Enhancing Environmental Protection and Flood Resilience: HEC-RAS Modeling at the Mattawoman WWTP

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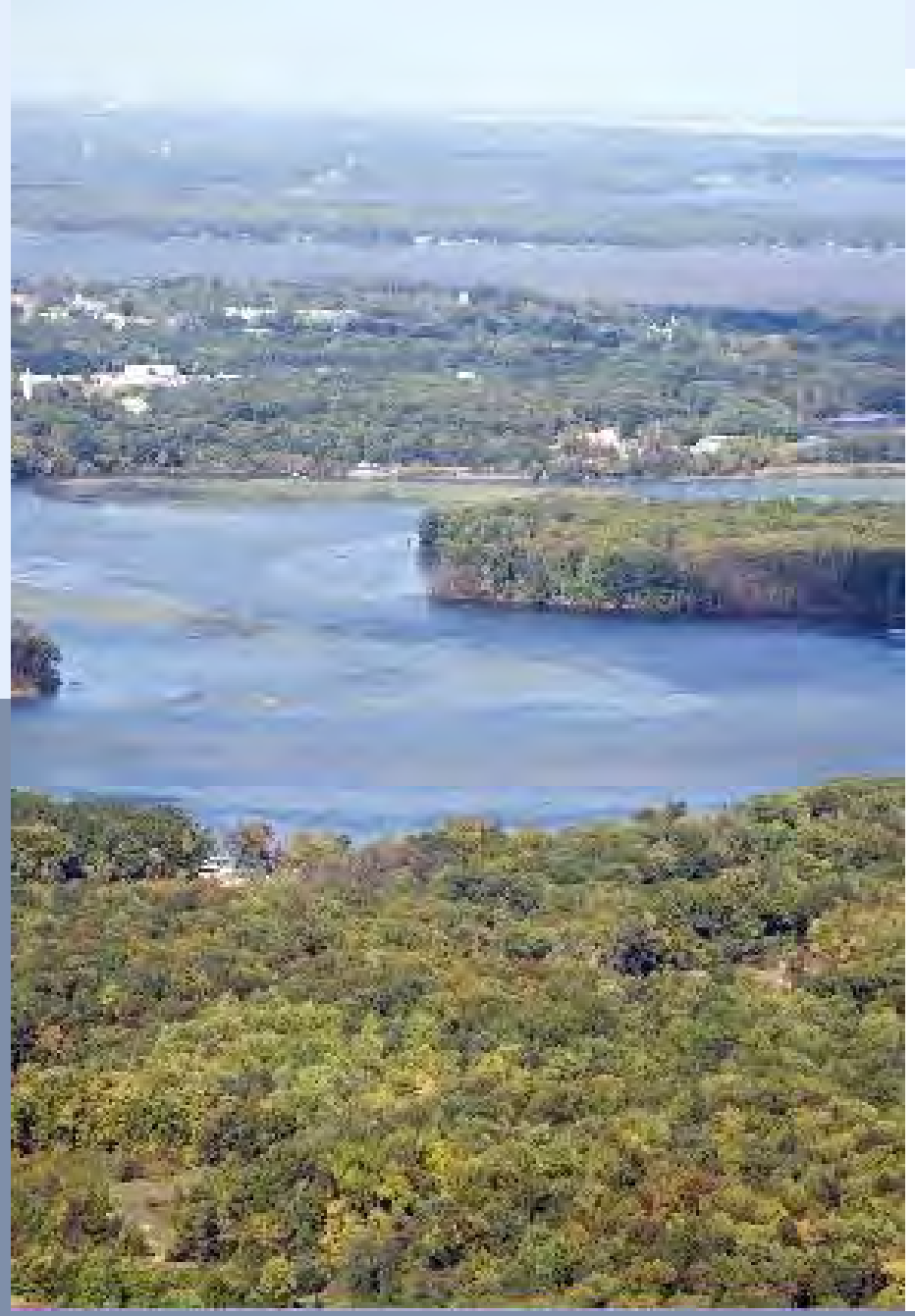
Agenda

- Background / Location
- Flooding History
- Regulatory Requirements
- Existing H&H Analysis
- Risk Assessment
- Potential Mitigation Measures & Structural Improvements
- Conclusions and Recommendations

