Enhancement of Historically Ditched Salt Marsh in Delaware's Inland Bays

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  - ✓ Delaware Center for the Inland Bays
    - *Eric Buehl & E.J. Chalabala*
  - ✓ Delaware DNREC Mosquito Control Section
    - *Bill Meredith, Chris Lesser & Crew*
- ENTRIX Team
    - *Chris Pfeifer, Nicole Saunders, Patti Reilly, Stephanie Kirkner & Dave Jackson*

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Need for Project

- Compensatory Restoration
- Natural Resource Damage Assessment (NRDA)
- Injuries to estuarine resources from subsurface fuel oil leak - 1999
- Power plant in Sussex Co. Delaware
- Indian River / Inland Bays

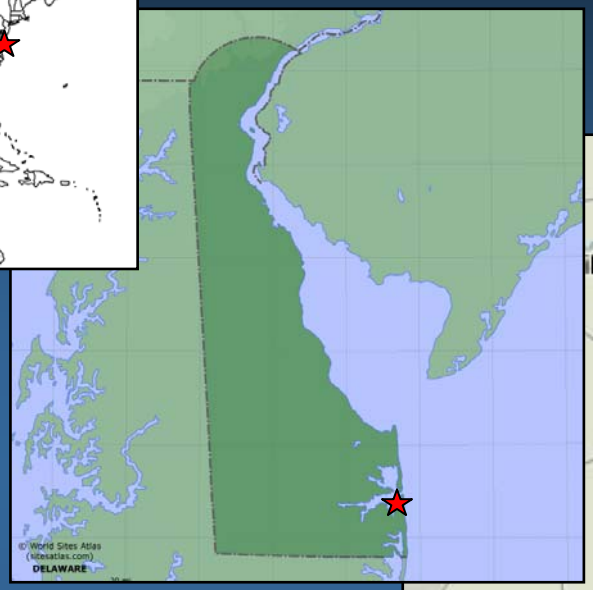
“Natural salt marsh landscapes of the eastern U.S. are characterized by a dendritic network of meandering tidal creeks and isolated marsh ponds set in a matrix of emergent halophytic vegetation.”

Chapman 1960; Redfield 1972 cited in Lathrop et al. 2000.

Salt Marsh Ditching

- By 1930s - 90% of Atlantic coastal marshes ditched for mosquito control
  - ✓ 2/3's of Delaware's 90,000 acres of salt marshes
- Remove standing water from marsh surface where mosquitoes might breed
- Indiscriminately drained non-mosquito breeding marsh habitat
- Adverse impacts to marsh structure & function

Project Location



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Aerial Photo of Slough's Gut Marsh, Summer 2003.
Courtesy of Center for the Inland Bays. Lewes, DE
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Aerial Photo of Slough's Gut Marsh, Summer 2003.
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Project Goals & Objectives

- Address habitat alteration from ditching
  - ✓ Fill mosquito ditches
  - ✓ Establish tidal creek network
  - ✓ Add pools & mudflats
- Enhance habitat for types of injured natural resources
  - ✓ Increase micro-habitat diversity
  - ✓ Expand foraging opportunities
  - ✓ Reintroduce natural hydrology
  - ✓ Stimulate plant growth

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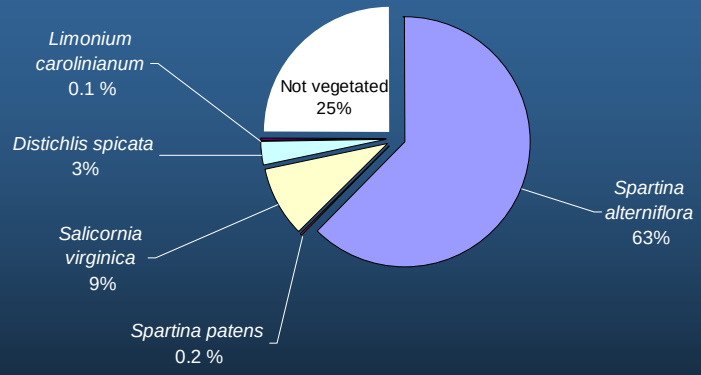
Pre-Restoration Monitoring

