DRAFT ENVIRONMENTAL IMPACT REPORT
for the
TOWN OF NORTH READING, MA

February 2016

APPENDICES

WRIGHT-PIERCE
Engineering a Better Environment

TOWN OF NORTH READING

DRAFT ENVIRONMENTAL IMPACT REPORT

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Wright-Pierce
Engineering a Better Environment

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December 7, 2012

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS ON THE ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME	: New Water and Wastewater Solutions
PROJECT MUNICIPALITY	: North Reading
PROJECT WATERSHED	: Ipswich
EEA NUMBER	: 14975
PROJECT PROPONENT	: Town of North Reading
DATE NOTICED IN MONITOR	: November 7, 2012

Pursuant to the Massachusetts Environmental Policy Act (M.G.L. c. 30, ss. 61-62I) and Section 11.03 of the MEPA Regulations (301 CMR 11.00), I hereby determine that this project **requires** the preparation of a mandatory Draft Environmental Impact Report (DEIR).

<u>Project Description</u>

As described in the Environmental Notification Form (ENF), the Town of North Reading (the Town) has commenced an investigation of alternative drinking water supply sources outside the Ipswich River basin to provide a reliable and safe long-term water supply. Concurrently, the Town commenced an investigation of alternative wastewater disposal options including alternatives outside the Town and the Ipswich River basin. The Town intends to pursue full-time membership as a Massachusetts Water Resources Authority (MWRA) water system customer. Membership as an MWRA wastewater customer is not a viable option given the capacity constraints on the existing MWRA wastewater treatment system.

According to the ENF, the Town currently withdraws approximately 0.50 million gallons per day (mgd) from its own groundwater wells and purchases approximately 1.0 mgd from the Town of Andover through an Interbasin Transfer Act (IBTA) approval.[1] The Town currently has a 0.96 mgd Water Management Act (WMA) Registration for a withdrawal from the Ipswich River basin. The Town intends to forfeit this WMA Registration to the Massachusetts Department of Environmental Protection (MassDEP) upon approval of MWRA membership and proven ability to utilize MWRA water. Wastewater within the Town is presently treated through the use of on-site septic systems. The Town is seeking alternative discharge and treatment options for approximately 0.50 mgd of wastewater.

Jurisdiction and Permitting

This project is subject to MEPA review and requires the preparation of a mandatory EIR because it requires a State Agency Action and exceeds several MEPA EIR review thresholds including:

- New interbasin transfer of water of 1,000,000 or more gpd or any amount determined to be significant by the Water Resources Commission (301 CMR 11.03(4)(a)(2));
- Provided that the Project is undertaken by an Agency, New water service to a municipality or water district across a municipal boundary through New or existing pipelines, unless a disruption of service emergency is declared in accordance with applicable statutes and regulations (301 CMR 11.03(4)(a)(4));
- Construction of one or more New sewer mains ten or more miles in length (301 CMR 11.03(5)(a)(3)); and
- Provided that the project is undertaken by an Agency, New sewer service to a municipality or sewer district across a municipal boundary through New or existing pipelines, unless an emergency is declared in accordance with applicable statutes and regulations (301 CMR 11.03(5)(a)(4));

The project will require several permits from MassDEP including: a Sewer System Extension, Connection, or Industrial Wastewater permit (BRP WP 55, 71, 74) and an Abandonment of a Water Source permit (BRP WS 36). The project must undergo the Admission of New Community to Waterworks System (OP-10) from the MWRA. The project will also require approval in accordance with the Interbasin Transfer Act (ITA) (M.G.L. c.21 ss. 8B-D; 313 CMR 4.00). The project is also subject to the MEPA Greenhouse Gas (GHG) Emissions Policy and Protocol.

It is likely that the project will require Financial Assistance from the State Revolving Fund (SRF) for subsequent planning and construction of all or portions of the project. Therefore, MEPA jurisdiction for this project is broad and extends to all aspects of the project that are likely, directly or indirectly, to cause Damage to the Environment as defined in the MEPA regulations. In the case that the Town can provide proof of non-State funding sources for the

[1] I note that the comment letter from the Town of Andover indicates that the Towns of Andover and North Reading currently have a contract that allows North Reading to purchase up to 1.5 mgd per the Interbasin Transfer Act permit held by North Reading for withdrawal of water from the Merrimack River basin (the watershed from which Andover withdraws its water).

project's components in their entirety, the Town may file a Notice of Project Change (NPC) in accordance with 301 CMR 11.10 with a request to modify the scope for the DEIR.

Review of the ENF

Given the nascent nature of the water supply and wastewater planning processes by the Town, the content of the ENF was relatively limited with regard to quantification of potential environmental impacts and proposed infrastructure improvements. At the MEPA scoping session held on November 14, 2012, the Town expressed concerns regarding the timing and implementation of the two distinct project components: connection to the MWRA water supply and overall community wastewater management. Based upon discussions at this scoping session and upon review of comments received and the MEPA regulations, I am requiring that the Town file a DEIR that addresses the potential environmental impacts of both the water supply and wastewater disposal projects. Data gathered as part of the existing conditions, Needs Area, and environmental constraints analyses will inform the recommended action plans and alternatives analyses for both the water supply and wastewater disposal projects. Upon completion of the DEIR review, the Town may choose to separate the water supply review process from the wastewater disposal review process due to the increased certainty and likelihood of joining the MWRA system prior to determination of the best course of action with regard to wastewater management. At the Town's request, I will consider reviewing an FEIR that addresses the water supply impacts only, with an expectation that an NPC will be filed by the Town when further study is advanced regarding wastewater disposal treatment options.[2]

SCOPE

General

The DEIR should follow Section 11.07 of the MEPA regulations for outline and content, as modified by this scope.

Project Description and Permitting

The DEIR should include a detailed description of the proposed project. This description should include: a project history, a description of the overall project scope, a discussion of key planning initiatives and reports completed to date regarding water supply planning and wastewater management, and project objectives and goals.

The DEIR should include a description of the existing environment in accordance with 301 CMR 11.07(6)(g). The DEIR should describe proposed conditions for each project alternative to allow for an accurate assessment of potential environmental impacts including, but not limited to, the location of water and sewer mains, the proposed locations of pump stations or other related equipment, and wastewater treatment facilities. These descriptions should encompass all areas of potential project impact, including areas beyond the boundaries of North

[2] I reserve the right pursuant to 301 CMR 11.08(8)(b)(3) and 301 CMR 11.08(8)(c)(2) to require supplemental review in the form of a Supplemental DEIR or Supplemental FEIR if I find either the DEIR or FEIR to be inadequate.

Reading.[3] According to MassDEP, the Town intends to update and expand a Draft Comprehensive Wastewater Management Plan (CWMP) (prepared in 2008) as part of the DEIR. The Town also indicated that a water supply and demand management/master plan (Water Master Plan) will be prepared to assess, among other items, water supply demand, conservation measures, and infrastructure requirements. The existing and proposed conditions assessments should be performed consistent with the results of these two planning documents.

The DEIR should provide a brief description and analysis of applicable statutory and regulatory standards and requirements, and a description of how the project will meet those standards. The DEIR should include a list of potentially required State permits, Financial Assistance, or other State approvals associated with completion of any portion of the overall projects components. While design may be conceptual in nature, the Town should use available environmental data to identify areas of impact that may result in permitting requirements beyond the water and wastewater-related permits identified in the ENF (i.e., Massachusetts Endangered Species Act (MESA) permits, Wetlands Protection Act (WPA) permits (e.g., Orders of Conditions, 401 Water Quality Certification), etc.). Additionally, the DEIR should identify any additional MEPA review thresholds not disclosed in the ENF upon review of existing conditions data and the proposed project scope.

Alternatives Analysis

The DEIR should include an alternatives analysis informed by the data gathered as part of the updated and revised Draft CWMP, Water Master Plan, and Town Master Plan processes conducted (or in progress) by the Town and in accordance with 301 CMR 11.07(6)(f). As part of the alternatives analysis, the DEIR should consider combinations of various alternatives to meet project goals. Recommended alternatives for analysis include:

Water Supply Alternatives:

1) No-Build Alternative (status quo) – the DEIR should evaluate a No-Build Alternative that assesses impacts associated with maintaining current groundwater withdrawals from Town wells and water purchased from the Town of Andover. This alternative should address the ability of the Town to supply future growth and demand (a period of approximately 20 years) without changes to permitted withdrawal limits. The DEIR should also address reliability concerns expressed in the ENF with regard to both the Town of Andover and the Town's groundwater wells as supply sources;
2) In-Town Alternative – the DEIR should evaluate an In-Town Alternative that assesses the ability of the Town to meet current and future water supply demand through groundwater or surface water withdrawals solely from sources within the Town (i.e., no longer sourcing a portion of the water supply from the Town of Andover); and

[3] To connect to MWRA infrastructure, work may be required within the Town of Reading. It is unclear from the ENF if any of the wastewater disposal alternatives may include use or modification to infrastructure in other communities.

3) MWRA Alternative – the DEIR should evaluate a connection to the MWRA water supply system that assesses the ability of the MWRA to meet current and future water demand for the Town in a manner consistent with the ITA.

Wastewater Disposal Alternatives:

1) No-Build Alternative (status quo) – the DEIR should evaluate a No-Build Alternative that assesses impacts associated with maintaining the current wastewater disposal mechanisms (e.g., septic systems) to treat current and future demand for a period of approximately 20 years;
2) In-Basin Alternatives – the DEIR should evaluate the use of the following wastewater management technologies located within the Ipswich River basin to meet current and future demand:
   a. decentralized facilities (including, but not limited to, conventional on-site systems, tight tanks (off-site treatment and disposal); Innovative/Alternative (I/A) systems, and cluster (shared) systems);
   b. satellite facilities (i.e., groundwater discharge facilities capable of treating an average design flow of up to 150,000 gpd); and
   c. centralized (groundwater or surface water discharge) capable of treating an average design flow in excess of 150,000 gpd.
3) Out-of-Basin Alternatives – the DEIR should evaluate regional facilities located outside the Ipswich River basin capable of treating wastewater generated by the Town to meet current and future demand; and
4) Water Reuse Alternatives – the DEIR should evaluate opportunities for use of reclaimed treated wastewater effluent as a means to offset Town water demand.

Interbasin Transfer Act

A connection to the MWRA's water supply triggers the ITA, as the Town is located in the Ipswich River basin and the MWRA's sources are located in the Chicopee and Nashua River basins. As requested in the Water Resources Commission (WRC) comment letter, the DEIR should clarify if the Town intends to undergo MassDEP's formal source decommissioning process for discontinuing use of its existing groundwater sources. If decommissioning will occur, the DEIR should discuss how decommissioning of abandoned wells will be conducted in a manner consistent with MassDEP's *Guidelines for Public Water Systems.* The DEIR should also clarify if the Town intends to discontinue its WRC-approved interbasin transfer from the Town of Andover. The DEIR should provide a clear explanation of the volumes and sources of water to be transferred, and those volumes and sources that will cease to be transferred as requested in the WRC comment letter.

The DEIR should also provide additional details and documentation clarifying if any of the proposed wastewater disposal alternatives will also be subject to ITA review. As noted by the WRC, if the Town gives up its Water Management Act (WMA) registration and decommissions its in-basin source, the WRC would consider this portion of the project to be a secondary transfer not subject to the ITA. Otherwise, the transfer of wastewater originating in the Ipswich River basin to another basin may be subject to ITA review.

The DEIR will serve as the project's ITA application to the WRC. The WRC comment letter includes ITA application scopes for both a Request for Admission to the MWRA and for a Wastewater Transfer (if required, see above). The MWRA will provide the donor basin analysis required as part of the ITA/DEIR review. I hereby incorporate by reference these two ITA scopes into the DEIR scope.

Water Supply

Comment letters received are generally supportive of the Town's proposal to connect to the MWRA's water supply and forfeit its WMA registration of 0.96 mgd. While the MWRA has confirmed capacity to serve the Town's request to purchase approximately 1.5 mgd of water on an annualized basis, additional information is required in the DEIR to evaluate the potential impacts of constructing and operating this new water supply for the Town. The comment letters also note the positive environmental benefits of reducing water withdrawals from the stressed Ipswich River basin. As noted by MassDEP, reducing water withdrawals from the subbasin within which North Readings wells are located will benefit stream flow and habitat conditions. Additionally, currently authorized water withdrawals within the Ipswich River basin are up to 32.8 mgd, 3.4 mgd more than the draft safe yield for the basin. MassDEP indicated that while actual water withdrawal volumes have been significantly lower than allocated volumes, efforts to reduce active allocations below safe yield are needed.

The MWRA's Policy #OP-10 explains the criteria and process the MWRA will use to evaluate a request for admission of a new community to the MWRA water system. The DEIR should discuss, and provide supporting data or documentation as necessary, how the Preferred Alternative will meet the approval criteria outlined in OP-10. I expect that much of this information will overlap with data prepared as part of the Water Master Plan or Draft CWMP. The Town should emphasize existing and expanded water conservation efforts to reduce demand in a manner consistent with the WRC's performance standards. Compliance with the WRC's *Water Conservation Standards* should be addressed as part of the ITA application and included in the DEIR. The DEIR should also discuss plans regarding how the Town will maintain an emergency water supply. Finally, the DEIR should discuss how the project will be consistent with the goals of the State's Sustainable Water Management Initiative (SWMI).

Wastewater

As noted previously, MassDEP reviewed a Draft CWMP prepared by the Town in 2008. The Town is currently evaluating wastewater disposal options for up to 500,000 gpd. The Town has already dismissed an option of connecting to the MWRA sanitary sewer system due to capacity issues within the system. MassDEP directly addressed this issue in a March 10, 2009 letter that was provided as an attachment to the MassDEP comment letter on the ENF. MassDEP acknowledged that an assessment of treatment alternatives that extend beyond the Ipswich River basin is necessary due to the complexities and cost of long-term wastewater management. However, some out-of-basin alternatives will present significant challenges to implementation due to lack of capacity at other regional sewer authorities, impacts to multiple communities, and potential impacts to donor and receiving basins. Integration of drinking water master plans will be an essential component of any plan to pursue out-of-basin wastewater management and the DEIR analyses should reflect this important relationship.

The Town should develop a detailed scope of work, in consultation with MassDEP, to update and revise the 2008 Draft CWMP. As recommended by MassDEP, the wastewater elements should build upon information developed for the Draft CWMP, and should include, at a minimum the following elements:

- An updated Needs Analysis, including reassessment of the existing and future wastewater flows and loads;
- An Expanded Alternatives Assessment, to include an update and review of the costs and impacts of the in-basin alternatives, and detailed development of out-of-basin alternatives; and
- Development of a recommended plan and schedule for long-term wastewater management facilities, including costs, impacts, permitting requirements, and in the case of any out-of-basin alternative, a discussion of any legal agreements needed to support the such alternatives.

I note the concerns raised by the Ipswich River Watershed Association (IRWA) regarding the potential for increased exportation of wastewater out of the Ipswich River basin. The IRWA strongly supports an in-basin wastewater treatment option. The Town should perform a robust and thorough alternatives analysis to support a recommended wastewater disposal alternative with consideration of long-term costs and benefits to the Town's fiscal and environmental health. I also encourage the Town to consider opportunities associated with hybrid wastewater treatment approaches in its analysis with potential combinations of in-basin and out-of-basin wastewater disposal options. As recommended by the IRWA, the Town should review the efforts and results of water and wastewater planning undertaken by the Town of Wilmington to inform its decision making and planning processes moving forward.

Land Impacts

The DEIR should discuss the potential impacts of the project on Article 97 lands, open space, or other recreational space. As part of the CWMP and/or Water Master Plan processes, the Town will be required to evaluate existing land uses, perform a build-out analysis, and discuss growth management strategies. These data should be presented in the DEIR. The MassDEP comment letter provides guidance and permitting requirements associated with the sale or transfer of any water supply land following well abandonment. The DEIR should address the potential sale or transfer of these properties or present a plan of how water supply protection properties will be managed if certain alternatives are selected.

Wetlands

The DEIR should describe and quantify potential wetland resource areas impacts along the alternative water and wastewater routes in order to provide a comparative understanding of environmental impacts. The DEIR should include plans at a readable scale that depict areas of wetland resource impacts as they relate to all project elements. The DEIR should explain how the project will be designed to comply with applicable performance standards in the wetlands regulations (310 CMR 10.00) and demonstrate that alteration of wetland resource areas can be either avoided or minimized. If wetlands replication areas will be required, these areas should be identified in the DEIR, areas of impact estimated, and proposed mitigation measures or replication areas provided in accordance with MassDEP *Massachusetts Inland Wetland Replication Guidelines*, March 2002. The DEIR should identify stream crossings along each alternative project route and the nature of the crossing (i.e., bridge span, culvert, etc.). The DEIR should note if culvert upgrades or other modifications to existing stream crossings will be required (or if new crossings are proposed) and confirm that new construction or modifications will meet MassDEP stream crossing requirements. Finally, I strongly encourage the Town to consider placing critical infrastructure outside of flood-prone areas to the maximum extent practicable.

Stormwater

It is not anticipated that the construction of new water or sewer mains will result in large new areas of impervious surfaces. However, the DEIR should describe Best Management Practices (BMPs) that the Town will implement to reduce erosion and manage stormwater runoff during the construction period for each project phase. The DEIR should also discuss stormwater management BMP's proposed for potential pump stations or wastewater management facilities.

Historic and Archaeological Resources

The DEIR should assess whether the project will impact historic resources that are included in the Massachusetts Historical Commission's (MHC) *Inventory of Historic and Archaeological Assets of the Commonwealth* or listed in the State Register of Historic Places. It is likely that various components of the project may be located within and/or adjacent to recorded archeological sites and archaeologically sensitive areas. The Town should continue to consult the *Inventory of Historic and Archeological Assets of the Commonwealth* during the planning and design process. The Town should coordinate with MHC to ensure appropriate review of any potential historic impacts from the project and the DEIR should provide an update on the status of these discussions. If MHC determines that the project will have an "adverse effect" on historic or archaeological resources, the DEIR should include a discussion of proposed mitigation measures the Town will undertake to address the adverse effect.

Rare Species

The Town should consult the Natural Heritage and Endangered Species Program (NHESP) current Natural Heritage Atlas to identify rare species and *Priority* and/or *Estimated Habitat* areas within the community. The DEIR should characterize known rare species, describe the potential impacts of proposed water supply and wastewater alternatives on rare species and their habitats, and evaluate avoidance and mitigation strategies (both permanent impact and temporary construction impacts). The Town should work directly with the NHESP during design advancement and the preparation of the DEIR to identify necessary project construction and post-construction conditions, commitments to avoid an adverse impact to resource area habitats of State-listed rare species located within and adjacent to the project, or mitigation requirements associated with potential permitting in accordance with the MESA regulations. The DEIR should report on the results of the Town's consultations with NHESP.

Hazardous Materials

The DEIR should assess the potential for contaminated soil and groundwater along the potential water and sewer main routes. The Town is advised that excavating, removing, and/or disposing of contaminated soil, pumping of contaminated groundwater, or working in contaminated media must be done under the provisions of M.G.L. c.21e (and potentially, c.21c) and OSHA. The DEIR should identify disposal sites within the project impact area, disclose the current status of review under the Massachusetts Contingency Plan (MCP), clarify the responsible party under the MCP, and discuss the anticipated schedule and scope of remediation, if necessary to implement the proposed projects. Construction activities conducted at a disposal site should not prevent or impede the implementation of likely assessment or remedial response actions at the site.

Greenhouse Gas Emissions

The project is subject to the MEPA Greenhouse Gas Emissions Policy and Protocol ("the Policy"). The Policy requires projects to quantify carbon dioxide (CO_2) emissions and identify measures to avoid, minimize or mitigate such emissions. The Town will be required to quantify the direct and/or indirect CO_2 emissions associated with the project's stationary source energy usage (e.g., building energy use, process-related energy use, pump stations, etc.) and transportation-related emissions (mobile sources), if applicable. To facilitate this evaluation, the GHG analysis should include a comparison of CO_2 emissions associated with an established project baseline to estimated CO_2 emissions associated with a final build condition that incorporates feasible mitigation measures to reduce CO_2 emissions.

Unlike many projects reviewed under the Policy, water and wastewater treatment process energy loads and subsequent CO_2 emissions play a large role in the overall project's GHG emissions rather than the buildings that contain the facilities themselves. Therefore, the embedded energy in the treatment and distribution systems for pumping, treating, distributing, and possibly pressurizing water and wastewater should be accounted for in the analysis. The Policy directs proponents to use applicable building codes to establish a project emissions baseline that is "code-compliant." However, there is no building energy code equivalent that applies specifically to wastewater treatment facilities (WWTF) or water treatment plants (WTP). Furthermore, there is no readily available energy use model (such as eQUEST) to estimate the projected energy use of these processing energy loads.

Given the estimated volumes of water withdrawal, distribution and treatment, it is appropriate to evaluate and assess potential GHG emissions to identify mitigation measures to reduce overall GHG emissions. It is anticipated that mitigation measures may be limited to equipment selection or operations modifications associated with proposed groundwater wells or MWRA facilities and transmission infrastructure, but the Town may also contemplate upgrades to existing equipment of its water treatment and transmission infrastructure to achieve GHG emissions reductions.

To evaluate potential groundwater water withdrawals, the DEIR should include a GHG analysis that calculates and compares GHG emissions associated with: 1) a Baseline, or Business As Usual case (direct and indirect emissions from energy consumption based upon a typical pumping and treatment design and operations) and 2) the proposed Preferred Alternative (direct and indirect emissions from energy consumption based upon the implementation of equipment and operations that achieve reduced GHG emissions compared to the Baseline). The GHG analysis should specifically evaluate proposed pumping and treatment equipment and/or operations protocols to determine if indirect GHG emissions can be reduced beyond the Baseline case. To evaluate potential GHG emissions associated with connections to the MWRA system, the Town should review average energy use data for the MWRA treatment and conveyance facilities (i.e., pump stations) to quantify GHG emissions associated with the Town's allotment of water. To evaluate pump station design for the purposes of this analysis, the Town may select a "model" pump station to represent an average pump station that will be included within the proposed distribution system. The DEIR should discuss MWRA's energy and GHG emissions reduction efforts and how the proposed infrastructure and operations will be designed in a manner consistent with MWRA's sustainability goals.

The GHG analysis should clearly demonstrate consistency with the objectives of MEPA review, one of which is to document the means by which the Town plans to avoid, minimize, or mitigate damage to the environment to the maximum extent feasible. The Town should identify the model or methodology used to analyze GHG emissions, clearly state modeling assumptions, and explicitly note which GHG reduction measures have been modeled and will be implemented within the system. If applicable, the DEIR should include the modeling printout for each alternative and emission tables that compare Baseline case emissions in tons with the Preferred Alternative showing the anticipated reduction in tons and percentage by emissions source (direct and indirect). Other tables and graphs may also be included to convey the GHG emissions and potential reductions associated with various mitigation measures as necessary. The Town should set up a pre-filing meeting to discuss assumptions and modeling protocols with Department of Energy Resources (DOER), the MWRA and the MEPA Office in advance of preparing the DEIR to assist in these modeling efforts.

Based upon the limited data regarding future wastewater treatment systems included in the ENF, it is premature at this time to outline a specific scope and methodology to assess GHG emissions associated with proposed wastewater treatment and conveyance infrastructure. As suggested previously, subsequent to advancing the scope of work for the CWMP and performing preliminary evaluations of feasible wastewater treatment options, the Town should meet with the MEPA Office, DOER, and MassDEP to discuss how GHG emissions can be effectively assessed in accordance with the Policy. The MEPA Office is continuing to work with representatives from DOER and MassDEP to determine modeling protocols for various components of the wastewater treatment process and associated pump stations.

In some cases, energy usage associated with treatment technologies can influence overall project costs and result in positive or negative environmental consequences. I strongly encourage the Town to consider power consumption demand for each treatment technology evaluated as part of the Draft CWMP process. I note that MEPA review of recent wastewater management projects (e.g., Sturbridge CWMP – EEA No. 14407 and Barnstable CWMP – EEA No. 14896), has included the use of the EPA's Energy Star Portfolio Manager (ESPM) computer modeling program to quantify the energy usage associated with wastewater treatment technologies. EPA's ESPM allows proponents to rank the estimated energy use of the proposed facilities and compare this ranking with the energy usage of other wastewater management facilities that have similar fundamental operating parameters and are located in similar climate zones. Often, Towns consider a commitment to minimum equipment performance standards as a method to meet GHG reduction goals given the conceptual nature of project design during the MEPA review process. The Town may also wish to review or conduct energy audits for existing regional facilities considered as part of the out-of-basin alternatives to assist in the identification of potential energy reduction measures that could be implemented into the existing portions of the wastewater treatment system.

The Town should use the energy use models indentified in the Policy (such as eQUEST) to perform stationary source modeling for WWTF-related or WTP buildings included in the Preferred Alternatives within the DEIR. In accordance with the Policy, the DEIR should include a GHG emissions analysis that calculates and compares GHG emissions associated with two alternatives as required by the Policy including 1) a Base Case corresponding to the current edition of the Massachusetts State Building Code with all associated amendments and 2) a Preferred Alternative which includes energy efficiency design measures. The DEIR should clearly state the types of modeling software used, the Building Code in effect at the time of the modeling, and emissions factors applied to GHG calculations. The DEIR should state modeling assumptions and explicitly note which GHG reduction measures have been modeled and those that cannot be modeled due to the constraints of the modeling software. The DEIR should include a clear and complete listing of modeling inputs (e.g., R-values, U-values, efficiencies, lighting power density, etc.) for items such as equipment, walls, ceilings, windows, lighting, HVAC units, etc. for both the Base Case and Preferred Alternative. The DEIR should explain, in reasonable detail, any measure not selected- either because it is not applicable to the project or is considered technically or financially infeasible- that would result in a significant reduction of GHG emissions. Further guidance on performing this analysis can be provided by the MEPA Office and DOER and provided at the meeting recommended previously in this Certificate.

The DEIR should include a preliminary feasibility study evaluating opportunities for installation of renewable energy on-site (e.g., solar (photovoltaic (PV)), wind, geothermal) in the case of water or wastewater alternatives that include Town properties. Installation of PV systems on municipal buildings or on municipal properties may achieve cost-savings beneficial to the community and offset ongoing operational costs. The DEIR should include a separate analysis to determine if PV systems (either ground-mounted or building-mounted) are feasible in association with this project. This feasibility analysis should use online DOER resources to calculate potential project cost, payback periods and returns on investment. The Town should consider both first-party and third-party ownership/lease scenarios. The DEIR should state assumptions with regard to available area for PV equipment, efficiencies, etc. If feasible, I encourage the Town to commit to the use of PV systems at its facilities. At a minimum, if proposed, buildings should be "solar ready" to facilitate future installation of PV systems.

The DEIR should also clarify if the project will include measurable transportation-related CO_2 emissions in the form of delivery of septic sludge/waste from septic haulers for treatment at any proposed wastewater facility. The Town should consult with the MEPA Office prior to preparation of the GHG analysis to discuss a potential methodology to calculate these GHG emissions, if applicable.

Public Participation

I note that the State's Revolving Fund (SRF) regulations require the Town to conduct a minimum of one public meeting and one public hearing for this project. The DEIR should include a discussion of the Town's public participation program activities completed and proposed to date.

Construction Period

The DEIR should discuss potential construction period impacts associated with each project alternative and analyze and outline feasible measures that can be implemented to eliminate or minimize these impacts. Specifically, the DEIR should focus on project construction phasing and sequencing, the availability of project staging areas, potential time-of-year constraints (either weather-related or due to potential habitat impacts), coordination with other communities within which work may be conducted, and mitigation of construction-period impacts related to noise, air quality, and traffic management. The project must comply with MassDEP's Solid Waste and Air Quality Control regulations, pursuant to M.G.L. Chapter 40, Section 54, during construction. The DEIR should discuss how water and/or wastewater services will be maintained during the construction period to all customers. Given the potential construction-related impacts near sensitive resources such as wetlands, endangered species habitat, or Article 97 lands, the DEIR should discuss post-construction mitigation measures for these areas with regard to re-seeding, revegetation, or other restoration efforts within the project corridor.

I encourage the Town to mitigate the construction period impacts of diesel emissions to the maximum extent feasible. This mitigation may be achieved through the installation of after-engine emission controls such as diesel oxidation catalysts (DOCs) or diesel particulate filters (DPFs). Construction equipment should use ultra low sulfur diesel (ULSD) fuel in off-road engines.

Mitigation

The DEIR should include a separate chapter summarizing proposed mitigation measures. This chapter should also include draft Section 61 Findings for each State Agency that will issue permits for the project (i.e., MassDEP, etc.). The DEIR should contain clear commitments to implement mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation, and contain a schedule for implementation. A schedule for implementation is particularly critical given the phased nature of typical infrastructure projects and the fact that this project may have impacts to multiple communities. The DEIR should clearly indicate the implementation of mitigation measures based upon project phasing, either tying mitigation commitments to connections to specific Needs Areas, or water supply or wastewater demand/generation threshold, etc., to ensure that measures are in place to mitigate the anticipated impact associated with each project phase.

In order to ensure that all GHG emissions reduction measures adopted by the Town in the preferred alternative are actually constructed or performed by the Town, the Secretary requires proponents to provide a self-certification to the MEPA Office indicating that all of the required mitigation measures, or their equivalent, have been completed. Specifically, the Secretary will require, as a condition of a Certificate approving an FEIR (or Supplemental FEIR if necessary), the Town to provide a certification to the MEPA Office signed by an appropriate professional (e.g., engineer, architect, transportation planner, general contractor) indicating that the all of the mitigation measures adopted by the Town as the preferred alternative have been incorporated into the project. Alternatively, the Town may certify that equivalent emissions reduction measures that collectively are designed to reduce GHG emissions by the same percentage as the measures outlined in the FEIR, based on the same modeling assumptions, have been adopted. The certification should be supported by plans that clearly illustrate where GHG mitigation measures have been incorporated. For those measures that are operational in nature the Town should provide an updated plan identifying the measures, the schedule for implementation and how progress towards achieving the measures will be obtained. The commitment to provide this self-certification in the manner outlined above should be incorporated into the draft Section 61 Findings included in the DEIR.

Responses to Comments/Circulation

The DEIR should contain a copy of this Certificate and a copy of each comment letter received. In order to ensure that the issues raised by commenters are addressed, the DEIR should include direct responses to comments to the extent that they are within MEPA jurisdiction. This directive is not intended to, and shall not be construed to, enlarge the scope of the Single EIR beyond what has been expressly identified in this certificate.

The Town should circulate the DEIR to those parties who commented on the ENF, to any State Agencies from which the Town will seek permits or approvals, and to parties specified in section 11.16(2) of the MEPA regulations to ensure adequate review opportunities for all State Agencies. A copy of the DEIR should be made available for review at the North Reading Public Library and the public library of any community within which work may be required to complete any of the proposed project alternatives presented in the DEIR.

December 7, 2012
Date

Richard K. Sullivan Jr.

Comments received:

11/21/2012	Water Resources Commission
11/26/2012	Ipswich River Watershed Association
11/27/2012	Massachusetts Department of Environmental Protection – NERO
11/27/2012	Massachusetts Water Resources Authority

11/27/2012 Massachusetts Water Resources Authority Advisory Board
11/27/2012 Water Supply Citizens Advisory Committee (WSCAC)
11/27/2012 Keith Saxon
11/27/2012 Town of Andover – Department of Public Works

RKS/HSJ/hsj

IPSWICH RIVER
WATERSHED
ASSOCIATION
The Voice of the River
P.O. Box 576
Ipswich, MA 01938

November 26, 2012

Holly Johnson
MEPA Office
Executive Office of Environmental Affairs
251 Causeway Street, Suite 900
Boston, MA 02114-2119

Re: EEA File No. 14975

Dear Ms. Johnson:

On behalf of the Ipswich River Watershed Association, I am writing to comment on the Town of North Reading's recently submitted ENF #14975 entitled "New Water and Wastewater Solutions." I commend the Town of North Reading for undertaking a comprehensive water and wastewater planning effort and view this as a once in a generation opportunity to address long standing environmental issues in the Ipswich River basin. Of particular interest is the recognition of the impact of groundwater withdrawals and the opportunity for the town to utilize an alternative source known to have less impact on the environment.

As you are aware, the Ipswich River has been classified as highly stressed by the Massachusetts Water Resources Commission and DEP and is perhaps the most flow impacted of the major river basins in the Commonwealth. The factors responsible for the current situation have been studied as much as any comparable river system in the country and have been conclusively determined to be mostly the result of the anthropogenic impacts of municipal water withdrawals and the transfer of wastewater out of basin by sewers. These impacts are particularly acute in the upper basin communities of Wilmington, Reading and North Reading. Unfortunately, despite a multitude of environmental laws and regulations promulgated to protect the environment and prevent these impacts, they have been largely ineffective and both water quantity and quality in many areas of the upper basin have yet to show improvement. For example, Martins Brook, one of the largest tributaries of the Ipswich River was pumped dry for several months this year due to the cumulative impacts of the North Reading and Wilmington wells.

Since the neighboring community of Wilmington recently completed virtually the identical project in terms of scope and scale being proposed by North Reading, I would strongly recommend that MEPA, the other state agencies and the Town carefully review the process and final outcome in Wilmington to inform the proposed planning project. After several years of study, dozens of public hearings and meetings, reviews by a multitude of state agencies, engagement by concerned local citizens and environmental organizations, administrative appeals and the significant investment made by the community on consulting and legal representation, the process did not result in an improvement to the conditions of the Ipswich River. More water is leaving the basin today in the form of wastewater than is being returned through water imports from WMWRA and groundwater withdrawals from Lubbers and Martins Brooks have since *increased* causing both brooks to run dry for months this year. I make this observation in the hopes of being constructive. If the Town and MEPA consider these issues at the outset of the planning effort and clearly identify them in the certificate, a better outcome for both the community and the River is possible.

Although I commend the town for proactively proposing to entirely replace their municipal groundwater withdrawals from the Ipswich basin with imported MWRA water, I am particularly concerned about the possibility of water leaving the basin in the form of wastewater. While the towns MEPA filing proposes to evaluate both in-basin and out of basin wastewater disposal alternatives, experience indicates that out of basin options are often recommended following traditional alternatives analyses. Therefore, I respectfully request that MEPA strongly indicate to the Town at the outset of the planning process that an in basin disposal alternative is the desired outcome as called for in the State's water and wastewater regulations and that out of basin alternatives will only be considered if it can be clearly demonstrated that no in-basin alternative is viable.

I am aware that the Town has done some preliminary analysis of in-basin alternatives and out of basin options currently appear more desirable, especially from a cost standpoint due to the proximity of existing sewers in neighboring communities and the lack of suitable local disposal options. As you are aware, alternative and decentralized wastewater technology has progressed significantly in recent years and viable options exist for virtually any situation. Although these options may initially appear more expensive than traditional sewers, a full accounting for all the hidden costs of sewering coupled with other local benefits can tip the scales in favor of keeping the water local. As such, I recommend that the Town and its consultants further investigate recent case studies to inform the process, including the recently completed "smart sewer" feasibility study in nearby Littleton Massachusetts which demonstrated that disposing the wastewater locally was a more desirable alternative from both an economic and environmental perspective. The Ipswich River Watershed Association is available to assist the Town and its consultants with this analysis in any way.

An ideal outcome for the environment would be for the Town to reduce its groundwater withdrawals located within the highly stressed Ipswich basin *and* continue to discharge its wastewater locally as called for in the Commonwealth's regulatory framework. If the proposed comprehensive planning effort were undertaken with this desired goal clearly identified from the beginning, the best possible outcome for both the Town and the river can result. Thank you for the opportunity to comment.

Sincerely,

Wayne Castonguay
Executive Director

Cc: Town of North Reading
Reading & N. Reading Stream Team
Wright-Pierce Consultants

TOWN OF ANDOVER, MASSACHUSETTS

TELEPHONE
(978) 623-8350

FAX
(978) 623-8359

DEPARTMENT OF PUBLIC WORKS
WATER TREATMENT PLANT
397 LOWELL STREET 01810-4416

To: Holly Johnson, Environmental Analyst, MEPA Office, EOEEA
From: Morris B. Gray, Jr., Superintendent Water/Sewer Division
Karen Martin, Environmental Compliance Coordinator
Subject: North Reading New Water and Wastewater Solutions ENF, EEA#14975
Date: November 27, 2012

We attended the MEPA consultation session on November 19, 2012 regarding the subject ENF submittal. We have the following comments.

A statement made by North Reading's consultant Wright-Pierce that the Town of Andover is able to only supply 1 million gallons per day (MGD) of water to the Town of North Reading was incorrect. Andover and North Reading currently have a contract for the supply and purchase of water. The contract allows North Reading to purchase up to 1.5 million gallons per day (MGD). This is the volume allowed per the Inter-Basin Transfer Act permit North Reading holds for the withdrawal of water from the Merrimack River Watershed (the watershed from which Andover draws its water).

The average daily volume of water that North Reading purchased from Andover, between January 2012 and October 2012, was 0.892 MGD; however, this value ranged between 1.031 and 1.355 MGD during the summer months of July, August and September. Attached are a table and a chart (See Attachments A and B) which provide a 10-year history (CY 2002-2011) of the average daily volume and the summer peak daily average volume of water purchased by North Reading. During the ten year period, the daily average volume of water purchased by North Reading ranged from 0.723 MGD to 0.987 MGD. The peak daily average of water purchased during the summer months of June, July and August ranged from 1.167 MGD to 1.652 MGD.

Andover maintains a Water Management Act Registration and Permit that presently allows adequate water withdrawals to service their customers, including the Town of North Reading. The registration and permit are not scheduled for renewal until late 2017 and late 2018, respectively.

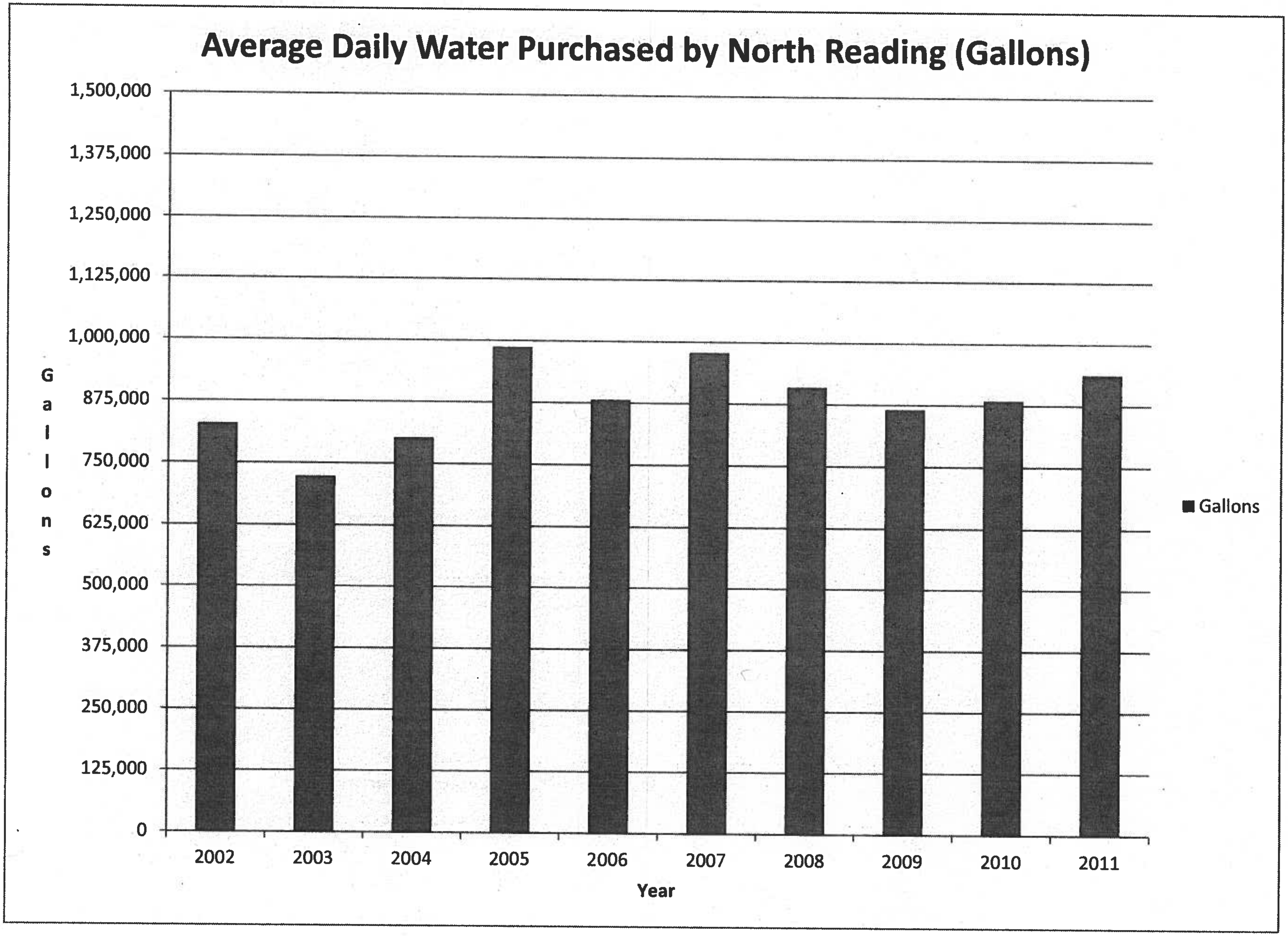
If you require additional information, please do not hesitate to contact Karen Martin at (978) 623-8350 x523, or kmartin@andoverma.gov.

ATTACHMENT A

Ten Year History of Water Purchased by North Reading

Year	Total MG	Annual Daily Average (Gallons)	Peak Daily Average (Gals)	Peak Month
2002	302.58	828,995	1,368,097	Aug
2003	263.90	723,014	1,280,710	Jul
2004	293.60	802,186	1,167,000	Jun
2005	360.17	986,779	1,652,287	Jul
2006	321.62	881,151	1,411,290	Jul
2007	356.98	978,027	1,534,190	Aug
2008	332.85	909,434	1,408,159	Jun
2009	315.81	865,233	1,290,323	Aug
2010	322.97	884,855	1,436,414	Jun
2011	342.33	937,891	1,596,926	Jul

ATTACHMENT B



THE COMMONWEALTH OF MASSACHUSETTS
WATER RESOURCES COMMISSION
100 CAMBRIDGE STREET, BOSTON MA 02114

November 21, 2012

Richard Sullivan, Secretary
Executive Office of Energy and Environmental Affairs
Attention: Holly Johnson, MEPA Office
EOEA #14975
100 Cambridge Street
Boston, MA 02114

Dear Secretary Sullivan:

The Water Resources Commission (WRC) staff has reviewed the ENF for Town of North Reading's New Water & Wastewater Solutions Project. The ENF discusses a proposal to obtain water supply from the Massachusetts Water Resources Authority (MWRA), an action that triggers the Interbasin Transfer Act (ITA). It also discusses sending a portion of the town's wastewater to an area, to be determined, out of town and out of basin. This latter proposal also has the potential to trigger the ITA.

Staff members of the WRC, MA Department of Environmental Protection (MassDEP), and the MWRA met with the town and its consultant on November 16, 2012, to discuss the project's components, schedule, and regulatory requirements. This provided the agencies with a clearer understanding of the proposed project; we hope that the meeting also has given the proponent a better understanding of applicable regulatory considerations. With a project involving the ITA, close communication between the WRC staff and a project proponent helps to ensure preparation of a complete response that satisfies the requirements of the ITA and avoids unnecessary prolonging of the process.

Below are additional comments on the ENF:

The ENF states that the transfer from the MWRA system will be a transfer from the Connecticut River basin. This is incorrect. The MWRA's sources are located in the Chicopee and Nashua River basins.

The ENF states that North Reading will discontinue use of its existing groundwater sources and surrender its Water Management Act registration. In its Draft Environmental Impact Report (DEIR), North Reading should clarify that it will be going through DEP's formal source decommissioning process for these wells. The DEIR should clarify if the Town will discontinue its WRC-approved transfer from Andover. The DEIR should also better define and document the proposed transfer amount. The ENF lists it as "up to" 1.5 mgd. Is this an average day amount or a maximum day amount? Is this amount over and above the existing transfer from Andover? Will this amount be documented in the Town's contract with the MWRA?

The wastewater portion of the project needs to be better described in the DEIR. It is not clear if a Comprehensive Wastewater Management Plan (CWMP) is needed for this project. The DEIR should document communication with MassDEP regarding the necessity for a CWMP, and if one is required, discuss the timeline for completion of the CWMP process.

If North Reading gives up its WMA registration and decommissions its in-basin sources, so that all the wastewater to potentially be transferred out of basin originates in a basin other than the Ipswich River basin, the WRC would consider this portion of the project to be a secondary transfer, not subject to the ITA. Otherwise, the transfer of wastewater originating in the Ipswich River basin and transferring to another basin may be subject to ITA review. Until we know exactly what the full project will involve, the WRC will not be able to make this decision.

We are concerned about the timing of each portion of the project. Under the MGL Chapter 21 §§ 8B- 8D, the Interbasin Transfer Act, the WRC cannot hold the required public hearings nor make a decision on a project until the MEPA process is complete. There is no flexibility on this under the Act. If one portion of the project holds up the completion of the MEPA process, the WRC cannot make a decision on either portion of the project – even if we have received all the required information - until the Secretary's Final Certificate has been issued. We suggest that the proponent consult with the MEPA office, if it appears that this scenario may occur, to determine if the project could be divided into two different filings or separate segments or phases.

The WRC uses the EIR as its ITA application. I have attached scopes to be used in the development of the ITA application section of the DEIR for both a request for admission to the MWRA under the ITA and for a wastewater transfer (if required). The proponent should pay particular attention to the water supply management criteria in the scope for admission to the MWRA. North Reading's average residential water use from 2007 to 2011 is 66 gallons per capita per day (gpcd), and its average unaccounted-for water amount is 15%. The ITA's performance standards require that unaccounted-for water should be 10% or less. North Reading should immediately implement a long-term water conservation program, which complies with the current Water Conservation Standards and includes a plan to reduce its unaccounted-for water. This plan should reflect the goal of maintaining unaccounted-for water at 10% or less of all water used, and of reducing future water use through a comprehensive residential water conservation program, if residential water use is greater than 65 gpcd.

We strongly urge the proponent to contact Michele Drury of WRC staff at 617-626-1366 to arrange a meeting to discuss the scopes and the pathway through the ITA prior to developing the DEIR. This will minimize requests by the WRC for additional information during and after the MEPA process and, we hope, lead to an expeditious review under the ITA.

Thank you for the opportunity to comment.

Sincerely,

Kathleen M Baskin

Kathleen Baskin, P.E.
Executive Director

cc: Water Resources Commission
ecc: Richard Carnevale, North Reading
Jon Beekman, Wright Pierce
Paul Brinkman, Wright Pierce
Michele Drury, DCR
Frank Hartig, DCR
Linda Hutchins, DCR
Nathaniel Tipton, DCR
Nancy Baker, MassDEP, NERO
Kevin Brander, MassDEP, NERO
Duane LeVangie, MassDEP
James Persky, MassDEP, NERO
Eric Worrell, MassDEP, NERO
Pamela Heidell, MWRA

THE COMMONWEALTH OF MASSACHUSETTS
WATER RESOURCES COMMISSION

EIR Scope for Communities

Seeking Approval Under the Interbasin Transfer Act

TO JOIN THE MWRA WATER SUPPLY SYSTEM

This scope replaces the WRC application form (1986/1992) "*Application for Approval of an Action to Increase Over the Present Rate of Interbasin Transfer*" and is required for transfers considered "significant" under the Act. The information requested here should be incorporated into the EIR required by the MEPA regulations, 301 CMR 11.03. Wherever possible, the applicant should provide this information in an electronic format.

This scope is only for that portion of the EIR that pertains to the INTERBASIN TRANSFER ACT. There may be other issues which need to be addressed in the EIR for a particular project. The MEPA program should be contacted to determine a comprehensive scope.

The Interbasin Transfer Act governs the transfer of water and wastewater between river basins within the Commonwealth. Any water transferred out of a river basin, either for water supply or wastewater treatment purposes, is no longer available to replenish the "donor" basin's rivers, aquifers, lakes or wetlands. The purpose of the Act is to assure that if an interbasin transfer does occur, the resources of the donor basin are not adversely impacted.

Admission to the MWRA, requires approval under the Interbasin Transfer Act. The following scope outlines the Interbasin Transfer Act issues to be addressed in the EIR for admission to the MWRA. Consultation with DCR's Office of Water Resources (617-626-1366) is strongly recommended to tailor this scope to a specific proposal.

SUMMARY OF PROJECT

- Project Name
- Location
- Proponent Name, Address, Phone Number
- Primary Contact's Name, Address, Phone Number, Fax Number, Email Address

DESCRIPTION OF THE PROPOSED INTERBASIN TRANSFER

- Describe and explain the reasons for the proposed interbasin transfer.
- Provide the approximate timetable for the proposed transfer, including the estimated commencement date and the estimated completion date.
- Where applicable, describe the existing transfer system, including out-of-basin conveyance capacity, storage capacity, withdrawal constraints or other limiting factors.
- Describe, in detail, the proposed interbasin transfer, including the maximum capacity, in millions of gallons per day (mgd) of the transfer facilities and the expected average daily transfer. Provide supporting information showing how the capacity of the conveyance was determined. Describe any proposed changes in existing structures and/or changes in operating rules of the water supplier or changes in transfer constraints.
- Describe the operating schedule of the proposed interbasin transfer, including the time periods, amounts to be transferred and the duration of the transfer.
- Provide the name, exact location and river basin of the source(s) of the proposed transfer of water, including the subbasin(s).
- List the communities, sections of communities, water districts or other areas that will use the water proposed to be transferred.
- Provide a precise description of the location, including river basin, of the wastewater discharge point.
- List the known users of this and associated resources, including agricultural operations and nurseries, whose use could be affected by the proposed transfer.
- Include a map of appropriate scale that clearly and accurately illustrates the information requested in this section. Wherever possible, MASSGIS data layers should be used.

OTHER PERMITS REQUIRED

- List the local, State or Federal agencies/commissions from which permits have been obtained or will be sought

INFORMATION NEEDED TO EVALUATE THIS PROJECT AGAINST THE SEVEN APPLICABLE CRITERIA OF THE INTERBASIN TRANSFER REGULATIONS, 313 CMR 4.05

Below, in **bold** the criteria for approval of an interbasin transfer are listed, as they appear in the regulations (313 CMR 4.05). In some cases, the WRC's interpretation of certain terminology appears in *italics*. Unless otherwise noted, the applicant must respond to all points listed under each criterion.

1. That an environmental review pursuant to M.G.L. c. 30, §§61 and 62H, inclusive, has been complied with for the proposed increase.

- Information needed for Interbasin Transfer review should be provided within the context of the EIR.
- Provide a copy of the ENF, including copies of comments received.
- When issued, provide a copy of the Secretary of Environmental Affairs certificate stating that the EIR properly complies with MEPA and its regulations.

2. That all reasonable efforts have been made to identify and develop all viable water supply sources in the receiving area of the proposed water supply interbasin transfer

Viable source means a source which can provide drinking water and meet the current water quality standards set by DEP, at a reasonable production cost compared to recently incurred costs for similar projects within the Commonwealth. Further, a viable source is one which can be used while maintaining a reasonable instream flow. Reasonable instream flow is evaluated by the same criteria as impacts on the donor basin. Receiving area is defined as the area which makes use of the water supply that has been transferred between basins.

Describe in detail the efforts made to identify and develop all viable sources in the receiving area. Discuss water supply alternatives considered, but rejected. State reasons for rejection. The discussion should include:

- Assessment of the development of abandoned (temporary or permanent), existing and potential in-basin water supply sources. Clearly and accurately locate these sources on a map of appropriate scale.
- Discuss and list studies and reports evaluating in-basin sources in the receiving area. Copies of studies should be made available upon request.
- Describe the costs of developing existing and proposed in-basin sources in the receiving area.
- If cost is a reason given for rejection of an inbasin source, compare these costs with the production costs recently incurred elsewhere in the Commonwealth for similar water supply sources. Refer to the Performance Standards from DCR's website: http://www.mass.gov/dcr/waterSupply/intbasin/download.htm
- Describe the impact on in-basin streamflow that would result from the development of any viable in-basin sources in the receiving area. Refer to 313 CMR 4.05 (5)(a) through (j).
- Discuss the feasibility of obtaining additional water supply from water supply agencies in cities, towns or districts within the same basin as the receiving area. Are interconnections in place? If not, are such interconnections feasible?

3. That all practical measures to conserve water have been taken in the receiving area

- Provide an updated Water Conservation Questionnaire (available from DEP's Division of Watershed Permitting or at DEP's website: http://www.state.ma.us/dep/brp/wtrm/files/con-wrc.doc, or DCR's Office of Water Resources or at DCR's website: http://www.mass.gov/dcr/waterSupply/intbasin/docs/consplan.doc). If a Conservation Plan or Questionnaire is on file with DEP, provide a copy, updated to the present. Refer to <u>Water Conservation Standards for the Commonwealth of Massachusetts</u> (WRC, 2006) and the Interbasin Transfer Performance Standards (1999), both available from DCR's website http://www.mass.gov/dcr/intbasin/download.htm.
- Describe the current leak detection and system repair program. Discuss the methodology used (refer to the Interbasin Transfer Act Performance Standards,

available from DCR's website: http://www.mass.gov/dcr/intbasin/download.htm). What was the date of the most recent leak detection survey? What is the date of the next scheduled leak detection survey?

- Describe the on-going meter installation, maintenance, and replacement program. State the percentage of the system that is metered. Provide documentation of the annual master meter calibration program and a description of that program. Provide data to show that all permanent water supply services (including public buildings) in the receiving area are metered.
- Describe the amount of unaccounted-for water (in gallons and percent) in the receiving area for the past five (5) years. Refer to the Interbasin Transfer Act Performance Standards for the definition of "Unaccounted-for Water". Describe on-going programs to reduce or keep the amount of unaccounted-for water at reasonable levels (less than 10%).
- Describe the current rate structure: (1) Does the rate structure reflect the cost of operation, proper maintenance, proposed capital improvements and water conservation. Does it encourage water conservation? If so, how? (2) Is the rate flat, increasing or decreasing? Is it charged according to water use, or some other method? (3) Are the funds dedicated in an enterprise account or is some other accounting procedure used? Describe. Refer to Appendix D of the Performance Standards.
- How often are customers billed? Is billing based on actual meter readings? Provide an example of the bill sent to customers.
- Provide the existing contingency plan(s) for adequately handling water supply emergencies, such as contamination of water supply sources or seasonal or drought related shortages of water supply. (See 313 CMR 4.02(4) for a definition of 'contingency plan'.) Explain, if not stated in the plan, how and when water use will be curtailed, when trigger points require action, which water users will be reduced by what measures, and over what period of time, what emergency sources will be utilized, such as interconnections with nearby communities, reactivated sources or new emergency sources.
- Do all public buildings under the control of the proponent have low flow plumbing fixtures? Describe the types of fixtures in these buildings.
- When was the last audit of public facilities? Provide a copy of the report. Has a system-wide water audit ever been conducted? When? Provide a copy of the report.
- Describe any past or current programs to supply low flow plumbing fixtures to residential customers. What is the residential gallons per capita per day (gpcd) figure for the water supply system? What is the overall gpcd for the system? Provide the Annual Statistical Reports, required by DEP, for the past five years.
- If residential gpcd is greater than 65, describe the comprehensive residential water conservation program that is or will be implemented to reduce this use. If this program is not in place, describe the timetable for implementation. Refer to the Performance Standards.
- Describe the current and proposed public information programs to promote water conservation, the use of water conserving devices, and industrial and commercial recycling and reuse. These programs should include a program which identifies, ranks and works with all commercial, industrial and institutional customers according to amount used in order to determine areas where the greatest potential for water savings

exists, should be in place. Are public education programs on-going or intermittent? Explain.

- Describe the measures in place to protect the water supply sources currently serving the receiving area that meet the requirements of the Department of Environmental Protection published in 310 CMR 22.20 and Wellhead Protection regulations 310 CMR 22.21. Include in this description all watershed or aquifer lands, even if not under the direct control of the water supply agencies.
- Is the plumbing code strictly enforced? By whom? Describe.

4. That a comprehensive forestry management program which balances water yields, wildlife habitat and natural beauty on watershed lands of surface water supply sources, presently serving the receiving area and under control of the proponent has been implemented.

- If the community does not have surface water sources, this criterion is not applicable. If the community does, describe existing and proposed watershed forestry management programs on watershed lands currently serving the receiving area and under the control of the proponent. Submit a copy of any applicable forestry watershed plans. Refer to the Interbasin Transfer Performance Standards for the information to be included in a Forestry Management Plan.

5. That reasonable instream flow in the river from which the water is transferred is maintained.

This part should describe the hydrologic characteristics of the river basins from which the water is to be diverted and any interdependent ground water regimens. The MWRA employs modeling tools to evaluate the impact of any withdrawals on the MWRA/MDC system and the impact on service to existing customer communities. Proponents are directed to work with MWRA, so that MWRA can provide appropriate documentation to respond to the requested information.

- Describe the proposed operating schedule for the interbasin transfer. This description should include variations throughout the seasons, the months, and the hours during a 24 hour period.
- Document that the safe yield of the MWRA watershed system is sufficient to meet the community's demands. This should evaluate the monthly performance of the Quabbin Reservoir over an extended period of years using observed hydrological data that includes the worst drought of record. It should also include an analysis of the impact of the community's demands together with the long-term demand of existing member communities during drought scenarios. The analysis must include the possibility of increased usage of MWRA supplies by partially supplied communities due to drought conditions. Impacts to service to other MWRA community connections under drought conditions and to MWRA supplies (including the Wachusett Reservoir) and the downstream environments must be evaluated. Provide the frequency or number of months that each MWRA reservoir level referenced in MWRA's Drought Management Plan is reached, beginning with the "Below Normal" stage under existing demands and with the addition of the proposed transfer.
- Provide graphs and tables that show the following:
  (a) The historic monthly Quabbin Reservoir levels from 1990 to the present.

(b) On the graph, superimpose the resulting reservoir levels after the proposed withdrawal, had the community been an MWRA customer since 1990.
(c) On the table, show the Quabbin Reservoir levels which would have been realized had the proponent been an MWRA customer since 1990.

- Provide a table of the modelled uncontrolled releases (spills) from the Quabbin Reservoir from 1990 to the present including what the releases would have been with the theoretical demand of the community, had the community been an MWRA customer. Show any changes in the frequency and duration of uncontrolled releases that will occur with the addition of the community's proposed withdrawal.
- Provide information and data to demonstrate that the MWRA will be able to meet all of its mandated controlled flow releases with the addition of the proposed demand.
- If new member communities have been added to the MWRA Water Works system since 1990 or if there are other communities in the process of applying for membership, include the demands for these communities in the analyses required in this section.
- Provide a discussion of the operation of the Wachusett Reservoir. Will this additional withdrawal have an impact on the resources of the Nashua River basin? Describe.
- Analyze and evaluate, in detail, the impact of the proposed interbasin transfer on water-dependent uses including:

  (1) Effect on the hydraulic characteristics in the stream below the point of withdrawal, including but not limited to flood flows, the aquatic base flow, the 7Q10 flow if used in a pollution abatement program, stage, velocity, sediment regimen, any flow values set for the donor basin by the WRC in DEM River Basin reports, etc.
  (2) Effect on anadromous fisheries.
  (3) Effect on resident fisheries.
  (4) Effect on wetlands and dependent flora and fauna.
  (5) Effects on water quality, recreational uses and aesthetic values, areas of critical environmental concern, areas protected under Article 97 of the Amendments to the Massachusetts Constitution, and designated scenic rivers.
  (6) Effect on existing and planned future uses dependent on reservoir levels.
  (7) Effect on hydropower production.
  (8) Effect on present and foreseeable water-dependent uses within the donor basin.
  (9) Effect on water use by agricultural operations, including nurseries.

6. In the case of groundwater withdrawals, the results of pumping tests will be used to indicate the impact of the proposed withdrawal on static water levels, the cone of depression, the potential impacts on adjacent wells and lake and pond levels, and the potential to affect instream values affect instream values as listed in 313 CMR 4.05(5)(a) through (j).

This criterion is not applicable to MWRA's sources.

7. That the communities and districts in the receiving area have adopted or are actively engaged in developing a local water resources management plan.

- Provide the Local Water Resources Management Plan, or the draft plan under development and timeline for completion. Refer to the Interbasin Transfer Performance Standards for the information to be included in a Local Water Resources Management Plan.

8. The Commission shall consider the impacts of all past, authorized or proposed transfers on streamflows in the donor basin.

- List and describe the impact of all past, authorized and other proposed transfers on the streamflow in the donor basins.
- In addition, the WRC considers that the addition of a community to the MWRA Water Works System could have potential cumulative impacts on the system's operations. Provide information to demonstrate that there will be no negative impacts to the operations of the MWRA Water Works System. The proponent should work with the MWRA to provide this documentation.

MITIGATION

- Describe any proposed flow augmentation provisions, flow protection thresholds, or other measures proposed to protect instream flow.

EO 385

Provide information to demonstrate that this proposal seeks to minimize unnecessary loss or depletion of environmental quality and resources.

Electronic copies (unless otherwise specified) of all Interbasin Transfer EIRs should be sent to the following people. This is only a listing of those people who will be reviewing the EIR specifically under the Interbasin Transfer Act and is not meant to be all inclusive.

Kathleen Baskin Executive Director Water Resources Commission EOEEA 100 Cambridge Street Boston, MA 02114 kathleen.baskin@state.ma.us	Michele H. Drury (3 bound copies in addition to the electronic copy) DCR Office of Water Resources 251 Causeway Street Boston, MA 02114 michele.drury@state.ma.us
Duane LeVangie DEP 1 Winter Street Boston, 02108 duane.levangie@state.ma.us	Richard Hartley DFW 1 Rabbitt Hill Rd Westboro, MA 01581
Pam Heidell MWRA 100 First Ave Charlestown, MA 02129 Pamela.heidell@mwra.state.ma.us	Laila Parker DFG Division of Ecological Restoration 251 Causeway Street Boston, MA 02114 laila.parker@state.ma.us
Clapp Memorial Library P.O. Box 627 Belchertown, MA 01007-0627 One bound copy	Bigelow Free Public Library 54 Walnut Street Clinton, MA 01510-2926 One bound copy
WSCAC 485 Ware Rd. Belchertown, MA 01007 info@wscac.org	

THE COMMONWEALTH OF MASSACHUSETTS
WATER RESOURCES COMMISSION

EIR Scope for Communities Seeking

APPROVAL FOR A WASTEWATER TRANSFER

Under the Interbasin Transfer Act

This scope replaces the WRC application form (1986/1992) "*Application for Approval of an Action to Increase Over the Present Rate of Interbasin Transfer*" and is required for transfers considered "significant" under the Act. The information requested here should be incorporated into the EIR required by the MEPA regulations, 301 CMR 11.03. Wherever possible, the applicant should provide this information in an electronic format.

This scope is only for that portion of the EIR that pertains to the INTERBASIN TRANSFER ACT. There may be other issues which need to be addressed in the EIR for a particular project. The MEPA program should be contacted to determine a comprehensive scope.

The Interbasin Transfer Act governs the transfer of water and wastewater between river basins within the Commonwealth. Any water transferred out of a river basin, either for water supply or wastewater treatment purposes, is no longer available to replenish the "donor" basin's rivers, aquifers, lakes or wetlands. The purpose of the Act is to assure that if an interbasin transfer does occur, the resources of the donor basin are not adversely impacted.

A wastewater transfer is a transfer of wastewater outside of a river basin for disposal. This includes only that wastewater which is generated from a water supply source within the river basin from which the wastewater will be transferred and any inflow and infiltration generated within that basin. Wastewater transfers can include the out-of-basin sewering of areas previously served by on-site and/or inbasin wastewater systems, enlargement of the capacity which facilitates an interbasin transfer of existing wastewater systems, the sewering of previously undeveloped areas which involves a new interbasin transfer, etc. The following scope outlines issues to be addressed in the EIR for these types of transfers. Consultation with DCR's Office of Water Resources (617-626-1366) is strongly recommended to tailor this scope to a specific proposal.

SUMMARY OF PROJECT

- Project Name
- Location
- Proponent Name, Address, Phone Number
- Primary Contact's Name, Address, Phone Number, Fax Number, Email Address

DESCRIPTION OF THE PROPOSED INTERBASIN TRANSFER

- Describe and explain the reasons for the proposed interbasin transfer.
- Provide the approximate timetable for the construction of the proposed transfer, including the estimated commencement date and the estimated completion date.
- Where applicable, describe the existing wastewater transfer system, including any factors limiting the ability to transfer wastewater out of basin, and the existing water supply sources from which the wastewater is generated. This should include the river basin location of these sources.
- Describe, in detail, the proposed interbasin transfer, including the maximum capacity, in millions of gallons per day (mgd) of the transfer facilities and the expected average daily transfer. Provide supporting information showing how the increased capacity was determined.
- Describe any proposed changes in existing structures and/or changes in operating rules of the wastewater system or changes in transfer constraints.
- Describe the operating schedule of the proposed interbasin transfer, including the time periods, amounts to be transferred and the duration of the transfer.
- Provide the name, exact location and river basin of the source(s) of the proposed transfer, including the subbasin(s).
- List the communities, sections of communities, sewer districts or other areas that will benefit from the proposed wastewater transfer.
- Provide a precise description of the location, including river basin location, of the wastewater discharge point.
- List the known users of associated resources, including agricultural operations and nurseries, whose use could be affected by the proposed transfer.
- Include a map of appropriate scale that clearly and accurately illustrates the information requested in this section. Wherever possible, MASSGIS data layers should be used.

OTHER PERMITS REQUIRED

- List the local, State or Federal agencies/commissions from which permits have been obtained or will be sought

INFORMATION NEEDED TO EVALUATE THIS PROJECT AGAINST THE SIX APPLICABLE CRITERIA OF THE INTERBASIN TRANSFER REGULATIONS, 313 CMR 4.05

Below, in **bold** the criteria for approval of an interbasin transfer are listed, as they appear in the regulations (313 CMR 4.05). Where appropriate, interpretations of some of the terminology in the regulations approved by the WRC to apply to wastewater transfers, in order to evaluate specific criteria within the "spirit" of the Act, appear in *italics*.

1. That an environmental review pursuant to M.G.L. c. 30, §§61 and 62H, inclusive, has been complied with for the proposed increase.

- Information needed for Interbasin Transfer review should be provided within the context of the EIR.
- Provide a copy of the ENF, including copies of comments received.
- When issued, provide a copy of the Secretary of Environmental Affairs certificate stating that the EIR properly complies with MEPA and its regulations.

2. That all reasonable efforts have been made to identify and develop all viable water supply sources in the receiving area of the proposed water supply interbasin transfer

For the purposes of evaluating wastewater transfers against this criterion, the WRC has defined a viable local wastewater discharge source as a cost-effective, technologically feasible, environmentally sound wastewater treatment system which treats and discharges wastewater within the basin of origin, and has been approved for general use by DEP. Such systems can include, but are not limited to, conventional Title 5 systems, groundwater discharge systems, NPDES-regulated surface water discharge systems, alternative/innovative on-site systems or package treatment plants.

For the purposes of evaluating wastewater transfers against this criterion, the WRC has defined receiving area as the community(ies) or portion of community(ies) whose wastewater is collected for discharge out of basin via an interbasin transfer.

Describe in detail the efforts made to identify and develop all viable sources in the receiving area. Discuss wastewater alternatives considered, but rejected. State reasons for rejection. The discussion should include:

- Discussion of the DEP-approved facilities plan[1], if completed. A copy should also be submitted to WRC staff. If this plan is not completed, the EIR should evaluate potential in-basin sources of disposal, including Title 5, groundwater and surface water discharges, as described in DEP's Comprehensive Wastewater Management Planning[2] Guidance. Submit copies of any other relevant studies and reports which evaluated in-basin wastewater disposal to WRC staff. The proponent should also discuss the feasibility of implementing DEP's wastewater reuse policy.
- If the preferred alternative for wastewater disposal is a connection to an all ready existing out of basin sewer system, the proponent must provide documentation from the host system that there is sufficient capacity to accept the proposed wastewater flows.
- Describe the costs of developing in-basin wastewater disposal facilities within the area of the proposed transfer, as defined above for this criterion.

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[1] Facilities Plans are also known as Comprehensive Water Management Plans, Comprehensive Water Resources Management Plans, and Integrated Water Resources Management Plans.

[2] See Footnote #1

- If cost is a reason given for rejection of an inbasin source, compare these costs with the production costs recently incurred elsewhere in the Commonwealth for similar wastewater disposal facilities. Refer to the Performance Standards, available from DCR's website: http://www.mass.gov/dcr/waterSupply/intbasin/docs.
- Describe the impact on in-basin streamflow that would result from the development of any viable in-basin wastewater disposal facilities in the area of the proposed transfer. Refer to 313 CMR 4.05 (5)(a) through (j).
- Discuss the feasibility of joining a regional or neighboring in-basin wastewater disposal facility in cities, towns or districts within the same basin location as the area of the proposed transfer. Are interconnections in place? If not, are such interconnections feasible?
- Provide documentation of the program to eliminate sources of inflow and infiltration (I/I). This program must meet the standards described under the Performance Standards for wastewater, available from DCR's website: http://www.mass.gov/dcr/waterSupply/intbasin/docs. Discuss the potential for eliminating enough I/I to eliminate the need for an interbasin transfer.

3. That all practical measures to conserve water have been taken in the receiving area

For the purposes of evaluating wastewater transfers against this criterion, the WRC has defined receiving area is the community(ies) or portion of community(ies) whose wastewater is collected for discharge out of basin via an interbasin transfer. To evaluate a wastewater transfer against this criterion, the WRC requires that the applicant:

- Indicate whether there are flow meters sufficient to document wastewater flows out of the basin of origin. Provide a map of appropriate scale clearly showing the meter location(s). (Use of regional sewer meters which document wastewater flows out of basin is acceptable where these meters are in place.) Provide documentation on calibration of these meters.
- Provide at least two years of data on the components of existing wastewater flow (sanitary, inflow, infiltration).
- Provide a copy of the DEP-approved Operation and Maintenance plan for the wastewater system.
- Where the applicant has control over the water supply system, describe the program for implementing a water conservation program based on the state water conservation standards.

4. That a comprehensive forestry management program which balances water yields, wildlife habitat and natural beauty on watershed lands of surface water supply sources, presently serving the receiving area and under control of the proponent has been implemented.

- This criterion does not apply to a wastewater transfer.

5. That reasonable instream flow in the river from which the water is transferred is maintained.

This part should describe the hydrologic characteristics of the river basin from which the wastewater is to be transferred from and any interdependent ground water regimen.

- Describe the proposed operating schedule for the interbasin transfer. This description should include variations throughout the seasons, the months, and the hours during a 24 hour period.
- Provide:
  - (1) Delineation of the areas proposed to be sewered, if applicable, or areas where the capacity of an existing sewer is proposed to be enlarged and the area served by this facility.
  - (2) Estimate of the amount of wastewater to be transferred, on both an average annual and peak flow basis. This should be based on the capacity of the proposed wastewater system, including but not limited to pumps, pipelines, tunnels, when properly operating to the maximum extent physically possible (i.e.without backups, overflows or other threats to public health and safety).
  - (3) As required under Criterion #2, a DEP-approved facilities plan[3] which evaluates potential in-basin sources of disposal, including Title 5, groundwater and surface water discharges.
  - (4) A map of the (sub)basin planning unit(s) to be used in the hydrologic analysis. These units should be determined in consultation with DCR's Office of Water Resources.
- Analyze and evaluate, in detail, the impact of the proposed interbasin transfer on water-dependent uses including:
  - (1) The existing and proposed water use budget for each (sub)basin(s). The existing and proposed change in ground water level for each (sub)basin(s). The existing and proposed change in the unregulated 7Q10, August median, and 95% and 99% flow duration statistics for the stream or river draining the (sub)basin(s).
  - (2) Effect on anadromous fisheries, specifically alewives, searun brook and brown trout, smelt and American shad.
  - (3) Effect on resident fisheries.
  - (4) Effect on wetlands and dependent flora and fauna.
  - (5) Effects on water quality, recreational uses and aesthetic values, areas of critical environmental concern, areas protected under Article 97 of the Amendments to the Massachusetts Constitution, and designated scenic rivers.
  - (6) Effect on existing and planned future water-dependent uses in the donor basin.
  - (7) Effect on rare and endangered species of plants and animals
  - (8) Effect on water use by agricultural operations, including nurseries.

6. In the case of groundwater withdrawals, the results of pumping tests will be used to indicate the impact of the proposed withdrawal on static water levels, the cone of depression, the potential impacts on adjacent wells and lake and pond levels, and the potential to affect instream values as listed in 313 CMR 4.05(5)(a) through (j).

- This criterion does not apply to a wastewater transfer.

[3] See Footnote #1

7. That the communities and districts in the receiving area have adopted or are actively engaged in developing a local water resources management plan.
For the purposes of evaluating wastewater transfers against this criterion, the WRC has defined receiving area is the community(ies) or portion of community(ies) whose wastewater is collected for discharge out of basin via an interbasin transfer.

