

# Estuaries in PEI

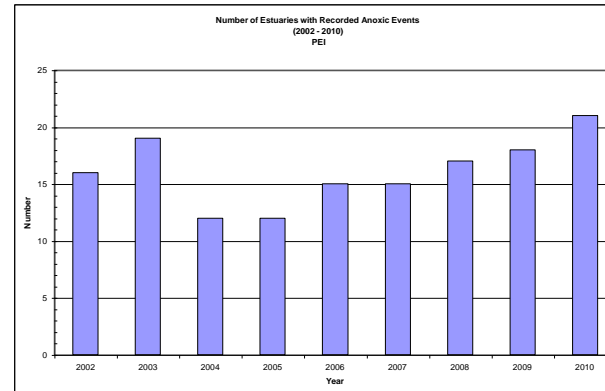
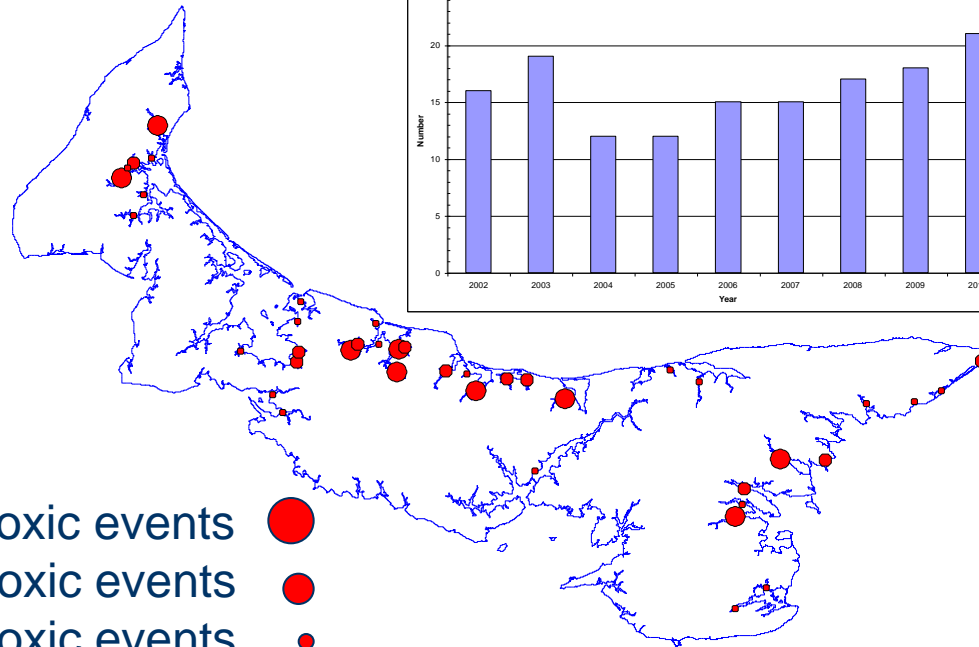
Why are some more susceptible to nutrient loads than others?

