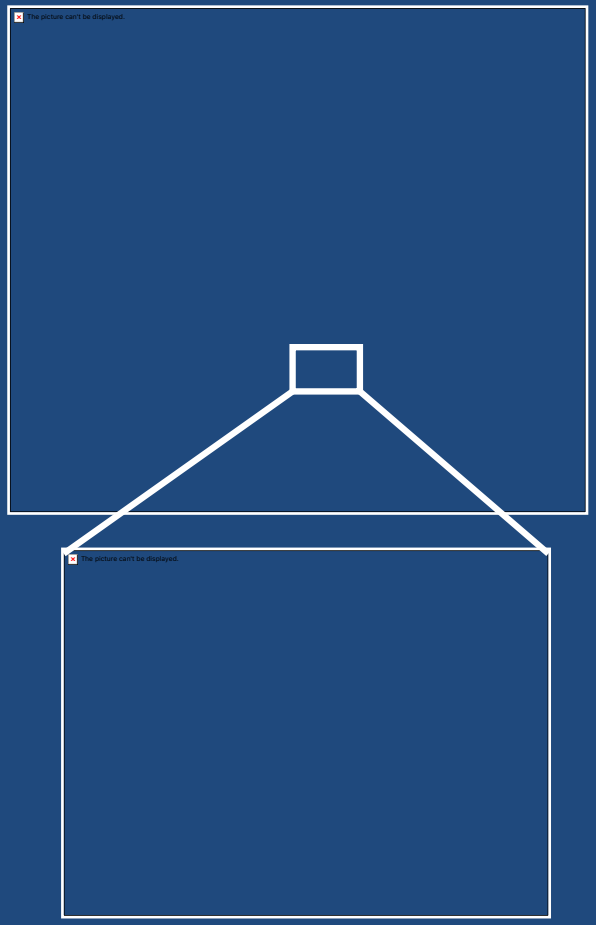
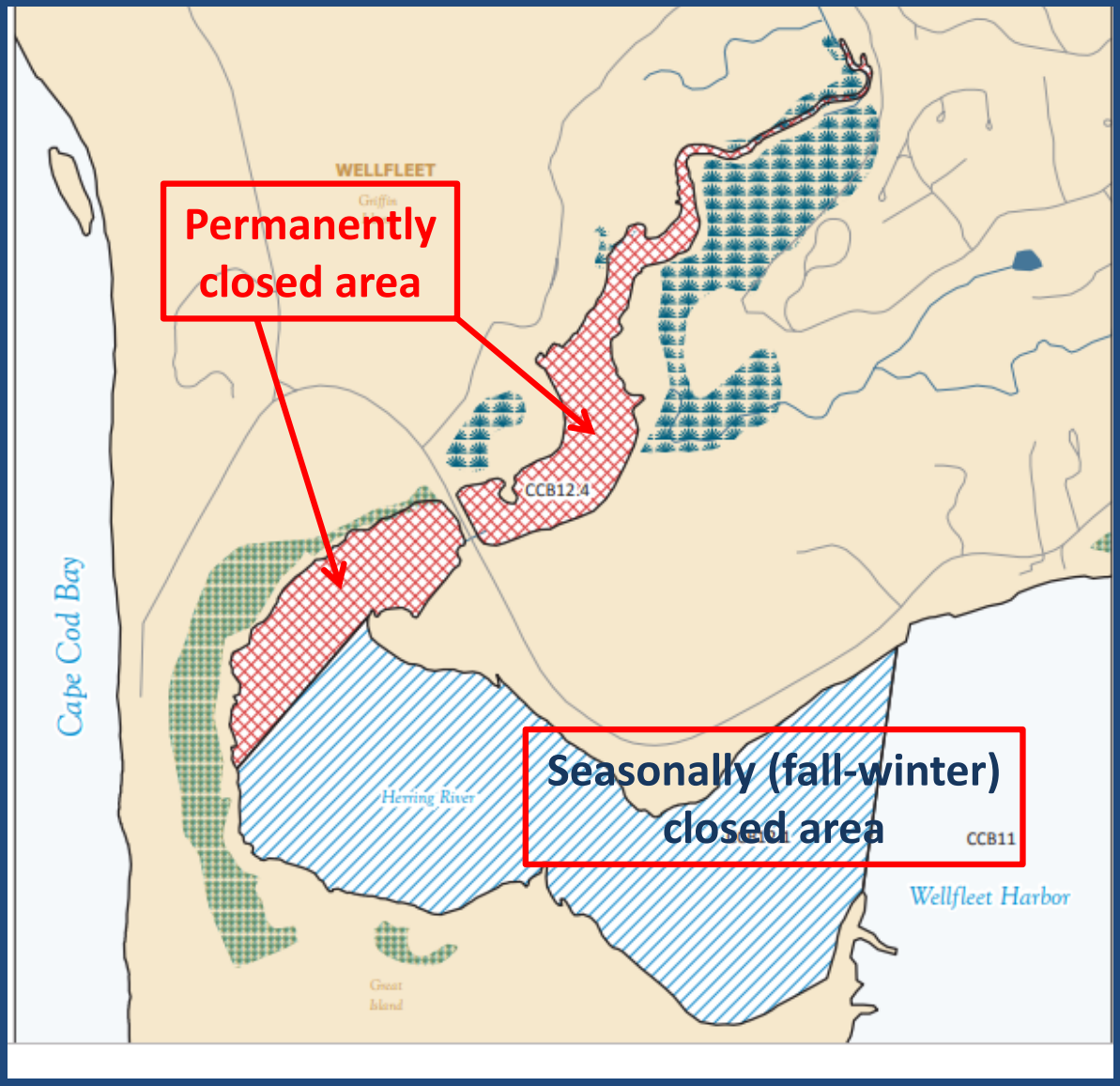
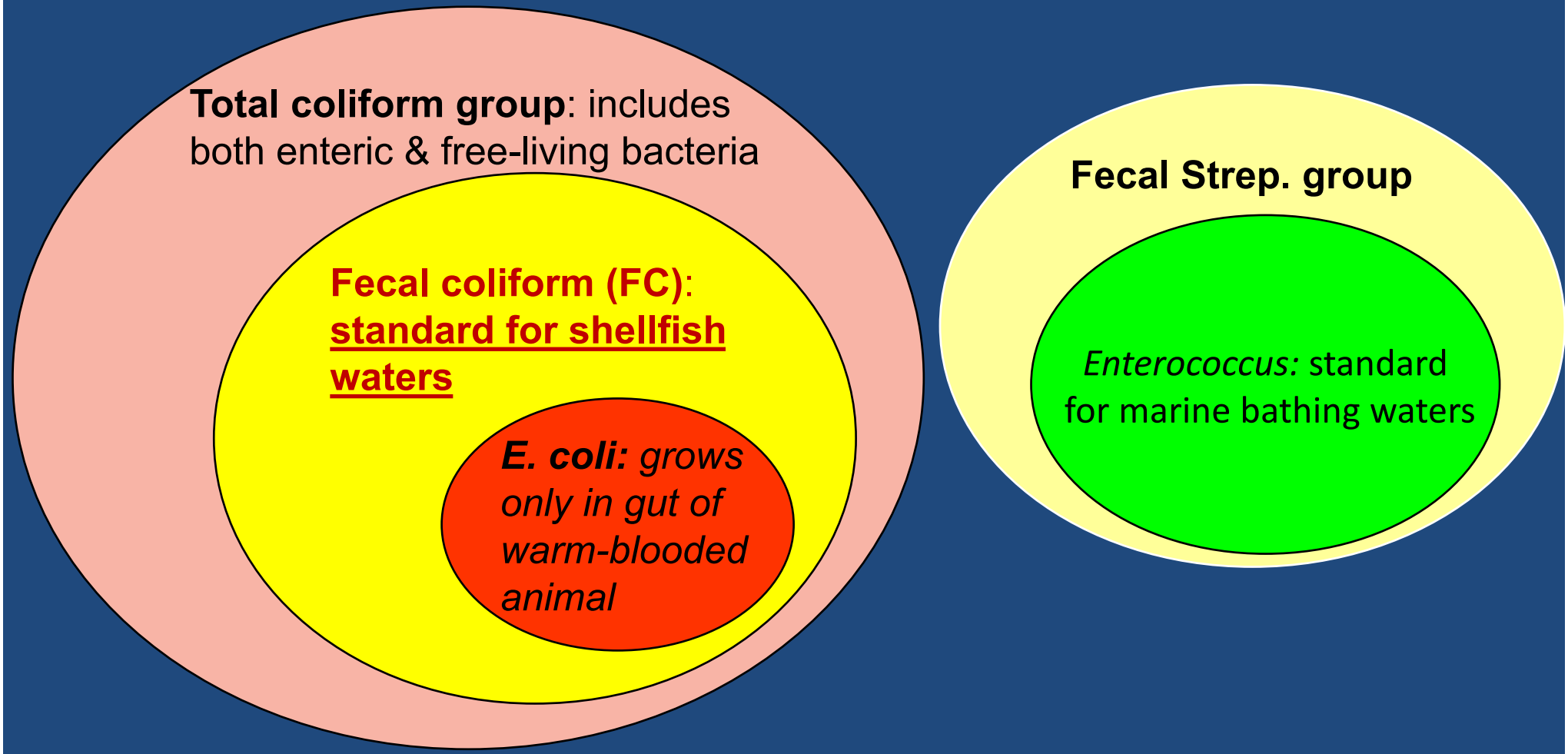
# The fecal coliform problem at Herring River:
## Loss of an important wild fishery since 1985
when state first tested.





