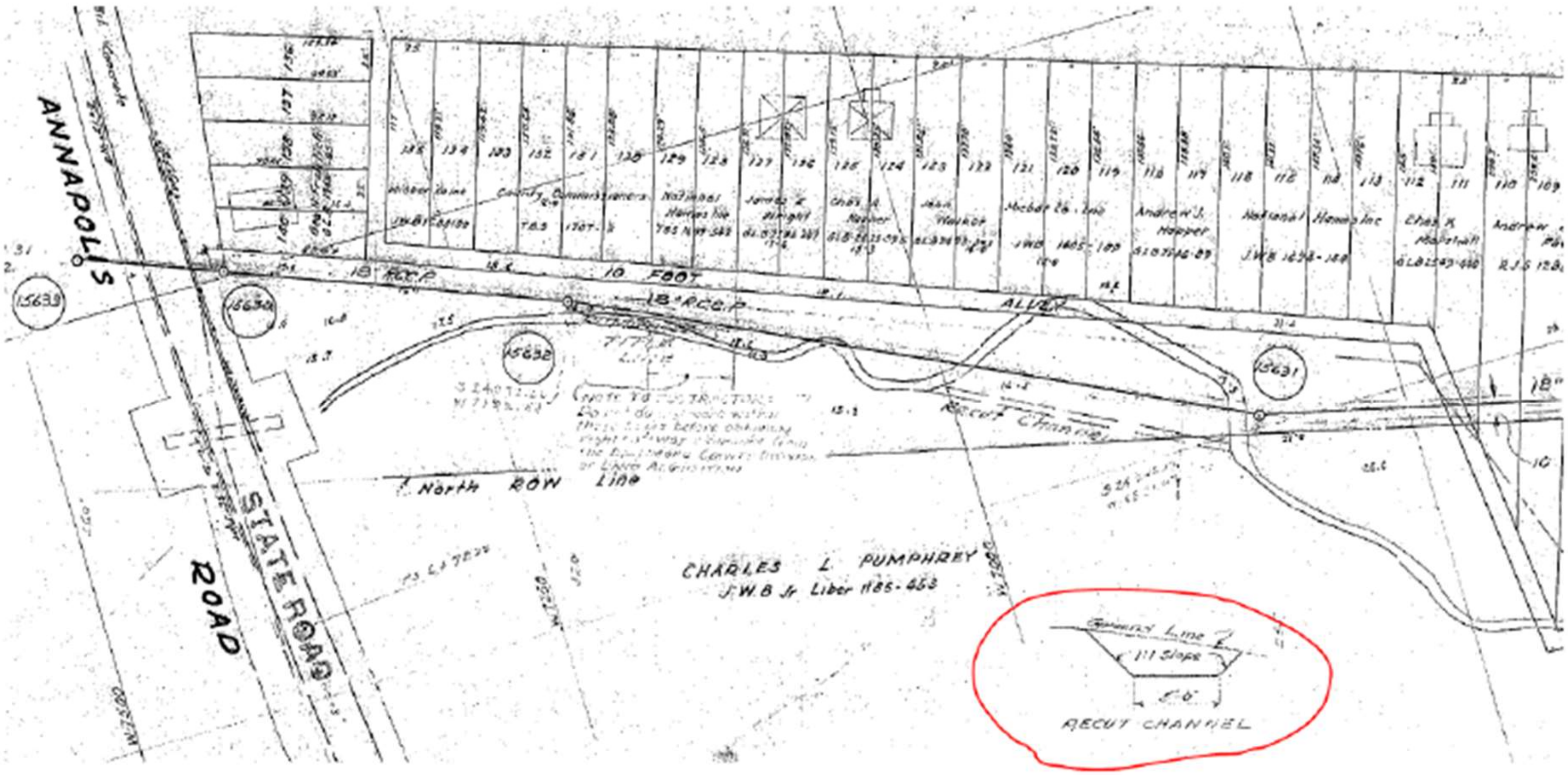


Figure 5: Map of completed Baltimore Highlands along stream (Baltimore County Department of Public Works, 1954).

The Issues

- ~60% impervious watershed
- Large portions of headwaters piped
- Sediment, woody debris and trash collect at the culvert
- Downstream culvert is undersized for present-day watershed conditions, but upsizing was constrained by a major water main above the crossing.



