Barnstable WRAC

Wastewater Planning Update

Department of Public Works
May 17, 2017
WRAC Proposed Timeline

- June 2016 – Complete Bookends
- Fall 2016
  - Complete Gap filling
  - Complete GIS Mapping Layers
- Winter 2016 through Spring 2017 - Plan Construction
  - Summer 2017 – Complete Draft Plan
  - Fall 2017 – Financial Subcommittee efforts
  - Winter 2017/18 – Update Town Council on Draft Plan
  - Winter and Spring 2018 – Public Outreach and Feedback
  - Summer 2018 update plan
  - Fall 2018 – Present “Final Draft” Plan to Town Council
  - Winter 2018 - Submit Final Draft to CCC and Regulatory Agencies for review
Outline

- Problem Statement
- Nontraditional Solutions
- Traditional Solutions
- WPCF Limitations
- Phasing
- Costs
- Next Steps
- Discussion
The Problem

- Wastewater issues
  - Impaired Embayments
  - Groundwater quality concerns
  - Pond water quality concerns
  - Failing/expensive septic systems
  - Economic development requirements
  - New flood zones
  - Regulatory requirements
Primary Regulation

- Massachusetts Estuaries Program (MEP)
- Collaboration between
  - Massachusetts DEP
  - UMASS-Dartmouth, School for Marine Science and Technology (“SMAST”).
- Watershed/estuary model
  - predicts water quality changes resulting from land use decision
Primary Regulation

- DEP develops **TMDLs**
  - **Total Maximum Daily Loads**
  - Max pollutant a water body can receive and still meet water quality standards
  - “pollutant budget”

- Eelgrass is the sentinel species

- Cape Divided by watersheds
  - Not geo-political boundaries
Average N Removal by Watershed

Target Nitrogen Removal Suggested by MEP

% Nitrogen Removal
- Undetermined
- 0.1% - 34%
- 50.1% - 75%
- 34.1% - 50%
- 75.1% - 100%
- +57%

Not Yet Determined

0 1 2 Miles

Average N Removal by Watershed
<table>
<thead>
<tr>
<th>Subembayment by Watershed</th>
<th>Total Attenuated Controllable N Load (from Barnstable) (kg/yr)</th>
<th>Target (kg/yr)</th>
<th>N Load Reduction Required (by Barnstable) (kg/yr)</th>
<th>% N Reduction Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barnstable Harbor Watershed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barnstable Harbor*</td>
<td>29,963</td>
<td>27,418</td>
<td>7,491</td>
<td>25%</td>
</tr>
<tr>
<td>Centerville River Watershed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centerville River East</td>
<td>19,236</td>
<td>9,022</td>
<td>10,214</td>
<td>53%</td>
</tr>
<tr>
<td>Centerville River West</td>
<td>3,004</td>
<td>3,454</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>East Bay</td>
<td>2,863</td>
<td>3,149</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Scudder Bay</td>
<td>16,235</td>
<td>19,208</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Lewis Bay Watershed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Halls Creek</td>
<td>7,317</td>
<td>13,236</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Hyannis Inner Harbor</td>
<td>5,722</td>
<td>2,716</td>
<td>4,098</td>
<td>72%</td>
</tr>
<tr>
<td>Lewis Bay</td>
<td>3,613</td>
<td>3,527</td>
<td>2,737</td>
<td>76%</td>
</tr>
<tr>
<td>Mill Creek</td>
<td>2,085</td>
<td>8,154</td>
<td>660</td>
<td>32%</td>
</tr>
<tr>
<td>Snows Creek</td>
<td>3,535</td>
<td>5,925</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Stewarts Creek</td>
<td>18,725</td>
<td>15,186</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Popponesset Bay Watershed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pinquickset Cove</td>
<td>344</td>
<td>277</td>
<td>67</td>
<td>19%</td>
</tr>
<tr>
<td>Popponesset Bay</td>
<td>221</td>
<td>664</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Shoestring Bay</td>
<td>4,115</td>
<td>7,194</td>
<td>1,829</td>
<td>44%</td>
</tr>
<tr>
<td>Three Bays Watershed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotuit Bay</td>
<td>7,683</td>
<td>8,153</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>North Bay</td>
<td>9,064</td>
<td>1,631</td>
<td>7,445</td>
<td>82%</td>
</tr>
<tr>
<td>Princes Cove</td>
<td>3,935</td>
<td>792</td>
<td>3,205</td>
<td>81%</td>
</tr>
<tr>
<td>Princes Cove Channel</td>
<td>2,088</td>
<td>281</td>
<td>1,807</td>
<td>87%</td>
</tr>
<tr>
<td>Seapuit River</td>
<td>969</td>
<td>1,375</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Warrens Cove</td>
<td>8,666</td>
<td>7,582</td>
<td>2,518</td>
<td>29%</td>
</tr>
<tr>
<td>West Bay</td>
<td>5,460</td>
<td>5,829</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Rushy Marsh Pond Watershed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rushy Marsh Pond</td>
<td>78</td>
<td>34</td>
<td>44</td>
<td>56%</td>
</tr>
<tr>
<td>Parkers River Watershed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Parkers River</td>
<td>20</td>
<td>3,061</td>
<td>11</td>
<td>55%</td>
</tr>
</tbody>
</table>