# Indicators of fecal contamination that may contain human pathogens.

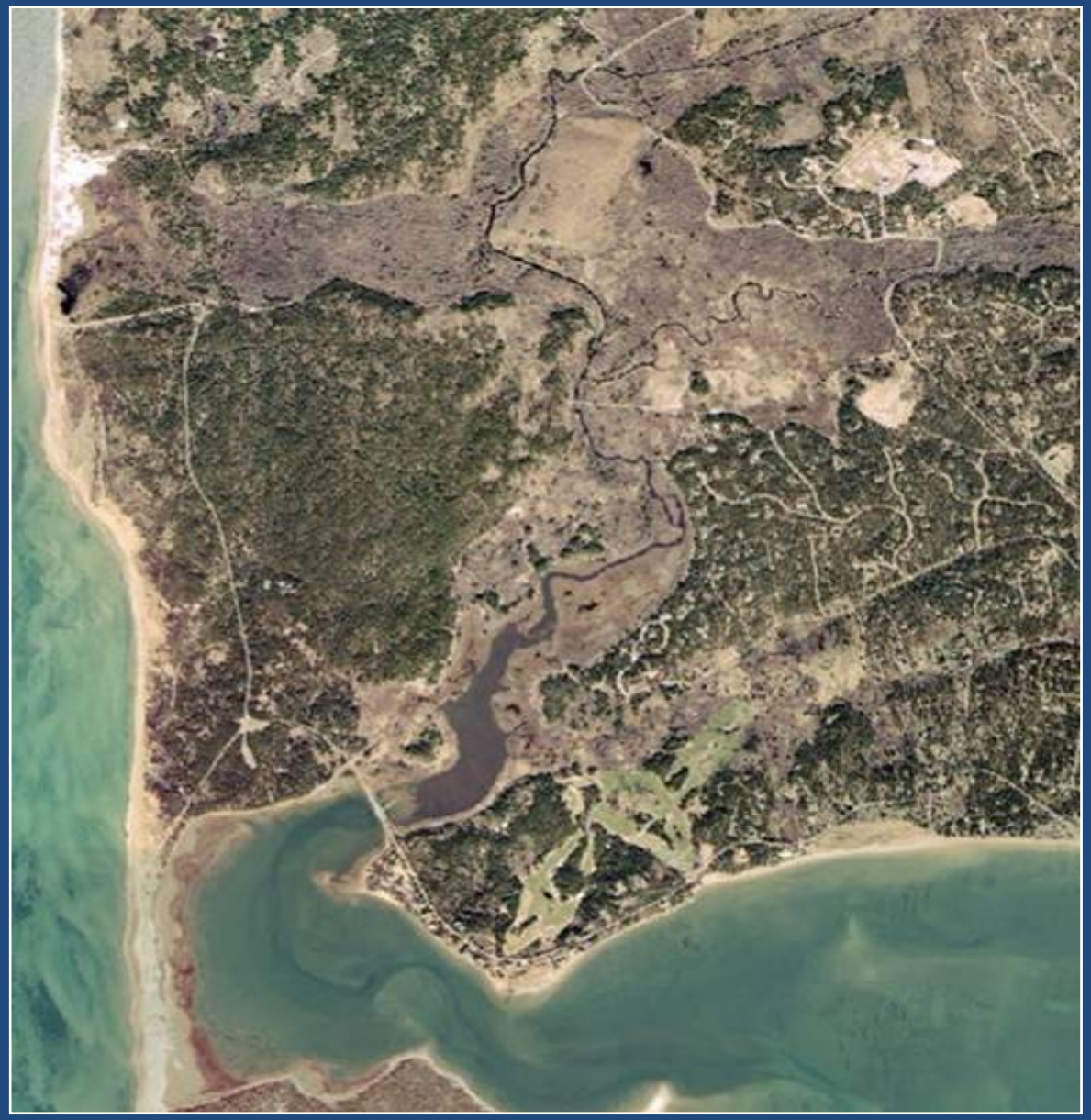



*Allowable FC in shellfish waters:*

***<14 colonies per 100 ml***

# Bacteria Sources?:

- Septic leachate?
  …probably not
- Stormwater runoff
- Wildlife



# *2005 NPS Study: How will tidal restoration affect shellfish water quality?