The Issues – Stream Health

- "Just a drainage conveyance"
- Limited to no in-stream habitat
- Heavy sediment deposition and aggradation
- Flow disappeared below sediment surface in places
- Poor channel definition and degraded function

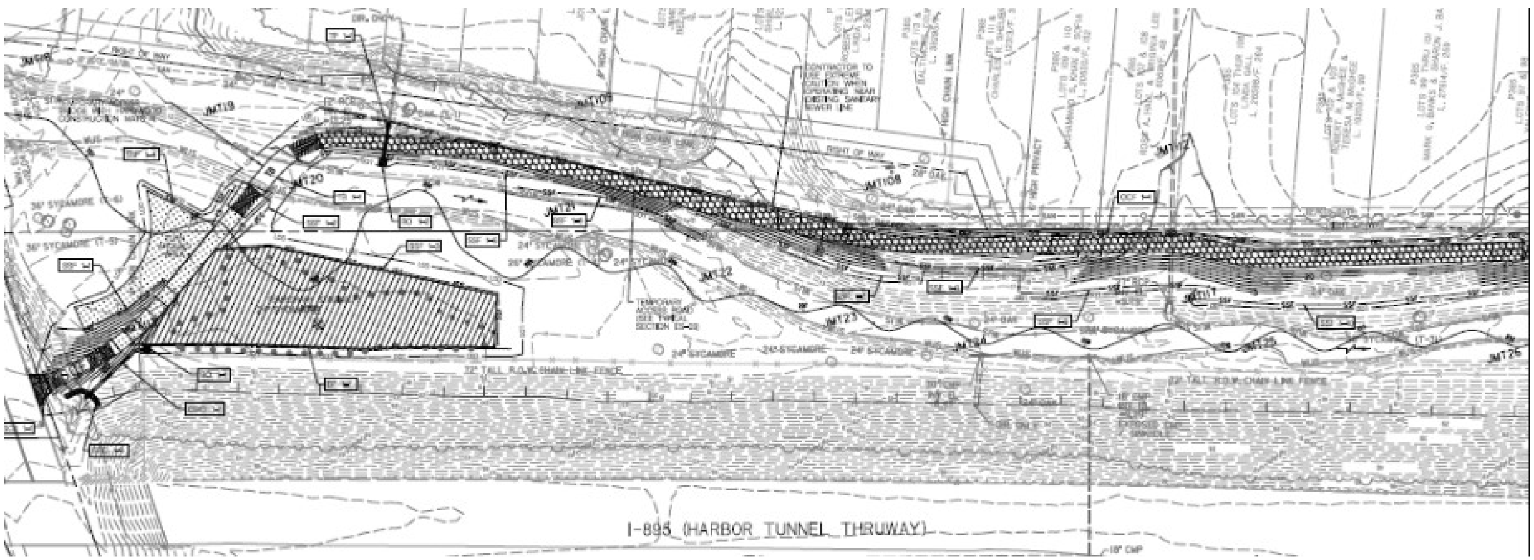
The Alternatives

- Increase the capacity of the culvert system?
- Stormwater solutions higher up in the watershed?

- Can we provide relief within our ROW?
  - 2017 Site Assessment evaluated the site for sediment reduction opportunities
  - Floodplain reconnection and sediment storage potential identified

The Constraints that Shaped the Design

- Upstream/downstream culvert tie-ins
- I-895 embankment and private property encroachment
- Sanitary sewer, storm-drain outfalls, limited staging
- Narrow access, county coordination, downstream tidal/backwater influence



