ABC's OF FRESHWATER WETLAND DESIGN: CONCEPT TO CONSTRUCTION

Michael Mak, P.E. (Design Engineer)

Karen Appell, P.E., C.P.E.S.C. (Project Manager)

Christopher Benosky, P.E., C.F.M (Engineer of Record)

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ABC's of Freshwater Wetland Design

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Background

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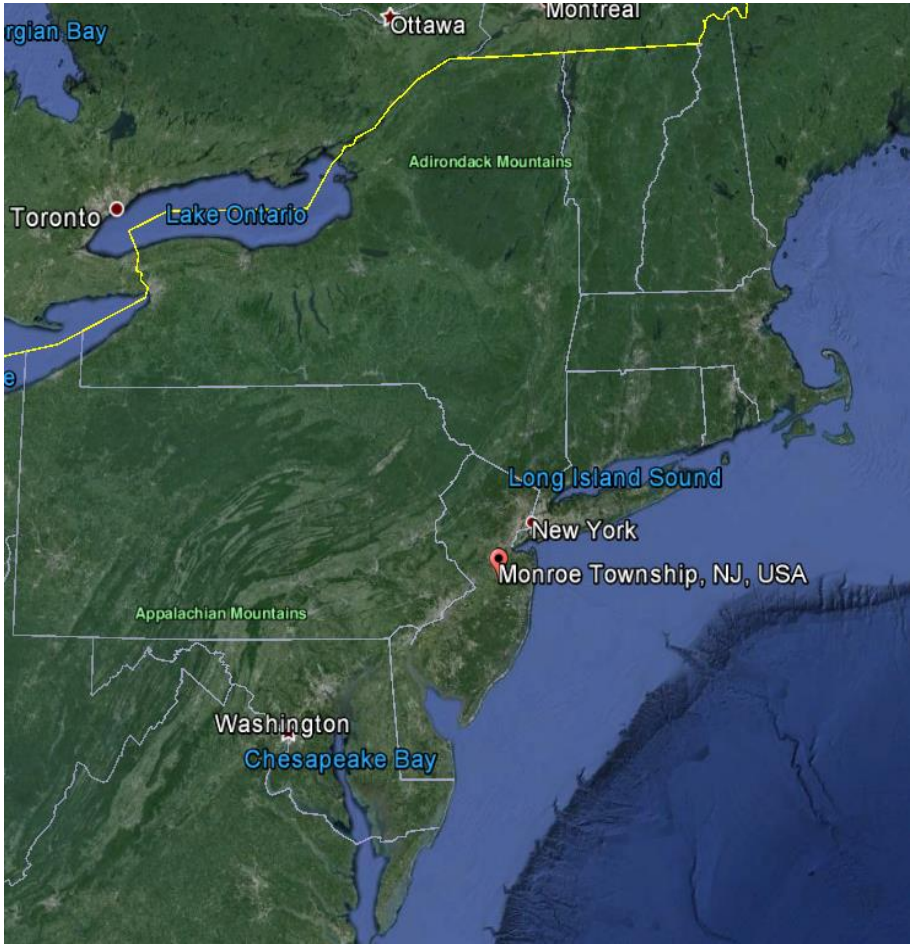
Background - Stakeholders

Client	New Jersey Turnpike Authority
Project	NJTA Interchange 6 to 9 Widening Program
Lead Agency	New Jersey Dept. of Env. Protection (NJDEP)
Prime Consultant	AECOM
Subconsultant	Amy S. Green Environmental Consultants, Inc.
Feasibility Study Consultant	The Louis Berger Group, Inc.

Site Overview



- Monroe Township, Middlesex County, NJ
- Millstone and Cranbury Rivers
- 400+ acre site w-157 acres designated for creation/enhancement
- Predominately modified agricultural fields
- Several cultural resource sensitive areas cannot be disturbed

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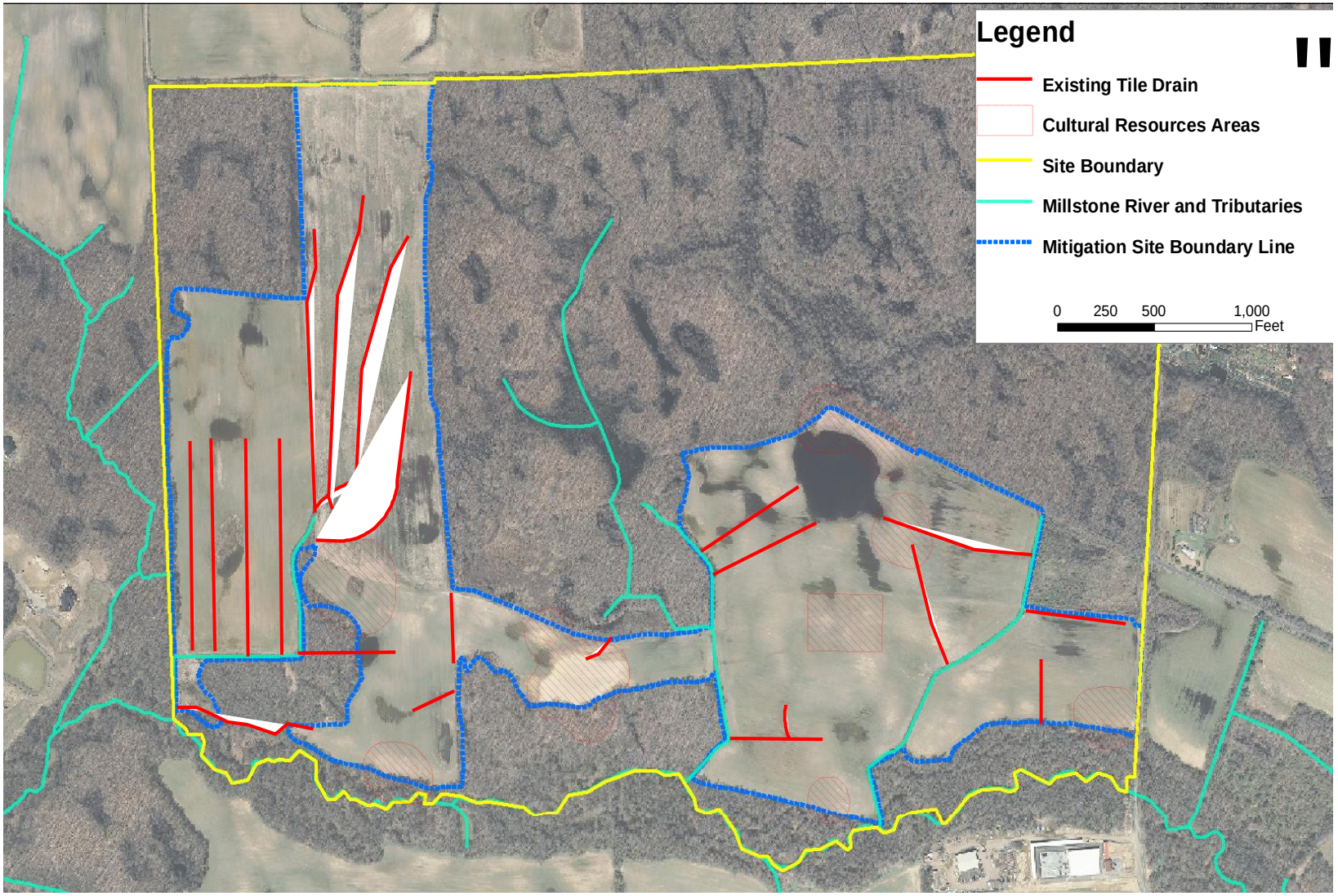
Site Overview