- Improve understanding of existing conditions & functions
- Confirm opportunities for enhancement
- Define baseline conditions for evaluating project performance (post-restoration monitoring)
- Validate assumptions
- Provide design guidance



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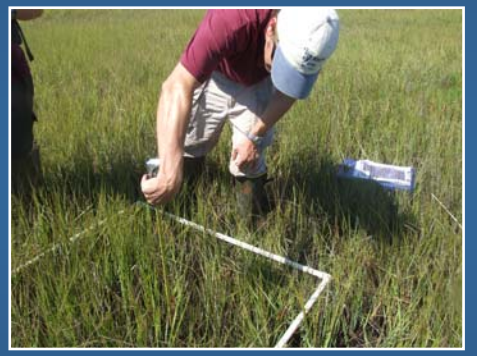
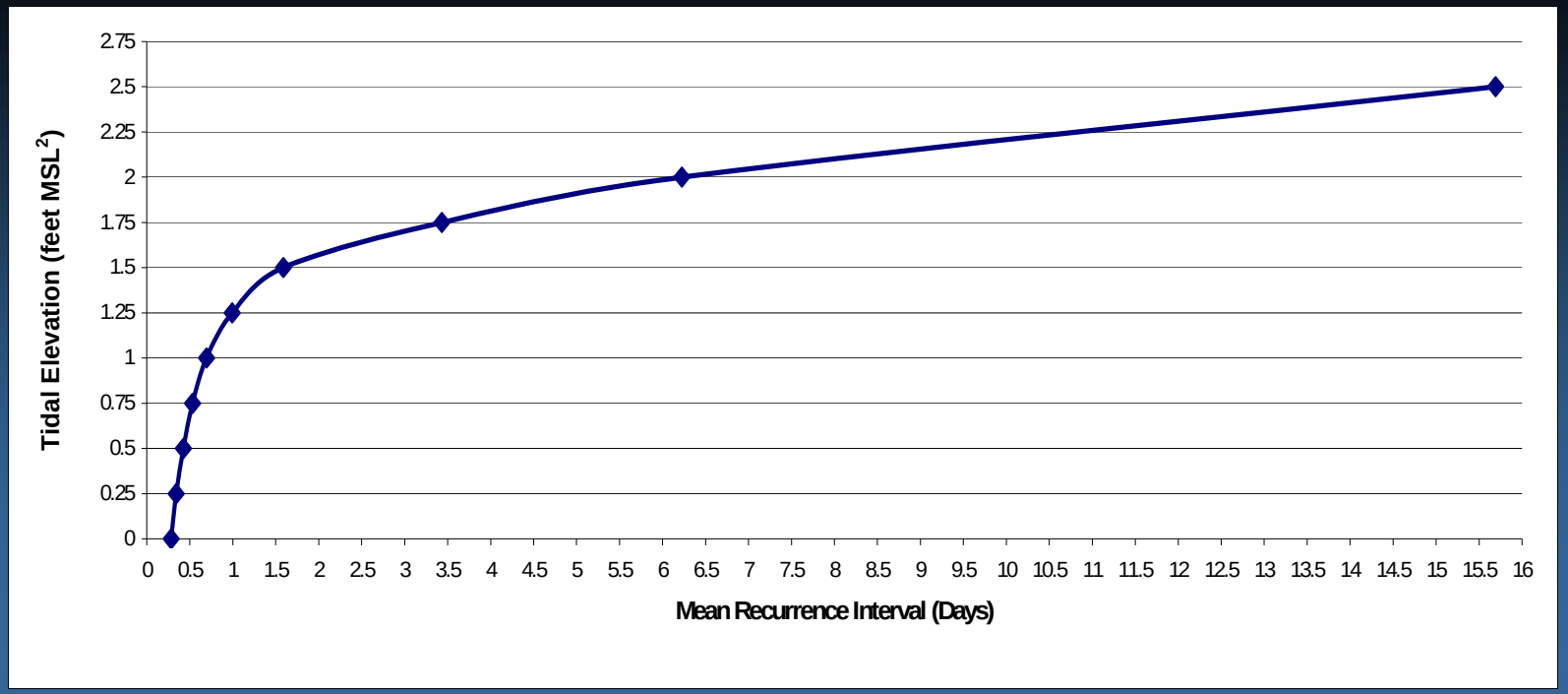
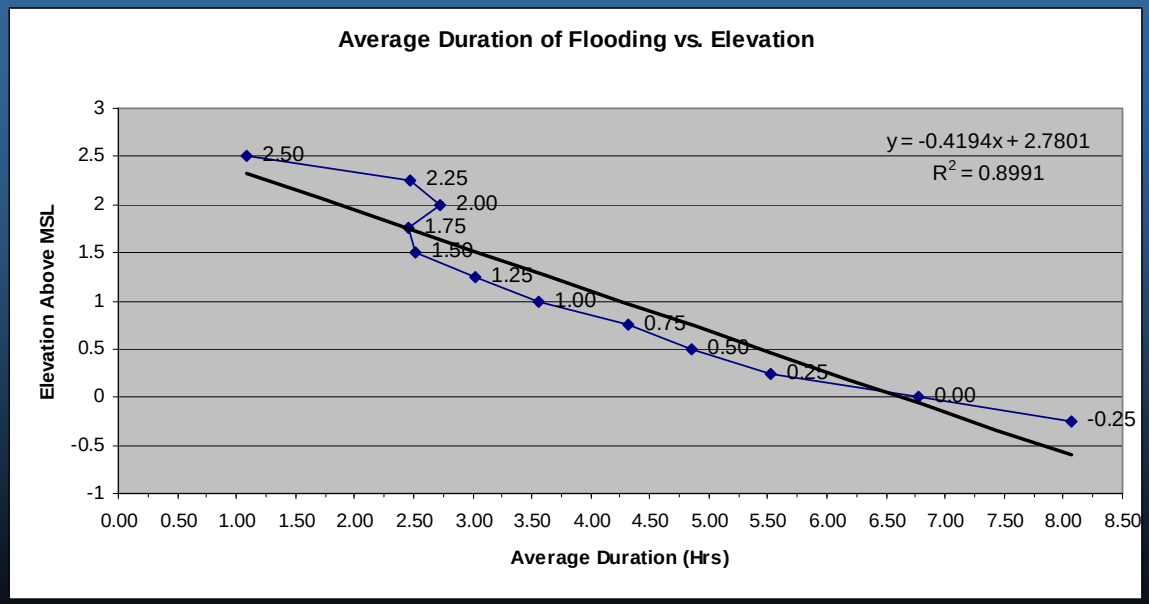
Pre-Restoration Monitoring