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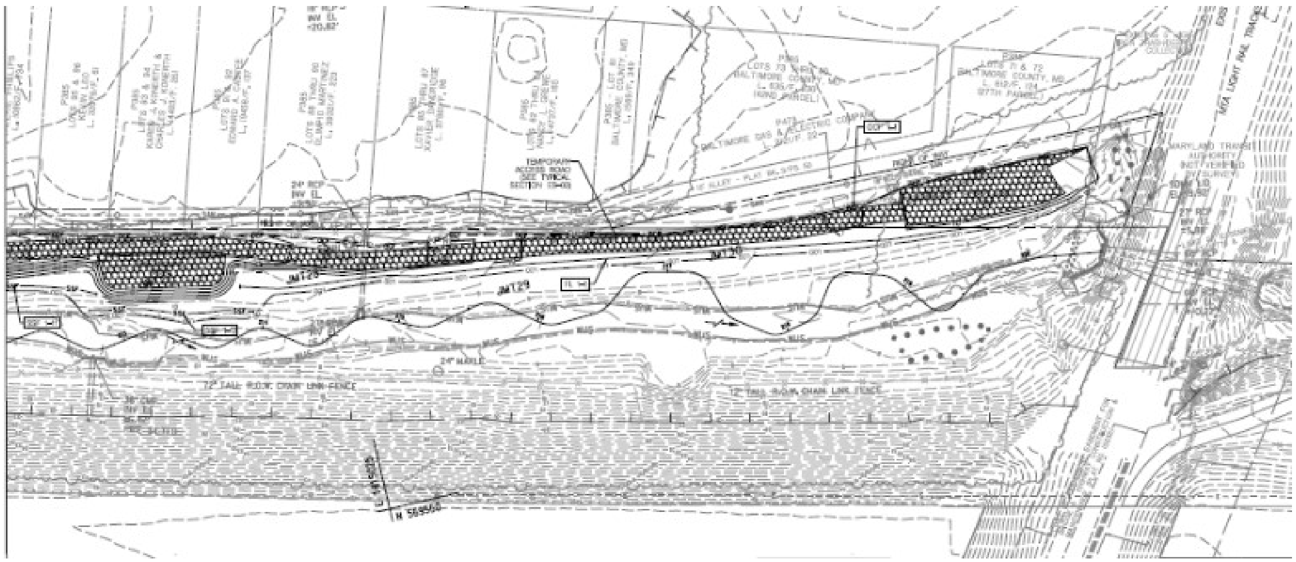
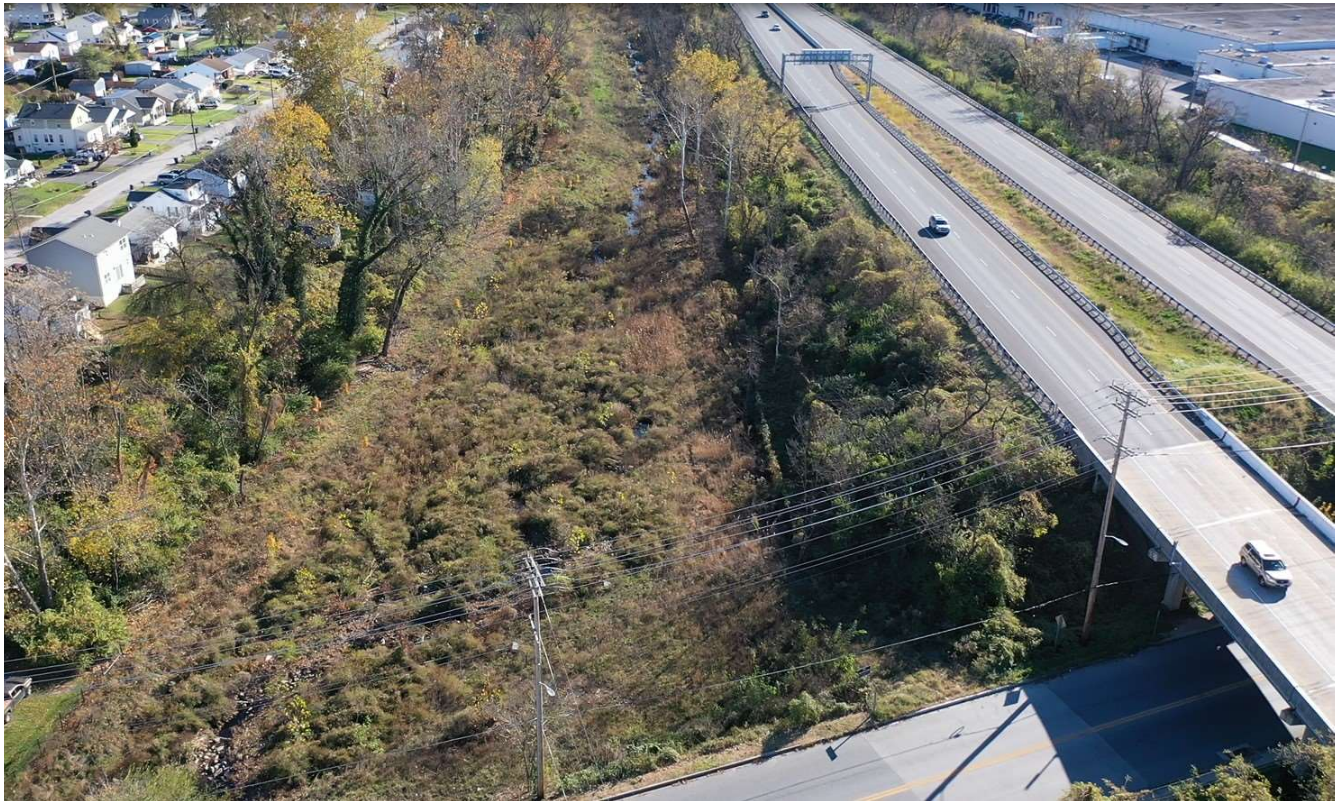