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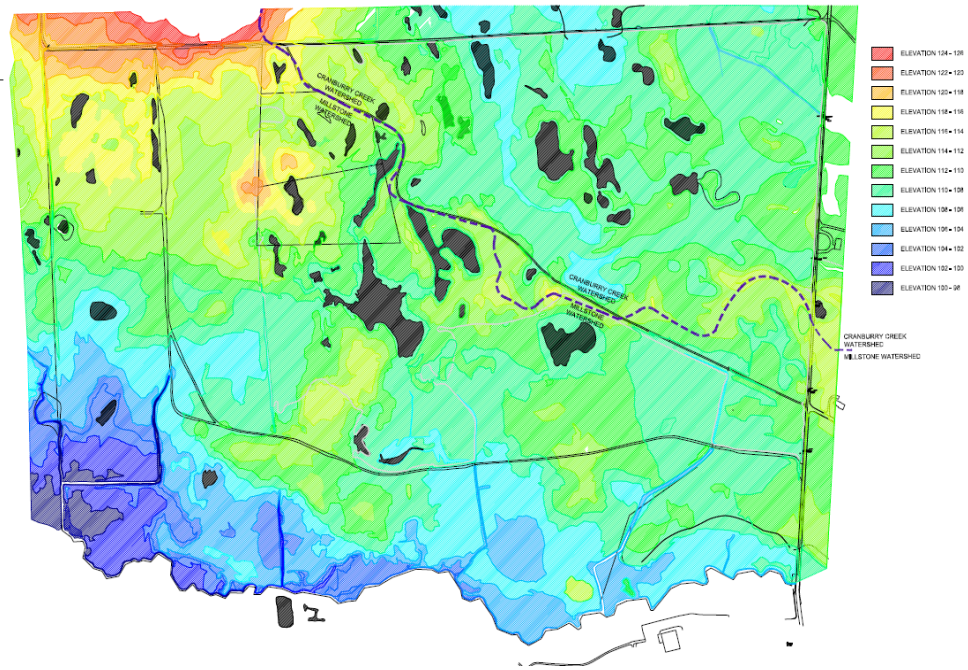
Assessment – Data Collection



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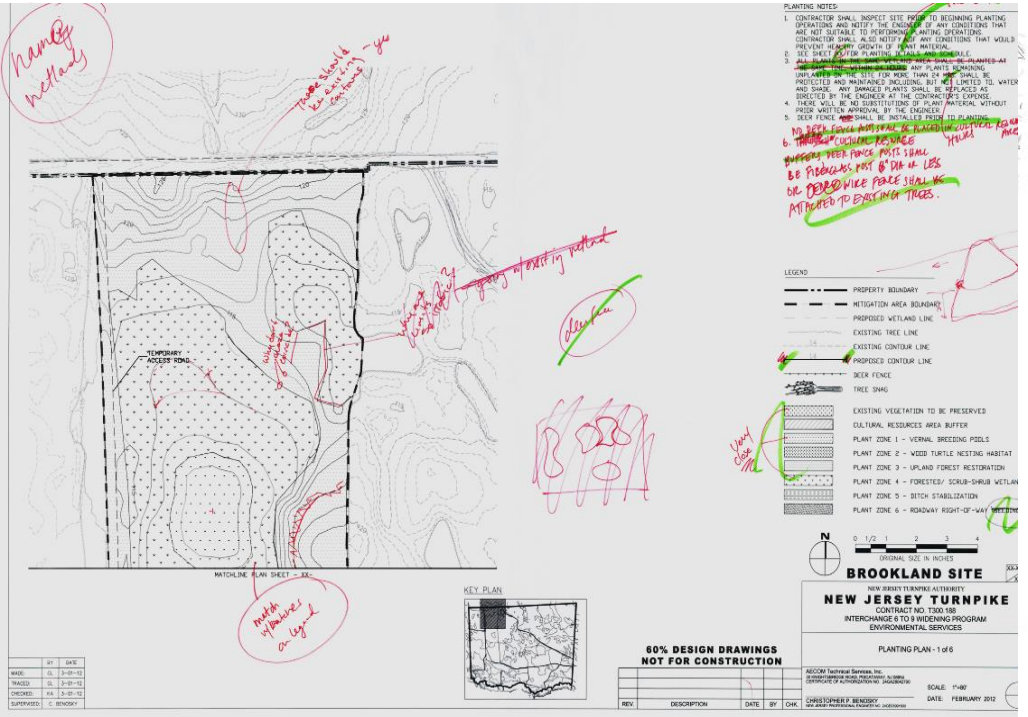
Assessment – Concept Design



