

Chapter 6

Alternatives Identification and Screening Approach

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ALTERNATIVES IDENTIFICATION AND SCREENING APPROACH

6.1 INTRODUCTION

The following chapters include identification and screening of alternative technologies, sites, and management plans to be used in detailed evaluations in the final phases of this Project, the development of the Wastewater Management Planning Project. This chapter describes the approach and criteria for identifying and screening alternative technologies and sites. The screening of the technologies discussed in subsequent chapters will be summarized in Chapter 14.

6.2 METHODOLOGY FOR IDENTIFICATION AND SCREENING OF ALTERNATIVE TECHNOLOGIES

The following seven groups of alternative technologies, facility sites, and management concepts will be identified and screened:

- On-site drinking water and wastewater treatment technologies.
- Community/municipal drinking water and wastewater treatment technologies.
- Collection system technologies.
- Treated water recharge technologies.
- Potential sites for water supply, wastewater treatment and recharge facilities.
- Flow and loading reduction alternatives.
- Additional non-wastewater nitrogen mitigation alternatives.

Each of these groups is briefly introduced and discussed below.

A. **On-Site Drinking Water Supply Technologies.** The on-site drinking water technologies are discussed further in Chapter 7. Technologies that will be identified include reverse osmosis. The reverse osmosis technology evaluated is a point of use technology which would be implemented in

individual homes Alternatives to this technology for on-site use, including bottled water supply, will be discussed as well.

B. On-Site Wastewater Treatment and Recharge Technologies. On-site treatment and treated water recharge technologies are defined as technologies that are regulated under both the Title 5 regulations for flows less than 10,000 gallons per day (gpd) and by the Groundwater Discharge Permit (GWDP) Regulations for small treatment facilities that treat flows greater than 10,000 gpd. On-site alternatives are typically used for individual units. The following on-site treatment and treated water recharge technologies will be identified and screened (this list is based on MassDEP's summary of innovative and alternative [I/A] technologies approved for use in Massachusetts as of September 2008).

1. Individual and Multiple Unit Systems for Flows Less Than 10,000 gpd.

a. **On-Site Systems.** Approved for general use, but not credited for nitrogen removal, which include:

- Title 5 septic systems.
- JET aerobic wastewater treatment.
- Orenco sand filters.

b. **On-site nitrogen removal systems.** Also called I/A technologies, which can be grouped into three categories:

- Nitrogen removal systems approved for general use by MassDEP in nitrogen-sensitive areas, including:
 - Recirculating sand filters that comply with Title 5
 - RUCK[®] systems (for flows less than 2,000 gpd)
- Nitrogen removal systems approved for provisional use by MassDEP in nitrogen-sensitive areas, including:
 - Bioclere (for flows less than 2,000 gpd)
 - MicroFAST, High Strength FAST, NitriFAST, and Modular FAST
 - Waterloo Biofilter
 - Amphidrome Process

- AdvanTex[®]
- NITREX[™]
- Nitrogen removal systems approved for piloting use by MassDEP in nitrogen-sensitive areas, including:
 - SeptiTech
 - Norweco Singulair
 - RUCK[®] CFT
 - Cromaglass WWT System
 - Omni Recirculating Sand Filter
 - Bio Barrier Membrane Bio-Reactor WWT System
 - NITREX[™] - Plus

2. **Non-Discharge Systems.**

- a. **Tight Tanks.**
- b. **Waterless Toilets (Composting and Incinerating).**
- c. **Urine Source Separation.**

These technologies will be described and screened based on their suitability in Eastham for individual unit applications based on the criteria described in this chapter.

C. Community/Municipal Drinking Water and Wastewater Treatment Technologies. This group includes community/municipal wastewater treatment technologies including cluster systems, residuals (sludge), and management technologies and concepts. Connection to a regional wastewater facility will also be considered and will be discussed in a later chapter. This group also includes municipal drinking water supply systems.

1. Community/Municipal Wastewater Treatment Alternatives. Community/municipal wastewater treatment technologies are defined as technologies designed to handle grouped flows from various locations/watersheds in the Town or to serve Eastham on a Town-wide basis (cluster systems are an example of community/municipal systems). Standard community/municipal treatment system components include preliminary and primary treatment, secondary/advanced

treatment, and treated water recharge. Systems may also include flow equalization, effluent filtration, and effluent disinfection depending on the type of treatment process, the facility location, and permitting requirements as set by MassDEP. The following list summarizes the community/municipal treatment technologies which will be considered and screened in this report in Chapter 8:

a. **Secondary/Advanced Treatment.**

- 1) Modified Ludzack-Ettinger (MLE) activated sludge process.
- 2) Rotating biological contactors.
- 3) Sequencing batch reactors.
- 4) Amphidrome system.
- 5) Membrane bio-reactors.
- 6) Oxidation ditches.
- 7) Aerated biological filters.
- 8) Denitrification filters.

b. **Technologies Used to Achieve Less Than 3 mg/L Total Nitrogen.**

- 1) Adsorption.
- 2) Advanced oxidation technologies.
- 3) Precipitation.
- 4) Ion exchange.
- 5) Breakpoint chlorination.
- 6) Membrane filtration.

c. **Technologies to Remove Endocrine Disruptors.**

- 1) Coagulant-assisted granular media filtration.
- 2) Lime clarification/reverse osmosis.
- 3) Microfiltration/reverse osmosis.

d. **Considerations on Treatment for Phosphorus Technologies.**

- 1) Biological uptake.
- 2) Chemical precipitation through addition of iron or aluminum salts.
- 3) Filtration.

e. **Disinfection Technologies.**

- 1) Chlorination.
- 2) Ozone.
- 3) Ultraviolet radiation.