*

***Fecal Coliform, Shellfishing, and Tidal Restoration in Wellfleet's Herring River***

## Observational study:

*How do tides, rainfall and water quality affect coliform bacteria concentrations and survival in the diked Herring River estuary?*

## Assumption:

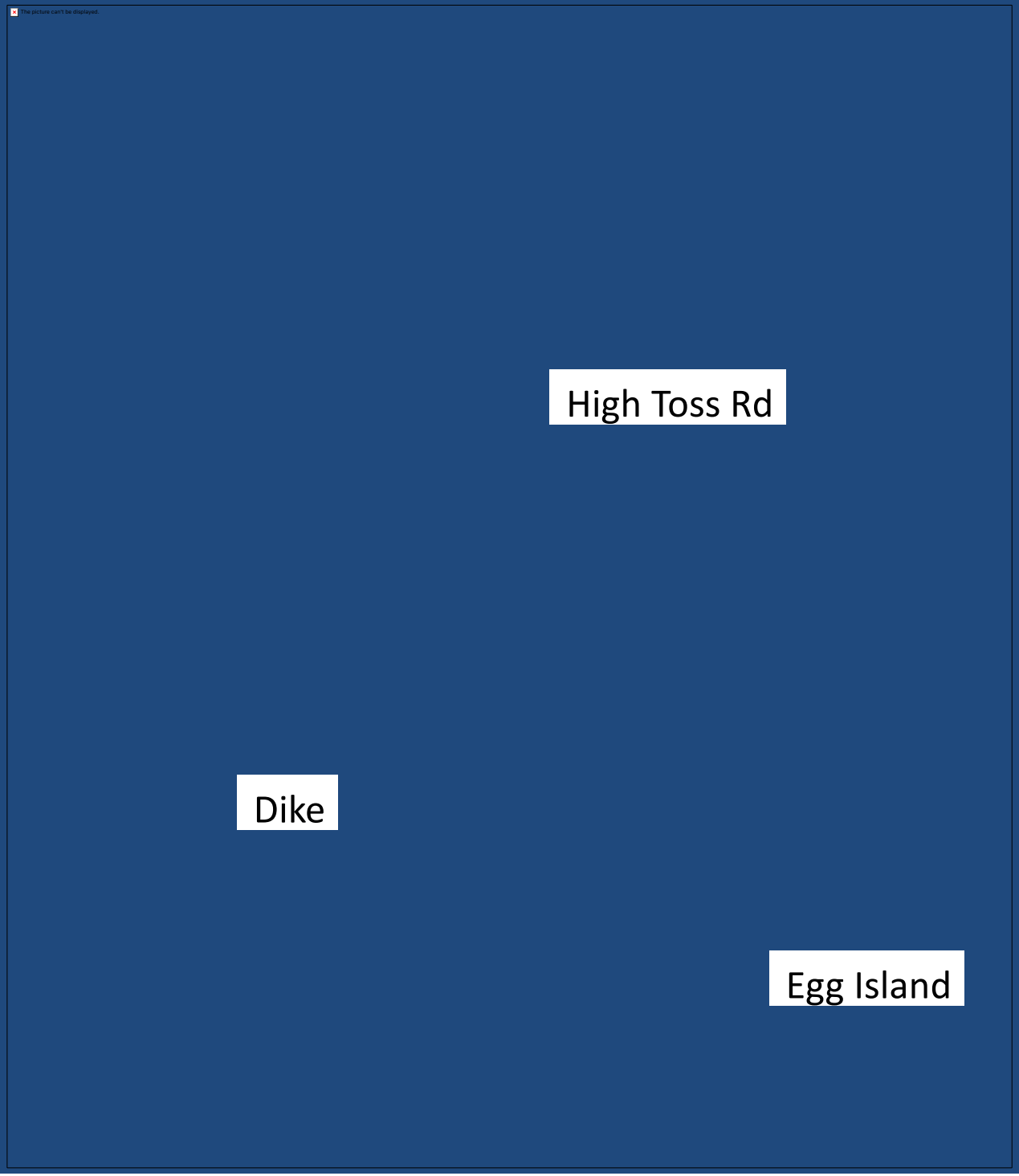
*With tidal restoration, **the source** of bacteria (probably wildlife) is unlikely to change.*