- Site constraints
- Flood Hazard permits
- Mitigation credits
- DEP approval

Concept Design

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Balance – Design Objectives

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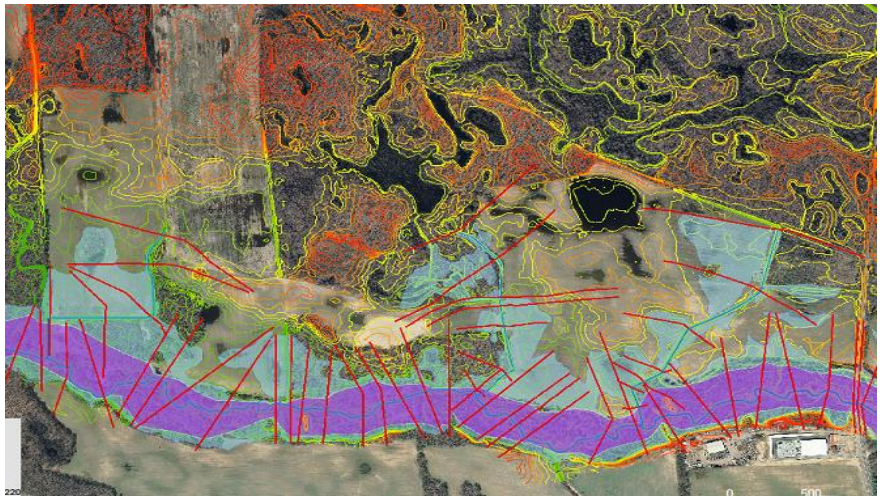
Balance – Flood Modeling



- Floodplain delineation
- Flood volume calculations
- Floodway constraints
- Ditch modifications
- Flood Hazard Area Permit

Flood Modeling

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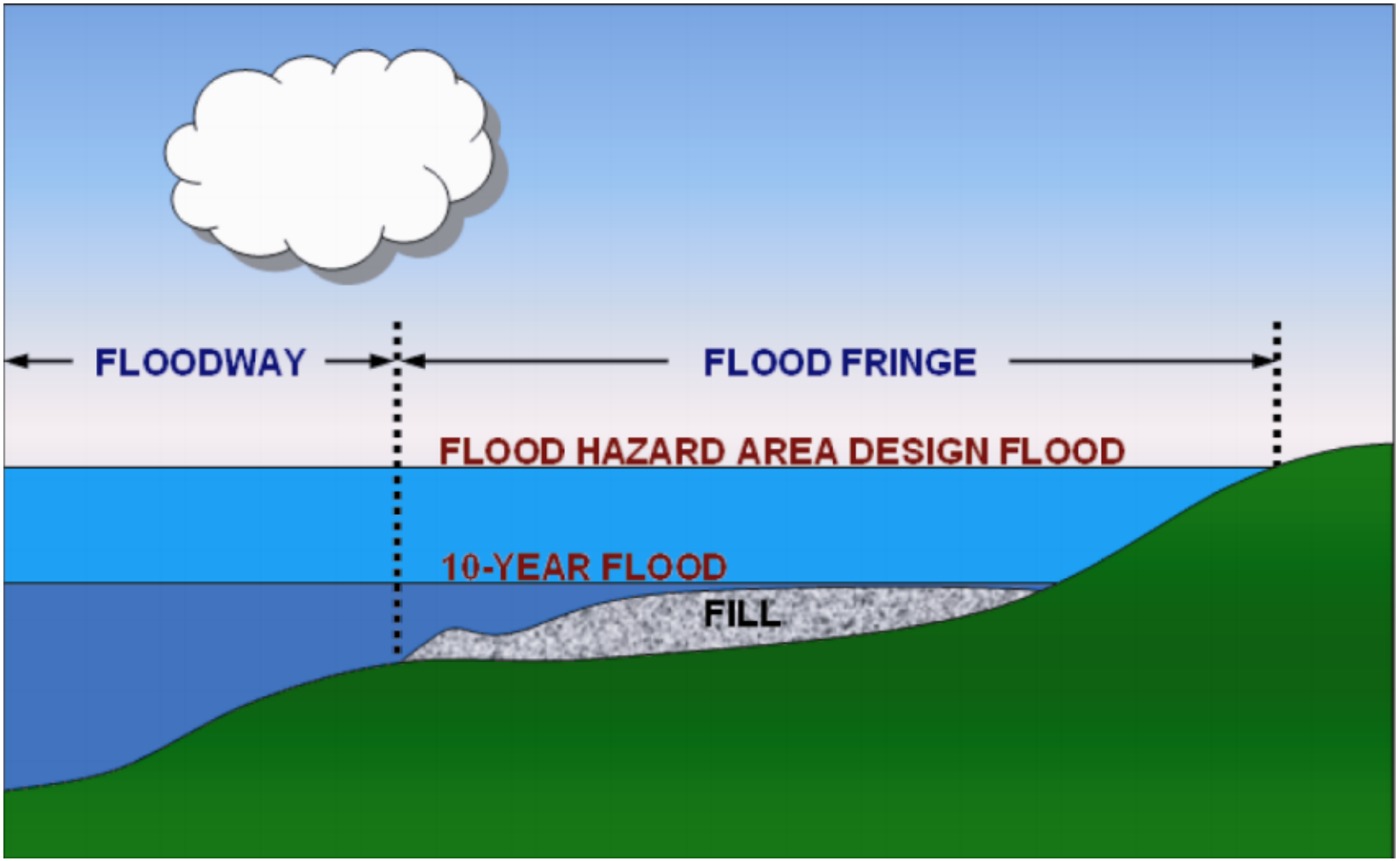
Balance – Flood Volumes