* = Assumed

CCC Table
The Plan Needs...

• Multiple solutions working together
  – Title V Systems
  – Traditional Solutions (sewers)
  – Non Traditional Solutions (aquaculture, PRBs, dredging, alternative toilets, etc.)
  – Management Controls (zoning, local regulations)

• Leverage Adaptive management
  – Phase Solutions
Two Macro Approaches

• **Source Reduction**
  – Management Controls (Zoning)
  – Alternative toilets
  – Fertilizer Reduction Ordinance
  – Collect and Treat
    • Collect Wastewater
    • Convey Wastewater
    • Treat Wastewater
    • Dispose of wastewater

• **In-situ Treatment**
  – Address N within the environment
“On which properties is a traditional (Title V) on-site wastewater system an adequate means of providing for the Town’s sanitation and environmental protection, and on which properties is it not?”
Nontraditional Solutions
Nontraditional Solutions - Focus on Three Bays

TEAM

– James Crocker, Town Councilor, Precinct 5
– Dr. Brian Howes, School of Marine Science and Technology, U.Mass. Dartmouth
– Zenas Crocker, Executive Director, Three Bays Preservation, Inc.
– Scott Horsley, Water Resources Consultant
– Dan Santos, Director, Barnstable DPW
– Rob Steen, Assistant Director, Barnstable DPW
Focus Area - Three Bays

Four major components to help remove nitrogen using nontraditional methods.

• Mill Pond
• Abandoned freshwater cranberry bogs
• Warren’s Cove
• Stormwater collection and disposal along the river
Mill Pond

• **The Issue:**
  – Mill Pond is full of silt and debris – 9 feet thick in places
  – In 20 years nitrogen removal capacity has declined from 20% to 10%
  – Healthy ponds = 30% to 50%
  – If 50% restored, estimated remove over 2,200 kg/year of additional nitrogen

• **The Solution:**
  – Dredge to its original depths (sand layer) and perimeter
  – Estimated 60,000 CYs of material (to be confirmed)
  – Pond depths restored to approximately 8 feet in the deepest areas
Abandon Bogs

• **The Issue:**
  – Potential locations for freshwater nontraditional solutions including floating wetlands.

• **The Solution:**
  – 208 plan estimated that floating wetlands can remove 8-15% of the nitrogen they encounter.
Warrens Cove

• The Issue:
  – Warrens Cove has silted in, currently not appropriate for aquaculture.
  – Has potential to be an ideal spot to serve as a nursery for aquaculture farms
  – The product could then be relocated to aquaculture farms in the lower bays

• The Solution:
  – Dredging Warrens Cove back to a sandy bottom
  – Establish aquaculture nurseries
  – The Cape Cod Commission has estimated that aquaculture beds/floating racks can remove 8-15% of the nitrogen they encounter
Stormwater

• The Issue:
  – Stormwater systems are in various states of repair

• The Solution:
  – A comprehensive survey identifying those that need repair, or replacement.
  – Identify new systems/BMP needed to protect water quality
  – Credit for work already done
    • Cotuit Town Dock, etc.
Other Nontraditional Opportunities

• PRBs
  – EPA Demonstration Project
    • Prince Cove Area
• Alternative Toilets
  – Prince Cove
  – Cape Cod Academy
Traditional Solutions
TEAM

– Lindsey Counsell, WRAC Chair
– Brian Dudley, DEP
– Amanda Ruggiero, Assistant Town Engineer
– James Benoit, GIS Manager
– Andy Boule, Division Supervisor Water Pollution Control Division
– Dr. Dale Saad, Senior Project Manager
– Casey Scrima, Intern for Wastewater Affairs
– Dan Santos, Director
– Rob Steen, Assistant Director
Lewis Bay
Three Bays - Lower
Three Bays - Upper
Town of Barnstable, Department of Public Works
Total View

Map printed on: 5/17/2019

Approx. Scale: 1 inch = 6,000 feet

This map is for illustration purposes only. It is not adequate for legal boundary determination or regulatory interpretation. This map does not represent actual ground survey. It may be generalized and may not reflect current conditions, and may contain cartographic errors or omissions.