## **Therefore, research question:**

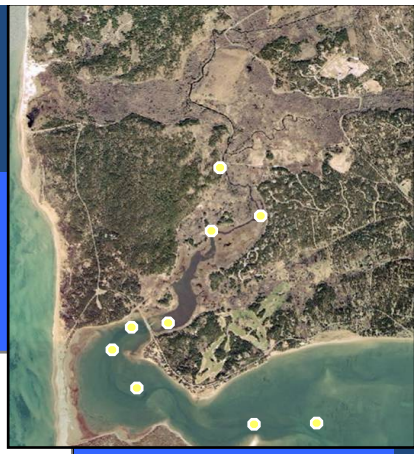
*How would restoration of tidal flow and water quality affect shellfish-water quality?*

# Methods:

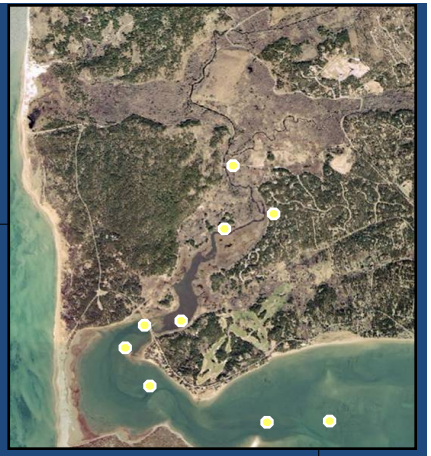
- Nine sampling stations from High Toss Rd to Egg Island.
- Eight sampling dates, May through October 2005.
- Collected samples for fecal coliform, salinity and turbidity in duplicate.