2. **Residual Management.** Several residual management technologies are identified and screened (Chapter 8) based on their suitability for the Town of Eastham according to the criteria identified in this chapter. Disposal alternatives for septage, trap grease, screenings, and grit will be identified and discussed. Sludge treatment, management, disposal, and reuse alternatives that will be evaluated and screened include:

a. **Sludge Thickening and Disposal at a Regional Facility.**

b. **Sludge Dewatering and Disposal at a Regional Facility.**

c. **Sludge Dewatering and Composting and Distribution to the Public.**

d. **Land Application of Sludge.**

3. **Alternative Treatment Sites.** Several alternative sites are identified, described, and screened in this Chapter 11.

4. **Municipal Drinking Water Supply System.** A municipal drinking water supply system is defined as a town-wide public drinking water supply system that would service every parcel in the Town of Eastham. These systems are reviewed in Chapter 8.

D. **Collection System Technologies.** The following collection system technologies will be evaluated and screened in Chapter 9:

- Gravity sewers and lift stations.
- Pressure sewers with grinder pumps.
- Septic tank effluent sewers.
- Vacuum sewer systems.

E. **Treated Water Recharge Technologies and Sites.** This group of alternatives will identify and screen technologies and potential sites to recharge the treated water back to the natural environment. The following technologies will be investigated in Chapters 10 and 11:

- Sand infiltration beds.
- Subsurface infiltration.
- Spray irrigation.
- Well injection.
- Wick well technology.
- Drip irrigation.
- Ocean outfall.
- Wetland restoration.

F. **Screening of Wastewater Management Technologies.** The wastewater management technologies will be described to allow the reader to understand the technology and related process. Advantages and disadvantages will be presented. The screened technologies will then have system characteristics summarized with respect to a set of standard criteria to allow a side-by-side comparison. The summary is typically in the form of a tabular matrix and will end with a recommendation to either eliminate the technology or retain it for further evaluation. The following is a summary of the standard criteria that will be used for screening alternative technologies:

1. **Environmental Factors.** The ability of each technology to address environmental concerns will be considered.

2. **Legal, Administrative, and Financial Criteria.** The administrative oversight and financial needs of each technology or management plan will be discussed.

3. **Relative Costs.** Relative capital costs for each alternative will be identified and compared to the other alternatives. Costs to operate and maintain a typical installation of an alternative will be identified and compared to other alternatives.

4. **Flexibility.** Flexibility of a treatment system relates to the ability of that system to respond to seasonal or future changes in flows, loads, and effluent requirements.

5. **Energy Use.** Energy used to operate an alternative will be noted and compared to the other alternatives.

6. **Effluent Quality.** Wastewater treatment systems provide various degrees of pollutant removal of BOD, TSS, and nitrogen. The expected effluent quality for each treatment technology will be identified and compared.

7. **Regulatory Requirements.** This criterion includes a discussion regarding the permits, variances, and monitoring requirements of federal, state, regional, and local regulatory agencies.

8. **Potential for Odors.** The potential for odors and other air emissions from treatment systems will be discussed.

9. **Land Requirements.** The estimated amount of land needed for each alternative treatment system will be discussed.

10. **Anticipated Public Acceptance.** This criterion involves how the public may react to a specific type of treatment system. Major public concerns regarding these alternatives are expected to include relative cost of installation, visibility, potential for odors, operation and maintenance requirements, and the perceived impact of proposed facilities on neighboring residents.

11. **Ease of Implementation.** Implementation issues will be discussed, such as methods the Town could use to monitor and operate on-site systems or treatment plants over the expected lifetime of the treatment system. Management issues to be discussed include public or private ownership of treatment facilities, obtaining land for multiple home treatment sites, and Town regulations needed to address the potential administrative issues.

12. **Potential for Promoting Additional Water Consumption.**

13. **Anticipated Maintenance Requirements.** This criterion is related to the complexity and number of mechanical components of each treatment process.

14. **Complexity of Operation.** Long-term reliability and the level of skill needed to maintain a technology will be considered. Reliability and technical feasibility of a process or plan is a function of how consistently it is expected to function and to achieve required effluent limits. In general, long-term reliability decreases as the complexity of mechanical equipment increases.

G. **Flow and Loading Reduction Alternatives.** These are alternatives to reduce wastewater flows and loadings and thereby reduce costs for construction and operation of wastewater facilities. The following alternatives and management opportunities will be reviewed for potential application in Eastham:

- Reduction of household water consumption.
- Wastewater reuse and recycling.
- Reduction of wastewater loadings.
- Waterless toilets.

H. **Non-Wastewater Nitrogen Mitigation Alternatives.** These are non-wastewater alternatives and opportunities to mitigate nitrogen loadings to the watershed and include:

- Fertilizer and pet waste management.
- Watershed modifications and constructed wetlands for nitrogen attenuation.
- Stormwater management and treatment.
- Improved flushing.
- Modified zoning.
- Nitrate barrier wall considerations.

These alternatives are screened and the feasible options are recommended for further consideration.