Parcel lines shown on this map are only graphic representations of Assessor’s tax parcels. They are not true property boundaries and do not represent accurate relationships to physical objects on the map such as building locations.

Legend

Needs Areas:
1. Required for Nitrogen Removal
2. Required for Economic Development
3. Required to be addressed with RMA
4. Requested for Pipes and Wells Protocols
5. Requested Other Needs

Town Boundary
Major Road Centerlines
Railroad Tracks
Water Bodies
Neighboring Towns

Town of Barnstable GIS Unit
267 Main Street, Hyannis, MA 02601
508-862-5224
gis@town.barnstable.ma.us
Other Traditional Opportunities

• Credit for the fertilizer control regulations
• Relocation of public water supply
  – Better protected sites
  – Eliminates difficult Zone IIs
  – Reuse of the current well sites
• Zoning opportunities
  – Potential infill control
  – New growth control
  – Types of growth control
### WPCF Capacity

- **Existing treatment limit ~ 4.2 MGD**
- **Onsite disposal limit ~ 3.0 MGD**
- **Biowin modeling**
- **More in-depth disposal study**

<table>
<thead>
<tr>
<th>Component</th>
<th>Flow Conditions</th>
<th>Capacity (MGD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parshall Flumes</td>
<td>Minimum Flow</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>Peak Hour</td>
<td>15.6</td>
</tr>
<tr>
<td>Aerated Grit Chamber</td>
<td>Peak Hour</td>
<td>20.0</td>
</tr>
<tr>
<td>Primary Clarifiers</td>
<td>Maximum Month</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td>Peak Hour</td>
<td>17.0</td>
</tr>
<tr>
<td>Aeration Tanks</td>
<td>Maximum Month</td>
<td>4.2</td>
</tr>
<tr>
<td>Secondary Clarifiers</td>
<td>Maximum Month</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td>Maximum Day</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>Peak Hour</td>
<td>7.1</td>
</tr>
<tr>
<td>Chlorination Facilities</td>
<td>Peak Hour</td>
<td>13.8</td>
</tr>
<tr>
<td>Sand Infiltration Beds</td>
<td>Maximum Month</td>
<td>6.0</td>
</tr>
</tbody>
</table>
WPCF Existing Flows

<table>
<thead>
<tr>
<th>Flow Component</th>
<th>Sewage (MGD)</th>
<th>Septage (MGD)</th>
<th>Total (MGD)</th>
<th>Time of Occurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Daily Flow</td>
<td>1.54</td>
<td>0.03</td>
<td>1.57</td>
<td>March 1 2012 - Feb 28 2017</td>
</tr>
<tr>
<td>Maximum Daily Flow</td>
<td>2.20</td>
<td>0.12</td>
<td>2.32</td>
<td>July 4, 2014</td>
</tr>
<tr>
<td>Minimum Daily Flow</td>
<td>0.88</td>
<td>0.00</td>
<td>0.88</td>
<td>January 24 2015</td>
</tr>
<tr>
<td>Peak Hour</td>
<td>4.92</td>
<td>N/A</td>
<td>4.92</td>
<td>July 1, 2015</td>
</tr>
<tr>
<td>Maximum Month</td>
<td>1.97</td>
<td>0.05</td>
<td>2.02</td>
<td>July 20 - Aug 18 2012</td>
</tr>
<tr>
<td>Minimum Month</td>
<td>1.24</td>
<td>0.01</td>
<td>1.25</td>
<td>Jan 18 - Feb 17 2015</td>
</tr>
</tbody>
</table>

- Therefore ~1-2 MGD of treatment capacity
- ~1 MGD of disposal capacity
- Some of this is already spoken for
Phasing
Phasing Plan

• Three 20-Year Phases
  – Phase I – Years 0-20
  – Phase 2 – Years 20-40
  – Year 3 – Years 40 -60
Phase Statistics

- Very conservative - No credit for nontraditional solutions
  - Installed in Phase I
  - Monitored throughout Phase I and II
  - Ideally will enable avoidance of Phase III via Adaptive Management