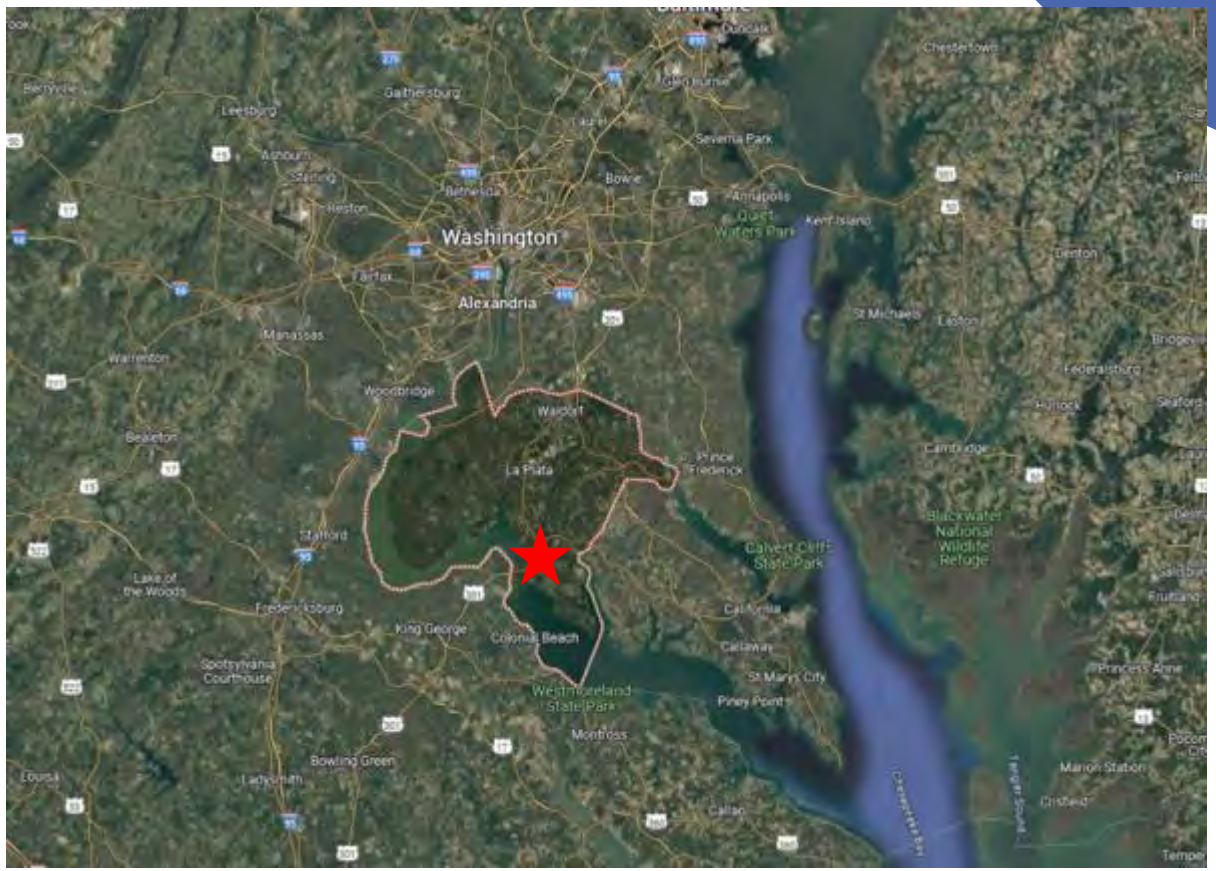


Location

Chesapeake Bay Watershed

Location

Charles County, Maryland



Background

Mattawoman Creek Watershed

- 30 mile long tributary to the Potomac River
- 94 square mile watershed
- Known for freshwater stream biodiversity and largemouth bass fishery
- Highly used for recreation: kayaking, fishing, biking
- Upland and riparian forests and wetland areas
- #4 “Most Endangered River” by American Rivers in 2009
- Named an ideal model for a restored Chesapeake Bay

Background

Mattawoman Wastewater Treatment Plant

- 20 MGD Average Treatment Capacity
- WWTP must continue to fully function to provide public health services during flood events
- Susceptible to both tidal influences and riverine flooding
- Several ongoing upgrades and expansions