NJDEP – Flood Hazard Area Control Act Rules – 2008 DRAFT Technical Manual

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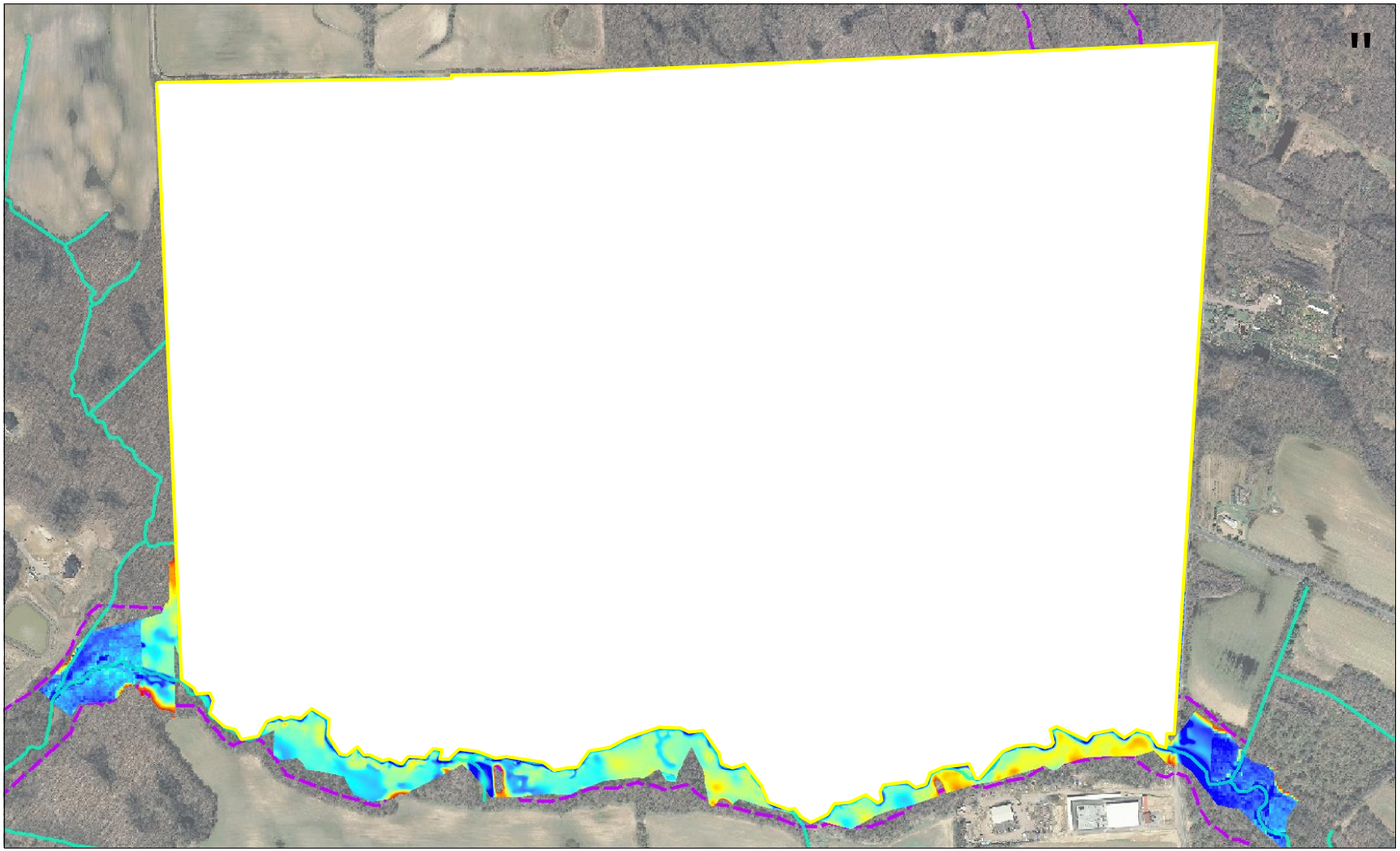
Balance – Floodway Constraints



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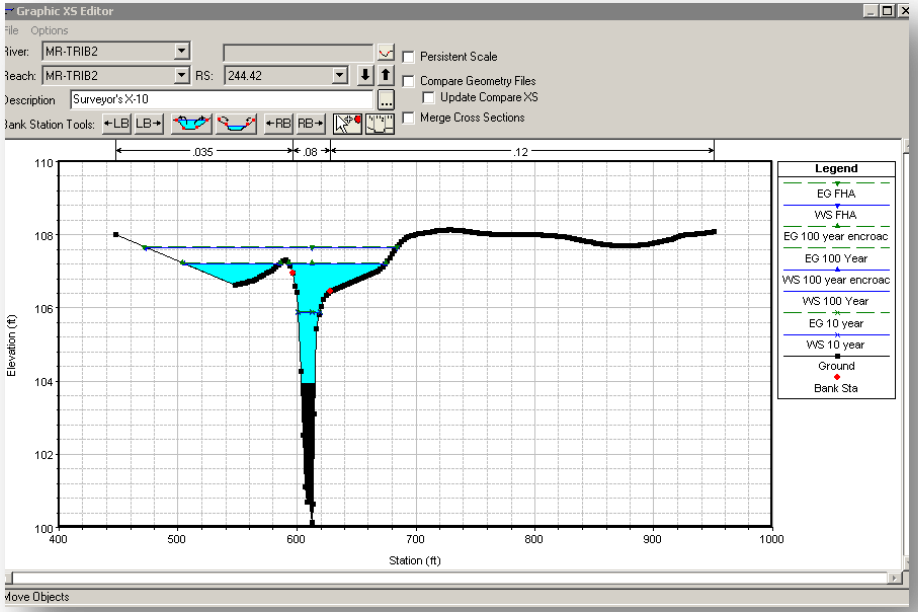
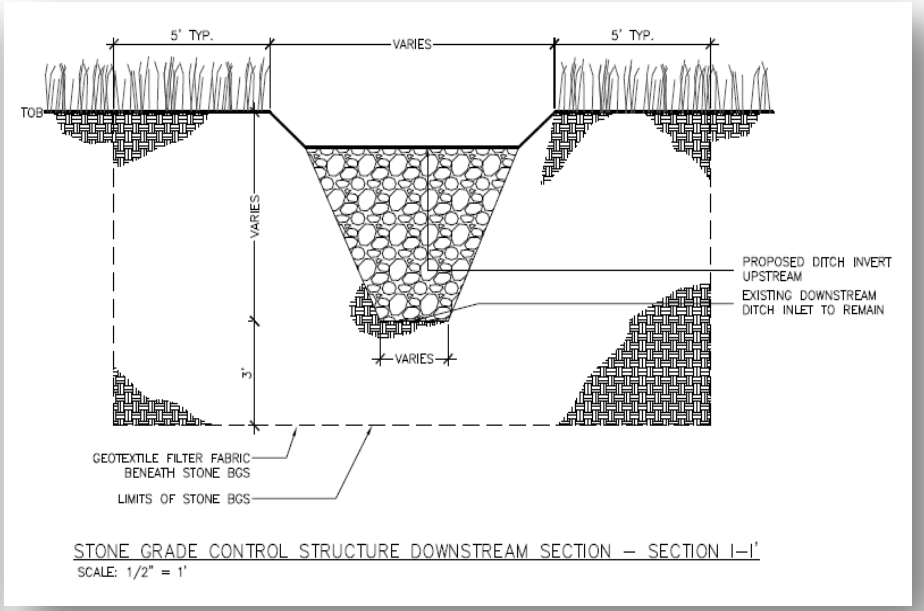
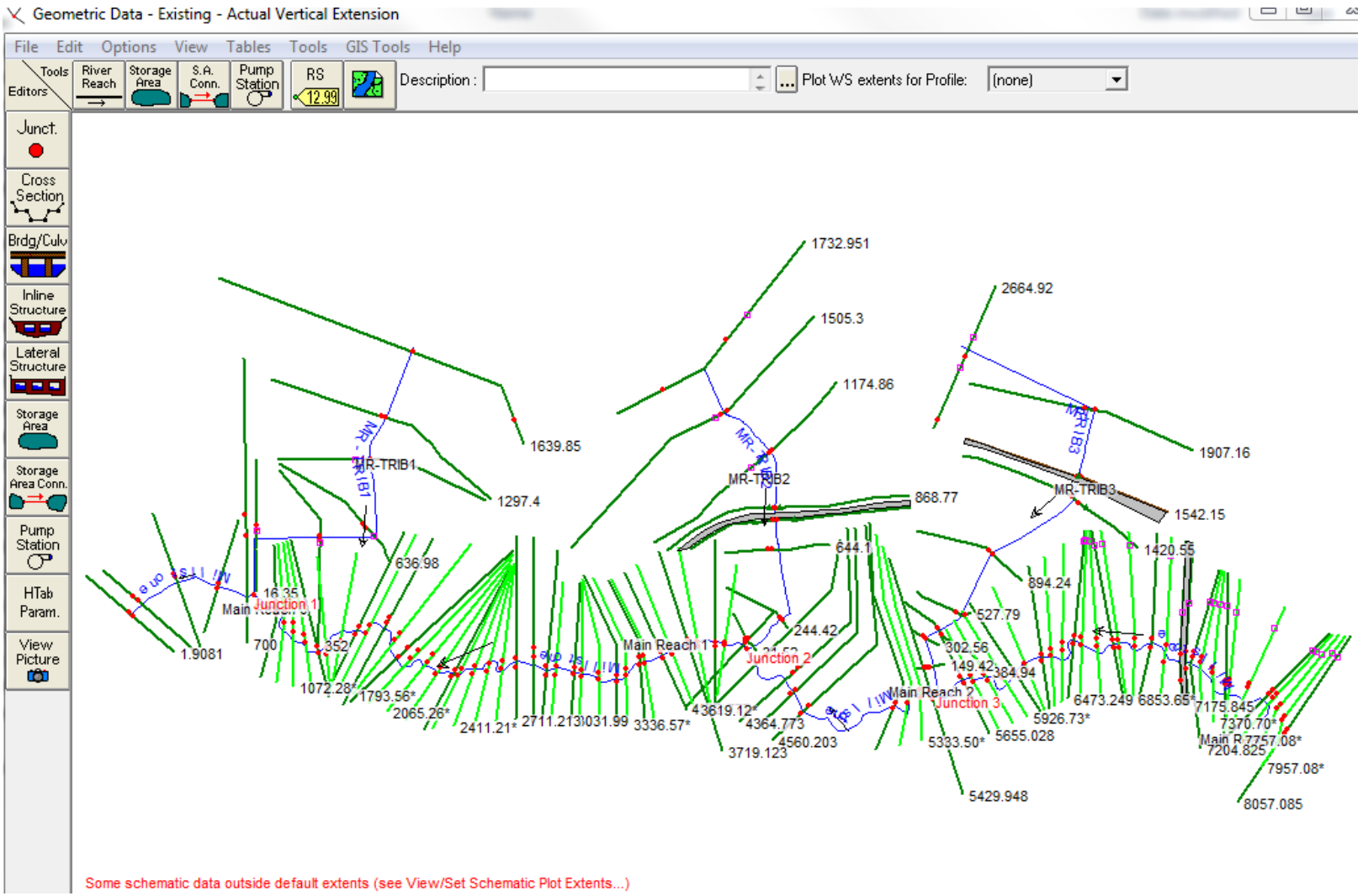
Balance – Ditch Modifications