# Nutrient Susceptibility

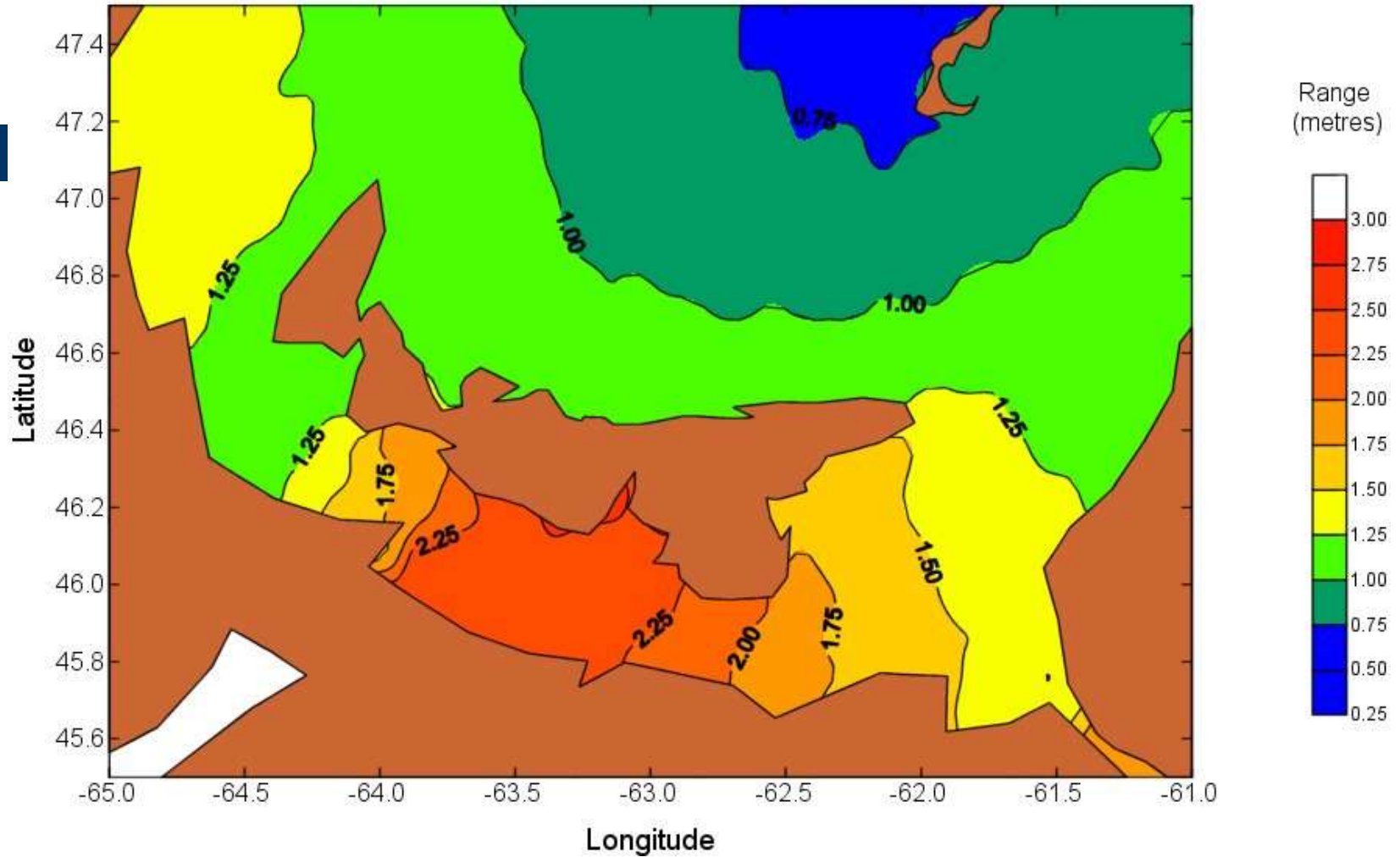


- It has been apparent for some time that each estuary in PEI has a specific load that it can tolerate
  - Some have re-occurring anoxia and “small” loads
  - Some have little or no anoxia despite high loads
- Something in the estuary itself is driving this
  - Biological/Chemical
  - Physical