Flooding History: Tropical Storm Diane - 1955

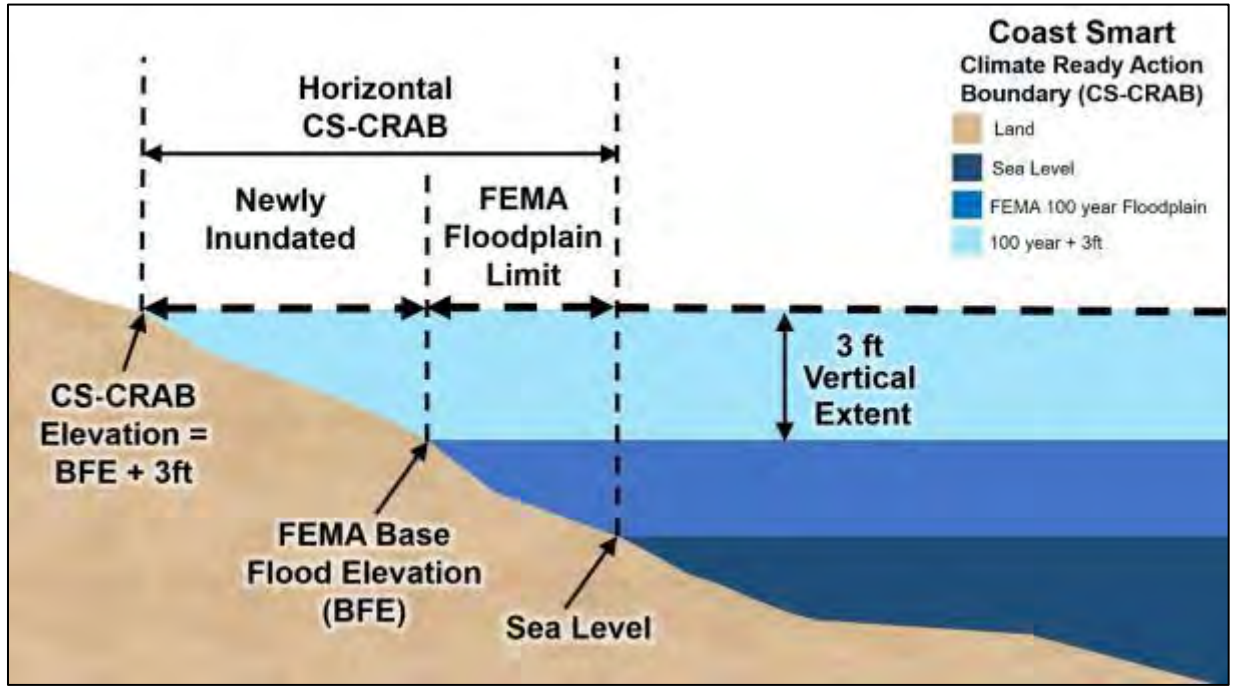
WWTP Flood History

- Constant issues with on-site drainage
- Minimal elevation change across WWTP
- Increased Development Upstream
- Bordered by Mattawoman Creek and Unnamed Tributary

March 2025

Regulatory Requirements

- FEMA 100 yr Flood Zone Area
- Maryland Coast Smart Climate Ready Action Boundary (CRAB)
- MDE 10 States Standards



FEMA

Coast Smart CRAB

RK&K

Hydrologic & Hydraulic Analysis

Existing H & H Analysis: Mattawoman Creek

- FEMA Effective (2015) vs Updated Existing (2024)
  - 2022 Peak Discharge FRREs – Western Coastal Plain
- FEMA Effective (2015) vs Potential Future (2100)
  - 2 - 4.2 feet of potential future sea level rise