- Provide the Local Water Resources Management Plan, or draft of the plan under development and the timeline for completion. Refer to the Interbasin Transfer Performance Standards, available from DCR's website: http://www.mass.gov/dcr/waterSupply/intbasin/docs, for the information to be included in a Local Water Resources Management Plan.

8. The Commission shall consider the impacts of all past, authorized or proposed transfers on streamflows in the donor basin.

- List and describe the impact of all past, authorized and other proposed transfers on the streamflow in the donor basin. This would include analysis of any water supply sources or sewer systems that have been recently developed or approved, consideration of any water supply sources in the new source approval or Water Management Act permitting processes, sewering plans under development, etc.

MITIGATION

- To the extent the EIR/IBT process identifies impacts that may need to be mitigated, the proponent should propose measures to mitigate these impacts. Proponents should consider such measures as additional I/I reduction, impervious surface remediation, groundwater recharge, or stormwater management programs consistent with DEP stormwater guidance that keep water in the donor basin.

EO 385

Provide information to demonstrate that this proposal seeks to minimize unnecessary loss or depletion of environmental quality and resources.

Electronic copies (unless otherwise specified) of all Interbasin Transfer EIRs should be sent to the following people. This is only a listing of those people who will be reviewing the EIR specifically under the Interbasin Transfer Act and is not meant to be all inclusive.

Kathleen Baskin Executive Director Water Resources Commission EOEEA 100 Cambridge Street Boston, MA 02114 kathleen.baskin@state.ma.us	Michele H. Drury (3 bound copies in addition to the electronic copy) DCR Office of Water Resources 251 Causeway Street Boston, MA 02114 michele.drury@state.ma.us
Richard Hartley DFW 1 Rabbitt Hill Rd Westboro, MA 01581	Amy Coman-Hoenig/Lauren Glorioso NHESP DFG 1 Rabbitt Hill Rd Westboro, MA 01581 amy.coman@state.ma.us lauren.glorioso@state.ma.us
Laila Parker DFG Division of Ecological Restoration 251 Causeway Street Boston, MA 02114 laila.parker@state.ma.us	Paul Diodati Division of Marine Fisheries 251 Causeway Street Boston, MA 02114 paul.diodati@state.ma.us
Jack Schwartz DMF Annisquam River Marine Fisheries Field Station 30 Emerson Ave. Gloucester, MA 01930 jack.schwartz@state.ma.us	The Public Libraries of the affected communities in both the donor and receiving basin One bound copy each

MassDEP
Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Northeast Regional Office • 205B Lowell Street, Wilmington MA 01887 • 978-694-3200

DEVAL L. PATRICK
Governor

RICHARD K. SULLIVAN JR.
Secretary

TIMOTHY P. MURRAY
Lieutenant Governor

KENNETH L. KIMMELL
Commissioner

November 27, 2012

Richard K. Sullivan Jr., Secretary
Executive Office of
Energy & Environmental Affairs
100 Cambridge Street
Boston MA, 02114

Attn: MEPA Unit

RE: North Reading
New Water and Sewer Solutions
Entire Town
EEA # 14975

Dear Secretary Sullivan:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed the Environmental Notification Form (ENF) submitted by the Town of North Reading for an investigation of an alternative water supply source and a treatment and disposal alternative for 0.5 gpd of wastewater (EEA #14975). Although at a preliminary stage, MassDEP recognizes the Town for undertaking this project and supports the plan to eliminate the Town's groundwater withdrawals from the Ipswich River Basin. The project is categorically included for the preparation of an environmental impact report (EIR). As explained in the comment that follows, the EIR has the opportunity to demonstrate that this project will contribute significantly toward achieving a more sustainable water balance in this highly stressed basin.

Alternatives

The preferred water and wastewater alternatives should, at a minimum, be compared to the existing conditions, and the environmental impacts associated with these alternatives should be evaluated thoughtfully. According to the ENF, the Town of North Reading has had discussions with the Town of Reading and the Massachusetts Water Resources Authority (MWRA) about admission to the MWRA in order to purchase drinking water. Issues relating to admission to the MWRA and an Interbasin Transfer Act approval will need to be considered in the EIR. Wastewater disposal alternatives are less defined in the ENF, which indicates that there are several treatment and disposal options. A preferred plan for wastewater treatment and disposal has not been identified yet.

Given that planning for the water and wastewater alternatives may not be able to proceed concurrently, MEPA may want to design a flexible review process to allow separation of the environmental impact analysis for water from wastewater, if the environmental impacts are addressed adequately to satisfy the scope, and it is practicable to commence permitting more quickly for either water or wastewater. The anticipated project sequencing should be explained in the DEIR to understand the planning schedule for bringing the new water and wastewater alternatives on line. It also should be clear how the Interbasin Transfer Act process will be evolving.

Drinking Water

In 2011, the Town of North Reading had an annual average daily water demand of 1.44 million gallons per day (MGD). The Town's municipal wells produced an average of 0.50 MGD of treated water. The remainder of the Town's water supply was purchased from the Town of Andover. North Reading's maximum daily water demand in 2011 was 2.38 MGD. The Town seeks to purchase its municipal water supply from the MWRA water system. The Town's interconnection with the Andover water system will be maintained for potential emergency use. The Town's wells will be abandoned and the Water Management Act Registration for the wells retired.

The ENF states that the volume of water to be purchased from the MWRA will be 1.5 MGD. This is a reasonable figure to use. From 2001 to 2011, North Reading's annual average water use only exceeded 1.5 MGD in 2005, when the Town averaged 1.57 MGD. The average use during this period was 1.40 MGD. The annual maximum daily demand in the 2001-2011 periods ranged from 2.07 to 2.56 MGD.

Well Abandonment

The Town of North Reading has six active municipal groundwater sources: Lakeside Wells Nos. 2, 3, and 4, the Railroad Bed Wells, the Central Street Wellfield, and the Route 125 Well. The Town also has an inactive source, the Stickney Well, which has not been used since 1978 due to trichloroethylene contamination, but has not been formally abandoned.

The ENF states that North Reading will submit a BRPWS36 permit application for abandonment of its wells as water sources. MassDEP uses the term "abandonment" to refer to an agreement between MassDEP and a public water supplier that the source will no longer be considered by either party to be a source of public water supply. Abandoned wells must be physically disconnected from the public water system. MassDEP strongly recommends that abandoned wells be properly decommissioned, as described in the MassDEP document *Guidelines for Public Water Systems.*

Wells that are formally abandoned in this manner no longer have any status as public water supply sources and will not be protected as public water supply sources under MassDEP programs, such as the Massachusetts Contingency Plan and Title 5. The wells will have no grandfathered status should the Town seek to reactivate them at some future date. MassDEP will rescind its approval of the Zone II wellhead protection area for the wells. The wells and their Zone II (and the Interim Wellhead Protection Area for the Stickney Well) will not appear on future maps produced by MassDEP's Geographic Information System staff. More than half of the area within North Reading's Zone II is also part of a Zone II for the Town of Wilmington's municipal wells — the Wilmington Zone II will continue to receive MassDEP protection.

MassDEP approval is required prior to any sale or transfer of land that is no longer needed for water supply purposes, in accordance with Massachusetts General Laws c.40, § 15B. If North Reading intends to sell or transfer any water supply land following the well abandonment, an application for Permit Category BRPWS26 must be submitted to MassDEP, including a map of the property, a description of the property, (i.e., the metes and bounds), and a MassDEP transmittal form. Under MEPA, an ENF is required for release of water supply land. In addition, Article 97 of the Massachusetts Declaration of Rights (the Massachusetts Constitution) requires the approval by two-thirds vote of both branches of the State legislature before lands and easements in public use can be converted to another purpose or otherwise be disposed.

Construction Permits

The specific means for getting the purchased water from the MWRA into the North Reading municipal water distribution system has not yet been determined. Construction of pump stations, or new physical interconnections between public water systems, will require Distribution System Modification permitting by MassDEP (Permit Category BRPWS32). The facilities may not be constructed until MassDEP has approved their construction design through this permitting. If multiple facilities of this sort are needed, the Town may combine some or all of the facilities into a single permit application rather than submitting a separate permit application for each facility.

Water Management Act

The Town of North Reading has a Water Management Act (WMA) registration that authorizes the Town to withdraw an annual average daily volume of 0.96 MGD from its wells in the Ipswich River Basin. North Reading also had a Water Management Act permit that authorized additional withdrawals of up to 0.25 MGD, but the permit was surrendered by the Town in 2008 and is no longer in effect. The North Reading registration was renewed on December 31, 2007 for the 10-year period 2008-2017. In 2011, the Town withdrew an annual average daily volume of 0.54 MGD of raw (untreated) water from its wells.

The ENF states that "Upon approval of MWRA membership and proven ability to utilize MWRA water, North Reading's intent would be to voluntarily forfeit this registration to the MA-DEP (sic)."

North Reading's drinking water withdrawal is from the highly stressed Ipswich River Basin. The draft EEA Massachusetts Sustainable Water Management Initiative Framework Summary, February 3, 2012, established draft streamflow alteration levels for 1,395 Massachusetts' subbasins on a scale of 1-5 and sets a draft safe yield for each of the state's 27 major river basins. The streamflow impairment for the subbasin where North Reading's wells are located is level 5, severely impacted. North Reading is not the only withdrawer in the subbasin, but reducing withdrawals will benefit streamflow and habitat conditions in the subbasin. In addition, the draft safe yield for the Ipswich basin is 29.4 MGD. Currently authorized withdrawals are up to 32.8 MGD, 3.4 MGD more than the draft safe yield for the basin. While actual withdrawal volumes have been significantly lower than allocated volumes, efforts to reduce active allocations below safe yield are necessary. North Reading's move to the

MWRA and forfeit of its WMA registration will remove 0.96 MGD in authorized withdrawals, and would reduce the projected shortfall between the draft safe yield and authorized withdrawals in the basin by 28 percent.

Therefore, MassDEP supports North Reading's proposal and recommends that the Town's request to forfeit its WMA registration be submitted concurrently with the application to abandon the municipal wells. The well abandonment will eliminate all of the Town's authorized withdrawal points that are on the Registration Statement, which will effectively terminate the WMA registration.

Performance Standards

Water Management Act permittees are required to meet the performance standards of 65 residential gallons per capita day (RGPCD) and 10 percent unaccounted-for-water (UAW), as set out in the Massachusetts Water Resources Commission's Water Conservation Standards, July 2006. MassDEP notes that in 2011, North Reading had an RGPCD of 74 and UAW of 16 percent, and does not meet the recommended performance standards. In order to purchase water from MWRA, North Reading will need to obtain an Interbasin Transfer Approval from the Water Resources Commission. This approval will require North Reading to implement demand management strategies to bring the Town into compliance with the Water Conservation standards, including the RGPCD and UAW performance standards. The "Water Conservation Standards" and WMA permits also require restrictions on non-essential outdoor summer water use from May through September. MassDEP recommends that North Reading develop an outdoor watering restriction plan consistent with the "Water Conservation Standards" and the standard WMA requirements.

Wastewater

MassDEP has worked with the Town of North Reading on a number of wastewater issues in the past, including review of the September 2008 Draft Comprehensive Wastewater Management Plan (DCWMP), which MassDEP understands will be updated and expanded in the DEIR. More recently, MassDEP has advised the Town on the design and permitting of the wastewater treatment facility which is an element of the New North Reading High School Project.

The ENF provided very limited details on the scope of the work to develop a final CWMP. However, it is clear from the ENF and discussions with the Town that the intention is to fully explore a range of wastewater alternatives, including alternatives which extend outside of the Ipswich River basin. While MassDEP has continually emphasized the importance of sustaining and protecting water resources in the Ipswich River basin, MassDEP is aware of the complexities and costs of long-term wastewater management in North Reading, and supports assessment of alternatives which extend beyond the Ipswich River Basin. However, MassDEP notes that some out-of-basin alternatives will present serious challenges, since some of the regional sewer authorities proximate to the Town have little capacity which they could provide to the Town. MassDEP directly addressed the matter of a potential wastewater connection to MWRA in the attached March 10, 2009 letter. Further, MassDEP also notes that the integration of drinking water master plans will be an essential component of any plan to pursue out-of-basin alternatives for long-term wastewater management planning.

The Town should develop a detailed scope of work for the CWMP that updates the former integrated water resource planning effort. In the DEIR, the wastewater elements should build upon information developed for the DCWMP, and should include, at a minimum, the following elements:

- Update and review of the Needs Analysis, including reassessment of the existing and future wastewater flows and loads;
- Expanded Alternatives Assessment, to include an update and review of the costs and impacts of the in-basin alternatives, and detailed development of out-of-basin alternatives;
- Development of a recommended plan and schedule for long-term wastewater management facilities, including costs, impacts, permitting requirements, and in the case of any out-of-basin alternative, a discussion of any legal agreements needed to support the alternative.

The Town also should include a public participation program as part of the scope, which is a required element of the planning work for any project for which funding will be sought under the State Revolving Fund (SRF) program.

Wetlands

The potential wetlands impacts along the alternative water and sewer routes should be described and quantified in order to provide a comparative understanding of the environmental impacts. Plans at a readable scale should show the resource area impacts. The proponent also should explain how the project would comply with the performance standards in the wetlands regulations and demonstrate that alteration of resource areas has been avoided and minimized. Where opportunities exist, consideration should be given to project alternatives and site design changes to demonstrate fully that the project conforms to the wetlands regulations and wetlands impacts have been avoided and minimized to the extent feasible. The Department also requests plans depicting and quantifying wetlands replication areas and information on how altered wetland functions will be restored. The wetlands replication/mitigation design should be based upon the MassDEP *Massachusetts Inland Wetland Replication Guidelines*, March 2002.

Greenhouse Gas Emissions

The proposed project is categorically included for the preparation of an environmental impact report and therefore, the project is subject to the MEPA Greenhouse Gas Emissions Policy and Protocol. Since the ENF did not consider GHG issues, MassDEP will review the GHG analysis in the EIR for consistency with the policy, and in particular will be looking for an understanding of the approach and objectives to reducing greenhouse gas emissions for this project. Sufficient information and modeling outputs should be presented to demonstrate that the project has avoided, minimized, and mitigated CO_2 emissions in conformance with the MEPA regulatory and policy standards.

Water-related energy consumption and corresponding CO_2 emissions should be evaluated and compared in the GHG analysis for the existing conditions and project alternatives. The embedded energy in the treatment and distribution systems for pumping, treating, distributing, and possibly pressurizing water and wastewater should be taken into account in the analysis. The opportunities to reduce energy and CO_2 emissions with water conservation, energy efficiencies, infiltration/inflow removal, and new technologies should be considered as mitigation. The energy intensity of water in the United States (US) has been quantified recently with a more robust methodology, according to an article entitled, *Evaluating the energy consumed for water use in the United States*, by Kelly T. Sanders and Michael E Webber, Department of Mechanical Engineering, The University of Texas at Austin, (dated March 12, 2012 and published September 20, 2012). The article reports that embedded energy in the 2010 water system accounted for about 12.6 percent of the US energy consumption. With respect to energy use, "High-energy scenarios usually include water systems that require extensive water pumping (e.g., the State Water Project and the Central Valley Project) and/or advanced water treatment." The need to address the energy for water and wastewater comes into perspective, when it is recognized that the energy intensity of water is about 25 percent greater than energy for residential and commercial lighting, an industry where energy consumption and efficiency for lighting is given significant attention. In Massachusetts, the cost of electricity is about $150 million per year to treat 662 billion gallons of wastewater and drinking water, where energy costs are about 35-40 percent of the facilities' operating budgets.

Massachusetts Contingency Plan/M.G.L. c.21E

Contaminated Soil and Groundwater: The EIR should assess the potential for contaminated soil and groundwater along the potential water and sewer main routes. The project proponent is advised that excavating, removing and/or disposing of contaminated soil, pumping of contaminated groundwater, or working in contaminated media must be done under the provisions of MGL c.21E (and, potentially, c.21C) and OSHA. If permits and approvals under these provisions are not obtained beforehand, considerable delays in the project can occur. The project proponent cannot manage contaminated media without prior submittal of appropriate plans to MassDEP, which describe the proposed contaminated soil and groundwater handling and disposal approach, and health and safety precautions. If contamination at the site is known or suspected, the appropriate tests should be conducted well in advance of the start of construction and professional environmental consulting services should be readily available to provide technical guidance to facilitate any necessary permits. If dewatering activities are to occur at a site with contaminated groundwater, or in proximity to contaminated groundwater where dewatering can draw in the contamination, a plan must be in place to properly manage the groundwater and ensure site conditions are not exacerbated by these activities. Dust and/or vapor monitoring and controls are often necessary for large-scale projects in contaminated areas. The need to conduct real-time air monitoring for contaminated dust and to implement dust suppression must be determined prior to excavation of soils, especially those contaminated with compounds such as metals and PCBs. An evaluation of contaminant concentrations in soil should be completed to determine the concentration of contaminated dust that could pose a risk to health of on-site workers and nearby human receptors. If this dust concentration, or action level, is reached during excavation, dust suppression should be implemented as needed, or earthwork should be halted.

Potential Indoor Air Impacts: Parties constructing and/or renovating buildings in contaminated areas should consider whether chemical or petroleum vapors in subsurface soils and/or groundwater could impact the indoor air quality of the buildings. All relevant site data, such as contaminant concentrations in soil and groundwater, depth to groundwater, and soil gas concentrations should be evaluated to determine the potential for indoor air impacts to existing or proposed building structures. Particular attention should be paid to the vapor intrusion pathway for sites with elevated levels of chlorinated volatile organic compounds such as tetrachloroethylene (PCE) and trichloroethylene (TCE). MassDEP has additional information about the vapor intrusion pathway on its website at http://www.mass.gov/dep/cleanup/laws/vifs.htm.

New Structures and Utilities: Construction activities conducted at a disposal site shall not prevent or impede the implementation of likely assessment or remedial response actions at the site. Construction of structures at a contaminated site may be conducted as a Release Abatement Measure if assessment and remedial activities prescribed at 310 CMR 40.0442(3) are completed within and adjacent to the footprint of the proposed structure prior to or concurrent with the construction activities. Excavation of contaminated soils to construct clean utility corridors should be conducted for all new utility installations.

The MassDEP appreciates the opportunity to comment on this proposed project. Please contact Duane.LeVangie@state.ma.us, at (617)-292- 5706 for guidance on Water Management Act issues, James.Persky@state.ma.us , at (978-694-3227 for information on drinking water issues, and Kevin.Brander@state.ma.us , at (978) 694-3236 for further information on the wastewater issues. If you have any general questions regarding these comments, please contact Nancy.Baker@state.ma.us , MEPA Review Coordinator at (978) 694-3338.

Sincerely,

John D. Viola
Deputy Regional Director

Attachment

cc: Brona Simon, Massachusetts Historical Commission
Pam Heidill, MWRA
Michele Drury, DCR
Kathleen Baskin, EEA
Duane LeVangie, MassDEP-Boston
Eric Worrall, Kevin Brander, Tom Mahin, Jim Persky, Jill Provencal, MassDEP-NERO

COMMONWEALTH OF MASSACHUSETTS
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IAN A. BOWLES
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LAURIE BURT
Commissioner

March 10, 2009

Kent Nichols, Jr., P.E.
Vice President
Weston & Sampson Engineers
5 Centennial Drive
Peabody, MA 01960-7985

Re: North Reading
Comprehensive Wastewater
Management Plan

Dear Mr. Nichols:

The Department of Environmental Protection ("MassDEP") Northeast Regional office is in receipt of your recent letter in which you request input from MassDEP on two specific alternatives being considered as elements of the draft Comprehensive Wastewater Management Plan (CWMP) for the Town of North Reading. MassDEP has reviewed your request and provides the following response.

The Town of North Reading lies entirely within the Ipswich River watershed, which has been identified as one of the most stressed watersheds in the state. There are fourteen communities that rely on water resources in the Ipswich basin in whole or in part for supply of drinking water. Given these and other stressors in the basin, flows in the mainstem of the Ipswich River are often very low, and the River has had completely dry segments during some years. Accordingly, the MA Water Resources Commission has designated the Ipswich River as a highly stressed watershed. These factors must be important considerations in development of the Town's Comprehensive Wastewater Management Plan (CWMP).

There is presently no sewer system in the Town, and wastewater has been managed by a collection of on-site disposal systems, in some cases regulated pursuant to Title 5 of the State Environmental Code administered by the Board of Health, and in some cases (where flows exceed 10,000 gallons per day) where individual groundwater discharge permits are issued by MassDEP. While these systems have operated effectively in many areas, as the Draft CWMP points out, there are some areas where there are high failure rates, and some receiving waters showing water quality impairments. These issues, along with the Town's future plans for growth, and the protection of water resources strongly indicate that the Town should develop a long-term CWMP to meet their needs. MassDEP concurs in this regard.

The Town has recently asked MassDEP for input on two specific alternatives which are being considered, though not at this time recommended, in the draft CWMP: conveyance of wastewater to the MWRA system, and construction of a wastewater treatment facility with a surface water discharge to the Ipswich River. MassDEP input on these alternatives follows.

MWRA connection

Pursuing a wastewater connection to the MWRA system would involve many hurdles. First, based on the aforementioned conditions in the Ipswich River watershed, connection to the MWRA system would involve an export of water from the watershed, since water resources would be transferred from the Ipswich basin and discharged to Massachusetts Bay after treatment at the Deer Island Treatment Plant. This would necessitate a permit under the Interbasin Transfer Act, administered by the Water Resources Commission at the Department of Conservation and Recreation (DCR). Given the depletion of resources in the Ipswich Basin, it is unlikely that such a permit would be granted. Second, MWRA, prior to allowing a connection to their system from a non-member community, has a rigorous review process, which involves both technical and institutional constraints. These are detailed in MWRA Policy No. OP-11, and include (in part):

- Legislative action: MWRA's enabling legislation does not allow them to connect services to a non-member community without amendment to the act, and therefore approval by the Governor and General Court. MWRA would also require MassDEP approval and compliance with other environmental requirements, such as the Interbasin Transfer Act.
- Technical review: The MWRA sewer system has limited capacity to accept any new flows. During wet weather events, sewer system overflows are not uncommon, both in the MWRA system and in member community systems. These overflows cause violations of state water quality standards, and significant public health risks. MWRA carefully reviews any proposed new connections to ensure that there will be no negative impacts from new connections. This would be a formidable constraint.
- Flow Mitigation: where MWRA determines that capacity exists, mitigation in the form of identification and removal of infiltration and inflow (I/I), based on removal of four gallons of I/I for every gallon of new flow is a requirement, at a minimum.
- Fees: MWRA imposes a fee upon acceptance of any non-member community as "fair compensation" for investments made in the sewage collection and treatment facilities by member communities.

These requirements suggest that pursuing a connection to the MWRA for wastewater flows would be a difficult and challenging task. MWRA's policy indicates that communities interested in such a connection write a letter of interest to the Executive Director. MWRA thereafter can respond as to their ability to accommodate the additional flows.

Surface Water Discharge

New and existing surface water discharges are subject to 314 CMR 3.00, the Surface Water Discharge Permit Program, and 314 CMR 4.00, the State Surface Water Quality Standards. The segment of the Ipswich River flowing through and downstream of North Reading is designated as Class B. These waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. The B classification for the Ipswich River also includes use as a source of public water supply with appropriate treatment. The Surface Water Standards also classify this segment of the River as a "High Quality Water." These designations establish the River as a critical resource, which needs to support many uses, and which must be afforded a very high level of protection.

The permitting of new surface water discharges is a joint action of MassDEP and the United States Environmental Protection Agency (EPA), under the state and federal Clean Water Act respectively. It is the duty of MassDEP and EPA to prohibit any discharges of pollutants to surface waters which would violate water quality standards or impair attainment of designated uses. The antidegration provisions contained in 314 CMR 4.04 establish the requirements for allowing any new or increased discharge of pollutants to receiving waters. Pursuant to 314 CMR 4.04(2):

> *"Limited degradation also may be allowed by the Department where it determines that a new or increased discharge is insignificant because it does not have the potential to impair any existing or designated water use and does not have the potential to cause any significant lowering of water quality."*

This criteria for approval is more formally defined in 314 CMR 4.04

(5) Authorizations.

(a) An authorization to discharge to waters designated for protection under 314 CMR 4.04(5) may be issued by the Department where the applicant demonstrates that:

1. The discharge is necessary to accommodate important economic or social development in the area in which the waters are located;

2. No less environmentally damaging alternative site for the activity, receptor for the disposal, or method of elimination of the discharge is reasonably available or feasible;

3. To the maximum extent feasible, the discharge and activity are designed and conducted to minimize adverse impacts on water quality, including implementation of source reduction practices; and

4. The discharge will not impair existing water uses and will not result in a level of water quality less than that specified for the Class.

For the Town of North Reading, the draft CWMP has indicated that alternatives other than a surface water discharge appear to be feasible. If the Town wishes to reassess this finding, there would need to be a demonstration in the CWMP that the identified groundwater discharge alternatives are infeasible, for technical, financial, or other reasons. Such a demonstration would be subject to the rigorous requirements of 314 CMR 4.00 and MassDEP's 1993 Antidegradation Policy which sets forth review procedures for proposed surface water discharges.

MassDEP continues to be of the opinion that a combination of on-site disposal systems and treated groundwater discharges are the most viable alternatives for long-term management of wastewater in the Town. If you have any questions regarding this letter, please contact Kevin Brander of my staff at (978) 694-3236.

Sincerely,

Eric Worrall
Deputy Regional Director
Bureau of Resource Protection

Cc: Mark Clark, Town of North Reading
David Ferris, Director of Watershed Permitting, MassDEP
Ron Lyberger, Bureau of Resource Protection, MassDEP
Paul Hogan, NPDES Program Manager, MassDEP
Michael Hornbrook, MWRA Chief Operating Officer

Johnson, Holly (EEA)

From: Keith Saxon [ksaxon@aol.com]
Sent: Tuesday, November 27, 2012 4:54 PM
To: Johnson, Holly (EEA)
Subject: Fwd: Comments on North Reading New Water/Wastewater - MEPA EEA#14975

-----Original Message-----
From: Keith Saxon <ksaxon@aol.com>
To: richard.sullivan <richard.sullivan@state.ma.us>; holly.johnson <holly.johnson@state.ma.us>
Cc: paul.brinkman <paul.brinkman@wright-pierce.com>
Sent: Tue, Nov 27, 2012 4:44 pm
Subject: Comments on North Reading New Water/Wastewater - MEPA EEA#14975

Secretary Richard K. Sullivan, Jr.
Executive Office of Energy & Environmental Affairs
Attn: MEPA Office
Holly Johnson, EEA #14975
100 Cambridge Street
Suite 900
Boston, MA 02114

Dear Secretary Sullivan,

I appreciate the opportunity to comment on this project and the mandatory EIR it requires. First off I commend the proponent for taking steps to address the stressed Ipswich River Basin.

WATER SUPPLY:
1) Reliability of Andover Water Supply: The proponent states that "The Andover water supply does not provide North Reading with reliable long-term solution it requires for the health, safety, and welfare of its residents". Given that water consumption is declining in general, Andover is close to build-out, and the Andover supply is provided significantly from the Merrimack River, the EIR should address why the Town of North Reading considers the Andover supply to be unreliable in the long-term. Are there specific risks to this supply which concern North Reading?
2) Future Use of Water Supply Lands: The EIR should address what will happen to existing Water Supply lands held by the Town for its Groundwater Sources. This land should remain protected and/or be transferred to the Conservation Commission in order to provide Chapter 97 protections. The current Water Department lands protect significant open space within the town & general area and could provide passive open space opportunities for residents (while still protecting watershed in case of future need to re-activate the groundwater source). In particular the water supply lands west of Rt 125 and south of Lowell Rd (Rt 62) abut existing conservation lands held by the Towns of North Reading, Andover, & Wilmington as well as private land trusts.
3) Management of New Water Supply: The EIR should address what water conservation measures that the Town will implement at its existing facilities, including the Hillview Country Club golf course property.

WASTEWATER:
1) Commercial / Industrial Users: The EIR should address and prioritize steps that a new sewer system will take to provide sewer services to the major commercial and industrial users along Rt 28 and Concord Rd. Further it should contain significant volumes from these users in order to handle existing on-site discharges to stormwater and/or septic systems that have the potential to cause contamination now and/or may have in the past (for example - car wash wastewater from car dealerships and auto repair facilities).

REQUIRED NEW INFRASTRUCTURE:
1) Impact to Abutting Towns: The EIR should address the environmental impacts from the installation of new water & sewer mains within in the Abutting Towns as required to connect into these new services.

Thank You for Your Consideration,
Keith Saxon

15 Wethersfield Drive
Andover, MA 01810
781-454-5330
ksaxon@aol.com

Johnson, Holly (EEA)

From: Lexi Dewey [info@wscac.org]
Sent: Wednesday, November 28, 2012 11:04 AM
To: Johnson, Holly (EEA)
Subject: FW: North Reading ENF

Holly,

Yesterday's email bounced back since I had an incorrect email address for you. Sorry for the delay.

Lexi

From: Lexi Dewey [mailto:info@wscac.org]
Sent: Tuesday, November 27, 2012 4:41 PM
To: 'holly.johnson@state.ma.us'
Subject: North Reading ENF

November 27, 2012

Holly Johnson, MEPA Analyst
100 Cambridge St., Suite 900
Boston, MA 02114

Re: Town of North Reading-ENF #14975

Dear Holly,

The WSCAC committee has had the opportunity to look at the ENF for the Town of North Reading. We look forward to following the Town's process and the eventual review of the DEIR. Please include us on the list as material becomes available.

Thank you,
Lexi Dewey

Lexi Dewey
Executive Director
WSCAC
485 Ware Rd.
Belchertown, MA 01007
Phone 413-213-0454
FAX 413-213-0537

MASSACHUSETTS WATER RESOURCES AUTHORITY
Charlestown Navy Yard
100 First Avenue, Building 39
Boston, MA 02129

Frederick A. Laskey
Executive Director

Telephone: (617) 242-6000
Fax: (617) 788-4899
TTY: (617) 788-4971

HJ

November 27, 2012

Mr. Richard K. Sullivan, Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

RECEIVED
NOV 29 2012
MEPA

Attention: MEPA Office – Holly Johnson

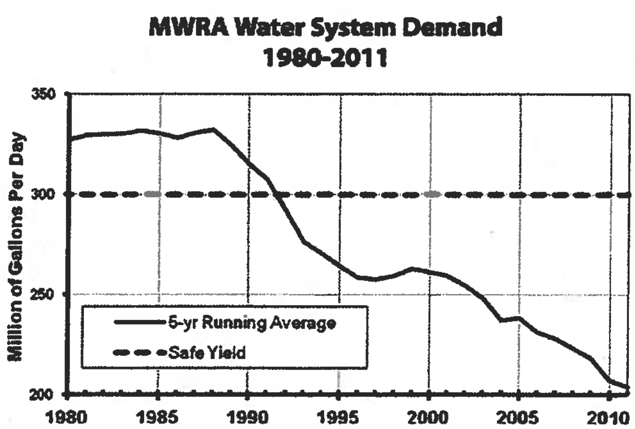
Subject: Environmental Notification Form, #14975
North Reading New Water and Wastewater Solutions

Dear Secretary Sullivan:

The Massachusetts Water Resources Authority (MWRA) appreciates the opportunity to comment on the Environmental Notification Form (ENF) for North Reading's New Water and Wastewater Solutions.

The ENF indicates North Reading's intent to become a fully-supplied MWRA Water system community, and to discontinue drinking water withdrawals from wells in the Ipswich River Basin and to reduce reliance on water supplied from Andover. The ENF also indicates that North Reading is pursuing wastewater disposal options, other than MWRA, for up to 500,000 gallons per day (gpd). Because a sewer connection with MWRA is not being pursued, MWRA's comments below are limited to water supply.

MWRA strongly supports North Reading's intent to become a permanent MWRA fully supplied water member and to purchase approximately 1.5 mgd of MWRA water on an annualized basis. Because MWRA has undertaken successful conservation programs and water demand has declined, MWRA is in a position to serve additional communities with demonstrated water needs. MWRA system demand now averages approximately 204 mgd (5-year average 2007-2011). As the figure below illustrates, service area demand has dropped significantly since the MWRA's formation (even though the geographic bounds of the MWRA service area have grown).



MWRA's analysis shows that geographic expansion of MWRA's Water Service area by the sale of at least 12 mgd to new communities, including North Reading, would have no adverse impacts on existing MWRA communities, the donor basins and the maintenance of reasonable in-stream flow in the Chicopee and Nashua River basins. At the same time, much study has shown that environmental benefits to the Ipswich River would result from reduced pumping of water supply wells in the basin. For example, when MWRA supplemented Wilmington's wells, and fully replaced Reading's use of local sources, pumping was reduced from streamside wells adjacent to the highly stressed Ipswich River and river flows benefitted. The environmental success may be replicated in North Reading. MWRA's large, multi-year Wachusett and Quabbin storage reservoirs can help reduce or replace withdrawals from local sources and can be part of an effective regional water management approach to address water supply needs in highly flow altered communities identified in the state's Sustainable Water Management Initiative investigations.

MWRA's donor basin analysis serves as the basis of some key findings that must be made for admission to the MWRA waterworks system, pursuant to MWRA's Enabling Act and MWRA O.P. #10, *Admission of a New Community into the Waterworks System* (attached). O.P #10 establishes the process and criteria that MWRA uses to evaluate requests for admission and key MWRA criteria overlap with the criteria of other regulatory review processes, including the Interbasin Transfer Act (IBTA). North Reading's proposal to become a full time, permanent member of the MWRA water system will require completion of an Environmental Impact Report (EIR) as well as IBTA review. MWRA will provide the donor basin analysis that is required as part of the MEPA/IBTA review. The donor basin review may occur simultaneously with review of other communities that are actively considering MWRA as a water supply option. MWRA anticipates that the donor basin analysis for the sale of at least 12 mgd to new communities subject to IBTA review may be presented either through incorporation of MWRA's analysis into North Reading's Draft EIR, or alternatively, through a Single Donor Basin EIR prepared by MWRA, or other MEPA process.

MWRA understands that North Reading is pursuing both water and wastewater solutions to address the town's infrastructure needs, and MEPA review will likely be required for both water and sewer. MWRA urges the MEPA process to be structured in a way that will allow the MEPA review for water to be completed on a schedule independent of wastewater, so that IBTA process for receipt of water from MWRA can proceed in an expeditious manner.

In closing, MWRA reiterates our support of North Reading's interest in becoming a fully-supplied MWRA Water system community and we look forward to working with the Town as this review process begins. Should you have any questions on these comments, please do not hesitate to contact Pamela Heidell, Policy & Planning Manager at (617) 788-1102.

Sincerely,

Marianne Connolly

Marianne Connolly
Sr. Program Manager,
Environmental Review and Compliance

Attachment

cc: Pam Heidell, Policy & Planning Manager, MWRA
Kathy Baskin, Water Policy Director, EEA
Eric Worrall, Northeast Director, DEP
Michelle Drury, Water Resources Commission, DCR
Richard M. Carnevale, Public Works Director, North Reading
Paul Brinkman, Wright-Pierce

C: 14975NorthReadingENF.docx

Admission of New Community to MWRA Water System

Policy #: OP.10

Effective Date: June 25, 1997	**Last Revised:** 10/11/2006
Contact: Planning Department or Executive Office	**Former Policy #:** OP.10
Reviewed by Chief Operating Officer: Michael J. Hornbrook	**Date:** 4/13/07
Reviewed by Internal Audit: John A. Mahoney	**Date:** 4/17/07
Approved by Executive Director: Frederick A. Laskey	**Date:** 4/17/07

Purpose

This policy explains the criteria and process the MWRA will use to evaluate a request for admission of a new community to the MWRA water system and requests from state, county, institutional and federal facilities for water service to locations in communities not included in section 8 (d) of MWRA's Enabling Act (St.1984, c.372).

Eligibility

This policy applies to communities seeking admission to the MWRA water system, and to state, county, institutional, and federal facilities seeking MWRA water for a location outside MWRA's water service area as set forth in section 8 (d) of MWRA's Enabling Act (St.1984, c.372).

Applicability

Each of the provisions of OP.10, Admission of New Community to Waterworks System, which was in existence just prior to its being amended by the MWRA Board of Director's vote of October 11, 2006 shall continue to apply in full to the entirety of the process by which the Towns of Reading, Wilmington, and by which the entity South Shore Tri-Town Development, created under section 3 of c.301 of the Acts of 1998, may each continue to seek admission to the MWRA Waterworks system and service area.

Continued on next page

In this Policy This policy contains the following parts:

Continued on next page

Admission Criteria

In evaluating whether to permit the admission of new communities to the MWRA waterworks system, the MWRA must evaluate the following two groups of criteria:

A. Enabling Act Criteria

- The MWRA must, in accordance with Section 8 (d) of Chapter 372 of the Acts of 1984, find that the following six criteria are met:
  - The safe yield of the watershed system, on the advice of the MDC, is sufficient to meet the new community's demand.
  - No existing or potential water supply source for the community has been abandoned, unless the Department of Environmental Protection (DEP) has declared that the source is unfit for drinking and cannot be economically restored for drinking purposes.
  - A water management plan has been adopted by the community and approved by the Water Resources Commission.
  - Effective demand management measures have been developed by the community, including the establishment of leak detection and other appropriate system rehabilitation programs.
  - A local water supply source feasible for development has not been identified by the community or DEP.
  - A water use survey has been completed which identifies all users within the community that consume in excess of twenty million gallons a year.
- Admission of the applicant community into the MWRA has received approval from the MWRA Advisory Board, the General Court, and the Governor.
- An applicant community has accepted the extension of MWRA's water system to the community by majority vote of the city council if a city or a majority vote of the town meeting if a town.

Continued on next page

Admission Criteria continued

- Providing water service to a state, county, institutional or federal facility outside MWRA's water service area has received approval from the MWRA Advisory Board.

B. Other Criteria

- Any expansion of the MWRA water service system shall strive for no negative impact on the interests of the current MWRA water communities, water quality, hydraulic performance of the MWRA water system, the environment, or on the interests of the watershed communities; shall attempt to achieve economic benefit for existing user communities; and shall preserve the rights of the existing member communities. Any evaluation of the impacts of new communities shall clearly evaluate all changes to system reliability.

- The applicant community has met all legal requirements for admission; and

- Upon admission, the applicant community will pay fair compensation for past investment in the MWRA waterworks system by existing user communities.

Application Process

A. Application

An applicant shall submit three copies of a completed application to the MWRA Executive Director for review. A copy shall also be submitted to the MWRA Advisory Board. MWRA staff will review and evaluate the completed application to determine whether the requirements of the Enabling Act and additional requirements can be met, and whether water service can be provided by MWRA without jeopardizing standards and requirements set forth in this policy.

Continued on next page

Application Process, continued

B. Requirements

- In a formal application for entrance to the MWRA waterworks system, an applicant community must provide detailed documentation to enable MWRA to make the necessary findings required by MWRA's Enabling Act (Section 8 (d) of St.1984, c.372).

  In addition to providing documentation for the Section 8 (d) findings above, the applicant must provide the following.

- Documentation of approvals from the Secretary of Environmental Affairs in the MEPA process, the Water Resources Commission in the Interbasin Transfer Act process, the MWRA Advisory Board, the DEP on local source feasibility, the General Court, and the Governor. Prior to a formal application to MWRA, MWRA will strive to streamline the approval process, by review of application material concurrently with other approval processes, and by coordination with state agencies to document environmental and hydraulic impacts on MWRA's system.

- A detailed description of the water conservation and water accountability programs undertaken by the community and other entities including: leak detection and repair, commercial and industrial water conservation, residential water conservation efforts, large meter downsizing, meter replacement, municipal facility conservation, unaccounted-for water analysis (present data for UAW levels in last 3 years), true cost pricing and conservation based pricing for water and sewer service.

- Communities shall provide a plan for water conservation. MWRA encourages communities to have a plan that adheres to the Commonwealth's water conservation standards, including guidelines for lawn and landscapes. (Enforcement shall be the responsibility of the Water Resources Commission (WRC), Department of Environmental Protection (DEP) and other Commonwealth agencies.)

- A description (and copy) of municipal zoning and non-zoning measures designed to protect local sources of supply with a comparison showing how they meet DEP's regulations and policies for adequate water supply protection measures.

Continued on next page

Application Process, continued

- Copies of any studies conducted on existing and potential local water source safe yield, protection needs, contamination threats, and water demand forecasts. If no studies are available on a potential local source known to the community or DEP, then the applicant should prepare documentation on estimated safe yield, protection needs and contamination threats, even for those sources previously determined to be infeasible to develop.

- A disaggregation of the community's total water consumption by customer class: residential, industrial, commercial, municipal facilities, unaccounted-for, other, and agricultural. A listing of large customers using over one million gallons a year should be provided.

- A Local Water Supply Management Plan if the applicant is a community. For a plan contents, refer to Attachment A. A Water Management Plan approved by the Water Resources Commission will also satisfy MWRA's Local Water Supply Management Plan requirement. A community's application must address how the requested connection is consistent with the stated objectives of the community's Local Water Supply Management Plan.

  All other applicants (*i.e.,* state, county, institutional, and federal facilities) must address how the proposed water connection/water use is consistent with a Local Water Supply Management Plan, if it exists. MWRA also reserves the right to reject applications for those cases in which the community does not have a Local Water Supply Management Plan.

Continued on next page

Application Process, continued

C. MWRA Review of Application

Upon receipt of an application for admission to the waterworks system the MWRA will:

- Review the application's documentation on the necessary findings required by the MWRA's Enabling Act, and other criteria listed in the Admission Criteria.

- Review documentation submitted pursuant to the Requirements section of this Policy (Section B.) to help determine if MWRA can make the findings required listed in Admission Criteria.

- Analyze the applicant's demand impact on the MWRA waterworks system and consider the projected long-term demand of the system with the new community and contrast it to the MWRA's operations through average, wet and drought scenarios. The analysis must include the possibility of increased usage of MWRA supplies by partially supplied and non-MWRA communities due to drought conditions. Impacts on service to other community connections under various hydraulic conditions and to reservoir and watershed conditions must also be evaluated.

- Upon the request of the applicant, and subsequent to the completion of application review by MWRA staff and following consultation with the Advisory Board, submit a status report to the Board of Directors to inform it of the request, staffs' review and the status of other pending per-nits or approvals.

Continued on next page

Application Process, continued

D. Concurrent Reviews

Other regulatory approvals or permits may be required before a request for service may be approved. It is the responsibility of the applicant to obtain all such approvals. Copies of all applications or requests for regulatory approval shall be submitted to the MWRA as early as practicable to facilitate MWRA review of the request. MWRA will cooperate with other regulatory agencies to coordinate its review where possible, and will review and comment in other regulatory processes as appropriate. Final action by MWRA cannot be taken until the following regulatory approvals, where required, have been obtained.

- Massachusetts Environmental Policy Act – Executive Office of Environmental Affairs
- Interbasin Transfer Act - Water Resources Commission
- Local water supply source feasibility - Massachusetts Department of Environmental Protection

E. Legislation

Legislation is required to extend MWRA's water system to a local body not listed in Section 8 (d). Proposed legislation should be submitted to MWRA for review before filing. MWRA may require that certain conditions be included in the proposed legislation.

Continued on next page

Water Supply Agreement

If MWRA approves the request for new service, it will establish appropriate terms and conditions of service in the form of a water supply agreement for an initial term of five years. The agreement will be consistent with MWRA's Continuation of Contract Water Supply regulations (360 CMR 11.00). Before contract renewal, MWRA will reevaluate and assess the status of the community's demand management efforts.

The agreement will set forth as appropriate:

- Firm limits on usage, including average and maximum daily use of MWRA water and a stipulation that any increase beyond the stated amounts would require a contract revision and recalculation of the entrance fee. Any significant increase will also require new approval by the MWRA Advisory Board and MWRA Board of Directors.

- A requirement that the applicant assume all costs of connection and pay an entrance fee.

- A requirement that the applicant continue to use all local non-MWRA sources of water to the maximum feasible extent.

- A requirement that the applicant continue to implement all practicable conservation measures. Communities shall be encouraged to adhere to the Commonwealth's water conservation standards, including guidelines for lawn and landscapes, and follow the MWRA's regulations for Leak Detection (360 C.M.R. 12.00).

- A requirement that the community protect local sources of supply in accordance with DEP's guidelines for water supply protection measures.

- Other conditions as may be appropriate.

Continued on next page

Attachment A

Local Water Supply Management Plan Outline

Water Supply

- Identify existing and potential water supplies in the community, zone II delineations, Interim Wellhead Protection Zones, and/or Zones A and B delineations for surface water sources, and watershed boundaries.
- Describe source water protection program, including compliance with DEP source water protection regulations.
- Identification of all water supply options, including compliance with DEP water protection regulations.
- Identification of all water supply options, including local, regional and conservation options.

Regional Plans

- Describe any existing regional or watershed plans and how these plans relate to the plans of the local community. Refer to reports and plans developed by regional planning agencies, local watershed associations, and other appropriate regional and/or non-governmental agencies.

Future Plans

- Analysis of existing zoning and master plan, including EOEA build-out analyses available from Massachusetts GIS.
- Identification of future water and wastewater needs and various alternatives for meeting these needs.
- Summary and evaluation of water infrastructure plans based on build-out and future needs.
- Overall summary based on above information.

Analysis and Conclusions

- An action plan, with timetables for implementation of the recommendations of the plan, a budget, and identification of people responsible for implementation.

H2

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Dedham • Everett • Framingham • Hingham • Holbrook • Leominster
Medford • Melrose • Milton • Nahant • Natick • Needham • Newton
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REPRESENTING 60 CITIES & TOWNS
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MEPA

November 27, 2012

Mr. Richard K. Sullivan, Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Attn: MEPA Office – Holly Johnson

Subject: Environmental Notification Form #14975
North Reading New Water and Wastewater Solutions

Dear Secretary Sullivan:

The Massachusetts Water Resources Authority Advisory Board appreciates the opportunity to comment on the Environmental Notification Form for North Reading's New Water and Wastewater Solutions.

The Advisory Board strongly supports North Reading's intent to purchase 1.5 million gallons per day of MWRA water.

The Advisory Board has long advocated that the Authority has ample capacity to provide water to communities with demand needs.

Recently, DEP Water Management Act Manager Duane LeVangie provided the Advisory Board with a presentation on the status of Sustainable Water Management Initiatives (SWMI). Could there be a better example of achieving the goals outlined by SWMI than North Reading's intent to purchase MWRA water and reducing the stress on the Ipswich River Basin?

Additionally, the Advisory Board fully expects that the state's environmental review process will be streamlined and undertaken in a consolidated manner.

Joseph E. Favaloro, Executive Director
100 First Avenue • Building 39 • 4th Floor • Boston, MA 02129 • Telephone: (617) 788-2050 • Fax: (617) 788-2059
Website: www.mwraadvisoryboard.com • Email: mwra.ab@mwra.state.ma.us

In closing, what we have here is a win for North Reading, a win for the state's environmental goals and a win for MWRA ratepayers. For these reasons, I reiterate the Advisory Board's strong support for North Reading's interest in becoming an MWRA water community.

If you have any questions and/or comments, please feel free to contact me at 617-788-2051 or at Joseph.Favaloro@mwra.state.ma.us.

Sincerely,

Joseph E. Favaloro, Jr.
Executive Director

cc: Pam Heidell, Policy & Planning Manager, MWRA
Kathy Baskin, Water Policy Director, EEA
Eric Worrell, Northeast Director, DEP
Michele Drury, Water Resources Commission, DCR
Richard M. Carnevale, Public Works Director, North Reading
Paul Brinkman, Wright-Pierce

THE COMMONWEALTH OF MASSACHUSETTS

WATER RESOURCES COMMISSION

100 CAMBRIDGE STREET, BOSTON MA 02114

November 21, 2012

Richard Sullivan, Secretary
Executive Office of Energy and Environmental Affairs
Attention: Holly Johnson, MEPA Office
EOEA #14975
100 Cambridge Street
Boston, MA 02114

Dear Secretary Sullivan:

The Water Resources Commission (WRC) staff has reviewed the ENF for Town of North Reading's New Water & Wastewater Solutions Project. The ENF discusses a proposal to obtain water supply from the Massachusetts Water Resources Authority (MWRA), an action that triggers the Interbasin Transfer Act (ITA). It also discusses sending a portion of the town's wastewater to an area, to be determined, out of town and out of basin. This latter proposal also has the potential to trigger the ITA.

Staff members of the WRC, MA Department of Environmental Protection (MassDEP), and the MWRA met with the town and its consultant on November 16, 2012, to discuss the project's components, schedule, and regulatory requirements. This provided the agencies with a clearer understanding of the proposed project; we hope that the meeting also has given the proponent a better understanding of applicable regulatory considerations. With a project involving the ITA, close communication between the WRC staff and a project proponent helps to ensure preparation of a complete response that satisfies the requirements of the ITA and avoids unnecessary prolonging of the process.

Below are additional comments on the ENF:

The ENF states that the transfer from the MWRA system will be a transfer from the Connecticut River basin. This is incorrect. The MWRA's sources are located in the Chicopee and Nashua River basins.

The ENF states that North Reading will discontinue use of its existing groundwater sources and surrender its Water Management Act registration. In its Draft Environmental Impact Report (DEIR), North Reading should clarify that it will be going through DEP's formal source decommissioning process for these wells. The DEIR should clarify if the Town will discontinue its WRC-approved transfer from Andover. The DEIR should also better define and document the proposed transfer amount. The ENF lists it as "up to" 1.5 mgd. Is this an average day amount or a maximum day amount? Is this amount over and above the existing transfer from Andover? Will this amount be documented in the Town's contract with the MWRA?

The wastewater portion of the project needs to be better described in the DEIR. It is not clear if a Comprehensive Wastewater Management Plan (CWMP) is needed for this project. The DEIR should document communication with MassDEP regarding the necessity for a CWMP, and if one is required, discuss the timeline for completion of the CWMP process.

If North Reading gives up its WMA registration and decommissions its in-basin sources, so that all the wastewater to potentially be transferred out of basin originates in a basin other than the Ipswich River basin, the WRC would consider this portion of the project to be a secondary transfer, not subject to the ITA. Otherwise, the transfer of wastewater originating in the Ipswich River basin and transferring to another basin may be subject to ITA review. Until we know exactly what the full project will involve, the WRC will not be able to make this decision.

We are concerned about the timing of each portion of the project. Under the MGL Chapter 21 §§ 8B- 8D, the Interbasin Transfer Act, the WRC cannot hold the required public hearings nor make a decision on a project until the MEPA process is complete. There is no flexibility on this under the Act. If one portion of the project holds up the completion of the MEPA process, the WRC cannot make a decision on either portion of the project – even if we have received all the required information - until the Secretary's Final Certificate has been issued. We suggest that the proponent consult with the MEPA office, if it appears that this scenario may occur, to determine if the project could be divided into two different filings or separate segments or phases.

The WRC uses the EIR as its ITA application. I have attached scopes to be used in the development of the ITA application section of the DEIR for both a request for admission to the MWRA under the ITA and for a wastewater transfer (if required). The proponent should pay particular attention to the water supply management criteria in the scope for admission to the MWRA. North Reading's average residential water use from 2007 to 2011 is 66 gallons per capita per day (gpcd), and its average unaccounted-for water amount is 15%. The ITA's performance standards require that unaccounted-for water should be 10% or less. North Reading should immediately implement a long-term water conservation program, which complies with the current <u>Water Conservation Standards</u> and includes a plan to reduce its unaccounted-for water. This plan should reflect the goal of maintaining unaccounted-for water at 10% or less of all water used, and of reducing future water use through a comprehensive residential water conservation program, if residential water use is greater than 65 gpcd.

We strongly urge the proponent to contact Michele Drury of WRC staff at 617-626-1366 to arrange a meeting to discuss the scopes and the pathway through the ITA prior to developing the DEIR. This will minimize requests by the WRC for additional information during and after the MEPA process and, we hope, lead to an expeditious review under the ITA.

Thank you for the opportunity to comment.

Sincerely,

Kathleen M Baskin

Kathleen Baskin, P.E.
Executive Director

cc: Water Resources Commission
ecc: Richard Carnevale, North Reading
Jon Beekman, Wright Pierce
Paul Brinkman, Wright Pierce
Michele Drury, DCR
Frank Hartig, DCR
Linda Hutchins, DCR
Nathaniel Tipton, DCR
Nancy Baker, MassDEP, NERO
Kevin Brander, MassDEP, NERO
Duane LeVangie, MassDEP
James Persky, MassDEP, NERO
Eric Worrell, MassDEP, NERO
Pamela Heidell, MWRA

EIR Scope for Communities

Seeking Approval Under the Interbasin Transfer Act

TO JOIN THE MWRA WATER SUPPLY SYSTEM

This scope replaces the WRC application form (1986/1992) "*Application for Approval of an Action to Increase Over the Present Rate of Interbasin Transfer*" and is required for transfers considered "significant" under the Act. The information requested here should be incorporated into the EIR required by the MEPA regulations, 301 CMR 11.03. Wherever possible, the applicant should provide this information in an electronic format.

This scope is only for that portion of the EIR that pertains to the INTERBASIN TRANSFER ACT. There may be other issues which need to be addressed in the EIR for a particular project. The MEPA program should be contacted to determine a comprehensive scope.

The Interbasin Transfer Act governs the transfer of water and wastewater between river basins within the Commonwealth. Any water transferred out of a river basin, either for water supply or wastewater treatment purposes, is no longer available to replenish the "donor" basin's rivers, aquifers, lakes or wetlands. The purpose of the Act is to assure that if an interbasin transfer does occur, the resources of the donor basin are not adversely impacted.

Admission to the MWRA, requires approval under the Interbasin Transfer Act. The following scope outlines the Interbasin Transfer Act issues to be addressed in the EIR for admission to the MWRA. Consultation with DCR's Office of Water Resources (617-626-1366) is strongly recommended to tailor this scope to a specific proposal.

SUMMARY OF PROJECT

- Project Name
- Location
- Proponent Name, Address, Phone Number
- Primary Contact's Name, Address, Phone Number, Fax Number, Email Address

DESCRIPTION OF THE PROPOSED INTERBASIN TRANSFER

- Describe and explain the reasons for the proposed interbasin transfer.
- Provide the approximate timetable for the proposed transfer, including the estimated commencement date and the estimated completion date.
- Where applicable, describe the existing transfer system, including out-of-basin conveyance capacity, storage capacity, withdrawal constraints or other limiting factors.
- Describe, in detail, the proposed interbasin transfer, including the maximum capacity, in millions of gallons per day (mgd) of the transfer facilities and the expected average daily transfer. Provide supporting information showing how the capacity of the conveyance was determined. Describe any proposed changes in existing structures and/or changes in operating rules of the water supplier or changes in transfer constraints.
- Describe the operating schedule of the proposed interbasin transfer, including the time periods, amounts to be transferred and the duration of the transfer.
- Provide the name, exact location and river basin of the source(s) of the proposed transfer of water, including the subbasin(s).
- List the communities, sections of communities, water districts or other areas that will use the water proposed to be transferred.
- Provide a precise description of the location, including river basin, of the wastewater discharge point.
- List the known users of this and associated resources, including agricultural operations and nurseries, whose use could be affected by the proposed transfer.
- Include a map of appropriate scale that clearly and accurately illustrates the information requested in this section. Wherever possible, MASSGIS data layers should be used.

OTHER PERMITS REQUIRED

- List the local, State or Federal agencies/commissions from which permits have been obtained or will be sought

INFORMATION NEEDED TO EVALUATE THIS PROJECT AGAINST THE SEVEN APPLICABLE CRITERIA OF THE INTERBASIN TRANSFER REGULATIONS, 313 CMR 4.05

Below, in **bold** the criteria for approval of an interbasin transfer are listed, as they appear in the regulations (313 CMR 4.05). In some cases, the WRC's interpretation of certain terminology appears in *italics*. Unless otherwise noted, the applicant must respond to all points listed under each criterion.

1. That an environmental review pursuant to M.G.L. c. 30, §§61 and 62H, inclusive, has been complied with for the proposed increase.

- Information needed for Interbasin Transfer review should be provided within the context of the EIR.
- Provide a copy of the ENF, including copies of comments received.
- When issued, provide a copy of the Secretary of Environmental Affairs certificate stating that the EIR properly complies with MEPA and its regulations.

2. That all reasonable efforts have been made to identify and develop all viable water supply sources in the receiving area of the proposed water supply interbasin transfer

Viable source means a source which can provide drinking water and meet the current water quality standards set by DEP, at a reasonable production cost compared to recently incurred costs for similar projects within the Commonwealth. Further, a viable source is one which can be used while maintaining a reasonable instream flow. Reasonable instream flow is evaluated by the same criteria as impacts on the donor basin. Receiving area is defined as the area which makes use of the water supply that has been transferred between basins.

Describe in detail the efforts made to identify and develop all viable sources in the receiving area. Discuss water supply alternatives considered, but rejected. State reasons for rejection. The discussion should include:

- Assessment of the development of abandoned (temporary or permanent), existing and potential in-basin water supply sources. Clearly and accurately locate these sources on a map of appropriate scale.
- Discuss and list studies and reports evaluating in-basin sources in the receiving area. Copies of studies should be made available upon request.
- Describe the costs of developing existing and proposed in-basin sources in the receiving area.
- If cost is a reason given for rejection of an inbasin source, compare these costs with the production costs recently incurred elsewhere in the Commonwealth for similar water supply sources. Refer to the Performance Standards from DCR's website: http://www.mass.gov/dcr/waterSupply/intbasin/download.htm
- Describe the impact on in-basin streamflow that would result from the development of any viable in-basin sources in the receiving area. Refer to 313 CMR 4.05 (5)(a) through (j).
- Discuss the feasibility of obtaining additional water supply from water supply agencies in cities, towns or districts within the same basin as the receiving area. Are interconnections in place? If not, are such interconnections feasible?

3. That all practical measures to conserve water have been taken in the receiving area

- Provide an updated Water Conservation Questionnaire (available from DEP's Division of Watershed Permitting or at DEP's website: http://www.state.ma.us/dep/brp/wtrm/files/con-wrc.doc, or DCR's Office of Water Resources or at DCR's website: http://www.mass.gov/dcr/waterSupply/intbasin/docs/consplan.doc). If a Conservation Plan or Questionnaire is on file with DEP, provide a copy, updated to the present. Refer to <u>Water Conservation Standards for the Commonwealth of Massachusetts</u> (WRC, 2006) and the Interbasin Transfer Performance Standards (1999), both available from DCR's website http://www.mass.gov/dcr/intbasin/download.htm.
- Describe the current leak detection and system repair program. Discuss the methodology used (refer to the Interbasin Transfer Act Performance Standards,

available from DCR's website: http://www.mass.gov/dcr/intbasin/download.htm). What was the date of the most recent leak detection survey? What is the date of the next scheduled leak detection survey?

- Describe the on-going meter installation, maintenance, and replacement program. State the percentage of the system that is metered. Provide documentation of the annual master meter calibration program and a description of that program. Provide data to show that all permanent water supply services (including public buildings) in the receiving area are metered.
- Describe the amount of unaccounted-for water (in gallons and percent) in the receiving area for the past five (5) years. Refer to the Interbasin Transfer Act Performance Standards for the definition of "Unaccounted-for Water". Describe on-going programs to reduce or keep the amount of unaccounted-for water at reasonable levels (less than 10%).
- Describe the current rate structure: (1) Does the rate structure reflect the cost of operation, proper maintenance, proposed capital improvements and water conservation. Does it encourage water conservation? If so, how? (2) Is the rate flat, increasing or decreasing? Is it charged according to water use, or some other method? (3) Are the funds dedicated in an enterprise account or is some other accounting procedure used? Describe. Refer to Appendix D of the Performance Standards.
- How often are customers billed? Is billing based on actual meter readings? Provide an example of the bill sent to customers.
- Provide the existing contingency plan(s) for adequately handling water supply emergencies, such as contamination of water supply sources or seasonal or drought related shortages of water supply. (See 313 CMR 4.02(4) for a definition of 'contingency plan'.) Explain, if not stated in the plan, how and when water use will be curtailed, when trigger points require action, which water users will be reduced by what measures, and over what period of time, what emergency sources will be utilized, such as interconnections with nearby communities, reactivated sources or new emergency sources.
- Do all public buildings under the control of the proponent have low flow plumbing fixtures? Describe the types of fixtures in these buildings.
- When was the last audit of public facilities? Provide a copy of the report. Has a system-wide water audit ever been conducted? When? Provide a copy of the report.
- Describe any past or current programs to supply low flow plumbing fixtures to residential customers. What is the residential gallons per capita per day (gpcd) figure for the water supply system? What is the overall gpcd for the system? Provide the Annual Statistical Reports, required by DEP, for the past five years.
- If residential gpcd is greater than 65, describe the comprehensive residential water conservation program that is or will be implemented to reduce this use. If this program is not in place, describe the timetable for implementation. Refer to the Performance Standards.
- Describe the current and proposed public information programs to promote water conservation, the use of water conserving devices, and industrial and commercial recycling and reuse. These programs should include a program which identifies, ranks and works with all commercial, industrial and institutional customers according to amount used in order to determine areas where the greatest potential for water savings

exists, should be in place. Are public education programs on-going or intermittent? Explain.

- Describe the measures in place to protect the water supply sources currently serving the receiving area that meet the requirements of the Department of Environmental Protection published in 310 CMR 22.20 and Wellhead Protection regulations 310 CMR 22.21. Include in this description all watershed or aquifer lands, even if not under the direct control of the water supply agencies.
- Is the plumbing code strictly enforced? By whom? Describe.

4. That a comprehensive forestry management program which balances water yields, wildlife habitat and natural beauty on watershed lands of surface water supply sources, presently serving the receiving area and under control of the proponent has been implemented.

- If the community does not have surface water sources, this criterion is not applicable. If the community does, describe existing and proposed watershed forestry management programs on watershed lands currently serving the receiving area and under the control of the proponent. Submit a copy of any applicable forestry watershed plans. Refer to the Interbasin Transfer Performance Standards for the information to be included in a Forestry Management Plan.

5. That reasonable instream flow in the river from which the water is transferred is maintained.

This part should describe the hydrologic characteristics of the river basins from which the water is to be diverted and any interdependent ground water regimens. The MWRA employs modeling tools to evaluate the impact of any withdrawals on the MWRA/MDC system and the impact on service to existing customer communities. Proponents are directed to work with MWRA, so that MWRA can provide appropriate documentation to respond to the requested information.

- Describe the proposed operating schedule for the interbasin transfer. This description should include variations throughout the seasons, the months, and the hours during a 24 hour period.
- Document that the safe yield of the MWRA watershed system is sufficient to meet the community’s demands. This should evaluate the monthly performance of the Quabbin Reservoir over an extended period of years using observed hydrological data that includes the worst drought of record. It should also include an analysis of the impact of the community’s demands together with the long-term demand of existing member communities during drought scenarios. The analysis must include the possibility of increased usage of MWRA supplies by partially supplied communities due to drought conditions. Impacts to service to other MWRA community connections under drought conditions and to MWRA supplies (including the Wachusett Reservoir) and the downstream environments must be evaluated. Provide the frequency or number of months that each MWRA reservoir level referenced in MWRA's Drought Management Plan is reached, beginning with the “Below Normal” stage under existing demands and with the addition of the proposed transfer.
- Provide graphs and tables that show the following:
  (a) The historic monthly Quabbin Reservoir levels from 1990 to the present.

(b) On the graph, superimpose the resulting reservoir levels after the proposed withdrawal, had the community been an MWRA customer since 1990.
(c) On the table, show the Quabbin Reservoir levels which would have been realized had the proponent been an MWRA customer since 1990.

- Provide a table of the modelled uncontrolled releases (spills) from the Quabbin Reservoir from 1990 to the present including what the releases would have been with the theoretical demand of the community, had the community been an MWRA customer. Show any changes in the frequency and duration of uncontrolled releases that will occur with the addition of the community's proposed withdrawal.
- Provide information and data to demonstrate that the MWRA will be able to meet all of its mandated controlled flow releases with the addition of the proposed demand.
- If new member communities have been added to the MWRA Water Works system since 1990 or if there are other communities in the process of applying for membership, include the demands for these communities in the analyses required in this section.
- Provide a discussion of the operation of the Wachusett Reservoir. Will this additional withdrawal have an impact on the resources of the Nashua River basin? Describe.
- Analyze and evaluate, in detail, the impact of the proposed interbasin transfer on water-dependent uses including:

  (1) Effect on the hydraulic characteristics in the stream below the point of withdrawal, including but not limited to flood flows, the aquatic base flow, the 7Q10 flow if used in a pollution abatement program, stage, velocity, sediment regimen, any flow values set for the donor basin by the WRC in DEM River Basin reports, etc.
  (2) Effect on anadromous fisheries.
  (3) Effect on resident fisheries.
  (4) Effect on wetlands and dependent flora and fauna.
  (5) Effects on water quality, recreational uses and aesthetic values, areas of critical environmental concern, areas protected under Article 97 of the Amendments to the Massachusetts Constitution, and designated scenic rivers.
  (6) Effect on existing and planned future uses dependent on reservoir levels.
  (7) Effect on hydropower production.
  (8) Effect on present and foreseeable water-dependent uses within the donor basin.
  (9) Effect on water use by agricultural operations, including nurseries.

6. In the case of groundwater withdrawals, the results of pumping tests will be used to indicate the impact of the proposed withdrawal on static water levels, the cone of depression, the potential impacts on adjacent wells and lake and pond levels, and the potential to affect instream values affect instream values as listed in 313 CMR 4.05(5)(a) through (j).

This criterion is not applicable to MWRA's sources.

7. That the communities and districts in the receiving area have adopted or are actively engaged in developing a local water resources management plan.

- Provide the Local Water Resources Management Plan, or the draft plan under development and timeline for completion. Refer to the Interbasin Transfer Performance Standards for the information to be included in a Local Water Resources Management Plan.

8. The Commission shall consider the impacts of all past, authorized or proposed transfers on streamflows in the donor basin.

- List and describe the impact of all past, authorized and other proposed transfers on the streamflow in the donor basins.
- In addition, the WRC considers that the addition of a community to the MWRA Water Works System could have potential cumulative impacts on the system's operations. Provide information to demonstrate that there will be no negative impacts to the operations of the MWRA Water Works System. The proponent should work with the MWRA to provide this documentation.

MITIGATION

- Describe any proposed flow augmentation provisions, flow protection thresholds, or other measures proposed to protect instream flow.

EO 385

Provide information to demonstrate that this proposal seeks to minimize unnecessary loss or depletion of environmental quality and resources.

Electronic copies (unless otherwise specified) of all Interbasin Transfer EIRs should be sent to the following people. This is only a listing of those people who will be reviewing the EIR specifically under the Interbasin Transfer Act and is not meant to be all inclusive.

Kathleen Baskin Executive Director Water Resources Commission EOEEA 100 Cambridge Street Boston, MA 02114 kathleen.baskin@state.ma.us	Michele H. Drury (3 bound copies in addition to the electronic copy) DCR Office of Water Resources 251 Causeway Street Boston, MA 02114 michele.drury@state.ma.us
Duane LeVangie DEP 1 Winter Street Boston, 02108 duane.levangie@state.ma.us	Richard Hartley DFW 1 Rabbitt Hill Rd Westboro, MA 01581
Pam Heidell MWRA 100 First Ave Charlestown, MA 02129 Pamela.heidell@mwra.state.ma.us	Laila Parker DFG Division of Ecological Restoration 251 Causeway Street Boston, MA 02114 laila.parker@state.ma.us
Clapp Memorial Library P.O. Box 627 Belchertown, MA 01007-0627 One bound copy	Bigelow Free Public Library 54 Walnut Street Clinton, MA 01510-2926 One bound copy
WSCAC 485 Ware Rd. Belchertown, MA 01007 info@wscac.org	

THE COMMONWEALTH OF MASSACHUSETTS
WATER RESOURCES COMMISSION

EIR Scope for Communities Seeking

APPROVAL FOR A WASTEWATER TRANSFER

Under the Interbasin Transfer Act

This scope replaces the WRC application form (1986/1992) "*Application for Approval of an Action to Increase Over the Present Rate of Interbasin Transfer*" and is required for transfers considered "significant" under the Act. The information requested here should be incorporated into the EIR required by the MEPA regulations, 301 CMR 11.03. Wherever possible, the applicant should provide this information in an electronic format.

This scope is only for that portion of the EIR that pertains to the INTERBASIN TRANSFER ACT. There may be other issues which need to be addressed in the EIR for a particular project. The MEPA program should be contacted to determine a comprehensive scope.

The Interbasin Transfer Act governs the transfer of water and wastewater between river basins within the Commonwealth. Any water transferred out of a river basin, either for water supply or wastewater treatment purposes, is no longer available to replenish the "donor" basin's rivers, aquifers, lakes or wetlands. The purpose of the Act is to assure that if an interbasin transfer does occur, the resources of the donor basin are not adversely impacted.

A wastewater transfer is a transfer of wastewater outside of a river basin for disposal. This includes only that wastewater which is generated from a water supply source within the river basin from which the wastewater will be transferred and any inflow and infiltration generated within that basin. Wastewater transfers can include the out-of-basin sewering of areas previously served by on-site and/or inbasin wastewater systems, enlargement of the capacity which facilitates an interbasin transfer of existing wastewater systems, the sewering of previously undeveloped areas which involves a new interbasin transfer, etc. The following scope outlines issues to be addressed in the EIR for these types of transfers. Consultation with DCR's Office of Water Resources (617-626-1366) is strongly recommended to tailor this scope to a specific proposal.

SUMMARY OF PROJECT

- Project Name
- Location
- Proponent Name, Address, Phone Number
- Primary Contact's Name, Address, Phone Number, Fax Number, Email Address

DESCRIPTION OF THE PROPOSED INTERBASIN TRANSFER

- Describe and explain the reasons for the proposed interbasin transfer.
- Provide the approximate timetable for the construction of the proposed transfer, including the estimated commencement date and the estimated completion date.
- Where applicable, describe the existing wastewater transfer system, including any factors limiting the ability to transfer wastewater out of basin, and the existing water supply sources from which the wastewater is generated. This should include the river basin location of these sources.
- Describe, in detail, the proposed interbasin transfer, including the maximum capacity, in millions of gallons per day (mgd) of the transfer facilities and the expected average daily transfer. Provide supporting information showing how the increased capacity was determined.
- Describe any proposed changes in existing structures and/or changes in operating rules of the wastewater system or changes in transfer constraints.
- Describe the operating schedule of the proposed interbasin transfer, including the time periods, amounts to be transferred and the duration of the transfer.
- Provide the name, exact location and river basin of the source(s) of the proposed transfer, including the subbasin(s).
- List the communities, sections of communities, sewer districts or other areas that will benefit from the proposed wastewater transfer.
- Provide a precise description of the location, including river basin location, of the wastewater discharge point.
- List the known users of associated resources, including agricultural operations and nurseries, whose use could be affected by the proposed transfer.
- Include a map of appropriate scale that clearly and accurately illustrates the information requested in this section. Wherever possible, MASSGIS data layers should be used.

OTHER PERMITS REQUIRED

- List the local, State or Federal agencies/commissions from which permits have been obtained or will be sought

INFORMATION NEEDED TO EVALUATE THIS PROJECT AGAINST THE SIX APPLICABLE CRITERIA OF THE INTERBASIN TRANSFER REGULATIONS, 313 CMR 4.05

Below, in **bold** the criteria for approval of an interbasin transfer are listed, as they appear in the regulations (313 CMR 4.05). Where appropriate, interpretations of some of the terminology in the regulations approved by the WRC to apply to wastewater transfers, in order to evaluate specific criteria within the "spirit" of the Act, appear in *italics*.

1. That an environmental review pursuant to M.G.L. c. 30, §§61 and 62H, inclusive, has been complied with for the proposed increase.

- Information needed for Interbasin Transfer review should be provided within the context of the EIR.
- Provide a copy of the ENF, including copies of comments received.
- When issued, provide a copy of the Secretary of Environmental Affairs certificate stating that the EIR properly complies with MEPA and its regulations.

2. That all reasonable efforts have been made to identify and develop all viable water supply sources in the receiving area of the proposed water supply interbasin transfer

For the purposes of evaluating wastewater transfers against this criterion, the WRC has defined a viable local wastewater discharge source as a cost-effective, technologically feasible, environmentally sound wastewater treatment system which treats and discharges wastewater within the basin of origin, and has been approved for general use by DEP. Such systems can include, but are not limited to, conventional Title 5 systems, groundwater discharge systems, NPDES-regulated surface water discharge systems, alternative/innovative on-site systems or package treatment plants.

For the purposes of evaluating wastewater transfers against this criterion, the WRC has defined receiving area as the community(ies) or portion of community(ies) whose wastewater is collected for discharge out of basin via an interbasin transfer.