- 3 years (2005-07)
- Multiple parameters
  - ✓ Surface water hydrology
  - ✓ Water table elevation
  - ✓ Pore water salinity
  - ✓ Vegetation
  - ✓ Nekton
  - ✓ Birds
  - ✓ Ribbed mussels







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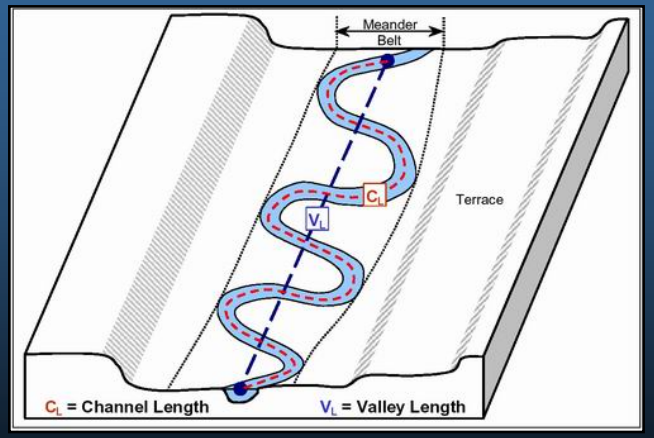
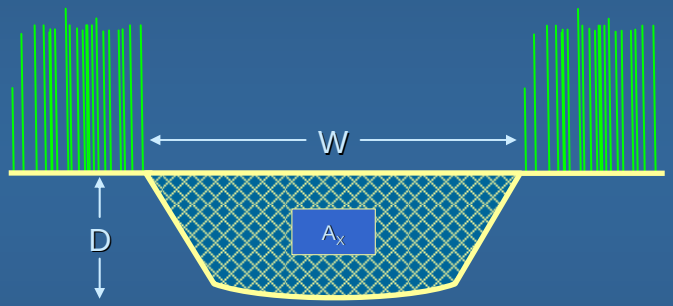
Channel Plan-Form Design

