Oyster Pond
Comprehensive Wastewater
Management Plan
Task 2 – Screening of Alternatives
Falmouth, Massachusetts

Presented by:

WRIGHT-PIERCE
Engineering a Better Environment

Oyster Pond CWMP

- **Targeted CWMP to:**
  - Identify water quality needs
  - Identify options/solutions
  - Recommend capital improvements
  - Identify funding mechanisms and schedule

- **Driver is:**
  - Mass. Estuaries Project TMDL
Project Status

- Task 1: Needs Assessment
- Task 2: Screen Alternatives
- Task 3: Develop Recommended Plan

Oyster Pond Information

- Size
  - 63 acres
  - 0 to 6 meters deep
  - 2 to 7 ppt salinity (typ.)
  - 250 – 365 day HRT

- History
  - Kettle holes
  - Sea level rise >3000 yrs ago
  - Longshore drifts (1700s)
  - Railroad (1800s)
  - Oysters no longer survive (early 1900s)
  - New culvert (late 1980s)
  - Weir (1998)
  - Listed as impaired water by DEP (2006)

Source: "A Coastal Pond", K.O. Emery, Fig 4
Key Issues

- Development
  - 160 dwelling units added since 1977

- Water column nitrogen

- Highly variable system
  - Thermal Stratification
  - Density Stratification
  - Trunk River sill

Needs Assessment

- Estimated WW Flows
  - 28,900-gpd, current
  - 34,500-gpd, future

- Reviewed needs
  - Sanitary
  - Water supply protection
  - Surface water protection
  - Convenience & aesthetics
  - Growth
TMDL is 1.44 kg/day TN

Key to approach is to address watershed loads, not just wastewater loads.

To achieve TN TMDL:
- WW - 77% reduction; Non-WW - 0% reduction
  or
- WW - 64% reduction; Non-WW - 33% reduction

Identification of Alternatives
- Non-Structural v Structural
- Source Control v Remediation
- On-Site v Off-Site
- Address N and/or P
- Currently DEP Approved
Alternatives - Source Control (Non-Structural)

- Zoning modifications and growth management
- Fertilizer control
- Water conservation
- Garbage grinder ban
- Septic system maintenance
- Atmospheric/air quality

Alternatives - Source Control (Structural)

- Stormwater BMPs

- Wastewater-related
  - Various methods of collection
  - On-Site (Title 5, I/A systems & Eco-toilets)
  - Off-Site locations
  - Various methods of disposal
### On-Site Systems

<table>
<thead>
<tr>
<th></th>
<th>TN Concentration</th>
<th>% Removal from House</th>
<th>% Removal from MEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>From House</td>
<td>60 mg/l</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>From Title 5</td>
<td>35 mg/l</td>
<td>42%</td>
<td>-</td>
</tr>
<tr>
<td>From Standard I/A</td>
<td>19 mg/l</td>
<td>68%</td>
<td>46%</td>
</tr>
<tr>
<td>From “Advanced” I/A</td>
<td>10 mg/l</td>
<td>83%</td>
<td>71%</td>
</tr>
</tbody>
</table>

### Off-Site Systems

- **Existing Blacksmith Shop Road (BSR) WWTF with disposal out-of-watershed**
- **Existing/ upgraded WHOI WWTF with disposal out-of-watershed**
- **New Decentralized WWTF with disposal in-watershed (87% rem from house, 77% rem from MEP)**
Some sites for:
- Treatment
- Disposal
- Treatment & Disposal

Need to:
- Review with watershed residents
- Review deed restrictions
- Review site-specific information
Concepts for Effluent Disposal

Alternatives - Remediation

- Permeable reactive barriers
- Aquaculture
- Inlet modifications
- Phytobuffers
- Fertigation
- Pond mixing
Pond Mixing

- Aesthetics
- Couple with source reduction
- Demonstration project:
  - Need DEP approval
  - Need MEP modeling
  - Need data collection
- Anticipate:
  - Spend ~$125,000 with 50% probability of saving >$100,000 per year.
Baseline & Alternative Measures

- **Baseline - Included in all plans:**
  - All non-structural source controls
  - Periodic maintenance dredging of Trunk River
  - Stormwater BMPs

- **Alternative - May consider:**
  - Changing water quality criteria
  - Implementing pond mixing
  - Modifying pond compliance elevation
  - Implementing fertigation, phytobuffers
  - Implementing watershed management district

Composite Plans for Screening Analysis

1. Sewer to BSR WWTF
2. Sewer to WHOI WWTF
3. Sewer to Decentralized WWTF
4. Hybrid - BSR WWTF and I/A
5. On-Site (Advanced I/A-10)
6. No Action
Plan 1 – Connect to BSR WWTF

- 172 dwelling units (70%)
- Out of watershed
- Meets TMDL
- Removes signif. TP
- Reduces freshwater recharge by ~4%
- Flow 26,700 gpd (AA)
- Issue: BSR capacity?