Describe in detail the efforts made to identify and develop all viable sources in the receiving area. Discuss wastewater alternatives considered, but rejected. State reasons for rejection. The discussion should include:

- Discussion of the DEP-approved facilities plan[1], if completed. A copy should also be submitted to WRC staff. If this plan is not completed, the EIR should evaluate potential in-basin sources of disposal, including Title 5, groundwater and surface water discharges, as described in DEP's Comprehensive Wastewater Management Planning[2] Guidance. Submit copies of any other relevant studies and reports which evaluated in-basin wastewater disposal to WRC staff. The proponent should also discuss the feasibility of implementing DEP's wastewater reuse policy.
- If the preferred alternative for wastewater disposal is a connection to an all ready existing out of basin sewer system, the proponent must provide documentation from the host system that there is sufficient capacity to accept the proposed wastewater flows.
- Describe the costs of developing in-basin wastewater disposal facilities within the area of the proposed transfer, as defined above for this criterion.

[1] Facilities Plans are also known as Comprehensive Water Management Plans, Comprehensive Water Resources Management Plans, and Integrated Water Resources Management Plans.
[2] See Footnote #1

- If cost is a reason given for rejection of an inbasin source, compare these costs with the production costs recently incurred elsewhere in the Commonwealth for similar wastewater disposal facilities. Refer to the Performance Standards, available from DCR's website: http://www.mass.gov/dcr/waterSupply/intbasin/docs.
- Describe the impact on in-basin streamflow that would result from the development of any viable in-basin wastewater disposal facilities in the area of the proposed transfer. Refer to 313 CMR 4.05 (5)(a) through (j).
- Discuss the feasibility of joining a regional or neighboring in-basin wastewater disposal facility in cities, towns or districts within the same basin location as the area of the proposed transfer. Are interconnections in place? If not, are such interconnections feasible?
- Provide documentation of the program to eliminate sources of inflow and infiltration (I/I). This program must meet the standards described under the Performance Standards for wastewater, available from DCR's website: http://www.mass.gov/dcr/waterSupply/intbasin/docs. Discuss the potential for eliminating enough I/I to eliminate the need for an interbasin transfer.

3. That all practical measures to conserve water have been taken in the receiving area

For the purposes of evaluating wastewater transfers against this criterion, the WRC has defined receiving area is the community(ies) or portion of community(ies) whose wastewater is collected for discharge out of basin via an interbasin transfer. To evaluate a wastewater transfer against this criterion, the WRC requires that the applicant:

- Indicate whether there are flow meters sufficient to document wastewater flows out of the basin of origin. Provide a map of appropriate scale clearly showing the meter location(s). (Use of regional sewer meters which document wastewater flows out of basin is acceptable where these meters are in place.) Provide documentation on calibration of these meters.
- Provide at least two years of data on the components of existing wastewater flow (sanitary, inflow, infiltration).
- Provide a copy of the DEP-approved Operation and Maintenance plan for the wastewater system.
- Where the applicant has control over the water supply system, describe the program for implementing a water conservation program based on the state water conservation standards.

4. That a comprehensive forestry management program which balances water yields, wildlife habitat and natural beauty on watershed lands of surface water supply sources, presently serving the receiving area and under control of the proponent has been implemented.

- This criterion does not apply to a wastewater transfer.

5. That reasonable instream flow in the river from which the water is transferred is maintained.

This part should describe the hydrologic characteristics of the river basin from which the wastewater is to be transferred from and any interdependent ground water regimen.

- Describe the proposed operating schedule for the interbasin transfer. This description should include variations throughout the seasons, the months, and the hours during a 24 hour period.
- Provide:
  - (1) Delineation of the areas proposed to be sewered, if applicable, or areas where the capacity of an existing sewer is proposed to be enlarged and the area served by this facility.
  - (2) Estimate of the amount of wastewater to be transferred, on both an average annual and peak flow basis. This should be based on the capacity of the proposed wastewater system, including but not limited to pumps, pipelines, tunnels, when properly operating to the maximum extent physically possible (i.e.without backups, overflows or other threats to public health and safety).
  - (3) As required under Criterion #2, a DEP-approved facilities plan[3] which evaluates potential in-basin sources of disposal, including Title 5, groundwater and surface water discharges.
  - (4) A map of the (sub)basin planning unit(s) to be used in the hydrologic analysis. These units should be determined in consultation with DCR's Office of Water Resources.
- Analyze and evaluate, in detail, the impact of the proposed interbasin transfer on water-dependent uses including:
  - (1) The existing and proposed water use budget for each (sub)basin(s). The existing and proposed change in ground water level for each (sub)basin(s). The existing and proposed change in the unregulated 7Q10, August median, and 95% and 99% flow duration statistics for the stream or river draining the (sub)basin(s).
  - (2) Effect on anadromous fisheries, specifically alewives, searun brook and brown trout, smelt and American shad.
  - (3) Effect on resident fisheries.
  - (4) Effect on wetlands and dependent flora and fauna.
  - (5) Effects on water quality, recreational uses and aesthetic values, areas of critical environmental concern, areas protected under Article 97 of the Amendments to the Massachusetts Constitution, and designated scenic rivers.
  - (6) Effect on existing and planned future water-dependent uses in the donor basin.
  - (7) Effect on rare and endangered species of plants and animals
  - (8) Effect on water use by agricultural operations, including nurseries.

6. In the case of groundwater withdrawals, the results of pumping tests will be used to indicate the impact of the proposed withdrawal on static water levels, the cone of depression, the potential impacts on adjacent wells and lake and pond levels, and the potential to affect instream values as listed in 313 CMR 4.05(5)(a) through (j).

- This criterion does not apply to a wastewater transfer.

---

[3] See Footnote #1

7. That the communities and districts in the receiving area have adopted or are actively engaged in developing a local water resources management plan.
For the purposes of evaluating wastewater transfers against this criterion, the WRC has defined receiving area is the community(ies) or portion of community(ies) whose wastewater is collected for discharge out of basin via an interbasin transfer.

- Provide the Local Water Resources Management Plan, or draft of the plan under development and the timeline for completion. Refer to the Interbasin Transfer Performance Standards, available from DCR's website: http://www.mass.gov/dcr/waterSupply/intbasin/docs, for the information to be included in a Local Water Resources Management Plan.

8. The Commission shall consider the impacts of all past, authorized or proposed transfers on streamflows in the donor basin.

- List and describe the impact of all past, authorized and other proposed transfers on the streamflow in the donor basin. This would include analysis of any water supply sources or sewer systems that have been recently developed or approved, consideration of any water supply sources in the new source approval or Water Management Act permitting processes, sewering plans under development, etc.

MITIGATION

- To the extent the EIR/IBT process identifies impacts that may need to be mitigated, the proponent should propose measures to mitigate these impacts. Proponents should consider such measures as additional I/I reduction, impervious surface remediation, groundwater recharge, or stormwater management programs consistent with DEP stormwater guidance that keep water in the donor basin.

EO 385

Provide information to demonstrate that this proposal seeks to minimize unnecessary loss or depletion of environmental quality and resources.

Electronic copies (unless otherwise specified) of all Interbasin Transfer EIRs should be sent to the following people. This is only a listing of those people who will be reviewing the EIR specifically under the Interbasin Transfer Act and is not meant to be all inclusive.

Kathleen Baskin Executive Director Water Resources Commission EOEEA 100 Cambridge Street Boston, MA 02114 kathleen.baskin@state.ma.us	Michele H. Drury (3 bound copies in addition to the electronic copy) DCR Office of Water Resources 251 Causeway Street Boston, MA 02114 michele.drury@state.ma.us
Richard Hartley DFW 1 Rabbitt Hill Rd Westboro, MA 01581	Amy Coman-Hoenig/Lauren Glorioso NHESP DFG 1 Rabbitt Hill Rd Westboro, MA 01581 amy.coman@state.ma.us lauren.glorioso@state.ma.us
Laila Parker DFG Division of Ecological Restoration 251 Causeway Street Boston, MA 02114 laila.parker@state.ma.us	Paul Diodati Division of Marine Fisheries 251 Causeway Street Boston, MA 02114 paul.diodati@state.ma.us
Jack Schwartz DMF Annisquam River Marine Fisheries Field Station 30 Emerson Ave. Gloucester, MA 01930 jack.schwartz@state.ma.us	The Public Libraries of the affected communities in both the donor and receiving basin One bound copy each

Appendix B

WRIGHT-PIERCE
Engineering a Better Environment™

Town of North Reading

Draft Environmental Impact Report

Project Meeting #1

September 18, 2014

Presented by: Paul Brinkman
Amy Coppers Costantino, PE

WRIGHT-PIERCE
Engineering a Better Environment

Invite List

- Secretary Maeve Vallely Bartlett; Executive Office of Energy and Environmental Affairs
- Department of Environmental Protection ; Commissioner's Office
- MassDEP/Northeast Regional Office; MEPA Coordinator
- Mass DOT - District #4 Office; MEPA Coordinator
- Massachusetts Historical Commission
- Merrimack Valley Planning Commission
- Metropolitan Area Planning Council
- Town of North Reading Board of Selectmen
- Michael Gilleberto; Town Administrator Town of North Reading
- Town of North Reading Community Planning Department
- Town of North Reading Conservation Commission
- Town of North Reading Health Department
- Town of Reading Board of Selectmen
- Robert W. LeLacheur, Jr., Town Manager Town of Reading
- Town of Wilmington Planning Department
- Town of Wilmington Health Department
- Town of Wilmington Conservation Commission
- Town of Wilmington Board of Selectmen
- Town of Reading Planning Department
- Town of Reading Conservation Commission
- Town of Reading Health Department
- Town of Andover Board of Selectmen
- Reginald S. Stapczynski; Town Manager Town of Andover
- Town of Andover Planning Board
- Town of Andover Conservation Commission
- Town of Andover Board of Health
- Natural Heritage and Endangered Species Program; Commonwealth of Massachusetts
- DCR; MEPA Coordinator
- Department of Public Health ; Director of Environmental Health
- Massachusetts Water Resource Authority; MEPA Coordinator
- Energy Facilities Siting Board; MEPA Coordinator
- Division of Energy Resources; MEPA Coordinator
- Ipswich River Watershed Association, Wayne Castonguay, Executive Director
- Martins Pond Association

MEPA Process/Outline

- ENF
- EIR Preparation and Filing Process
  - Draft EIR
  - Submission of Draft EIR and Public Comment Period
  - Issuance of Secretary's Certificates
  - Response to Comments
  - Final EIR

Draft EIR

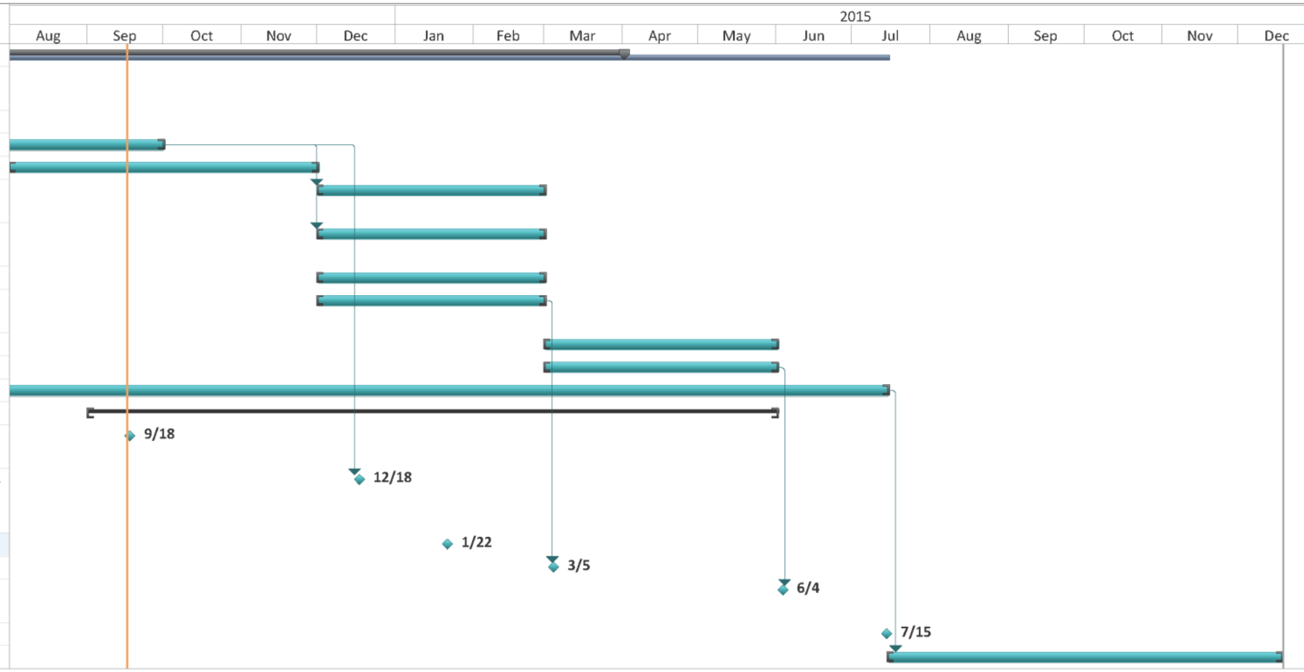
- Table of Contents
- Secretary's Certificates
- Summary
- Project Description
- Existing Environment
- Alternatives to the Project
- Assessment of Impacts
- Statutory and Regulatory Standards and Requirements
- Mitigation Measures
- Proposed Section 61 Findings
- Appendices

North Reading MEPA Process Framework

Step		Water	Wastewater
1	Existing Conditions	Meeting #1	Meeting #1
2	Needs Assessment	Meeting #1/#2	Meeting #2
3	Alternatives Analysis	Meeting #2	Meeting #2/#3
4	Impact Analysis	Meeting #4	Meeting #4
5	Recommended Plan	Meeting #5	Meeting #5

Anticipated Schedule

ID	Task Name	Start	Finish
1	**DEIR Water and Wastewater**	**Fri 11/1/13**	**Wed 4/1/15**
2	Project Description and Permitting	Fri 11/1/13	Mon 6/30/14
3	Existing Conditions	Fri 11/1/13	Thu 7/31/14
4	WW Needs Analysis	Fri 11/1/13	Wed 10/1/14
5	Alternatives Analysis	Fri 8/1/14	Mon 12/1/14
6	Address IBTA Requirements	Mon 12/1/14	Sun 3/1/15
7	Address MWRA OP#10 Requirements	Mon 12/1/14	Sun 3/1/15
8	Collateral Impacts	Mon 12/1/14	Sun 3/1/15
9	Greenhouse Gas Emissions Analysis	Mon 12/1/14	Sun 3/1/15
10	Construction Period	Sun 3/1/15	Mon 6/1/15
11	Mitigation	Sun 3/1/15	Mon 6/1/15
12	DEIR Report	Fri 11/1/13	Wed 7/15/15
13	**Stakeholder Meetings**	**Mon 9/1/14**	**Mon 6/1/15**
14	Existing Conditions/ Preliminary Needs Analysis	Thu 9/18/14	Thu 9/18/14
15	Needs Analysis/ Alternatives Screening Methodology	Thu 12/18/14	Thu 12/18/14
16	Alternatives Assessment	Thu 1/22/15	Thu 1/22/15
17	Impacts Analysis	Thu 3/5/15	Thu 3/5/15
18	Recommended Alternatives & Mitigation	Thu 6/4/15	Thu 6/4/15
19	Draft DEIR	Wed 7/15/15	Wed 7/15/15
20	Public Comment Period	Wed 7/15/15	Fri 12/18/15



Agenda - DEIR

- Project Background
  - Project History
  - Planning Tools
- Project Objectives and Goals
  - Water
  - Wastewater
- Project Scope
  - Alternatives
  - Permitting

Background - Water

- North Reading Water Supplies
  - Wells through Water Registrations
    - Registered Use (0.96 MGD)
  - Surface Supply from Andover (Merrimack River)
    - IBTA (1.50 MGD)
- Can't meet all needs through either source. (>2.6 MGD)
- Ipswich River
  - Stressed Basin - "Over Allocated"
  - Stormwater

Goals - Water

- Provide long-term, sustainable option(s) for water supply
- Reduce water system complexity
- Allow community to provide services to maintain existing and future commercial/industrial base
- Manage capital and O&M costs
- Mitigate stress on the Ipswich River

Background - Wastewater

- Primarily served through on-site disposal systems
- Water Quality Impairments from inadequate systems
- Failure/pumping rates
- Difficulty in areas of upgrades due to limited parcel area and soils
- Evaluated limited alternatives through CWMP process

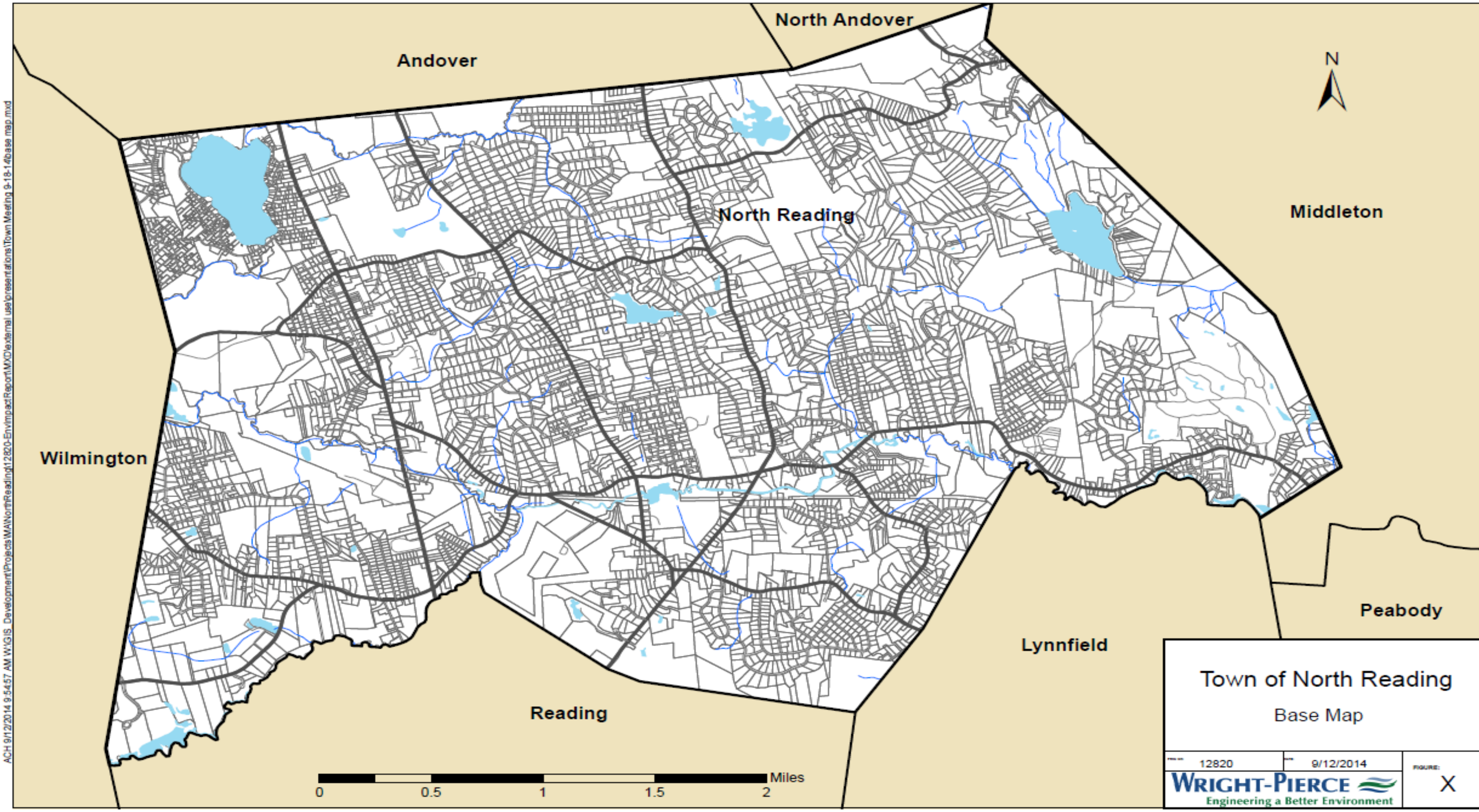
Goals Wastewater

- Improve surface and ground water quality
- Provide long-term sustainable option(s) for wastewater treatment and disposal
- Allow community to provide services to maintain existing and future commercial/industrial base
- Address water quality impairments

North Reading, MA

- Area – 13.5 square miles
  - Water Surface 0.3 square miles
- 2010 Population – 14,892
- MHI - $76,962
- Suburban
- Limited Commercial/Industrial Area

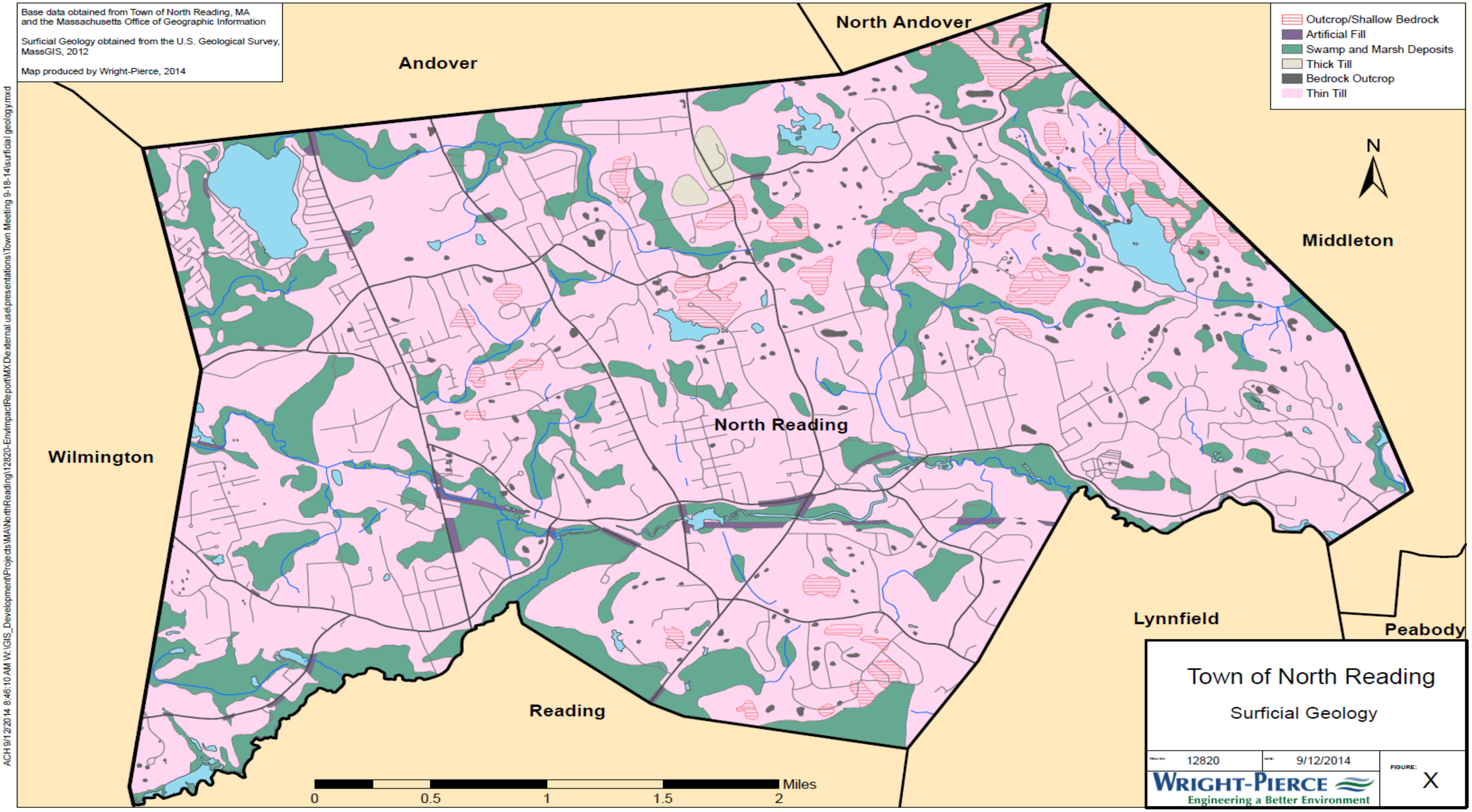
North Reading, MA



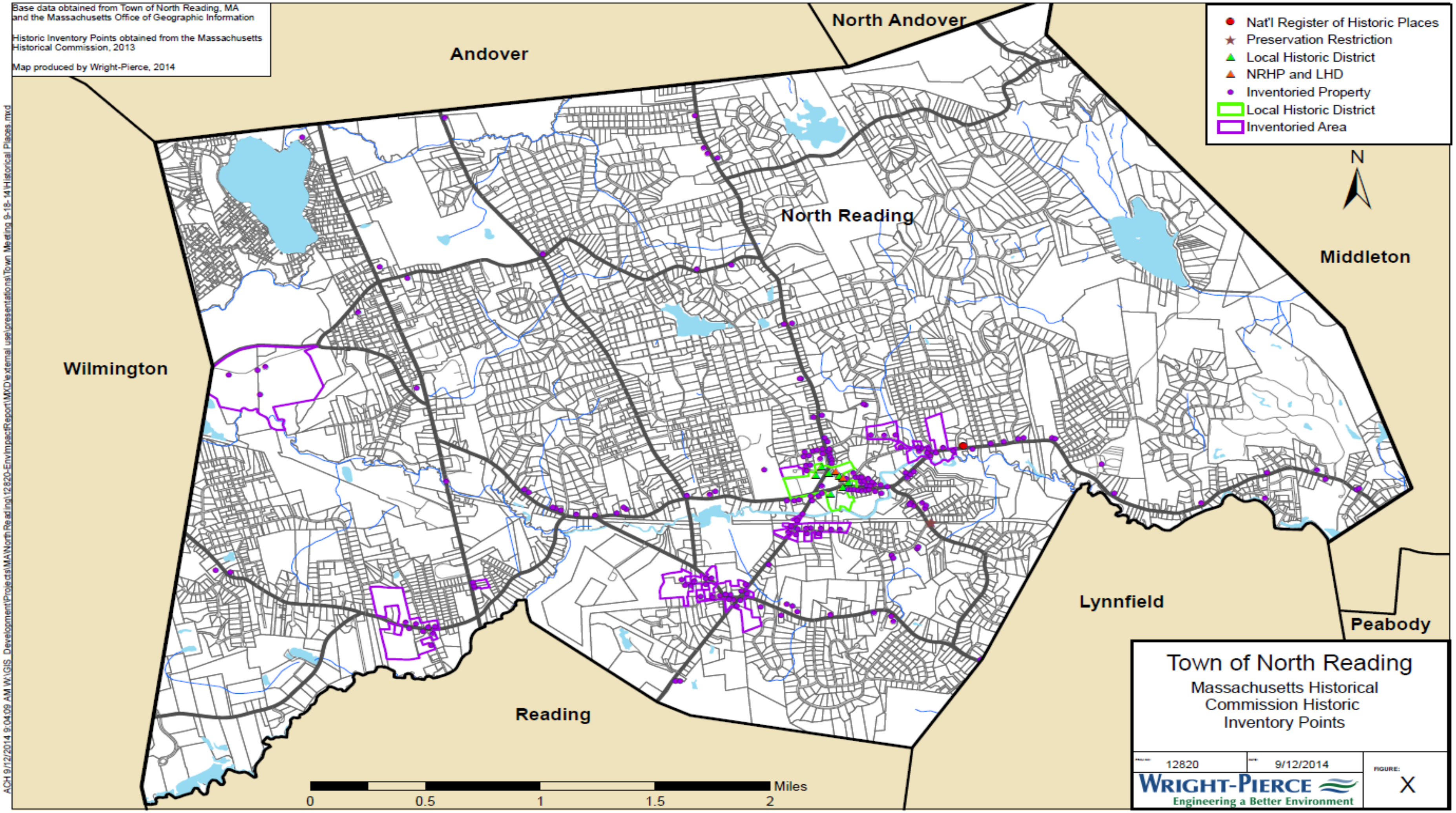
Existing Environmental Conditions

- Natural Environment (Non-aqueous)
  - Climate
  - Geology and Soils
  - Topography
  - Species Habitats
  - Historical and Archaeological Sites
  - Air Quality

Surficial Geology



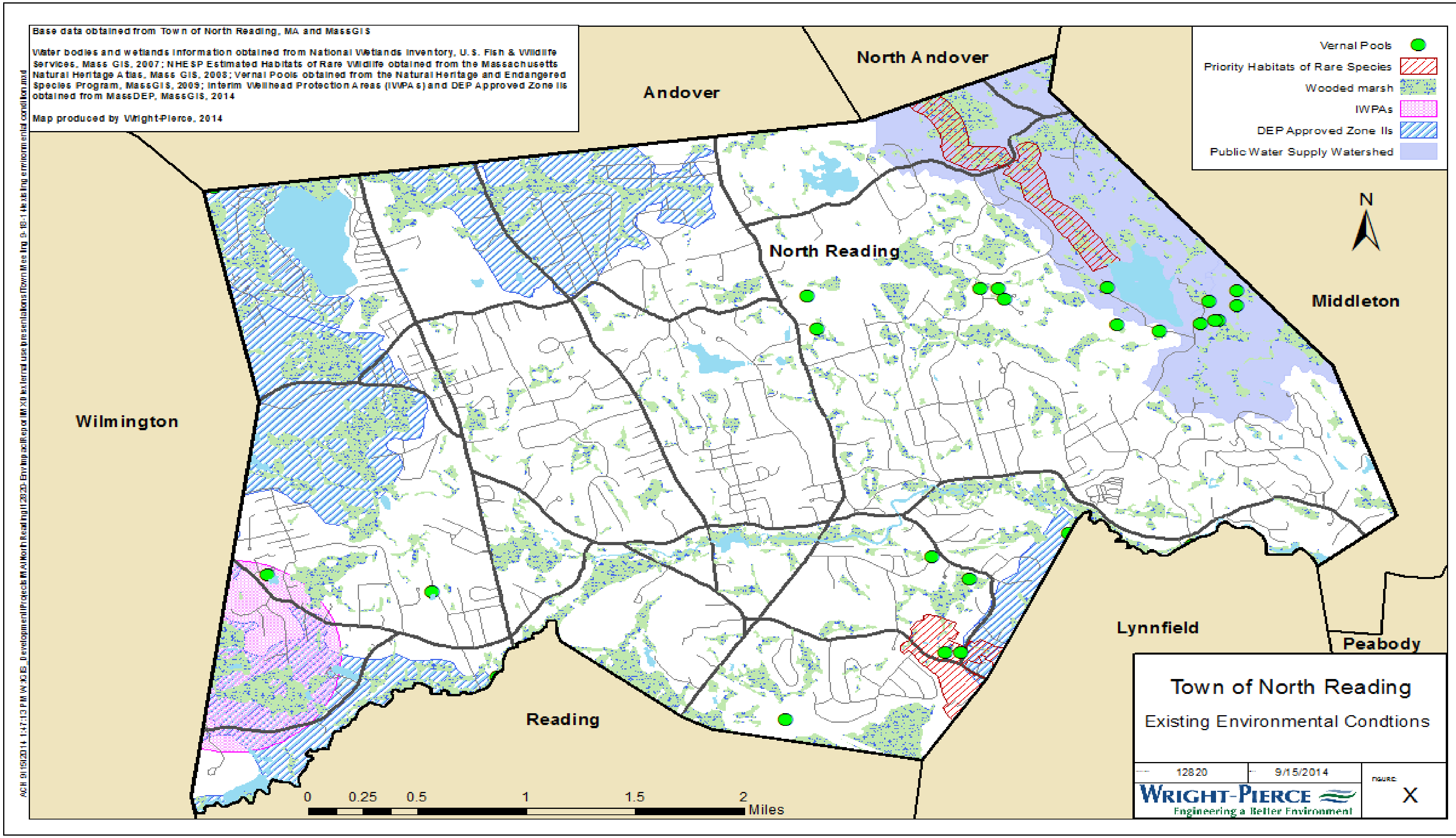
Historic Resources



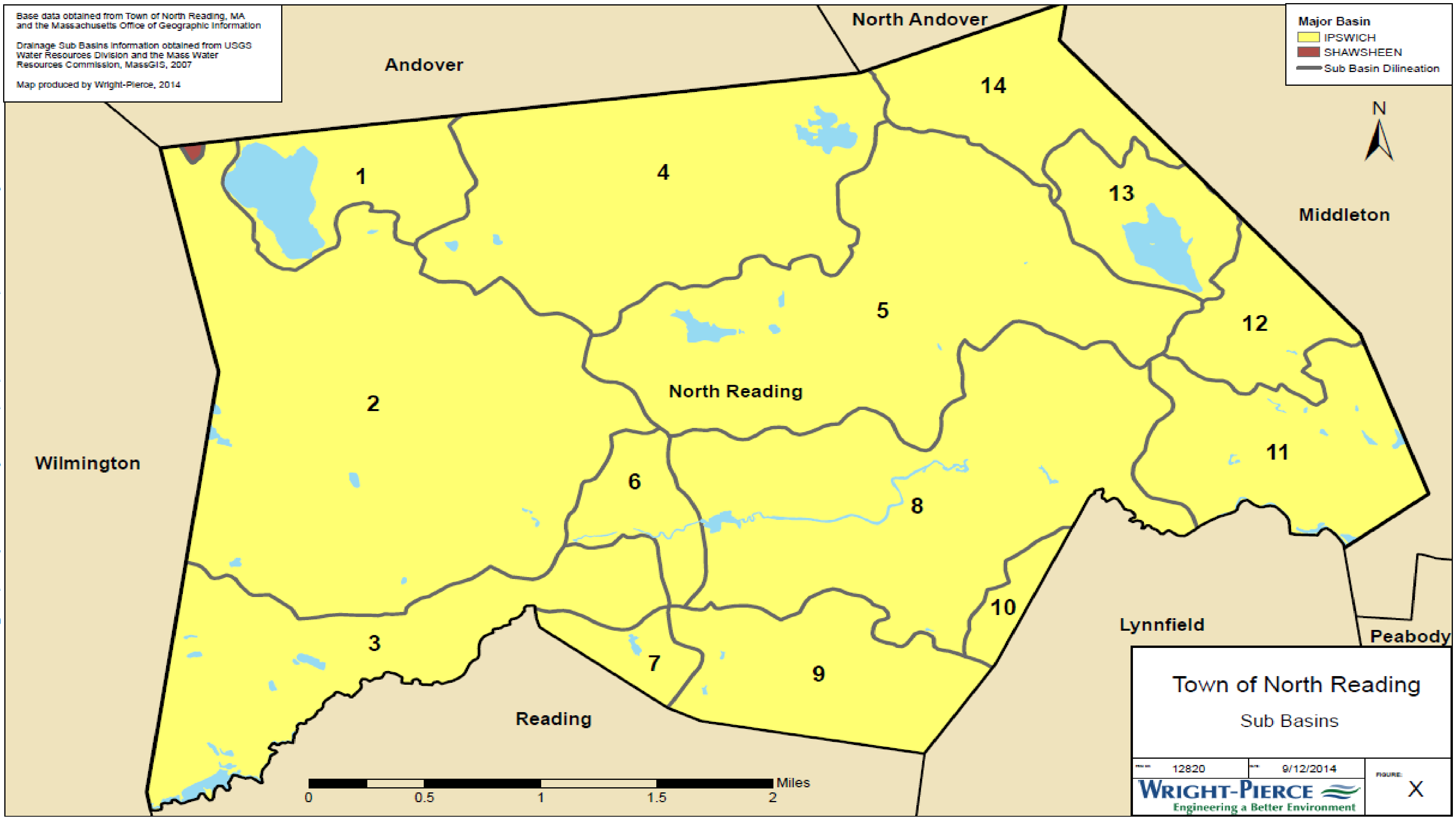
Existing Environmental Conditions

- Natural Environment (Aqueous)
  - Hydrologic Conditions and Water Resources
  - Hydrogeology
  - Water Quality
  - Wetlands
  - Floodplains

Water Resources / Wildlife



Sub-Basins


Base data obtained from Town of North Reading, MA and the Massachusetts Office of Geographic Information
Drainage Sub Basins information obtained from USGS Water Resources Division and the Mass Water Resources Commission, MassGIS, 2007
Map produced by Wright-Pierce, 2014
Major Basin
IPSWICH
SHAWSHEEN
Sub Basin Dilineation
N
North Andover
Andover
Middleton
Wilmington
North Reading
Lynnfield
Peabody
Reading
1
2
3
4
5
6
7
8
9
10
11
12
13
14
0
0.5
1
1.5
2
Miles
Town of North Reading
Sub Basins
12820
9/12/2014
FIGURE:
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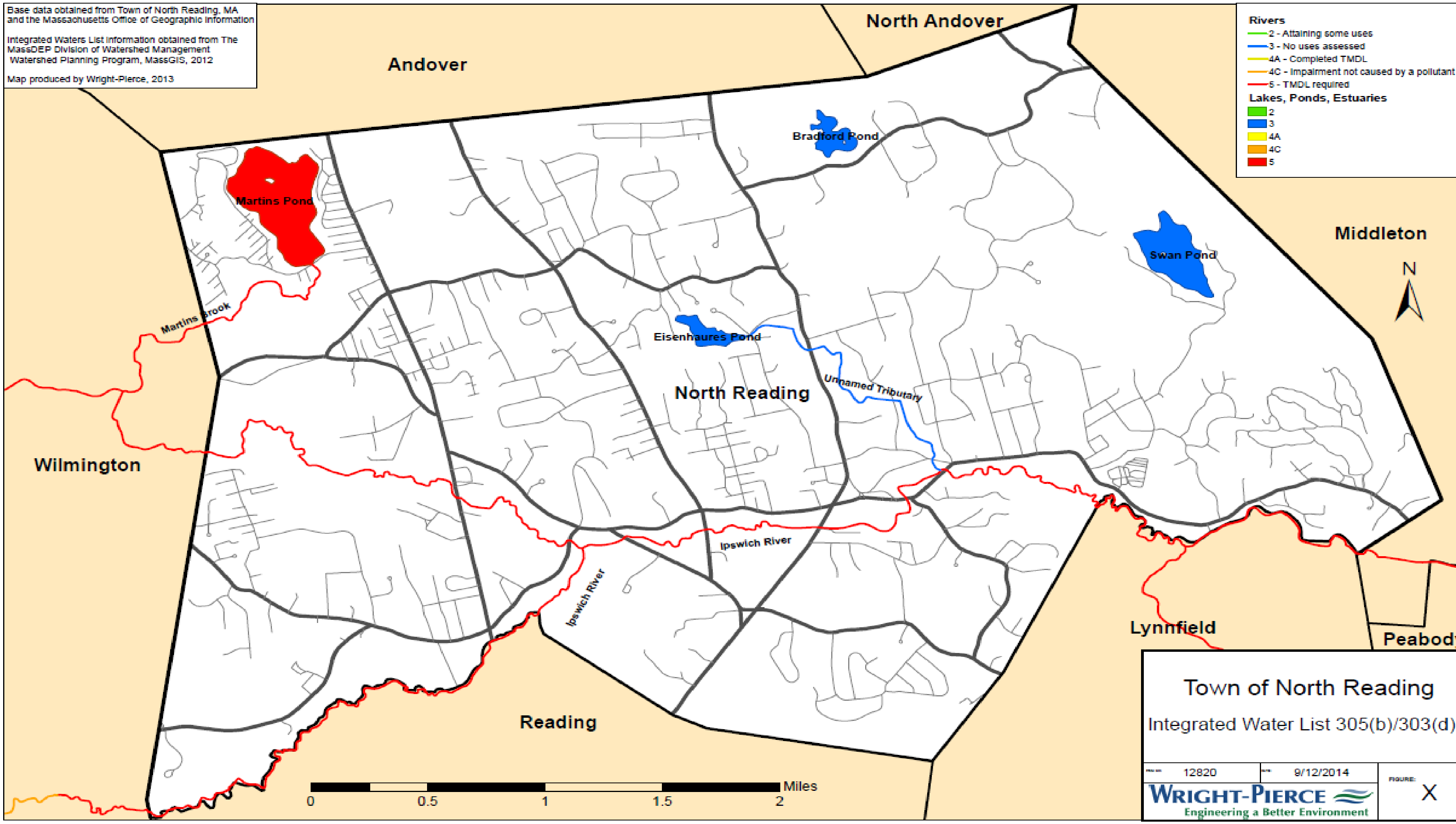
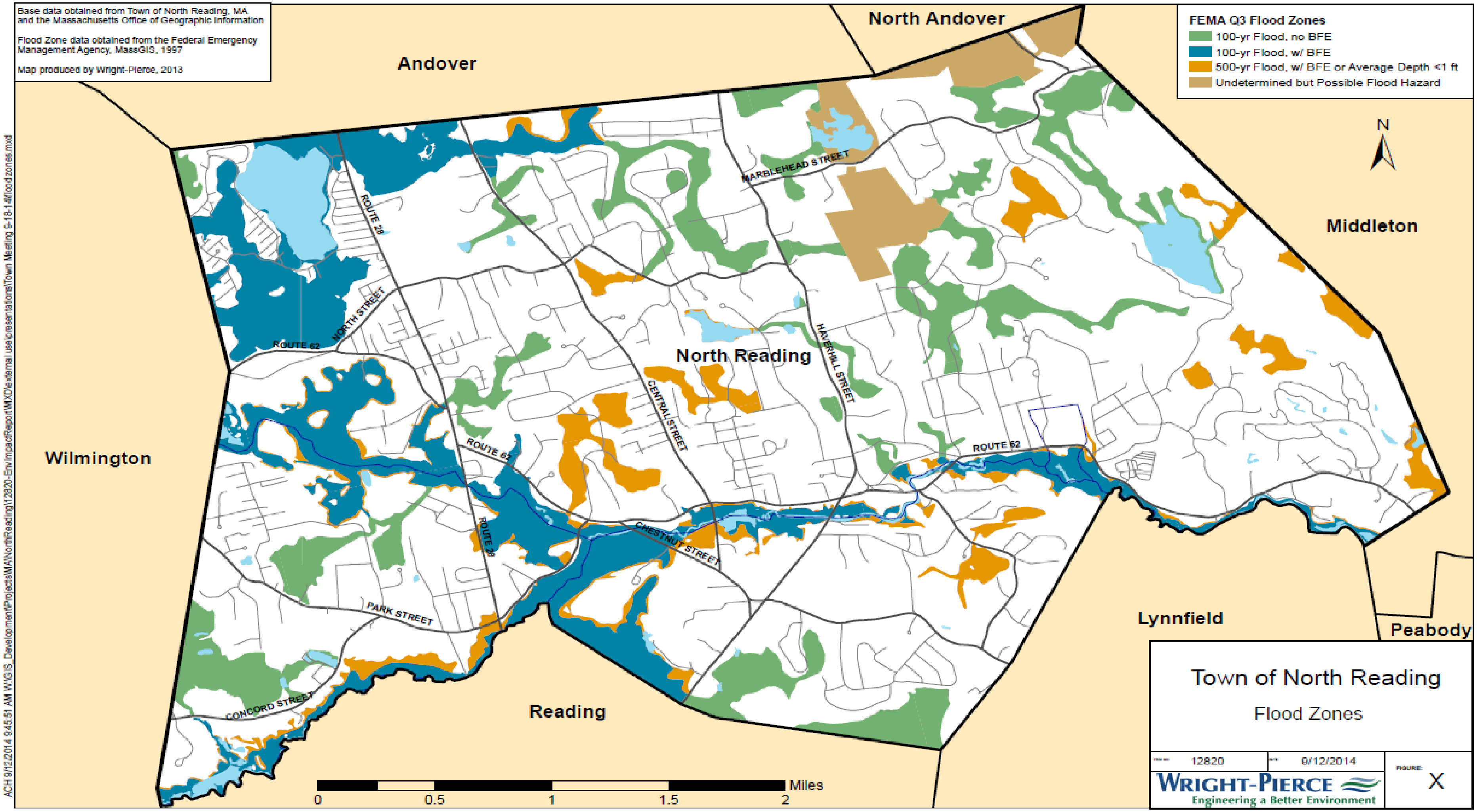
WRIGHT-PIERCE
Engineering a Better Environment

Water Quality



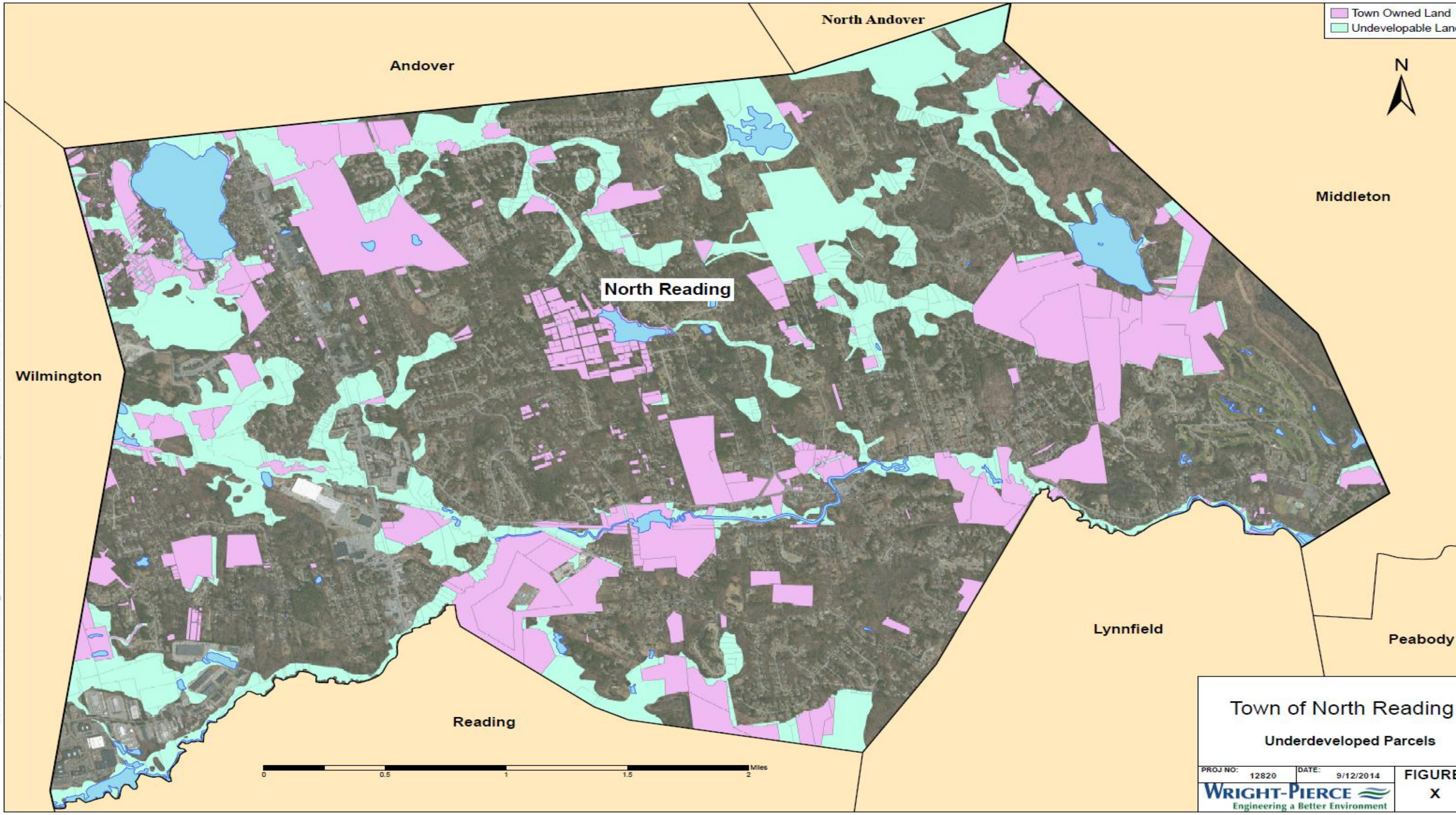
Floodplains/Zones



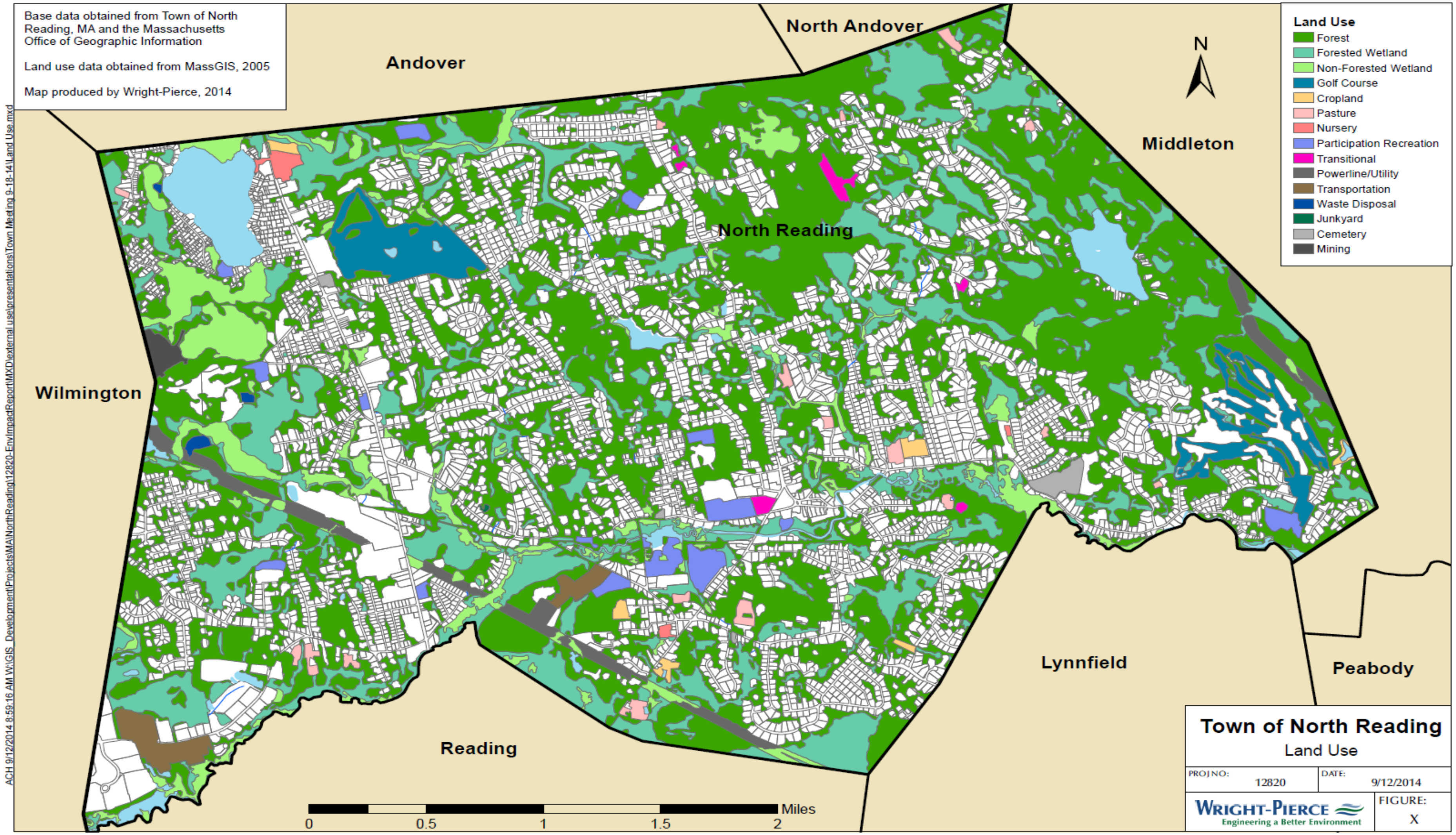
Existing Conditions

- Infrastructure and Human Environment
  - Land Use
  - Zoning
  - Environmental Impacts
  - Buildout Analysis
    - Residential
    - Commercial/Industrial
  - Population Demographics
  - Planning Initiatives

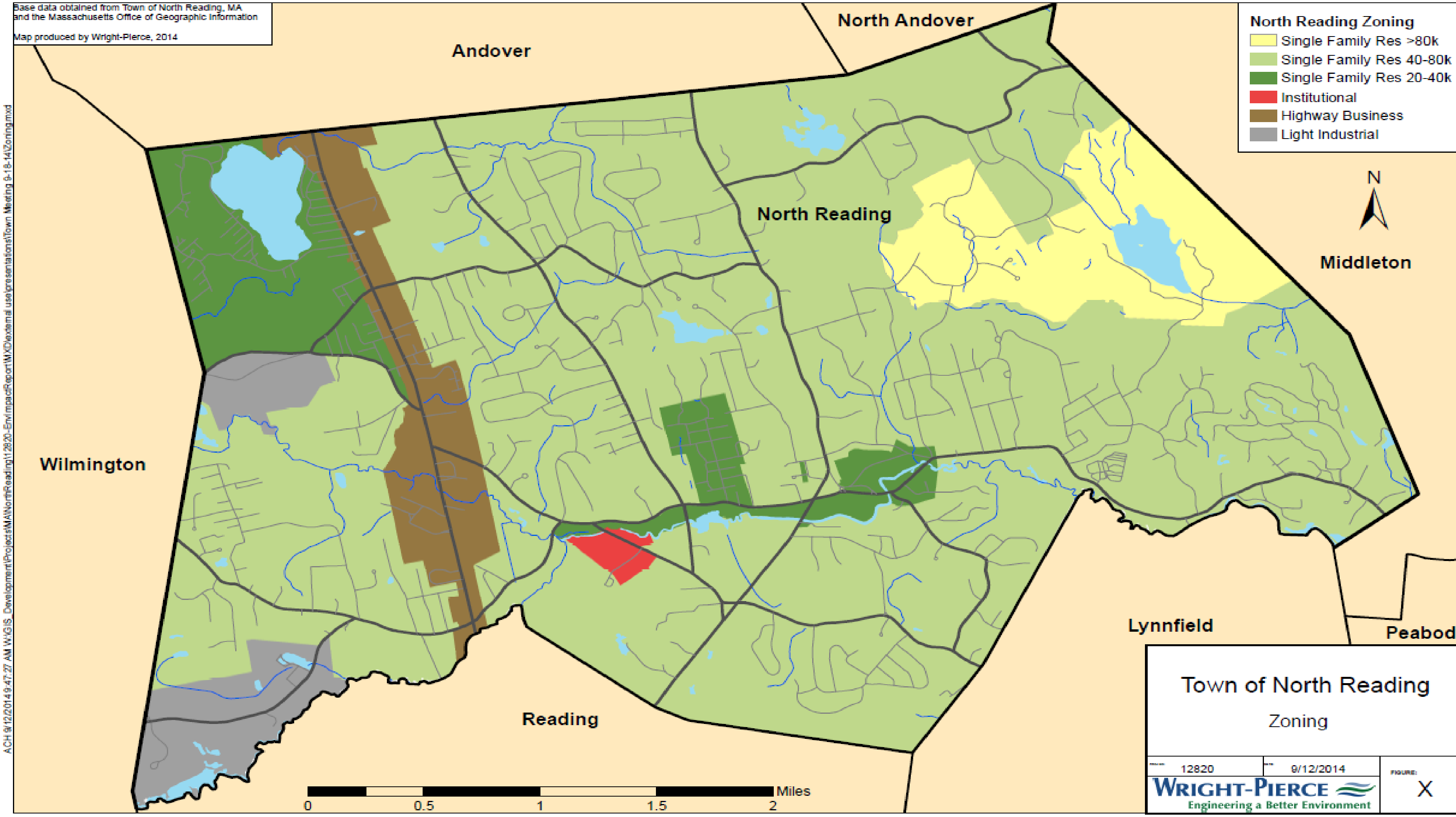
Town Owned Land



Land Use

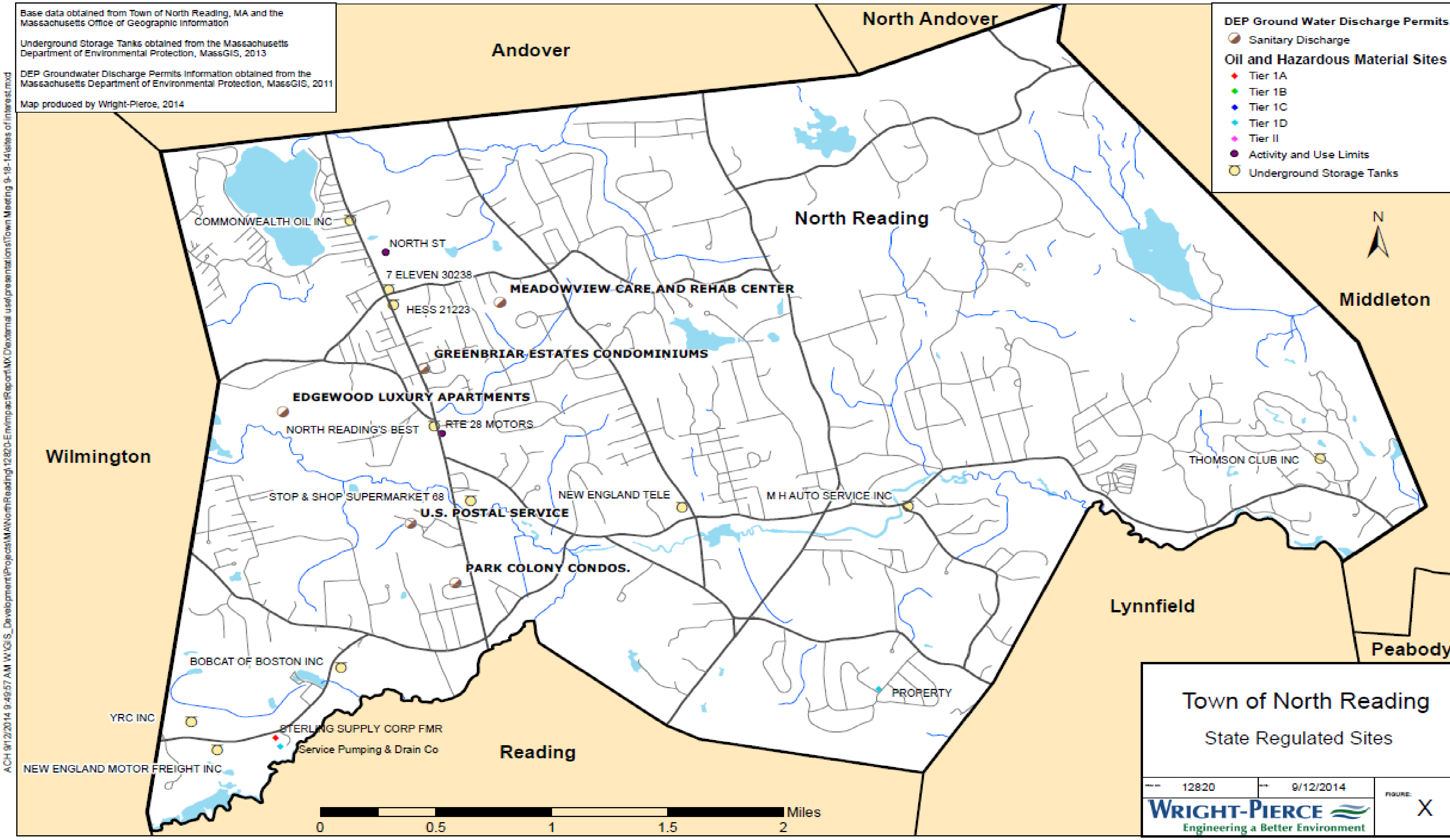

Base data obtained from Town of North Reading, MA and the Massachusetts Office of Geographic Information
Land use data obtained from MassGIS, 2005
Map produced by Wright-Pierce, 2014
Andover
North Andover
Middleton
Wilmington
North Reading
Reading
Lynnfield
Peabody
N
Land Use
Forest
Forested Wetland
Non-Forested Wetland
Golf Course
Cropland
Pasture
Nursery
Participation Recreation
Transitional
Powerline/Utility
Transportation
Waste Disposal
Junkyard
Cemetery
Mining
0
0.5
1
1.5
2
Miles
Town of North Reading
Land Use
PROJ NO: 12820
DATE: 9/12/2014
WRIGHT-PIERCE
Engineering a Better Environment
FIGURE: X
ACH 9/12/2014 8:59:16 AM W:\GIS_Development\Projects\MA\NorthReading\12820-EnvImpactReport\MXD\external use\presentations\Town Meeting 9-18-14\Land Use.mxd

Zoning

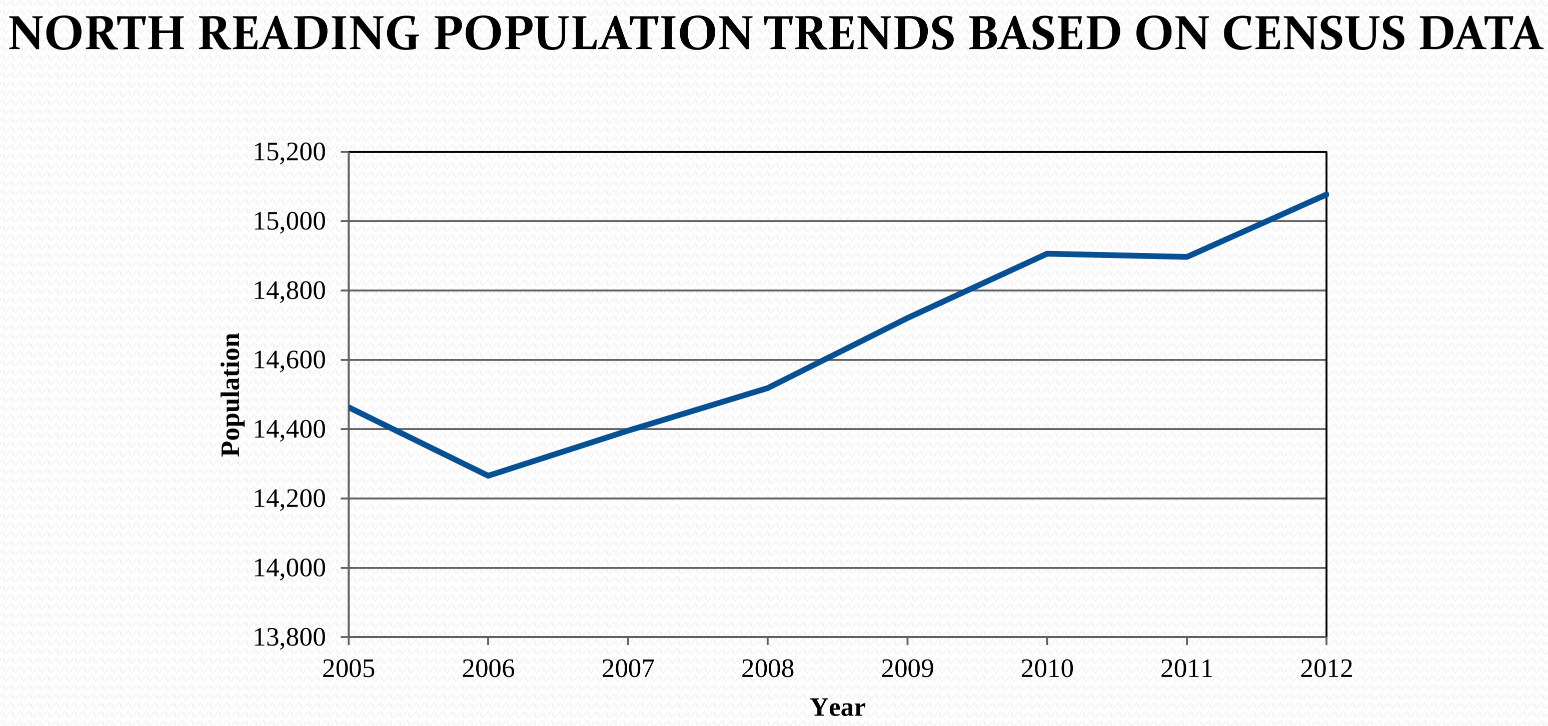


Base data obtained from Town of North Reading, MA
and the Massachusetts Office of Geographic Information
Map produced by Wright-Pierce, 2014
North Reading Zoning
Single Family Res >80k
Single Family Res 40-80k
Single Family Res 20-40k
Institutional
Highway Business
Light Industrial
N
Andover
North Andover
North Reading
Middleton
Wilmington
Lynnfield
Peabody
Reading
Miles
0
0.5
1
1.5
2
Town of North Reading
Zoning
12820
9/12/2014
FIGURE:
X
WRIGHT-PIERCE
Engineering a Better Environment

State Regulated Sites



Population Trend



Population Trend

POPULATION TRENDS FOR NORTH READING AND SIMILAR NEIGHBORING COMMUNITIES

Town	1950	1960	1970	1980	1990	2000	2010	%Change 2000-2010
North Reading	4,402	8,331	11,264	11,455	12,002	13,837	14,892	7.08%
Andover	12,437	15,878	23,695	26,370	29,151	31,247	33,201	5.89%
Lynnfield	3,927	8,398	10,826	11,267	11,274	11,542	11,596	0.47%
Middleton	2,916	3,718	4,044	4,135	4,921	7,744	8,987	13.83%
North Andover	8,485	10,908	16,284	20,129	22,792	27,202	28,352	4.06%
Peabody	22,645	32,202	48,080	45,976	47,039	48,129	51,251	6.09%
Reading	14,006	19,259	22,539	22,678	22,539	23,708	24,747	4.20%
Tewksbury	7,505	15,902	22,755	24,635	27,266	28,851	28,961	0.38%
Wilmington	7,039	12,475	17,102	17,471	17,651	21,363	22,325	4.31%
							Average	5.79%

Water System and Requirements

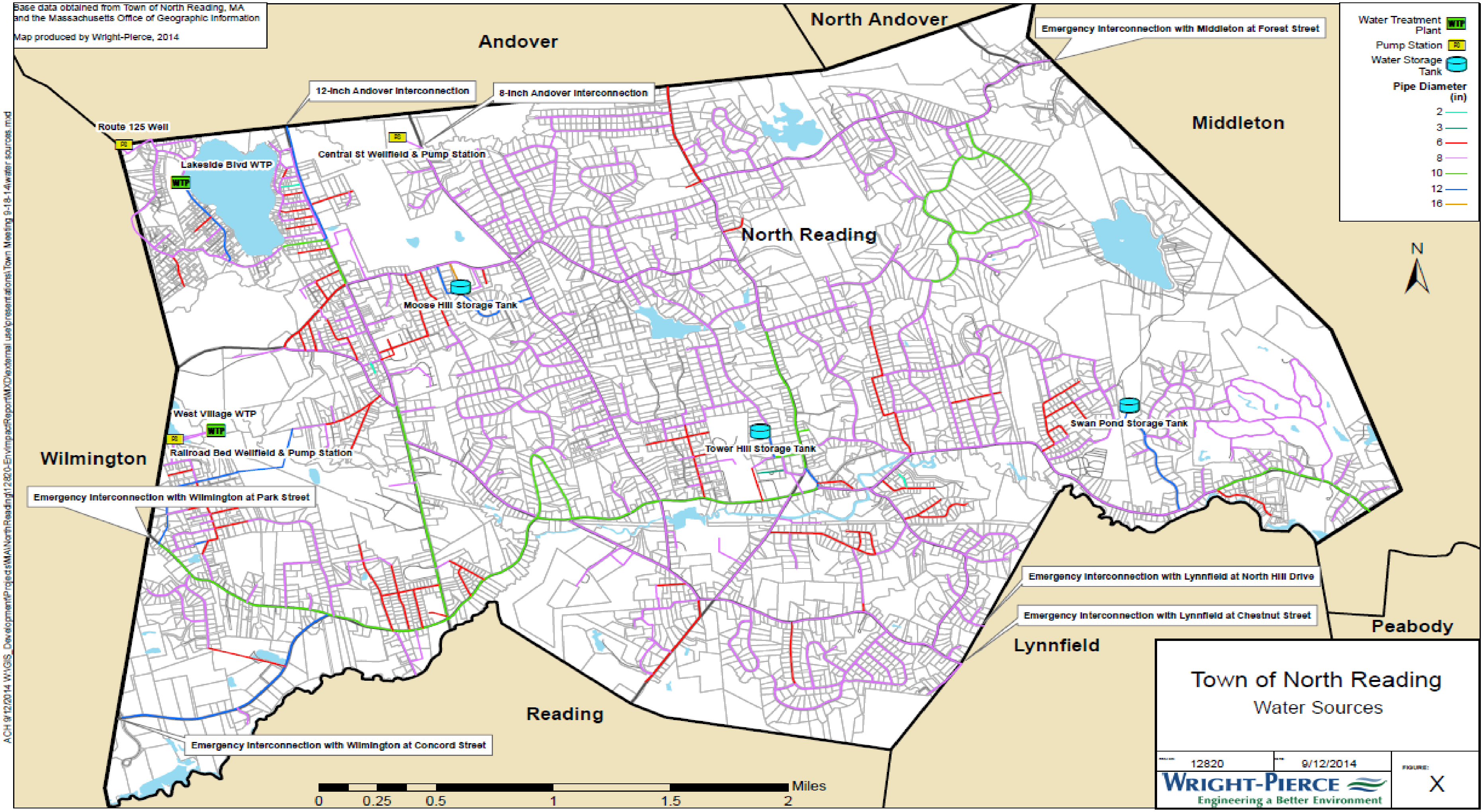
Existing Water Supply Systems

- Water Supply and Interconnections
  - Local Sources
    - Wells with on-site treatment
      - Lakeside Boulevard WTP (Lakeside Wells and Rte 125)
      - West Village WTP (Railroad Bed Wellfield)
      - Central Street Wellfield
  - Interconnections
    - 2 with Andover
      - Main Street
      - Central Street
  - Emergency Interconnections
    - Wilmington at Park Street
    - Wilmington at Concord Street
    - Lynnfield at Chestnut Street
    - Lynnfield at North Hill Drive
    - Middleton at Forest Street

Existing Water Supply Systems

- Water Distribution Storage
  - Three Water Storage Tanks
    - Tower Hill (0.525 M)
    - Moose Hill (1.58 M)
    - Swan Pond (1.3 M)
- Water Distribution Piping
  - 90 miles

Facilities



Base data obtained from Town of North Reading, MA and the Massachusetts Office of Geographic Information
Map produced by Wright-Pierce, 2014
North Andover
Andover
Middleton
Emergency Interconnection with Middleton at Forest Street
12-inch Andover Interconnection
8-inch Andover Interconnection
Route 125 Well
Central St Wellfield & Pump Station
Lakeside Blvd WTP
North Reading
Moose Hill Storage Tank
West Village WTP
Railroad Bed Wellfield & Pump Station
Wilmington
Tower Hill Storage Tank
Swan Pond Storage Tank
Emergency Interconnection with Wilmington at Park Street
Emergency Interconnection with Lynnfield at North Hill Drive
Emergency Interconnection with Lynnfield at Chestnut Street
Lynnfield
Peabody
Reading
Emergency Interconnection with Wilmington at Concord Street
Water Treatment Plant
Pump Station
Water Storage Tank
Pipe Diameter (in)
2
3
6
8
10
12
16
N
Miles
0
0.25
0.5
1
1.5
2
Town of North Reading
Water Sources
12820
9/12/2014
X
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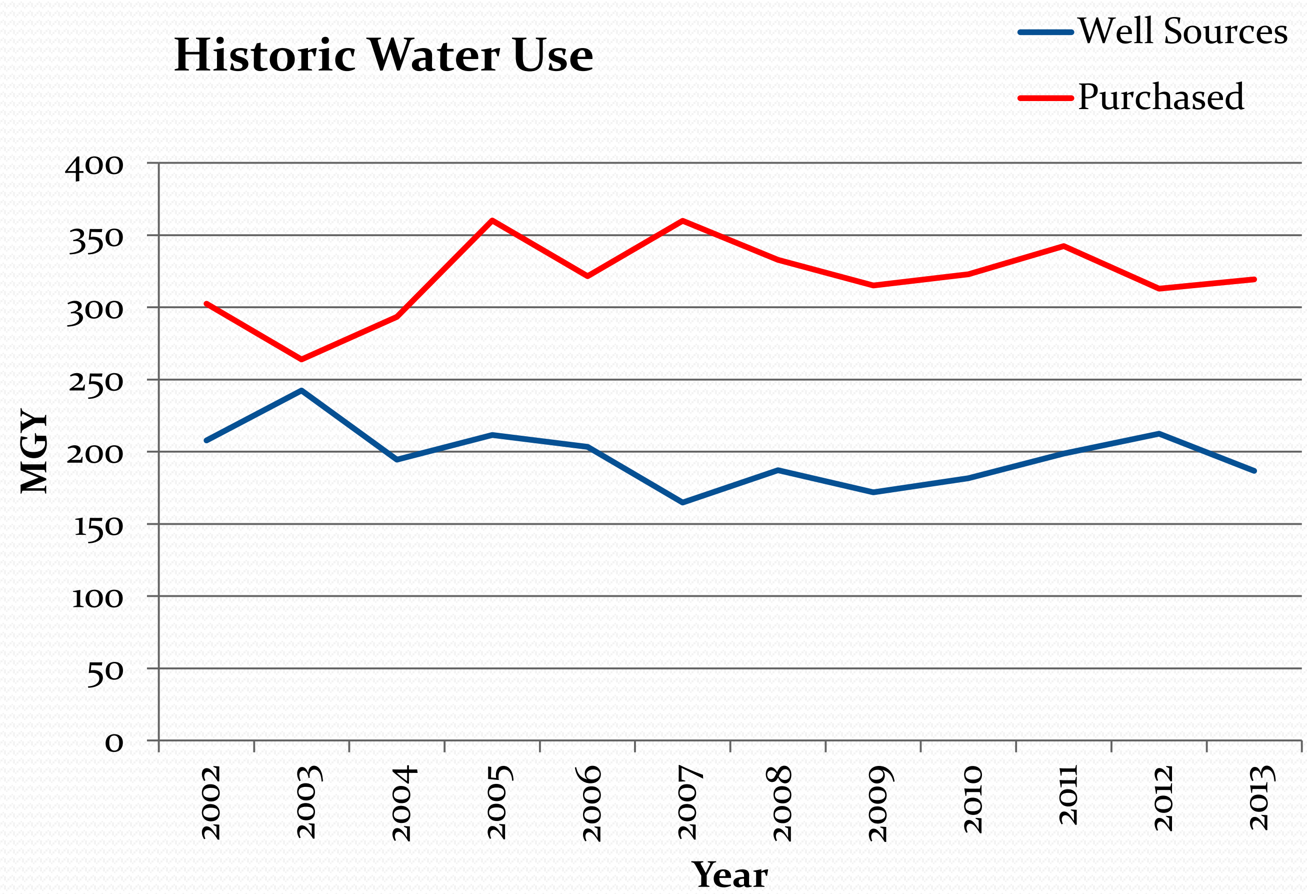
Existing Water Use

- Historical Water Use
  - Residential Water Usage
  - Commercial Water Usage
  - Industrial Water Usage
  - Institutional Water Usage
  - Municipal Water Usage
  - Unaccounted For Water
  - Average Day Demand and Maximum Day Demand
  - Peak Hour Demand

Historic Use



Historical Water Demand

Year	Total Production (Town Sources) (MG/year)	Total Purchased (MG/year)	ADD (MGD)	MDD (MGD)	Ratio of MDD/ADD
2002	207.8	302.6	1.40	2.38	1.70
2003	242.5	263.9	1.39	2.39	1.72
2004	194.5	293.5	1.34	2.07	1.55
2005	211.7	360.2	1.57	2.56	1.63
2006	203.5	321.6	1.44	2.27	1.58
2007	164.9	359.9	1.43	2.27	1.58
2008	187.2	332.9	1.42	2.36	1.66
2009	171.8	315.2	1.33	2.17	1.62
2010	181.7	322.9	1.38	2.47	1.79
2011	198.7	342.3	1.48	2.38	1.61
2012	212.6	313.0	1.44	2.26	1.57
2013	186.8	319.4	1.39	2.15	1.55

* Data as reported in the 2002 – 2013 Massachusetts DEP Annual Reports.