# Island Estuaries with Re-Occurring Anoxic Events 2002 - 2010



# Tidal Range (m)



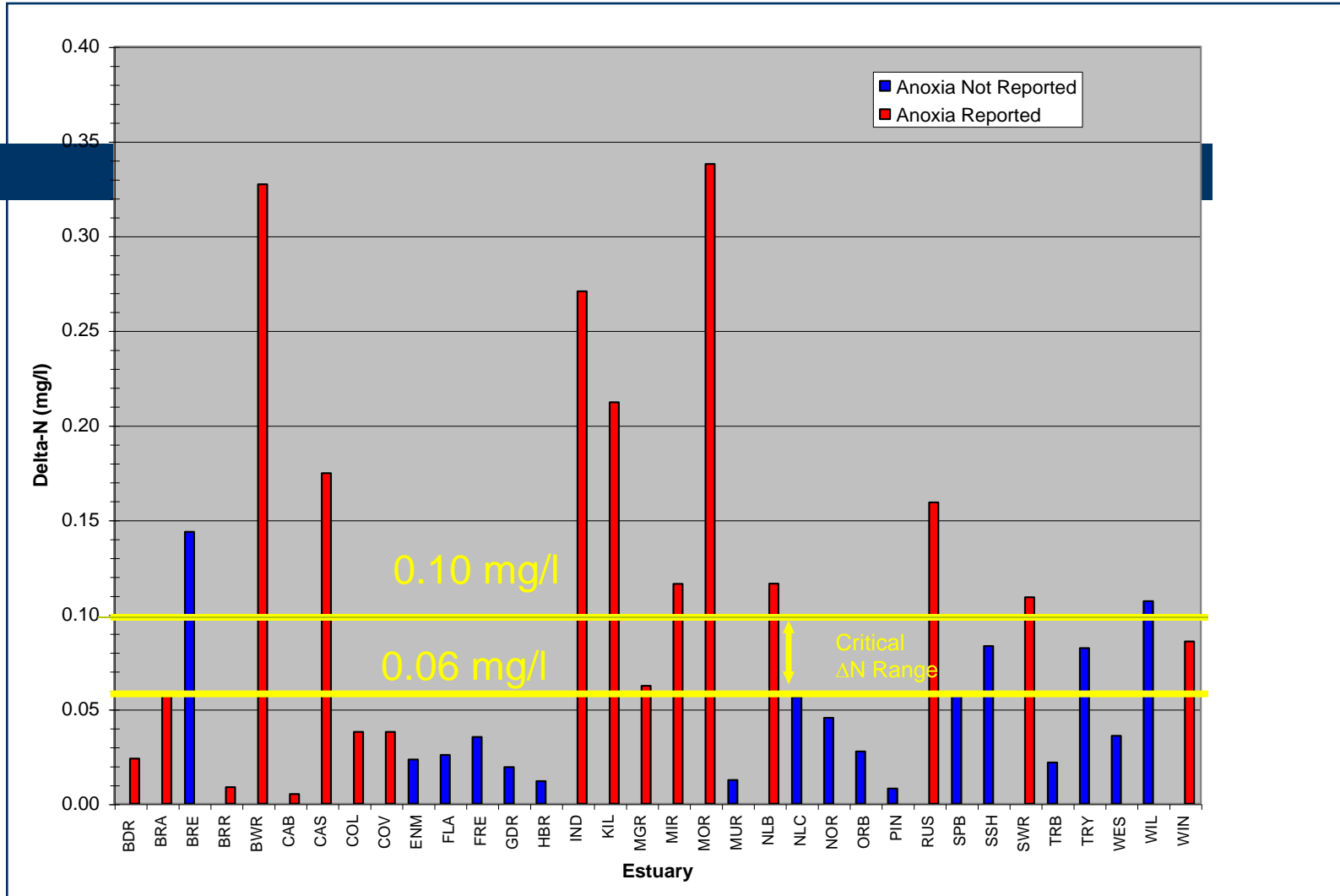
# Nutrient Target Setting for PEI Estuaries

- Ambient tidal ranges appeared to be driving much of the susceptibility to nutrients in PEI estuaries
- A very simple model developed (Gary Bugden, DFO-BIO)

$$\frac{\text{Estuary Load}}{\text{FW Volume} + \text{SW Volume}}$$

- Model appears to work for most estuaries on PEI

# Results



# Issue - Tidal Flushing

- Causeways and Bridges
  - Many of them date from the 50's and 60's
  - Small openings easier and cheaper to build
  - Not always engineered for a full opening
    - lack of planning
    - other reasons (freshwater impoundments)