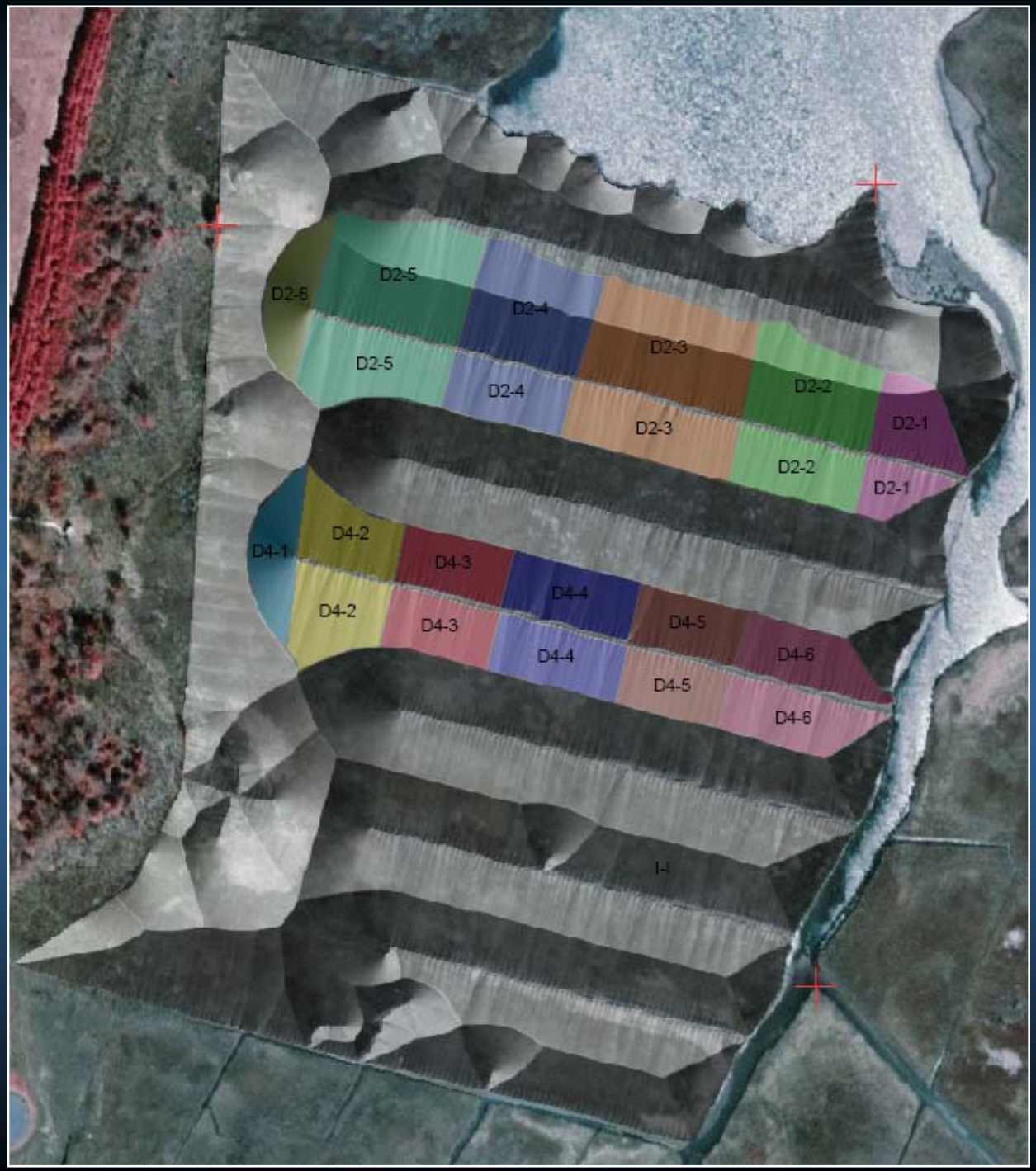
- Empirical approach
- Morphometric analysis
  - ✓ channel order & length distribution
  - ✓ bifurcation ratios
  - ✓ sinuosity
  - ✓ drainage density
- Evaluated Delaware Bay reference marshes