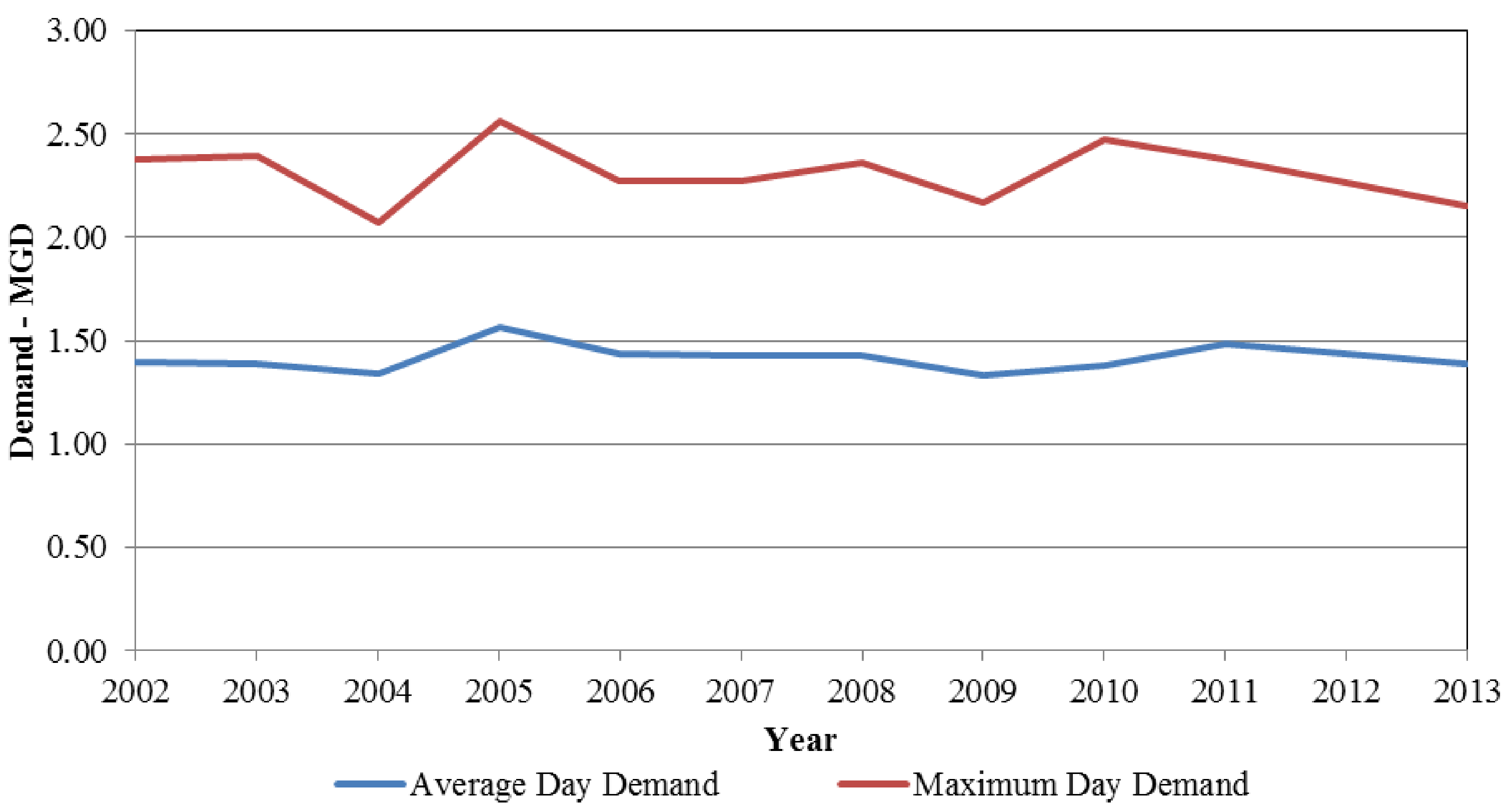
Historical Water Use by Category

Year	Residential	Institution	Commercial	Total
2002	1.07	0.08	0.12	1.28
2003[1]	1.0	0.11	0.11	1.22
2004	0.84	0.11	0.06	1.01
2005	0.90	0.10	0.06	1.07
2006	0.83	0.12	0.10	1.04
2007	0.93	0.11	0.07	1.11
2008	0.91	0.12	0.04	1.07
2009	0.86	0.14	0.08	1.07
2010	0.94	0.11	0.07	1.12
2011	1.07	0.08	0.06	1.21
2012	1.03	0.05	0.07	1.15
2013	0.89	0.05	0.05	1.00
Average	0.94	0.10	0.07	1.11

Unaccounted For Water Use

Year	Total (MG/Yr)	% of Total Production
2002	44.4	8.7
2003	59.8	11.8
2004	59.8	12.2
2005	97	17
2006	85.7	16.3
2007	68	13.6
2008	76.1	15.0
2009	63.1	13.3
2010	64.5	13.2
2011	66.6	12.7
2012	70	13.72
2013	84.9	17.2

ADD/MDD

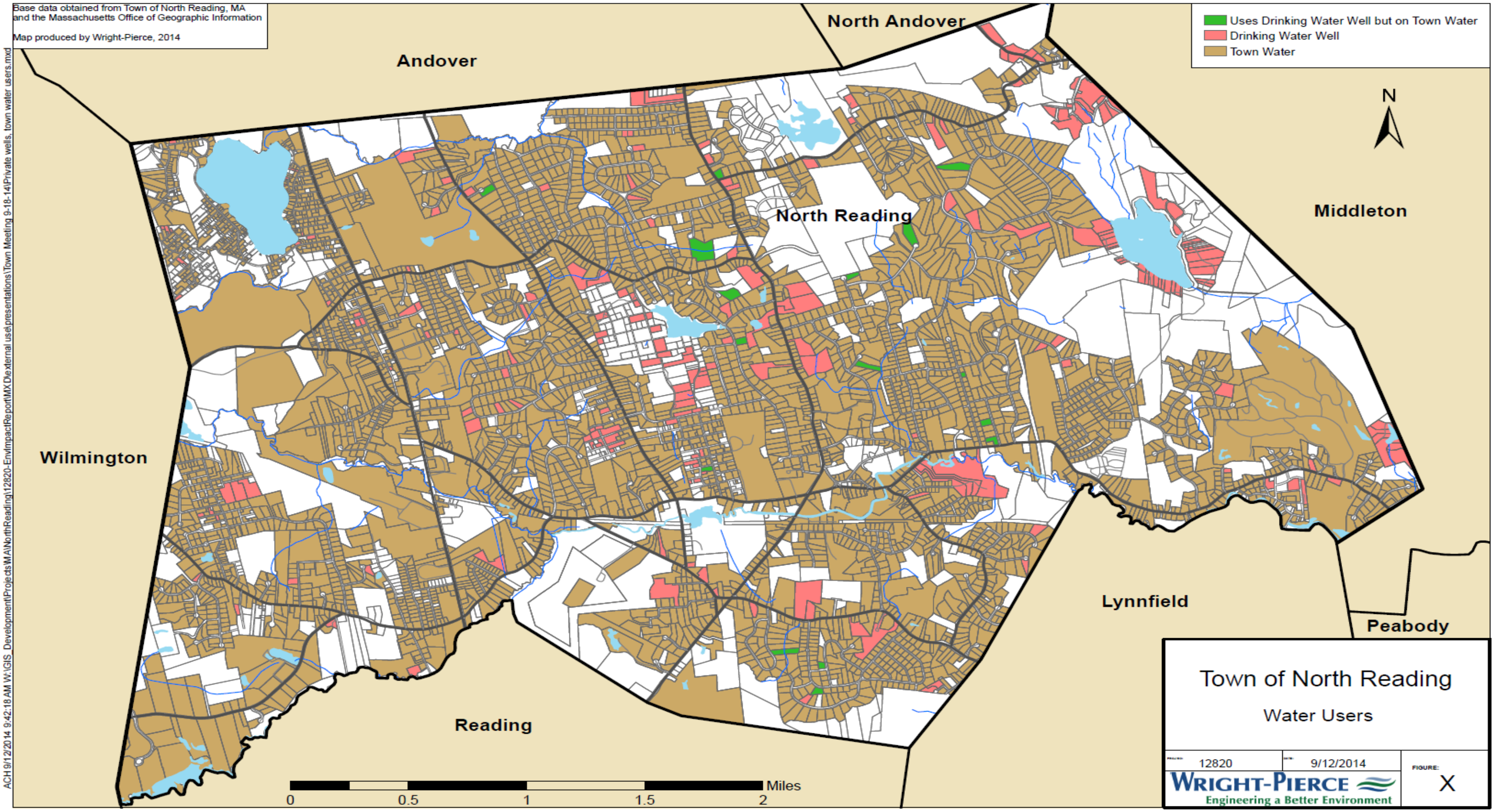


3.00
2.50
2.00
1.50
1.00
0.50
0.00
Demand - MGD
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Year
Average Day Demand
Maximum Day Demand

Future Demands

- Residential Use
- Commercial/Industrial
- Build-out
- Population
- MassDEP/MWRA OP.10 Requirements
- MDD/ADD

Public/Private Water



Population Served - Existing

Source/Use	Number
Municipal Water	14,725
Private Potable Water Well	229 Parcels (621 persons)
Irrigations Wells	362 Parcels
Commercial Industrial Users	358 Parcels

Future Requirements

Base Population	**14896**	2013 population
Well users	**0**	Well users (all transitioned public water)
Population growth: Undeveloped/underdeveloped Future Users	**2512**	un/underdeveloped lots *2.71 people per household
Population Served	**17408**	Includes Wells & growth
Residential Average Day Demand (MGD)	**1.13**	Based on 65 gpcd
Non-Residential Average Day Demand (MGD)	**0.19**	80% of 12yr max + undeveloped
Unaccounted Water %	**10.0%**	assume 10%
Unaccounted Water (MGD)	**0.16**	
Confidently Estimated Municipal Use (MGD)	**0.12**	based on 2013
Total Average Day Demand (MGD)	**1.60**	
Total Maximum Day Demand (MGD)	**2.58**	MDD/ADD of 1.79

Water Conservation

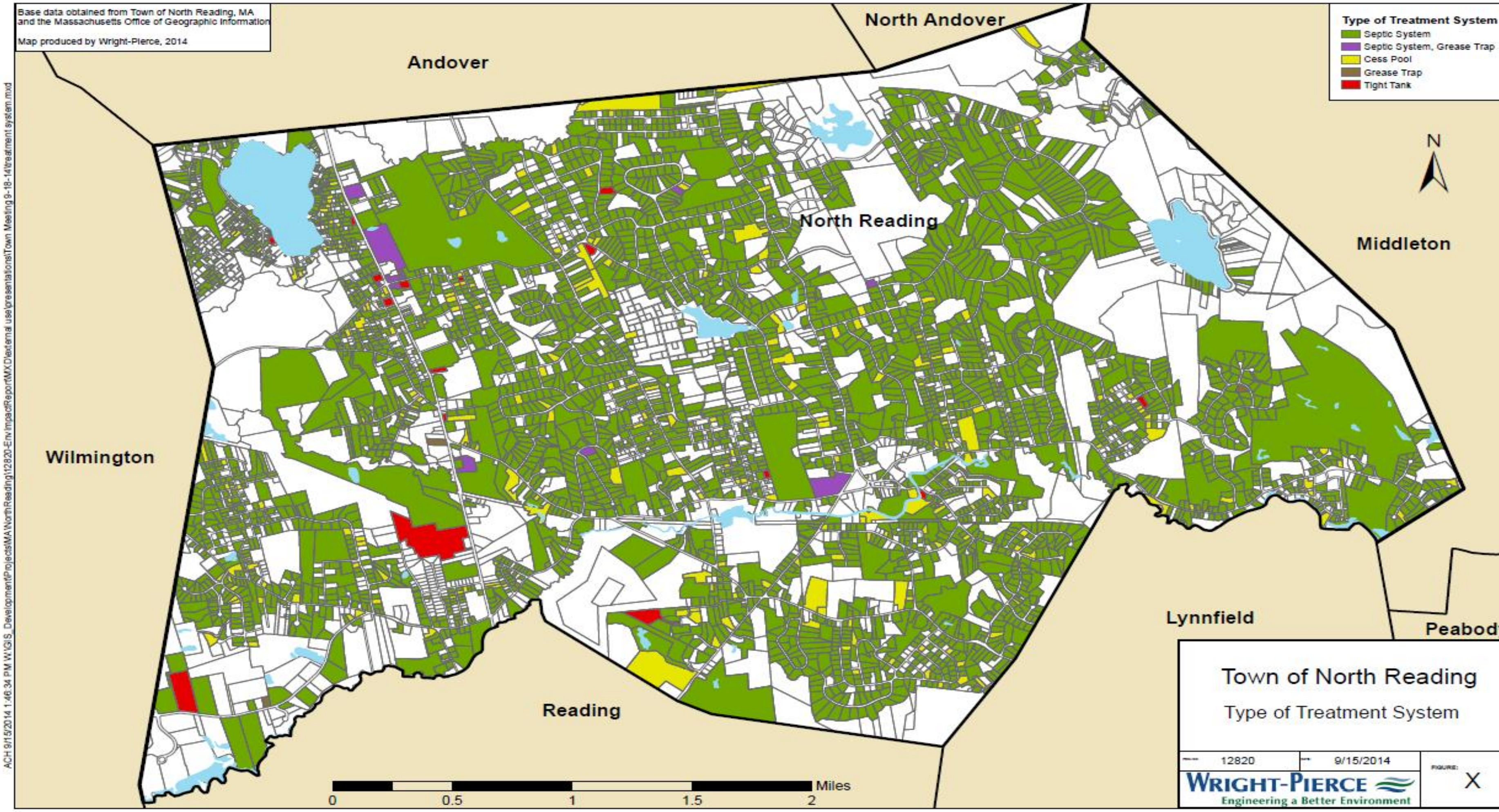
- Comprehensive Planning & Drought Management Planning ✓
- Water Audit ✓
- Leak Detection ✓
- Metering ✓
- Pricing ✓
- Residential ✓
- Public Sector ✓
- Industrial, Commercial, and Institutional- relatively low % of North Reading Water Use- no FY 15 action planned
- Agricultural- relatively low % of North Reading Water Use- no FY 15 action planned
- Lawn & Landscape ✓
- Public Education & Outreach ✓

Wastewater System and Requirements

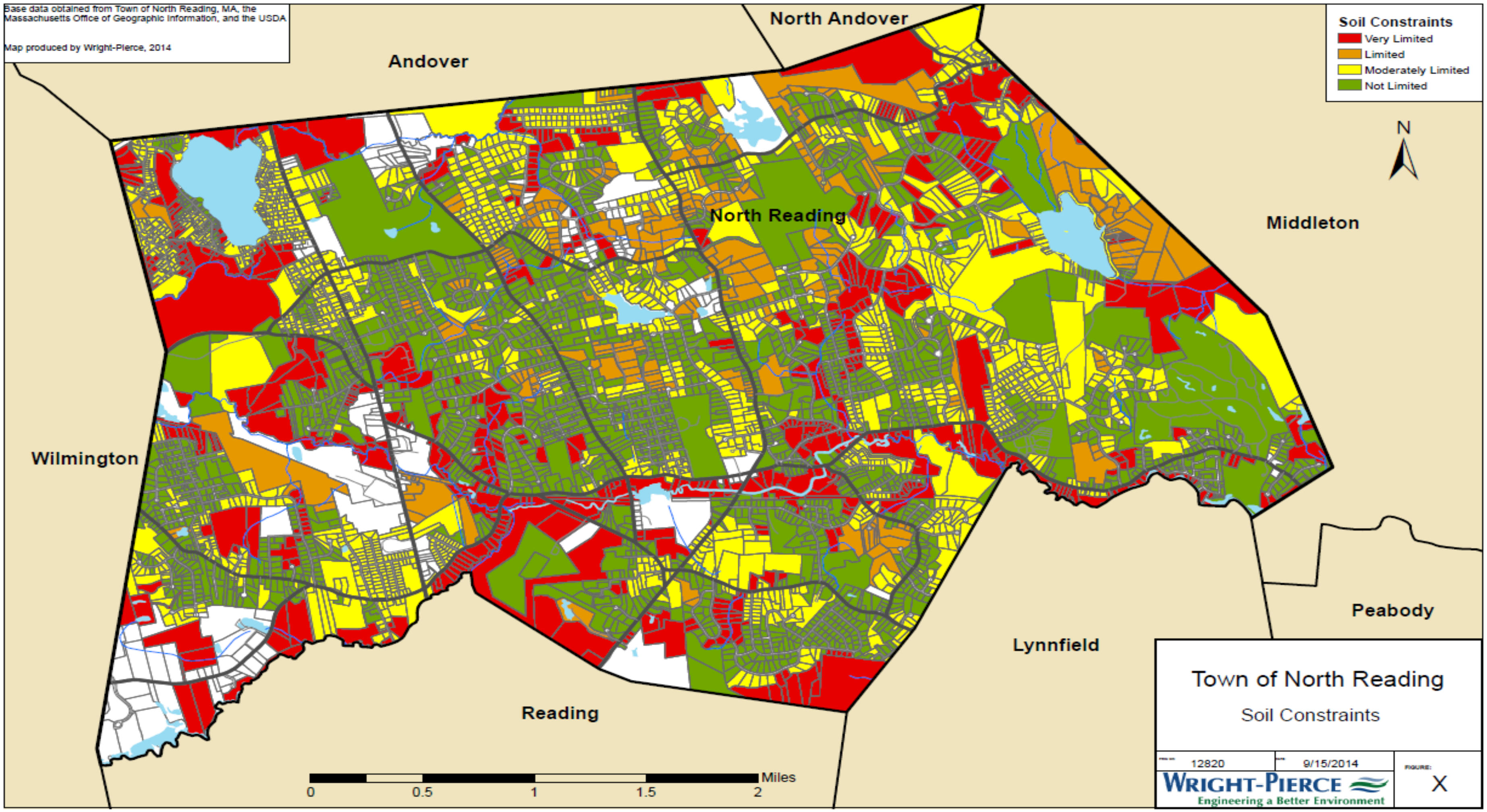
Existing Wastewater Management Systems

- On-site Wastewater Disposal Systems
  - Septic Systems
  - Cesspools
  - Tight Tanks
  - Innovative/Alternative Technologies
  - Treatment Facilities (MassDEP GW Permit)
  - Residuals Management
- On-site Wastewater Disposal Systems Effectiveness
  - Septic System Failures
  - DEP Violations

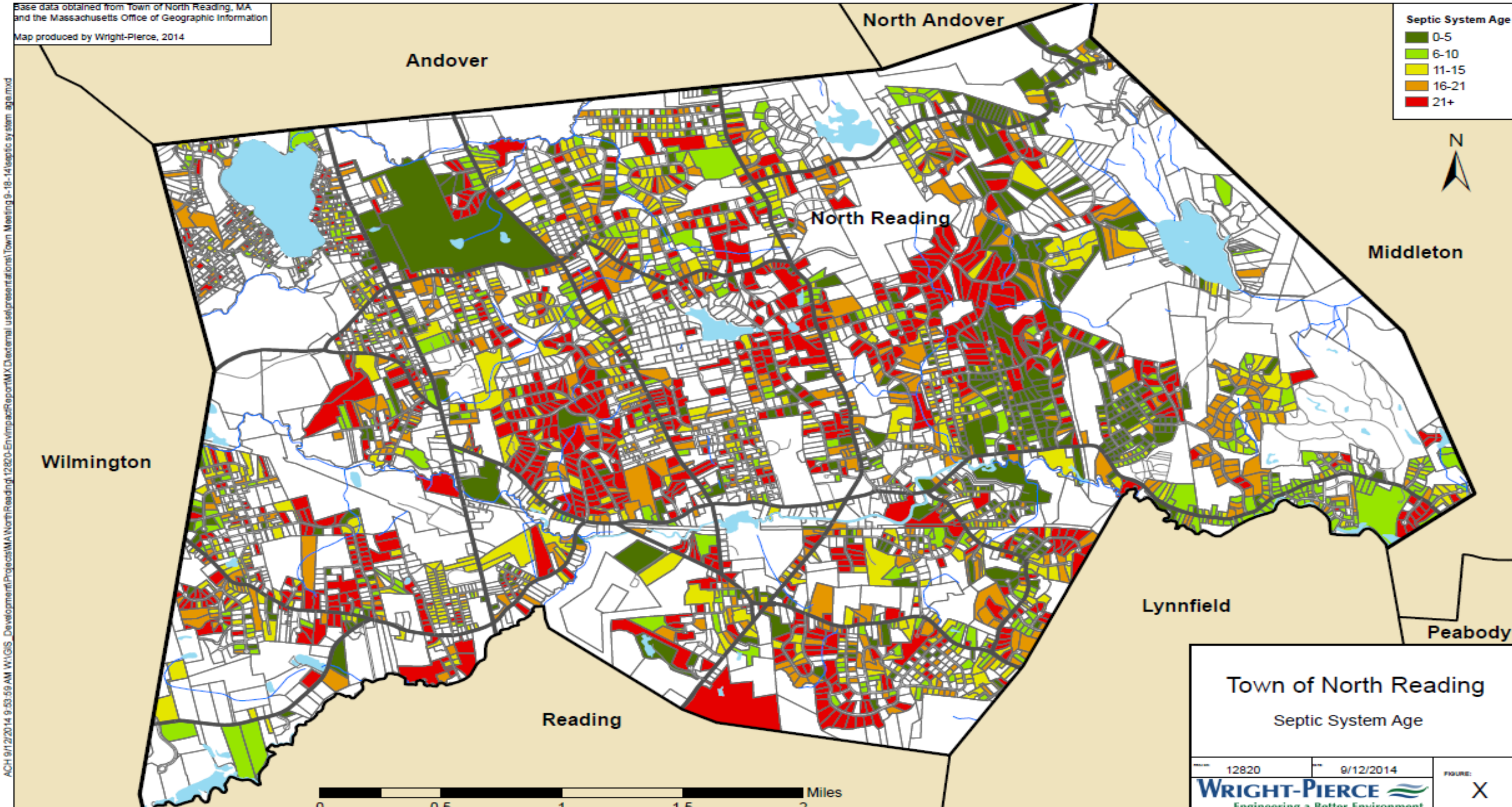
Treatment System Types



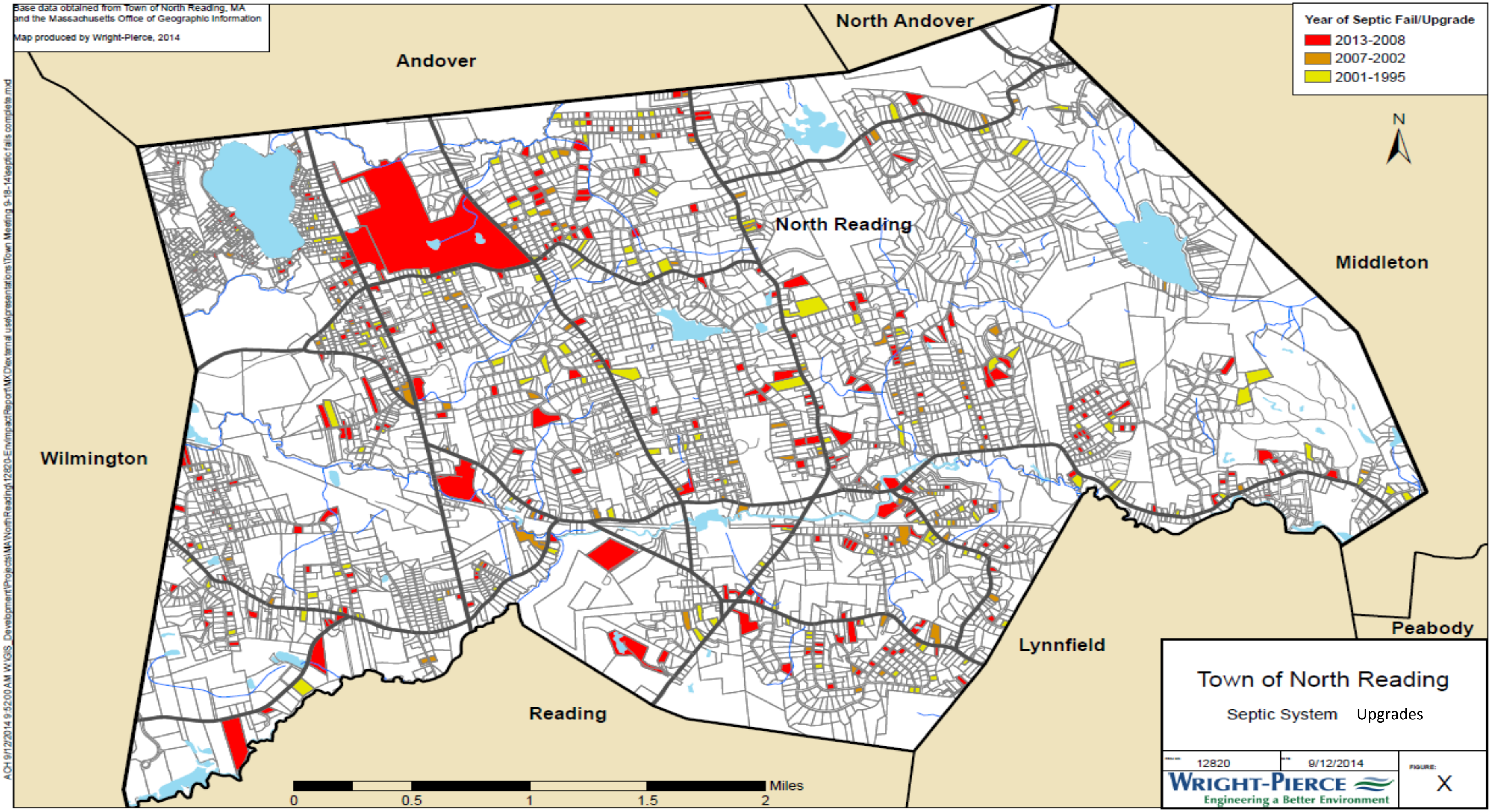
Soil Constraints



Septic System Age



Septic System Upgrades



Upgrades Data Set

2008	2009	2010	2011	2012	2013
40	52	37	48	52	48

Existing Wastewater Management Systems

- North Reading Board of Health Septic System Regulations and Procedures
- Collection Systems
  - Private Collection Systems
  - Existing MWRA Sewer Connection

Wastewater Management Needs Assessment Process

- Develop Criteria
  - Physical
  - Location
- Collect Data – Validate
- Rank/weight Criteria
- Determine Needs

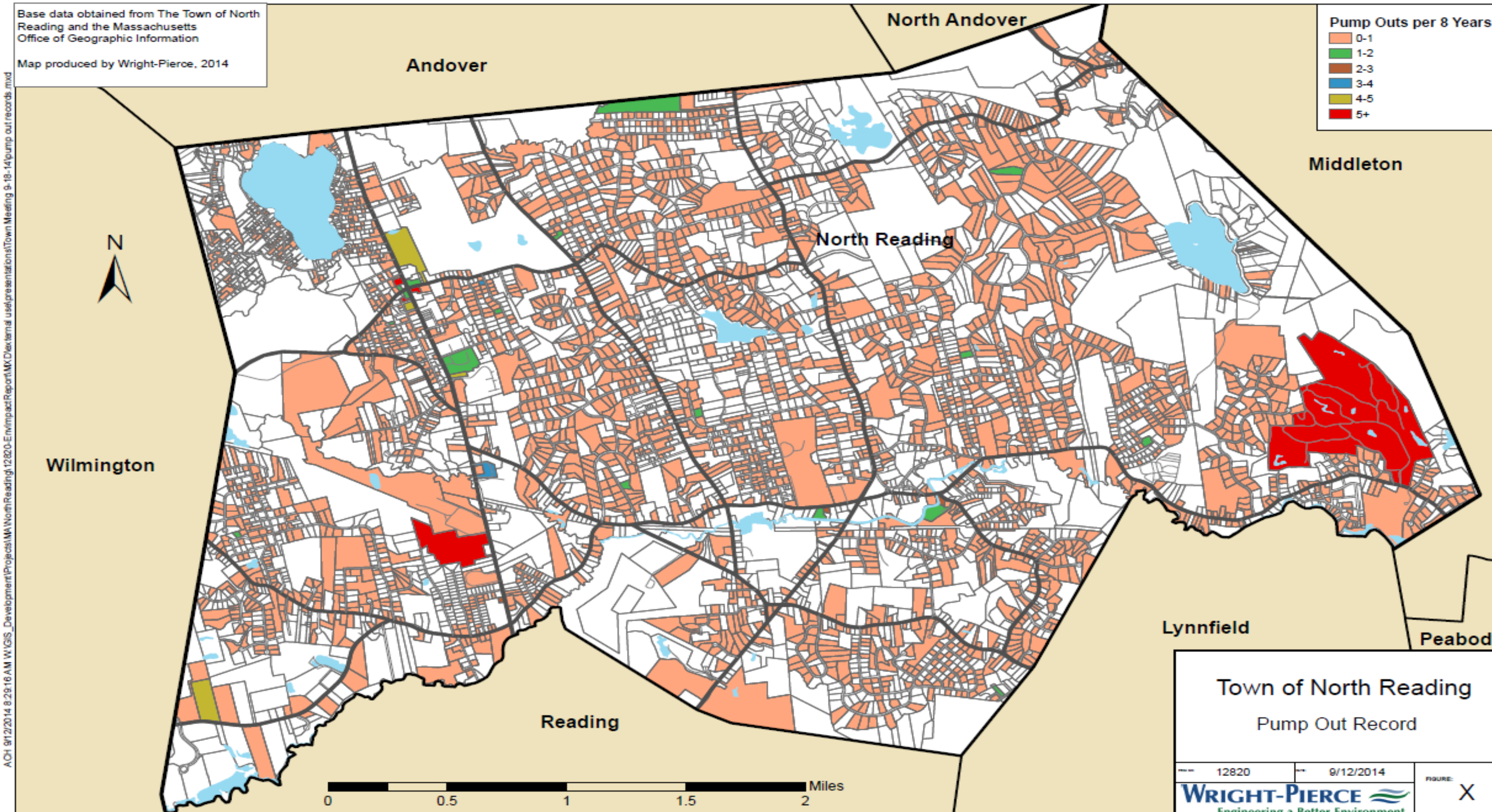
Criteria - Physical

- Lot Size
- Water Use per SF
- Water Use Class
- Known Septic Failures
- Septic System Age
- System Type – Cesspool/Tight Tank/Treatment System
- Pump Out Frequency
- Permit Violations
- Household Size/No. of Rooms
- Percent Impervious
- Private Well

Criteria - Location

- Depth to GW
- Depth to Restrictive Layer
- Soil Drainage
- Ponding
- Flooding
- Private Wells
- Within Zone 2
- Within IWPA
- Adjacent to Wetlands
- Proximity to Impaired Water
- Percent Impervious
- Surface Water Protection Zone

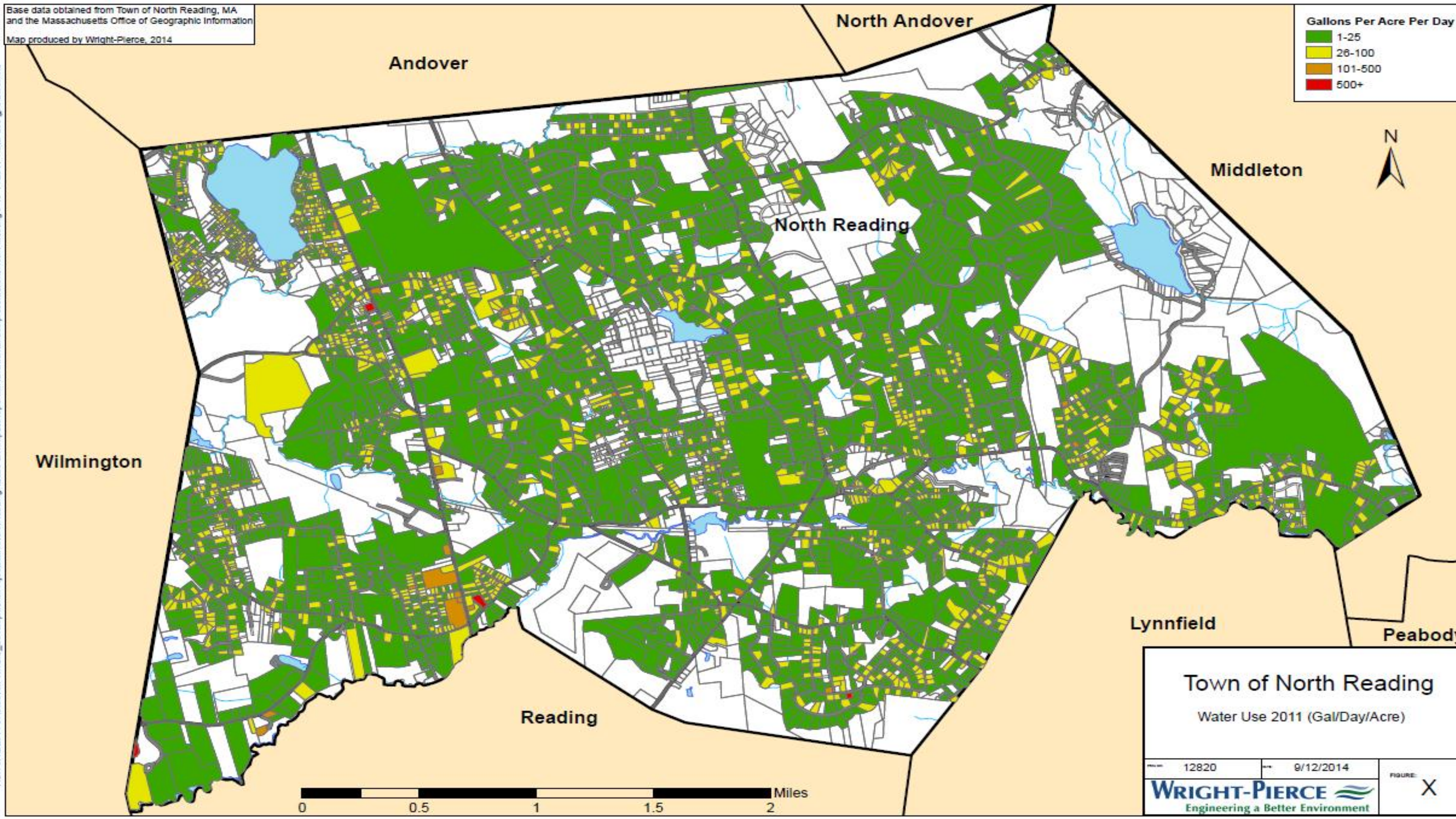
Septic Pump Out Frequency



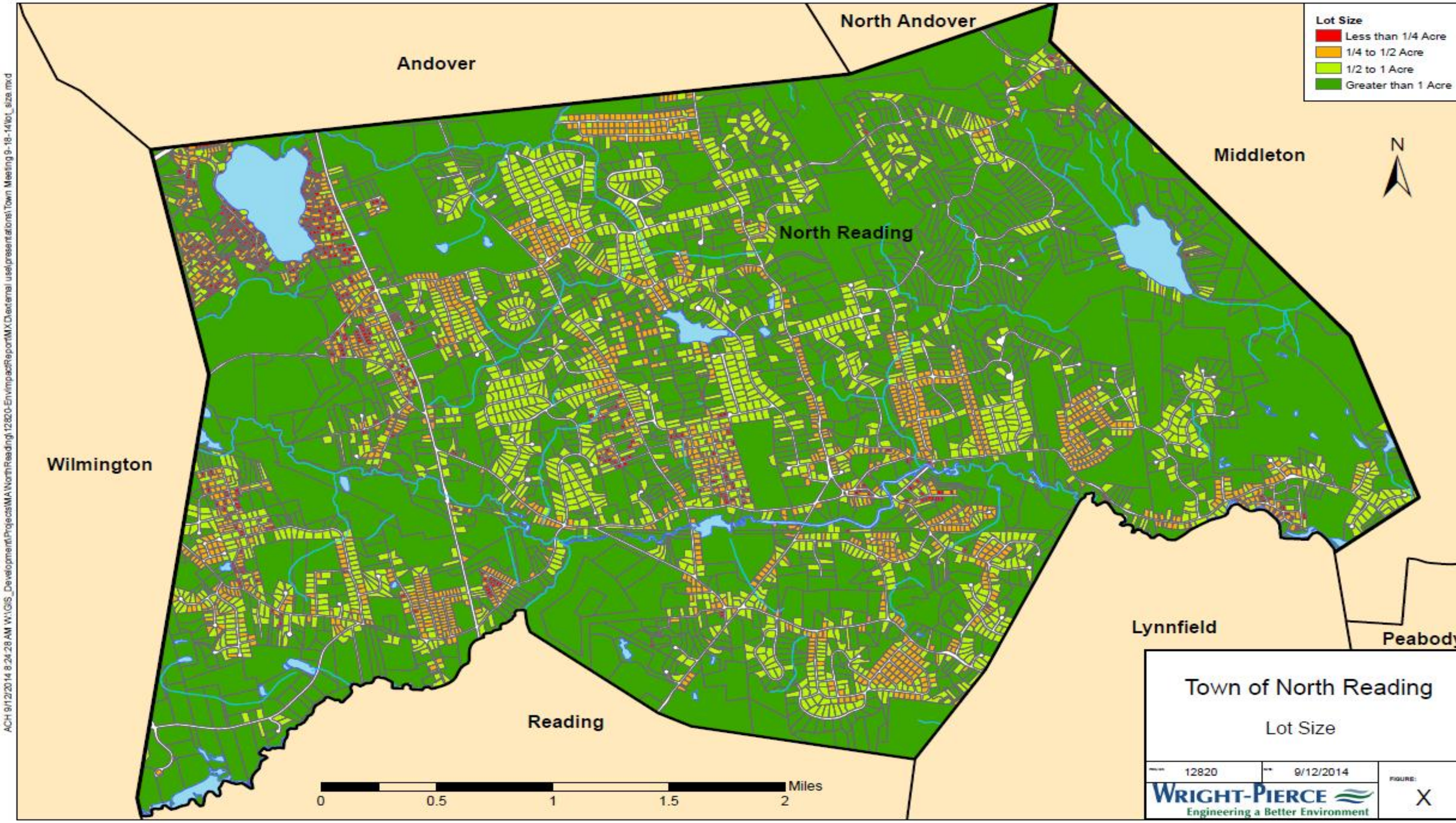
Pump Out Data Set

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
217	603	610	838	745	687	713	738	760	62

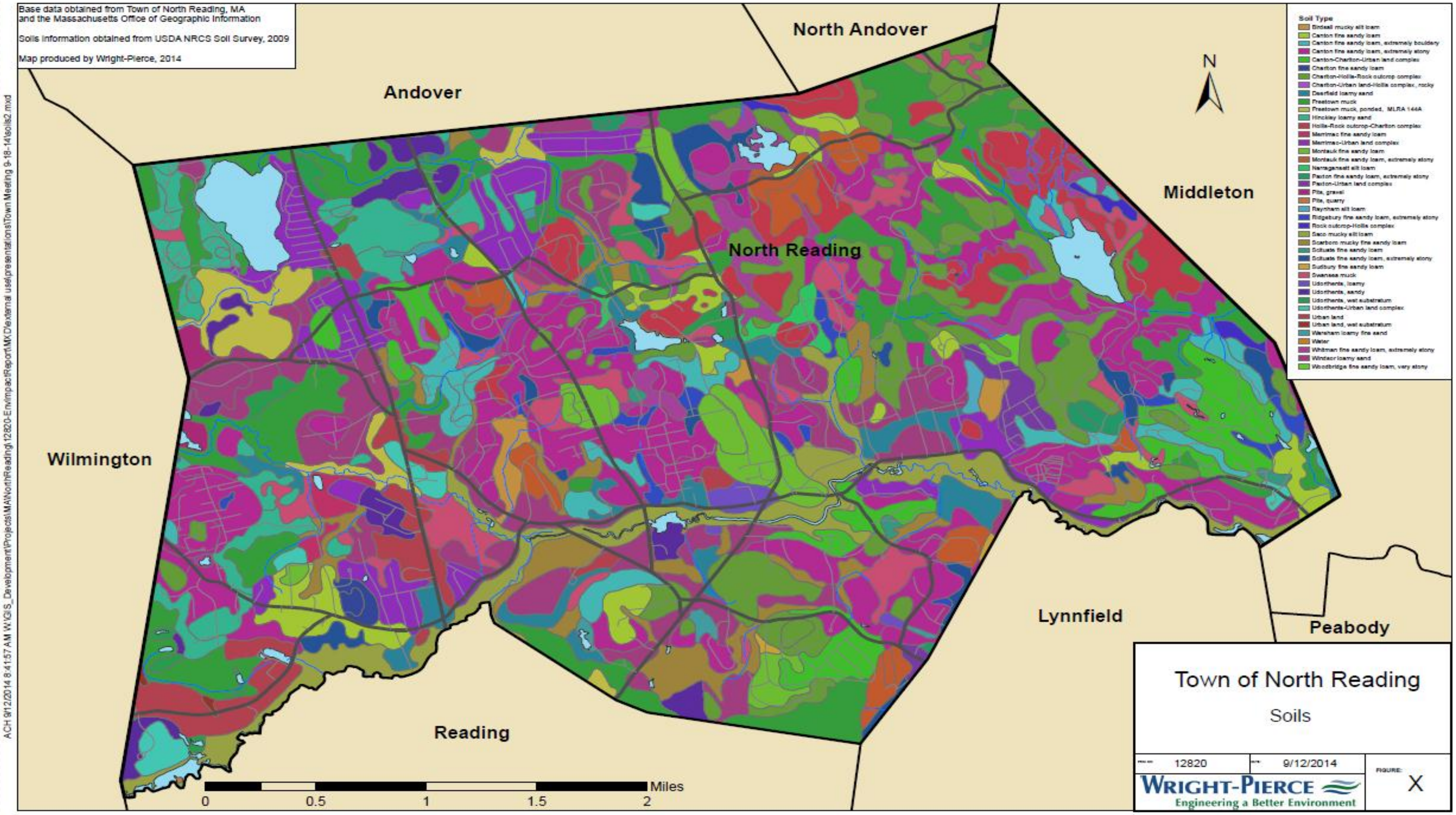
Water Use per Acre



Lot Size


ACH 9/12/2014 8:24:28 AM W:\GIS_Development\Projects\MA\NorthReading\12820-EnvImpactReport\MXD\external use\presentations\Town Meeting 9-18-14\lot_size.mxd
Lot Size
Less than 1/4 Acre
1/4 to 1/2 Acre
1/2 to 1 Acre
Greater than 1 Acre
N
North Andover
Andover
Middleton
North Reading
Wilmington
Lynnfield
Peabody
Reading
Miles
0
0.5
1
1.5
2
Town of North Reading
Lot Size
12820
9/12/2014
FIGURE:
X
WRIGHT-PIERCE
Engineering a Better Environment

Soils



Base data obtained from Town of North Reading, MA
and the Massachusetts Office of Geographic Information
Soils information obtained from USDA NRCS Soil Survey, 2009
Map produced by Wright-Pierce, 2014
North Andover
Andover
Middleton
North Reading
Wilmington
Lynnfield
Peabody
Reading
N
Soil Type
Birdsall mucky silt loam
Canton fine sandy loam
Canton fine sandy loam, extremely bouldery
Canton fine sandy loam, extremely stony
Canton-Charlton-Urban land complex
Charlton fine sandy loam
Charlton-Hollis-Rock outcrop complex
Charlton-Urban land-Hollis complex, rocky
Deerfield loamy sand
Freetown muck
Freetown muck, ponded, MLRA 144A
Hinckley loamy sand
Hollis-Rock outcrop-Charlton complex
Merrimac fine sandy loam
Merrimac-Urban land complex
Montauk fine sandy loam
Montauk fine sandy loam, extremely stony
Narragansett silt loam
Paxton fine sandy loam, extremely stony
Paxton-Urban land complex
Pits, gravel
Pits, quarry
Raynham silt loam
Ridgebury fine sandy loam, extremely stony
Rock outcrop-Hollis complex
Saco mucky silt loam
Scarboro mucky fine sandy loam
Scituate fine sandy loam
Scituate fine sandy loam, extremely stony
Sudbury fine sandy loam
Swansea muck
Udorthents, loamy
Udorthents, sandy
Udorthents, wet substratum
Udorthents-Urban land complex
Urban land
Urban land, wet substratum
Wareham loamy fine sand
Water
Whitman fine sandy loam, extremely stony
Windsor loamy sand
Woodbridge fine sandy loam, very stony
Miles
0
0.5
1
1.5
2
Town of North Reading
Soils
12820
9/12/2014
FIGURE:
X
WRIGHT-PIERCE
Engineering a Better Environment

Preliminary Agenda for Next Meeting

Anticipated Date December 18, 2014

- Finalize Water Needs
- Water Supply Alternatives Analysis
- Detailed Wastewater Needs Analysis
- Preliminary Wastewater Management Alternatives

Questions / Discussion

BY ______________ DATE ______________

CHCKD. BY ________ DATE ______________

WRIGHT-PIERCE
Engineering a Better Environment

SHEET NO. ________ OF ________

PROJECT NO. ______________

PROJECT ______________________________

BOOK NO. ______________

NAME	AFFILIATION	E-MAIL
Joe Lobao	Town of Wilmington	JLobao@wilmingtonma.g
Karen Martin	Town of Andover	kmartin@andoverma.ge
JOE HUGGINS	TOWN OF READING	JHUGGINS@CI.READING.MA.U
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WAYNE CASTONGUAY	Ipswich River	wcastonguay@Ipswichriver.org
Richard Carnevale	TOWN OF NR	rcarnevale@northreadingma.gov

Town of North Reading

Draft Environmental Impact Report

Project Meeting #2

June 25, 2015

Presented by: Paul Brinkman
Amy Coppers Costantino, PE

WRIGHT-PIERCE
Engineering a Better Environment

Invite List

- Secretary Matthew A. Beaton; Executive Office of Energy and Environmental Affairs
- Department of Environmental Protection; Commissioner's Office
- MassDEP/Northeast Regional Office; MEPA Coordinator
- Mass DOT - District #4 Office; MEPA Coordinator
- Massachusetts Historical Commission
- Merrimack Valley Planning Commission
- Metropolitan Area Planning Council
- Town of North Reading Board of Selectmen
- Michael Gilleberto; Town Administrator Town of North Reading
- Town of North Reading Community Planning Department
- Town of North Reading Conservation Commission
- Town of North Reading Health Department
- Town of Reading Board of Selectmen
- Robert W. LeLacheur, Jr., Town Manager Town of Reading
- Town of Wilmington Planning Department
- Town of Wilmington Health Department
- Town of Wilmington Conservation Commission
- Town of Wilmington Board of Selectmen
- Town of Reading Planning Department
- Town of Reading Conservation Commission
- Town of Reading Health Department
- Town of Andover Board of Selectmen
- Reginald S. Stapczynski; Town Manager Town of Andover
- Town of Andover Planning Board
- Town of Andover Conservation Commission
- Town of Andover Board of Health
- Natural Heritage and Endangered Species Program; Commonwealth of Massachusetts
- DCR; MEPA Coordinator
- Department of Public Health ; Director of Environmental Health
- Pamela Heidell; Massachusetts Water Resource Authority; MEPA Coordinator
- Energy Facilities Siting Board; MEPA Coordinator
- Division of Energy Resources; MEPA Coordinator
- Ipswich River Watershed Association, Wayne Castonguay, Executive Director
- Martins Pond Association

MEPA Process/Outline

- ENF
- EIR Preparation and Filing Process
  - Draft EIR
  - Submission of Draft EIR and Public Comment Period
  - Issuance of Secretary's Certificates
  - Response to Comments
  - Final EIR

Draft EIR

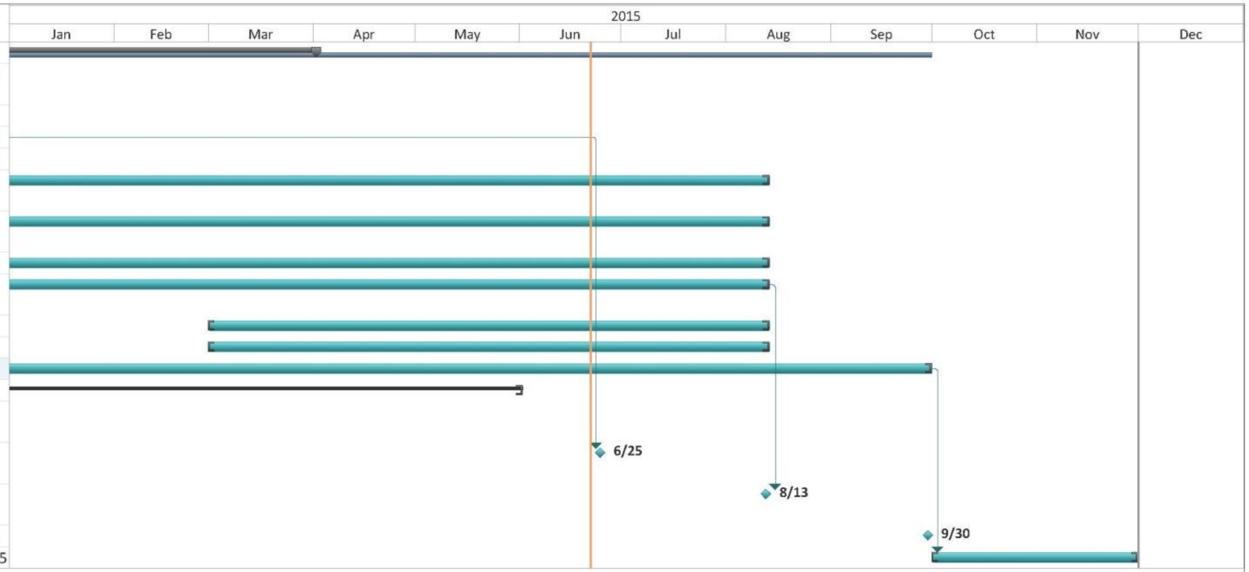
- Table of Contents
- Secretary's Certificates
- Summary
- Project Description
- Existing Environment
- Alternatives to the Project
- Assessment of Impacts
- Statutory and Regulatory Standards and Requirements
- Mitigation Measures
- Proposed Section 61 Findings
- Appendices

North Reading MEPA Process Framework

Tasks	Water & Wastewater	Tentative Date
Existing Conditions	Meeting #1	Completed
Needs and Identify Alternatives	Meeting #2	Current
Impact Analysis and Recommended Plan	Meeting #3	Fall 2015

Anticipated Schedule

ID	Task Name	Start	Finish
1	**DEIR Water and Wastewater**	**Fri 11/1/13**	**Wed 4/1/15**
2	Project Description and Permitting	Fri 11/1/13	Mon 6/30/14
3	Existing Conditions	Fri 11/1/13	Thu 7/31/14
4	WW Needs Analysis	Fri 11/1/13	Wed 10/1/14
5	Alternatives Analysis	Fri 8/1/14	Mon 12/1/14
6	Address IBTA Requirements	Mon 12/1/14	Thu 8/13/15
7	Address MWRA OP#10 Requirements	Mon 12/1/14	Thu 8/13/15
8	Collateral Impacts	Mon 12/1/14	Thu 8/13/15
9	Greenhouse Gas Emissions Analysis	Mon 12/1/14	Thu 8/13/15
10	Construction Period	Sun 3/1/15	Thu 8/13/15
11	Mitigation	Sun 3/1/15	Thu 8/13/15
12	DEIR Report	Fri 11/1/13	Wed 9/30/15
13	**Stakeholder Meetings**	**Mon 9/1/14**	**Mon 6/1/15**
14	Existing Conditions/ Preliminary Needs Analysis	Thu 9/18/14	Thu 9/18/14
15	Need and Alternatives Analysis	Thu 6/25/15	Thu 6/25/15
16	Impacts Analysis & Recommended Plan	Thu 8/13/15	Thu 8/13/15
17	Draft DEIR	Wed 9/30/15	Wed 9/30/15
18	Public Comment Period	Thu 10/1/15	Mon 11/30/15



Project: DEIR Preliminary Schedu
Date: Mon 6/22/15

Task | Split | Milestone | Summary | Project Summary | External Tasks | External Milestone | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | Deadline | Progress

Agenda - DEIR

- Water Needs Recap
  - Updates and Clarifications from last Meeting
- Water Alternatives Analysis
  - Alternatives Screening
  - Selected Alternatives
- Wastewater Needs Analysis
  - Scoring Matrix Methodology
  - Results
- Wastewater Alternatives Analysis
  - Preliminary Screening
  - Potential Alternatives

Project Background – Water & Stormwater

- North Reading Water Supplies
  - Wells through Water Registrations
    - Registered Use (0.96 MGD)
  - Surface Supply from Andover (Merrimack River)
    - IBTA (1.50 MGD)
- Can’t meet all needs through either source (2.6 MGD)
- Ipswich River
  - Stressed Basin - “Over Allocated”
  - Stormwater

Project Background - Wastewater

- Primarily served through on-site disposal systems
- Water Quality Impairments from inadequate systems
- Known system rehabilitation/pumping rates
- Difficulty in areas of upgrades due to limited parcel area and soils
- Evaluated limited alternatives through CWMP process

Goals Water

- Provide long-term, sustainable option(s) for water supply
- Reduce water system complexity
- Allow community to provide services to maintain existing and future commercial/industrial base
- Manage capital and O&M costs
- Mitigate stress on the Ipswich River

Goals Wastewater

- Improve surface and ground water quality
- Provide long-term sustainable option(s) for wastewater treatment and disposal
- Allow community to provide services to maintain existing and future commercial/industrial base
- Address water quality impairments

Water Alternatives

Existing Water Supply Systems

- Local Sources
  - Wells with on-site treatment
    - Lakeside Boulevard WTP (Lakeside Wells and Rt 125)
    - West Village WTP (Railroad Bed Wellfield)
    - Central Street Wellfield
- Interconnections
  - 2 with Andover
    - Main Street
    - Central Street
- Emergency Interconnections
  - Wilmington at Park Street
  - Wilmington at Concord Street
  - Lynnfield at Chestnut Street
  - Lynnfield at North Hill Drive
  - Middleton at Forest Street

Future Demands

- Residential Use
- Commercial/Industrial
- Build-out
- Population
- MassDEP/MWRA OP.10 Requirements
- MDD/ADD

Future Requirements

2013 Base Population	14,896
Well Users (assuming well users transition to public water)	0
Population growth (undeveloped/underdeveloped lots * 2.71 people per household)	2,512
Population Served (Base + Well Users + Growth)	17,408

Gallons per capita per day	65 GPCD	50 GPCD
	Flow (MGD)	
Residential ADD	1.13	0.87
Non-Residential ADD 80% of highest recent year + undeveloped	0.19	0.19
2013 Confidently Estimated Municipal Use	0.12	0.12
Unaccounted Water (10% of total ADD)	0.16	0.13
Total ADD	1.60	1.31
Total Maximum Day Demand (1.6 peaking factor)	2.58	2.11

Water Alternatives: Overview

- Conservation
  - Mandatory
  - In addition to other alternatives
- No Build
- New supply sources
  - In town
  - Out of town

Water Alternatives: Conservation

- Comprehensive Planning & Drought Management Planning ✓
- Water Audit ✓
- Leak Detection ✓
- Metering ✓
- Pricing ✓
- Residential ✓
- Public Sector ✓
- Lawn & Landscape ✓
- Public Education & Outreach ✓
- Industrial, Commercial, and Institutional, Agricultural- relatively low % of North Reading Water Use- action planned

Water Alternatives: No Build

- Optimize local sources
  - Replacement wells
  - Enhance treatment
- Maintain Andover connection

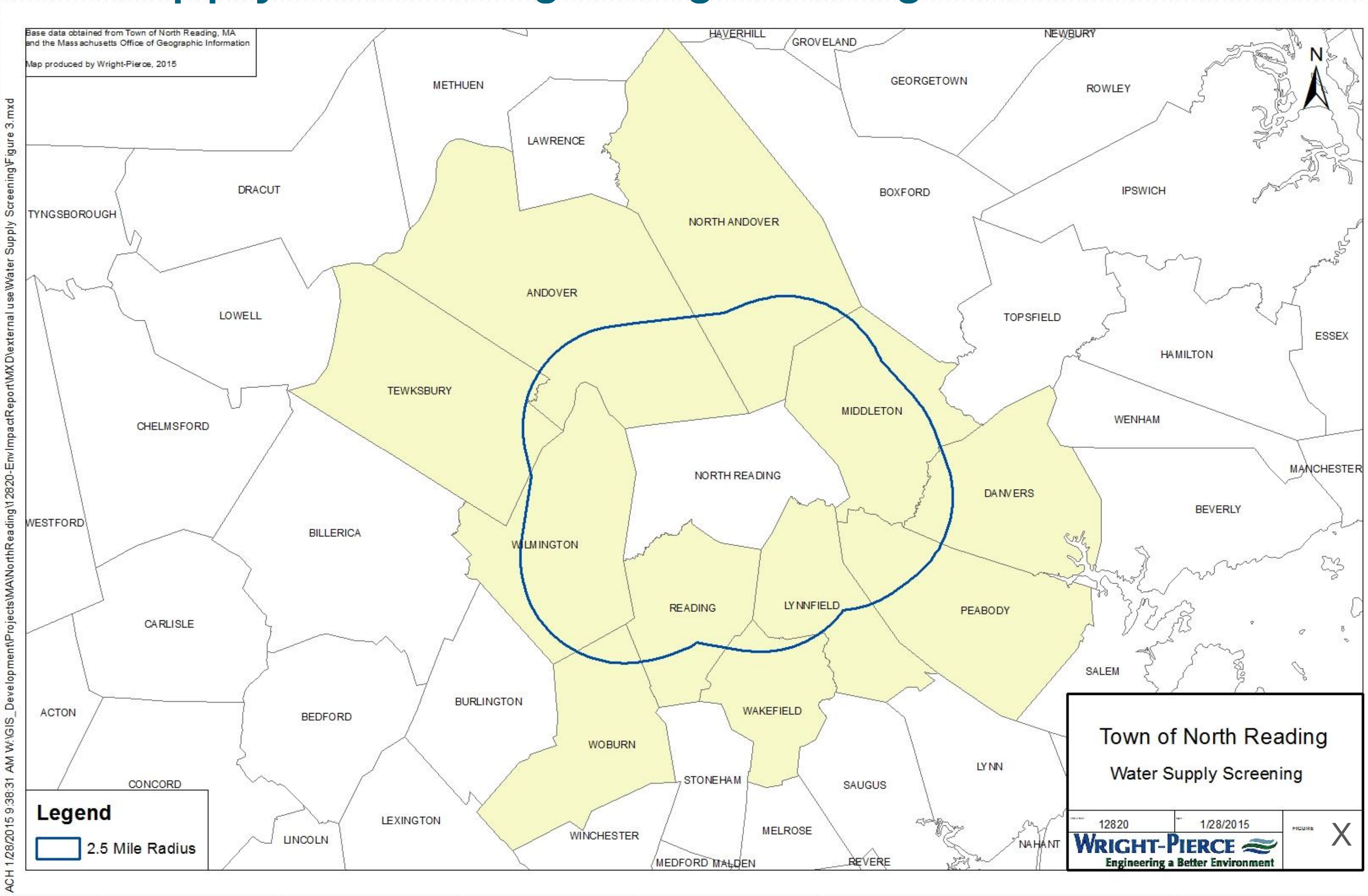
Water Alternatives: New Supply Sources In Town

- Optimize existing wells
- Identify potential groundwater withdrawal sites through geotechnical and hydrogeological exploration
  - Permits; SWMI
  - Ipswich-stressed basin
- Investigate in-town surface water sources
  - Martins Pond, Eisenhaures Pond, Bradford Pond, Swam Pond
  - Limited size, capacity and water quality

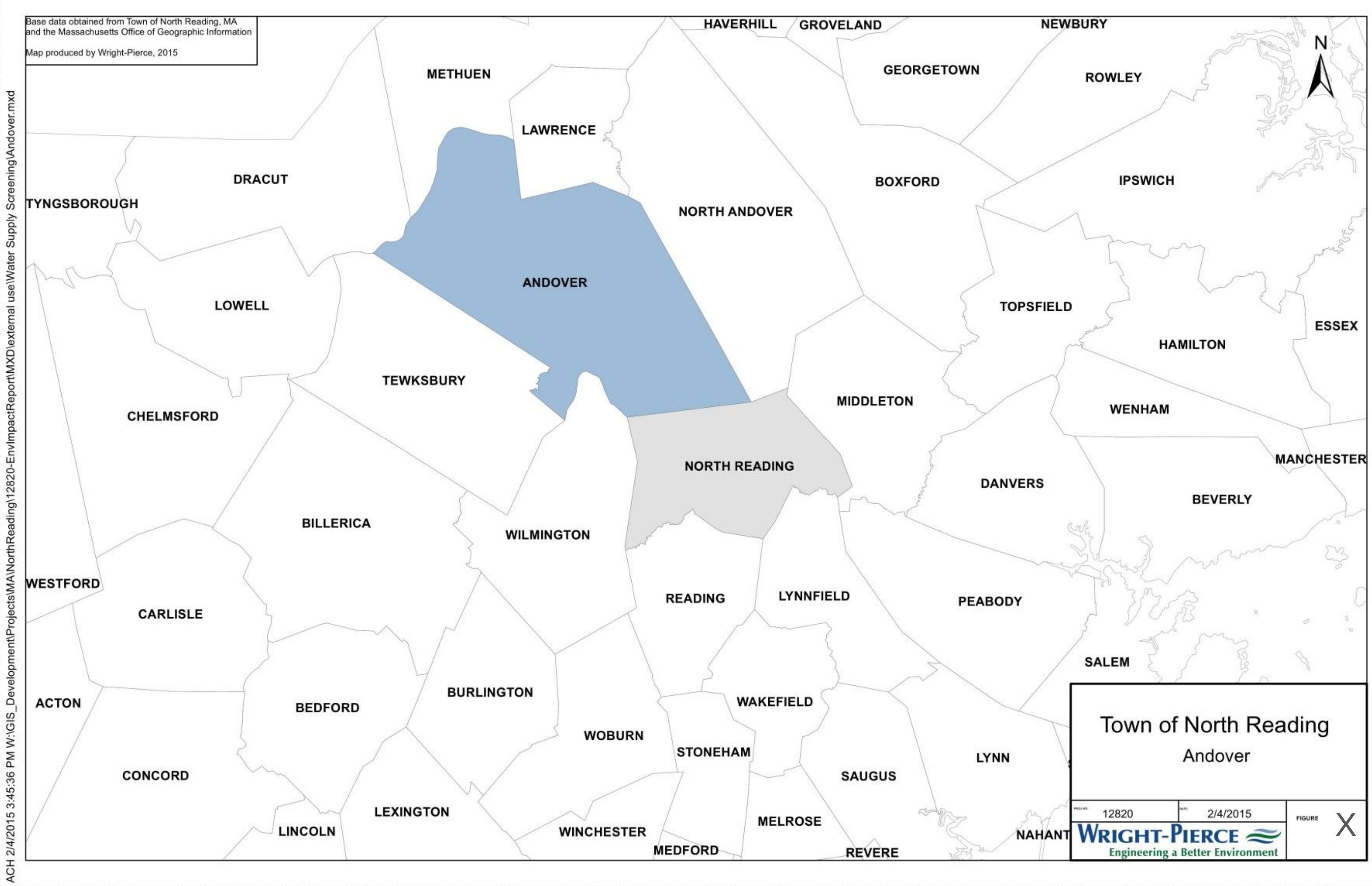
Water Alternatives: New Supply Sources Out of town

- Neighboring communities
- MWRA

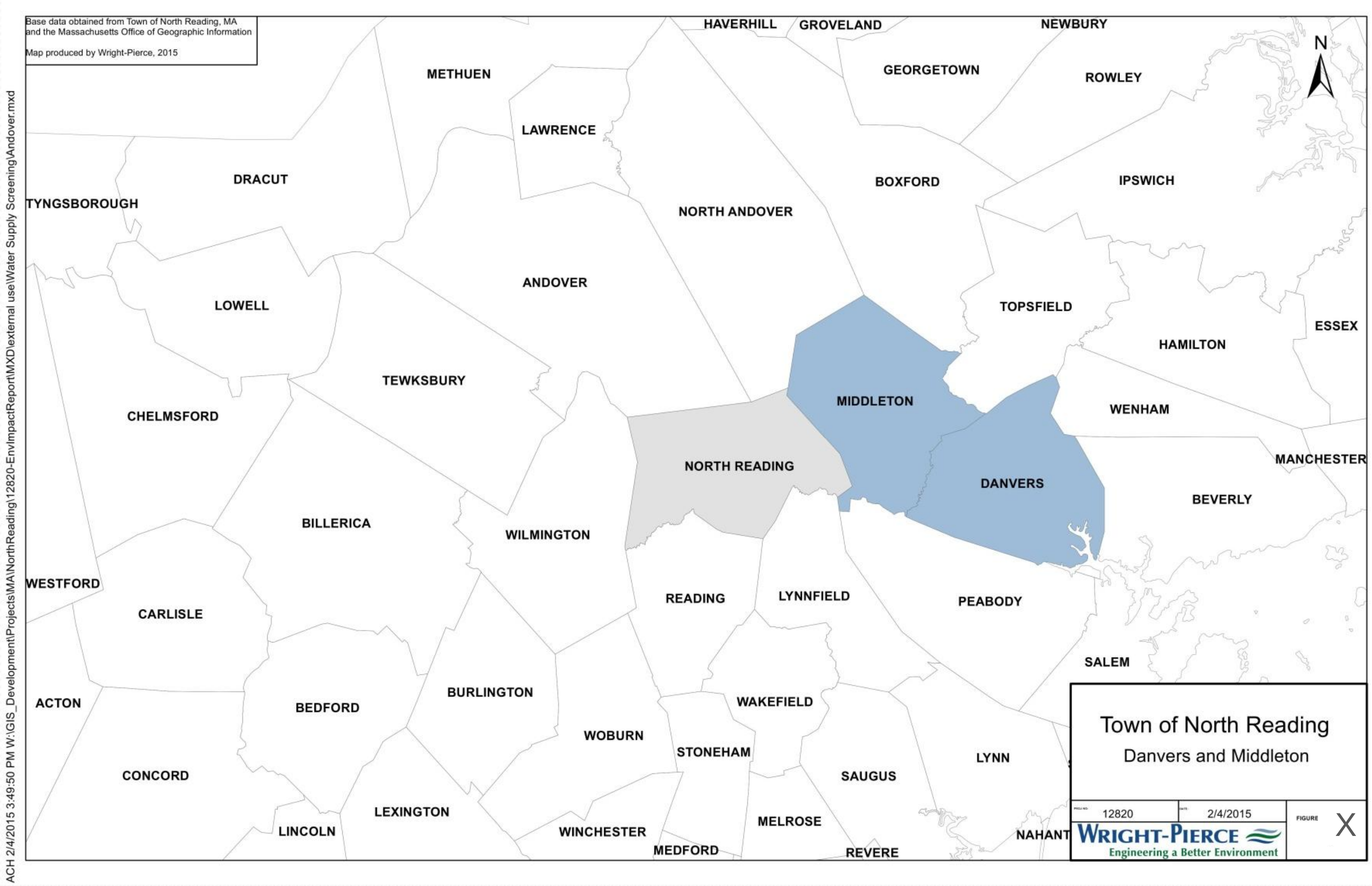
Water Supply Screening: Neighboring Communities



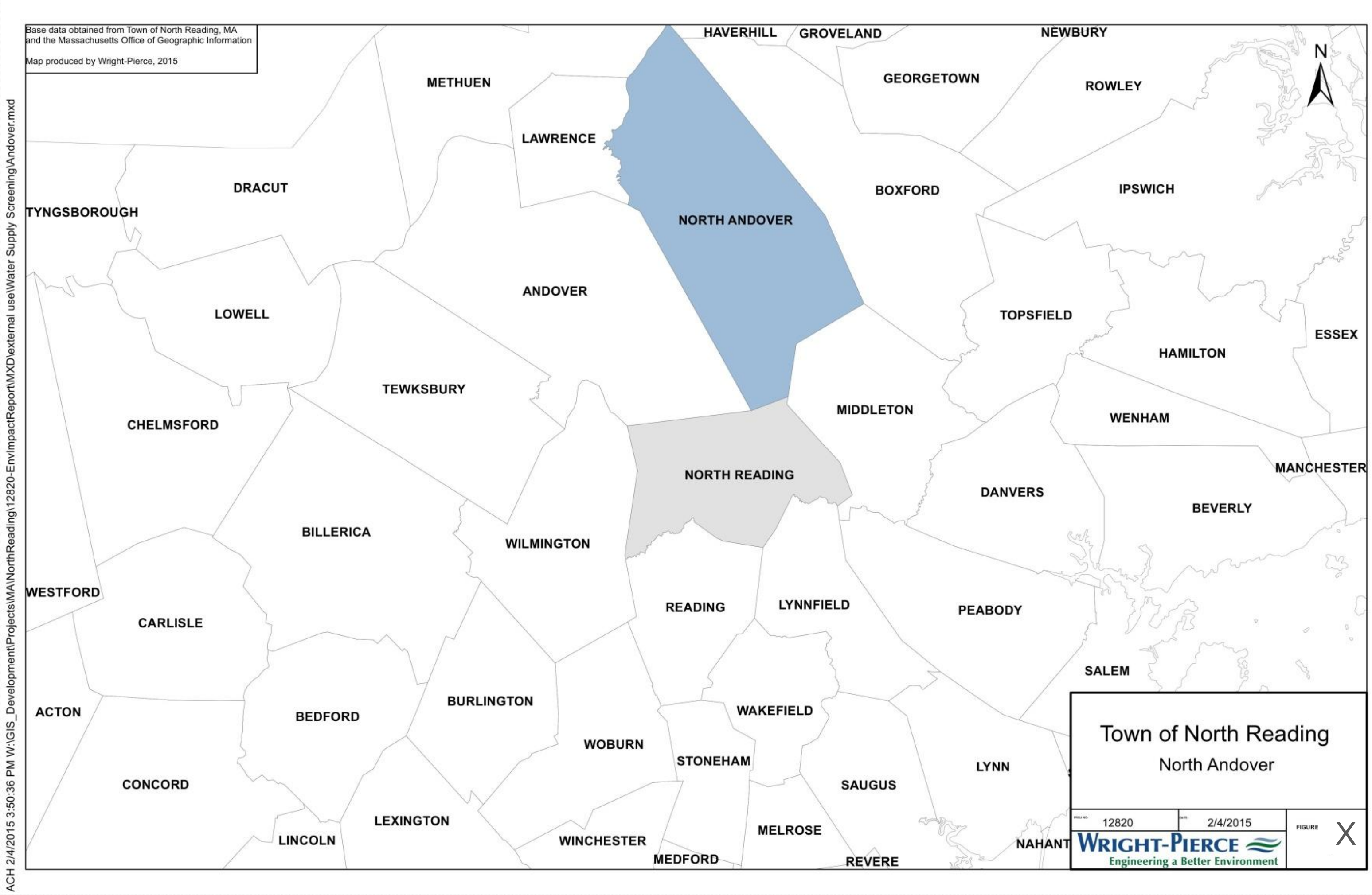
Andover – 8.51 MGD authorized, 7 MGD used in 2012



