Chapter 3

Surface Water Supply Development

Acronyms used in this chapter:

MassDEP - MA Dept. of Environmental Protection
MEPA - Massachusetts Environmental Policy Act
DCR – Dept. of Conservation and Recreation
THM – trihalomethane
SWTR - Surface Water Treatment Rule

Chapter 3
Surface Water Supply Development

A surface water supply includes all tributary streams and drainage basins, natural lakes, and artificial reservoirs or impoundments used as sources of water by a public water system. In selecting the source to be developed, the design engineer must prove to MassDEP's satisfaction that an adequate quantity of water will be available and that the water delivered to consumers will meet all state drinking water standards with respect to microbiological, physical, chemical, and radiological qualities. Each water system should draw its raw water from the best available source that is economically reasonable and technically possible.

Massachusetts general law requires water suppliers to obtain the consent and approval of MassDEP before acquiring lands for the construction, operation, or protection of a water supply. The land acquisition requirements in Section 4.16, items 2 through 5, in Chapter 4 of these Guidelines, are also applicable to surface water supplies

3.1 Source Approval Process

Prior to placing a new or inactive surface water source on-line, the proponent shall apply for and obtain new source approval from the MassDEP Drinking Water Program. The Source Approval process, including applicable permits, shall be applied by MassDEP for the following:

1. A new surface water source (includes existing private surface water sources converted to public water supply use);

2. An increase in the approved Firm Yield of an existing public water supply source, or an exceedance of the Firm Yield;

3. The reactivation of a public water supply source that has been off-line per order of MassDEP;

4. The reactivation of a public water supply source not in use for the last 5 years;

5. An expansion of an existing approved source.

The expansion of an existing approved source shall include any proposed activities that would increase the surface area of the reservoir at full reservoir capacity and/or that would potentially increase the Firm Yield of the reservoir (whether or not a Firm Yield has already been approved by MassDEP). Proposed modifications that would potentially decrease the Firm Yield do not require new source approval; however, the proponent shall notify the MassDEP Water Management Program of any such modifications. In addition to physically expanding the lateral

dimensions of a reservoir, expansions requiring the application for new source approval shall include but not be limited to the following:

1. Lowering of the intake;

2. Dredging to increase useable storage volume from the volume that existed when the source was initially approved by MassDEP;

3. Increasing the public water system's volumetric pumping capacity from the source (either through the installation of greater capacity pumps and/or improvements in piping);

4. Raising the main spillway elevation (does not include routine changes in spillway elevations for existing spillway structures that have multiple elevation settings).

Step 1: Submit Preliminary Report

The public water supplier must submit a report to MassDEP that includes the following:

1. Topographic map showing the exact locations of the proposed source and the proposed intake;

2. Map of appropriate scale delineating the tributaries and Zones A, B, and C as described in the definitions section;

3. Identification of land uses in the watershed and identification of the land owned or controlled by the public water supplier;

4. Estimated average daily demand and peak daily demand;

5. Schedule for development of the source;

6. Detailed estimated cost of operation, maintenance, and operating expenses;

7. Proposed methods to finance both capital charges and operating expenses.

Step 2: Conduct Site Visit

MassDEP will conduct a site visit after the water supplier has gathered the proper information from the property owners and obtained any necessary approvals for visiting the site. At the site exam, MassDEP will evaluate the proposed sampling locations and schedule to be used during the development of the source.

Step 3: Attend Coordination Meeting

MassDEP will arrange a coordination meeting with the programs whose approval may be needed. Meeting participants will include, but not be limited to:

1. MassDEP Wetlands Program (including dredging program);
2. MassDEP Water Management Act Program;
3. MEPA Office;
4. DCR (concerning the safety of existing dams or surface impoundments);
5. Department of Fish and Game Natural Heritage Program;
6. Army Corps of Engineers.

The main goal of this meeting is to establish a schedule for getting the necessary approvals from all programs involved.