Design Approach – Core Restoration Strategy

- Preferred strategy: modified floodplain restoration where constraints allowed
- Reconnect channel to low-elevation riparian floodplain
- Reduce flow depth and dissipate energy
- Capture sediment and nutrients before they reach the culvert
- Wood structures were able to be used in low stress areas



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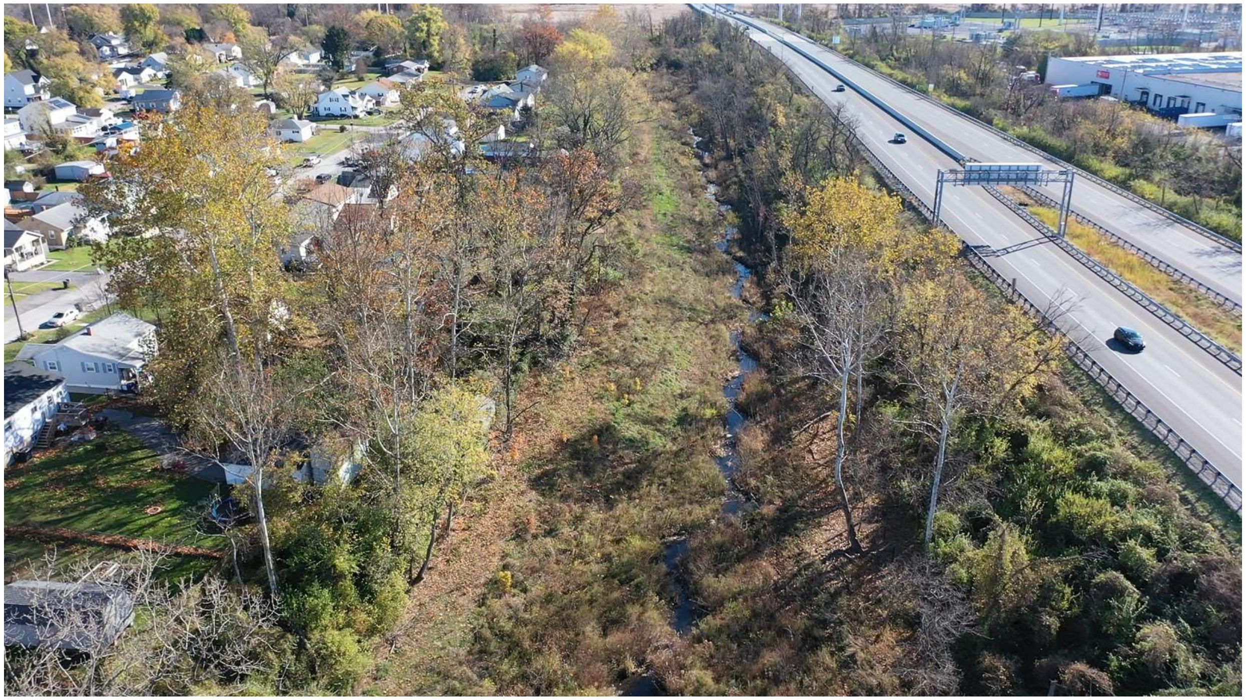
Design Approach – Adapting to Site Constraints

- Where the valley constricted, the design approach shifted closer to a step-pool system with limited floodplain access
- Rock structures and buried log vanes were used
- Elevations of multiple storm drain tie-ins drove stream profile
  - Pools were designed/sized for the stream system and as scour pools for storm drain tie-ins



