The Sewering of an Entire Town
How Chatham Massachusetts is gaining control of wastewater in order to restore the marine environment

Marc Drainville | Senior Manager - Wastewater Processes
Town of Chatham, MA

- Small residential community
- Year-round population – 6,125 (2010 Census)
- Summer population – 3x year-round
- Over 5,000 developed properties
- Year-round fishing industry and heritage
Main issues and challenges

- Extensive use of septic systems in Chatham
- Small, 38-year old, existing WWTF
- Highly seasonal flow variations
- Nitrogen and Phosphorus are causing eutrophication of the coastal estuaries and inland ponds
- Water supplies are becoming impacted
Main issues and challenges
Typical nitrogen sources and contribution percentage

**Total Sources**
- Wastewater: 69%
- Fertilizers: 17%
- Runoff from roads and roofs: 4%
- Atmospheric deposition on ponds & bays: 8%

**Controllable Sources**
- Atmospheric deposition on natural (forest) areas: 10%
- Fertilizers: 5%

**Note:** The percentages add up to more than 100% due to the inclusion of uncontrolled sources.
History of planning process

Massachusetts Estuary Project (MEP) in Southeast MA

Development of Total Maximum Daily Loads (TMDLs)

State Adopts TMDLs in Groundwater & WWTF Discharge Permits

Incorporate TMDLs in Comprehensive Wastewater Management Plan (CWMP)
**CWMP in Chatham**

**Wastewater facilities plan completed in 1982**
- Due to concerns about uncontrolled growth, it did not move forward.
- Consent order in 1987 (by MADEP) to complete the CWMP

**Comprehensive Wastewater Management Plan (CWMP)**
- Started in 1998
- Final CWMP approved in July 2009
- Took over 10 years to complete (waiting for TMDLs)
- 20-year planning period from 2010 to 2030
14-year planning project 1997 - 2011

Primary Components Comprehensive Wastewater Management Plan (CWMP)

- CAC formation and meetings
- Needs assessment
  - All water resources
  - Water and wastewater infrastructure
  - Buildout projections of Town landuse and wastewater flows
- Alternatives identification and screening
- Detailed evaluation and plan development
- Environmental review and approval
**Wastewater** nitrogen that requires removal to meet the nitrogen TMDLs
## Wastewater nitrogen alternatives evaluations

### Summary of typical nitrogen removals for the wastewater management options

<table>
<thead>
<tr>
<th>Technology</th>
<th>Typical nitrogen concentration in the effluent</th>
<th>Typical percent removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title 5 septic system</td>
<td>20 to 40 mg/l</td>
<td>23%</td>
</tr>
<tr>
<td>Individual nitrogen removal septic system</td>
<td>15 to 25 mg/l</td>
<td>50%</td>
</tr>
<tr>
<td>Community/cluster system</td>
<td>5 to 15 mg/l</td>
<td>75%</td>
</tr>
<tr>
<td>Upgraded Chatham WWTF</td>
<td>3 mg/l</td>
<td>93%</td>
</tr>
</tbody>
</table>
Public outreach & participation

- Televised meetings and presentations
- Newsletters
- Town website
Design considerations & phased approach

In order to meet TMDLs in all watersheds

- Required sewer 2/3 of the Town
- Improve WPCF performance
- 3 mg/L total nitrogen discharge limit

Phase 1 (to meet TMDLs)

- Sewer 2/3 of the Town
- 61 sewer sheds
- WPCF Upgrade (expand on existing site)

Phase 2

- Sewer the rest of the Town (a fiscally fair approach)
- Expect 33 additional sewer sheds
- Expand WPCF
Project findings and town guidance

- The CWMP needs to be “growth neutral”
- Decentralized wastewater management is appealing; but not feasible for all parts of Town
- Phase 1 of the plan should allow for sewer extension to meet the TMDLs in first 20 years
- Phase 2 should allow for sewer extension to the rest of the Town in the following 10 years
**Wastewater** plan components

- Sewer extension to approximately two-thirds of Town (Phase 1 area)
- WWTF expansion for the Phase 1 flows, and upgrade to **Enhanced Nitrogen Removal (ENR) standards of 3 mg/l TN** on average to meet the TMDLs in first 20 years
- Allowance for phosphorus removal if needed in the future
- Phase 2 sewer and WWTF expansion in 20 years
Phase 1 & 2 Sewer expansion
Estimated construction costs

<table>
<thead>
<tr>
<th>Phase</th>
<th>Collection System</th>
<th>WPCF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1 Initiate Implementation Remaining Phase 1</td>
<td>$170 M, $20 M, $150 M</td>
<td>$40 M, $40 M, -</td>
</tr>
<tr>
<td>Phase 2</td>
<td>$80 M</td>
<td>$10 M</td>
</tr>
<tr>
<td>Total</td>
<td>$250 M</td>
<td>$50 M</td>
</tr>
</tbody>
</table>
**CWMP initial implementation plan**