# Highest FC during low tide



# Highest FC above and 1000 m below dike

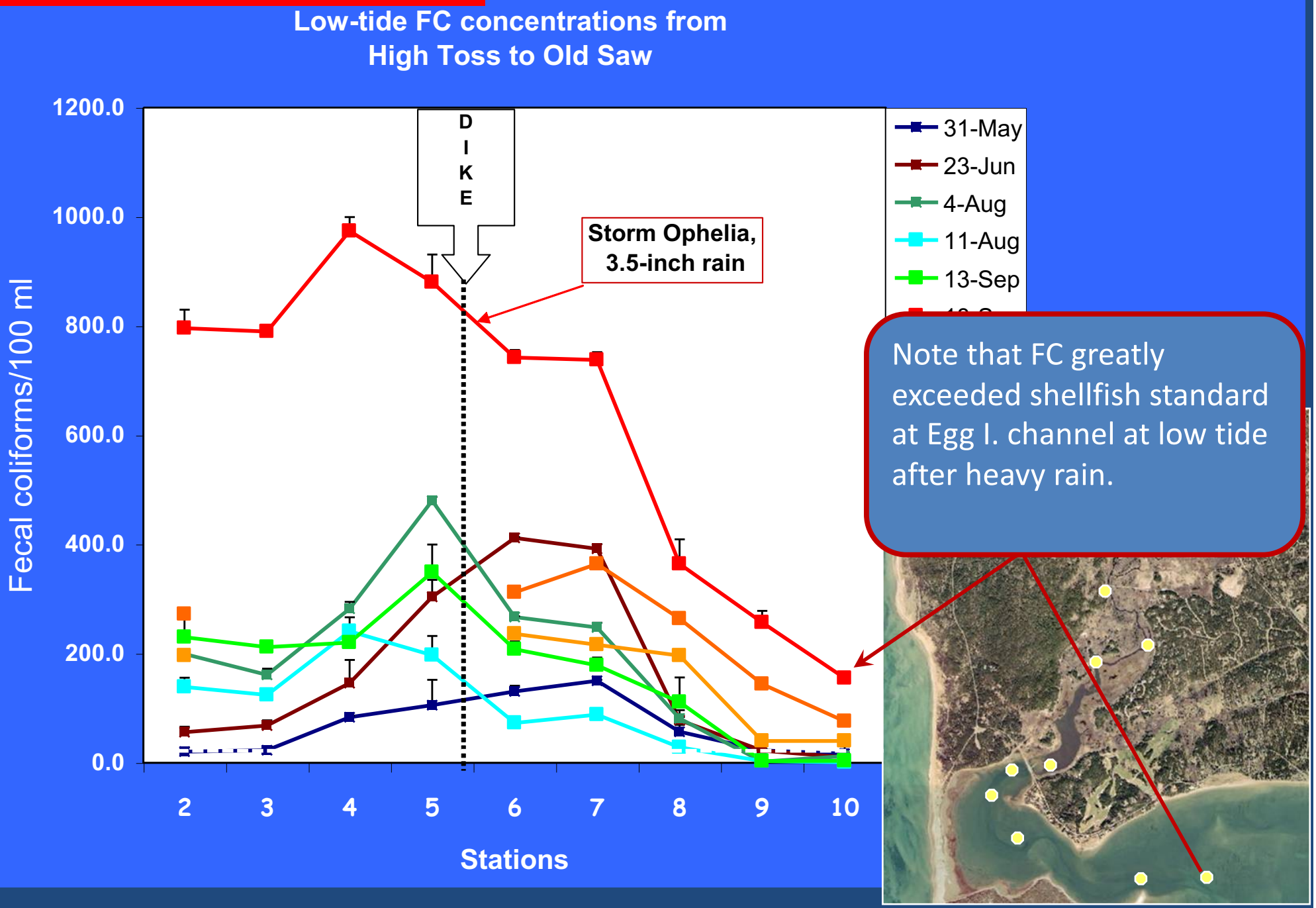


SHELLFISH STANDARD

FC bacteria most concentrated at LOW tide & lowest salinity.

<u>Interpretation</u>: The diked river is the source.