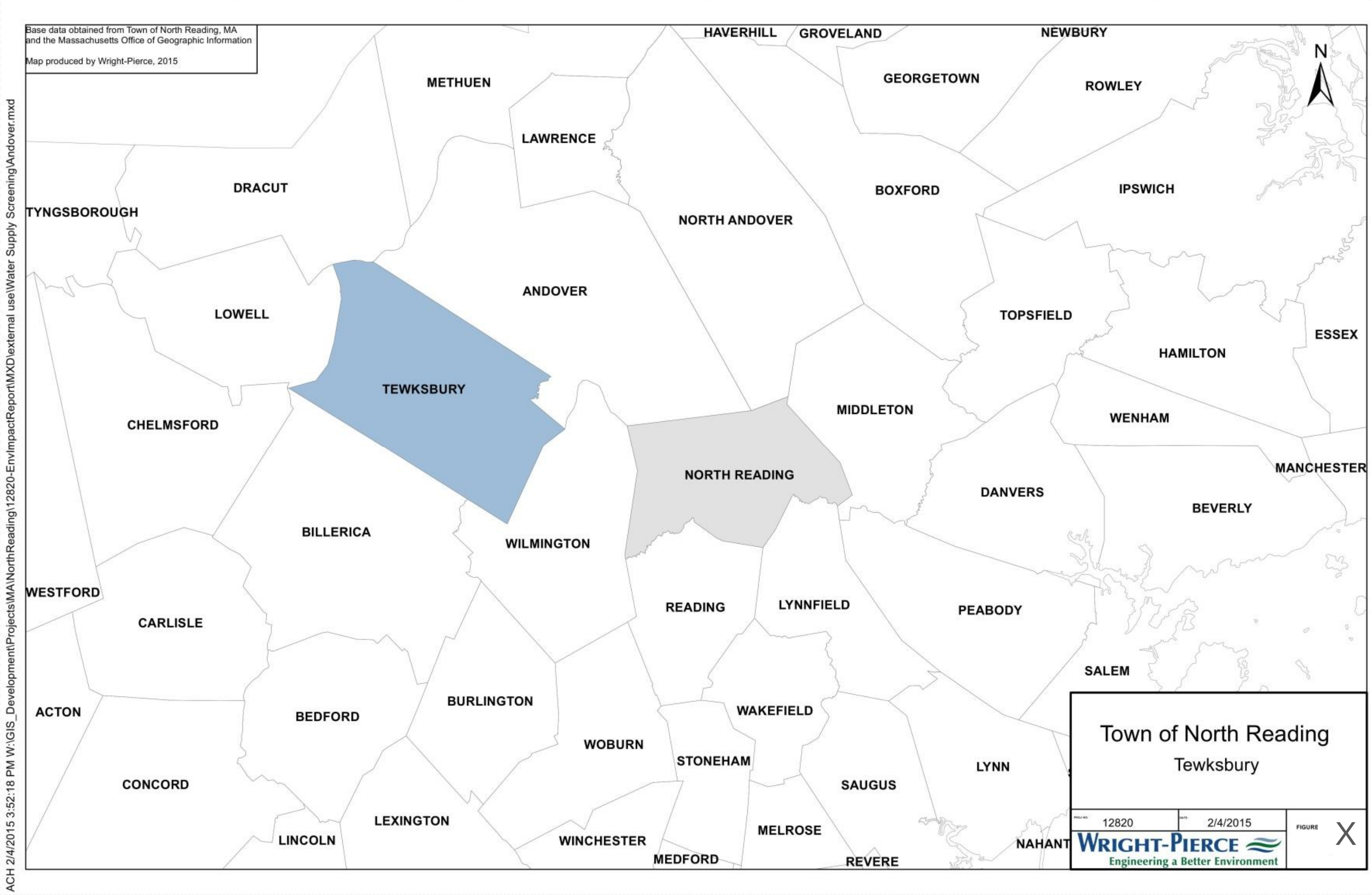
Middleton/Danvers- 3.72 MGD authorized, 3.14 MGD used in 2012



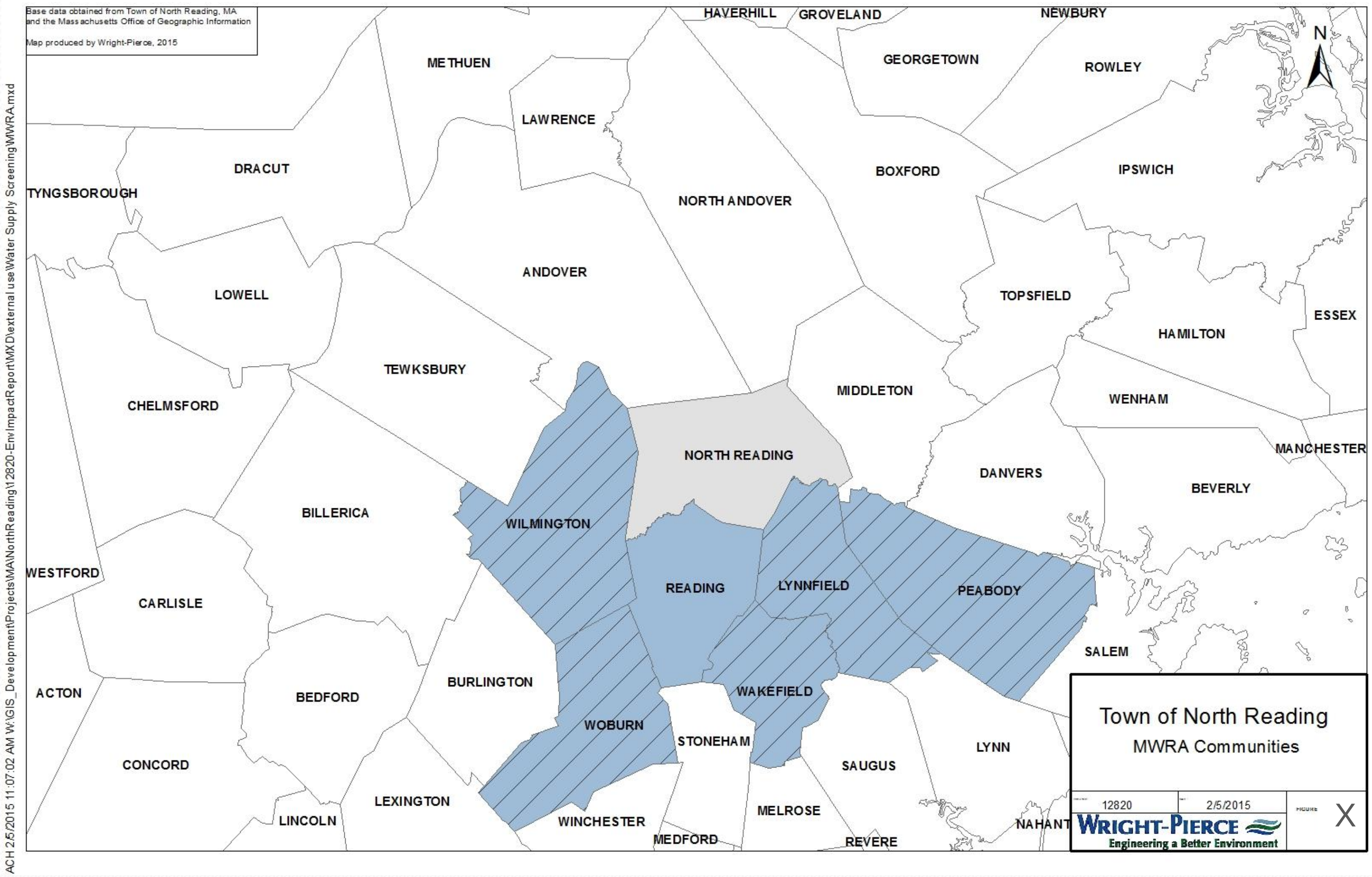
North Andover- 4.40 MGD authorized, 3.35 MGD used in 2012



Tewksbury- 3.17 MGD authorized, 2.39 MGD used in 2012



MWRA Communities



- Partial MWRA

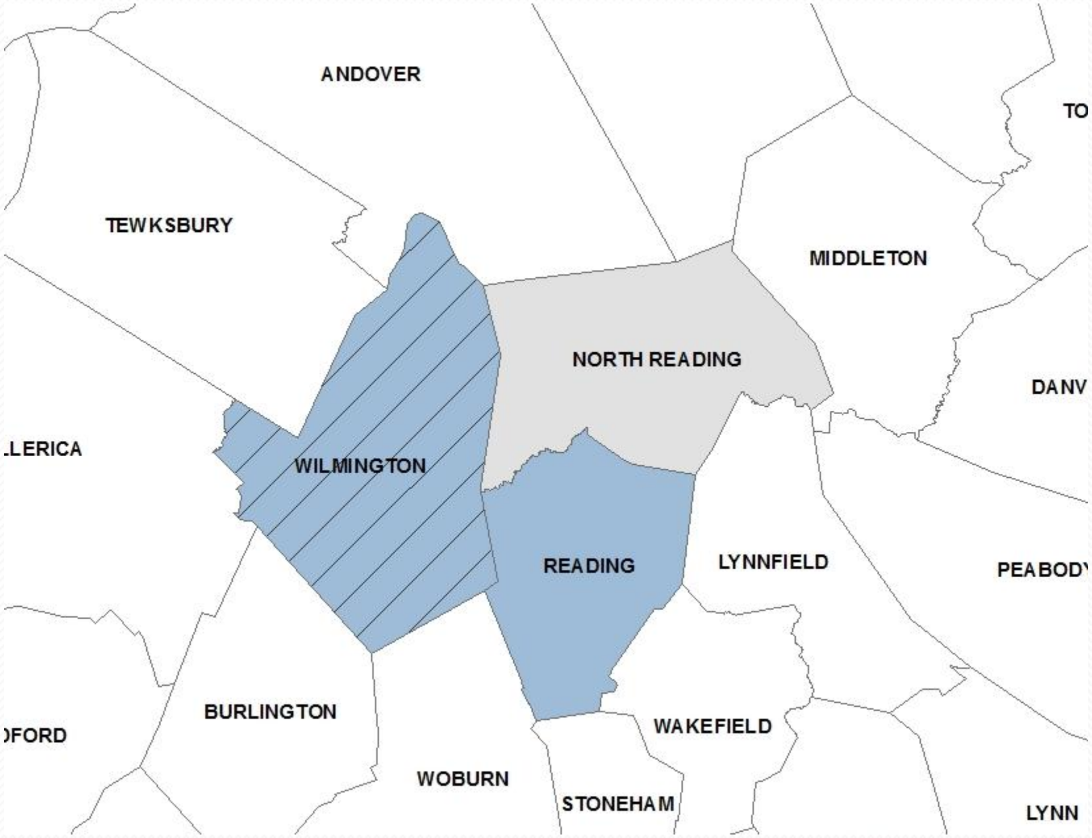
- Full MWRA

Water Alternatives Screening

Community	Local source (Y/N)	MWRA (Full/Partial/N)	Available Capacity (Y/N)
Andover	Y	N	N
Danvers/Middleton	Y	N	N
Lynnfield (LWD)	N	Full	Y
Lynnfield Center (LCWD)	Y	N	N
North Andover	Y	N	N
Peabody	Y	Partial	Y
Reading	N	Full	Y
Tewksbury	Y	N	N
Wakefield	Y	Partial	Y
Wilmington	Y	Partial	Y
Woburn	Y	Partial	Y

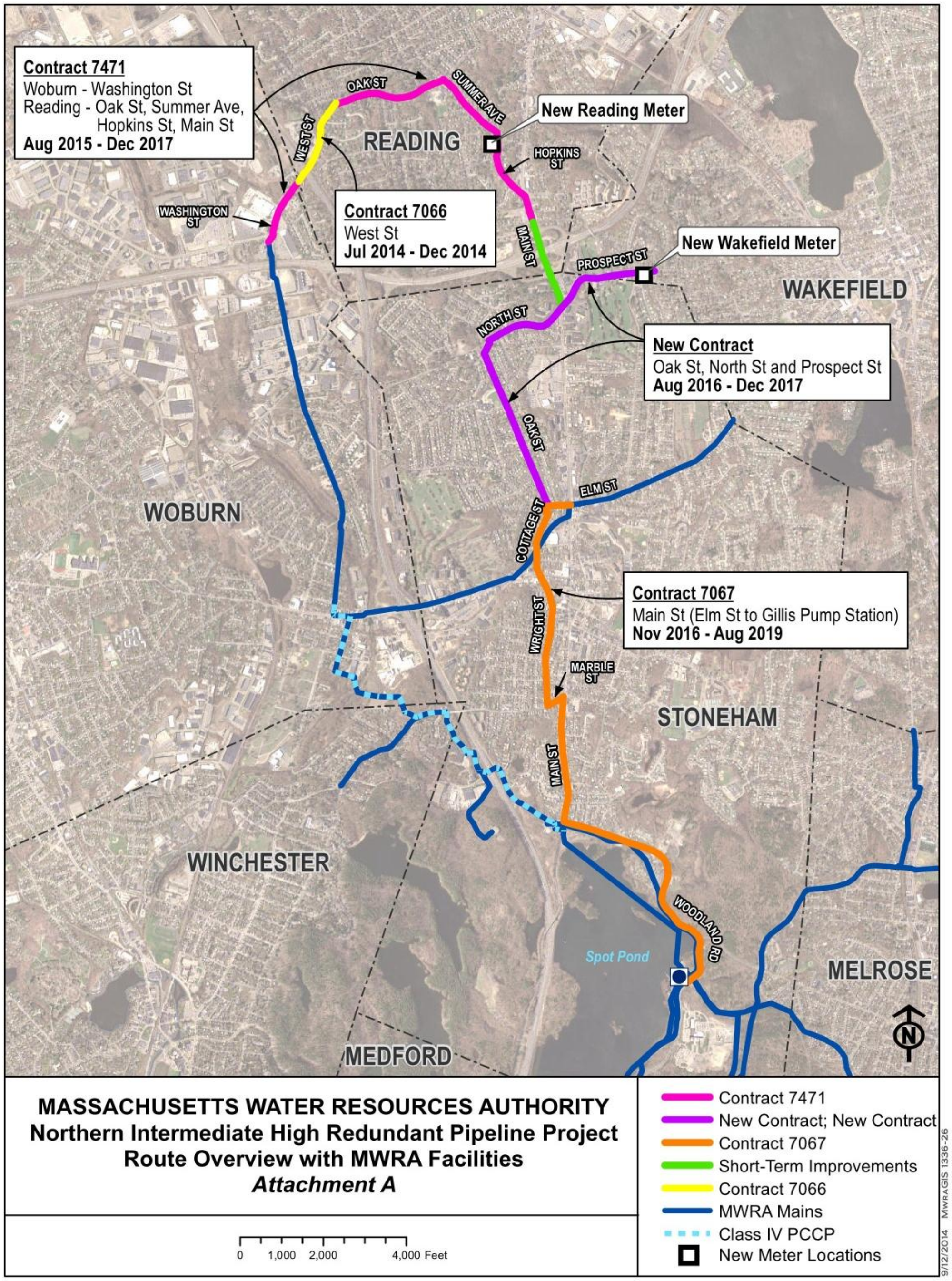
MWRA Alternatives

- Further screening
  - MWRA discussions
  - Reading
  - Wilmington

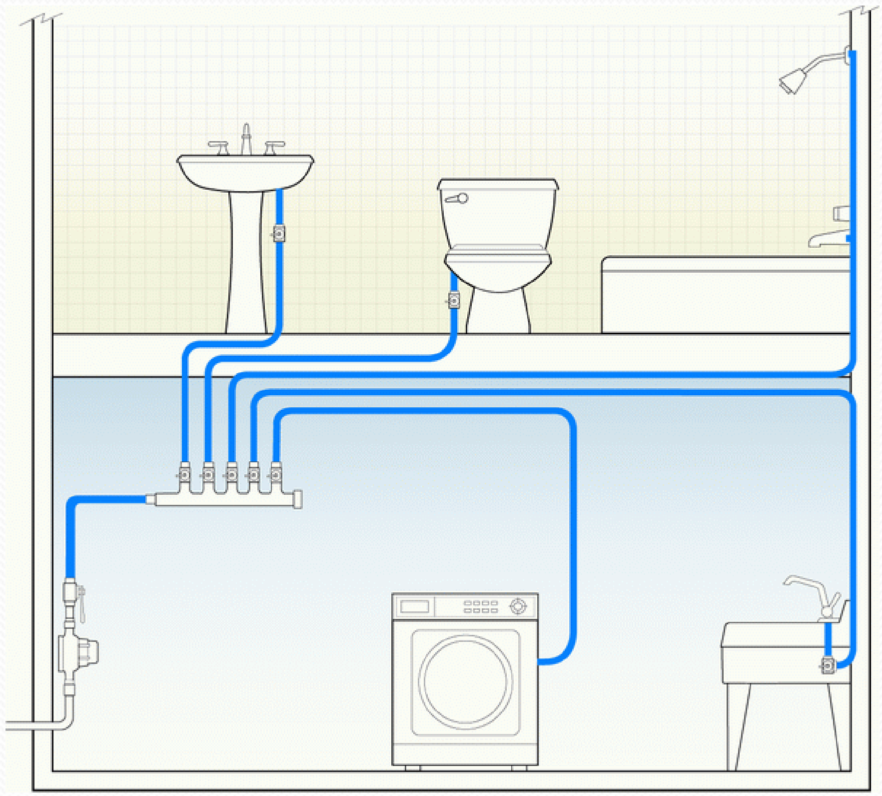


Final Alternatives:

- MWRA connection through Reading
- No build
- Local sources
- Conservation



Wastewater Alternatives



Existing Wastewater Management Systems

- North Reading Board of Health Septic System Regulations and Procedures
- Collection Systems
  - Private Collection Systems
  - Existing MWRA Sewer Connection

Wastewater Management Needs Assessment Process

- Develop Criteria
  - Physical
  - Location
- Collect Data – Validate
- Rank/weight Criteria
- Determine Needs

Criteria

Parameter	Unit	Source
Known Septic Failure	Yes/No	North Reading Board of Health Records
Has Tight Tank	Yes/No	North Reading Board of Health Records
Water Use Class	Class	North Reading Zoning GIS Layer
Proximity to impaired water	Miles	MassGIS Integrated Waters Layer
Lot size	Acres	North Reading Tax Parcel GIS Layer
Soil Drainage	Categories	USDA National Cooperative Soil Survey
Ponding	Yes/No	USDA National Cooperative Soil Survey
Flooding	Frequency	MassGIS FEMA Flood Mapping
Septic System Age	Years	North Reading Board of Health Records
Pump Out frequency	Years/pump	North Reading Board of Health Records
Within Zone 2 or IWPA	Yes/No	MassGIS Zone 2 and IWPA GIS Layers
Depth to GW	Feet	USDA National Cooperative Soil Survey
Depth to Restrictive Layer	Feet	USDA National Cooperative Soil Survey
Water Use per Acre	GPSF	North Reading Water Billing records
Adjacent to wetland	Yes/No	MassGIS MassDEP Wetlands Layer
Private well	Yes/No	North Reading Well Records
Outstanding Water Resource Protection Zone	Yes/No	MassGIS OWR Layer

Weighted Screening List

Parameter	Weight
Known Septic Failure	5
Has Tight Tank	5
Water Use Class	5
Proximity to impaired water	5
Lot size	2
Soil Drainage	2
Ponding	2
Flooding	2
Septic System Age	2
Pump Out frequency	2
Within Zone 2 or IWPA	2
Depth to GW	1
Depth to Restrictive Layer	1
Water Use per Acre	1
Adjacent to wetland	1
Private well	1
Outstanding Water Resource Protection Zone	1

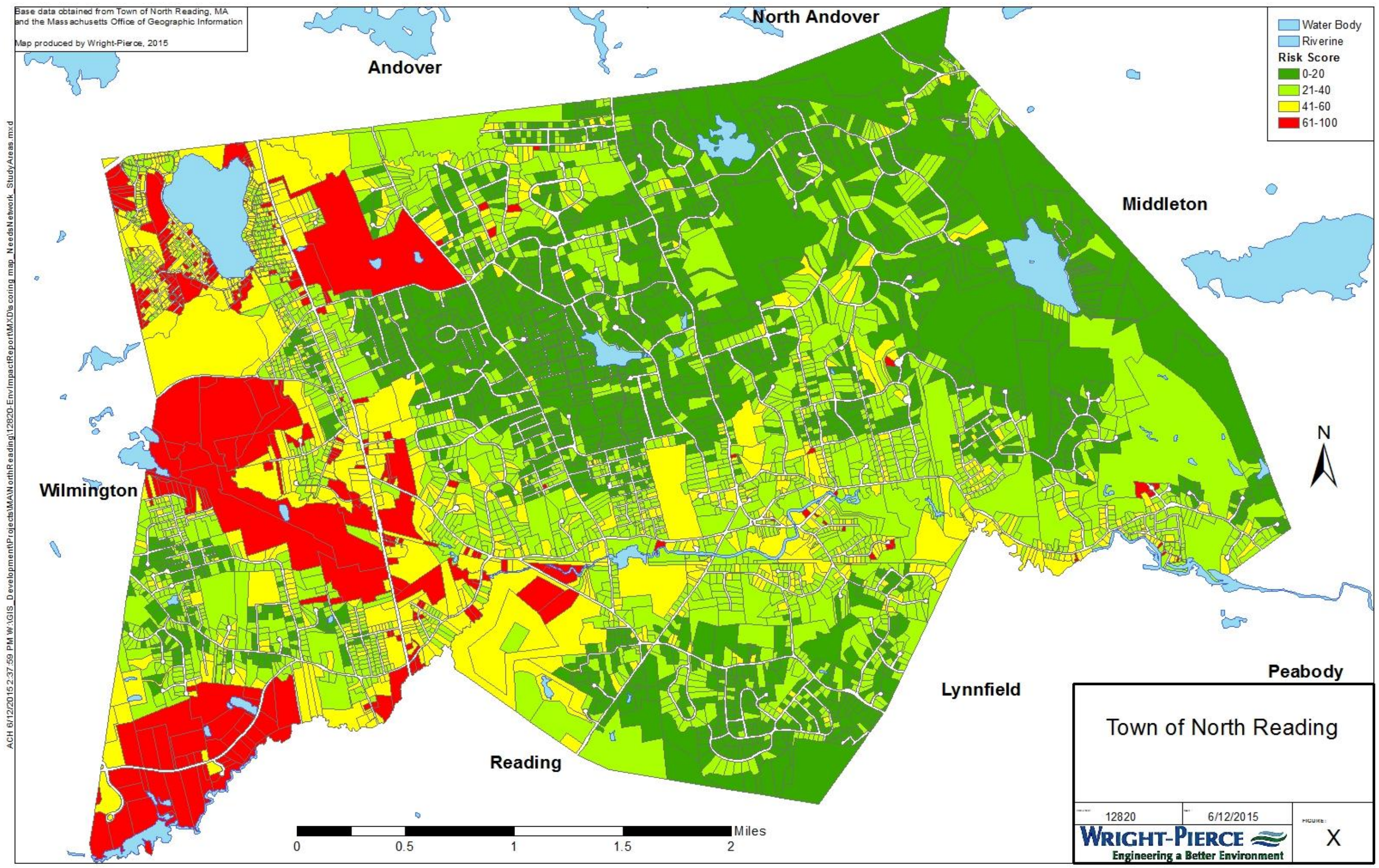
Wastewater Screening Map Results

Parameter	Weight	Range 1	Score 1	Range 2	Score 2	Range 3	Score 3	Range 4	Score 4	Range 5	Score 5
Known Septic Rehab	5	Yes	5	no	0						
Has Tight Tank	5	Yes	5	no	0						
Water Use Class	5	Industrial	5	Commercial	4	Institutional	3	All others	0		
Proximity to Impaired water	5	Within 1/4 mile	5	Within 1/2 mile	2	> ½ mile	0				
Lot size	2	<0.25 acre	5	0.26-0.33	3	0.34-0.5	2	0.51-1	1	>1	0
Soil Drainage	2	Very Poorly Drained	5	Poorly Drained	4	Moderately well drained or better					
Ponding	2	Frequent	5	Rare/Never	0						
Flooding	2	Within 100yr	5	Not in Floodplain	0						
Septic System Age	2	>20	5	15-20	3	10-15	1	<10	0		
Pump Out frequency	2	frequent	3	normal	0						
Within Zone 2 or IWPA	2	Yes	5	no	0						
Depth to GW	1	<1	5	2-1	2	4-2	1	>4	0		
Depth to Restrictive Layer	1	<1	5	2-1	2	4-2	1	>4	0		
Water Use (gpd per acre)	1	>500	5	250-499	4	100-249	3	25-99	2	<25	0
Adjacent to wetland	1	In Wetland	5	In buffer	3	not in buffer or wetland	0				
Private well	1	Yes	5	no	0						
Outstanding Water Resource Protection Zone	1	Yes	5	no	0						

WASTEWATER SCREENING RESULTS

Parameter	Weight	Range	Score	Count	Range	Score	Count	Range	Score	Count	Range	Score	Count	Range	Score	Count
Known Septic Rehab	5	Yes	5	479	No	0	4869									
Has Tight Tank	5	Yes	5	19	No	0	5329									
Water Use Class	5	Industrial	5	63	Commercial	4	295	Institutional	3	12	All others	0	4978			
Proximity to Impaired water	5	Within 1/4 mile	5	1939	Within 1/2 mile	3	1276	> ½ mile	1	2479						
Lot size	2	<0.25 acre	5	692	0.26-0.33	3	343	0.34-0.5	2	1160	0.51-1	1	1699	>1	0	1454
Soil Drainage	2	Very Poorly Drained	5	786	Poorly drained	4	44	Moderately well drained or better	0	4515						
Ponding	2	Frequent	5	492	Rare/ Never	0	4856									
Flooding	2	Within 100yr	5	1221	Not in Flood-plain	0	4132									
Septic System Age	2	>20	5	1022	15-20	3	580	10-15	1	567	<10	0	0			
Pump Out frequency	2	Frequent	3	2	Normal	0	5346									
Within Zone 2 or IWPA	2	Yes	5	1141	No	0	4207									
Depth to GW	1	<1	5	835	2-1	2	608	4-2	1	3905	>4	0	0			
Depth to Restrictive Layer	1	<1	5	70	2-1	2	151	4-2	1	389	>4	0	4738			
Water Use per sqft	1	>0.151	5	452	0.091-0.15	4	993	0.041-0.09	2	1601	<.041	0	883	>25	0	1419
Adjacent to wetland	1	In Wetland	5	1787	In buffer	3	2918	Not in buffer or wetland	0	2430						
Private well	1	Yes	5	228	No	0	5120									
Outstanding Water Resource Protection Zone	1	Yes	5	257	No	0	5091									

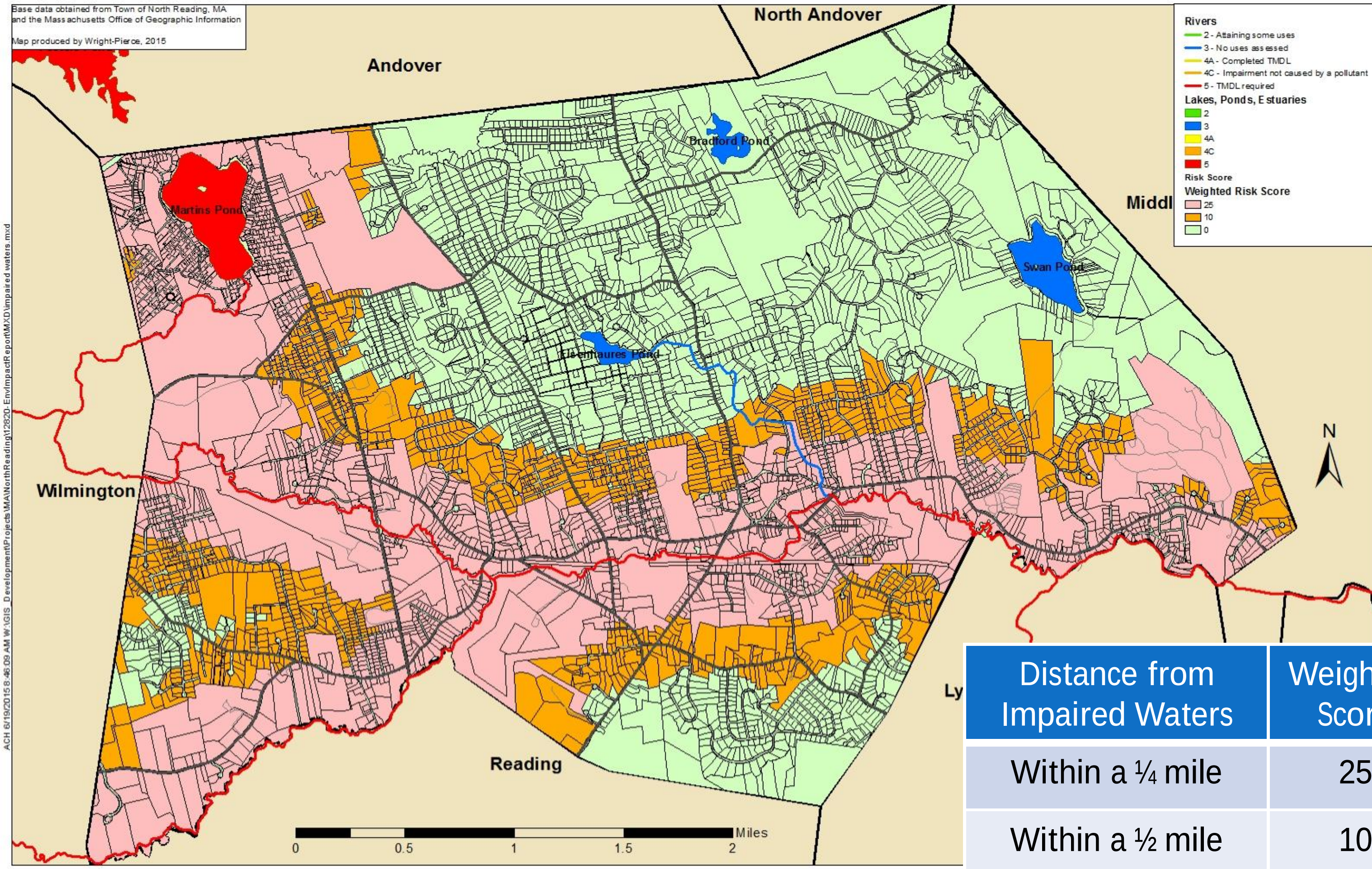
Wastewater Risk Mapping



Risk Factor Trends Summary

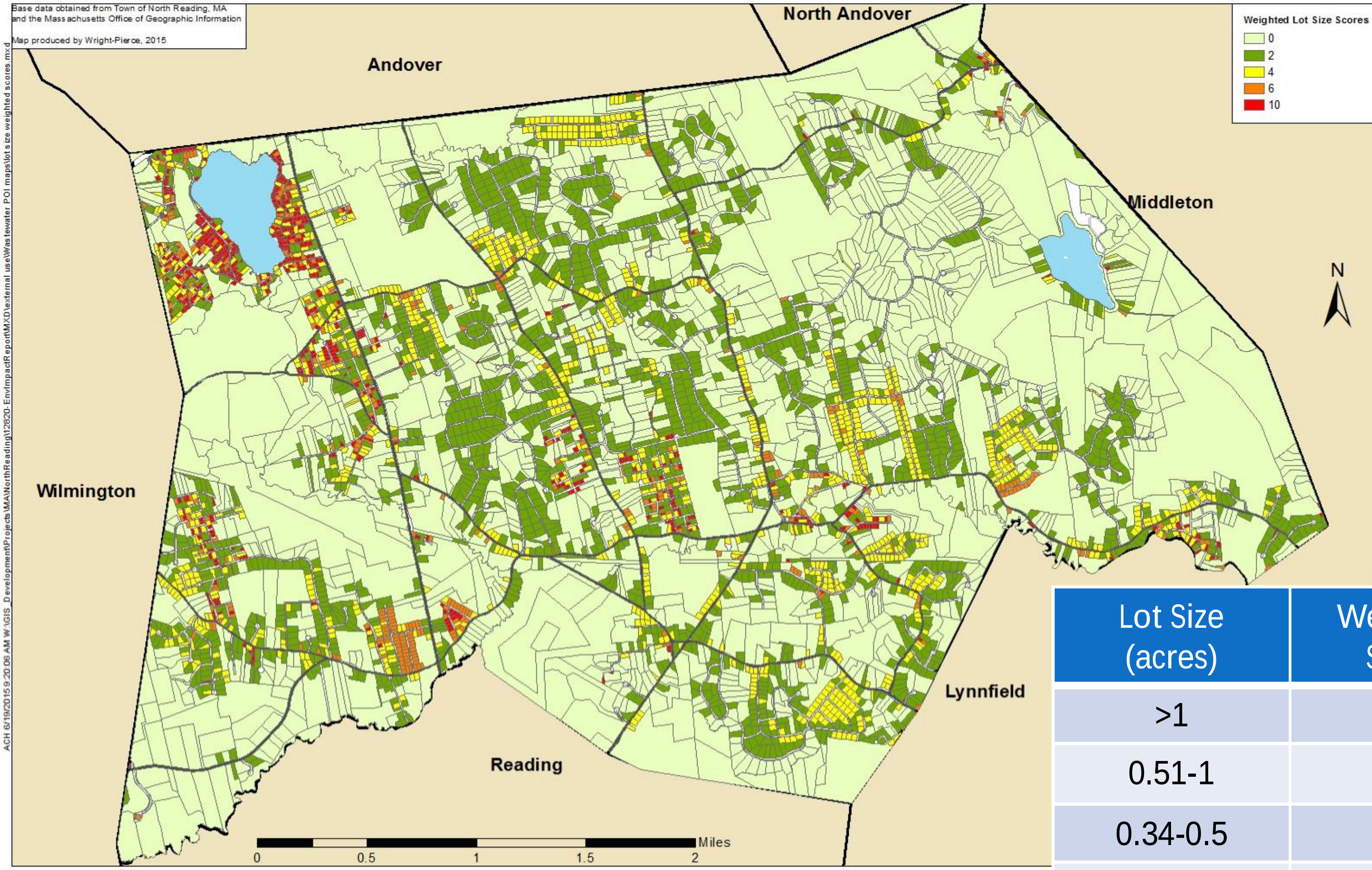
Risk Factor Summary							
				Top 3 Factors Appearances			
Factors	Total Points for Town	% of Town Risk Points	Rank	1	2	3	Total
Impaired Water	60,990	32.5%	1	10	1	0	11
Lot Size	17,008	9.1%	2	0	3	3	6
System Age	14,806	7.9%	3	2	3	4	9
Water Use	12,789	6.8%	4	0	1	2	3
Wetlands	12,316	6.6%	5	2	0	0	2
Flood Zone	12,160	6.5%	6	0	1	4	5
Septic Fails	11,925	6.4%	7	0	3	0	3
Zone 2/IWPA	11,420	6.1%	8	1	1	2	4
Water Table	9,286	5.0%	9	0	0	0	0
Soil Drainage	8,210	4.4%	10	0	0	0	0
Zoning Class	7,635	4.1%	11	1	2	0	3
Ponding	4,900	2.6%	12	0	0	0	0
ORW	1,290	0.7%	13	0	1	1	2
Drinking Water Supply	1,135	0.6%	14	0	0	0	0
Restrictive Layer	1,044	0.6%	15	0	0	0	0
Tight Tank	475	0.3%	16	0	0	0	0
Pump Out	12	0.0%	17	0	0	0	0

Impaired Waters



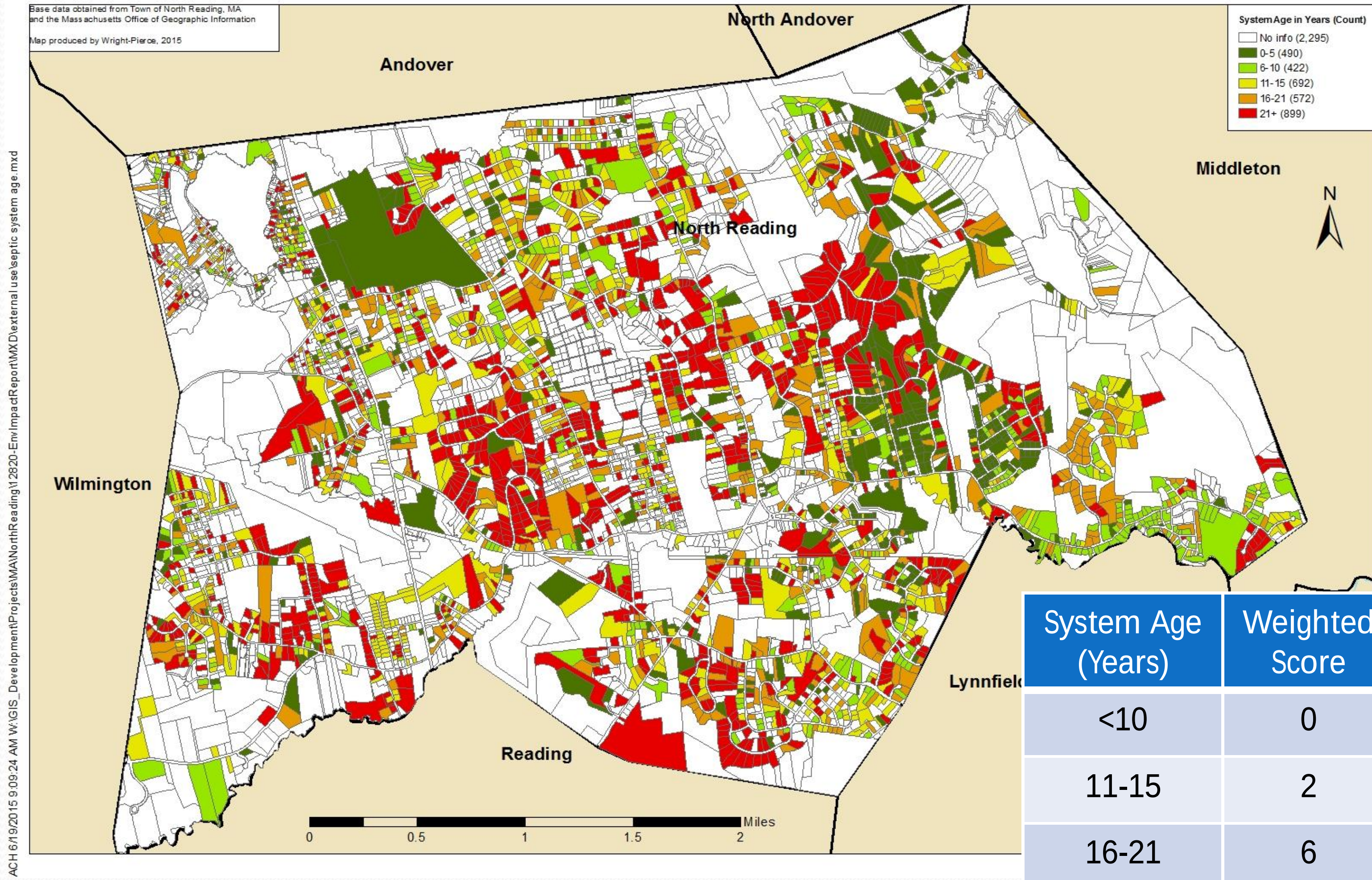
Distance from Impaired Waters	Weighted Score
Within a ¼ mile	25
Within a ½ mile	10
> 1/2	0

Lot Size



Lot Size (acres)	Weighted Score
>1	0
0.51-1	2
0.34-0.5	4
0.26-0.33	6
0.25	10

Septic System Age

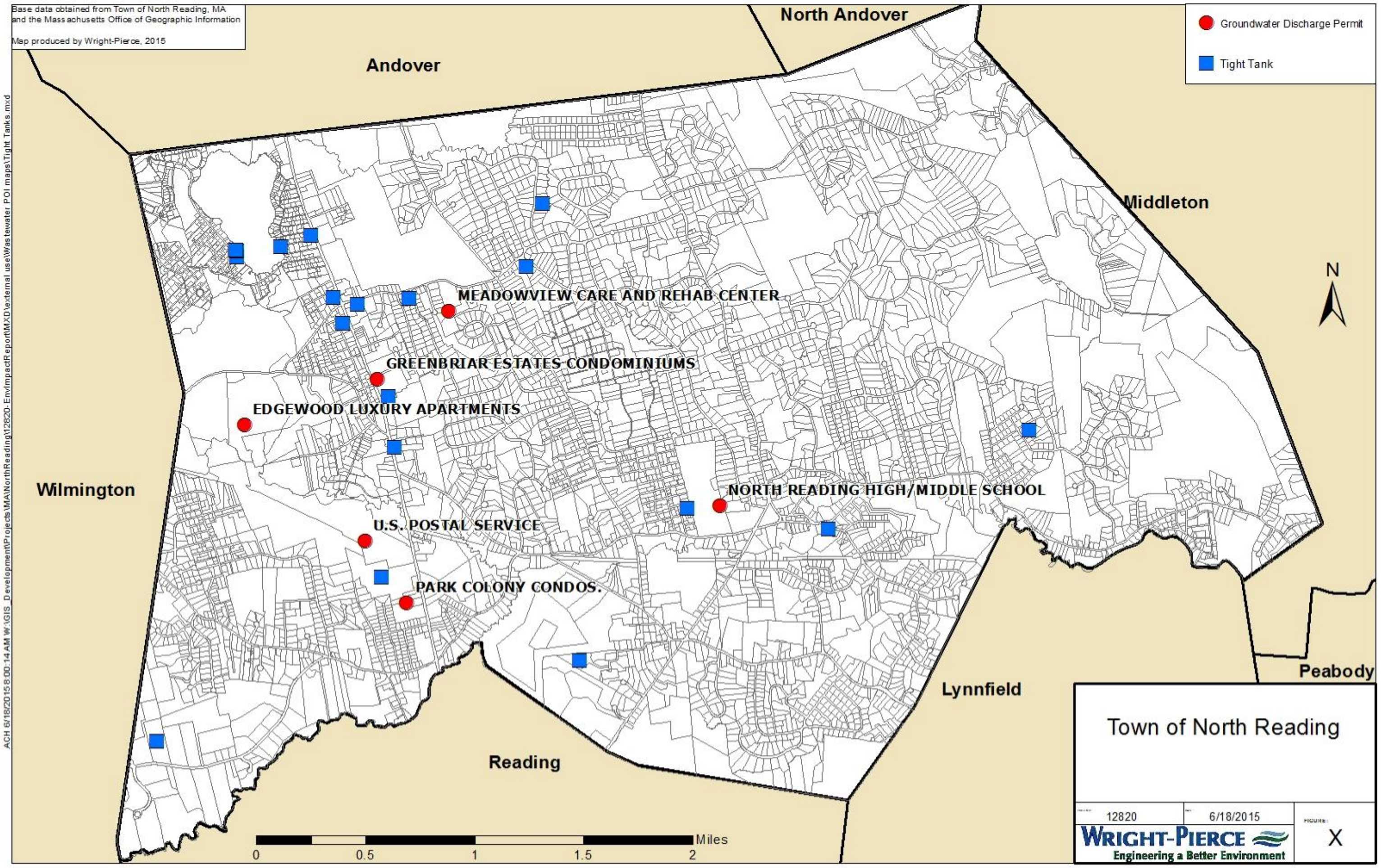


System Age (Years)	Weighted Score
<10	0
11-15	2
16-21	6
21+	10

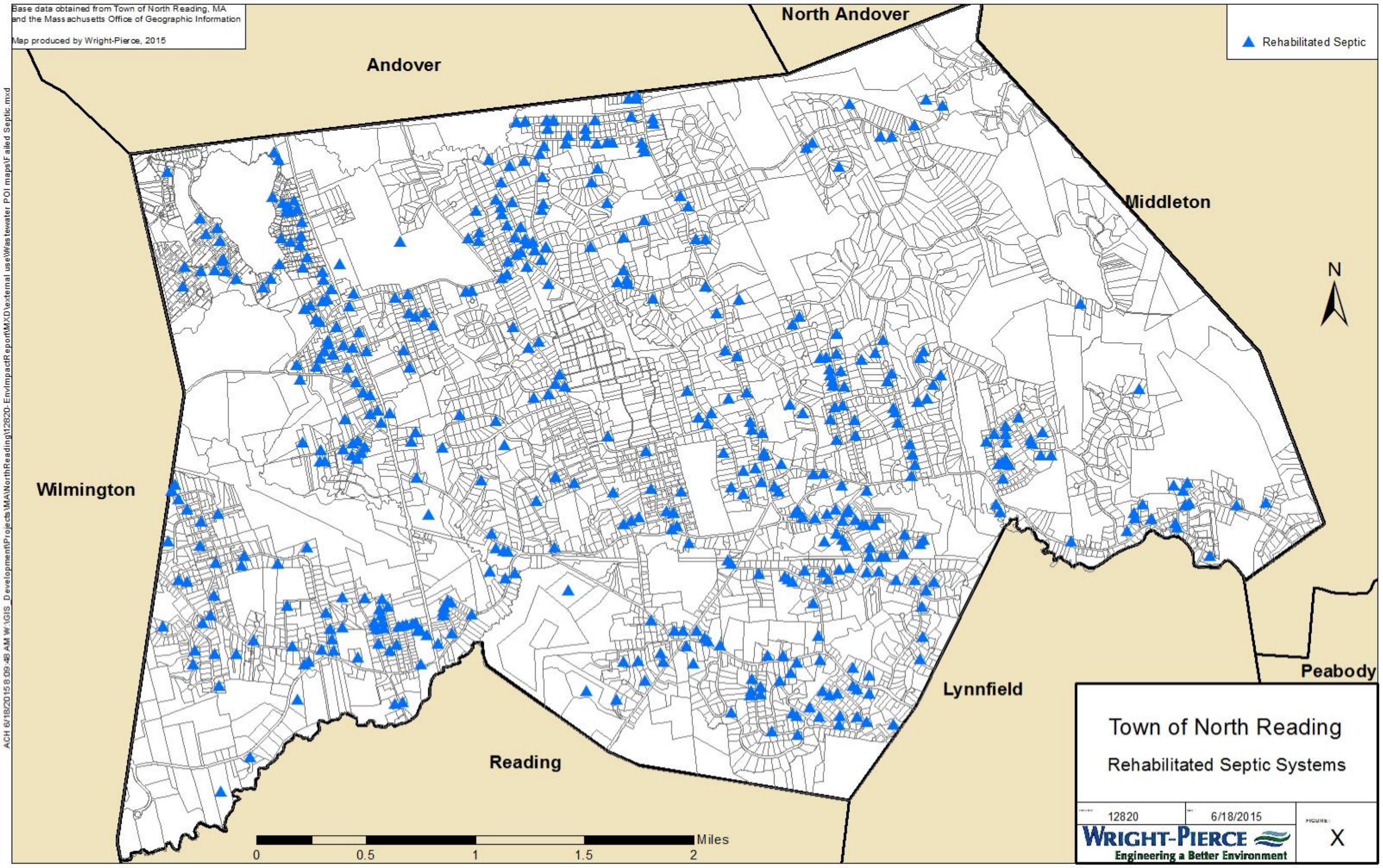
Additional Considerations

- TMDL for Martins Pond, Martins Brook and Ipswich River identified pollution from septic systems
- Sites with tight tanks, recent septic system rehabilitations, and Groundwater Discharge Permits
- Sites with recent septic system rehabilitation represent failed systems

Additional Considerations: Groundwater/Sanitary Discharge Permits and Tight Tanks

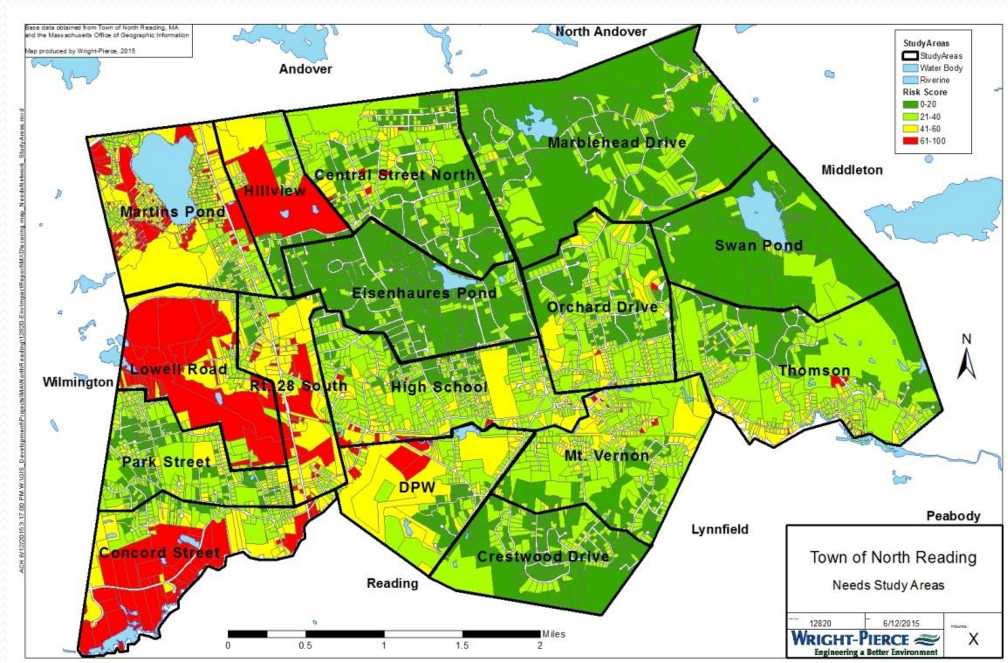


Additional Considerations : Rehabilitated Septic Systems

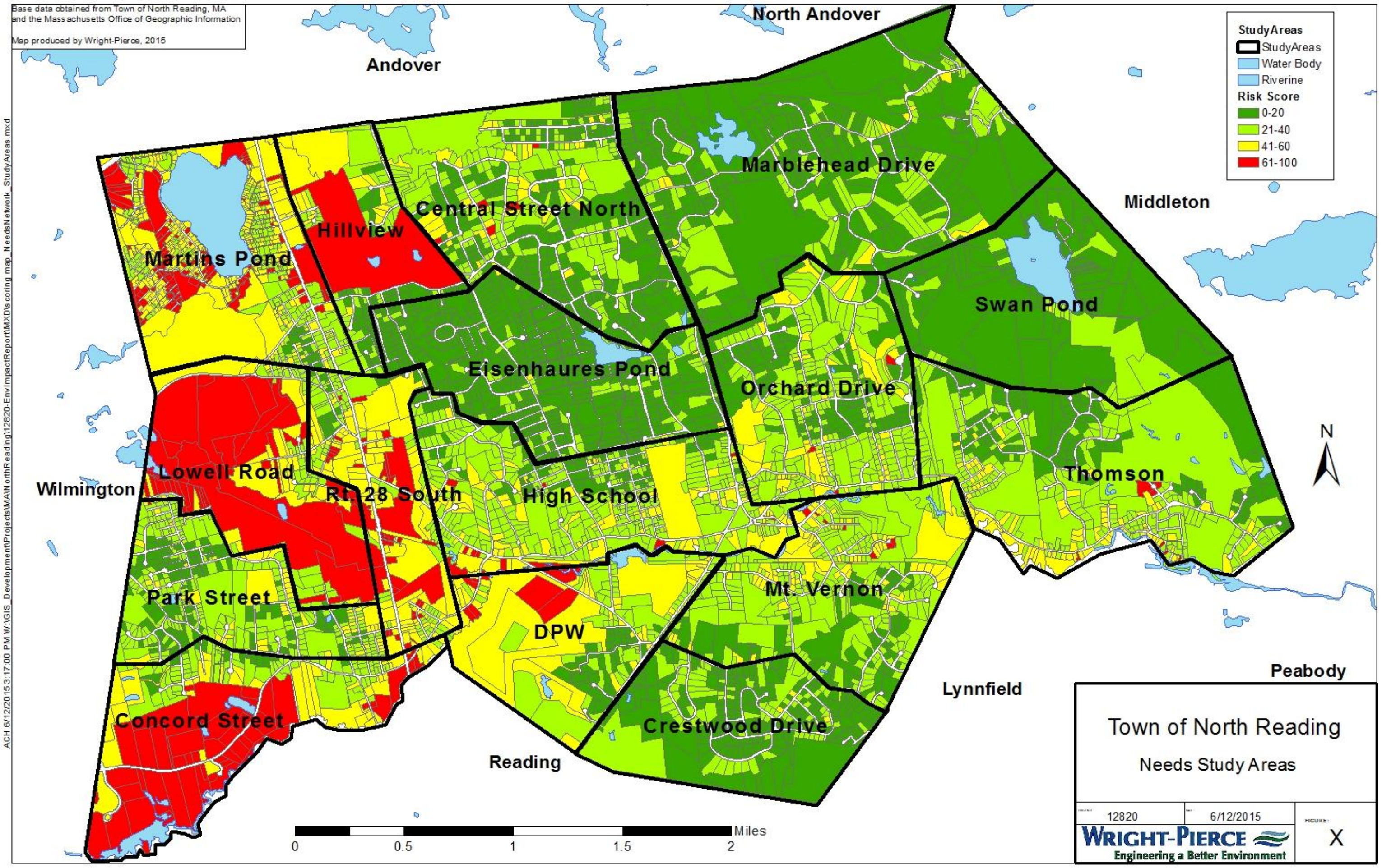


Needs Study Areas

- To facilitate a closer look at the risks, the Town was broken into 16 Needs Study Areas.
- The boundaries were developed based on geographical, characteristic, and risk similarities.
- The study areas do not represent potential sewer districts.



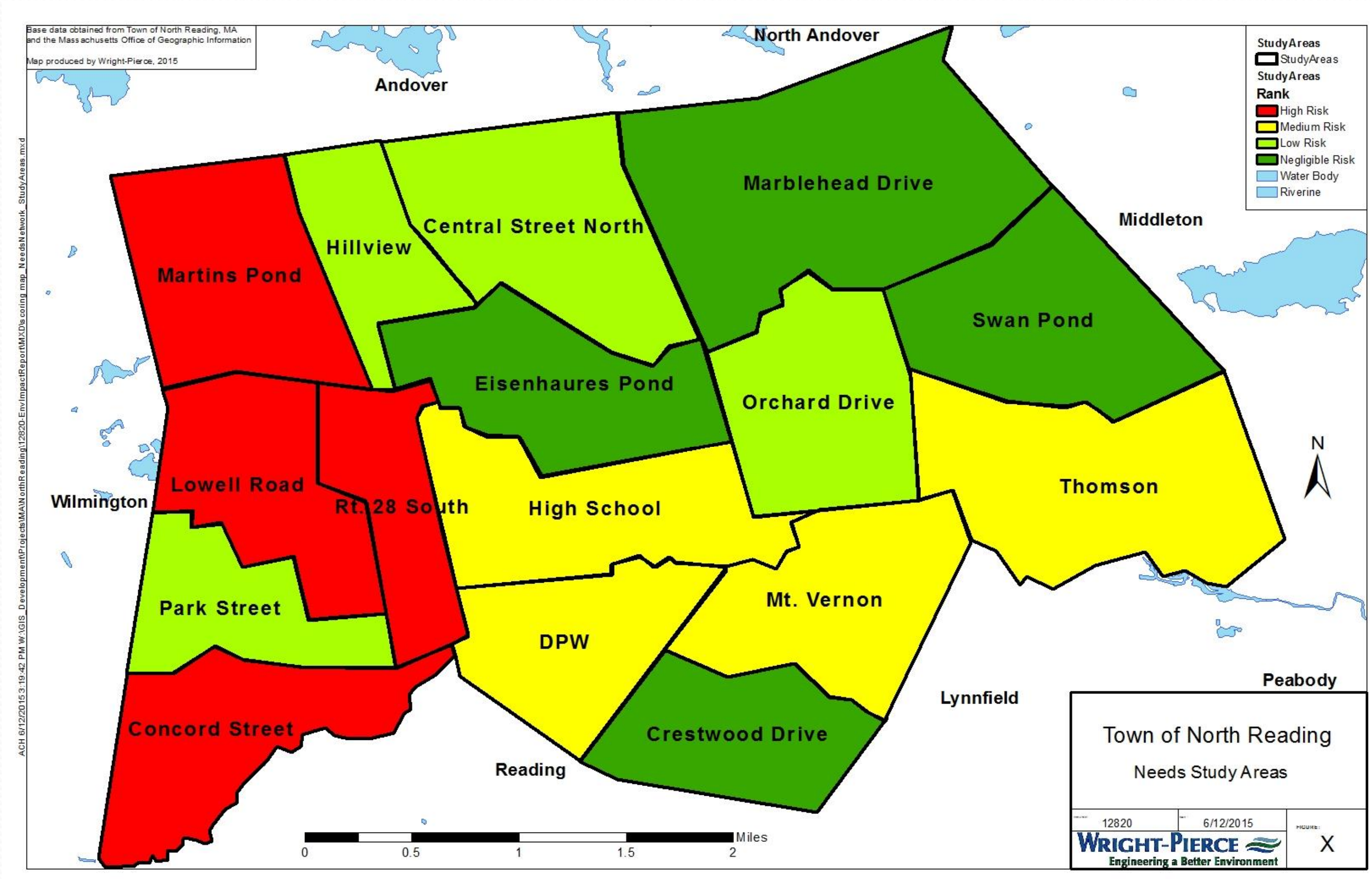
Needs Study Areas: A Closer Look



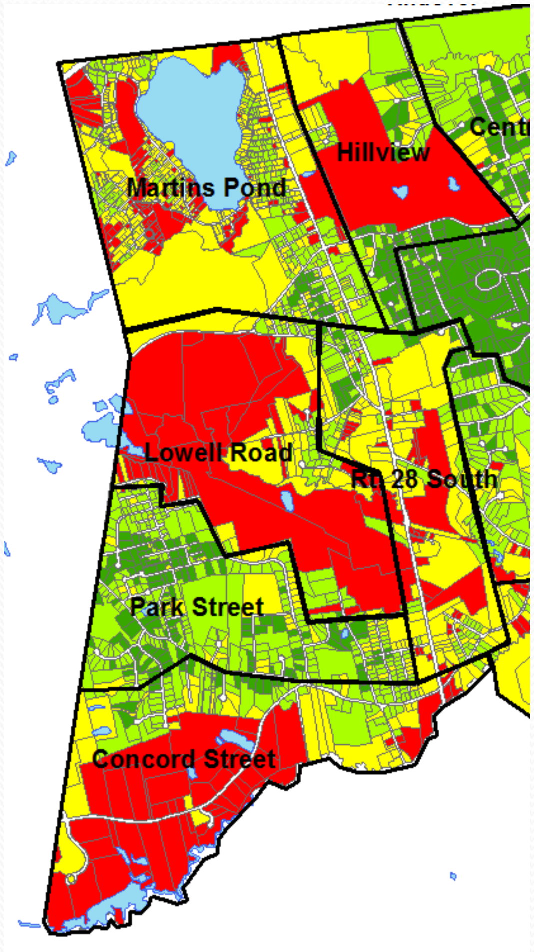
Needs Study Area Trends - Summary

Study Area	Total Risk Points	% of Town Risk Points	Points per Lot	Rank	Top 3 Factors		
					1	2	3
Lowell Road	7,057	3.8%	56.5	1	Impaired Water	Zone2/IWPA	Flood Zone
Martin's Pond	39,288	21.0%	55.1	2	Impaired Water	LotSize	Zone2/IWPA
Rt 28 South	11,876	6.3%	53.5	3	Impaired Water	Water Use Class	Lot Size
Concord Street	9,387	5.0%	49.7	4	Impaired Water	Water Use Class	Zone2/IWPA
DPW	5,838	3.1%	39.7	5	Impaired Water	System Age	System Age
Mt. Vernon	14,198	7.6%	38.4	6	Impaired Water	Septic Fails	System Age
High School	19,287	10.3%	37.7	7	Impaired Water	System Age	Lot Size
Thomson	15,272	8.1%	35.3	8	Impaired Water	Water Use	Lot Size
Orchard Drive	13,453	7.2%	33.3	9	Impaired Water	System Age	Flood Zone
Park Street	13,024	6.9%	32.8	10	Impaired Water	Lot Size	System Age
Hillview	3,353	1.8%	29.9	11	Water Use Class	Impaired Water	System Age
Central Street North	12,815	6.8%	26.2	12	Zone2/IWPA	Septic Fails	Flood Zone
Marblehead Drive	8,216	4.4%	20.5	13	Wetlands	Flood Zone	ORW
Crestwood Drive	5,331	2.8%	20.0	14	System Age	Septic Fails	Water Use
Swan Pond	1,921	1.0%	19.6	15	Wetlands	ORW	Flood Zone
Eisenhuaer Pond	7,085	3.8%	15.3	16	System Age	Lot Size	Water Use
Town Total	187,401	100.0%	35.1				

Needs Study Areas



Wastewater Screening Analysis



Study Area	Top 3 Factors		
	1	2	3
Lowell Road	Impaired Water	Zone2/IWPA	Flood Zone
Martin's Pond	Impaired Water	Lot Size	Zone2/IWPA
Rt 28 South	Impaired Water	Water Use Class	Lot Size
Concord Street	Impaired Water	Water Use Class	Zone2/IWPA

Windshield survey summary

- Each study area was observed to verify results of risk analysis.
- Reviewed isolated high risk locations to determine if the lots are typical to the area.
- Neighborhood characteristics observed matched area summaries created.
- Windshield survey validated the criteria identified, and relative risk.

Wastewater Screening Analysis: No Build Option

- Property owners responsible for maintaining their own disposal systems
- Limited improvement to water quality
- Non residential users continue to impact water quality
- Privately managed system operate less reliably and effectively
- I/A systems may improve water quality for individual lots, but not a town wide solution.
  - Does not reduce Title 5 septic system design requirements.

Wastewater Screening Analysis : Municipal In-Town Options

- Consideration was given to a single centralized system and to a combination of decentralized systems.
- A wastewater flow of 0.5 MGD was used to determine approximate groundwater discharge system sizing.
- Required system sizes were compared to the lot size of underdeveloped Town-owned parcels.
- Each parcel in Town was given a groundwater discharge score based on its likelihood to be able to sustain a groundwater discharge system on site.

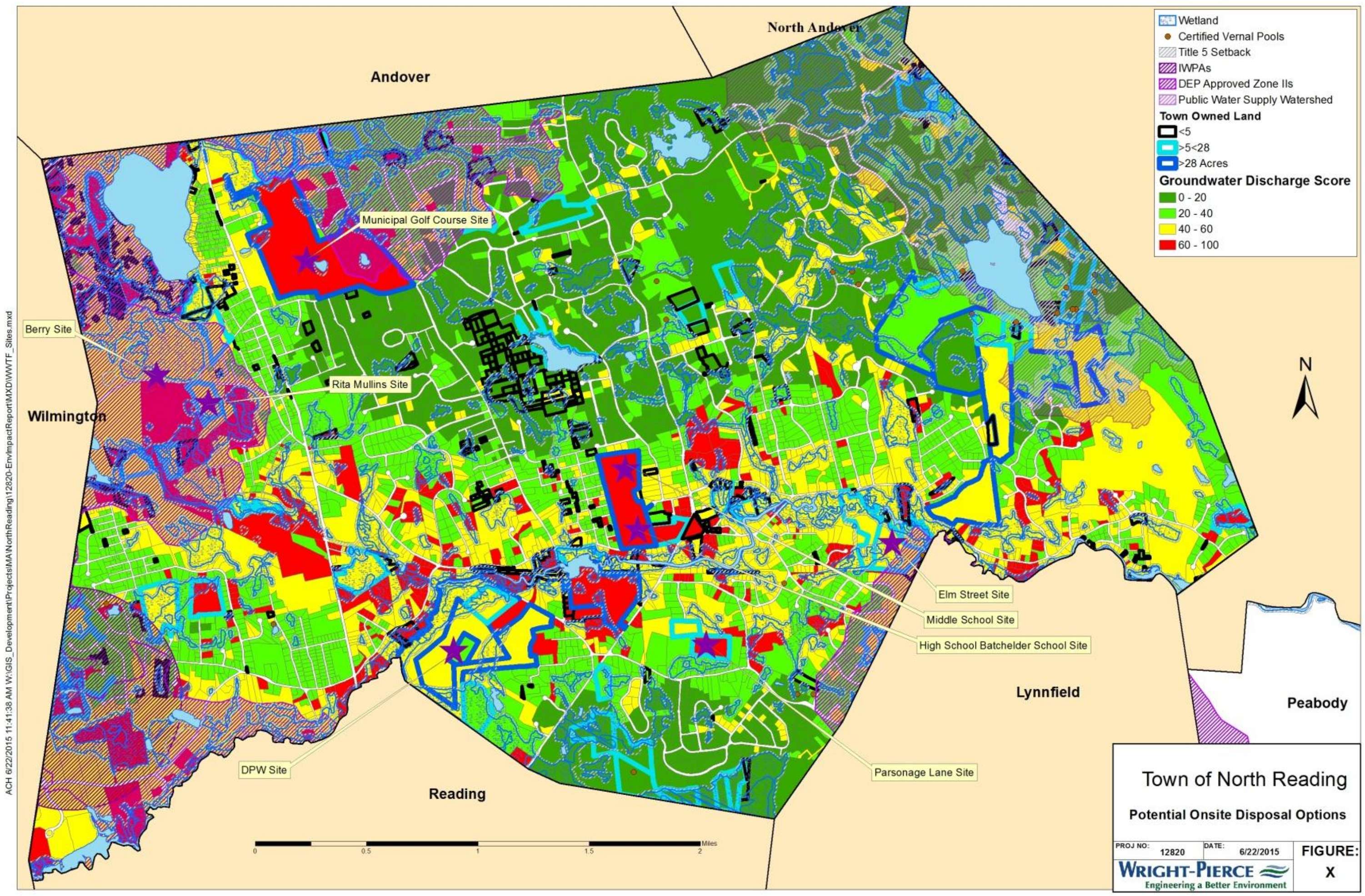
Wastewater Screening Analysis : In-Town Centralized System

- Centralized System: GWDP facility for entire needs area.
- 28 acres or larger to accommodate the flows
- Criteria: minimum lot size, town owned, undeveloped or under developed, GW risk level moderate or below, no environmental constraints.
- Cross-referenced with the sites identified in the draft CWMP

Wastewater Screening Analysis: In-Town Decentralized System

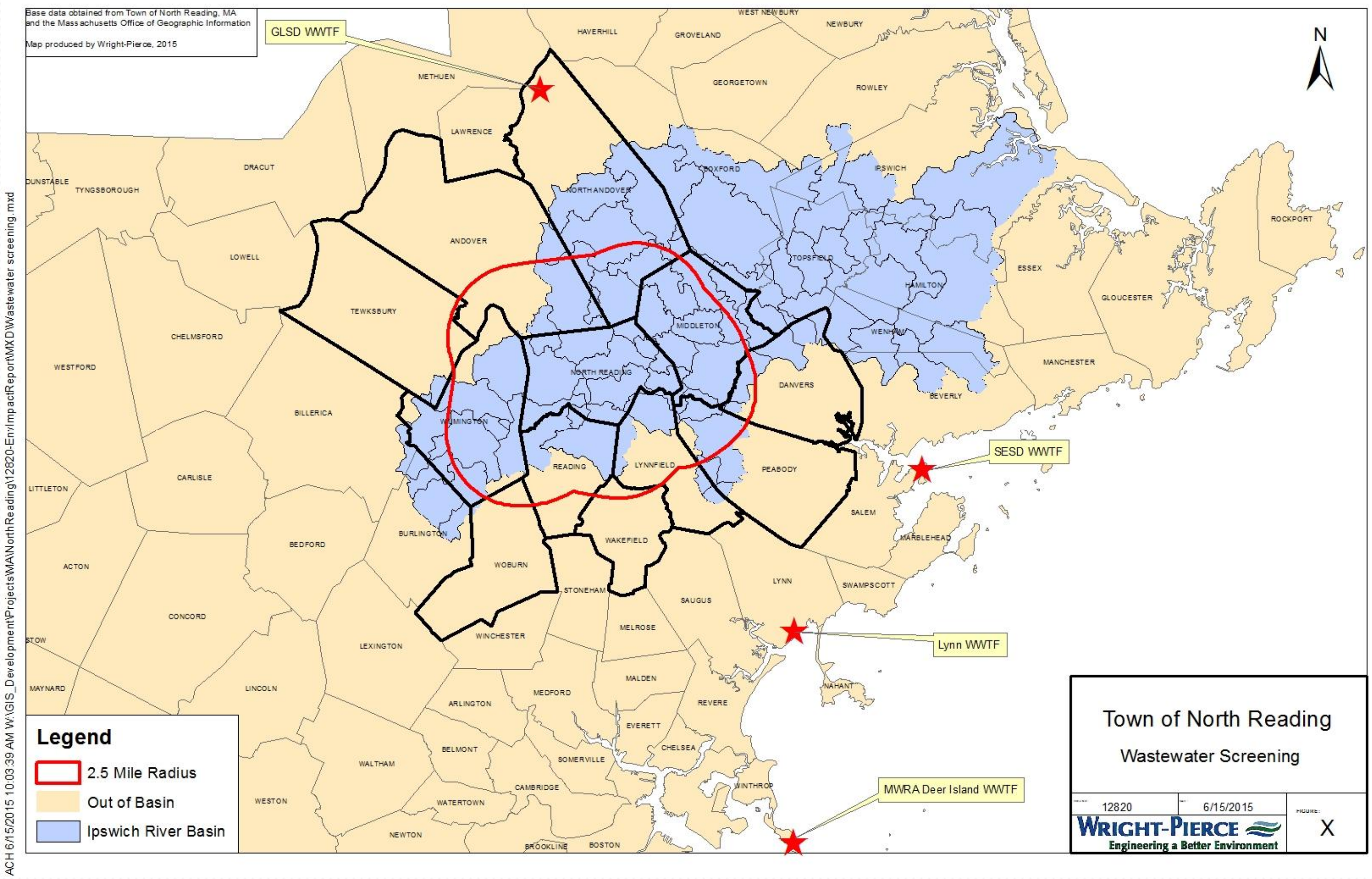
- Decentralized System: Multiple smaller GWDP systems (typically <150,000 gpd)
- Potential discharge sites reviewed in proximity to Needs Area.
- Used same criteria as Centralized System analysis
- Too many Decentralized Systems not feasible
  - Inefficient: increased cost per gallon and energy consumption.
- Minimum lots size 5 acres based on 50,000 gpd.