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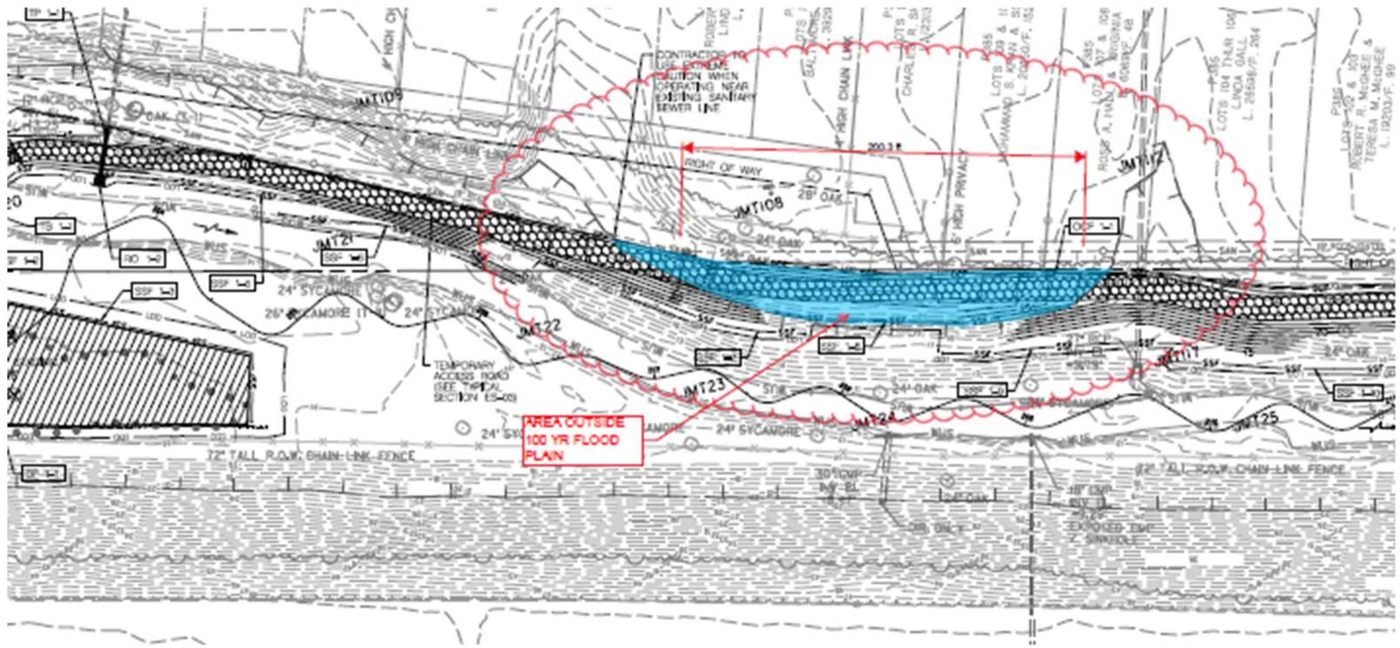
Design Approach

Design Approach

Construction Risk Management

- Flood Action Plan with forecast/observation triggers
- Off-site staging outside floodplain
- Access/MOT coordination to de-risk delivery
- Contractor bid provisions for invasive management



Outcomes

- Restored reach functioning as stream-floodplain system
  - Informal Client Feedback: “wetlands are developing even better than we imagined”
  - Informal Client Feedback : “no major problems but a lot of trash from storm events”
- Through 5 years of monitoring, all performance standards have been met/exceeded
  - 92% Native Species
  - 88% FAC, FACW, or OBL within the floodplain
  - 2025 saw a significant drought during the growing season, all groundwater wells held water within 24 inches of the surface
- Reduced maintenance at the culvert system

O&M Realities

- Client continues to collect data on trash cleanup
  - April 2023 – Approximately 12 bags of trash removed.
  - April 2024 – Approximately 32 bags of trash removed, including 3 tires.
  - Early 2026 had a total of 29 contractor trash bags each weighing 30-35 lbs.
- Less trash is making its way to the trash rack
- MDTA has explored in-stream trash collectors
- Maintenance plan also includes invasive control, deer browse monitoring and storm checks
- Aggressive vegetation oversight

Takeaways

- Upstream restoration can protect downstream infrastructure
- Floodplain reconnection can function as a passive retrofit
- Follow the process: assess the site, understand constraints, mitigate risk
- In urban systems, resilience requires design + operations

Questions

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