Balance – HEC-RAS Model



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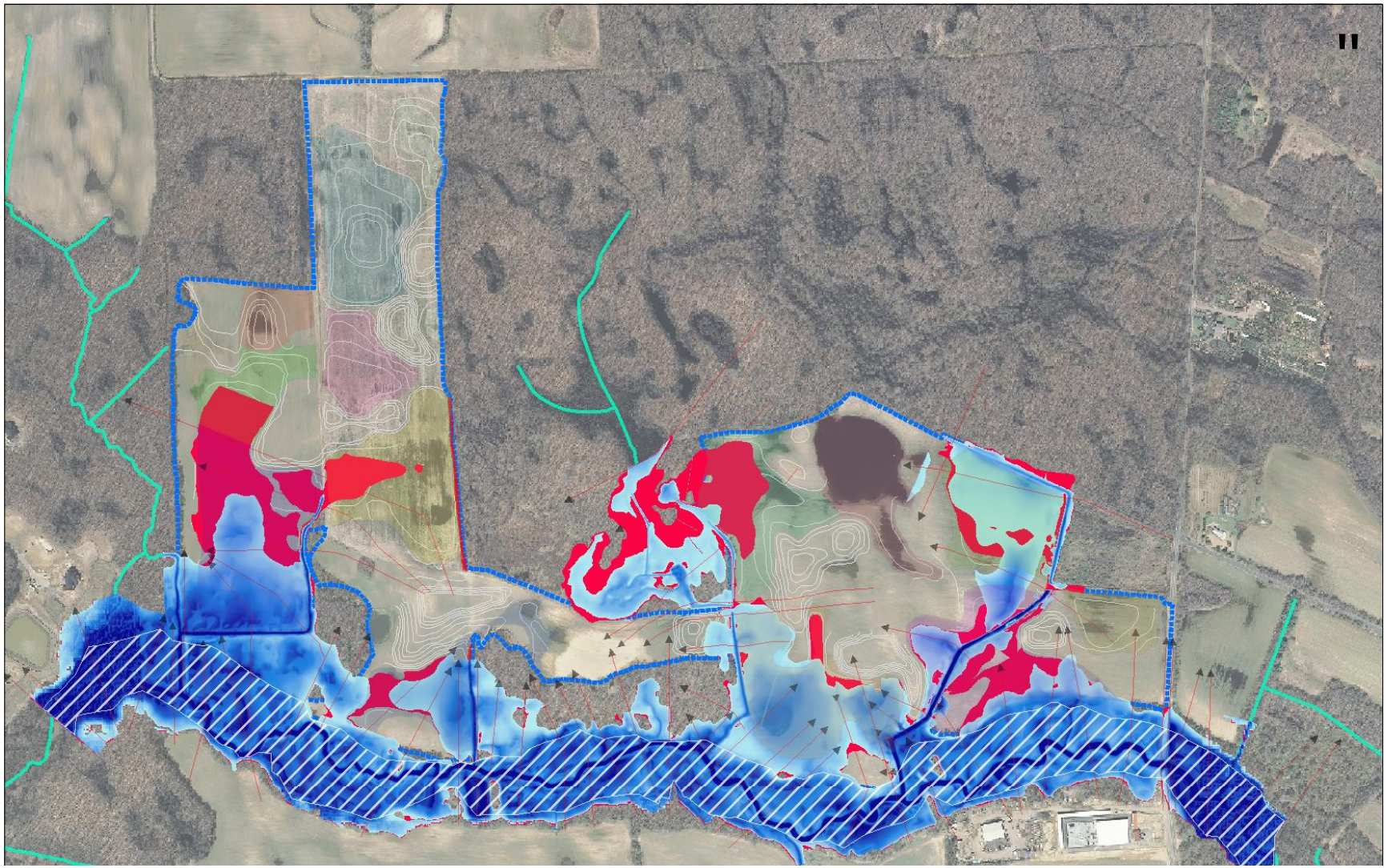
Balance – Flood Hazard Area and Floodway