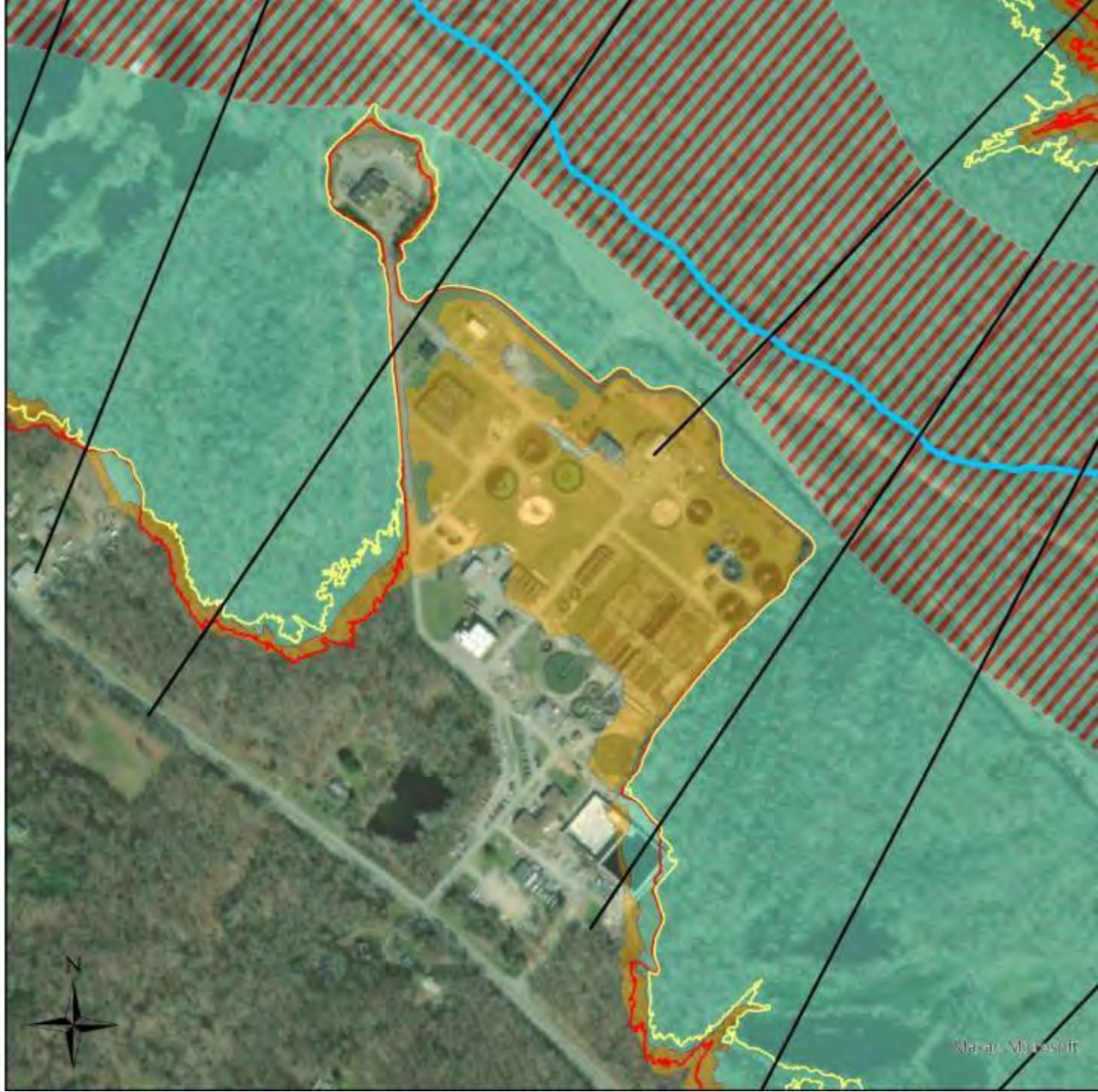
Characteristic	Value
Watershed Area (mi^2)	76
Impervious Area (%)	13
% A Soils	12

Existing Hydrology Results:

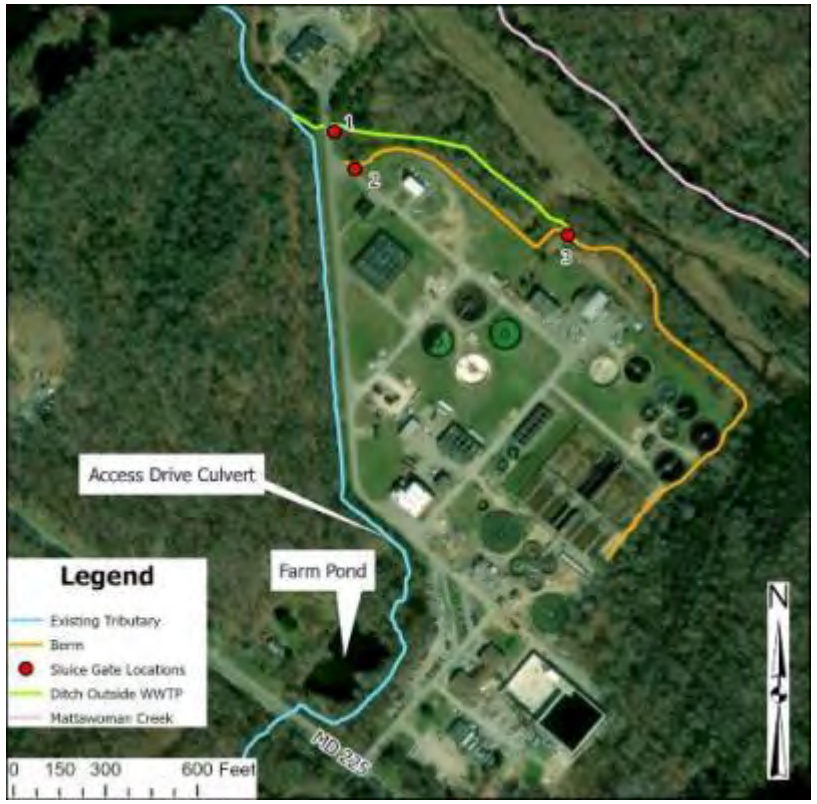
Mattawoman Creek
Updated Existing (2024)

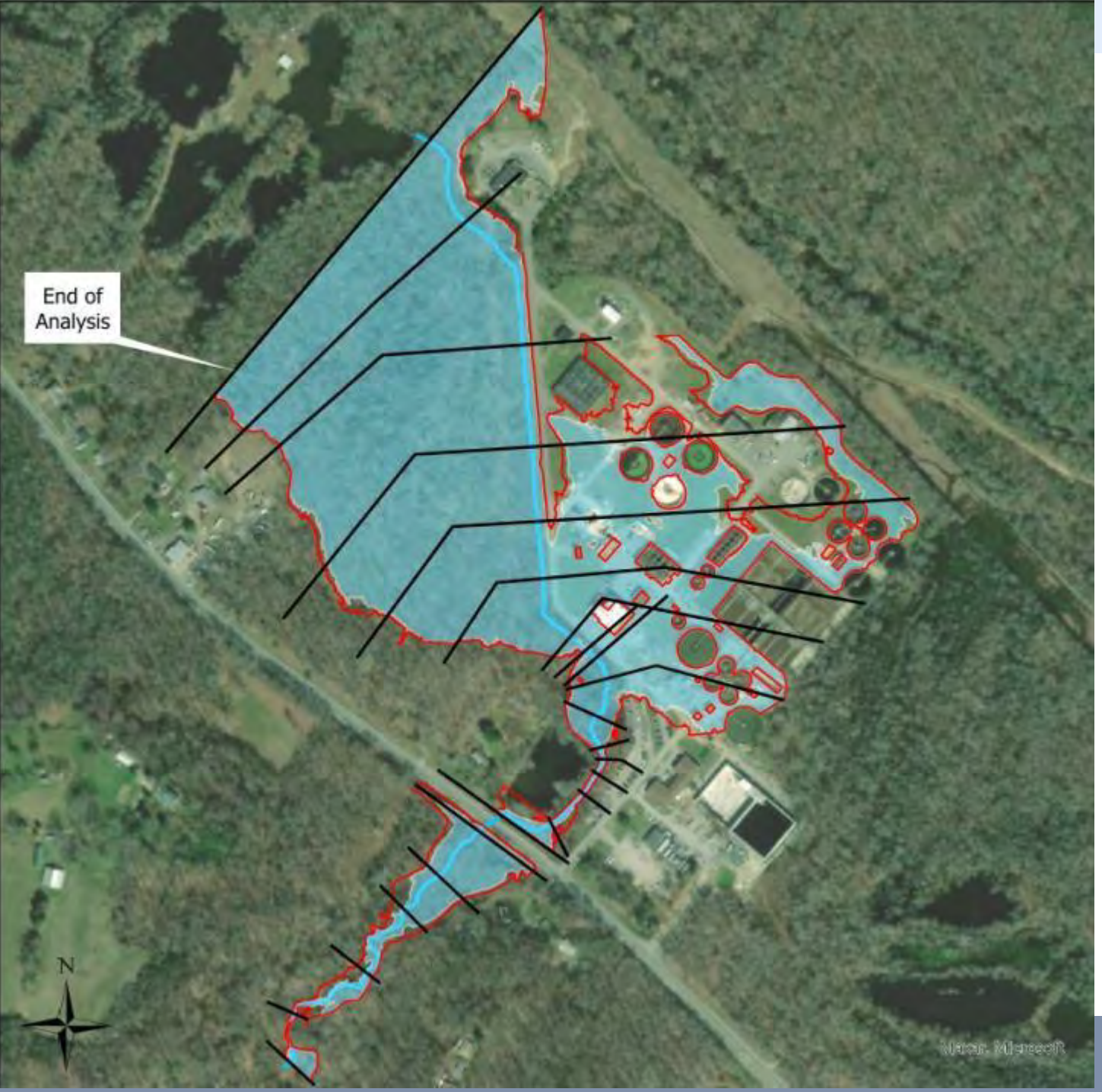
Existing Hydrology Results:

Mattawoman Creek
Potential Future (2100)



Existing Hydrologic Analysis:
UNT to Mattawoman Creek





Existing Hydrology Results:

UNT to
Mattawoman Creek

Legend

- UNT to Mattawoman Creek Centerline
- 4% Annual Chance Flood Hazard (Normal)
- 1% Annual Chance Flood Hazard (Normal)
- UNT HEC-RAS Cross Sections

Risk Assessment

- 2021 GHD analysis
  - Interpolated the base flood elevations from the FEMA effective model to determine free-board needed across the WWTP
- 2025 RK&K analysis
  - The Updated Existing (2024) and Potential Future (2100) base floods interpolated across the WWTP
  - CS-CRAB utilized for the required freeboard.

Risk Assessment

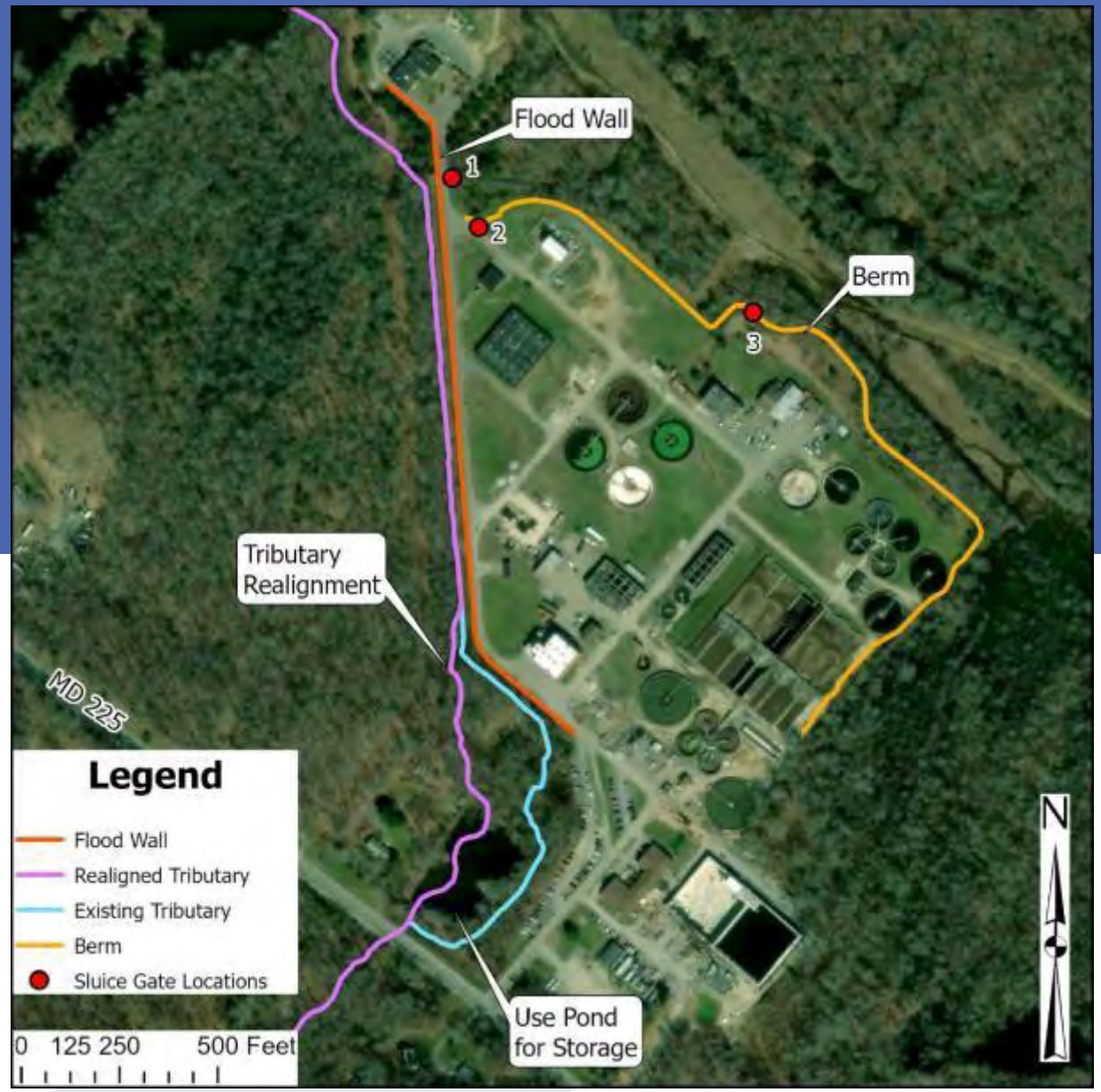
The 100-yr base flood elevations for the WWTP buildings and structures were then compared to the CS-CRAB required freeboard of 3-feet.