Channel Cross-Sectional Design

- Tidal prism model
- Empirical relationship:
  - ✓ channel width, depth & cross-sectional area
  - ✓ contributing drainage volume/area
- Pioneered in CA Bay Area
- Existing equations inappropriate for mid-Atlantic
- Developed site-specific equations from existing ditches
- Predicted cross-sectional area for new channels





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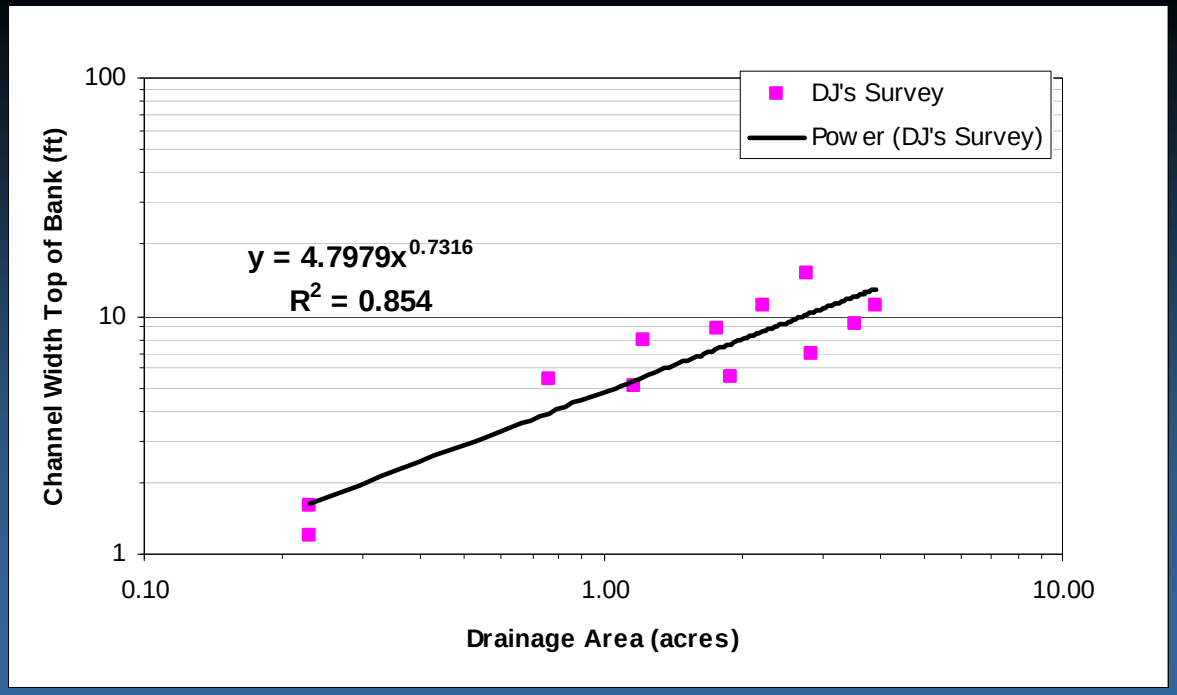