Wastewater Screening Analysis: In-Town System Potential Locations



Wastewater Screening Analysis: Out of Town Options

In-basin option preferred, but not possible



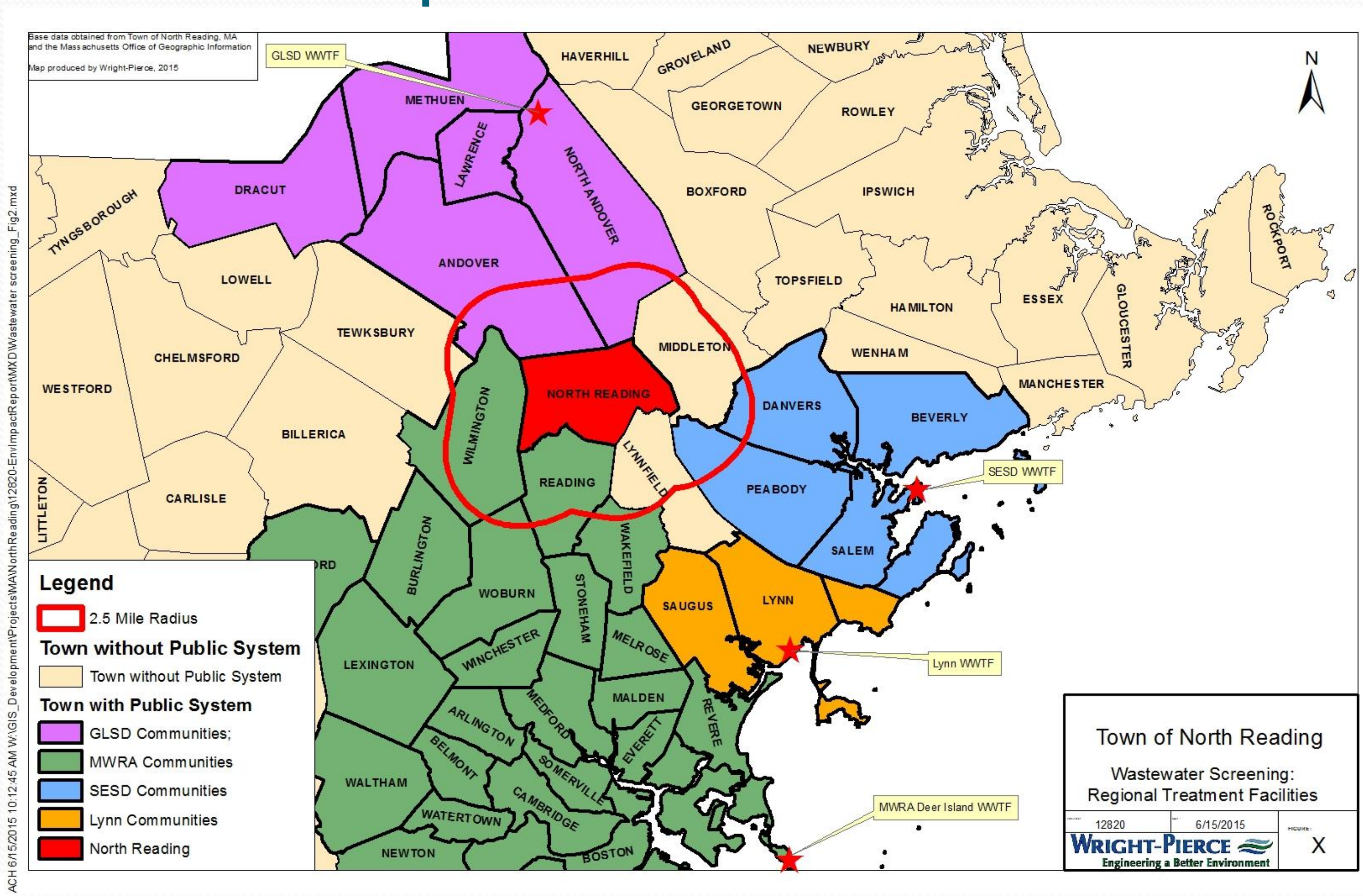
Wastewater Screening Analysis: Out of Town Options

Community/District	Municipal System (Y/N)	Capacity (Y/N)
Greater Lawrence Sanitary District	Y	Y
MWRA	Y	Y[1]
South Essex Sewerage District	Y	N
Lynn Regional Sanitary District	Y	N
Lynnfield	N	N
Middleton	N	N
Tewksbury	Y[2]	N

1: MWRA is not actively expanding wastewater service area. Connection possible with significant I/I removal within MWRA system by connecting community

2:Tewksbury discharges its sewer to the Greater Lowell WWTP

Wastewater Screening Analysis: Out of Town Options



Final Selected Alternatives

- No build
- In basin
  - Centralized
  - Decentralized
- Out of basin
  - GLSD
  - MWRA

Meeting Summary

- Presented water and wastewater needs
- Covered water and wastewater screening
- Water:
  - Selected alternatives
    - Further explore MWRA connection through Reading
- Wastewater:
  - Selected alternatives

Preliminary Agenda for Next Meeting

- Anticipated Date: Fall 2015, likely September
- Final Selected Alternatives
- Impacts Analysis

Questions / Discussion

Sign In Sheet

Project Meeting #2 6-25-2015
Draft Environmental Impact Report 9:00 AM

Name:	Email:
JOE Lobao	JLobao@wilmingtonma.GOV
PAM Heidell	Pamela.Heidell@mwra.com
Karen Martin	KMartin@andoverma.gov
Jane Krieger	kriegerjane@verizon.net
Danielle McKnight	dmcknight@northreadingma.gov
Keith Saxon	ksaxon@aol.com
WAYNE CASTONGUAY	wcastonguay@ipswichriver.com

Town of North Reading

Draft Environmental Impact Report

Project Meeting #3

February 4, 2016

Presented by: Paul Brinkman

Wright-Pierce

Engineering a Better Environment

Invite List

- Secretary Matthew A. Beaton; Executive Office of Energy and Environmental Affairs
- Department of Environmental Protection; Commissioner's Office
- MassDEP/Northeast Regional Office; MEPA Coordinator
- Mass DOT - District #4 Office; MEPA Coordinator
- Massachusetts Historical Commission
- Merrimack Valley Planning Commission
- Metropolitan Area Planning Council
- Town of North Reading Board of Selectmen
- Michael Gilleberto; Town Administrator Town of North Reading
- Town of North Reading Community Planning Department
- Town of North Reading Conservation Commission
- Town of North Reading Health Department
- Town of Reading Board of Selectmen
- Robert W. LeLacheur, Jr., Town Manager Town of Reading
- Town of Wilmington Planning Department
- Town of Wilmington Health Department
- Town of Wilmington Conservation Commission
- Town of Wilmington Board of Selectmen
- Town of Reading Planning Department
- Town of Reading Conservation Commission
- Town of Reading Health Department
- Town of Andover Board of Selectmen
- Reginald S. Stapczynski; Town Manager Town of Andover
- Town of Andover Planning Board
- Town of Andover Conservation Commission
- Town of Andover Board of Health
- Natural Heritage and Endangered Species Program; Commonwealth of Massachusetts
- DCR; MEPA Coordinator
- Department of Public Health ; Director of Environmental Health
- Pamela Heidell; Massachusetts Water Resource Authority; MEPA Coordinator
- Energy Facilities Siting Board; MEPA Coordinator
- Division of Energy Resources; MEPA Coordinator
- Ipswich River Watershed Association, Wayne Castonguay, Executive Director
- Martins Pond Association

MEPA Process/Outline

- ENF
- EIR Preparation and Filing Process
  - Draft EIR
  - Submission of Draft EIR and Public Comment Period
  - Issuance of Secretary's Certificates
  - Response to Comments
  - Final EIR

Draft EIR

- Table of Contents
- Secretary's Certificates
- Summary
- Project Description
- Existing Environment
- Alternatives to the Project
- Assessment of Impacts
- Permitting Requirements
- Mitigation Measures
- Appendices

North Reading MEPA Process Framework

Tasks	Water & Wastewater	Tentative Date
Existing Conditions	Meeting #1	Completed
Needs and Identify Alternatives	Meeting #2	Completed
Impact Analysis and Recommended Plan	Meeting #3	February 2016

Schedule

- Final DEIR Public Participation Meeting: February 4, 2016
- Submit DEIR to MEPA: February
- DEIR Public Comment Period: 30 days
- MEPA Letter: 7 days
- Complete FEIR: TBD

Agenda - DEIR

- Project Background
- Water Alternatives Analysis
  - Selected Alternative Summary
- Wastewater Alternatives Analysis
  - Selected Alternative Summary
- Recommended Plan
  - Water and Wastewater Plan
  - Cost & Financial Plan
  - Implementation Schedule
  - Permitting
- Environmental Impacts
  - GHGs, Stormwater
  - Mitigation

Project Background – Water & Stormwater

- North Reading Water Supplies
  - Wells through Water Registrations
    - Registered Use (0.96 MGD)
  - Surface Supply from Andover (Merrimack River)
    - IBTA (1.50 MGD)
- Can’t meet all needs through either source (2.6 MGD)
- Ipswich River
  - Stressed Basin - “Over Allocated”
  - Stormwater

Project Background - Wastewater

- Primarily served through on-site disposal systems
- Water Quality Impairments from inadequate systems
- Known system rehabilitation/pumping rates
- Difficulty in areas of upgrades due to limited parcel area and soils
- Evaluated limited alternatives through CWMP process

Goals Water

- Provide long-term, sustainable option(s) for water supply
- Reduce water system complexity
- Allow community to provide services to maintain existing and future commercial/industrial base
- Manage capital and O&M costs
- Mitigate stress on the Ipswich River

Goals Wastewater

- Improve surface and ground water quality
- Provide long-term sustainable option(s) for wastewater treatment and disposal
- Allow community to provide services to maintain existing and future commercial/industrial base
- Address water quality impairments

Water Alternatives

Existing Water Supply Systems

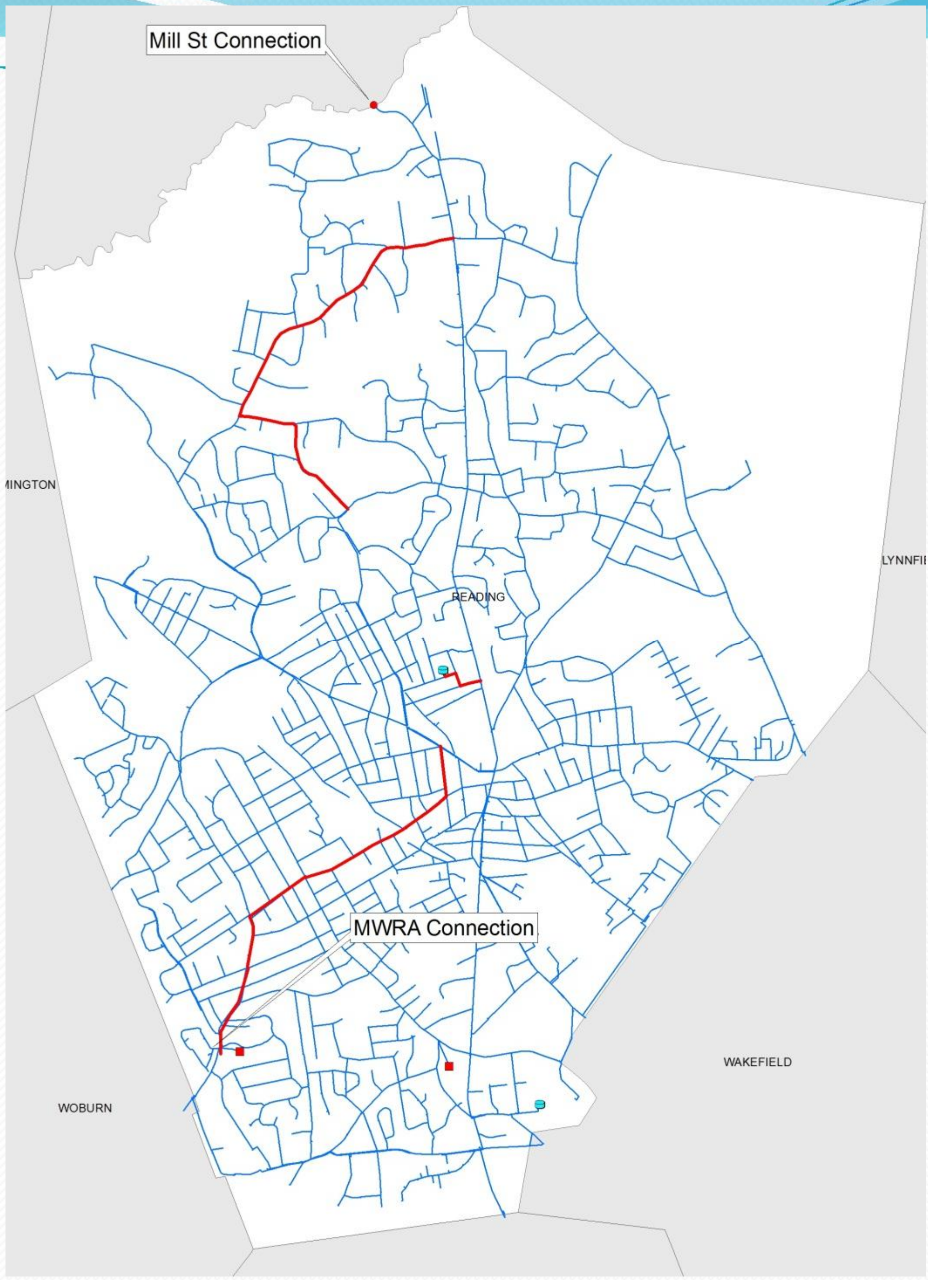
– Local Sources
  - Lakeside Boulevard WTP (Lakeside Wells and Rt 125)
  - West Village WTP (Railroad Bed Wellfield)
  - Central Street Wellfield
– Andover Interconnections
– Needs
  - ADD: 1.6
  - MDD: 2.58

Water Alternatives Screened

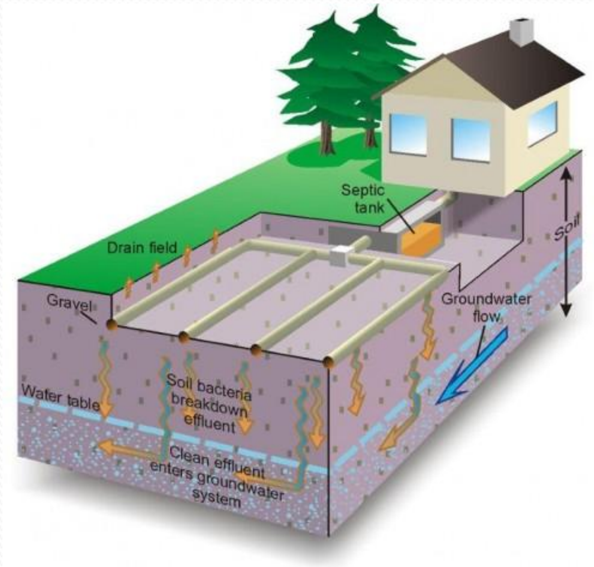
- Conservation
  - Viable alternative to be incorporated throughout
- No Build
  - Optimize local sources
    - Unreliable, declining raw water quality , Ipswich River basin
  - Maintain Andover connection
    - Future water supply insufficient
- New supply sources
  - In town – Surface/Ground Water Supplies
    - No viable surface water supplies, Ipswich River
  - Out of town –
    - No neighboring communities have capacity to serve North Reading with their local supplies
    - Connection through Reading /Wilmington to MWRA

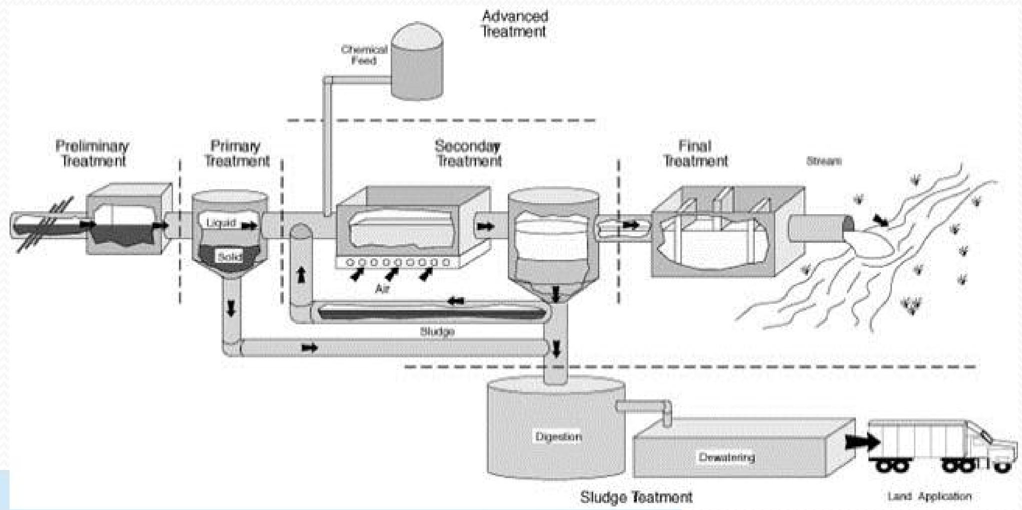
Final Selected Alternative:

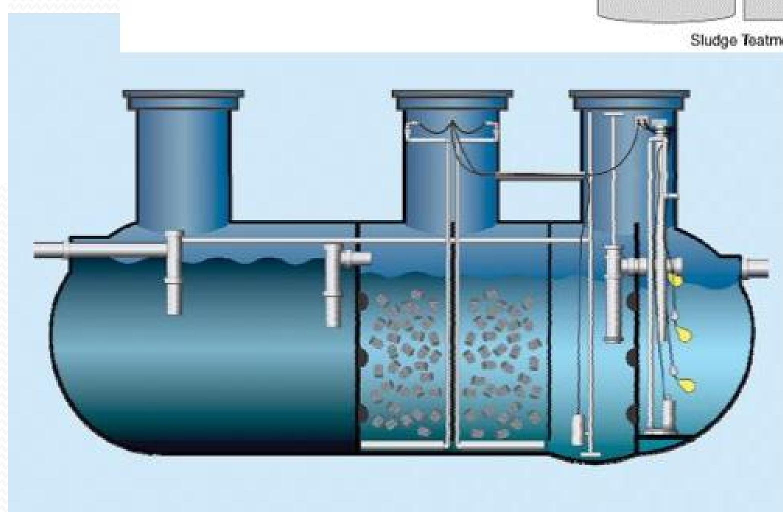
- MWRA connection through Reading
- Conservation



Wastewater Alternatives







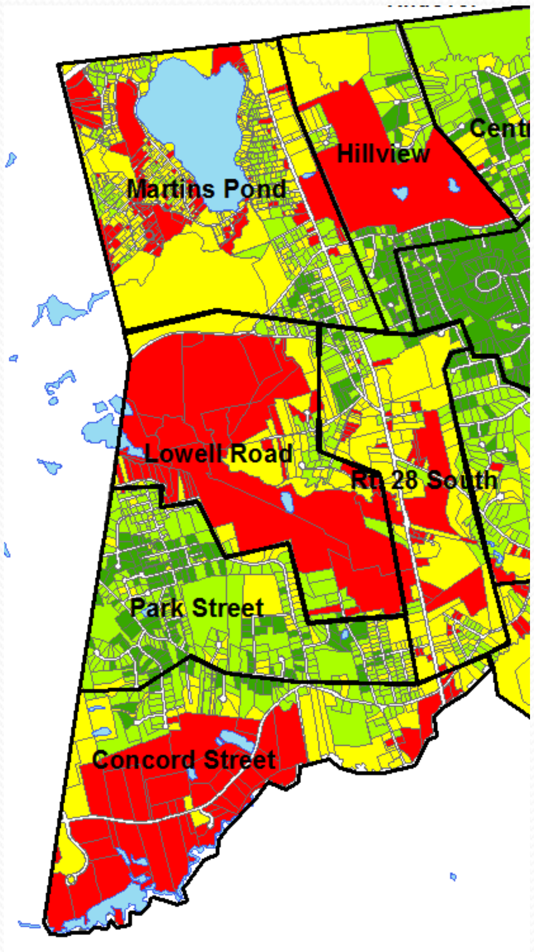
Existing Wastewater Management Systems

- North Reading Board of Health Septic System Regulations and Procedures
- Collection Systems
  - Public/Private Collection Systems
  - Existing MWRA Sewer Connection

Wastewater Management
Needs Assessment Process

- Develop Criteria
  - Physical
  - Location
- Collect Data – Validate
- Rank/weight Criteria
- Determine Needs

Wastewater Screening Analysis



Study Area	Top 3 Factors		
	1	2	3
Lowell Road	Impaired Water	Zone2/IWPA	Flood Zone
Martin's Pond	Impaired Water	Lot Size	Zone2/IWPA
Rt 28 South	Impaired Water	Water Use Class	Lot Size
Concord Street	Impaired Water	Water Use Class	Zone2/IWPA

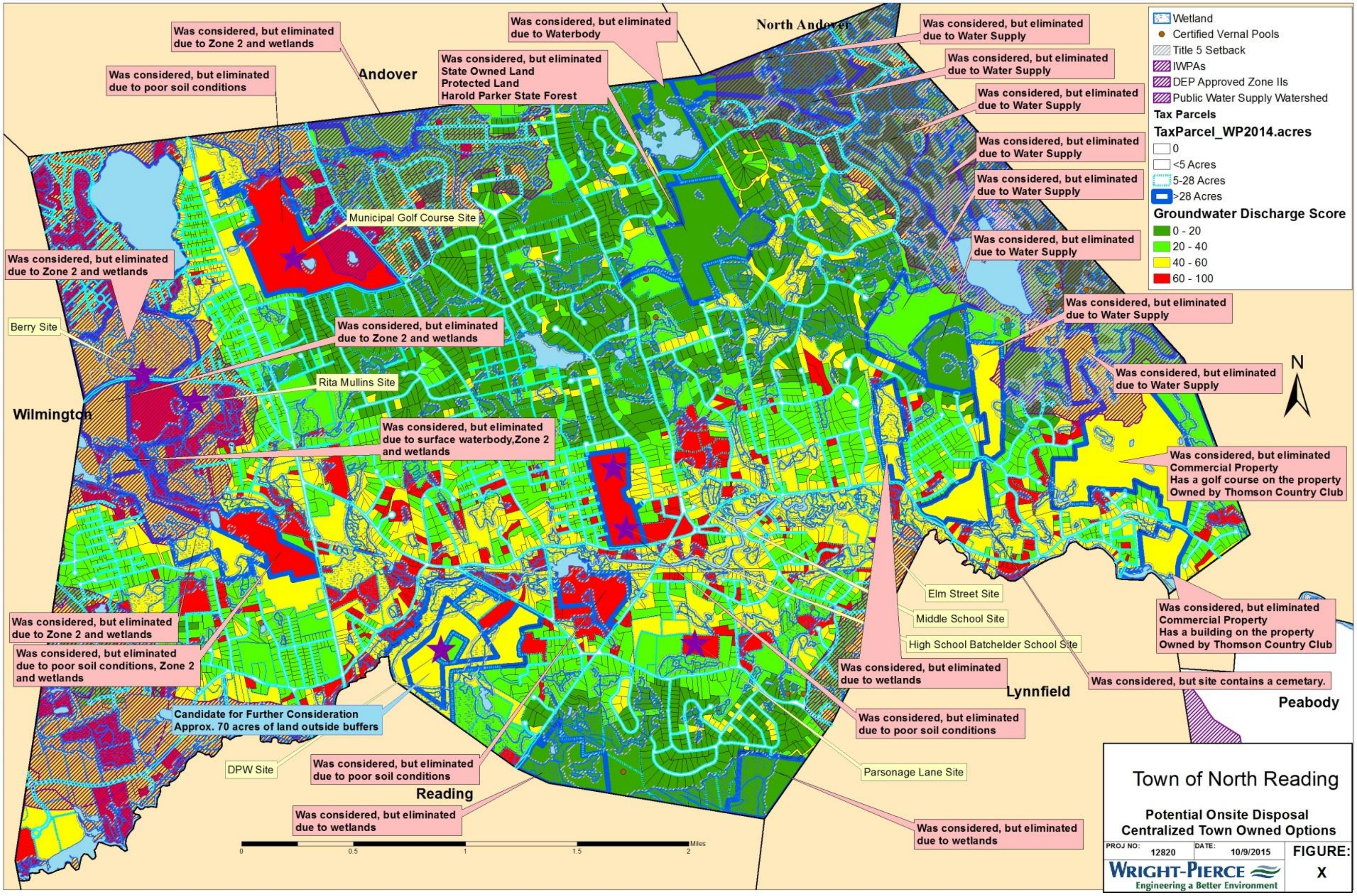
Screened Alternatives

- No build
- In basin
  - Decentralized
  - Centralized
- Out of basin
  - GLSD
  - MWRA
  - Others

Final Selected Alternatives

- No build
  - Results in no improvement and may cause further deterioration of water quality in Ipswich River Basin
  - I/A systems for residential lots could be used in sensitive areas for improved water quality, but can not be sited on restricted lots.
    - Does not change Title 5 septic system application rates.
    - Small reduction in SAS only helps marginal lots.
  - Non residential users continue to impact water quality
    - Privately managed system operate less reliably and effectively

Wastewater Screening Analysis: In-Town System Potential Locations

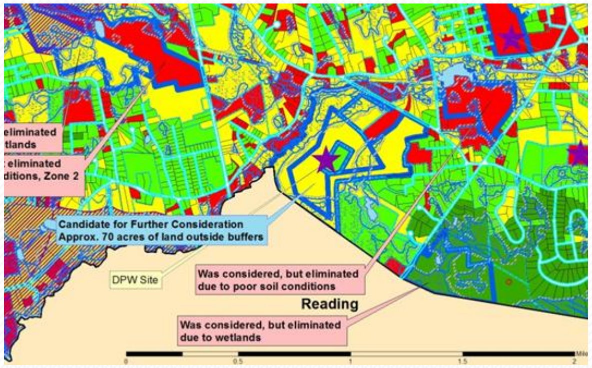


Alternatives

- In basin - Centralized
    - Reviewed all public and private lots large enough to site 500,000 gpd WWTF
    - There are no feasible sites within North Reading to site a centralized WWTF
    - Findings consistent with CWMP

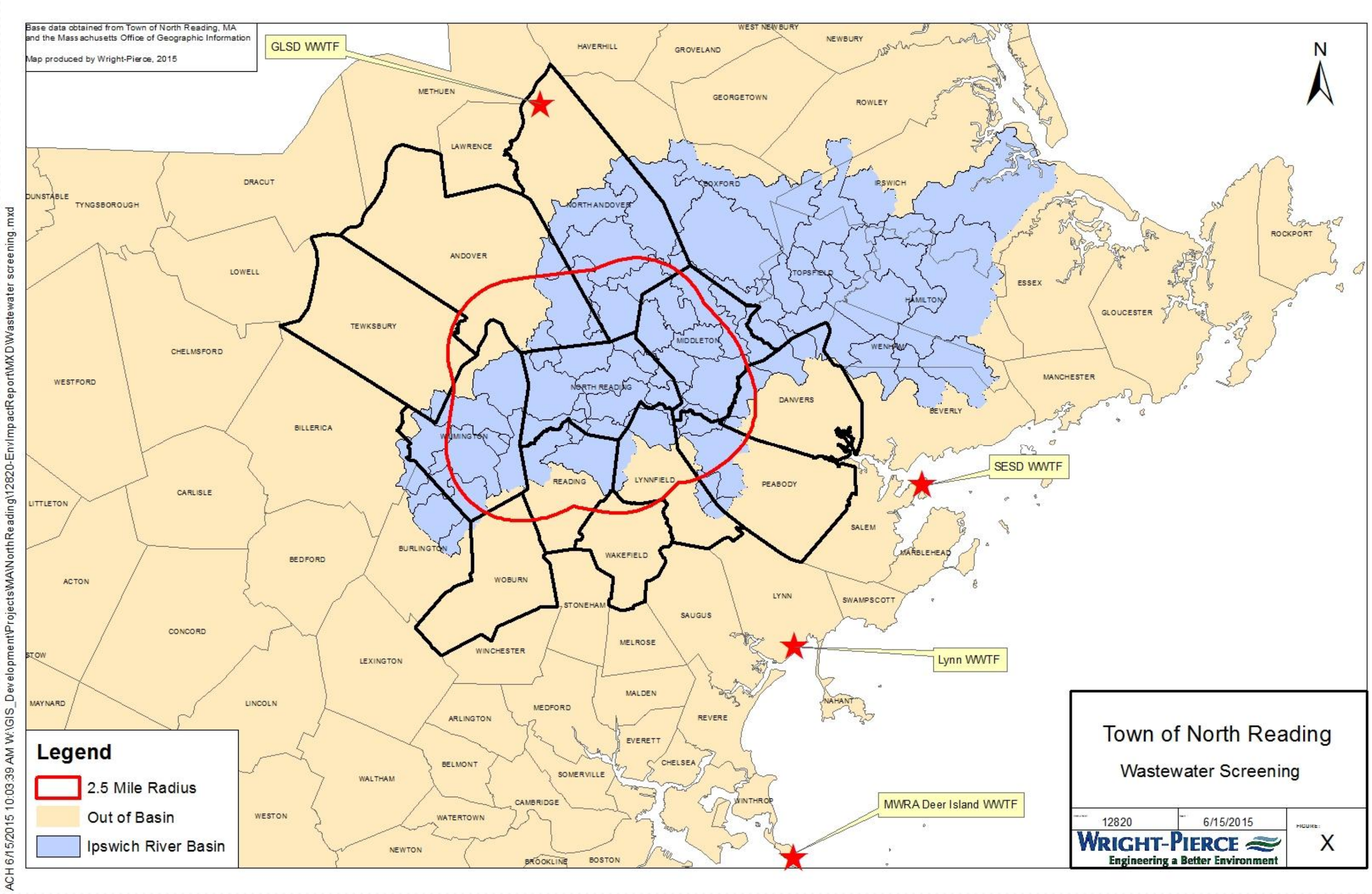
Alternatives

- In basin - Decentralized
  - Reviewed all public and private lots feasible to site decentralized WWTF larger than 50,000 gpd.
    - WWTF smaller than 50,000 uneconomical (would need 10 WWTF)
  - DPW Site was determined to be only site likely viable and economically feasible site for a decentralized WWTF.
    - Environmental Impacts lead to elimination of this site
      - Much of site is in 100 year flood plain
      - Would require cutting down 10 acres of trees and vegetation
      - Increase in impervious surface with limited area for mitigation
      - Increased GHG footprint
        - WWTF less efficient than GLSD WWTF
        - Trees help reduce CO2



Wastewater Alternatives:
Out of Town Options

In-basin option preferred, but not possible



Wastewater Alternatives: Out of Town Options

Community/District	Municipal System (Y/N)	Capacity (Y/N)
Greater Lawrence Sanitary District	Y	Y
MWRA	Y	Y[1]
South Essex Sewerage District	Y	N
Lynn Regional Sanitary District	Y	N
Lynnfield	N	N
Middleton	N	N
Tewksbury	Y[2]	N

1: MWRA is not actively expanding wastewater service area. Connection possible with significant I/I removal within MWRA system by connecting community

2:Tewksbury discharges its sewer to the Lowell Regional Wastewater Utility

Wastewater Alternatives

- Out of basin
  - MWRA
    - MWRA collection system does not have existing capacity for North Reading flows.
  - GLSD
    - GLSD has capacity.
    - Wastewater conveyed through Andover.
      - Upgrades required to manage North Reading flow

Recommended Plan

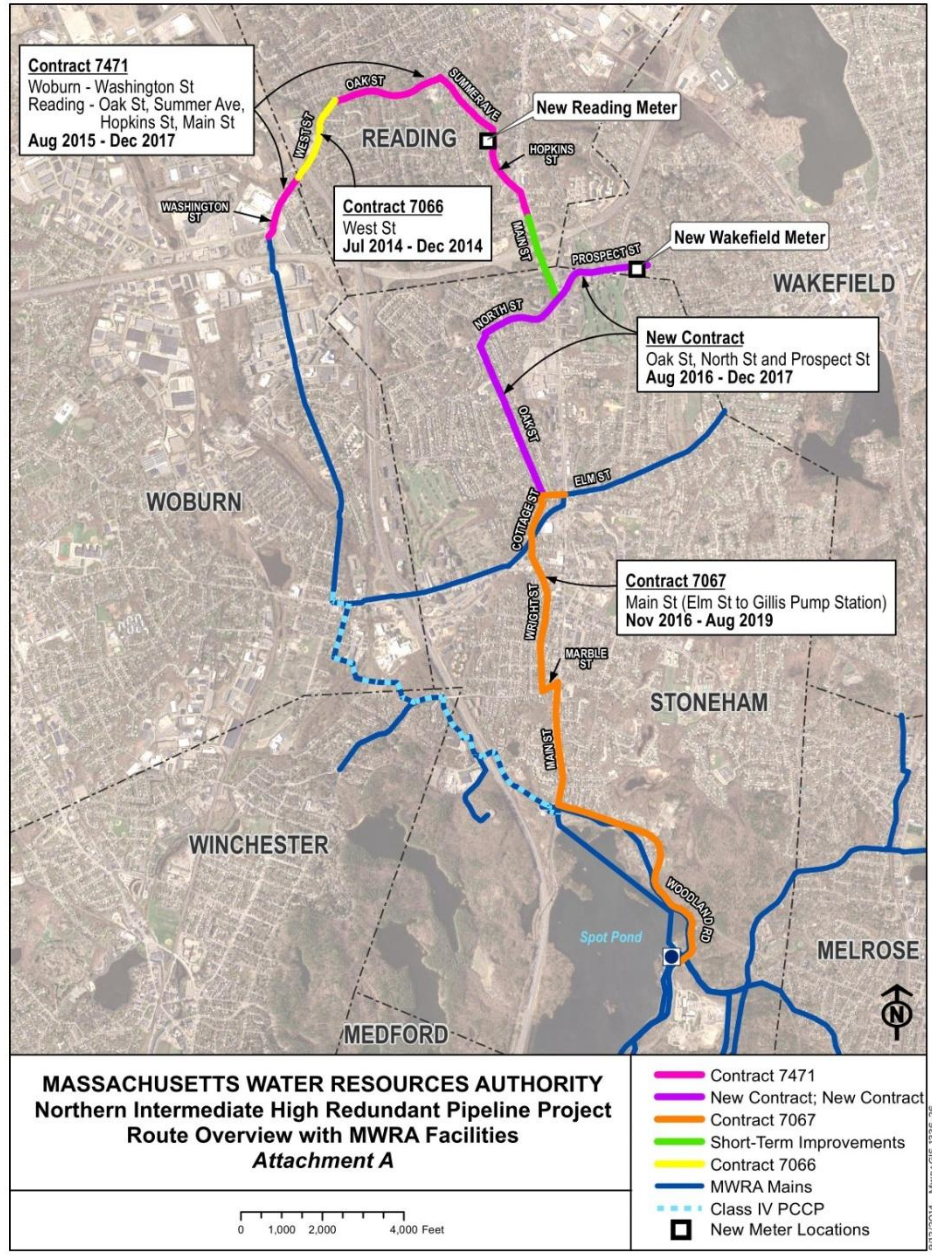
– Water Solution: MWRA Connection through Reading
– Wastewater Solution: Connection of portion of Town (needs areas) to GLSD through Andover

Recommended Plan: Water

- Connection to MWRA through Reading
- Water wheeled through existing Reading distribution system
- MWRA has the capacity to serve North Reading’s future needs
- MWRA will help reduce the stress on the Ipswich River
- Improvements in Water Quality
- Increased reliability to North Reading with MWRA Connection.

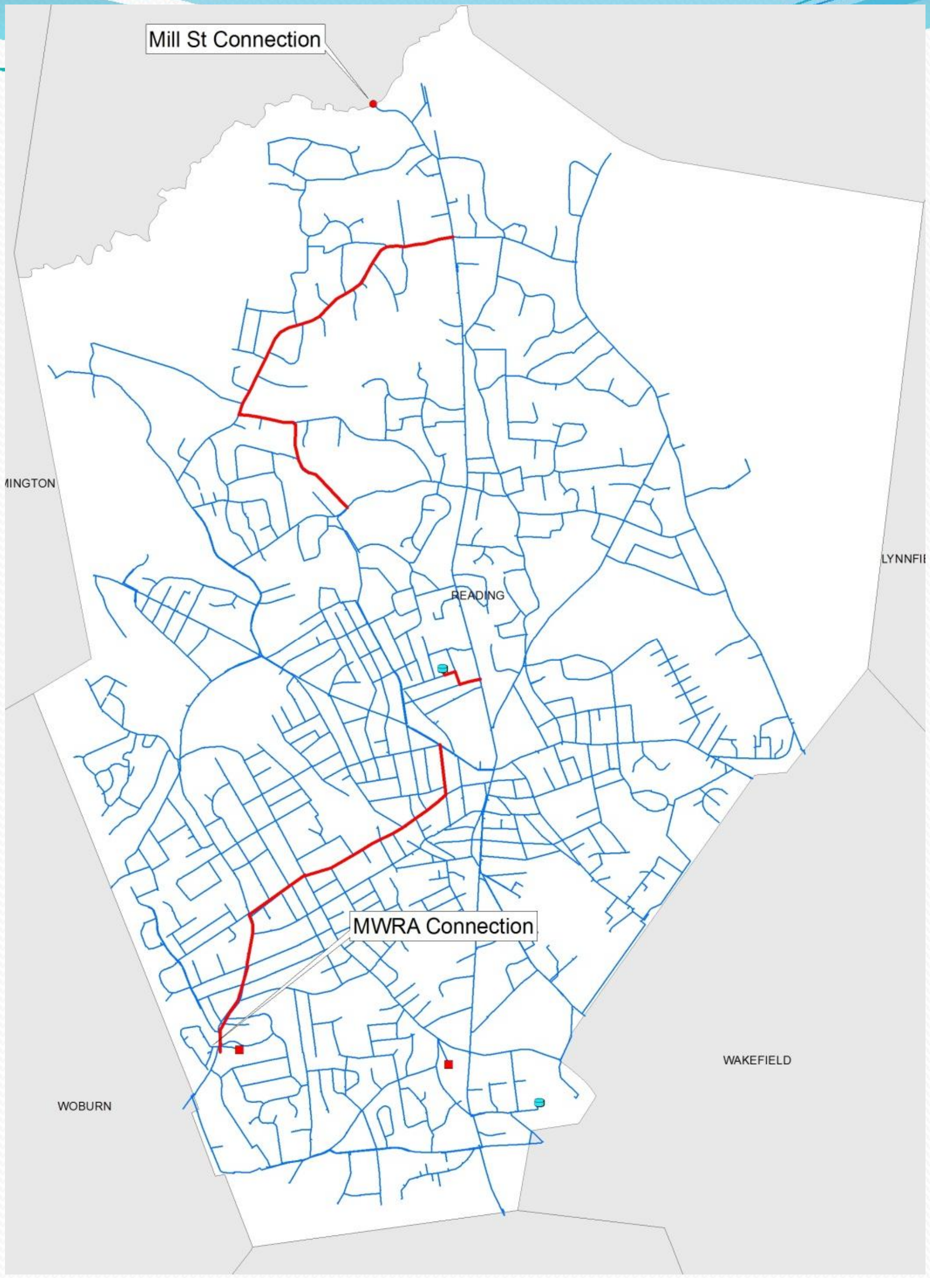
Recommended Plan: MWRA System Improvements

– MWRA has ongoing capital work to provide additional capacity and reliability north of Boston
  - Covered Reservoir in Stoneham
  - Redundant Loop



Recommended Plan: Reading Water System Improvements

– Clean and line portions of existing water mains
– Replace various portions of water main with larger pipes, including Woburn Street and Auburn Street
– Increase inlet/outlet piping from the Auburn street tank



Recommended Plan: Wastewater

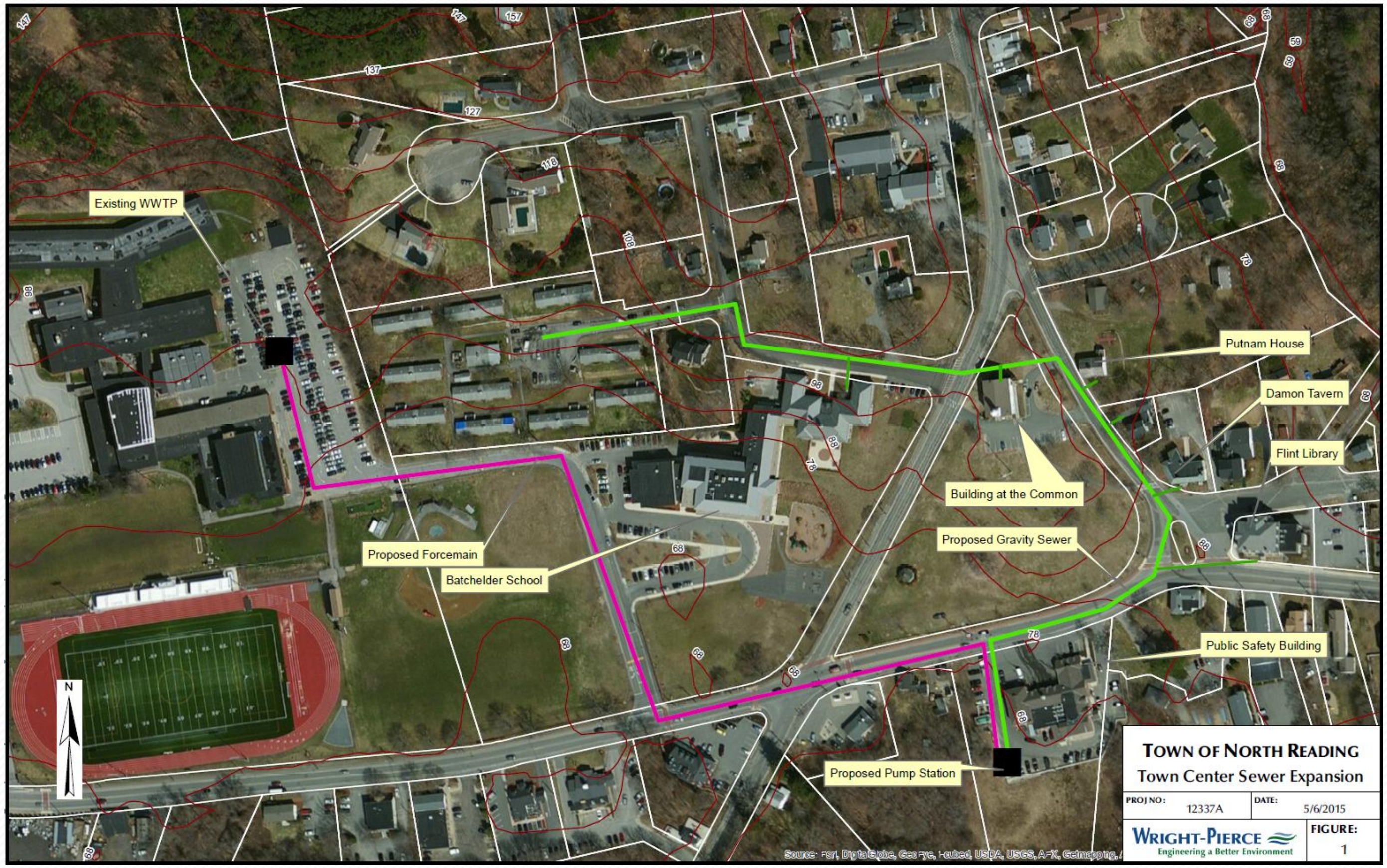
- Blended approach with in town and out of town options
- Connection to GLSD
  - Discharge 503,000 gpd
- Optimize existing WWTF at High School and capture select users in the Town center.
- Other users remain on individual systems

Recommended Plan: Wastewater

- Existing Septic System not in Needs Area remain and upgraded by home owners as needed.
  - Continued enforcement of Public Health regulations.
  - Education for failing systems and implementation of innovative / alternative technologies.

Recommended Plan: Wastewater

– Optimize existing WWTF at High School and municipal users in the center of Town.

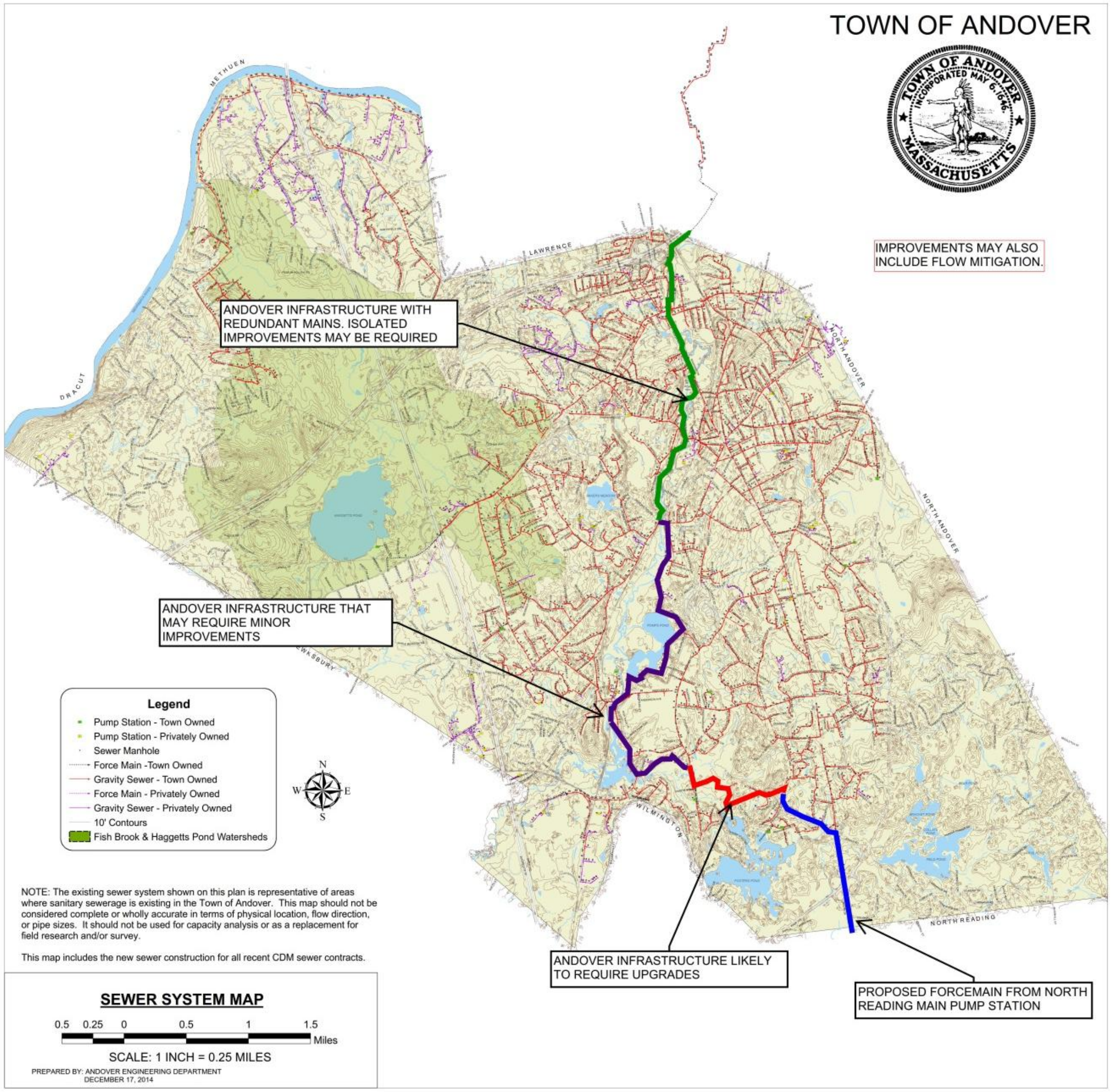


Recommended Plan: Wastewater

- – Construct Municipal Collection System
  - § ~ 25 miles of sewer
  - § 6 Pump Stations
  - § Limited number served by low pressure sewer

Recommended Plan: Wastewater

- Out of town discharges:
  - Connection to GLSD through Andover
  - 503,000 gpd average daily flow



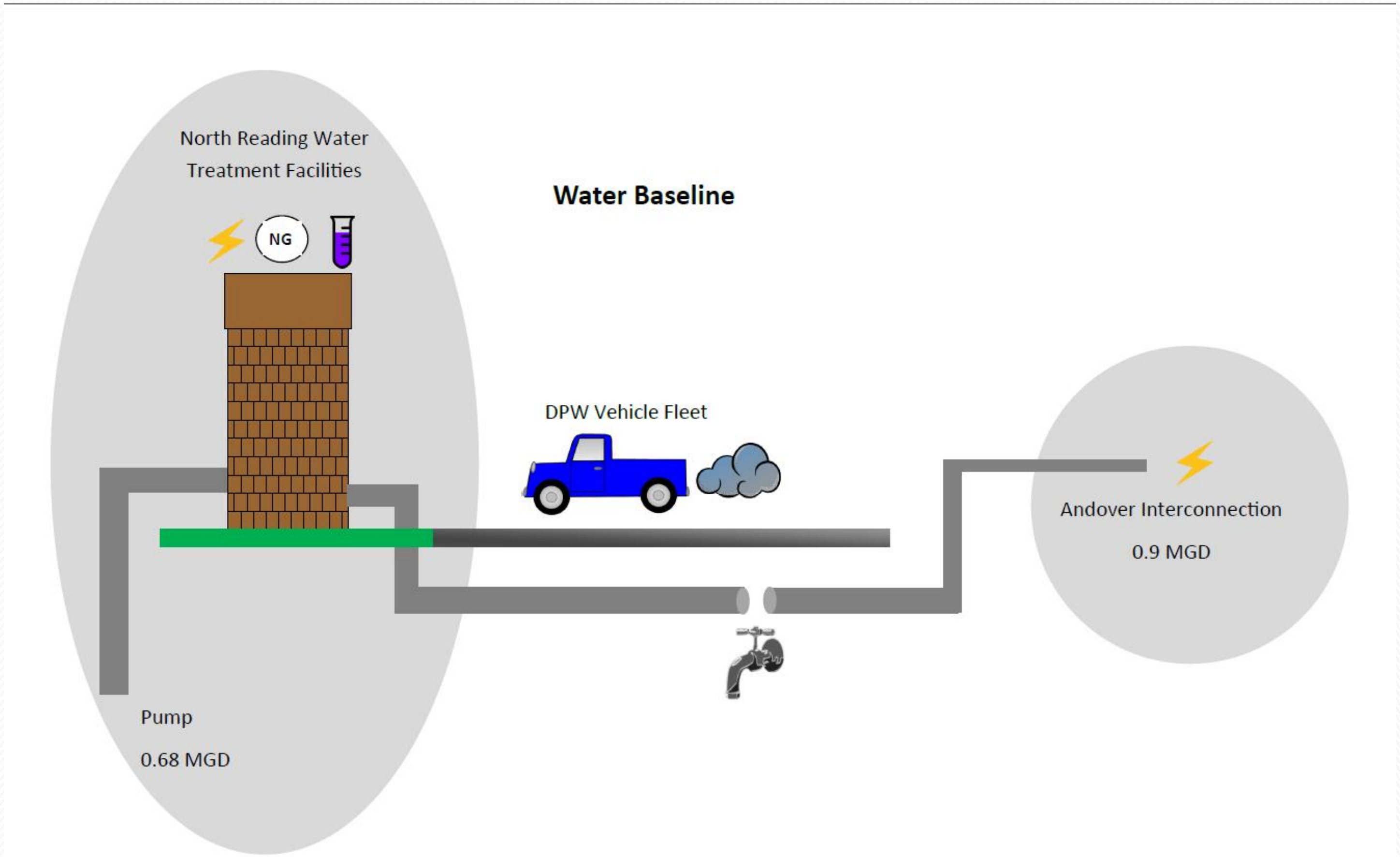
Environmental Impacts

– Greenhouse Gases
– Stormwater impacts
– Ipswich River
– Resource Areas
– Mitigation Measures

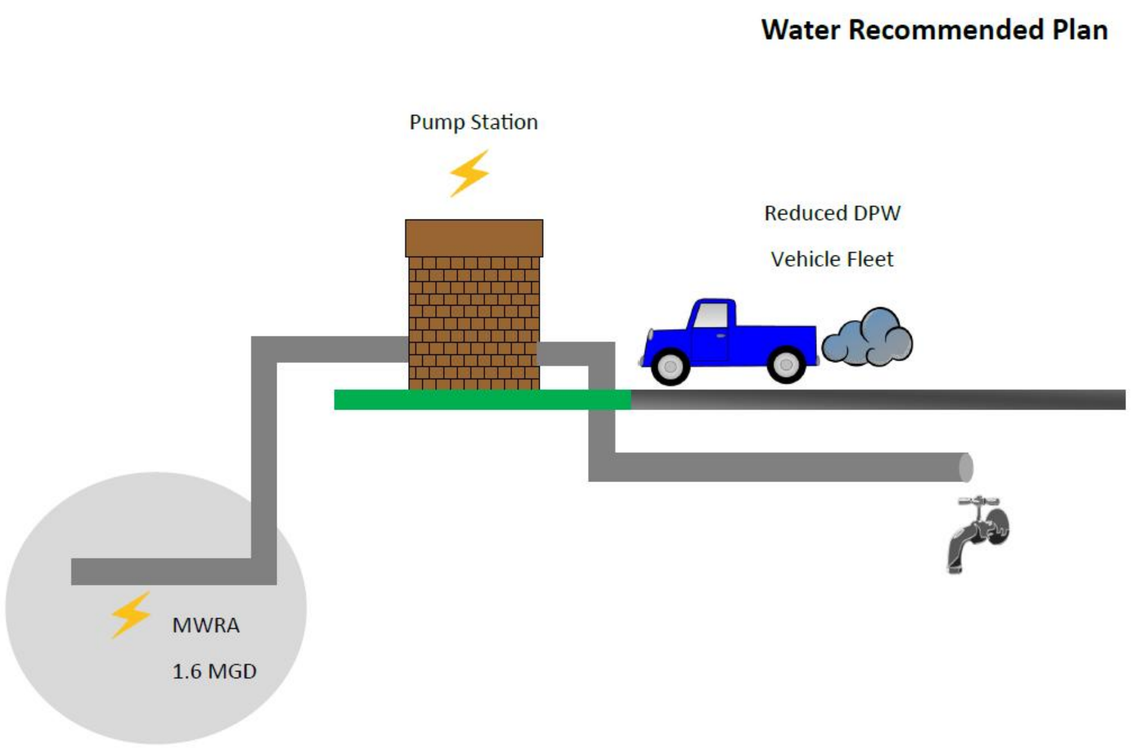
Environmental Impacts: Greenhouse Gases

- Analysis required per MEPA/ENF Certificate
- Quantify CO_2 emissions for baseline (no build) and preferred alternative
- Factors considered
  - Water: Treatment plant and pump station electricity, chlorine production, maintenance vehicle fleet emissions, treatment plant natural gas use
  - Wastewater: Septic tank methane production, septic tank hauling, biological treatment processes, vehicle fleet emissions, treatment plant electricity

GHG - Existing Conditions Water



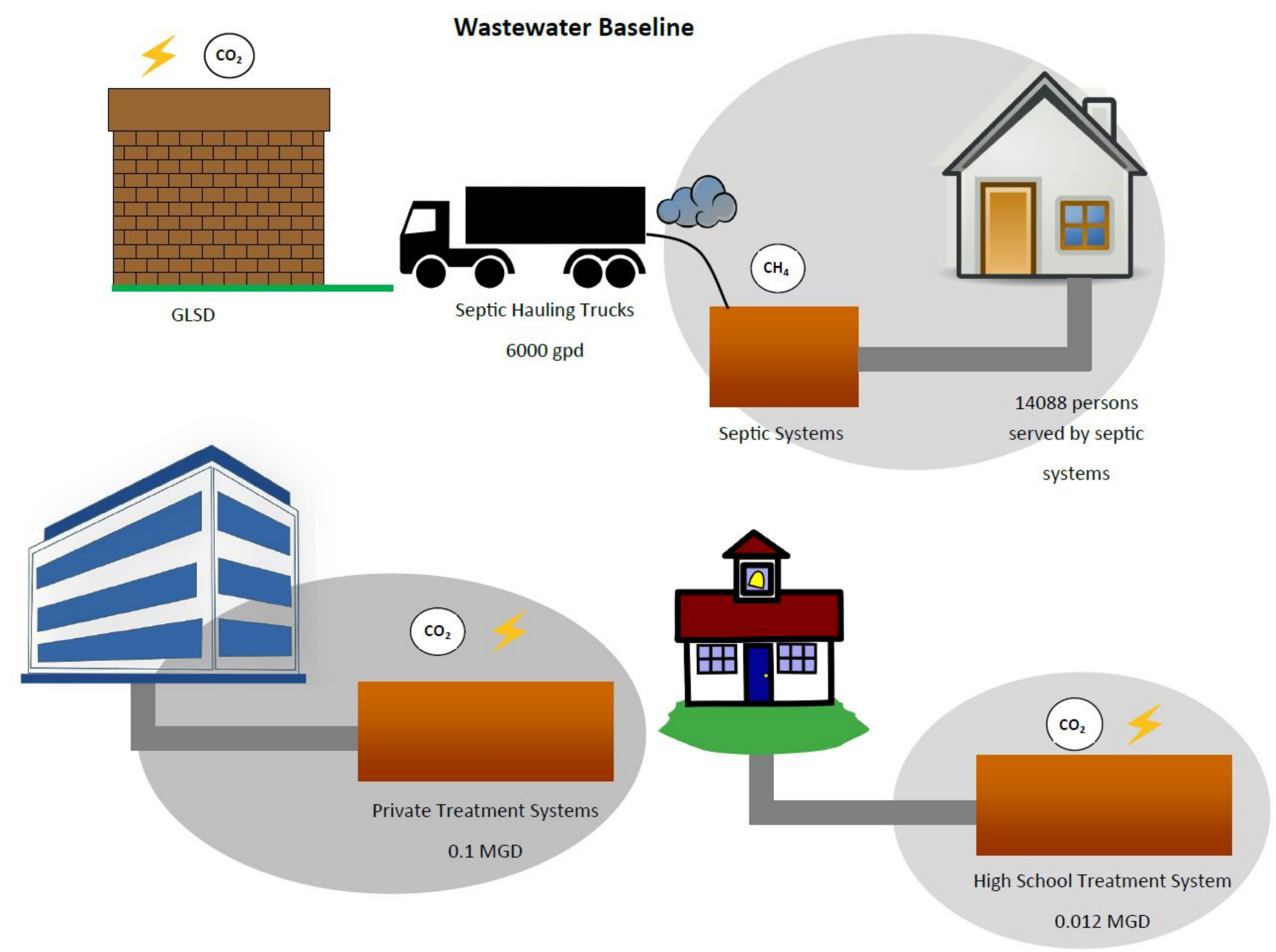
GHG – Water Recommended



Greenhouse Gases: Water

Emission Source	Emission Type (lbs/day)							Total
	Treatment Plant Electricity			Natural Gas	Vehicle Fleet Fuel	Chemical Production	Pump Stations	
	North Reading	Andover	MWRA					
Baseline	1508	975	-	104	282	73	-	2942
MWRA	-	-	313	-	226	-	156	694
Emissions Reduction								76%

GHG – Existing Conditions Wastewater

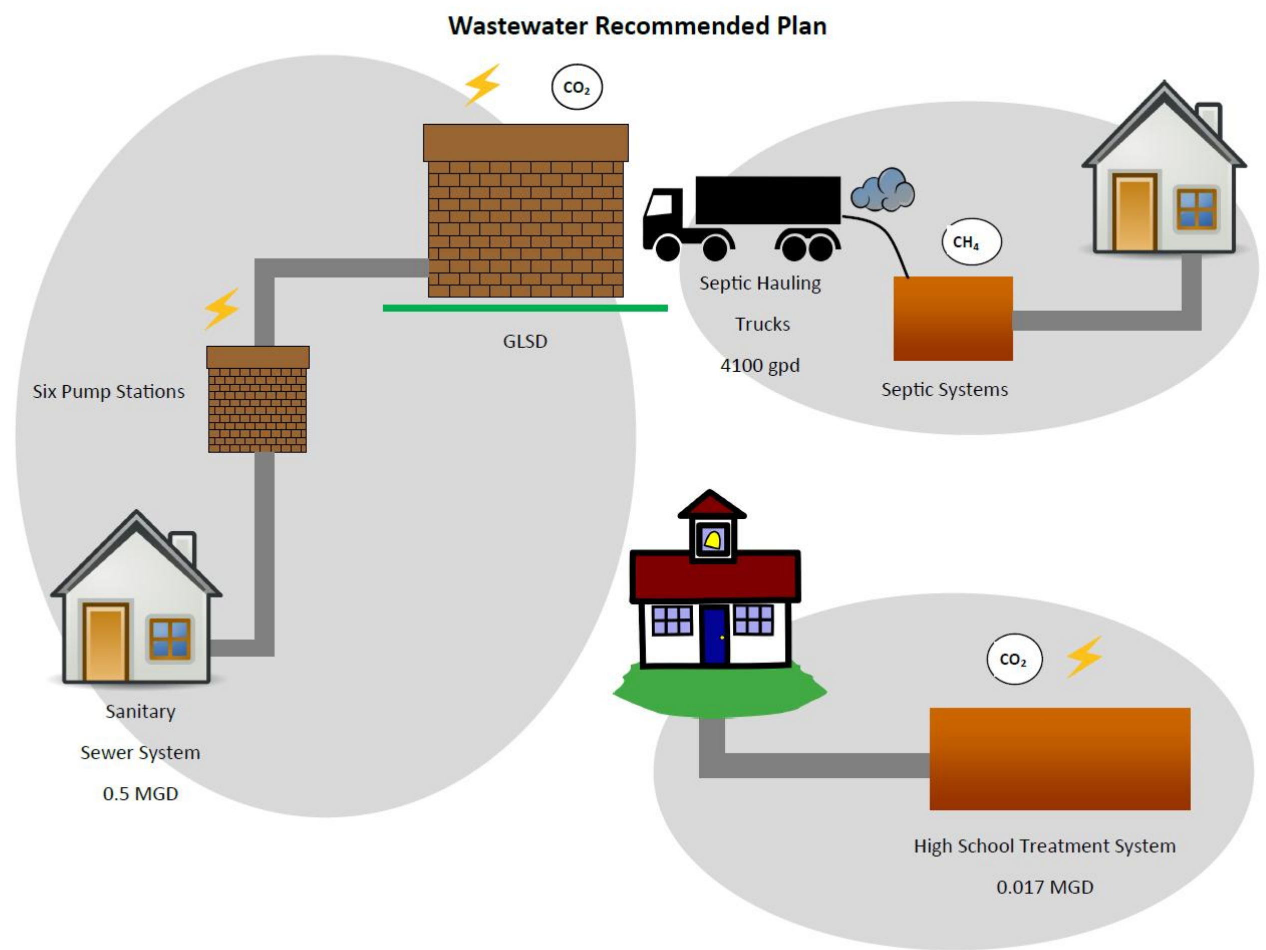


Greenhouse Gases: Wastewater

Baseline (As is)

Emission Source	Emission Type (lbs/day)				Total (lbs/day)
	Treatment Electricity	From Biological Treatment Processes	Hauling Fuel	Methane in CO_2e	
Septic Systems	10.06	47.59	727.33	17,610.12	18,395.28
High School Treatment Facility	121.70	9.85	-	-	131.56
Private Treatment Facilities	183.77	86.96	-	-	270.74
				Total	18,797.58

GHG – Wastewater Recommended



Greenhouse Gases: Wastewater

Emission Source	Emission Type (lbs/day)					Total (lbs/day)
	Treatment Electricity	Operating Electricity	From Biological Treatment Processes	Fuel	Methane in CO_2e	
Septic Systems	7.04	-	33.32	509.25	12327.08	12,876.70
High School Treatment Facility	171.17	-	13.86	-	-	185.04
Pump Stations	-	645.5	-	-	-	645.5
GLSD	846.6	-	400.62	-	-	1247.22
Vehicle Fleet				70.5		70.5
					Total	15,025.01

Recommended Plan – 20% emissions reduction compared to baseline

Greenhouse Gases: Summary

– 20% reduction in GHG emissions from wastewater recommended plan compared to baseline
– 76% reduction in GHG emissions from water recommended plan compared to baseline

Environmental Impacts: Ipswich River

Water Balance in Relation to Ipswich River Basin

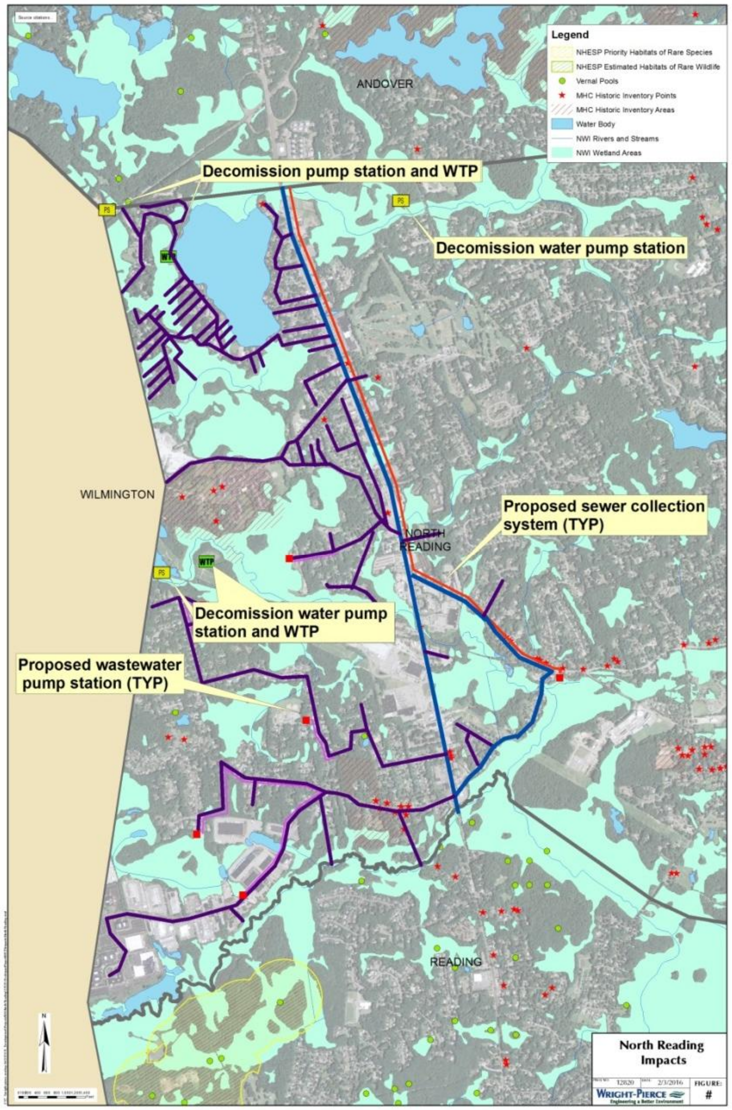
	Existing Conditions	Recommended Plan (Future Conditions)
Sources - Approvals		
Local Source Registration (annual AVG)	0.96 MGD	0.00 MGD
Andover IBTA (Max Day)	1.50 MGD	Emergency Only
MWRA IBTA (Max Day)	0.00 MGD	2.58 MGD
Sources –Withdrawals		
Local Source Registration (annual AVG)	0.52 MGD	0.00 MGD
Andover IBTA (annual AVG)	0.89 MGD	Emergency Only
MWRA: ADD	0.00 MGD	1.60[1] MGD
MDD (IBTA)	0.00 MGD	2.58 MGD
Ipswich River Basin		
Total Withdrawal from Basin	- 0.52 MGD	- 0.00 MGD
Wastewater Generated	+ 1.41 MGD[2]	+ 1.60 MGD[2]
Wastewater Conveyed out of Basin	- 0.00 MGD	- 0.503 MGD[3]
Net Water Change to the Basin	+ 0.89 MGD	+ 1.10 MGD

1. Assumes current well users are added to system, 65 gpcd, 10%UAW, maintain current trends in CEMU and Non-residential use. DEIR includes detailed analysis.
2. Assumes 100% of water use become wastewater discharge.
3. Assumes 0.503 MGD of wastewater is sent to GLSD under recommended plan.

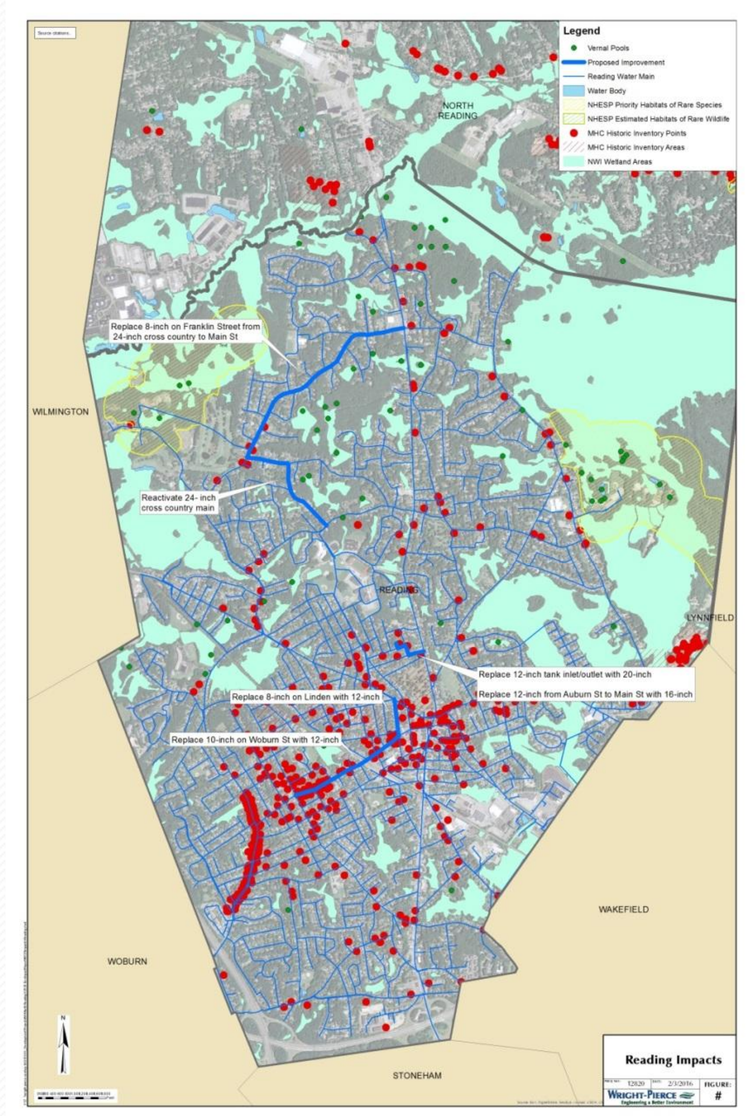
Environmental Impacts & Mitigation:

- Negligible increases in impervious surfaces at pump stations (Approximately 3,000 sqft)
  - Mitigated with BMPs such as onsite detention and treatment.
- Temporary Construction Impacts to wetlands/water resource areas
  - Mitigated by BMPs such as erosion control devices
- Hazardous Materials encountered mitigated through proper soils management
- No anticipated impacts to Endangered Habitats
- No anticipated impacts to Historical Archeological properties
- No anticipated land impacts
- Overall reduction in GHG

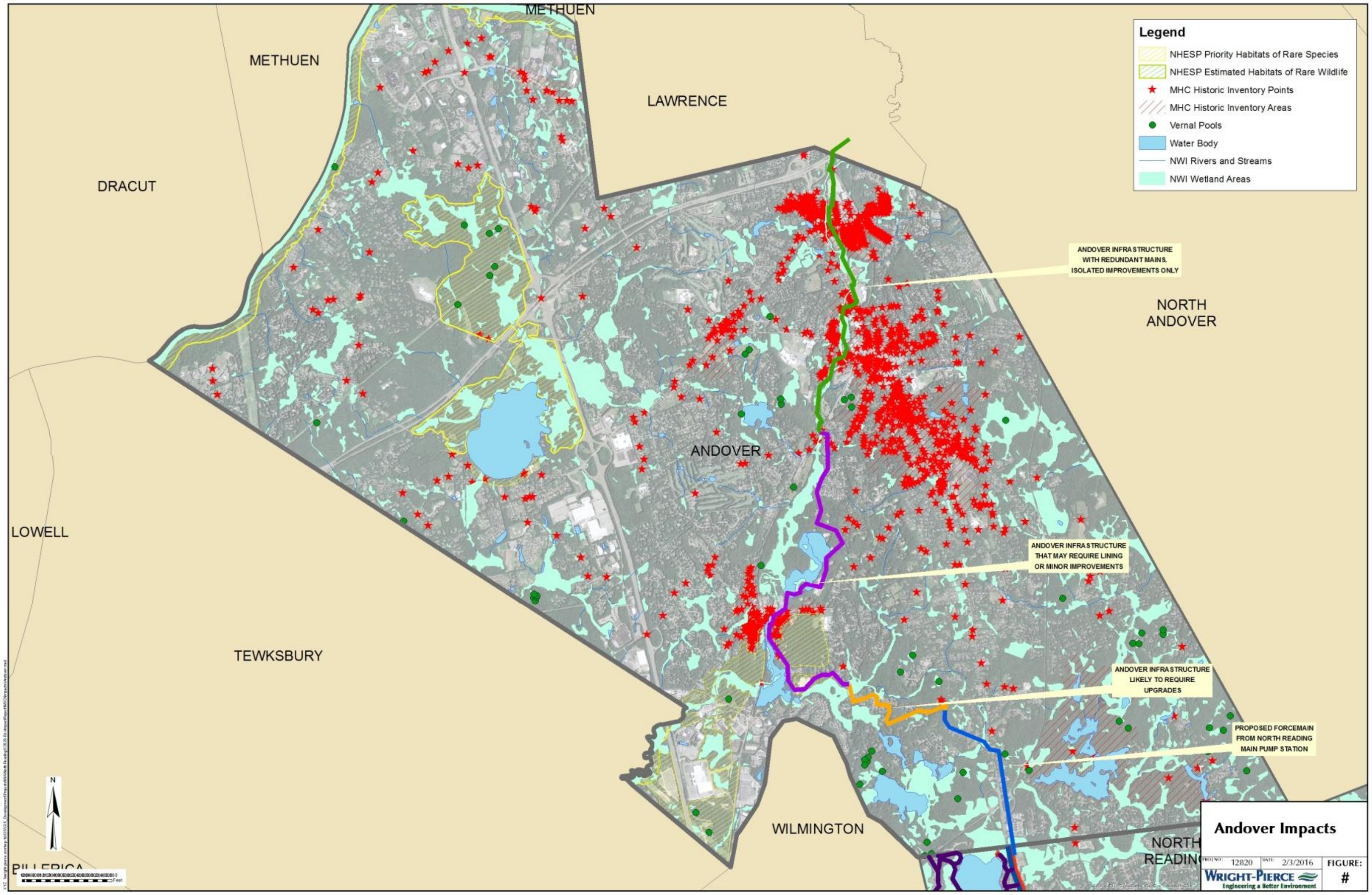
Environmental Impacts: Resource Areas



Environmental Impacts: Resource Areas



Environmental Impacts: Resource Areas



Recommended Plan: Implementation Schedule

- Permitting Phase:
  - IBTA- Following FEIR Certificate
  - IMA with Reading
  - Agreement with MWRA
- Design – Est. June 2016 to June 2017
- Construction – Est. June 2017 to June 2019
- Target Date for MWRA Connection - July 2019
- Decommission water treatment plants/wells

Recommended Plan: Implementation Schedule

- Preliminary: 2017-2019
  - IMA with Andover
  - Agreement with GLSD
- Phase 1 Andover Sewer Improvements
  - Design– 2020 - 2021
  - Construction – 2022 - 2024
- Phase 2 Rt. 28 and Concord Street Sewer, Main PS and FM
  - Design – 2024 - 2025
  - Construction – 2026 - 2028

Recommended Plan: Implementation Schedule (Cont.)