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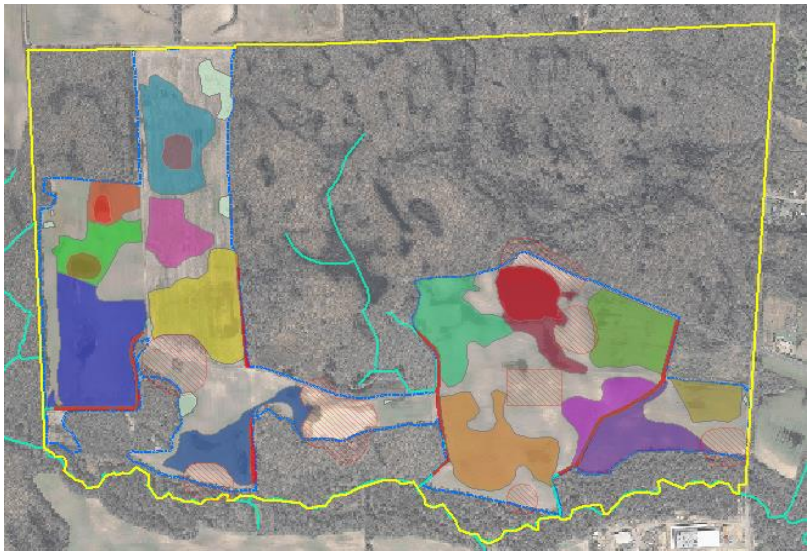
Balance – Water Budgets



- 14 inter-connected wetlands
- Groundwater and surface water interactions
- Existing tile drains to be plugged
- Regulatory criteria – wetlands and vernal pools

Water Budgets

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Balance – Water Budget Equation

$$\Delta S = [P + S_i + G_i] - [ET + S_o + G_o]$$

ΔS = change in volume of water storage in a defined area over time

P = precipitation

S_i = surface-water inflow

G_i = ground-water inflow

ET = evapotranspiration

S_o = surface-water outflow

G_o = ground-water outflow

Calculated on a Daily Time Step

Balance – Time Step Calculations

Precipitation, Surface-Water, & ET

- P – NOAA Hightstown 2W Gage
- S_i – runoff, antecedent soil moisture, CN
- S_o – iterative calculation of ΔWSL corresponding to a rise in WSE over designated overflow point
- ET – Hargreaves Samani

Balance – Time Step Calculations

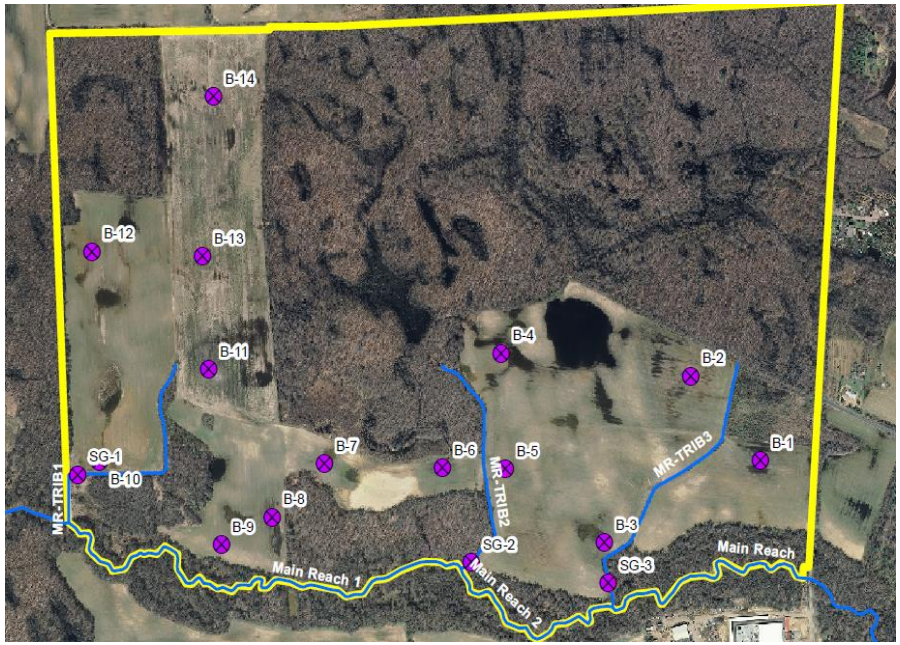
Groundwater Inflow and Outflow – Dupuit's Equation

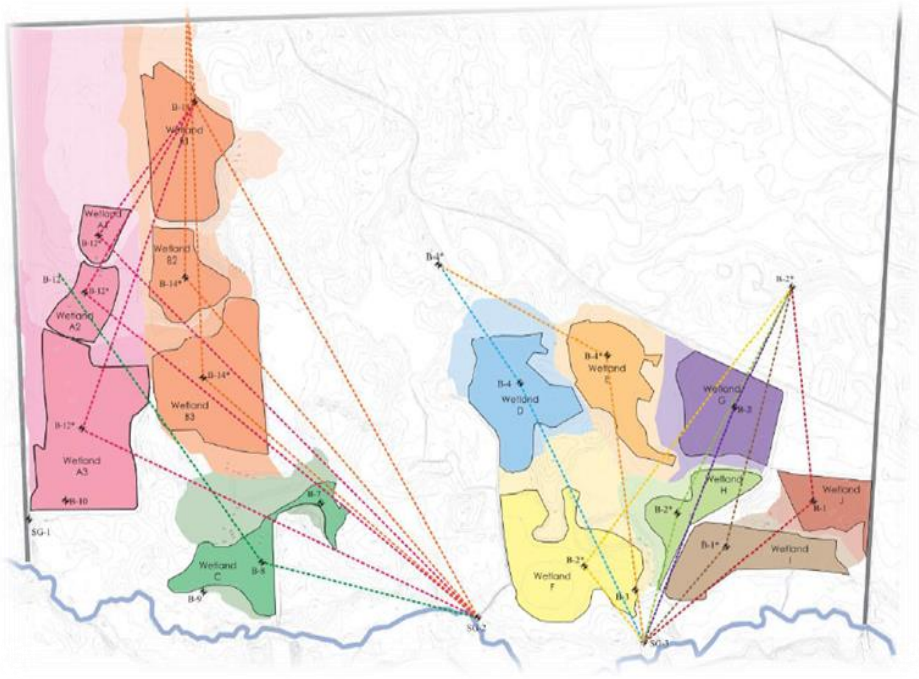
$$q' = 1/2 * K * ((h_1^2 - h_2^2) / L)$$