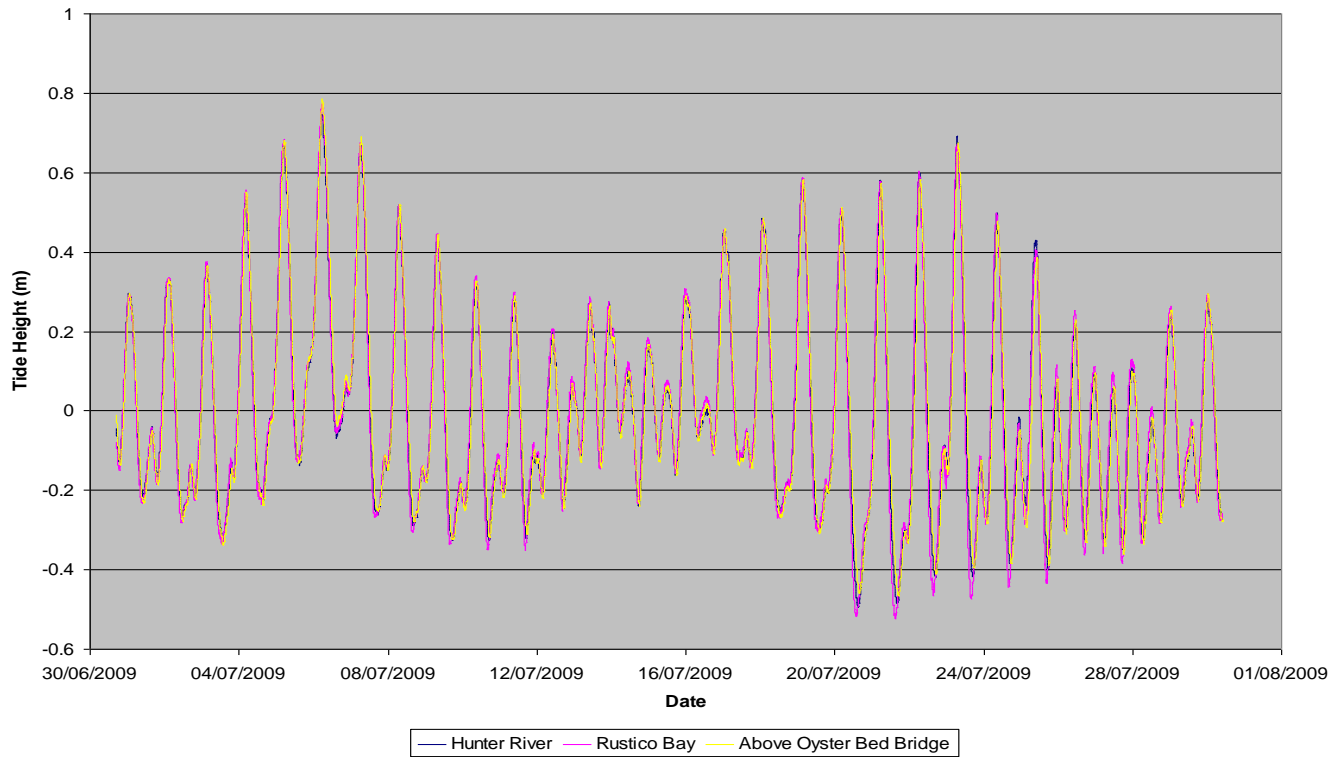
# Wheatley River Has A Bridge!