- Phase 3 Rt.62 Area Sewer
  - Design – 2028 - 2029
  - Construction – 2030 - 2031
- Phase 4 Martins Pond Area Sewer
  - Design – 2031 - 2032
  - Construction – 2033 - 2034
- Phase 5 Park St Area Sewer
  - Design – 2031 - 2032
  - Construction – 2033 - 2034

Recommended Plan: Permitting Water

- IBTA/Water Resource Commission
- Massachusetts Environmental Policy Act
- Local approval (planning, zoning, BOH, conservation commission)
- MWRA/OP.10
  - Advisory Board
  - Board of Directors
- MassDEP approval
  - Modification to distribution system
  - Decommissioning/abandonment of current infrastructure

Recommended Plan: Permitting Wastewater

- MassDEP
- Local approval (planning, zoning, BOH, conservation commission)
- Stormwater management - Construction

Meeting Summary

– Reviewed water and wastewater needs and alternatives
– Covered final selected alternatives:
  - Water: MWRA connection through Reading
  - Wastewater
    - In-Town
    - GLSD
  - Implementation schedule, permitting
  - Environmental Impacts

Next Steps

- Submit DEIR
- Public Comment Period
- File FEIR

Questions / Discussion

Appendix C

WRIGHT-PIERCE
Engineering a Better Environment™

North Reading Interbasin Transfer Application
WRC Staff Recommendation

I. Background

On May 11, 1990, the Town of North Reading submitted an application for an increase over the present rate of interbasin transfer. North Reading is proposing to construct a new 12-inch diameter water main in order to purchase additional water from the Town of Andover, which derives its water supply entirely from the Merrimack River basin. The proposed water main will be used in addition to the existing 8-inch water main and will increase the ability of North Reading to transfer water by an additional 1.0 mgd. The water will ultimately be discharged to the Ipswich River basin through on-site septic systems. This application will be judged on this 1.0 mgd alone. The original 0.5 mgd transfer has been in place since 1958, and thus is "grandfathered".

North Reading is projecting water supply deficits of greater than 1.0 mgd by the year 2015, without additional supplies. The Ipswich River Basin Plan, prepared by the Department of Environmental Management (DEM), recommended that the town reactivate the Stickney Well, closed due to volatile organic chemical contamination in 1978, and purchase additional water from Andover in order to meet projected demands.

The Department of Environmental Protection (DEP) has concluded that the Stickney Well is not a viable water supply option at this time. The well has extensive contamination, which will require a permanent treatment plant. This is not economically feasible for the Town unless the costs are able to be recovered from the responsible party through legal action. Even if the well becomes economically viable, it is questionable if it would be environmentally viable under the Water Management Act, as the Ipswich River basin has been identified as a deficit basin in terms of water resource availability, by DEM and the USGS.

On September 10, 1990, after receiving additional information from North Reading, the Water Resources Commission voted that the application was complete. Public hearings were held in North Reading and Andover on October 30, 1990. Public comment was accepted until November 6, 1990.

100 CAMBRIDGE STREET, BOSTON, MA 02202 (617) 727-9800

II. Evaluation of the Proposed Interbasin Transfer

1. This interbasin transfer application was reviewed on its own merits.

2. The staff recommendation is made on facts relevant to the Interbasin Transfer Act and its regulations. Other factors, such as economic hardship, are not pertinent.

3. The staff used guidelines and interpretations which have been in effect for more than 5 years.

III. Recommendation

On December 10, 1990, the Water Resources Commission will discuss the merits of an application submitted by the Town of North Reading, in the Ipswich River basin, to increase its present rate of interbasin transfer through the purchase additional water from the Town of Andover, in the Merrimack River basin.

North Reading meets all of the six applicable criteria required under the Interbasin Transfer Act (Chapter 658, Acts of 1983) provided certain water conservation conditions are met. Because the Town has demonstrated a commitment to meet these conditions, staff for the Water Resources Commission recommends a conditional approval of this application.

IV. Synopsis of Evaluation of Criteria

CRITERION	PROPOSED IBT MEETS CRITERION?
o Criterion 1: MEPA Compliance	Yes
o Criterion 2: Viable Sources	Yes
o Criterion 3: Conservation	Yes, with conditions
o Criterion 4: Watershed Management	Does not apply
o Criterion 5: Reasonable Instream Flow	Yes
o Criterion 6: Ground Water	Does not apply

o Criterion 7: Local Water Resources Plan — Yes

o Criterion 8: Other Transfers — Yes

V. Basis for WRC's Staff Recommendation of Conditional Approval

North Reading has made great efforts in the area of water conservation and source protection. These efforts include:

- The Town is 100% metered, with 92% of all billings from actual meter readings.
- The rate structure was recently changed to an increasing block rate; the minimum use charge was eliminated.
- All Water Department revenues are placed in a dedicated account and used to cover operating and maintenance expenses.
- The Town instituted mandatory water restrictions in the Summer of 1990. There are restrictions on the use of Town water for lawn watering in all new commercial and high density residential developments. Existing facilities and one- and two-family homes are being encouraged to install wells for outside water use.
- The Town has enforcement powers to levy fines under its DEP-approved drought contingency plan.
- Critical aquifer recharge areas have been identified and protected through aquifer protection zoning by-laws, wetland and floodplain overlay districts, and direct purchase. Limited use is allowed in these areas and the zoning regulations are strictly enforced.
- The Town's unaccounted-for water is 12%.

In addition to these actions, North Reading must complete certain additional actions to fully comply with Criterion #3: All practical measures to conserve water have been taken in the receiving area. Specifically:

- North Reading must complete its scheduled leak detection survey.
- North Reading must establish a program of meter replacement or repair. At the present time, meters are serviced only if a customer complains of erroneous readings.
- All public buildings need to be retrofit with water saving devices.
- A program to provide residential retrofit devices was instituted in 1984, but was not successful. A more effective residential retrofit program must be instituted.

Throughout the application process, Town officials have expressed a willingness to respond to the above mentioned deficiencies. Their application for a leak detection grant was awarded by DEP in August 1990. A second system-wide leak detection survey is scheduled to begin in Spring 1991, to be completed in December 1991. The Town's goal is to begin to replace all existing residential meters with externally-read meters in FY 1991. The Town also is proposing to readvertise the availability of residential retrofit devices, giving them away free of charge.

Therefore Staff recommends that approval of this interbasin transfer application be conditional upon the completion of the following points:

- Provide evidence that the proposed leak detection survey has been completed and that all leaks have been repaired. Provide evidence that additional surveys of the entire system will be conducted every 4-5 years as planned.

- Institute a formal meter replacement/repair program. Provide a schedule of the work to be completed and evidence of the Town's ability to conduct this work.

- Retrofit the police and fire department buildings with water saving devices. Consult with MWRA to determine the type of residential retrofit program that will be most effective for North Reading and implement this program.

VI. Reasonable Streamflow

It is the judgement of the staff that this transfer will not have a significant effect on the instream flow of the Merrimack River and that reasonable instream flows will be maintained. On the lowest flow day of the drought of record, a transfer of the maximum proposed amount (1.0 mgd) would only result in a 0.70% (less than one percent) decrease in streamflow. (See Table). Additionally, Andover's withdrawals are governed by the flow releases required under the Lawrence Hydroelectric Associates FERC license. This requires that 615 mgd (951 cfs) be released from the dam directly downstream of Andover's intake. The Town of Andover does not withdraw water from the Merrimack when it approaches this level.

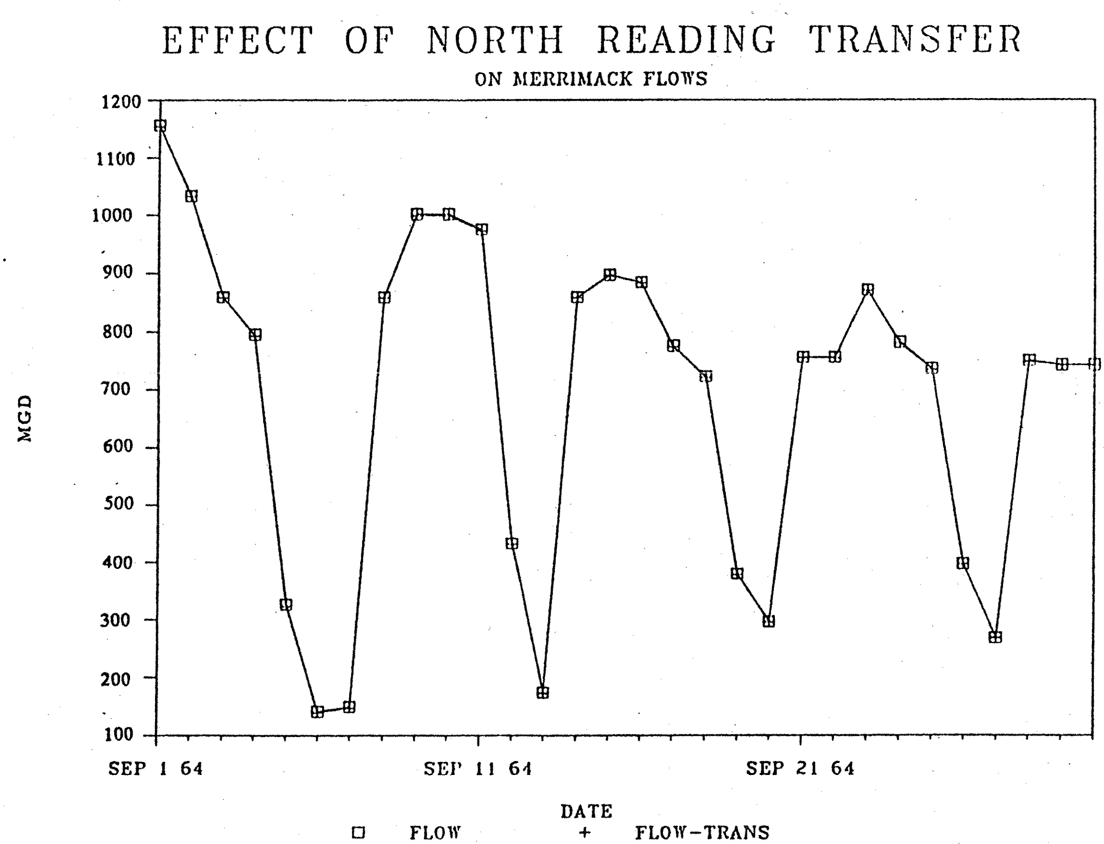
When the basin plan for the Merrimack River basin is formulated, a minimum streamflow threshold which takes all water uses into account will be developed. This will occur in 1995.

MERRIMACK RIVER
WITHDRAWAL AS PERCENT OF FLOW

PERIOD OF TRANSFER	MGD	MAXIMUM INCREASE (1.0 MGD)	AVERAGE INCREASE (0.10 MGD)
AVERAGE FLOW	3,421	0.03%	<0.01%
MAY	7,536	0.01%	<0.01%
JUNE	3,785	0.03%	<0.01%
JULY	2,112	0.05%	<0.01%
AUGUST	1,714	0.06%	<0.01%
SEPTEMBER	1,960	0.05%	<0.01%

HIGHEST PERCENT TRANSFER ON A GIVEN DAY FOR THE PERIOD OF RECORD (SEPT 6, 1964): 142 MGD 0.70%

PROPOSED HYDRAULIC CAPACITY OF THE NEW PIPE FROM ANDOVER: 1.0 MGD
AVERAGE TRANSFER: 0.10 MGD
MAXIMUM TRANSFER: 1.5 MGD (ASSUMES EXISTING 0.5 MGD TRANSFER + 1.0 MGD INCREASE)



The volume to be transferred is too small to be depicted on a graph of this scale.

INTERBASIN TRANSFER ACT
CRITERIA FOR EVALUATING AN APPLICATION
APPLICATION BY THE TOWN OF NORTH READING TO TRANSFER WATER FROM THE TOWN OF ANDOVER

CRITERION #1 An environmental review pursuant to MGL, c.30, ss 61 and 62H, inclusive has been complied with for the proposed IBT.

On January 11, 1990 the Town of North Reading, through its consultant, CDM, contacted the MEPA unit to determine what requirements under the Massachusetts Environmental Policy Act would need to be satisfied before this project could be carried out. The MEPA unit determined, in a letter dated February 12, 1990, that MEPA compliance is not required for this project.

CRITERION #2 All reasonable efforts have been made to identify and develop all viable sources in the receiving area of the proposed interbasin transfer.

The Town has investigated the following in-basin sources:

<u>Reactivation of the Stickney Well</u>: This well was closed in December 1978 due to the presence of volatile organic compounds in excess of drinking water standards. The well's estimated dependable yield was 0.54 mgd. According to DEP, this is not a viable source at this time. Potentially responsible parties have been identified and cost recovery procedures are underway. However, the well has been damaged through vandalism and Iron and Manganese clogging. The well will need to be replaced. It could only be operated at reduced capacity. Any reactivation of this well would be subject to the Water Management Act. A careful evaluation of its pumping effects on nearby Reading Wells and the entire Ipswich basin would have to be completed before it could come back on line.

<u>Installation of additional wells in sand and gravel aquifers</u>: The Town has explored for water extensively within its borders. Approximately 200 test wells have been drilled, without result. The USGS has determined that the existing water supply development is in excess of safe yield (USGS Water Supply Paper No. 1694).

<u>Installation of bedrock wells</u>: Through the limited work in the field of bedrock well development in North Reading, it has been determined that such wells would provide only very low yield. Additionally, DEP will not approve bedrock wells for municipal water supply if other options exist. Therefore this option has not been actively pursued.

Surface water development at Mill Meadow: A reservoir at this site was studied in the 1960's. This reservoir would have been filled by pumping Ipswich River water. For this project to be completed today, the wetlands at Mill Meadow would have to be flooded. It also would cause additional stress to the already stressed Ipswich River, and might not be permitted under the Water Management Act. The project, if able to overcome these environmental problems, would be quite expensive ($10-$15 million 1993 dollars) and have a low cost/benefit ratio.

Purchase of water from neighboring communities in-basin: As stated in the WRC-approved Ipswich River Basin plan, the communities within the Ipswich River basin are stressed, with many facing potential water shortages. Others have supplies that are only marginally adequate for their needs.

CRITERION #3 All practical measures to conserve water have been taken in the receiving area, including but not limited to the following:

CONSERVATION MEASURE	DEP/MWRA RECOMMENDATIONS	NORTH READING ACCOMPLISHMENTS
Leak Detection	Entire system surveyed every two years.	Received confirmation of leak detection award from DEP in August 1990. Will begin second system-wide leak detection survey in Spring 1991, to be completed by December 1991. Last leak detection survey was completed in 1983. Minimal leaks were found and fixed, saving the Town approximately 0.02 mgd. The Town plans to conduct a leak detection study every 4-5 years with the frequency adjusted based on the annual computation of unaccounted -for water. Currently the Town's unaccounted-for water is 12%.

Metering	100% of system metered. Test all meters over 10 years old.	100% of system metered. 92% of all billings are based on actual readings; 8% are estimated. No formal program of meter replacement and repair. The Town's goal is to begin converting all existing residential meters with externally read meters in FY 1991.
	Quarterly meter readings.	Residential meters are read twice a year.
Rate Structure which reflects and encourages conservation.	Full cost / No decreasing block rate.	Increasing block rate; true cost pricing, informal Enterprise Account, covers all costs related to operating, maintaining and improving the water supply system. Recent (Spring 1988) pricing change to eliminate the minimum use charge.
Public Information Program	Bill stuffers.	Advertises conservation measures in newspaper. Annual voluntary water restrictions up until Summer 1990, when they became mandatory. Restriction on the use of Town water for lawn watering in new commercial and high density residential developments. The Town has been encouraging existing facilities and single family homes to install their own wells for outside water use.
Drought Contingency Plan		Completed contingency plan under DEP WMA regulations. The Town has enforcement powers, including the power to levy fines.

Implement land use controls for sources in the receiving area that meet the requirements DEP regulations 310 CMR 22.20.		Have identified and protected critical aquifer recharge areas through aquifer protection zoning by-laws, wetland and floodplain overlay districts, and direct purchase. Allow limited use and strictly enforce the zoning regulations.
Plumbing fixtures	Enforce state plumbing code/ retrofit public buildings with water saving devices / make retrofit devices available at cost if residential GPCD is over 80.	State plumbing code is enforced. All public buildings, but the police and fire department buildings, have been retrofit with water saving devices. Residential GPCD is 72; retrofit devices were made available to residential customers in 1984; program was not successful. The Town is proposing to readvertise the availability of these devices and give them away free of charge.

CRITERION #4 Forestry management program: not applicable to this project.

CRITERION #5 Reasonable instream flow in the river from which the water is transferred is maintained.

A preliminary minimum streamflow is being developed by OWR. It will be refined during the River Basin planning process. North Reading also has an agreement with Lawrence Hydroelectric Associates (LHA) which states that the Town will compensate LHA ($10/million gallons) for all withdrawals made when the river's flows are less that 12,000 cfs.

CRITERION #6 Ground water criterion; not applicable to this project.

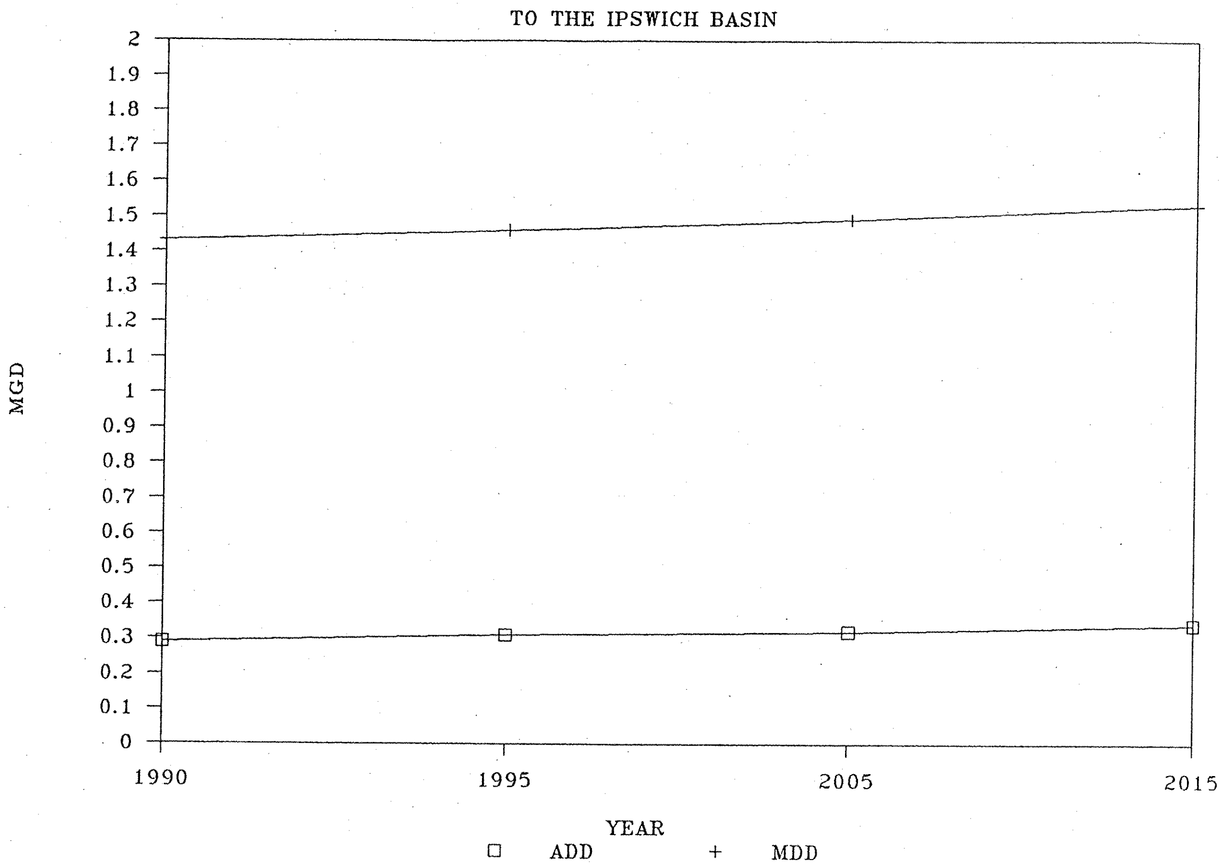
CRITERION #7 Communities have adopted or are actively engaged in developing a local water resources management plan.

North Reading has completed both a Municipal Water Supply questionnaire and a conservation plan. Additionally, DEM has completed a river basin plan for the Ipswich River basin, the receiving basin.

CRITERION #8 The Commission shall consider the impacts of all past, authorized or proposed transfers in the donor basin.

The Water Resources Commission recognizes the need for cooperation with the State of New Hampshire on all matters affecting the quality and quantity of the Merrimack River. The EPA's Merrimack River Initiative, is a good first step at coordinating interstate issues. Through the Initiative and the river basin planning program, we will continue to work closely with New Hampshire. The State of Massachusetts takes upstream transfers into account through readings at the USGS gage on the Merrimack River below the Concord River, the first gage downstream from the New Hampshire/Massachusetts border. At the present time, no other proposals for interbasin transfers are known to the Commission.

TRANSFERS FROM THE MERRIMACK BASIN



CONCERNS RAISED THROUGH PUBLIC AND AGENCY COMMENT REGARDING THE NORTH READING/MERRIMACK RIVER INTERBASIN TRANSFER APPLICATION

- That North Reading will close its existing wells. This issue is addressed in the November 6, 1990 letter from CDM.

- North Reading's conservation plan is not adequate or in place. Additional information on North Reading's conservation program has been received (November 6th CDM letter).

- North Reading would sell water to Ipswich basin neighbors during emergencies.

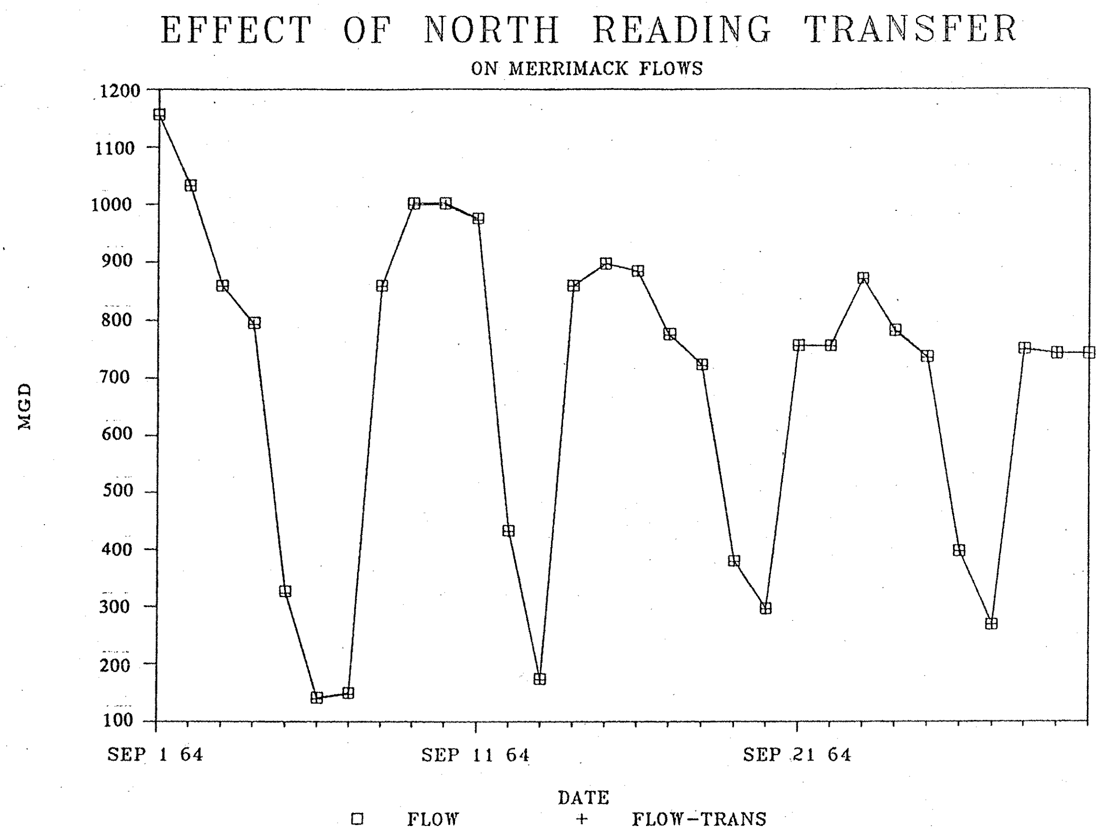
- Lack of Merrimack River basin plan and Water Management Act permitting.

- Can the intake be retrofitted in the future if necessary to address entrainment concerns? (Fisheries restoration program) Can it be done now?

- Currently, North Reading's wells often clog with Iron and Manganese when they are used at full capacity under stressed conditions.

- Transferring water from the Merrimack to the Ipswich basin could improve conditions within the Ipswich River basin.

- What are the prospects of the Stickney Well being reactivated and permitted under the Water Management Act?



The volume to be transferred is too small to be depicted on a graph of this scale.

North Reading Interbasin Transfer Application
WRC Decision

I. Decision

On January 14, 1991, the Water Resources Commission voted on an application submitted by the Town of North Reading, in the Ipswich River basin, to increase its present rate of interbasin transfer through the purchase of up to an additional 1.0 mgd of water from the Town of Andover in the Merrimack River basin.

The WRC voted unanimously (8-0) to approve the application provided that the Town furnish proof that it has completed the conservation measures described herein, thus fully complying with the Interbasin Transfer Act (Chapter 658, Acts of 1983).

II. Background

On May 11, 1990, the town of North Reading submitted an application for an increase over the present rate of interbasin transfer. North Reading is proposing to construct a new 12-inch diameter water main in order to purchase additional water from the Town of Andover, which derives its water supply entirely from the Merrimack River basin. The proposed water main will be used in addition to the existing 8-inch water main and will increase the ability of North Reading to transfer water by an additional 1.0 mgd. The water will ultimately be discharged to the Ipswich River basin through on-site septic systems. The Town currently purchases up to 0.5 mgd. This transfer has been in place since 1958, and thus is "grandfathered".

North Reading is projecting water supply deficits of greater than 1.0 mgd by the year 2015, without additional supplies. The Ipswich River Basin Plan, prepared by the Department of Environmental Management (DEM), recommended that the town reactivate the Stickney Well, closed due to volatile organic chemical contamination in 1978, and purchase additional water from Andover in order to meet projected demands.

The Department of Environmental Protection (DEP) has concluded that the Stickney Well is not a viable water supply option at this time. The well has extensive contamination, which will require a permanent treatment plant. This is not economically feasible for the Town unless the costs are able to be recovered from the responsible party through legal action. Even if the well becomes economically viable, it is questionable if it would be environmentally viable under the Water Management Act, as the Ipswich River basin has been identified as a deficit basin in terms of water resource availability, by DEM and the USGS.

On September 10, 1990, after receiving additional information from North Reading, the Water Resources Commission voted that the application was complete. Public hearings were held in North Reading and Andover on October 30, 1990. Public comment was accepted until November 6, 1990.

III. Evaluation of the Proposed Interbasin Transfer

1. This interbasin transfer application was reviewed on its own merits.

2. The decision was made on facts relevant to the Interbasin Transfer Act and its regulations. Other factors, such as water need or economic hardship, are not pertinent.

3. The WRC used guidelines and interpretations which have been in effect for more than 5 years.

IV. Synopsis of Evaluation of Criteria

CRITERION	**PROPOSED IBT MEETS CRITERION?**
o Criterion 1: MEPA Compliance	Yes
o Criterion 2: Viable Sources	Yes
o Criterion 3: Conservation	Yes, with conditions
o Criterion 4: Watershed Management	Does not apply
o Criterion 5: Reasonable Instream Flow	Yes
o Criterion 6: Ground Water	Does not apply

o Criterion 7: Local Water Resources Plan — Yes

o Criterion 8: Other Transfers — Yes

V. Basis for WRC's Decision of Conditional Approval

North Reading meets all of the six applicable criteria required under the Interbasin Transfer Act (Chapter 658, Acts of 1983) provided certain water conservation conditions are met. North Reading has made great efforts in the area of water conservation and source protection. These efforts include:

- o The Town is 100% metered, with 92% of all billings from actual meter readings.
- o The rate structure was recently changed to an increasing block rate; the minimum use charge was eliminated.
- o All Water Department revenues are placed in a dedicated account and used to cover operating and maintenance expenses.
- o The Town instituted mandatory water restrictions in the summer of 1990. There are restrictions on the use of town water for lawn watering in all new commercial and high density residential developments. Existing facilities and one- and two-family homes are being encouraged to install wells for outside water use.
- o The Town has enforcement powers to levy fines under its DEP-approved drought contingency plan.
- o Critical aquifer recharge areas have been identified and protected through aquifer protection zoning by-laws, wetland and floodplain overlay districts, and direct purchase. Limited use is allowed in these areas and the zoning regulations are strictly enforced.
- o The Town's unaccounted-for water is 12%.

In addition to these actions, North Reading must complete certain additional actions to fully comply with Criterion #3: All practical measures to conserve water have been taken in the receiving area. Specifically:

- o North Reading must complete its scheduled leak detection survey.
- o North Reading must establish a program of meter replacement or repair. At the present time, meters are serviced only if a customer complains of erroneous readings.
- o All public buildings need to be retrofit with water saving devices.
- o A program to provide residential retrofit devices was instituted in 1984, but was not successful. A more effective residential retrofit program must be instituted.

Throughout the application process, Town officials have expressed a willingness to respond to the above mentioned deficiencies. Their application for a leak detection grant was awarded by DEP in August 1990. A second system-wide leak detection survey is scheduled to begin in Spring 1991, to be completed in December 1991. The Town's goal is to begin to replace all existing residential meters with externally-read meters in FY 1991. On December 10,1990, the Commission received verbal notice from the Town that all public buildings had been retrofit with water saving devices. The Town also is proposing to readvertise the availability of residential retrofit devices, giving them away free of charge.

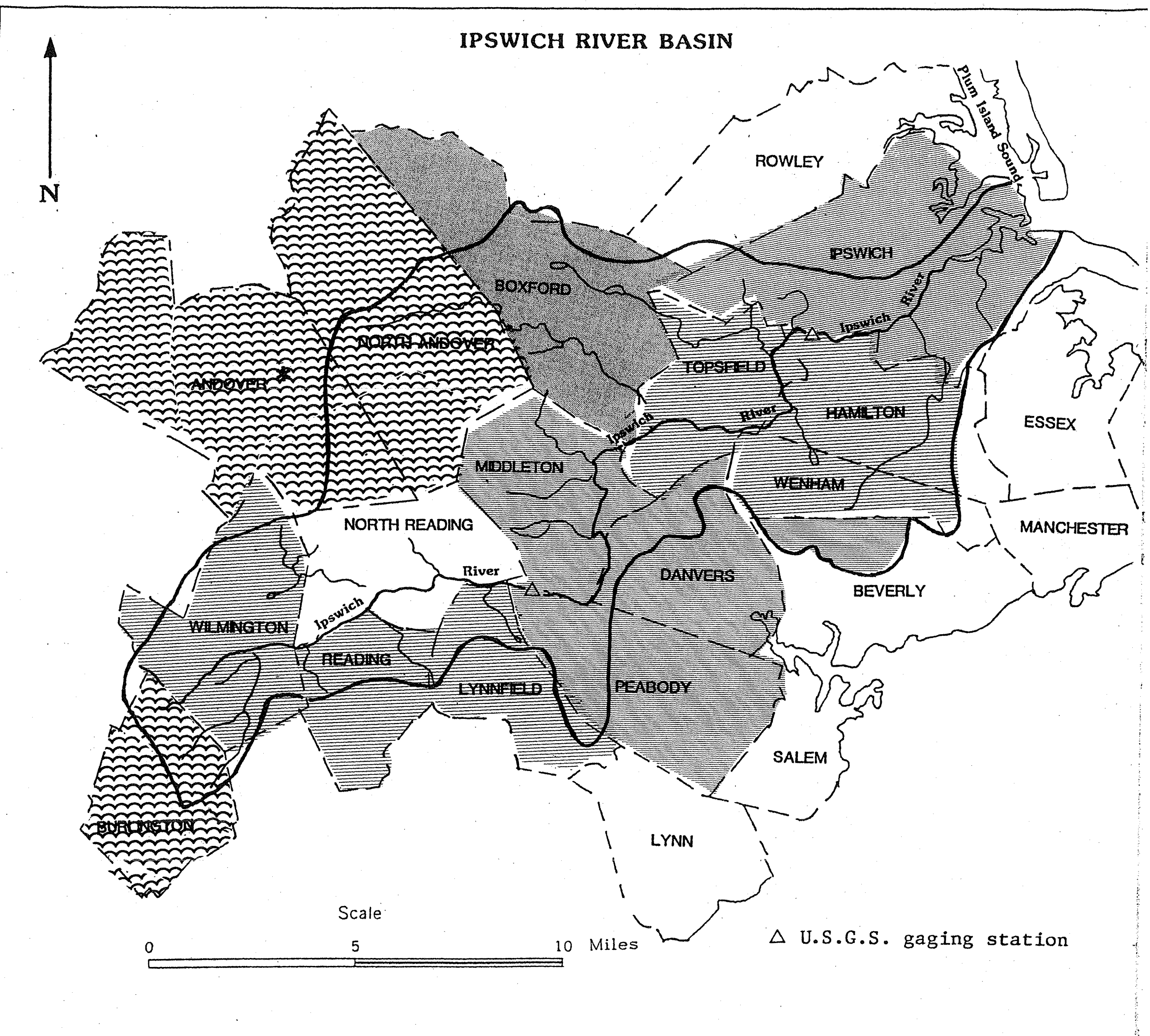
Therefore approval of this interbasin transfer application is conditional upon the completion of the following points:

- Provide evidence that the proposed leak detection survey has been completed and that all leaks have been repaired. Provide evidence that additional surveys of the entire system will be conducted every 4-5 years as planned.
- Institute a formal meter replacement/repair program. Provide a schedule of the work to be completed and evidence of the Town's ability to conduct this work.
- Provide documentation that the police and fire department buildings have been retrofit with water saving devices. Consult with MWRA to determine the type of residential retrofit program that will be most effective for North Reading and implement this program.

VI. Reasonable Instream Flow

It is the judgement of the commission that this transfer will not have a significant effect on the instream flow of the Merrimack River and that reasonable instream flows will be maintained. On the lowest flow day of the drought of record, a transfer of the maximum proposed amount (1.0 mgd) would only result in a 0.70% decrease in streamflow. Additionally, Andover's withdrawals are governed by the flow releases required under the Lawrence Hydroelectric Associates FERC license. This requires that 615 mgd (951 cfs) be released from the dam directly downstream of Andover's intake. The Town of Andover does not withdraw water from the Merrimack when it approaches this level.

When the basin plan for the Merrimack River basin is formulated, a reasonable instream flow threshold, which takes all water uses into account, will be developed. This will occur in 1995.



Deficit Communities

No Excess Capacity

No Sources In-Basin

No Public Supply

Appendix D

WRIGHT-PIERCE
Engineering a Better Environment

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program
2010 Public Water Supply Annual Statistical Report
Reporting Year 2010

PWSID#: 3213000
Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

System Information (COM/NTNC)

1. PWS Street Address

NORTH READING WATER DEPT.
PWS Name

235 NORTH STREET
PWS Street Address Line 1

PWS Street Address Line 2

NORTH READING
City/Town

Massachusetts
State

01864
Zip Code

978-357-5246
Phone Number

978-664-1713
Fax Number (if available)

HTTP://WWW.NORTHREADINGMA.GOV
Web Site Address of PWS (if available)

2. PWS Mailing Address Same as street address

NORTH READING WATER DEPT.
Mailing Name

235 NORTH STREET
Mailing address Line 1

Mailing address Line 2

NORTH READING
City/Town

Massachusetts
State

01864
Zip Code

3. Is this a Seasonal System? (This question is not applicable to your PWS)

4. Owner Information:

Owners Name (if not municipal):

Phone Number

This is a new owner

5. Primary Contact:

MARK E
CLARK
Name (First, Middle Int, Last) • one name only•

978-664-6046
Phone Number

This is a new contact

mclark@northreadingma.gov
Email Address (For Emergency Purposes)

6. Certified Drinking Water Operators employed by the PWS:

Name			Grade	License Number	Primary Operator	Delete
MICHAEL		GREENOUGH	D2/T2	5707/7577		
ROBERT	E	DUNN	D2/T2	5447/5682		
KEITH	W	ELLIS	D2/T2	8882/8881		
MARK	E	CLARK	D4/T4	2519/2717		
MARTIN	G	DAUPHINEE	D2	8332		
JAMES	F	VIGNEAU	D2/T2	11836/11837		

To add an operator, enter a license # in the field below and then click the "Add Operator" button.

License Number: Add Operator

7. Primary Certified Operator Contact Information: (5707/7677)

MICHAEL GREENOUGH	978-664-6071	978-664-1712
Name	Phone Number	Fax Number
255 NORTH STREET		
Mailing Address 1	Mailing Address 2	

NORTH READING	Massachusetts	01864	mgreenough@northread
Town/City	State	Zip Code	E-Mail Address

If you use a contract certified operator, does your system have a signed Public Water System Certified Operator Compliance Notice approved by the DEP

N/A Yes No

8. Names of Water Commissioners/Selectmen/Trustees/Association Board Members (if applicable). Please attach an organizational chart, if available. Check here to upload

Name			Phone	Title
GREG	L	BALUKONIS	978-357-5210	TOWN ADMINISTRATO
RICHARD	M	CARNEVALE	978-357-5227	DPW DIRECTOR
STEPHEN	A	CASAZZA	978-357-5260	CHAIR - WATER COMM

Add Person

9. Owner Type:
MUNICIPAL

Federal Employment Identification Number (FEIN):
046001248
(FEIN) - Do NOT provide SSN

10. Is this system a not-for-profit organization

Yes No

If yes, indicate Tax Exempt code (e.g., 501C): MGL CH64H

11. Population Served(DailyAverage):

Winter Population (October March): 14906
Summer Population (April September): 14906
By what method was the population figured — Census Type: City/Town Annual
Other Description:

12. Testing requirements for lead and copper and bacteria in your system is based on the population .

	Number of Samples	Frequency of Samples
Lead and copper samples required:	30	3YEARS
Winter Bacteria samples required:	15	MONTH
Summer Bacteria samples required:	15	MONTH

13. **Distribution Meter information:**

a. Number of Service Connections: 4819
b. Percentage of service connections that are metered: 100 %
c. Are all publicly owned buildings metered? Yes No N/A
d. If No, what percent are %

14. System Information

a. Number of Distribution Systems: 1
b. Finished Water Storage Capacity in Million Gallons (MG): 3.3
[Conversion factor is (# of gallons)/(1,000,000)= MG]
c. Pumping Capacity (GPM): 1150

15. Percentage of Source Types (must add up to 100%)

Ground Water	Surface Water	Purchased Ground	Purchased Surface
36 %	0 %	0 %	64 %

16. Emergency Response Actions:

a. Has your system completed an Emergency Response Plan (ERP).(DO NOT submit your ERP to MassDEP. MassDEP will review the ERP during your next sanitary survey.)

Yes No

I have made changes to the ERP.
I have made no changes to the ERP.

b. Does your system have an Emergency Response (ER) annual training plan

Yes No

If Yes, please attach a copy of the plan. Describe the training performed during the reporting period, including the types of training, the date(s) of training, and number of staff and local officials trained on each date and their job titles.

c. Is your system registered for the Health and Homeland Alert Network (HHAN)

Yes No

d. Has your system signed the agreement and joined the Massachusetts Water and Wastewater Agency Response Network

Yes No

e. How often does your system test the following

Alarms:	Monthly	Other Frequency:	
Interlocks:	Monthly	Other Frequency:	
Back-up power sources:	Other	Other Frequency:	WEEKLY

f. List and describe all Level 3 or higher ER incidents during the reporting period.

Date of ER incident	Level	Description
Add Incident		

17. Do you have an antenna or other appurtenance (not needed for drinking water purposes) attached to any of your storage tank(s)

Yes No No storage tanks

If Yes, list the antennae or other appurtenances, owner(s) names, and the date installed:

Storage Tank Name	Antennae or Appurtenance	Owner Name	Date (mm/dd/yyyy) Installed
	FIRE DEPARTMENT CO	NR FIRE DEPARTMETN	7/1/1994
	CELLULAR PHONE AN	T-1 MOBILE	7/1/2005

Add Attachment

18. Comments or additional information regarding this section:

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program
2010 Public Water Supply Annual Statistical Report
Reporting Year 2010

PWSID#: 3213000
Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

1. Cross Connection Program Coordinator
Please select one of the following

Keep current coordinator and update if needed
Remove current Coordinator and add new coordinator information referencing a MassDEP Certification ID.
Remove current Coordinator and add a new Coordinator by typing into the fields.

MARK	CLARK	
Coordinator First Name	**Coordinator Last Name**	
MassDEP Certification ID #	**Expiration Date**	
235 NORTH STREET		
Coordinator Street Address Line 1	**Coordinator Street Address Line 2**	
NORTH READING	Massachusetts	01864
City/Town	**State**	**Zip Code**
978-664-6046	978-664-1713	
Phone Number	**Fax Number (if available)**	
MCLARK@NORTHREADINGMA.GOV		
Coordinator email		

Surveyor Personnel Information :
To add a surveyor, enter the certification ID # in the field below and then click the "Add Surveyor" button.
MassDEP Certification ID Number

Add Surveyor

Tester Personnel Information :
To add a Tester enter the certification ID # in the field below and then click the "Add Tester" button.
MassDEP Certification ID Number

Add Tester

2. Did your system use the services of a third party/consultant for the implementation of your Cross-connection Control Program or a portion of i

Yes No

If Yes, Please provide :

Update Insert

RICHARD	HARRIS	AAA BACKFLOW
Contact First Name	**Contact Last Name**	**Doing Business As (Company/Individual Name)**
4 MEADE ROAD		
Consultant Street Address Line 1	**Consultant Street Address Line 2**	
NORTH READING	Massachusetts	01864
City/Town	**State**	**Zip Code**
978-664-1941		
Phone Number	**Fax Number (if available)**	
Consultant email		

Third Party Consultant Surveyor Personnel Information:
To add a surveyor, enter the certification ID # in the field below and then click the "Add Surveyor" button.
MassDEP Certification ID Number 3326

Add Consultant Surveyor

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program
2010 Public Water Supply Annual Statistical Report
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PWSID#: 3213000
Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Purchased Water Sources

Individual Purchased Water Source Statistics

Source ID: 3213000-01P
Source Name: ANDOVER SUPPLY
Location: MAIN STREET (ROUTE 28) AND CENTRAL STREET (GOULD ROAD)
Seller ID# (PWS ID): 3009000
Seller Name: ANDOVER WATER DEPT
Status: A
Source Availability: ACTIVE
Comments:

Withdrawal Units: MG
January: 17.280000
February: 15.452000
March: 19.554000
April: 26.654000
May: 40.323000
June: 43.092000
July: 36.470000
August: 29.876000
September: 34.679000
October: 23.874000
November: 17.356000
December: 18.251000
Total Amount Pumped: 322.971000
Total # of Days Pumped: 365

Source Metered: Yes *This is a Required field
Date of Meter Installation: 10/1/1995
Type of water metered for source: FINISHED
Last Meter Calibration: 9/15/2010

Maximum Single Day Pumped Volume: 1.751000
Date of Maximum Amount Pumped: 7/3/2010

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PWSID#: 3213000
Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Purchased Water Sources

Individual Purchased Water Source Statistics

Source ID: 3213000-01P
Source Name: ANDOVER SUPPLY
Location: MAIN STREET (ROUTE 28) AND CENTRAL STREET (GOULD ROAD)
Seller ID# (PWS ID): 3009000
Seller Name: ANDOVER WATER DEPT
Status: A
Source Availability: ACTIVE
Comments:

Withdrawal Units: MG

January:	17.280000
February:	15.452000
March:	19.554000
April:	26.654000
May:	40.323000
June:	43.092000
July:	36.470000
August:	29.876000
September:	34.679000
October:	23.674000
November:	17.356000
December:	18.251000
Total Amount Pumped:	322.971000
Total # of Days Pumped:	365
Maximum Single Day Pumped Volume:	1.751000
Date of Maximum Amount Pumped:	7/3/2010

Source Metered: Yes *This is a Required field.
Date of Meter installation: 10/1/1995
Type of water metered for source: FINISHED
Last Meter Calibration: 9/15/2010

Massachusetts Department of Environmental Protection
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PWSID#: 3213000
Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Water Production & Consumption Information

Volume Units Gallons (GAL) Million Gallons (MG)

FINISHED Water Production and Consumption Summary for Last Year :

Month	(1) Amount of **finished** water from own sources (MG)	(2) Amount of **finished** water purchased from other systems (MG)	(3) Amount of **finished** water sold to other systems (MG)	(4) Net **finished** Water that entered your distribution system (1) + (2) - (3)= (4) (MG)
January	17.206	17.280	0.000	34.455
February	15.003	15.452	0.000	30.455
March	14.460	19.854	0.000	34.314
April	6.475	26.654	0.000	35.129
May	9.112	40.323	0.000	49.435
June	6.758	40.092	0.000	51.85
July	17.177	36.470	0.000	53.647
August	15.431	29.876	0.000	45.307
September	12.329	34.679	0.000	47.008
October	15.319	23.674	0.000	38.993
November	16.973	17.366	0.000	34.339
December	15.311	18.251	0.000	36.562
TOTAL	169.554	322.971	0	491.525

Maximum Daily Finished Water Consumption: Volume (MG): 2.424 Date: 7/1/2010

RAW Water Production and Consumption Summary for Last Year :

Same as finished water (it is not necessary to complete Table if same volume as above)

Month	(1) Amount of **raw water** pumped from own sources (MG)	(2) Amount of **raw water** purchased from other systems (MG)	(3) Amount of **raw water** sold to other systems (MG)	(4) Net **raw** Water Consumption (1) + (2) - (3) = (4) (MG)
January	18.417	17.280	0.000	35.697
February	16.101	15.452	0.000	31.553
March	15.652	19.854	0.000	35.506
April	9.026	26.654	0.000	35.68
May	9.684	40.323	0.000	50.007
June	9.358	40.092	0.000	52.45
July	18.538	36.470	0.000	55.008
August	16.686	29.876	0.000	46.562
September	13.621	34.679	0.000	48.3
October	16.549	23.674	0.000	40.223
November	18.344	17.366	0.000	35.71
December	19.769	18.251	0.000	38.02
TOTAL	181.745	322.971	0	504.715

Maximum Daily Raw Water Pumping: Volume (MG): 2.469 Date: 7/1/2010

Summary of Water Sold

Sold Water

System Name	PWS ID#	Total Volume Sold (MG)	Water type

Metered Finished Water Consumption by Service Type

U.S. EPA requires every PWS to report what their water is used for in order to characterize each system. In this table, report the percentages of metered water for each category below, ONLY for those categories over 10%. For municipal water suppliers, most of the water will be reported as Residential Area. If any other categories are more than 10% of your metered use, report it in the appropriate category. If any category is less than 10%, do NOT report it. The precentage do NOT have to add to 100%, since water use in some categories will be less than 10% and therefore is not reported.

ONLY report uses for categories over 10% of total metered use. Report ALL metered water use in the Water Management Distribution System Form (if appropriate)

%	Primary Service Area	Type	%	Primary Service Area	Type
	Yes	Day Care Center		Yes	Other Residential
	Yes	Dispenser		Yes	Other Transient
	Yes	Homeowners Association		Yes	Recreation Area
	Yes	Hotel/Motel	70	Yes	Residential Area
	Yes	Highway Rest Area		Yes	Restaurant
	Yes	Industrial/Agricultural		Yes	Retail Employees
	Yes	Interstate Carrier		Yes	School
	Yes	Institution		Yes	Sanitary Improvement District
	Yes	Medical Facility		Yes	Summer Camp
	Yes	Mobile Home Park		Yes	Secondary Residences
	Yes	Mobile Home Park, Principal Residence		Yes	Service Station
	Yes	Municipality		Yes	Subdivision
	Yes	Other Area		Yes	Water Bottler
	Yes	Other Non-Transient Area		Yes	Wholesaler

Summary of Treatment Plant Losses (complete only if finished water volume is less than raw water)

☐ No treatment plant losses (not applicable)

Treatment PlantID:	Total Raw Water into treatment plant last year (raw pumped + raw purchased - raw sold):	-	Total Finished Water from treatment plant last year:	=	Total Water Lost to Treatment Process last year:
3213000-01T	75.744		69.277		6.47
3213000-02T	87.862		81.136		6.72

Briefly describe the fate of the waste product (slurry or sludge) produced by your treatment process (discharge to sewer, groundwater discharge, settling lagoons, re-circulate back into treatment plant, etc.):

BACKWASH WATER IS DISCHARGED FROM THE FILTERS TO SETTLING LAGOONS

X. Comments or additional information regarding this section

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Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Water Management Act Annual Report - Distribution

All public water suppliers distributing 100,000 gallons per day or more must complete Tables DS-1 through DS-5 and Tables DS-7 and DS-8. Tables DS-6 and DS-9 are optional. Instructions for completing Tables DS-1 through DS-8 are included in the ASR Instructions available at MassDEP's website. If you have any questions concerning completion of the Distribution System Report, please contact Richard Friend with the WMA Program at (617) 654-6522 or email him at richard.friend@state.ma.us

Table DS-1 Summary of Leak Detection Activities During the Reporting Year

1. Total miles of water mains *	32
2. Miles of mains surveyed this year	42
3. Number of leaks found	18
4. Number of leaks repaired	18
5. Estimated volume lost (mg) if a reliable estimate can be made	10.42
6. Date of last leak detection survey of entire system: *	12/31/2010 (mm/dd/yyyy)

Table DS-2 Water Conservation - Limits on Withdrawals

1. **Did your PWS implement mandatory nonessential outdoor water use restrictions in the reporting year? ***

   Yes No

2. **If yes,why did you institute mandatory restrictions (check all that apply)?**

   a. Required by WMA permit

   Calendar trigger in permit

   Streamflow trigger in permit

   Other trigger in permit — If "Other Trigger" then describe:

   b. Reason other than permit requirement

   Describe: NORTH READING BYLAWS MANDATE ODD/EVEN OUTDOOR WATERING, TOTAL OUTDOOR WATER

3. **Please characterize the type of mandatory restrictions that were in place (Check all that apply)**

   Total outdoor ban

   Hand-held only

   Hourly — Describe:

   If "Other Daily"

Daily: Odd/Even Twice/Week Once/Week Other Daily then describe:

4. **If you instituted mandatory restrictions, on what dates were restrictions in place?**
(you may have had only one period of restriction)

	Start Date	End Date
Period 1	1/1/2010 (mm/dd/yyyy)	12/31/2010 (mm/dd/yyyy)
Period 2	7/1/2010 (mm/dd/yyyy)	8/31/2010 (mm/dd/yyyy)
Period 3	(mm/dd/yyyy)	(mm/dd/yyyy)

5. **Indicate if you plan or expect to institute nonessential outdoor water use restrictions in the upcoming summer. If you hold a WMA permit with Seasonal Limits on Nonessential Outdoor Water Use conditions, indicate whether you plan on instituting calendar-based or streamflow trigger-based outdoor water use restrictions. Remember that if you plan on instituting calendar restrictions, they must be in place by May 1. Streamflow-based restrictions must be in place once the trigger specified in your WMA permit has been reached for three consecutive days. Refer to your permit for specific nonessential outdoor water use requirements. Indicate if you plan on instituting restrictions even though you do not hold a WMA permit with outdoor water use restriction or do not hold a permit at all.**

- [ ] Planning to institute calendar-based nonessential outdoor water use restrictions per WMA permit
- [ ] Planning to institute streamflow-based nonessential outdoor water use restrictions per WMA permit
- [x] Planning to institute nonessential outdoor water use restrictions for reasons other than WMA permit requirements
- [ ] Do not intend on instituting nonessential outdoor water use restrictions

Please Note: Enter volumes in Tables DS-3, DS-4, DS-5 and DS-6 in million gallons per year (mgy).
Example 1: if a volume is 654,120,152 gallons, enter 645.120152 mgy.
Example 2: if a volume is 580,123 gallons, enter 0.580123 mgy.
Example 3: if a volume is 86,000 gallons, enter 0.086 mgy.

Table DS-3 Metered Finished Water Use Complete Table DS-3 to account for all of your metered water volumes (e.g. permanent and temporary; private and municipal/government; billed and non-billed). Do not include water sold to other PWSs, which is reported on the Water Production & Consumption Information form

Use Category	No. of Service Connections	Total Volume (mgy)	Category Description
Residential *	4553	343.449	Water provided to residences in your distribution system, including for-profit apartments, condos, and seasonal homes. All water used for lawn watering at residential buildings belongs in this category.
Residential Institutions	14	3.020	Water provided to institutions with residential population such as colleges. It is optional to account institutions volumes separately (may be included in Residential above - see instructions).
Commercial/Business	184	25.470	Water served to businesses and other commercial entities.
Agricultural	0	0.000	Water used mainly to grow food, raise animals, or run a garden center.
Industrial	49	28.877	Water used mainly for industrial purposes.
Municipal/Institutional/Non-profits	19	7.049	Water used for municipal purposes, including schools, playing fields, municipal buildings, treatment plant; non-profits such as churches; non-residential institutions such as private schools.
Other*	0	0.000	Water used for purposes not included in above categories.
TOTALS	4819	407.865	Total number of service connections and metered volume.

* If you include a volume under "Other", list the use(s):

UNACCOUNTED FOR WATER (UAW)

Table DS-4 Confidently Estimated Municipal Use volume To qualify as confidently estimated municipal use calculations/documentation for each estimated use must be attached to this ASR or mailed to MassDEP. If no documentation is provided, DEP will count the volumes as unaccounted for water. See ASR Instructions for more detail. Leak detection volumes are not counted as a confidently estimated municipal use. Optional Excel spreadsheets for calculating confidently estimated use can be found at the MADEP website at http://www.mass.gov/dep/water/approvals/dwsforms.htm#statrep

Confidently Estimated Municipal Use (CEMU)	Estimated million gallons per year
Fire protection & training	2.00
Hydrant/water main flushing/main construction	+ 0.06
Flow testing	+ 0.30
Bleeders/ Blow offs	+ 4.05
Tank overflow & drainage	+ 0.00
Sewer & stormwater system flushing	+ 0.00
Street cleaning	+ 0.05
Source meter calibration adjustments	+ 12.12
Major water main breaks (not leak detection)	+ 0.58
Total Confidently Estimated Municipal Use	= 19.16

YOU MUST PROVIDE DOCUMENTATION FOR ALL OF YOUR CEMU VOLUMES.

Are you attaching electronic files to the eASR that document your CEMU volumes?

Yes No

Paper copies of CEMU volumes may be mailed to:
Mass DEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

Table DS-5 Unaccounted for Water To calculate UAW, subtract total metered use and confidently estimated municipal use volumes from the total volume of finished water entering your distribution system.

	Million Gallons/Year (MGY)	% of Total Water Available for Distribution
Total Finished Water Available for Distribution **(Total Net Finished Water from Production Form)**	491.526	100%
Total Metered Use **(System Total Metered Use from Table DS-3)**	- 407.866	- 83.0 %
Total Confidently Estimated Municipal Use **(Total from Table DS-4)**	- 19.16	- 3.9 %
Unaccounted for Water (UAW)	= 64.5	= 13.1 %

Table DS-6 Sources of Unaccounted for Water (Optional) Use this table to provide estimated volumes of your unaccounted for water.

Known or Suspected Source of Unaccounted for Water	Estimated Volume (MGY)
Leak Detection	10.40
Water Theft	0.82
Meter Malfunction/mis-registration	9.62

Other (specify):	ASSUMES 2% OF PRODUCTION LOST TO THEFT AND METER UNDER-REGISTRATION	
Other (specify):	UNAVOIDABLE/UNRECOVERABLE LEAKAGE	5.00
	Total:	35.06

RESIDENTIAL GALLONS PER CAPITA DAY (RGPCD)
RGPCD is a performance standard for public water suppliers serving municipalities and is a measure of the average amount of water a resident uses each day during the reporting period. High RGPCD values are associated with unrestricted outdoor water use, especially lawn watering. See ASR Instructions for further explanation and examples. There are two steps to determine your RGPCD number: Step 1: Determine the residential population served by your system (2 options to choose from). Step 2: Calculate RGPCD from population served and residential metered water volume.

RGPCD Step 1 - Choose one of two options to determine Population Served

Population Option 1: Accurate Count (census data): If your PWS serves an entire municipality, then use the most recent local or Federal census number for the total residential population. Partially served communities can use the most recent local or Federal census if private well users and/or those served by other PWS systems are subtracted out (attach documentation to this ASR). Communities with high seasonal fluctuations can pro-rate the population for the duration of the influx. See ASR Instructions for further detail and examples.

Population Option 2: Estimate from Households Served If your PWS serves a portion of one or more communities and you cannot obtain a reliable census, click on the_following link to open an excel spreadsheet for estimating your population. Click Here. This estimate is calculated from the number of households connected to your distribution system and the average household size. Save the spreadsheet onto your computer for use in subsequent years' reporting. If you are using a spreadsheet from your assessor's office or planning board to estimate number of households served, attach the spreadsheet or mail it to DEP and report the population served on Table DS-7 below.

If mailing Population Calculations or documentation send to:
Mass DEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

Table DS-7 Residential Population Served

Community(ies) served by PWS is (are) :	Partially Served
Method of Determining Population Served:	Option 1(Census)
Census Type (Federal or Local):	Local
Census year:	2010
Population Served:	14406

RGPCD Step 2 – Calculate RGPCD
Table DS-8 Residential Gallons per Capita Day To determine RGPCD, your metered residential volume (million gallons/year) is divided by 365 days. The result in then divided by the population served and multiplied by 1,000,000 to obtain gallons per person per day. If you include Residential Institutions volume in your RGPCD volume, also include the Residential Institutions population. See ASR instructions

Residential Water Use (million gallons)	**/ 365**	**/ Population Served**	**X 1,000,000**	**=**	**Residential Gallons per Capita Day (gallons/person/day)**
343.440	/365	/ 14406	X1,000,000	=	65

Table DS-9 Use this table to provide comments or additional information regarding this section of the ASR. You may explain discrepancies, provide supplemental information, or provide any other information to assist MassDEP in processing the data in your ASR.

POPULATION SERVED IS TOWN CENSUS OF 14,906 LESS ESTIMATED POPULATION OF 500 NOT CONNECTED TO THE TOWN'S WATER SYSTEM WHO MAKE USE OF PRIVATE WELLS AS THERI SOURCE OF WATER.

Massachusetts Department of Environmental Protection
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PWSID#: 3213000
Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Water Management Act Annual Report - Basin Withdrawal

Instructions for completing Tables BW-1 through BW-4 are included in the ASR Instructions available at MassDEP's website. If you have any questions concerning completion of the Water Management Act Annual Report, please contact Richard Friend with the WMA Program at (617) 654-6522 or email him at richard.friend@state.ma.us

Table BW-1 Permit & Registration Information

River Basin (Watershed)	Registration Number	Permit Number
17-IPSWICH	31721301	

Water Withdrawal by Watershed

Calculation of Daily Average Withdrawal: Use Table BW-2 to calculate 2010 withdrawal volume(s) by watershed. Table BW-3 compare's 2010 actual withdrawal volume(s) to the volume(s) authorized under your WMA registration(s) and/or permit(s). The total volumes for each source and their respective watershed are reported in the Ground Water Sources and for Surface Water Sources report forms. Enter the total of all sources for each watershed in Table BW-2.

Table BW-2 Average Daily Withdrawal by Watershed

River Basin	*Total Raw Water Pumped in 2010 (mgy)	/ 365 =	Watershed Average Daily Withdrawal (mgd)
17-IPSWICH	181.745	/ 365 =	0.50

Table BW-3 WMA Authorized Volume vs. Actual Withdrawal Volume

River Basin	Registered Volume (mgd)	+	Permitted Volume (mgd)	=	WMA Authorized Withdrawal Volume (mgd)	-	Daily Avg. Water Use (mgd) (from Table BW-2 above)	=	Difference*
17-IPSWICH	0.96	+	0.25	=	1.21	-	0.50	=	0.71

*** A positive difference indicates that the volume withdrawn is less than the authorized volume. A negative value indicates that more water was pumped than is authorized and that your PWS may be out of compliance.**

Table BW-4 Permit Special Conditions

Review your WMA permit and list any Special Conditions of your WMA permit that require submission of an annual report to MassDEP. If the required report is being submitted with this ASR, please note in Table BW-4. If a required report was submitted earlier in the year, please provide the date submitted.

WMA Permit Special Condition Requiring

Annual Report to MassDEP	Report Attached to ASR	If not attached, date submitted to MassDEP
Add Special Condition		

If mailing annual report, send to:
MADEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

Table BW-5 Use this table to provide comments or additional information regarding this section of the ASR. You may explain discrepancies, provide supplemental information, or provide any other information to assist MassDEP in processing the data in your ASR.

System Information (COM/NTNC)

1. PWS Street Address

NORTH READING WATER DEPT.
PWS Name

235 NORTH STREET	
PWS Street Address Line 1	PWS Street Address Line 2

NORTH READING	Massachusetts	01864
City/Town	State	Zip Code

978-357-5246	978-664-1713
Phone Number	Fax Number (if available)

HTTP://WWW.NORTHREADINGMA.GOV
Web Site Address of PWS (if available)

2. PWS Mailing Address ☑ Same as street address

NORTH READING WATER DEPT.
Mailing Name

235 NORTH STREET	
Mailing address Line 1	Mailing address Line 2

NORTH READING	Massachusetts	01864
City/Town	State	Zip Code

3. Is this a Seasonal System? (This question is not applicable to your PWS)

4. Owner Information:

		☐ This is a new owner.
Owners Name- First, Middle Int, Last - one name only(if not municipal):	Phone Number	

5. Primary Contact:

MARK	E	CLARK	978-664-6046	☐ This is a new contact.
Name (First, Middle Int, Last) • one name only•			Phone Number	

mclark@northreadingma.gov
Email Address (For Emergency Purposes)

10. Is this system a not-for-profit organization

(•) Yes ( ) No

If yes, indicate Tax Exempt code (e.g., 501C):	MGL CH 64H

11. Population Served(DailyAverage):

Winter Population (October March):	14897	
Summer Population (April September):	14897	
By what method was the population figured	Census Type:	City/Town
	Other Description:	

12. Testing requirements for lead and copper and bacteria in your system is based on the population .

	Number of Samples	Frequency of Samples
Lead and copper samples required:	30	3YEARS
Winter Bacteria samples required:	15	MONTH
Summer Bacteria samples required:	15	MONTH

13. Distribution Meter information:

a. Number of Service Connections:	4830
b. Percentage of service connections that are metered:	100 %
c. Are all publicly owned buildings metered?	(•) Yes ( ) No ( ) N/A
d. If No, what percent are	%

14. System Information

a. Number of Distribution Systems:	1
b. Finished Water Storage Capacity in Million Gallons (MG): [Conversion factor is (# of gallons)/(1,000,000)= MG]	3.3
c. Pumping Capacity (GPM):	1150

15. Percentage of Source Types (must add up to 100%)

Ground Water	Surface Water	Purchased Ground	Purchased Surface
37 %	0 %	0 %	63 %

16. Emergency Response Actions:

a. Has your system completed an Emergency Response Plan (ERP).(DO NOT submit your ERP to MassDEP. MassDEP will review the ERP during your next sanitary survey.)

(●) Yes ( ) No

(●) I have made changes to the ERP (attach copies of all changes.)
( ) I have made no changes to the ERP.

b. Does your system have an Emergency Response (ER) annual training plan

( ) Yes (●) No

If Yes, please attach a copy of the plan. Describe the training performed during the reporting period, including the types of training, the date(s) of training, and number of staff and local officials trained on each date and their job titles.

c. Is your system registered for the Health and Homeland Alert Network (HHAN)

( ) Yes (●) No

d. Has your system signed the agreement and joined the Massachusetts Water and Wastewater Agency Response Network

( ) Yes (●) No

e. How often does your system test the following

Alarms:	Monthly	Other Frequency:	
Interlocks:	Monthly	Other Frequency:	
Back-up power sources:	Other	Other Frequency:	WEEKLY

f. List and describe all Level 3 or higher ER incidents during the reporting period.

Date of ER incident	Level	Description

17. Do you have an antenna or other appurtenance (not needed for drinking water purposes) attached to any of your storage tank (s)

(●) Yes ( ) No ( ) No storage tanks

If Yes, list the antennae or other appurtenances, owner(s) names, and the date installed:

Storage Tank Name	Antennae or Appurtenance	Owner Name	Date (mm/dd/yyyy) Installed
	FIRE DEPARTMENT COM	NR FIRE DEPARTMENT	7/1/1994
	CELLULAR PHONE ANTE	T-1 MOBILE	7/1/2008

18. Comments or additional information regarding this section:

FIRE DEPARTMENT COMMUNICATIONS ANTENNAE ARE LOCATED ON ALL THREE WATER STORAGE TANKS IN NORTH READING (TOWER HILL, MOOSE HILL AND SWAN POND TANKS). THE T-1 MOBILE CELLULAR ANTENNAE ARE ON THE SWAN POND TANK.

Cross Connection Control Program (CCCP)

1. Cross Connection Program Coordinator

MARK	CLARK	
Coordinator First Name	Coordinator Last Name	
235 NORTH STREET		
Coordinator Street Address Line 1	Coordinator Street Address Line 2	
NORTH READING	Massachusetts	01864
City/Town	State	Zip Code
978-664-6046	978-664-1713	
Phone Number	Fax Number (if available)	
MCLARK@NORTHREADINGMA.GOV		
Coordinator email		

Surveyor Personnel Information :

To add a surveyor, enter the certification ID # in the field below and then click the "Add Surveyor" button.

MassDEP Certification ID Number

Massachusetts Department of Environmental Protection
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Reporting Year 2011

PWSID#: 3213000
Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Water Production & Consumption Information

Volume Units ○ Gallons (GAL) ◉ Million Gallons (MG)

FINISHED Water Production and Consumption Summary for Last Year (2009):

Month	(1) Amount of **finished** water from own sources (MG)	(2) Amount of **finished** water purchased from other systems (MG)	(3) Amount of **finished** water sold to other systems (MG)	(4) Net **finished** Water that entered your distribution system (1) + (2) - (3)= (4) (MG)
January	17.320	19.353	0.000	36.673
February	15.452	17.486	0.000	32.938
March	13.858	21.464	0.000	35.322
April	8.757	27.172	0.000	35.929
May	15.535	30.472	0.000	46.007
June	16.203	40.691	0.000	56.894
July	16.077	49.505	0.000	65.582
August	13.856	38.414	0.000	52.270
September	12.431	34.124	0.000	46.555
October	18.084	26.082	0.000	44.166
November	17.680	18.197	0.000	35.877
December	18.735	19.372	0.000	38.107
TOTAL	183.988	342.332	0.000	526.320

Maximum Daily Finished Water Consumption: Volume (MG): 2.381 Date: 7/23/2011

RAW Water Production and Consumption Summary for Last Year:

☐ Same as finished water (it is not necessary to complete Table if same volume as above)

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PWS Class: COM

Month	(1) Amount of **raw** water pumped from own sources (MG)	(2) Amount of **raw** water purchased from other systems (MG)	(3) Amount of **raw** water sold to other systems (MG)	(4) Net **raw** Water Consumption (1) + (2) - (3) = (4) (MG)
January	18.720	19.353	0.000	38.073
February	16.702	17.486	0.000	34.188
March	15.168	21.464	0.000	36.632
April	09.309	27.172	0.000	36.481
May	16.726	30.472	0.000	47.198
June	17.617	40.691	0.000	58.308
July	17.543	49.505	0.000	67.048
August	15.333	38.414	0.000	53.747
September	13.603	34.124	0.000	47.727
October	19.511	26.082	0.000	45.593
November	18.765	18.197	0.000	36.962
December	19.726	19.372	0.000	39.098
TOTAL	198.723	342.332	0.000	541.055
Maximum Daily Raw Water Pumping:	Volume (MG): 2.381	Date: 7/23/2011		

Summary of Water Sold

Sold Water

System Name	PWS ID#	Total Volume Sold	Water type

Metered Finished Water Consumption by Service Type

U.S. EPA requires every PWS to report what their water is used for in order to characterize each system. In this table, report the percentages of metered water for each category below, ONLY for those categories over 10%. For municipal water suppliers, most of the water will be reported as Residential Area. If any other categories are more than 10% of your metered use, report it in the appropriate category. If any category is less than 10%, do NOT report it. The precentage do NOT have to add to 100%, since water use in some categories will be less than 10% and therefore is not reported.

ONLY report uses for categories over 10% of total metered use. Report ALL metered water use in the Water Management Distribution System Form (if appropriate)

%	Primary Service Area	Type	%	Primary Service Area	Type
	Yes	Day Care Center		Yes	Other Residential
	Yes	Dispenser		Yes	Other Transient
	Yes	Homeowners Association		Yes	Recreation Area
	Yes	Hotel/Motel	72	(•) Yes	Residential Area
	Yes	Highway Rest Area		Yes	Restaurant
	Yes	Industrial/Agricultural		Yes	Retail Employees
	Yes	Interstate Carrier		Yes	School
	Yes	Institution		Yes	Sanitary Improvement District
	Yes	Medical Facility		Yes	Summer Camp
	Yes	Mobile Home Park		Yes	Secondary Residences
	Yes	Mobile Home Park, Principal Residence		Yes	Service Station
	Yes	Municipality		Yes	Subdivision
	Yes	Other Area		Yes	Water Bottler
	Yes	Other Non-Transient Area		Yes	Wholesaler
	Yes	Commercial			

Summary of Treatment Plant Losses (complete only if finished water volume is less than raw water)

☐ No treatment plant losses (not applicable)

Treatment PlantID:	Total Raw Water into treatment plant last year (raw pumped + raw purchased - raw sold):	-	Total Finished Water from treatment plant last year:	=	Total Water Lost to Treatment Process last year:
3213000-01T	86.351		78.239		8.110
3213000-02T	94.115		87.492		6.620

Briefly describe the fate of the waste product (slurry or sludge) produced by your treatment process (discharge to sewer, groundwater discharge, settling lagoons, re-circulate back into treatment plant, etc.):

BACKWASH WATER IS DISCHARGED FROM THE FILTERS TO SETTLING LAGOONS.

X. Comments or additional information regarding this section

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PWSID#: 3213000
Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Water Management Act Annual Report - Distribution

All public water suppliers distributing 100,000 gallons per day or more must complete Tables DS-1 through DS-5 and Tables DS-7 and DS-8. Tables DS-6 and DS-9 are optional. Instructions for completing Tables DS-1 through DS-8 are included in the ASR Instructions available at MassDEP's website. If you have any questions concerning completion of the Distribution System Report, please contact Richard Friend with the WMA Program at (617) 654-6522 or email him at richard.friend@state.ma.us

Table DS-1 Summary of Leak Detection Activities During the Reporting Year	
1. Total miles of water mains	82
2. Miles of mains surveyed this year	40
3. Number of leaks found	20
4. Number of leaks repaired	20
5. Estimated volume lost (mg) if a reliable estimate can be made	9.44
6. Date of last leak detection survey of entire system:	12/31/2011 (mm/dd/yyyy)

Table DS-2 Water Conservation - Limits on Withdrawals

1. **Did your PWS implement mandatory nonessential outdoor water use restrictions in the reporting year?**

   (●) Yes ( ) No

2. **If yes,why did you institute mandatory restrictions (check all that apply)?**

a. ☐ Required by WMA permit

   ☐ Calendar trigger in permit
   ☐ Streamflow trigger in permit
   ☐ Other trigger in permit — If "Other Trigger" then describe:

b. ☑ Reason other than permit requirement

   Describe: NORTH READING BYLAWS MANDATE ODD/EVEN OUTDOOR WATERING.