- q' = flow per unit width (ft^2/d)
- K = hydraulic conductivity (ft/d)
- h_1 = head at origin (ft)
- h_2 = head at L (ft)
- L = flow length (ft)

Calculated on a Daily Time Step

Balance – Water Budget Calibration





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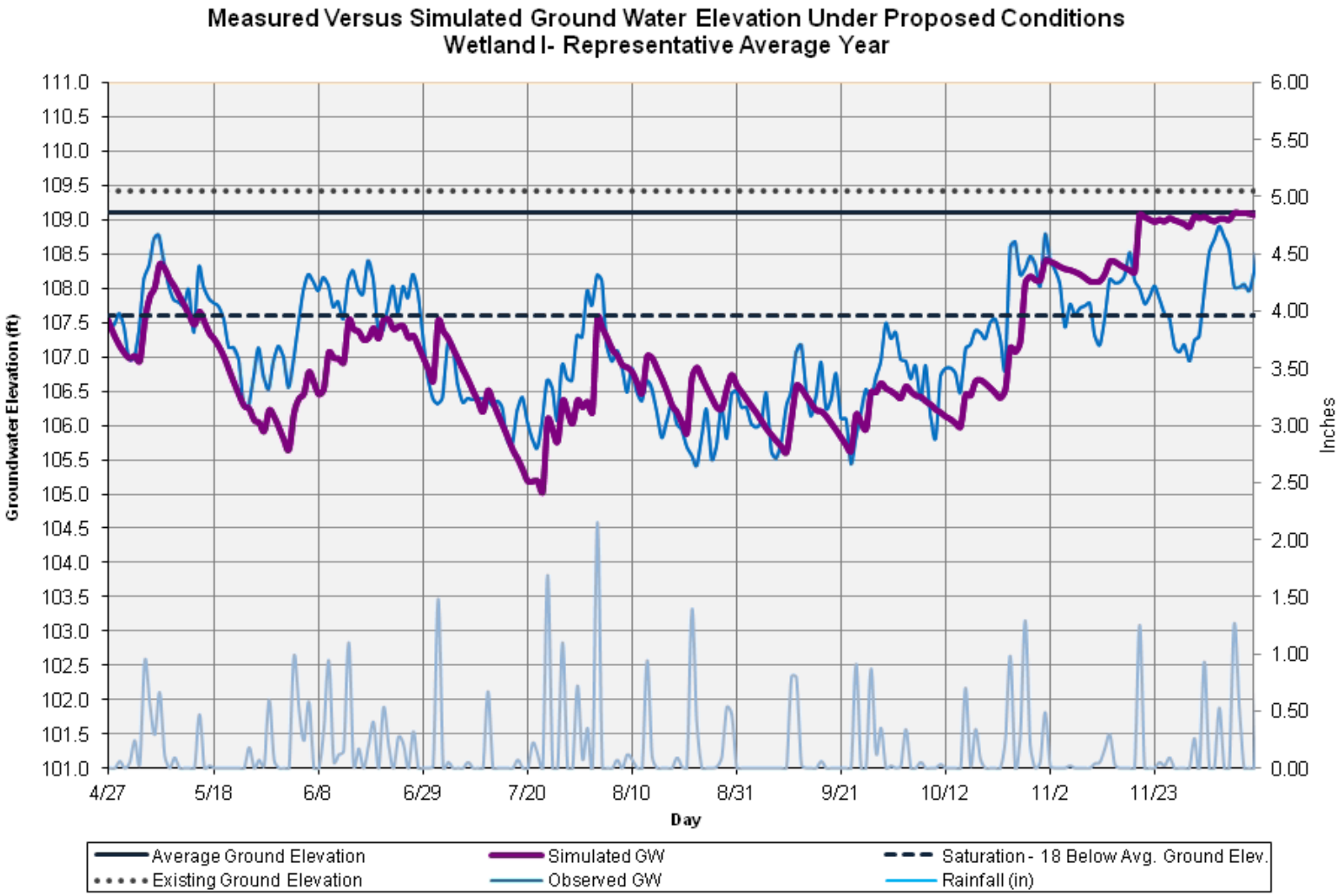
Balance – Water Budget Calibration