Structure Number	Structure Elevation (ft)	RK&K Base Flood Elevation Converted to Site Datum (ft)	Height above Freeboard (ft)	Additional Freeboard Required (ft)
3	17.22	16.51	0.71	2.29
4	16.27	16.65	-0.38	3.38
5	17.13	15.96	1.17	1.83
6	15.56	14.30	1.26	1.74
9A	17.23	16.35	0.88	2.12

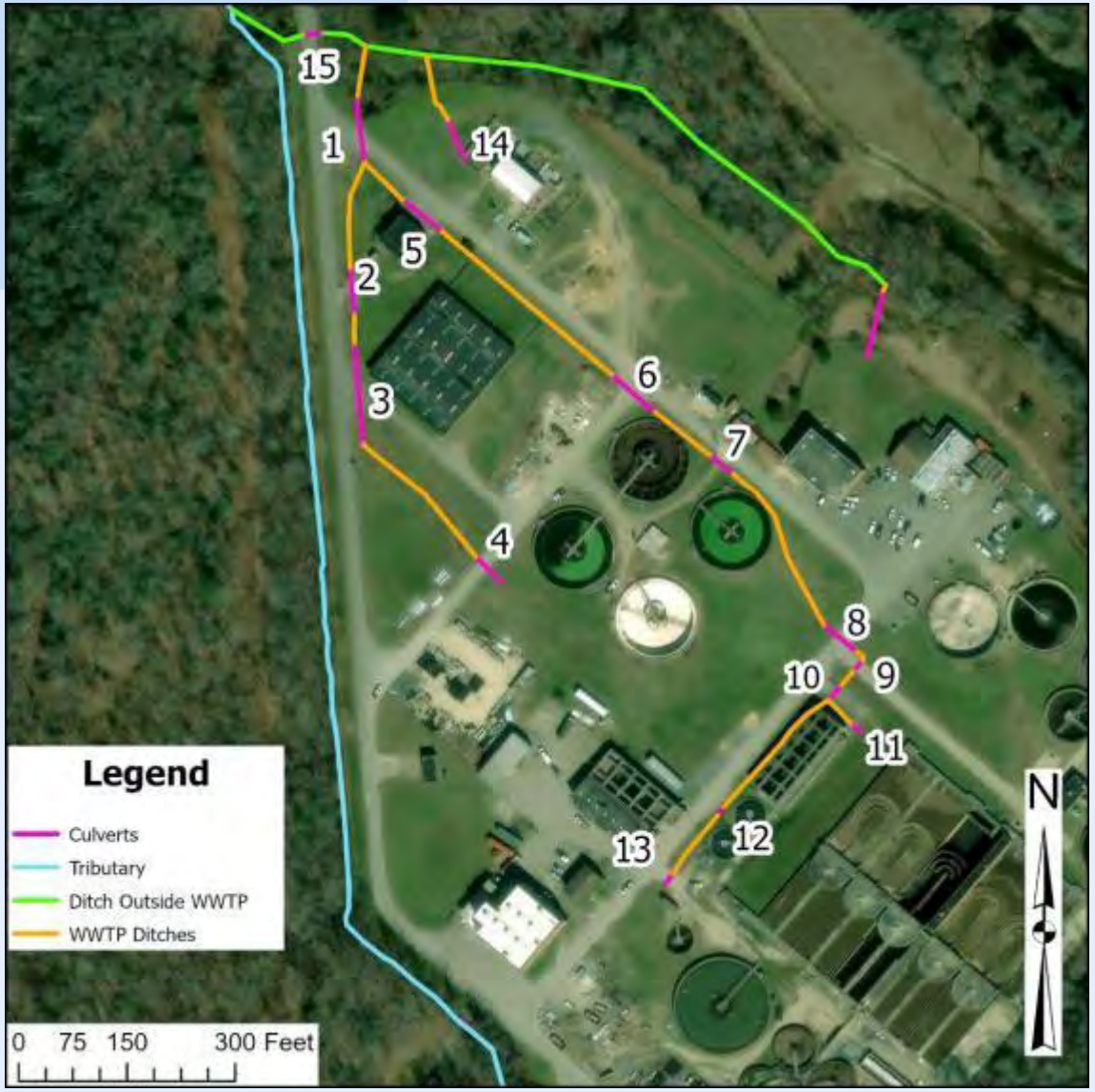
Potential Mitigation Measures & Structural Improvements