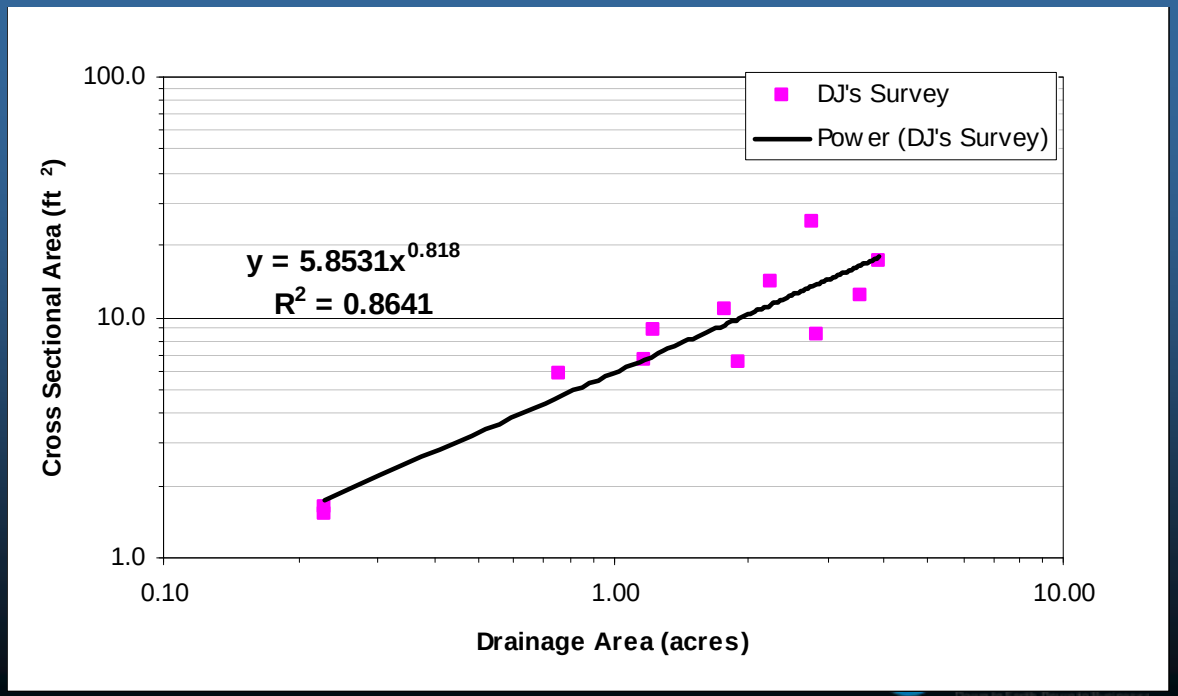

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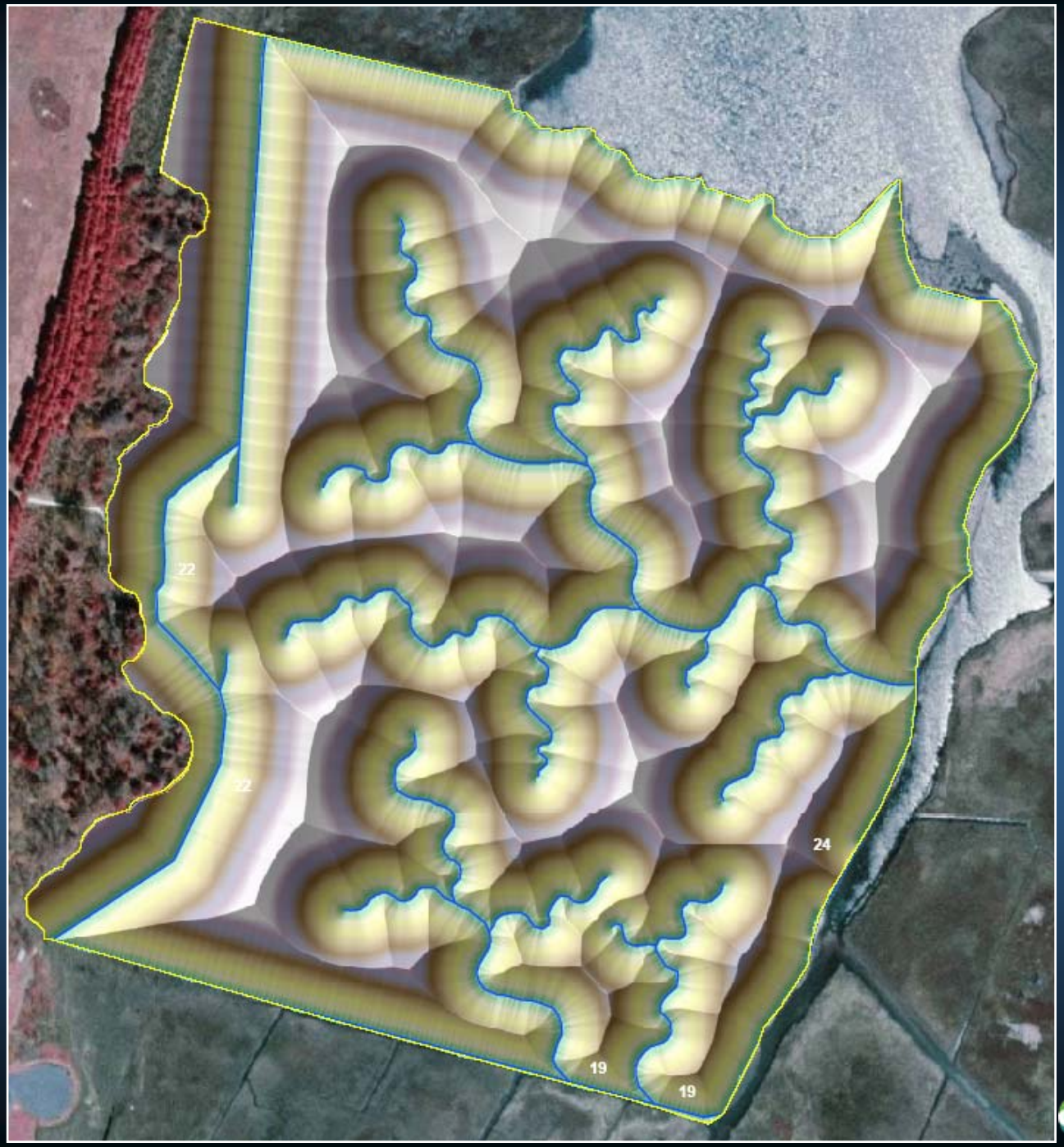