Step 4: Submit Formal Documentation

The following information must be submitted to MassDEP before a new surface water source can be approved:

1. Firm Yield Analysis - For stream dominated sand and gravel reservoirs, the firm yield will be estimated by using the firm yield model as described in the Water Management Program document Estimating the Firm Yield of a Surface Water Reservoir Supply System in Massachusetts, A Guidance Document, Version 1.0, January 1996. An on-line version of the firm yield model is available at: http://www.mass.gov/dep/water/resources/watercon.htm#managemt. For non-stream-dominated reservoirs the proponent should contact MassDEP to discuss an acceptable firm yield assessment approach. One alternative approach for establishing the firm yield for a non-stream-dominated reservoir is to conduct a pumping test that meets the following criteria:
    a. The pumping test shall be conducted for a minimum of 30 days.
    b. The pumping test shall be conducted at 133% of the rate at which approval is sought.
    c. The approved pumping rate will be based on the rate at which stabilization occurs.
    d. Reservoir water level measurements will be taken twice daily (frequency of measurements will be at least 8 hours apart).
    e. Stabilization will have been achieved when either:

(1) Drawdown readings do not fluctuate more than 0.5 inch in the last 24 hours of the test;

(2) When using a semi-log plot extrapolation of the time-drawdown curve derived from the pumping test and projected over a 180- day period, 10% of the water height between the top of the intake and the static water level remains above the intake.

f. As constant a pumping rate as possible shall be maintained for the duration of the pumping test. The pumping rate shall not fluctuate more than 10% during the final 10 days of the pumping test, excluding shutdowns.

g. One pump shutdown per day not to exceed 1 hour shall be allowed during the 30-day test period. If the shutdown criteria are exceeded, MassDEP will require the pumping test to be rerun; therefore, backup pumping equipment is recommended.

h. A flow-measuring device capable of providing instantaneous flow measurements accurate to within ±3% of the pumping rate shall be used.

i. The discharge from the pumping test shall be located to minimize the recirculation of water. Any groundwater discharge permits should be obtained prior to commencement of the pumping test.

j. Daily static water level measurements will commence 7 days prior to pumping test startup.

k. The pumping test should be conducted during low water level conditions.

l. Precipitation during the pumping test should be measured on-site to the nearest one-hundredth (0.01) of an inch. Precipitation measurements should commence 7 days prior to pumping test startup.

m. Recovery readings shall be taken twice daily (frequency of measurements at least 8 hours apart) for a period of no less than 10 days following pumping test shutdown.

2. Hydrogeologic Report - Discuss the hydrogeologic system providing recharge to the reservoir and include a delineation of the drainage basin. If applicable, a fracture trace analysis of the reservoir area should be provided.

3. Identification of Dredging Impacts (if applicable)

4. Water Quality Monitoring Report - The water supplier must submit a report describing the required monitoring at this time. The water supplier may also elect to perform any additional monitoring required by *Policy 90-04, Pilot Study Requirements for Proposed Treatment*.

The water supplier must conduct the following monitoring at a location as close as possible to the proposed intake:

a. Fecal and Total Coliform - Weekly for 1 year. (If interested in filtration waiver, frequency of sampling is population-dependent (3 - 5 times/week).)

b. Turbidity, Color, Odor, Temperature, Suspended and Total Dissolved Solids – Weekly. (If interested in a filtration waiver, turbidity must be done daily for one year.)

c. Secondary Contaminants (as listed in Appendix A) - Addressing reservoir turnover, typically spring and fall.

d. All SDWA Contaminants - Taken during spring turnover.

e. Total Organic Carbon – Seasonally.

f. Giardia and Cryptosporidium - Every other month.

g. Nitrogen Series (nitrate, nitrite, ammonia) – Monthly.

h. THM Formation Potential - Monthly in July, August, and September.

i. Algae - Monthly throughout the year at intake, major tributaries and at one or more locations in the reservoir.

j. Perchlorate – One sample collected during low flow conditions in August, September, or October.