- $60 million appropriation in 2009
- Initial implementation of Phase 1 collection system and pump station expansion and upgrade
  - Construct backbone of collection system
- Phase 1 WPCF improvements
- Water quality improvements projects
  - Stormwater remediation projects
- Alum treatment of 2 freshwater ponds
### Project Costs

<table>
<thead>
<tr>
<th>Projects</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>WPCF – Contract 1</td>
<td>$40M</td>
</tr>
<tr>
<td>Pumping Stations – Contract 2</td>
<td>$3M</td>
</tr>
<tr>
<td>Collection System – Contracts 3 &amp; 4</td>
<td>$10M</td>
</tr>
</tbody>
</table>
Funding

- Pay for capital costs with property taxes and the general fund (no betterments)
  - Most affordable way to fund the projects
- American Recovery and Reinvestment Act (ARRA) of 2009
- Evaluated funding options
  - State Revolving Fund (SRF)
  - United States Department of Agriculture (USDA) Rural Development Funding Options

Elected to use
- SRF Funding for Collection System and Pumping Stations
- USDA Funding for WPCF
- Chatham meets the small community threshold
- Received 45% grant of almost $18 million
- Low interest loans
WPCF upgrade design challenges

- Wide range of flow (0.08 – 5.6 mgd) and load
- Very low winter wastewater temperatures – 7°C
- Low effluent nutrient limit (3 mg/L TN)
- Applied LEED principles in the design of the facility
- Compressed design phase to get funding
### WPCF upgrade design & construction timelines

<table>
<thead>
<tr>
<th>Task</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Official design start of final design</td>
<td>July 6, 2009</td>
</tr>
<tr>
<td>Advertise</td>
<td>November 18, 2009</td>
</tr>
<tr>
<td>General contractor’s bid opening</td>
<td>December 22, 2009</td>
</tr>
<tr>
<td>Construction start (notice to proceed)</td>
<td>March 1, 2010</td>
</tr>
<tr>
<td>Substantial completion (liquid stream)</td>
<td>April, 2012</td>
</tr>
<tr>
<td>Substantial completion (entire project)</td>
<td>June, 2012</td>
</tr>
</tbody>
</table>
**WPCF upgrade** flow and load variations

Town Goal – Achieve TN < 3 at all times while collection system grows by:

- Dual piping
- Special valving for denitrification filter influent
- Return activated sludge pumping system
  - Designed for 10 years of use
- Changing operating conditions of oxidation ditch and denitrification filters
- Future ring for Orbal® Oxidation Ditch
- Flexibility for future upgrades
  - Space allowed for additional clarifier, phosphorus removal, process equipment, etc.
Discharge permit

Groundwater discharge permit issued by MADEP in December 2009

Total nitrogen discharge limit

- 3 mg/L (limit of technology) at design average annual flow
- 10 mg/L maximum daily
WPCF before upgrade

WPCF schematics (liquid stream) before upgrade

1. Preliminary Treatment
2. MLE
3. Clarifiers
4. Sand Beds

Return activated sludge
WPCF upgrade Phase 1

WPCF schematics (liquid stream)

- Preliminary Treatment
- Oxidation Ditch (Orbal)
- Clarifiers
- Denitrification Filter
- UV Disinfection
- Sand Beds

Supplemental Carbon
Return Activated Sludge
WPCF upgrade effluent nitrogen results since substantial completion
Closing project status

- WPCF (Phase 1)
  - Substantially completed May 31, 2012 (entire project)
  - Have been meeting discharge permit limits
  - Below original budget and completed on schedule

- Collection System Expansion
  - Completed the initial implementation (Phase 1A)
  - Phase 1B
    - A main pump station upgrade (Stage Harbor PS)
    - Forcemain replacement and sewer extension near State Harbor PS
  - Phase 1C – Extend sewers to new PS constructed as part of Phase 1A
Non-Wastewater plan components

- Targeted stormwater management and remediation
- Fertilizer management
- Pond treatment
- Wetland restoration by eliminating undersized culverts
- Growth-Neutral bylaw
Adaptive Management

- Program intended to monitor success of the implementation of the CWMP
- Intended to monitor program over life of the plan (20 years)
Acknowledgement

Dr. Robert Duncanson
Director of Chatham’s Department of Health & Environment

Val Peter
Water and Sewer Project Manager of Chatham

Michael Keller
Chief Wastewater Operator of Chatham WPCF

Thank you for your contributions!
Initial implementation
Continuing challenges

- Chatham Concerned Taxpayers Assn., and challenge to MassDEP and MassEOEEA approvals
- Conservation Law Foundation (CLF) legal action against USEPA and Barnstable County challenging the Nitrogen TMDLs
Thank you