Plan 2 – Connect to WHOI WWTF

- 172 dwelling units (70%)
- Out of watershed
- Meets TMDL
- Removes signif. TP
- Reduces freshwater recharge by ~4%
- Flow 26,700 gpd (AA)
- Issue: WHOI interest?
Plan 3 – New Decentralized WWTF

- 213 dwelling units (87%)
- In watershed
- Meets TMDL
- Removes signif. TP
- No change in freshwater recharge
- Flow 32,600 gpd (AA)
- Issue: Site location(s)? Site restrictions?

Plan 4 – Hybrid WWTF & I/A

- 229 dwelling units (94%)
- Out/In watershed
- Meets TMDL
- Removes moderate TP
- Reduces freshwater recharge by ~2%
- Flow 14,000 gpd (AA)
- Issue: BSR capacity?
**Plan 5 – On-Site (I/A-10) Systems**

- 229 dwelling units (94%)
- In watershed
- Meets TMDL
- Removes little TP
- No change in freshwater recharge
- Issues: Will not meet TMDL beyond PH growth. Limited options for I/A systems.

**Plan 6 – No Action**

- “n/a” parcels
- “n/a” dwelling units
- In watershed
- Does not meet TMDL
- Does not remove TP
- No change in freshwater recharge
- Still have to maintain septic system
Principal Commonalities of Plans

- All include “baseline measures”

- All can include “alternative measures”:

  - All can include Eco-Toilets where desired by homeowner and approved by Town

Principal Differences between Plans

- Plans 1, 2, 3, 4 & 5 meet the TMDL; Plan 6 does not.

- Plans 1, 2, 3 & 4 involve sewers and off-site treatment; Plans 5 & 6 do not.

- Plans 1, 2 & 4 remove wastewater from the watershed; Plans 3, 5 & 6 do not.

- Plans 1, 2, 3 & 4 remove significant TP; Plans 5 & 6 do not.
Preliminary Costs

- Developed cost model and unit quantities for system components for current and future needs.

- Used capital and O&M unit costs from Barnstable County Cost Report.

- Included planning-level allowances for site investigations, legal, administrative, technical services and contingencies.

### Preliminary Cost Estimates (PH)

<table>
<thead>
<tr>
<th>Plan</th>
<th>Capital Cost</th>
<th>Equivalent Annual Cost</th>
<th>EAC per Pound N removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan 1 – BSR WWTF</td>
<td>$6.0M</td>
<td>$0.32M</td>
<td>$120</td>
</tr>
<tr>
<td>Plan 2 – WHOI WWTF</td>
<td>$11.1M</td>
<td>$0.70M</td>
<td>$260</td>
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<tr>
<td>Plan 3 – Decentralized WWTF</td>
<td>$13.8M</td>
<td>$0.84M</td>
<td>$310</td>
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<td>Plan 4 – Hybrid WWTF-I/A</td>
<td>$7.2M</td>
<td>$0.93M</td>
<td>$350</td>
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<td>Plan 5 – I/A-10</td>
<td>$9.4M</td>
<td>$1.59M</td>
<td>$590</td>
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<tr>
<td>Plan 6 – No Action</td>
<td>$0M</td>
<td>$0.23M</td>
<td>n/a</td>
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</tbody>
</table>

Equivalent Annual Cost (EAC) includes debt service on capital costs.
### Preliminary Cost Estimates (Current)

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<th>Capital Cost</th>
<th>Equivalent Annual Cost</th>
<th>EAC per Pound N removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan 1 – BSR WWTF</td>
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<td>$100</td>
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<tr>
<td>Plan 2 – WHOI WWTF</td>
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<td>$0.58M</td>
<td>$220</td>
</tr>
<tr>
<td>Plan 3 – Decentralized WWTF</td>
<td>$11.1M</td>
<td>$0.68M</td>
<td>$250</td>
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<tr>
<td>Plan 4 – Hybrid WWTF-I/A</td>
<td>$6.9M</td>
<td>$0.92M</td>
<td>$345</td>
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<tr>
<td>Plan 5 – I/A-10</td>
<td>$8.0M</td>
<td>$1.38M</td>
<td>$520</td>
</tr>
<tr>
<td>Plan 6 – No Action</td>
<td>$0M</td>
<td>$0.23M</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Equivalent Annual Cost (EAC) includes debt service on capital costs.

### Next Steps

- **Meet with Working Group to address comments received from watershed residents**
- **Initiate Task 3 - Develop the Recommended Plan**
  - Shortlist composite plan(s)
  - Account for changes in watershed since MEP
  - Develop a phasing plan
  - Develop a monitoring plan
  - Develop a funding plan (including cost apportionment)
  - Determine consistency with CCC 208 Plan
  - Coordinate with DEP, MEP, MEPA and CCC
Questions & Discussion