# Effect of heavy rain



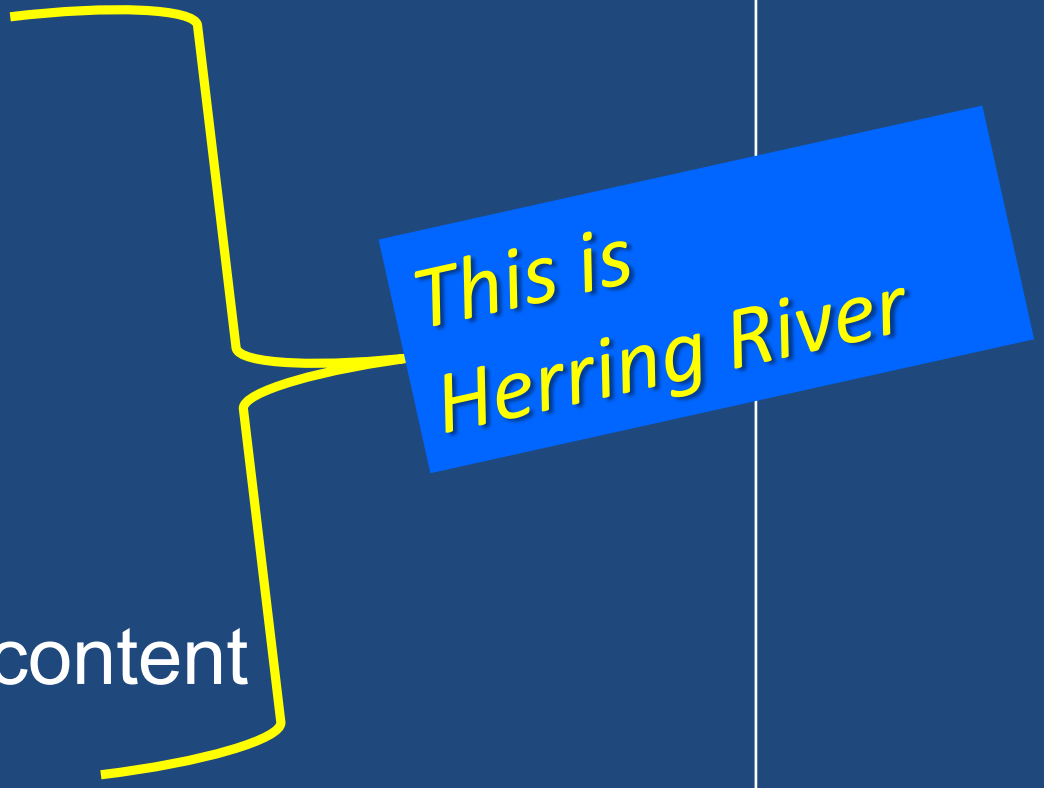
Observation: Heavy rain greatly increases FC bacteria in the river from High Toss Rd to Egg Island.

Interpretation: Bacteria accumulate on the diked & drained wetland surface during dry weather, and are flushed into surface water during rains.

***As it's currently managed,***
***the river is a threat to shellfish harvest on Egg Island***

## Factors extending coliform survival in the environment:

- Low salinity
- Low pH (high acidity)
- Low dissolved oxygen
- High sediment organic content