5. Watershed Resource Protection Plan - Guidance can be found in the document *Developing a Local Surface Water Supply Protection Plan*, MassDEP, 2000, or as amended.

6. Zone A Surface Water Protection Zoning and Non-Zoning Controls – New or physically expanded surface water sources and sources that are increasing their withdrawal by more than the threshold volume as defined by 310 CMR 36.00 shall demonstrate compliance with Surface Water Supply Protection Regulations (310 CMR 20.20C).

7. Proposed Treatment Plan - Every surface water supply is subject to the federal Surface Water Treatment Rule (SWTR), as written in 310 CMR 22.20A of the Massachusetts Drinking Water Regulations. The water supplier must submit a report discussing how it plans to meet the requirements of the SWTR. If planning to filter, treatment of the source must be determined through piloting according to *Policy 90-04, Pilot Study Requirements for Proposed Treatment*.

If a public water supplier is interested in a filtration waiver as specified in 310 CMR 22.20A, the water supplier must pursue development of a Watershed Protection/Control Program. The program must meet the criteria defined in the program to measure success of watershed protection efforts conducted by public surface water suppliers to obtain, and maintain, a waiver from filtration requirements (current version), and *Developing a Local Surface Water Supply Protection Plan*, MassDEP 2000 (or as amended). This program must be developed on a dual track with the treatment plant design. The water supplier must meet all criteria to avoid filtration. In addition, the water supplier must discuss how the system will provide disinfection in the interim if a waiver from filtration is pursued.

8. Operation and Maintenance Manual - for management of the source.

3.2 General Reservoir Construction

Construction and Maintenance

1. Reservoirs must be constructed to ensure that:

    a. Water quality is protected by controlling runoff into the reservoir;

    b. Dikes are structurally sound, free of significant vegetation, and protected against wind action and erosion;

    c. The point of influent flow is separated from the point of withdrawal;

    d. Separate pipes are provided for influent to and effluent from the reservoir;

    e. The volume of water in storage can be determined at all times.

2. Dams must receive appropriate safety approval from DCR.

3. Construction may require:

    a. Approval from MassDEP and DCR, as necessary, of the safety features for stability and spillway design; and/or

    b. A permit from the MassDEP and other regulatory agencies for controlling streamflow or installing a structure on the bed of a stream or interstate waterway.

Site Preparation (if applicable)

Site preparation for the reservoir shall include, where applicable:

1. Removal of brush and trees up to high water elevation;

2. Protection from floods during construction;

3. Proper abandonment and decommissioning (Section 4.14) of all wells and other structures or other facilities that will be inundated;

4. Erosion minimization during development of the source.

Intake Structures and Design

Intake structures and design shall include:

1. Intake screens;

2. Withdrawal of water from more than one level if quality varies with depth;

3. Separate facilities for release of less desirable water held in storage;

4. Where ice may be a problem, holding the velocity of flow into the intake structure to a minimum, generally not to exceed 0.5 feet per second;

5. Manholes every 1000 feet for pipe sizes large enough to permit visual inspection;

6. Cleaning of the intake pipe and screen, as needed;

7. Adequate protection against rupture by ice and other potential hazards;

8. Location of the intake above the bottom of the stream, lake, or impoundment, but at sufficient depth to be kept submerged at low water level.

3.3 New Feeder Reservoirs

1. The water supplier must meet all applicable requirements in Chapter 3 of these Guidelines.

2. Proposals for new feeder reservoirs must address physical and chemical changes to the terminal reservoir and any effects on existing treatment.

3. Both the terminal reservoir and the feeder reservoir must be monitored during the approval process.

4. The water supplier should meet with the appropriate MassDEP Regional Office to discuss the specific reporting requirements for the proposed feeder reservoir prior to submitting the Preliminary Report.