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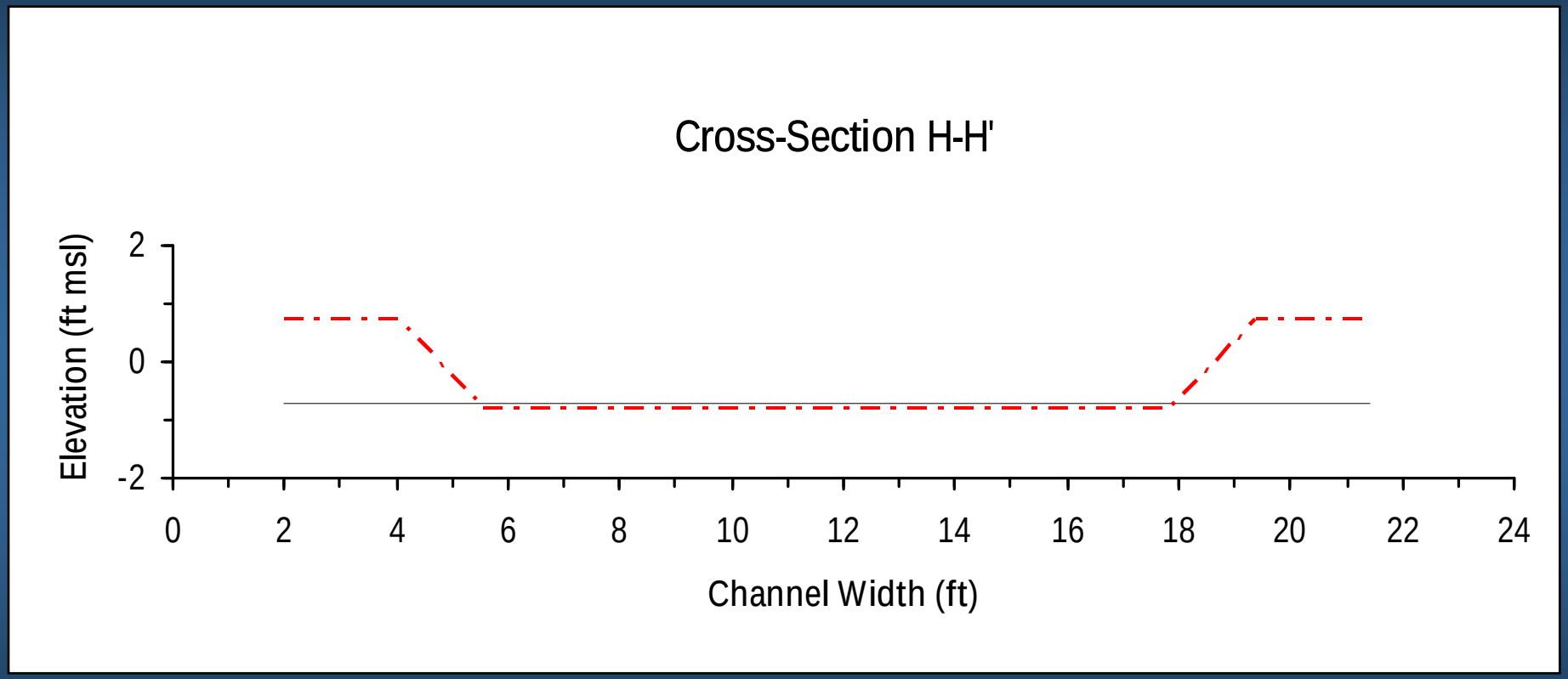