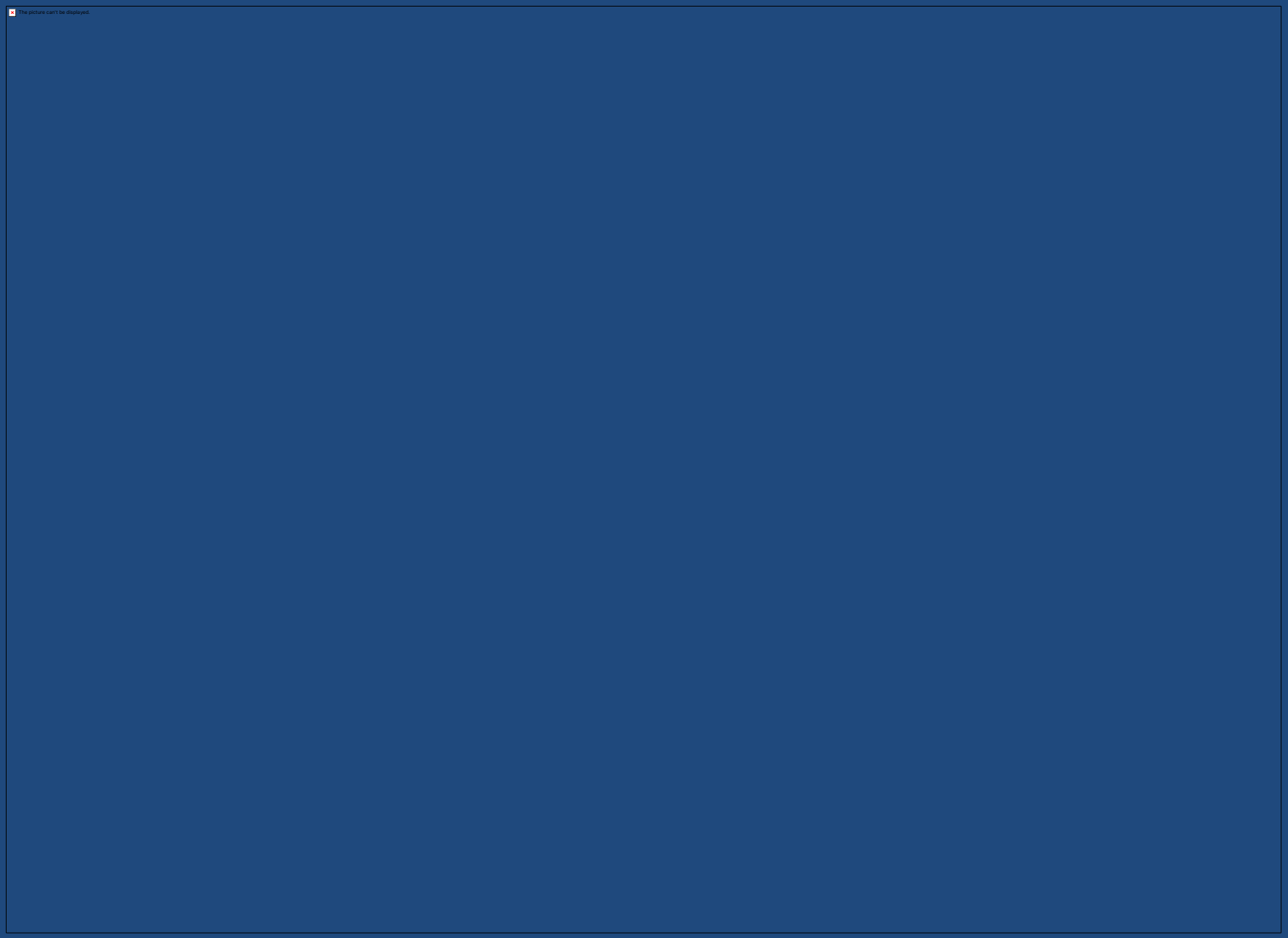


**Tidal restoration** ⟶

- **Dilution of high-FC river water.**
- **Increased salinity, dissolved oxygen & pH.**
- **Increased exposure of bacteria to predation, UV & sedimentation on the wetland surface.**

***All factors that should reduce FC concentration and survival time.***

# *Restored tidal dilution, dry weather:*



# *Restored tidal dilution, wet weather:*

# Conclusions :

1. Fecal coliform (FC) contamination was highest 3000 feet above and below the dike at low tide.

2. Egg Island aquaculture was currently protected (barely) from FC by high-salinity Cape Cod Bay water.

3. Restored river tidal exchange should decrease FC by:
   Dilution with clean seawater.
   Increased salinity, dissolved oxygen and pH.
   Exposure to predation, UV, and sedimentation on the restored wetland surface.

4. Dilution alone may reduce observed FC to levels that would allow the re-opening of presently closed shellfish beds.

# Fecal coliform and other outer Cape tide restrictions

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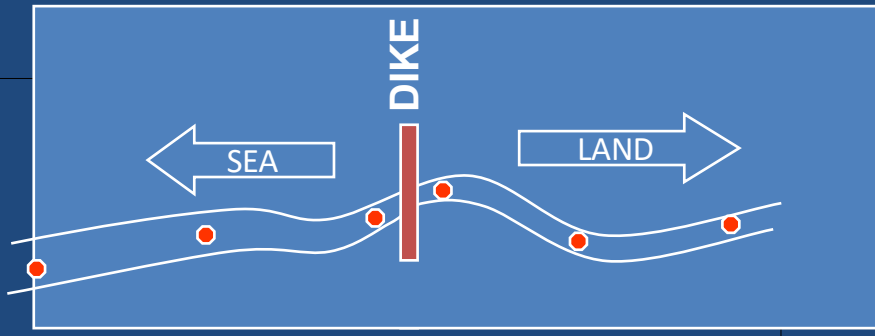

# Fecal Coliform Monitoring (proposed):

- Begin the summer before new construction.
- Stations 2, 6 and 10 = High Toss, Landing, Egg Island channel.
- One low tide per month, May – September.
- Samples collected in triplicate.
- Analysis by Barnstable Co. Lab.