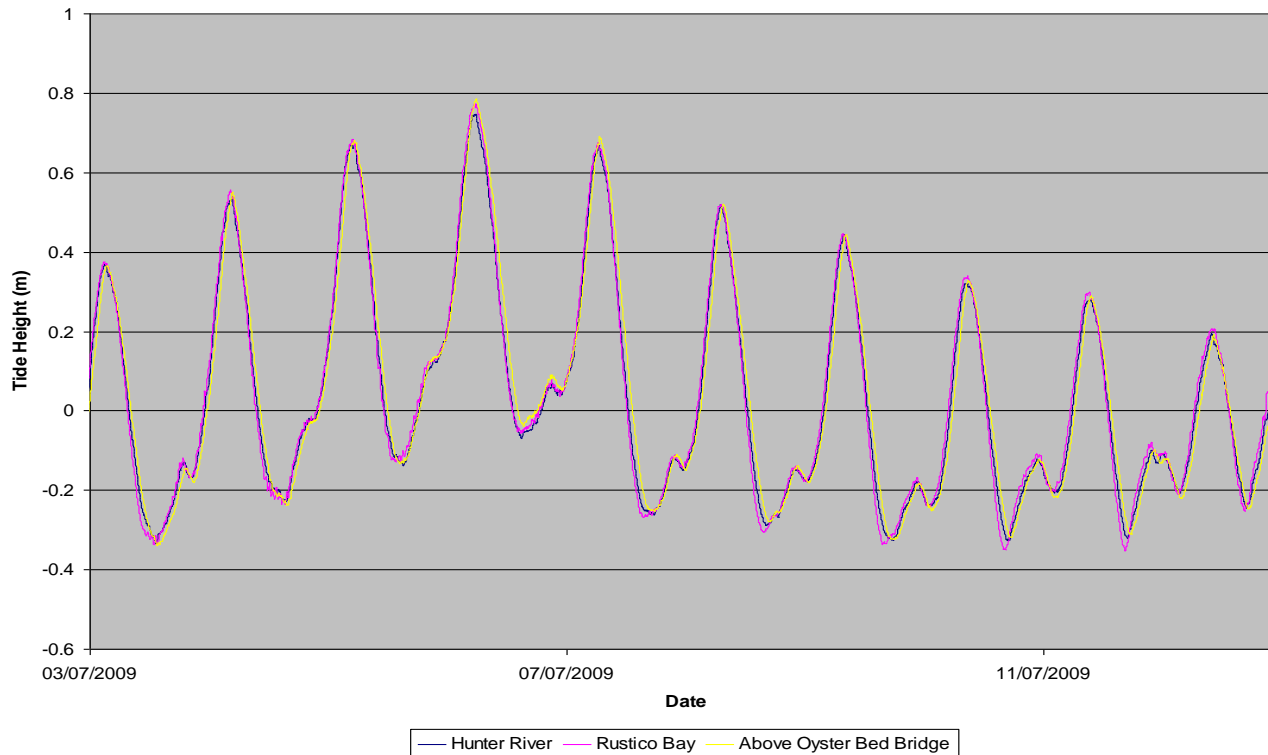
From MacNeil. 2009

- Was constructed ~1972. There was also a bridge there prior to that. Bridge is in good shape.
- Opening (gap) is 20m. Effective water depth is 1.7 m (was 1.3 m)
- Studied in 2009 for TIF, (Mark MacNeil)
- Results
  - No sill present
  - Admitted 95% of the tide (all but the highest tides)
  - Restriction due to the bridge channel and not downstream or upstream shoal area
  - Debris from previous structure present. Removal of debris recommended increasing depth under bridge by 0.4 m and restoring 100% of tide.
  - Tidal currents under the bridge have decreased slightly as a result.
  - Work has been carried out (2009)