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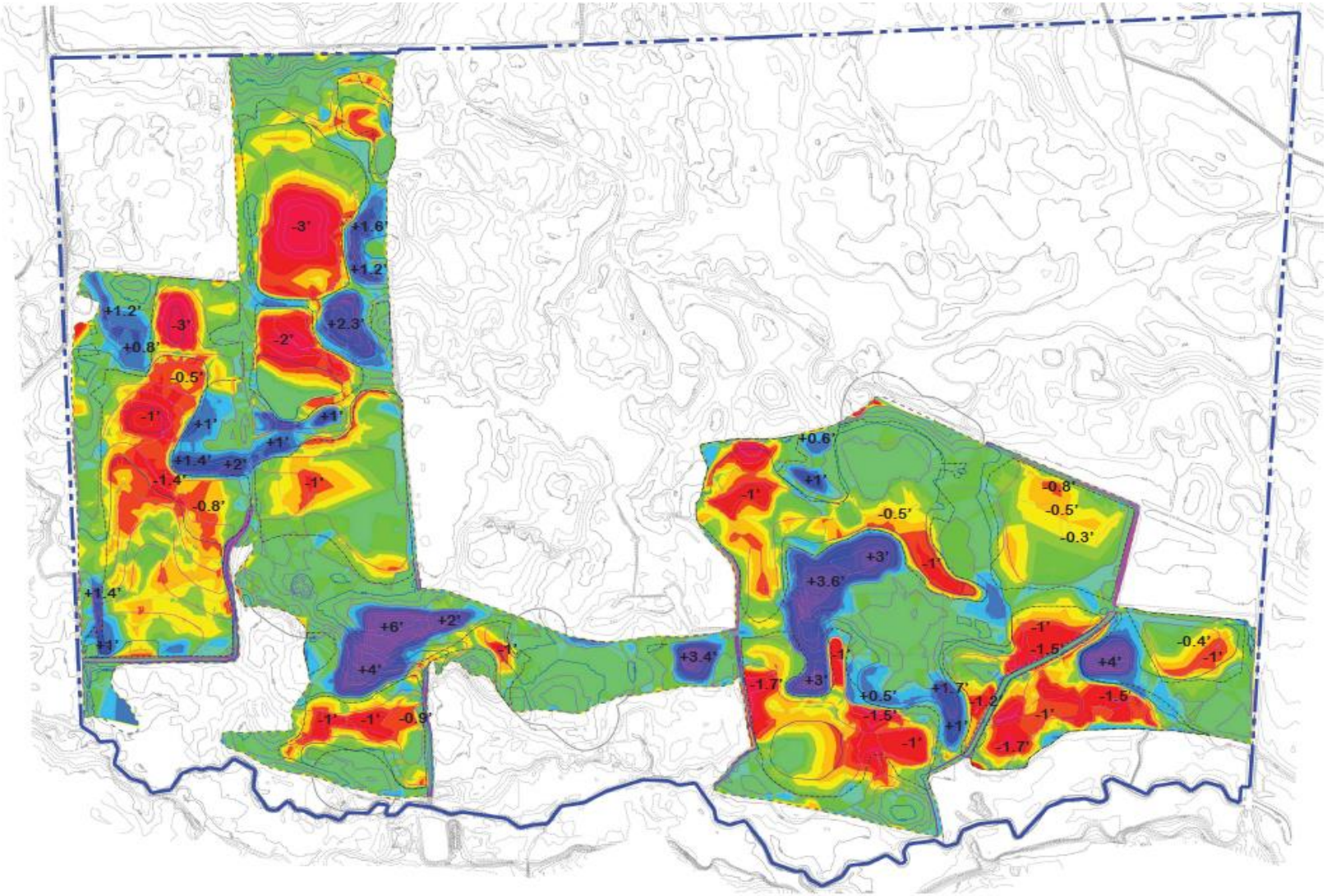
Balance – Grading Plan



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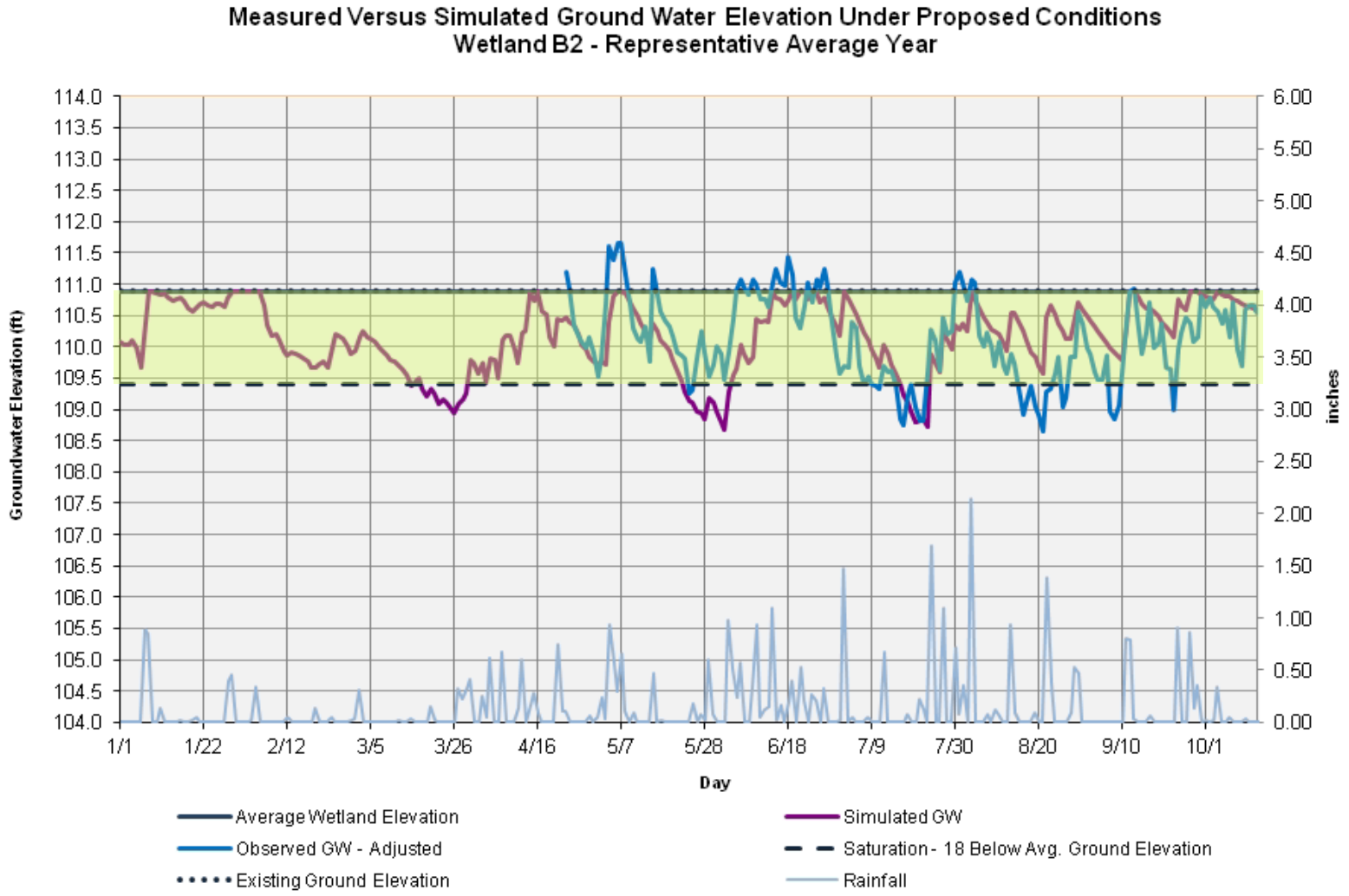
Balance – Meeting Regulatory Criteria



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Thank You!

Michael Mak, P.E.

Michael.Mak@aecom.com

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Oakland, CA 94612