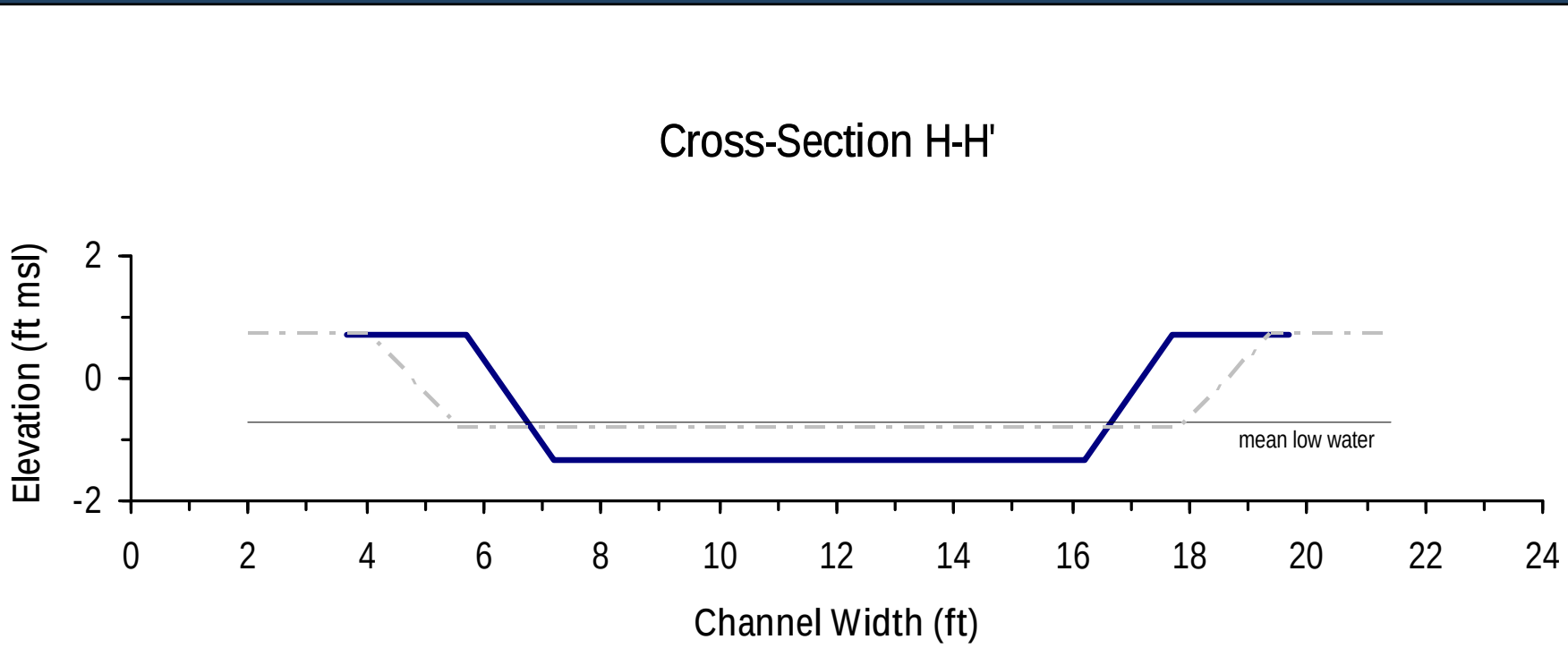


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Questions ???