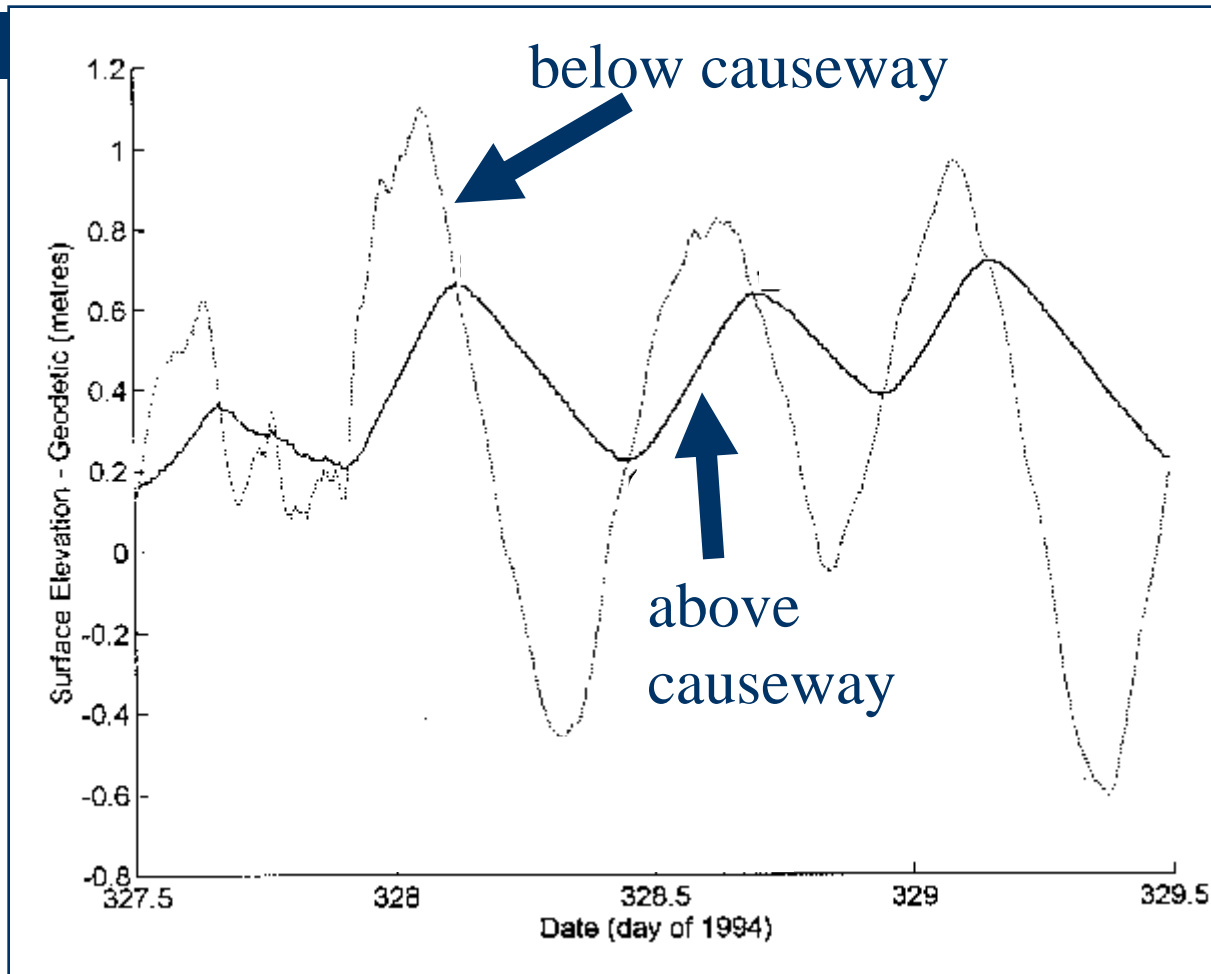
# Wheatley River Tidal Ranges



# Wheatley River Tidal Ranges



# Vernon River Restricted Tide Heights



# Other Studies

- 1986 “*A Study of Water Quality Issues at Selected Prince Edward Island Causeways*” For PEI Department of Transportation and Public Works (P. Lane and Jacques Whitford)
- 1996. “*Numerical Modelling of Rustico Inlet, PEI*” for Parks Canada (Baird and Associates)
- 1998. “*Computer Modelling of Rustico Bay Hydrodynamics*” for Parks Canada (Baird and Associates)
- 1998. “*Assessment of Potential Water Quality Impacts Resulting from Removal of Rustic Island Causeway*”. For Parks Canada (Mike Brylinsky)

# Other Physical Factors in Estuary Susceptibility

- Residence time
  - How long does it take a molecule of water entering at the upper end to exit the lower?
- Bathymetry
  - Relative size of photic zone
  - Presence of stratification
- Size/Shape
  - Are there tidal flats?
  - Long and skinny may force water in rather than out
- Orientation
  - Prevailing wind direction
  - Movement of sediments/sand
- Presence of Sills
  - Upstream Stagnation

# END

- Questions?

Cindy Crane

Surface Water Biologist

PEI Department of Environment, Energy and  
Forestry

902-368-5179

[cscrane@gov.pe.ca](mailto:cscrane@gov.pe.ca)