<table>
<thead>
<tr>
<th>Item</th>
<th>Phase 1 (0-20 Years)</th>
<th>Phase 2 (20-40 Years)</th>
<th>Phase 3 (40-60 Years)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>WW Captured (GPD)</td>
<td>637,000</td>
<td>740,000</td>
<td>326,000</td>
<td>1,703,000</td>
</tr>
<tr>
<td>Load N Removed (kg/year)</td>
<td>21,400</td>
<td>26,700</td>
<td>11,800</td>
<td>59,900</td>
</tr>
<tr>
<td>Number of Parcels Affected</td>
<td>3,176</td>
<td>3,781</td>
<td>1,925</td>
<td>8,882</td>
</tr>
<tr>
<td>Road Miles</td>
<td>62</td>
<td>66</td>
<td>38</td>
<td>166</td>
</tr>
<tr>
<td>% N Removed</td>
<td>41%</td>
<td>30%</td>
<td>29%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Town of Barnstable, Department of Public Works
Costs
Cost Estimate Assumptions

- Developed a per mile collection system cost estimate
  - Assumptions
    - One pump station for every 2 miles sewers
    - One mile FM for every pump station
    - Average pipe size is 10 inch diameter
    - Gravity Service to ROW = 1,060
    - Minimal bridge crossing
    - Four foot diameter SMH every 300 feet, age depth 6 feet
    - No Storm Drain as part of this project
    - 10 test pits per mile (~1 every 500 feet)
    - Pave full width, 30 foot width assumed, 1.5 inch top coat, 2.5 inch binder
    - 1,000 feet of waterline per mile needs to be disturbed
    - Five foot sidewalk reconstructed, 1 side, 1/3 of mile
    - Curb reset or replaced for 1/4 of the mile, both sides = 2,640 ft curbing per mile
    - Package Pump Station "neighborhood" sized
    - $25,000 traffic control allowance
    - $15,000 electrical allowance
    - 5% construction contingency
    - 20% technical services
    - 10% land acquisition
  - Results $2.7M/mile
- Cost for plant upgrade assumed at 30% collection system costs
### Potential Costs/Phase

- Very rough, planning level cost estimate
- Predicated on a large number of assumptions
- Nontraditional Solution costs not included

<table>
<thead>
<tr>
<th>Item</th>
<th>Phase 1 (0-20 Years)</th>
<th>Phase 2 (20-40 Years)</th>
<th>Phase 3 (40-60 Years)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Miles</td>
<td>62</td>
<td>66</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Cost per Mile</td>
<td>$2,700,000</td>
<td>$2,700,000</td>
<td>$2,700,000</td>
<td></td>
</tr>
<tr>
<td>Collection System Costs ($)</td>
<td>$167,400,000</td>
<td>$178,200,000</td>
<td>$102,600,000</td>
<td></td>
</tr>
<tr>
<td>Assumed WPCF Cost %</td>
<td>0.00%</td>
<td>30.00%</td>
<td>30.00%</td>
<td></td>
</tr>
<tr>
<td>Assumed WPCF Cost ($)</td>
<td>$0</td>
<td>$53,460,000</td>
<td>$30,780,000</td>
<td></td>
</tr>
<tr>
<td>Total Cost:</td>
<td>$167,400,000</td>
<td>$231,660,000</td>
<td>$133,380,000</td>
<td>$532,440,000</td>
</tr>
</tbody>
</table>

All costs in 2017 dollars
Next Steps

• June – August,
  – WRAC reviews
    • Technical Solutions
    • Phasing
  – Financial Subcommittee
    • Craft the financial plan
  – DPW
    • Submit draft plan to MEP for modeling and confirmation of removals
    • Continue to develop the Nontraditional Solutions and costs
    • Start to write background document

• September, WRAC approves the plan

• October – November,
  – WRAC, develop public outreach plan
  – DPW
    • Update modeling if required
    • Start discussions with regulatory agencies
    • Continue background document
    • Begin preliminary design efforts

• December presentation to Town Council - (workshop?)
• January - August 2018 Public Outreach
• Fall 2018 – Present “Final Draft” Plan to Town Council
• Winter 2018 - Submit Final Draft to CCC and Regulatory Agencies
Special Thanks

• Amanda Ruggiero, Assistant Town Engineer
• James Benoit, GIS Manager
• Casey Scrima, Intern for Wastewater Affairs
Discussion?