Potential Mitigation Measures & Structural Improvements

- Inspection & Maintenance of Tide Surge Protection
- Storm Drain Network Improvements
- Potable Well Building Driveway Improvements
- Inspection & Fortification of Berm
- Access Drive Floodwall & Driveway Improvements
- Unnamed Tributary Realignment
- Flood Control Facility

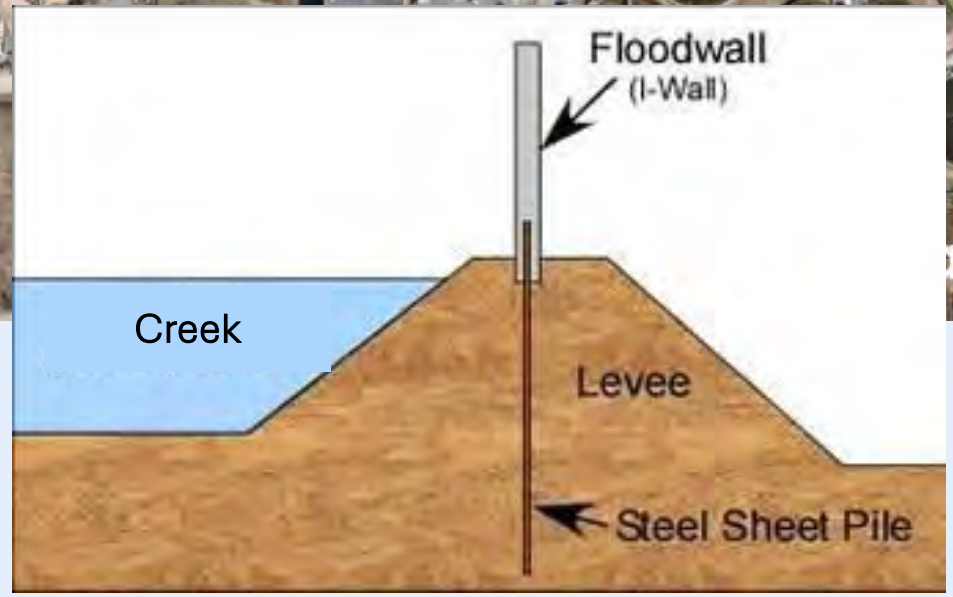


Storm Drain Network Improvements



Potable Well Building Driveway Improvements

Inspection & Fortification of Berm



Conclusions & Recommendations

1) Perform inspection and maintenance of the existing sluice gates on site.

2) Perform maintenance on access drive culverts throughout the WWTP.

3) Culvert replacement of the existing box culvert under the Potable Well Building driveway, minimal access drive grading, and dredging of the downstream tributary.

4) Acquire portable pump systems to be deployed during tidal impacted flood events.

5) Inspect and fortify the existing berm between the WWTP property and Mattawoman Creek.

RK&K

Responsive People | Creative Solutions

Thank you!

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