3. **Please characterize the type of mandatory restrictions that were in place (Check all that apply)**

   ☐ Total outdoor ban

   ☐ Hand-held only
   ☐ Hourly Describe:

   Daily: (●) Odd/Even ( ) Twice/Week ( ) Once/Week ( ) Other Daily — If "Other Daily" then describe:

4. **If you instituted mandatory restrictions, on what dates were restrictions in place? (you may have had only one period of restriction)**

	Start Date	End Date
Period 1	1/1/2011	12/31/2011
	(mm/dd/yyyy)	(mm/dd/yyyy)
Period 2		
	(mm/dd/yyyy)	(mm/dd/yyyy)
Period 3		
	(mm/dd/yyyy)	(mm/dd/yyyy)

5. **Indicate if you plan or expect to institute nonessential outdoor water use restrictions in the upcoming summer. If you hold a WMA permit with Seasonal Limits on Nonessential Outdoor Water Use conditions, indicate whether you plan on instituting calendar-based or streamflow trigger-based outdoor water use restrictions. Remember that if you plan on instituting calendar restrictions, they must be in place by May 1. Streamflow-based restrictions must be in place once the trigger specified in your WMA permit has been reached for three consecutive days. Refer to your permit for specific nonessential outdoor water use requirements. Indicate if you plan on instituting restrictions even though you do not hold a WMA permit with outdoor water use restriction or do not hold a permit at all.**

- ☐ Planning to institute calendar-based nonessential outdoor water use restrictions per WMA permit.
- ☐ Planning to institute streamflow-based nonessential outdoor water use restrictions per WMA permit.
- ☑ Planning to institute nonessential outdoor water use restrictions for reasons other than WMA permit requirements.
- ☐ Do not intend on instituting nonessential outdoor water use restrictions.

Please Note: Enter volumes in Tables DS-3, DS-4, DS-5 and DS-6 in million gallons per year (mgy).
Example 1: if a volume is 654,120,152 gallons, enter 645.120152 mgy.
Example 2: if a volume is 580,123 gallons, enter 0.580123 mgy.
Example 3: if a volume is 86,000 gallons, enter 0.086 mgy.

Table DS-3 Metered Finished Water Use Complete Table DS-3 to account for all of your metered water volumes (e.g. permanent and temporary; private and municipal/government; billed and non-billed). Do not include water sold to other PWSs, which is reported on the Water Production & Consumption Information form

Use Category	No. of Service Connections	Total Volume (mgy)	Category Description
Residential	4578	392.194	Water provided to residences in your distribution system, including for-profit apartments, condos, and seasonal homes. All water used for lawn watering at residential buildings belongs in this category.
Residential Institutions	0	0.000	Water provided to institutions with residential population such as colleges. It is optional to account institutions volumes separately (may be included in Residential above - see instructions).
Commercial/Business	169	20.172	Water served to businesses and other commercial entities.
Agricultural	2	0.105	Water used mainly to grow food, raise animals, or run a garden center.
Industrial	47	19.469	Water used mainly for industrial purposes.
Municipal/Institutional/Non-profits	34	9.234	Water used for municipal purposes, including schools, playing fields, municipal buildings, treatment plant; non-profits such as churches; non-residential institutions such as private schools.
Other*	0	0.000	Water used for purposes not included in above categories.
TOTALS	4830	441.174	Total number of service connections and metered volume.

* If you include a volume under "Other", list the use(s): RESIDENTIAL INSTITUTION VOLUME INCLUDED UNDER RESIDENTIAL TOTAL.

UNACCOUNTED FOR WATER (UAW)

Table DS-4 Confidently Estimated Municipal Use volume To qualify as confidently estimated municipal use calculations/documentation for each estimated use must be attached to this ASR or mailed to MassDEP. If no documentation is provided, DEP will count the volumes as unaccounted for water. See ASR Instructions for more detail. Leak detection volumes are not counted as a confidently estimated municipal use. Optional Excel spreadsheets for calculating confidently estimated use can be found at the MADEP website at http://www.mass.gov/dep/water/approvals/dwsforms.htm#statrep

Confidently Estimated Municipal Use (CEMU)	Estimated million gallons per year
Fire protection & training	2.00
Hydrant/water main flushing/main construction	+ 1.27
Flow testing	+ 0.05
Bleeders/ Blow offs	+ 4.43
Tank overflow & drainage	+ 0.000
Sewer & stormwater system flushing	+ 0.000
Street cleaning	+ 0.05
Source meter calibration adjustments	+ 10.04
Major water main breaks (not leak detection)	+ 0.67
Total Confidently Estimated Municipal Use	= 18.51

YOU MUST PROVIDE DOCUMENTATION FOR ALL OF YOUR CEMU VOLUMES.

Are you attaching electronic files to the eASR that document your CEMU volumes?

○ Yes ◉ No

Paper copies of CEMU volumes may be mailed to:
Mass DEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

Table DS-5 Unaccounted for Water To calculate UAW, subtract total metered use and confidently estimated municipal use volumes from the total volume of finished water entering your distribution system.

	Million Gallons/Year (MGY)	**% of Total Water Available for Distribution**
Total Finished Water Available for Distribution **(Total Net Finished Water from Production Form)**	526.32	100%
Total Metered Use **(System Total Metered Use from Table DS-3)**	- 441.174	- 83.8 %
Total Confidently Estimated Municipal Use **(Total from Table DS-4)**	- 18.51	- 3.5 %
Unaccounted for Water (UAW)	= 66.6	= 12.7 %

Table DS-6 Sources of Unaccounted for Water (Optional) Use this table to provide estimated volumes of your unaccounted for water.

Known or Suspected Source of Unaccounted for Water	**Estimated Volume (MGY)**
Leak Detection	9.44
Water Theft	15.79
Meter Malfunction/mis-registration	15.79
Other (specify): ASSUMES 3% OF PRODUCTION LOST TO THEFT AND METER UNDER-REGISTRATION	
Other (specify): UNAVOIDABLE/UNRECOVERABLE LEAKAGE	5
Total:	46.02

RESIDENTIAL GALLONS PER CAPITA DAY (RGPCD)

RGPCD is a performance standard for public water suppliers serving municipalities and is a measure of the average amount of water a resident uses each day during the reporting period. High RGPCD values are associated with unrestricted outdoor water use, especially lawn watering. See ASR Instructions for further explanation and examples. There are two steps to determine your RGPCD number: Step 1: Determine the residential population served by your system (2 options to choose from). Step 2: Calculate RGPCD from population served and residential metered water volume.

RGPCD Step 1 - Choose one of two options to determine Population Served

Population Option 1: Accurate Count (census data): If your PWS serves an entire municipality, then use the most recent local or Federal census number for the total residential population. Click Here for 2010 U.S. census populations for MA cities and towns. Partially served communities can use the most recent local or Federal census if private well users and/or those served by other PWS systems are subtracted out (attach documentation to this ASR). Communities with high seasonal fluctuations can pro-rate the population for the duration of the influx. See ASR Instructions for further detail and examples.

Population Option 2: Estimate from Households Served If your PWS serves a portion of one or more communities and you cannot obtain a reliable census, click on the following link to open an excel spreadsheet for estimating your population. Click Here. This estimate is calculated from the number of households connected to your distribution system and the average household size. Save the spreadsheet onto your computer for use in subsequent years' reporting. If you are using a spreadsheet from your assessor's office or planning board to estimate number of households served, attach the spreadsheet or mail it to DEP and report the population served on Table DS-7 below.

If mailing Population Calculations or documentation send to:
Mass DEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

Table DS-7 Residential Population Served	
Community(ies) served by PWS is (are) :	Partially Served
Method of Determining Population Served:	Option 1(Census)
Census Type (Federal or Local):	Local
Census year:	2011
Population Served:	14397

RGPCD Step 2 – Calculate RGPCD
Table DS-8 Residential Gallons per Capita Day To determine RGPCD, your metered residential volume (million gallons/year) is divided by 365 days. The result in then divided by the population served and multiplied by 1,000,000 to obtain gallons per person per day. If you include Residential Institutions volume in your RGPCD volume, also include the Residential Institutions population. See ASR instructions

Residential Water Use (million gallons)	**/ 365**	**/ Population Served**	**X 1,000,000**	**=**	**Residential Gallons per Capita Day (gallons/person/day)**
392.194	/365	/ 14397	X1,000,000	=	74

Table DS-9: Use this table to provide comments or additional information regarding this section of the ASR. You may explain discrepancies, provide supplemental information, or provide any other information to assist MassDEP in processing the data in your ASR.

POPULATION SERVED IS CENSUS POPULATION OF 14,897 LESS APPROXIMATELY 500 PEOPLE SUPPLIED BY PRIVATE WELLS.

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PWSID#: 3213000
Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Water Management Act Annual Report - Basin Withdrawal

Instructions for completing Tables BW-1 through BW-4 are included in the ASR Instructions available at MassDEP's website. If you have any questions concerning completion of the Water Management Act Annual Report, please contact Richard Friend with the WMA Program at (617) 654-6522 or email him at richard.friend@state.ma.us

Table BW-1 Permit & Registration Information

River Basin (Watershed)	Registration Number	Permit Number
17-IPSWICH	31721301	

Water Withdrawal by Watershed

Calculation of Daily Average Withdrawal: Use Table BW-2 to document the reporting year withdrawal volume(s) by watershed. Table BW-3 compare's the reporting year actual withdrawal volume(s) to the volume(s) authorized under your WMA registration (s) and/or permit(s). The total volumes for each source and their respective watershed are reported in the Ground Water Sources and for Surface Water Sources report forms. Enter the total of all sources for each watershed in Table BW-2.

Enter volumes in million gallons per year(MGY). Example: If you pumped 400,512,000 gallons in the year, enter 400.512.

Table BW-2 Average Daily Withdrawal by Watershed

River Basin	Total Raw Water Pumped in the reporting year (mgy)	/ 365 =	Watershed Average Daily Withdrawal (mgd)
17-IPSWICH	198.723	/ 365 =	0.54

Table BW-3 WMA Authorized Volume vs. Actual Withdrawal Volume

River Basin	Registered Volume (mgd)	+	Permitted Volume (mgd)	=	WMA Authorized Withdrawal Volume (mgd)	-	Daily Avg. Water Use (mgd) (from Table BW-2 above)	=	Difference*
17-IPSWICH	0.96	+	0.00	=	0.96	-	0.54	=	0.42

*** A positive difference indicates that the volume withdrawn is less than the authorized volume. A negative value indicates that more water was pumped than is authorized and that your PWS may be out of compliance.**

Table BW-4 Permit Special Conditions

Review your WMA permit and list any Special Conditions of your WMA permit that require submission of an annual report to MassDEP. If the required report is being submitted with this ASR, please note in Table BW-4. If a required report was submitted earlier in the year, please provide the date submitted.

WMA Permit Special Condition Requiring Annual Report to MassDEP	Report Attached to ASR	If not attached, date submitted to MassDEP
	○ Yes ○ No	(mm\dd\yyyy)

If mailing annual report, send to:
MADEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

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PWSID#: 3213000
Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

System Information (COM/NTNC)

1. PWS Street Address

NORTH READING WATER DEPT		
PWS Name		
235 NORTH STREET		
PWS Street Address Line 1	PWS Street Address Line 2	
NORTH READING	Massachusetts	01864
City/Town	State	Zip Code
978-357-5246	978-664-1713	
Phone Number	Fax Number (if available)	
HTTP://WWW.NORTHREADINGMA.GOV		
Web Site Address of PWS (if available)		

2. PWS Mailing Address ☑ Same as street address.

NORTH READING WATER DEPT.		
Mailing Name		
235 NORTH STREET		
Mailing address Line 1	Mailing address Line 2	
NORTH READING	Massachusetts	01864
City/Town	State	Zip Code

3. Is this a Seasonal System? (This question is not applicable to your PWS)

4. Owner Information:

	☐ This is a new owner
Owners Name- First, Middle Int, Last - one name only(if not municipal):	Phone Number

5. Primary Contact:

MARK E CLARK	978-664-6046 ☐ This is a new contact
Name (First, Middle Int, Last) - one name only-	Phone Number
mclark@northreadingma.gov	
Email Address (For Emergency Purposes)	Re-enter Email Address

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PWS Class: COM

10. Is this system a not-for-profit organization

(•) Yes ( ) No

If yes, indicate Tax Exempt code (e.g., 501C):	MGL CH 64H

11. Population Served(DailyAverage):

Winter Population (October March):		14897
Summer Population (April September):		14897
By what method was the population figured	Census Type:	City/Town
	Other Description:	

12. Testing requirements for lead and copper and bacteria in your system is based on the population .

	Number of Samples	Frequency of Samples
Lead and copper samples required:	30	3YEARS
Winter Bacteria samples required:	15	MONTH
Summer Bacteria samples required:	15	MONTH

13. **Distribution Meter information:**

a. Number of Service Connections:	4829
b. Percentage of service connections that are metered:	100 %
c. Are all publicly owned buildings metered?	(•) Yes ( ) No ( ) N/A
d. If No, what percent are	%

14. System Information

a. Number of Distribution Systems:	1
b. Finished Water Storage Capacity in Million Gallons (MG): [Conversion factor is (# of gallons)/(1,000,000)= MG]	3.3
c. Pumping Capacity (GPM):	1150

15. Percentage of Source Types (must add up to 100%)

Ground Water	Surface Water	Purchased Ground	Purchased Surface
40 %	0 %	0 %	60 %

16. Emergency Response Actions:

a. Has your system completed an Emergency Response Plan (ERP).(DO NOT submit your ERP to MassDEP. MassDEP will review the ERP during your next sanitary survey.)

(•) Yes ( ) No

( ) I have made changes to the ERP (attach copies of all changes.)
(•) I have made no changes to the ERP.

b. Does your system have an Emergency Response (ER) annual training plan

( ) Yes (•) No

If Yes, please attach a copy of the plan. Describe the training performed during the reporting period, including the types of training, the date(s) of training, and number of staff and local officials trained on each date and their job titles.

c. Is your system registered for the Health and Homeland Alert Network (HHAN)

( ) Yes (•) No

d. Has your system signed the agreement and joined the Massachusetts Water and Wastewater Agency Response Network

( ) Yes (•) No

e. How often does your system test the following

Alarms:	Monthly	Other Frequency:	
Interlocks:	Monthly	Other Frequency:	
Back-up power sources:	Other	Other Frequency:	WEEKLY

f. List and describe all Level 3 or higher ER incidents during the reporting period.

Date of ER incident	Level	Description

17. Do you have an antenna or other appurtenance (not needed for drinking water purposes) attached to any of your storage tank (s)

(•) Yes ( ) No ( ) No storage tanks

If Yes, list the antennae or other appurtenances, owner(s) names, and the date installed:

Storage Tank Name	Antennae or Appurtenance	Owner Name	Date (mm/dd/yyyy) Installed
MOOSE HILL	CELLULAR PHONE ANTE	T-1 MOBILE	7/1/2012
SWAN POND	CELLULAR PHONE ANTE	T-1 MOBILE	7/1/2008
TOWER HILL	CELLULAR PHONE ANTE	T-1 MOBILE	7/1/2010
MOOSE HILL	FIRE DEPARTMENT COM	NR FIRE DEPARTMENT	7/1/1994

18. Comments or additional information regarding this section:

FIRE DEPARTMENT COMMUNICATIONS ANTENNAE ARE LOCATED ON ALL THREE WATER STROAGE TANKS IN NORTH READING (MOOSE HILL, SWAN POND AND TOWER HILL). ALL THREE TANKS ALSO HAVE CELLULAR ANTENNAE ON THEM.

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Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Cross Connection Control Program (CCCP)

1. Cross Connection Program Coordinator

MARK	CLARK	
Coordinator First Name	Coordinator Last Name	
235 NORTH STREET		
Coordinator Street Address Line 1	Coordinator Street Address Line 2	
NORTH READING	Massachusetts	01864
City/Town	State	Zip Code
978-664-6046	978-664-1713	
Phone Number	Fax Number (if available)	
MCLARK@NORTHREADINGMA.GOV		
Coordinator email		

Surveyor Personnel Information :

To add a surveyor, enter the certification ID # in the field below and then click the "Add Surveyor" button.

MassDEP Certification ID Number

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PWS Class: COM

Water Production & Consumption Information

How to report in Gallons vs. Million Gallons
When Coverting gallons to Million gallons, decimal point moves 6 places to the left.

	If Reporting in Gallons (Gal)	If Reporting in Million Gallons (MG)
Example 1	45,462,100	45.5621
Example 2	340,212	0.340212
Example 3	631,020,000	631.02
Example 4	96,543	0.096543

Volume Units ( ) Gallons (GAL) (•) Million Gallons (MG) ( ) No Meter

FINISHED Water Production and Consumption Summary for Reporting Year :

Finished Water means water that is introduced into the distribution system of a public water system and is intended for distribution and consumption without further treatment, except as treatment necessary to maintain water quality in the distribution system (e.g. booster disinfection, addition of corrosion control chemicals).

Month	(1) Amount of **finished** water from own sources (MG)	(2) Amount of **finished** water purchased from other systems (MG)	(3) Amount of **finished** water sold to other systems (MG)	(4) Net **finished** Water that entered your distribution system (1) + (2) - (3)= (4) (MG)
January	17.683	20.547	0.000	38.230
February	16.023	19.148	0.000	35.171
March	20.404	19.115	0.000	39.519
April	22.974	19.488	0.000	42.462
May	20.823	26.955	0.000	47.778
June	21.467	29.176	0.000	50.643
July	17.527	42.007	0.000	59.534
August	09.173	39.416	0.000	48.589
September	13.171	30.932	0.000	44.103
October	14.295	25.309	0.000	39.604
November	13.625	17.155	0.000	30.780
December	10.042	23.780	0.000	33.822
TOTAL	197.207	313.028	0.000	510.235

Maximum Daily Finished Water Consumption:	Volume (MG): 2.202	Date: 7/2/2012

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RAW Water Production and Consumption Summary for Reporting Year :

Raw Water means water in its natural state, prior to treatment and is usually the water entering the first treatment process of a water treatment plant.

☐ Same as finished water (it is not necessary to complete Table if same volume as above)

Month	(1) Amount of **raw** water pumped from own sources (MG)	(2) Amount of **raw** water purchased from other systems (MG)	(3) Amount of **raw** water sold to other systems (MG)	(4) Net **raw** Water Consumption (1) + (2) - (3) = (4) (MG)
January	18.683	20.547	0.000	39.230
February	16.924	19.148	0.000	36.072
March	21.416	19.115	0.000	40.531
April	24.389	19.488	0.000	43.877
May	22.327	26.954	0.000	49.281
June	23.066	29.176	0.000	52.242
July	19.063	42.007	0.000	61.070
August	10.069	39.416	0.000	49.485
September	14.528	30.932	0.000	45.460
October	15.858	25.309	0.000	41.167
November	15.214	17.155	0.000	32.369
December	11.062	23.780	0.000	34.842
TOTAL	212.599	313.027	0.000	525.626

Maximum Daily Raw Water Pumping:	Volume (MG): 2.256	Date: 7/2/2012

Summary of Water Sold

Sold Water

System Name	PWS ID#	Total Volume Sold	Water type

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Metered Finished Water Consumption by Service Type

U.S. EPA requires every PWS to report what their water is used for in order to characterize each system. In this table, report the percentages of metered water for each category below, ONLY for those categories over 10%. For municipal water suppliers, most of the water will be reported as Residential Area. If any other categories are more than 10% of your metered use, report it in the appropriate category. If any category is less than 10%, do NOT report it. The precentage do NOT have to add to 100%, since water use in some categories will be less than 10% and therefore is not reported.

ONLY report uses for categories over 10% of total metered use. Report ALL metered water use in the Water Management Distribution System Form (if appropriate)

%	Primary Service Area	Type	%	Primary Service Area	Type
	Yes	Day Care Center		Yes	Other Residential
	Yes	Dispenser		Yes	Other Transient
	Yes	Homeowners Association		Yes	Recreation Area
	Yes	Hotel/Motel	73	Yes (selected)	Residential Area
	Yes	Highway Rest Area		Yes	Restaurant
	Yes	Industrial/Agricultural		Yes	Retail Employees
	Yes	Interstate Carrier		Yes	School
	Yes	Institution		Yes	Sanitary Improvement District
	Yes	Medical Facility		Yes	Summer Camp
	Yes	Mobile Home Park		Yes	Secondary Residences
	Yes	Mobile Home Park, Principal Residence		Yes	Service Station
	Yes	Municipality		Yes	Subdivision
	Yes	Other Area		Yes	Water Bottler
	Yes	Other Non-Transient Area		Yes	Wholesaler
	Yes	Commercial			

Summary of Treatment Plant Losses (complete only if finished water volume is less than raw water)

☐ No treatment plant losses (not applicable)

Treatment PlantID:	Total Raw Water into treatment plant last year (raw pumped + raw purchased - raw sold):	-	Total Finished Water from treatment plant last year:	=	Total Water Lost to Treatment Process last year:
3213000-01T	96.559		87.957		8.600
3213000-02T	98.253		91.463		6.790

Briefly describe the fate of the waste product (slurry or sludge) produced by your treatment process (discharge to sewer, groundwater discharge, settling lagoons, re-circulate back into treatment plant, etc.):

BACKWASH WATER IS DISCHARGED FROM THE FILTERS TO SETTLING LAGOONS.

X. Comments or additional information regarding this section

Water Management Act Annual Report - Distribution

All public water suppliers distributing 100,000 gallons per day or more must complete Tables DS-1 through DS-5 and Tables DS-7 and DS-8. Tables DS-6 and DS-9 are optional. Instructions for completing Tables DS-1 through DS-8 are included in the ASR Instructions available at MassDEP's website. If you have any questions concerning completion of the Distribution System Report, please contact Richard Friend with the WMA Program at (617) 654-6522 or email him at richard.friend@state.ma.us

Table DS-1 Summary of Leak Detection Activities During the Reporting Year

1. Total miles of water mains	82
2. Miles of mains surveyed this year	42
3. Number of leaks found	7
4. Number of leaks repaired	7
5. Estimated volume lost (mg) if a reliable estimate can be made	2.92
6. Date of last leak detection survey of entire system:	12/31/2012 (mm/dd/yyyy)

Table DS-2 Water Conservation - Limits on Withdrawals

1. **Did your PWS implement mandatory nonessential outdoor water use restrictions in the reporting year?**

   (●) Yes ( ) No

2. **If yes,why did you institute mandatory restrictions (check all that apply)?**

a. ☐ Required by WMA permit

   ☐ Calendar trigger in permit

   ☐ Streamflow trigger in permit

   ☐ Other trigger in permit — If "Other Trigger" then describe:

b. ☑ Reason other than permit requirement

   Describe: NORTH READING BYLAWS MANDATE ODD/EVEN OUTDOOR WATERING.

3. **Please characterize the type of mandatory restrictions that were in place (Check all that apply)**

   ☐ Total outdoor ban

   ☐ Hand-held only

   ☐ Hourly Describe:

   Daily: (●) Odd/Even ( ) Twice/Week ( ) Once/Week ( ) Other Daily — If "Other Daily" then describe:

4. **If you instituted mandatory restrictions, on what dates were restrictions in place?**
(you may have had only one period of restriction)

	Start Date	End Date
Period 1	5/1/2012	10/31/2012
	(mm/dd/yyyy)	(mm/dd/yyyy)
Period 2		
	(mm/dd/yyyy)	(mm/dd/yyyy)
Period 3		
	(mm/dd/yyyy)	(mm/dd/yyyy)

5. **Indicate if you plan or expect to institute nonessential outdoor water use restrictions in the upcoming summer. If you hold a WMA permit with Seasonal Limits on Nonessential Outdoor Water Use conditions, indicate whether you plan on instituting calendar-based or streamflow trigger-based outdoor water use restrictions. Remember that if you plan on instituting calendar restrictions, they must be in place by May 1. Streamflow-based restrictions must be in place once the trigger specified in your WMA permit has been reached for three consecutive days. Refer to your permit for specific nonessential outdoor water use requirements. Indicate if you plan on instituting restrictions even though you do not hold a WMA permit with outdoor water use restriction or do not hold a permit at all.**

- [ ] Planning to institute calendar-based nonessential outdoor water use restrictions per WMA permit.
- [ ] Planning to institute streamflow-based nonessential outdoor water use restrictions per WMA permit.
- [x] Planning to institute nonessential outdoor water use restrictions for reasons other than WMA permit requirements.
- [ ] Do not intend on instituting nonessential outdoor water use restrictions.

Please Note: Enter volumes in Tables DS-3, DS-4, DS-5 and DS-6 in million gallons per year (mgy).
Example 1: if a volume is 654,120,152 gallons, enter 645.120152 mgy.
Example 2: if a volume is 580,123 gallons, enter 0.580123 mgy.
Example 3: if a volume is 86,000 gallons, enter 0.086 mgy.

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Table DS-3 Metered Finished Water Use Complete Table DS-3 to account for all of your metered water volumes (e.g. permanent and temporary; private and municipal/government; billed and non-billed). Do not include water sold to other PWSs, which is reported on the Water Production & Consumption Information form

Use Category	No. of Service Connections	Total Volume (mgy)	Category Description
Residential	4577	376.464	Water provided to residences in your distribution system, including for-profit apartments, condos, and seasonal homes. All water used for lawn watering at residential buildings belongs in this category.
Residential Institutions	0	0.000	Water provided to institutions with residential population such as colleges. It is optional to account institutions volumes separately (may be included in Residential above - see instructions).
Commercial/Business	176	24.781	Water served to businesses and other commercial entities.
Agricultural	0	0.000	Water used mainly to grow food, raise animals, or run a garden center.
Industrial	48	12.868	Water used mainly for industrial purposes.
Municipal/Institutional/Non-profits	28	5.667	Water used for municipal purposes, including schools, playing fields, municipal buildings, treatment plant; non-profits such as churches; non-residential institutions such as private schools.
Other*	0	0.000	Water used for purposes not included in above categories.
TOTALS	4829	419.78	Total number of service connections and metered volume.

* If you include a volume under "Other", list the use(s):

UNACCOUNTED FOR WATER (UAW)

Table DS-4 Confidently Estimated Municipal Use volume To qualify as confidently estimated municipal use calculations/documentation for each estimated use must be attached to this ASR or mailed to MassDEP. If no documentation is provided, DEP will count the volumes as unaccounted for water. See ASR Instructions for more detail. Leak detection volumes are not counted as a confidently estimated municipal use. Optional Excel spreadsheets for calculating confidently estimated use can be found at the MADEP website at http://www.mass.gov/dep/water/approvals/dwsforms.htm#statrep

Confidently Estimated Municipal Use (CEMU)	Estimated million gallons per year
Fire protection & training	2.00
Hydrant/water main flushing/main construction	+ 1.37
Flow testing	+ 0.05
Bleeders/ Blow offs	+ 4.45
Tank overflow & drainage	+ 0.00
Sewer & stormwater system flushing	+ 0.00
Street cleaning	+ 0.05
Source meter calibration adjustments	+ 12.14
Major water main breaks (not leak detection)	+ 0.43
Total Confidently Estimated Municipal Use	= 20.49

YOU MUST PROVIDE DOCUMENTATION FOR ALL OF YOUR CEMU VOLUMES.

Are you attaching electronic files to the eASR that document your CEMU volumes?

○ Yes ● No

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Paper copies of CEMU volumes may be mailed to:
Mass DEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

Table DS-5 Unaccounted for Water To calculate UAW, subtract total metered use and confidently estimated municipal use volumes from the total volume of finished water entering your distribution system.

	Million Gallons/Year (MGY)	% of Total Water Available for Distribution
Total Finished Water Available for Distribution **(Total Net Finished Water from Production Form)**	510.235	100%
Total Metered Use **(System Total Metered Use from Table DS-3)**	- 419.78	- 82.3 %
Total Confidently Estimated Municipal Use **(Total from Table DS-4)**	- 20.49	- 4.0 %
Unaccounted for Water (UAW)	= 70.0	= 13.7 %

Table DS-6 Sources of Unaccounted for Water (Optional) Use this table to provide estimated volumes of your unaccounted for water.

Known or Suspected Source of Unaccounted for Water	**Estimated Volume (MGY)**
Leak Detection	2.92
Water Theft	15.31
Meter Malfunction/mis-registration	20.41
Other (specify): ASSUMES 3% OF WATER PRODUCTION LOST TO THEFT AND 4% TO METER UNDER-REGISTRATION	
Other (specify): UNAVOIDABLE/UNRECOVERABLE LEAKAGE	5.00
Total:	43.64

RESIDENTIAL GALLONS PER CAPITA DAY (RGPCD)

RGPCD is a performance standard for public water suppliers serving municipalities and is a measure of the average amount of water a resident uses each day during the reporting period. High RGPCD values are associated with unrestricted outdoor water use, especially lawn watering. See ASR Instructions for further explanation and examples. There are two steps to determine your RGPCD number: Step 1: Determine the residential population served by your system (2 options to choose from). Step 2: Calculate RGPCD from population served and residential metered water volume.

RGPCD Step 1 - Choose one of two options to determine Population Served

Population Option 1: Accurate Count (census data): If your PWS serves an entire municipality, then use the most recent local or Federal census number for the total residential population. Click Here for 2010 U.S. census populations for MA cities and towns. Partially served communities can use the most recent local or Federal census if private well users and/or those served by other PWS systems are subtracted out (attach documentation to this ASR). Communities with high seasonal fluctuations can pro-rate the population for the duration of the influx. See ASR Instructions for further detail and examples.

Population Option 2: Estimate from Households Served If your PWS serves a portion of one or more communities and you cannot obtain a reliable census, click on the following link to open an excel spreadsheet for estimating your population. Click Here. This estimate is calculated from the number of households connected to your distribution system and the average household size. Save the spreadsheet onto your computer for use in subsequent years' reporting. If you are using a spreadsheet from your assessor's office or planning board to estimate number of households served, attach the spreadsheet or mail it to DEP and report the population served on Table DS-7 below.

If mailing Population Calculations or documentation send to:
Mass DEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

Table DS-7 Residential Population Served

Community(ies) served by PWS is (are) :	Partially Served
Method of Determining Population Served:	Option 1(Census)
Census Type (Federal or Local):	Local
Census year:	2011
Population Served:	14397

RGPCD Step 2 – Calculate RGPCD

Table DS-8 Residential Gallons per Capita Day To determine RGPCD, your metered residential volume (million gallons/year) is divided by 365 days. The result in then divided by the population served and multiplied by 1,000,000 to obtain gallons per person per day. If you include Residential Institutions volume in your RGPCD volume, also include the Residential Institutions population. See ASR instructions

Residential Water Use (million gallons)	/ 365	/ Population Served	X 1,000,000	=	Residential Gallons per Capita Day (gallons/person/day)
376.464	/365	/ 14397	X1,000,000	=	72

Table DS-9: Use this table to provide comments or additional information regarding this section of the ASR. You may explain discrepancies, provide supplemental information, or provide any other information to assist MassDEP in processing the data in your ASR.

POPULATION SERVED IS CENSUS POPULATION OF 14,897 LESS THE APPROXIMATELY 500 PEOPLE SUPPLIED BY PRIVATE WELLS.

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Water Management Act Annual Report - Basin Withdrawal

Instructions for completing Tables BW-1 through BW-4 are included in the ASR Instructions available at MassDEP's website. If you have any questions concerning completion of the Water Management Act Annual Report, please contact Richard Friend with the WMA Program at (617) 654-6522 or email him at richard.friend@state.ma.us

Table BW-1 Permit & Registration Information

River Basin (Watershed)	Registration Number	Permit Number
17-IPSWICH	31721301	

Water Withdrawal by Watershed

Calculation of Daily Average Withdrawal: Use Table BW-2 to document the reporting year withdrawal volume(s) by watershed. Table BW-3 compare's the reporting year actual withdrawal volume(s) to the volume(s) authorized under your WMA registration (s) and/or permit(s). The total volumes for each source and their respective watershed are reported in the Ground Water Sources and for Surface Water Sources report forms. Enter the total of all sources for each watershed in Table BW-2.

Enter volumes in million gallons per year(MGY). Example: If you pumped 400,512,000 gallons in the year, enter 400.512.

Table BW-2 Average Daily Withdrawal by Watershed

River Basin	Total Raw Water Pumped in the reporting year (mgy)	/ 365 =	Watershed Average Daily Withdrawal (mgd)
17-IPSWICH	212.599	/ 365 =	0.58

Table BW-3 WMA Authorized Volume vs. Actual Withdrawal Volume

River Basin	Registered Volume (mgd)	+	Permitted Volume (mgd)	=	WMA Authorized Withdrawal Volume (mgd)	-	Daily Avg. Water Use (mgd) (from Table BW-2 above)	=	Difference*
17-IPSWICH	0.96	+	0.00	=	0.96	-	0.58	=	0.38

*** A positive difference indicates that the volume withdrawn is less than the authorized volume. A negative value indicates that more water was pumped than is authorized and that your PWS may be out of compliance.**

Table BW-4 Permit Special Conditions

Review your WMA permit and list any Special Conditions of your WMA permit that require submission of an annual report to MassDEP. If the required report is being submitted with this ASR, please note in Table BW-4. If a required report was submitted earlier in the year, please provide the date submitted.

WMA Permit Special Condition Requiring Annual Report to MassDEP	Report Attached to ASR	If not attached, date submitted to MassDEP
	○ Yes ○ No	(mm\dd\yyyy)

If mailing annual report, send to:
MADEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

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System Information (COM/NTNC)

1. PWS Street Address

NORTH READING WATER DEPT.		
PWS Name		
235 NORTH STREET		
PWS Street Address Line 1	PWS Street Address Line 2	
NORTH READING	Massachusetts	01864
City/Town	State	Zip Code
978-357-5246	978-664-1713	
Phone Number	Fax Number (if available)	
HTTP://WWW.NORTHREADINGMA.GOV		
Web Site Address of PWS (if available)		

2. PWS Mailing Address ☐ Same as street address.

NORTH READING WATER DEPT.		
Mailing Name		
235 NORTH STREET		
Mailing address Line 1	Mailing address Line 2	
NORTH READING	Massachusetts	01864
City/Town	State	Zip Code

3. Is this a Seasonal System? (This question is not applicable to your PWS)

4. Owner/Responsible Person:

	☐ This is a new owner.
Owners Name- First, Middle Int, Last - one name only(if not municipal):	Phone Number

5. Primary Contact:

MARK E CLARK	978-664-6046 ☐ This is a new contact.
Name (First, Middle Int, Last) ▪ one name only▪	Phone Number
mclark@northreadingma.gov	
Email Address (For Emergency Purposes)	Re-enter Email Address

8. Names of Water Commissioners/Selectmen/Trustees/Association Board Members (if applicable). Please attach an organizational chart, if available. ☐ Check here to upload

Name			Phone	Title
GREG L BALUKONIS	L	BALUKONIS	978-664-6010	TOWN ADMINISTRATOR
RICHARD	M	CARNEVALE	978-664-6027	DPW DIRECTOR
SEAN		DELANEY	978-664-6025	CHAIR - BOARD OF SELE
VINCENT		RAGUCCI		CHAIR - WATER COMMIS

9. Owner Type:
MUNICIPAL

Federal Employment Identification Number (FEIN):
046001248
(FEIN) - Do NOT provide SSN

10. Is this system a not-for-profit organization	
(●) Yes ( ) No	
If yes, indicate Tax Exempt code (e.g., 501C):	MGL CH 64H
11. Population Served(DailyAverage):	
Winter Population (October March):	15077
Summer Population (April September):	15077
By what method was the population figured	Census Type: City/Town
	Other Description:

12. Testing requirements for lead and copper and bacteria in your system is based on the population .	Number of Samples	Frequency of Samples
Lead and copper samples required:	30	3YEARS
Winter Bacteria samples required:	15	MONTH
Summer Bacteria samples required:	15	MONTH

13. **Distribution Meter information:**	
a. Number of Service Connections:	4842
b. Percentage of service connections that are metered:	100 %
c. Are all publicly owned buildings metered?	(●) Yes ( ) No ( ) N/A
d. If No, what percent are	%

14. System Information	
a. Number of Distribution Systems:	1
b. Finished Water Storage Capacity in Million Gallons (MG): [Conversion factor is (# of gallons)/(1,000,000)= MG]	3.3
c. Pumping Capacity (GPM):	1150

15. Percentage of Source Types (must add up to 100%)

Ground Water	Surface Water	Purchased Ground	Purchased Surface
37 %	0 %	0 %	63 %

16. Emergency Response Actions:

a. Has your system completed an Emergency Response Plan (ERP).(DO NOT submit your ERP to MassDEP. MassDEP will review the ERP during your next sanitary survey.)

(●) Yes ( ) No

(●) I have made changes to the ERP (attach copies of all changes.)
( ) I have made no changes to the ERP.

b. Does your system have an Emergency Response (ER) annual training plan

( ) Yes (●) No

If Yes, please attach a copy of the plan. Describe the training performed during the reporting period, including the types of training, the date(s) of training, and number of staff and local officials trained on each date and their job titles.

c. Is your system registered for the Health and Homeland Alert Network (HHAN)

( ) Yes (●) No

d. Has your system signed the agreement and joined the Massachusetts Water and Wastewater Agency Response Network

( ) Yes (●) No

e. How often does your system test the following

Alarms:	Monthly	Other Frequency:	
Interlocks:	Monthly	Other Frequency:	
Back-up power sources:	Other	Other Frequency:	WEEKLY

f. List and describe all Level 3 or higher ER incidents during the reporting period.

Date of ER incident	Level	Description

17. Do you have an antenna or other appurtenance (not needed for drinking water purposes) attached to any of your storage tank (s)

(●) Yes ( ) No ( ) No storage tanks

If Yes, list the antennae or other appurtenances, owner(s) names, and the date installed:

Storage Tank Name	Antennae or Appurtenance	Owner Name	Date (mm/dd/yyyy) Installed
MOOSE HILL	CELLULAR PHONE ANTE	T-1 MOBILE	7/1/2012
MOOSE HILL	FIRE DEPARTMENT COM	NR FIRE DEPARTMENT	7/1/1994
SWAN POND	CELLULAR PHONE ANTE	T-1 MOBILE	7/1/2008
TOWER HILL	CELLULAR PHONE ANTE	T-1 MOBILE	7/1/2010

18. Comments or additional information regarding this section:

FIRE DEPARTMENT COMMUNICATIONS ANTENNAE ARE LOCATED ON ALL THREE WATER STORAGE TANKS IN NORTH READING (MOOSE HILL, SWAN POND AND TOWER HILL) ALL THREE TANKS ALSO HAVE CELLULAR ANTENNAE ON THEM.

Cross Connection Control Program (CCCP)

1. Cross Connection Program Coordinator

MARK	CLARK	
Coordinator First Name	Coordinator Last Name	
235 NORTH STREET		
Coordinator Street Address Line 1	Coordinator Street Address Line 2	
NORTH READING	Massachusetts	01864
City/Town	State	Zip Code
978-664-6046	978-664-1713	
Phone Number	Fax Number (if available)	
MCLARK@NORTHREADINGMA.GOV		
Coordinator email		

Surveyor Personnel Information :

To add a surveyor, begin typing the certification ID # in the field below. Pick the license # off the list and then click the "Add Surveyor" button.

MassDEP Certification ID Number

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Water Production & Consumption Information

How to report in Gallons vs. Million Gallons
When Converting gallons to Million gallons, decimal point moves 6 places to the left.

	If Reporting in Gallons (Gal)	If Reporting in Million Gallons (MG)
Example 1	45,562,100	45.5621
Example 2	340,212	0.340212
Example 3	631,020,000	631.02
Example 4	96,543	0.096543

Volume Units ○ Gallons (GAL) ◉ Million Gallons (MG) ○ No Meter

FINISHED Water Production and Consumption Summary for Reporting Year :

Finished Water means water that is introduced into the distribution system of a public water system and is intended for distribution and consumption without further treatment, except as treatment necessary to maintain water quality in the distribution system (e.g. booster disinfection, addition of corrosion control chemicals).

Month	(1) Amount of **finished** water from own sources (MG)	(2) Amount of **finished** water purchased from other systems (MG)	(3) Amount of **finished** water sold to other systems (MG)	(4) Net **finished** Water that entered your distribution system (1) + (2) - (3)= (4) (MG)
January	09.580	24.090	0.000	33.670
February	12.819	15.549	0.000	28.368
March	17.833	14.494	0.000	32.327
April	16.858	16.619	0.000	33.477
May	17.312	29.136	0.000	46.448
June	17.220	30.934	0.000	48.154
July	18.200	39.055	0.000	57.255
August	15.345	39.075	0.000	54.420
September	11.610	35.095	0.000	46.705
October	12.025	32.071	0.000	44.096
November	11.578	22.599	0.000	34.177
December	13.687	20.706	0.000	34.393
TOTAL	174.067	319.423	0.000	493.490

Maximum Daily Finished Water Consumption:	Volume (MG): 2.122	Date: 7/22/2013

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RAW Water Production and Consumption Summary for Reporting Year :

Raw Water means water in its natural state, prior to treatment and is usually the water entering the first treatment process of a water treatment plant.

☐ Same as finished water (it is not necessary to complete Table if same volume as above)

Month	(1) Amount of **raw** water pumped from own sources (MG)	(2) Amount of **raw** water purchased from other systems (MG)	(3) Amount of **raw** water sold to other systems (MG)	(4) Net **raw** Water Consumption (1) + (2) - (3) = (4) (MG)
January	10.347	24.090	0.000	34.437
February	13.799	15.549	0.000	29.348
March	19.151	14.494	0.000	33.645
April	18.220	16.619	0.000	34.839
May	18.558	29.136	0.000	47.694
June	18.235	30.934	0.000	49.169
July	19.234	39.055	0.000	58.289
August	16.344	39.075	0.000	55.419
September	12.685	35.095	0.000	47.780
October	12.943	32.071	0.000	45.014
November	12.548	22.599	0.000	35.147
December	14.698	20.706	0.000	35.404
TOTAL	186.762	319.423	0.000	506.185

Maximum Daily Raw Water Pumping:	Volume (MG): 2.145	Date: 7/22/2013

Summary of Water Sold

Sold Water

System Name	**PWS ID#**	**Total Volume Sold**	**Water type**

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City: NORTH READING
PWS Class: COM

Metered Finished Water Consumption by Service Type

U.S. EPA requires every PWS to report what their water is used for in order to characterize each system. In this table, report the percentages of metered water for each category below, ONLY for those categories over 10%. For municipal water suppliers, most of the water will be reported as Residential Area. If any other categories are more than 10% of your metered use, report it in the appropriate category. If any category is less than 10%, do NOT report it. The precentage do NOT have to add to 100%, since water use in some categories will be less than 10% and therefore is not reported.

ONLY report uses for categories over 10% of total metered use. Report ALL metered water use in the Water Management Distribution System Form (if appropriate)

%	Primary Service Area	Type	%	Primary Service Area	Type
	Yes	Day Care Center		Yes	Other Residential
	Yes	Dispenser		Yes	Other Transient
	Yes	Homeowners Association		Yes	Recreation Area
	Yes	Hotel/Motel	89	Yes (selected)	Residential Area
	Yes	Highway Rest Area		Yes	Restaurant
	Yes	Industrial/Agricultural		Yes	Retail Employees
	Yes	Interstate Carrier		Yes	School
	Yes	Institution		Yes	Sanitary Improvement District
	Yes	Medical Facility		Yes	Summer Camp
	Yes	Mobile Home Park		Yes	Secondary Residences
	Yes	Mobile Home Park, Principal Residence		Yes	Service Station
	Yes	Municipality		Yes	Subdivision
	Yes	Other Area		Yes	Water Bottler
	Yes	Other Non-Transient Area		Yes	Wholesaler
	Yes	Commercial			

Summary of Treatment Plant Losses (complete only if finished water volume is less than raw water)

☐ No treatment plant losses (not applicable)

Treatment PlantID:	Total Raw Water into treatment plant last year (raw pumped + raw purchased - raw sold):	-	Total Finished Water from treatment plant last year:	=	Total Water Lost to Treatment Process last year:

Briefly describe the fate of the waste product (slurry or sludge) produced by your treatment process (discharge to sewer, groundwater discharge, settling lagoons, re-circulate back into treatment plant, etc.):

BACKWASH WATER FROM THE FILTERS IS DISCHARGED TO SETTLING LAGOONS.

X. Comments or additional information regarding this section

NOTE - I AM HAVING A PROBLEM ENTERING THE TREATMENT PLANT LOSSES ABOVE. THE FIGURES ARE: 3213000-01T: 90.994 MG (RAW) - 84.198 MG (FINISH) = 6.796 MG (LOSS) 3213000-02T: 82.425 MG (RAW) - 76.526 MG (FINISH) = 5.899 MG (LOSS)

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PWSID#: 3213000
Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Water Management Act Annual Report - Distribution

All public water suppliers distributing 100,000 gallons per day or more must complete Tables DS-1 through DS-5 and Tables DS-7 and DS-8. Tables DS-6 and DS-9 are optional. Instructions for completing Tables DS-1 through DS-8 are included in the ASR Instructions available at MassDEP's website. If you have any questions concerning completion of the Distribution System Report, please contact Richard Friend with the WMA Program at (617) 654-6522 or email him at richard.friend@state.ma.us

Table DS-1 Summary of Leak Detection Activities During the Reporting Year	
1. Total miles of water mains	82
2. Miles of mains surveyed this year	0
3. Number of leaks found	0
4. Number of leaks repaired	0
5. Estimated volume lost (mg) if a reliable estimate can be made	0
6. Date of last leak detection survey of entire system:	12/31/2012 (mm/dd/yyyy)

Table DS-2 Water Conservation - Limits on Withdrawals

1. **Did your PWS implement mandatory nonessential outdoor water use restrictions in the reporting year?**

   (●) Yes ( ) No

2. **If yes,why did you institute mandatory restrictions (check all that apply)?**

a. ☐ Required by WMA permit

   ☐ Calendar trigger in permit

   ☐ Streamflow trigger in permit

   ☐ Other trigger in permit — If "Other Trigger" then describe:

b. ☑ Reason other than permit requirement

Describe: NORTH READING BYLAWS MANDATE ODD/EVEN OUTDOOR WATERING.

3. **Please characterize the type of mandatory restrictions that were in place (Check all that apply)**

☐ Total outdoor ban

☐ Hand-held only

☐ Hourly Describe:

Daily: (●) Odd/Even ( ) Twice/Week ( ) Once/Week ( ) Other Daily — If "Other Daily" then describe:

Table DS-3 Metered Finished Water Use Complete Table DS-3 to account for all of your metered water volumes (e.g. permanent and temporary; private and municipal/government; billed and non-billed). Do not include water sold to other PWSs, which is reported on the Water Production & Consumption Information form

Use Category	No. of Service Connections	Total Volume (mgy)	Category Description
Residential	4582	325.707	Water provided to residences in your distribution system, including for-profit apartments, condos, and seasonal homes. All water used for lawn watering at residential buildings belongs in this category.
Residential Institutions	0	0.000	Water provided to institutions with residential population such as colleges. It is optional to account institutions volumes separately (may be included in Residential above - see instructions).
Commercial/Business	170	19.834	Water served to businesses and other commercial entities.
Agricultural	0	0.000	Water used mainly to grow food, raise animals, or run a garden center.
Industrial	60	12.260	Water used mainly for industrial purposes.
Municipal/Institutional/Non-profits	30	5.386	Water used for municipal purposes, including schools, playing fields, municipal buildings, treatment plant; non-profits such as churches; non-residential institutions such as private schools.
Other*	0	0.000	Water used for purposes not included in above categories.
TOTALS	4842	363.187	Total number of service connections and metered volume.

* If you include a volume under "Other", list the use(s):

UNACCOUNTED FOR WATER (UAW)

Table DS-4 Confidently Estimated Municipal Use volume To qualify as confidently estimated municipal use calculations/documentation for each estimated use must be attached to this ASR or mailed to MassDEP. If no documentation is provided, DEP will count the volumes as unaccounted for water. See ASR Instructions for more detail. Leak detection volumes are not counted as a confidently estimated municipal use. Optional Excel spreadsheets for calculating confidently estimated use can be found at the MADEP website at http://www.mass.gov/eea/agencies/massdep/water/approvals/drinking-water-forms.html#16

Confidently Estimated Municipal Use (CEMU)	Estimated million gallons per year
Fire protection & training	2.00
Hydrant/water main flushing/main construction	+ 1.43
Flow testing	+ 0.05
Bleeders/ Blow offs	+ 3.86
Tank overflow & drainage	+ 0
Sewer & stormwater system flushing	+ 0
Street cleaning	+ 0.05
Source meter calibration adjustments	+ 37.60
Major water main breaks (not leak detection)	+ 0.38
Total Confidently Estimated Municipal Use	= 45.37

YOU MUST PROVIDE DOCUMENTATION FOR ALL OF YOUR CEMU VOLUMES.

Are you attaching electronic files to the eASR that document your CEMU volumes?

○ Yes ◉ No

Paper copies of CEMU volumes may be mailed to:
Mass DEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

Table DS-5 Unaccounted for Water To calculate UAW, subtract total metered use and confidently estimated municipal use volumes from the total volume of finished water entering your distribution system.

	Million Gallons/Year (MGY)	% of Total Water Available for Distribution
Total Finished Water Available for Distribution **(Total Net Finished Water from Production Form)**	493.49	100%
Total Metered Use **(System Total Metered Use from Table DS-3)**	- 363.187	- 73.6 %
Total Confidently Estimated Municipal Use **(Total from Table DS-4)**	- 45.37	- 9.2 %
Unaccounted for Water (UAW)	= 84.9	= 17.2 %

Table DS-6 Sources of Unaccounted for Water (Optional) Use this table to provide estimated volumes of your unaccounted for water.

Known or Suspected Source of Unaccounted for Water	Estimated Volume (MGY)
Leak Detection	0.000
Water Theft	14.805
Meter Malfunction/mis-registration	19.740
Other (specify): ASSUMES 3% OF WATER PRODUCTION LOST TO THEFT AND 4% TO METER UNDER-REGISTRATION . . . SMALL WATER SERVICE LEAKS	2.90
Other (specify): UNAVOIDABLE/UNRECOVERABLE LEAKAGE	5.000
Total:	42.445

RESIDENTIAL GALLONS PER CAPITA DAY (RGPCD)

RGPCD is a performance standard for public water suppliers serving municipalities and is a measure of the average amount of water a resident uses each day during the reporting period. High RGPCD values are associated with unrestricted outdoor water use, especially lawn watering. See ASR Instructions for further explanation and examples. There are two steps to determine your RGPCD number: Step 1: Determine the residential population served by your system (2 options to choose from). Step 2: Calculate RGPCD from population served and residential metered water volume.

RGPCD Step 1 - Choose one of two options to determine Population Served

Population Option 1: Accurate Count (census data): If your PWS serves an entire municipality, then use the most recent local or Federal census number for the total residential population. Click Here for 2010 U.S. census populations for MA cities and towns. Partially served communities can use the most recent local or Federal census if private well users and/or those served by other PWS systems are subtracted out (attach documentation to this ASR). Communities with high seasonal fluctuations can pro-rate the population for the duration of the influx. See ASR Instructions for further detail and examples.

Population Option 2: Estimate from Households Served If your PWS serves a portion of one or more communities and you cannot obtain a reliable census, click on the following link to open an excel spreadsheet for estimating your population. Click Here. This estimate is calculated from the number of households connected to your distribution system and the average household size. Save the spreadsheet onto your computer for use in subsequent years' reporting. If you are using a spreadsheet from your assessor's office or planning board to estimate number of households served, attach the spreadsheet or mail it to DEP and report the population served on Table DS-7 below.

If mailing Population Calculations or documentation send to:
Mass DEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

Table DS-7 Residential Population Served	
Community(ies) served by PWS is (are) :	Partially Served
Method of Determining Population Served:	Option 1(Census)
Census Type (Federal or Local):	Local
Census year:	2013
Population Served:	14577

RGPCD Step 2 – Calculate RGPCD

Table DS-8 Residential Gallons per Capita Day To determine RGPCD, your metered residential volume (million gallons/year) is divided by 365 days. The result in then divided by the population served and multiplied by 1,000,000 to obtain gallons per person per day. If you include Residential Institutions volume in your RGPCD volume, also include the Residential Institutions population. See ASR instructions

Residential Water Use (million gallons)	/ 365	/ Population Served	X 1,000,000	=	Residential Gallons per Capita Day (gallons/person/day)
325.707	/ 365	/ 14577	X1,000,000	=	61

Table DS-9: Use this table to provide comments or additional information regarding this section of the ASR. You may explain discrepancies, provide supplemental information, or provide any other information to assist MassDEP in processing the data in your ASR.

POPULATION SERVED IS CENSUS POPULATION OF 15,077 LESS THE APPROXIMATELY 500 PEOPLE ON PRIVATE WELLS IN NORTH READING.

PWSID#: 3213000
Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Water Management Act Annual Report - Basin Withdrawal

Instructions for completing Tables BW-1 through BW-4 are included in the ASR Instructions available at MassDEP's website. If you have any questions concerning completion of the Water Management Act Annual Report, please contact Richard Friend with the WMA Program at (617) 654-6522 or email him at richard.friend@state.ma.us

Table BW-1 Permit & Registration Information

River Basin (Watershed)	Registration Number	Permit Number
17-IPSWICH	31721301	

Water Withdrawal by Watershed

Calculation of Daily Average Withdrawal: Use Table BW-2 to document the reporting year withdrawal volume(s) by watershed. Table BW-3 compare's the reporting year actual withdrawal volume(s) to the volume(s) authorized under your WMA registration (s) and/or permit(s). The total volumes for each source and their respective watershed are reported in the Ground Water Sources and for Surface Water Sources report forms. Enter the total of all sources for each watershed in Table BW-2.

Enter volumes in million gallons per year(MGY). Example: If you pumped 400,512,000 gallons in the year, enter 400.512.

Table BW-2 Average Daily Withdrawal by Watershed

River Basin	Total Raw Water Pumped in the reporting year (mgy)	/ 365 =	Watershed Average Daily Withdrawal (mgd)
17-IPSWICH	186.762	/ 365 =	0.51

Table BW-3 WMA Authorized Volume vs. Actual Withdrawal Volume

River Basin	Registered Volume (mgd)	+	Permitted Volume (mgd)	=	WMA Authorized Withdrawal Volume (mgd)	-	Daily Avg. Water Use (mgd) (from Table BW-2 above)	=	Difference*
17-IPSWICH	0.96	+	0.25	=	1.21	-	0.51	=	0.70

*** A positive difference indicates that the volume withdrawn is less than the authorized volume. A negative value indicates that more water was pumped than is authorized and that your PWS may be out of compliance.**

Table BW-4 Permit Special Conditions

Review your WMA permit and list any Special Conditions of your WMA permit that require submission of an annual report to MassDEP. If the required report is being submitted with this ASR, please note in Table BW-4. If a required report was submitted earlier in the year, please provide the date submitted.

WMA Permit Special Condition Requiring Annual Report to MassDEP	Report Attached to ASR	If not attached, date submitted to MassDEP
	○ Yes ○ No	(mm\dd\yyyy)

If mailing annual report, send to:
MADEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

Purchased Water Sources

Individual Purchased Water Source Statistics

Source ID:	3213000-01P
Source Name:	ANDOVER SUPPLY
Location:	MAIN STREET (ROUTE 28) AND CENTRAL
	STREET (GOULD ROAD)
Seller ID# (PWS ID):	3009000
Seller Name:	ANDOVER WATER DEPT
Status:	A
Source Availability:	ACTIVE

		Withdrawal Units:	MG
		January:	24.090000
		February:	15.549000
		March:	14.494000
		April:	16.619000
		May:	29.136000
		June:	30.934000
		July:	39.055000
		August:	39.075000
		September:	35.095000
		October:	32.071000
		November:	22.599000
		December:	20.706000
Source Metered:	Yes	Total Amount Pumped:	319.423000
Date of Meter Installation:	10/1/1995	Total # of Days Pumped:	365
Type of water metered for source:	FINISHED	Maximum Single Day Pumped Volume:	1.497000
Last Meter Calibration:	9/12/2012	Date of Maximum Amount Pumped:	8/22/2013

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2014 Public Water Supply Verification

Please verify the information below and then click the Continue button.

PWS ID:	**3213000**
PWS Name:	**NORTH READING WATER DEPT.**
PWS Street Address Line 1:	**235 NORTH STREET**
PWS Street Address Line 2:	
City/Town:	**NORTH READING**
State:	**MA**
Zip Code:	**01864-0000**
Class:	**COM**

Legally Responsible Party Contact Information

The Legally Responsible Party is that individual who has the ultimate authority to ensure that your system is in compliance with the federal and state drinking water regulations. This may be the owner of a private facility, a town or school official or other similarly authorized person.

Book/Page:	
First Name	MARK
Middle Initial	E
Last Name	CLARK
Company Name	NORTH READING WATER DEPARTMENT
Phone Number	9786646046
Street Address 1	235 NORTH STREET
Street Address 2	
City/Town	NORTH READING
State	MA
Zip Code	01864

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Name: NORTH READING WATER DEPT.
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PWS Class: COM

System Information (COM/NTNC)

1. PWS Street Address

NORTH READING WATER DEPT.
PWS Name

235 NORTH STREET	
PWS Street Address Line 1	PWS Street Address Line 2

NORTH READING	Massachusetts	01864
City/Town	State	Zip Code

978-357-5246	978-664-1713
Phone Number	Fax Number (if available)

Web Site Address of PWS (if available)

2. PWS Mailing Address ☐ Same as street address.

NORTH READING WATER DEPT.
Mailing Name

235 NORTH STREET	
Mailing address Line 1	Mailing address Line 2

NORTH READING	Massachusetts	01864
City/Town	State	Zip Code

3. Is this a Seasonal System? (This question is not applicable to your PWS)

4. Owner/Responsible Person:

	☐ This is a new owner.
Owners Name- First, Middle Int, Last - one name only(if not municipal):	Phone Number

5. Primary Contact:

MARK E CLARK	978-664-6046 ☐ This is a new contact.
Name (First, Middle Int, Last) • one name only•	Phone Number
mclark@northreadingma.gov	
Email Address (For Emergency Purposes)	Re-enter Email Address

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8. Names of Water Commissioners/Selectmen/Trustees/Association Board Members (if applicable). Please attach an organizational chart, if available. ☐ Check here to upload

Name			Phone	Title
MICHAEL		GILLEBERTO	978-664-6010	TOWN ADMINISTRATOR
RICHARD		CARNEVALE	978-664-6027	DPW DIRECTOR
ROBERT		MAUCERI	978-664-6025	CHAIR - BOS
VINCENT		RAGUCCI		CHAIR - WATER COMMIS

9. Owner Type:

MUNICIPAL

Federal Employment Identification Number (FEIN):

046001248

(FEIN) - Do NOT provide SSN

10. Is this system a not-for-profit organization

◉ Yes ○ No

If yes, indicate Tax Exempt code (e.g., 501C):	MGL CH 64H

11. Population Served(DailyAverage):

Winter Population (October March):	15200	
Summer Population (April September):	15200	
By what method was the population figured	Census Type:	City/Town
	Other Description:	

12. Testing requirements for lead and copper and bacteria in your system is based on the population .

	Number of Samples	Frequency of Samples
Lead and copper samples required:	30	3YEARS
Winter Bacteria samples required:	15	MONTH
Summer Bacteria samples required:	15	MONTH

13. **Distribution Meter information:**

a. Number of Service Connections:	4849
b. Percentage of service connections that are metered:	100 %
c. Are all publicly owned buildings metered?	◉ Yes ○ No ○ N/A
d. If No, what percent are	%

14. System Information

a. Number of Distribution Systems:	1
b. Finished Water Storage Capacity in Million Gallons (MG): [Conversion factor is (# of gallons)/(1,000,000)= MG]	3.3
c. Pumping Capacity (GPM):	1150

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15. Percentage of Source Types (must add up to 100%)

Ground Water	Surface Water	Purchased Ground	Purchased Surface
35 %	0 %	0 %	65 %

16. Emergency Response Actions:

a. Has your system completed an Emergency Response Plan (ERP).(DO NOT submit your ERP to MassDEP. MassDEP will review the ERP during your next sanitary survey.)

(●) Yes ( ) No

(●) I have made changes to the ERP (attach copies of all changes.)
( ) I have made no changes to the ERP.

b. Does your system have an Emergency Response (ER) annual training plan

( ) Yes (●) No

If Yes, please attach a copy of the plan. Describe the training performed during the reporting period, including the types of training, the date(s) of training, and number of staff and local officials trained on each date and their job titles.

c. Is your system registered for the Health and Homeland Alert Network (HHAN)

( ) Yes (●) No

d. Has your system signed the agreement and joined the Massachusetts Water and Wastewater Agency Response Network

( ) Yes (●) No

e. How often does your system test the following

Alarms:	Monthly	Other Frequency:	
Interlocks:	Monthly	Other Frequency:	
Back-up power sources:	Other	Other Frequency:	WEEKLY

f. List and describe all Level 3 or higher ER incidents during the reporting period.

Date of ER incident	Level	Description

17. Do you have an antenna or other appurtenance (not needed for drinking water purposes) attached to any of your storage tank (s)

(●) Yes ( ) No ( ) No storage tanks

If Yes, list the antennae or other appurtenances, owner(s) names, and the date installed:

Storage Tank Name	Antennae or Appurtenance	Owner Name	Date (mm/dd/yyyy) Installed
MOOSE HILL	CELLULAR PHONE ANTE	T-1 MOBILE	7/1/2012
MOOSE HILL	FIRE DEPARTMENT COM	NR FIRE DEPARTMENT	7/1/1994
SWAN POND	CELLULAR PHONE ANTE	T-1 MOBILE	7/1/2008
TOWER HILL	CELLULAR PHONE ANTE	T-1 MOBILE	7/1/2010

18. Comments or additional information regarding this section:

FIRE DEPARTMENT COMMUNICATIONS ANTENNAE ARE LOCATED ON ALL THREE WATER STORAGE TANKS IN NORTH READING (MOOSE HILL, SWAN POND AND TOWER HILL). ALL THREE TANKS ALSO HAVE CELLULAR ANTENNAE ON THEM.

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Cross Connection Control Program (CCCP)

1. Cross Connection Program Coordinator

MARK	CLARK	
Coordinator First Name	Coordinator Last Name	
235 NORTH STREET		
Coordinator Street Address Line 1	Coordinator Street Address Line 2	
NORTH READING	Massachusetts	01864
City/Town	State	Zip Code
978-664-6046	978-664-1713	
Phone Number	Fax Number (if available)	
MCLARK@NORTHREADINGMA.GOV		
Coordinator email		

Surveyor Personnel Information :

To add a surveyor, begin typing the certification ID # in the field below. Pick the license # off the list and then click the "Add Surveyor" button.

MassDEP Certification ID Number

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Water Production & Consumption Information

How to report in Gallons vs. Million Gallons
When Converting gallons to Million gallons, decimal point moves 6 places to the left.

	If Reporting in Gallons (Gal)	If Reporting in Million Gallons (MG)
Example 1	45,562,100	45.5621
Example 2	340,212	0.340212
Example 3	631,020,000	631.02
Example 4	96,543	0.096543

Volume Units ○ Gallons (GAL) ● Million Gallons (MG) ○ No Meter

FINISHED Water Production and Consumption Summary for Reporting Year :

Finished Water means water that is introduced into the distribution system of a public water system and is intended for distribution and consumption without further treatment, except as treatment necessary to maintain water quality in the distribution system (e.g. booster disinfection, addition of corrosion control chemicals).

Month	(1) Amount of **finished** water from own sources (MG)	(2) Amount of **finished** water purchased from other systems (MG)	(3) Amount of **finished** water sold to other systems (MG)	(4) Net **finished** Water that entered your distribution system (1) + (2) - (3)= (4) (MG)
January	13.931	21.209	0.000	35.140
February	10.847	22.438	0.000	33.285
March	11.645	25.232	0.000	36.877
April	11.310	22.718	0.000	34.028
May	13.001	30.755	0.000	43.756
June	16.730	41.230	0.000	57.960
July	18.305	42.026	0.000	60.331
August	16.865	37.822	0.000	54.687
September	10.488	38.410	0.000	48.898
October	15.127	24.844	0.000	39.971
November	15.097	19.723	0.000	34.820
December	16.477	20.508	0.000	36.985
TOTAL	169.823	346.915	0.000	516.738

Maximum Daily Finished Water Consumption: Volume (MG): 2.233 Date: 6/28/2014

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City: NORTH READING
PWS Class: COM

RAW Water Production and Consumption Summary for Reporting Year :

Raw Water means water in its natural state, prior to treatment and is usually the water entering the first treatment process of a water treatment plant.

☐ Same as finished water (it is not necessary to complete Table if same volume as above)

Month	(1) Amount of **raw** water pumped from own sources (MG)	(2) Amount of **raw** water purchased from other systems (MG)	(3) Amount of **raw** water sold to other systems (MG)	(4) Net **raw** Water Consumption (1) + (2) - (3) = (4) (MG)
January	14.965	21.209	0.000	36.174
February	11.788	22.438	0.000	34.226
March	12.693	25.232	0.000	37.925
April	12.326	22.718	0.000	35.044
May	14.052	30.755	0.000	44.807
June	18.308	41.230	0.000	59.538
July	20.089	42.026	0.000	62.115
August	18.156	37.822	0.000	55.978
September	11.359	38.410	0.000	49.769
October	16.406	24.844	0.000	41.250
November	16.318	19.723	0.000	36.041
December	17.750	20.508	0.000	38.258
TOTAL	184.210	346.915	0.000	531.125

Maximum Daily Raw Water Pumping:	Volume (MG): 2.292	Date: 6/28/2014

Summary of Water Sold

Sold Water

System Name	PWS ID#	Total Volume Sold	Water type

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Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Metered Finished Water Consumption by Service Type

U.S. EPA requires every PWS to report what their water is used for in order to characterize each system. In this table, report the percentages of metered water for each category below, ONLY for those categories over 10%. For municipal water suppliers, most of the water will be reported as Residential Area. If any other categories are more than 10% of your metered use, report it in the appropriate category. If any category is less than 10%, do NOT report it. The precentage do NOT have to add to 100%, since water use in some categories will be less than 10% and therefore is not reported.

ONLY report uses for categories over 10% of total metered use. Report ALL metered water use in the Water Management Distribution System Form (if appropriate)

%	Primary Service Area	Type	%	Primary Service Area	Type
	Yes	Day Care Center		Yes	Other Residential
	Yes	Dispenser		Yes	Other Transient
	Yes	Homeowners Association		Yes	Recreation Area
	Yes	Hotel/Motel	87	● Yes	Residential Area
	Yes	Highway Rest Area		Yes	Restaurant
	Yes	Industrial/Agricultural		Yes	Retail Employees
	Yes	Interstate Carrier		Yes	School
	Yes	Institution		Yes	Sanitary Improvement District
	Yes	Medical Facility		Yes	Summer Camp
	Yes	Mobile Home Park		Yes	Secondary Residences
	Yes	Mobile Home Park, Principal Residence		Yes	Service Station
	Yes	Municipality		Yes	Subdivision
	Yes	Other Area		Yes	Water Bottler
	Yes	Other Non-Transient Area		Yes	Wholesaler
	Yes	Commercial			

Summary of Treatment Plant Losses (complete only if finished water volume is less than raw water)

☐ No treatment plant losses (not applicable)

Treatment PlantID:	Total Raw Water into treatment plant last year (raw pumped + raw purchased - raw sold):	-	Total Finished Water from treatment plant last year:	=	Total Water Lost to Treatment Process last year:
3213000-01T	100.944		92.333		8.610
3213000-02T	71.945		66.152		

Briefly describe the fate of the waste product (slurry or sludge) produced by your treatment process (discharge to sewer, groundwater discharge, settling lagoons, re-circulate back into treatment plant, etc.):

SETTLING LAGOONS

X. Comments or additional information regarding this section

Massachusetts Department of Environmental Protection
Bureau of Water Resources (BWR) – Drinking Water Program
Public Water Supply Annual Statistical Report
Reporting Year 2014

PWSID#: 3213000
Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Water Management Act Annual Report - Distribution

All public water suppliers distributing 100,000 gallons per day or more must complete Tables DS-1 through DS-5 and Tables DS-7 and DS-8. Tables DS-6 and DS-9 are optional. Instructions for completing Tables DS-1 through DS-8 are included in the ASR Instructions available at MassDEP's website. If you have any questions concerning completion of the Distribution System Report, please contact Richard Friend with the WMA Program at (617) 654-6522 or email him at richard.friend@state.ma.us

Table DS-1 Summary of Leak Detection Activities During the Reporting Year

1. Total miles of water mains	82
2. Miles of mains surveyed this year	82
3. Number of leaks found	27
4. Number of leaks repaired	24
5. Estimated volume lost (mg) if a reliable estimate can be made	24.6
6. Date of last leak detection survey of entire system:	12/31/2014 (mm/dd/yyyy)

Table DS-2 Water Conservation - Limits on Withdrawals

1. **Did your PWS implement mandatory nonessential outdoor water use restrictions in the reporting year?**

   (●) Yes ( ) No

2. **If yes,why did you institute mandatory restrictions (check all that apply)?**

a. ☐ Required by WMA permit

   ☐ Calendar trigger in permit

   ☐ Streamflow trigger in permit

   ☐ Other trigger in permit — If "Other Trigger" then describe:

b. ☑ Reason other than permit requirement

Describe: NORTH READING WATER CONSERVATION BYLAW REQUIRES MANDATORY CONSERVATION

3. **Please characterize the type of mandatory restrictions that were in place (Check all that apply)**

☐ Total outdoor ban

☐ Hand-held only

☐ Hourly Describe:

Daily: (●) Odd/Even ( ) Twice/Week ( ) Once/Week ( ) Other Daily — If "Other Daily" then describe:

4. **If you instituted mandatory restrictions, on what dates were restrictions in place? (you may have had only one period of restriction)**

	Start Date	End Date
Period 1	5/1/2014	10/31/2014
	(mm/dd/yyyy)	(mm/dd/yyyy)
Period 2		
	(mm/dd/yyyy)	(mm/dd/yyyy)
Period 3		
	(mm/dd/yyyy)	(mm/dd/yyyy)

5. **Indicate if you plan or expect to institute nonessential outdoor water use restrictions in the upcoming summer. If you hold a WMA permit with Seasonal Limits on Nonessential Outdoor Water Use conditions, indicate whether you plan on instituting calendar-based or streamflow trigger-based outdoor water use restrictions. Remember that if you plan on instituting calendar restrictions, they must be in place by May 1. Streamflow-based restrictions must be in place once the trigger specified in your WMA permit has been reached for three consecutive days. Refer to your permit for specific nonessential outdoor water use requirements. Indicate if you plan on instituting restrictions even though you do not hold a WMA permit with outdoor water use restriction or do not hold a permit at all.**

- [ ] Planning to institute calendar-based nonessential outdoor water use restrictions per WMA permit.
- [ ] Planning to institute streamflow-based nonessential outdoor water use restrictions per WMA permit.
- [x] Planning to institute nonessential outdoor water use restrictions for reasons other than WMA permit requirements.
- [ ] Do not intend on instituting nonessential outdoor water use restrictions.

Please Note: Enter volumes in Tables DS-3, DS-4, DS-5 and DS-6 in million gallons per year (mgy).
Example 1: if a volume is 654,120,152 gallons, enter 645.120152 mgy.
Example 2: if a volume is 580,123 gallons, enter 0.580123 mgy.
Example 3: if a volume is 86,000 gallons, enter 0.086 mgy.

Massachusetts Department of Environmental Protection PWSID#: 3213000
Bureau of Water Resources (BWR) – Drinking Water Program
Public Water Supply Annual Statistical Report
Reporting Year 2014

Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Table DS-3 Metered Finished Water Use Complete Table DS-3 to account for all of your metered water volumes (e.g. permanent and temporary; private and municipal/government; billed and non-billed). Do not include water sold to other PWSs, which is reported on the Water Production & Consumption Information form

Use Category	No. of Service Connections	Total Volume (mgy)	Category Description
Residential	4593	373.175	Water provided to residences in your distribution system, including for-profit apartments, condos, and seasonal homes. All water used for lawn watering at residential buildings belongs in this category.
Residential Institutions	0	0.000	Water provided to institutions with residential population such as colleges. It is optional to account institutions volumes separately (may be included in Residential above - see instructions).
Commercial/Business	177	31.438	Water served to businesses and other commercial entities.
Agricultural	0	0.000	Water used mainly to grow food, raise animals, or run a garden center.
Industrial	49	18.269	Water used mainly for industrial purposes.
Municipal/Institutional/Non-profits	30	7.043	Water used for municipal purposes, including schools, playing fields, municipal buildings, treatment plant; non-profits such as churches; non-residential institutions such as private schools.
Other*	0	0.000	Water used for purposes not included in above categories.
TOTALS	4849	429.925	Total number of service connections and metered volume.

* If you include a volume under "Other", list the use(s):

UNACCOUNTED FOR WATER (UAW)

Table DS-4 Confidently Estimated Municipal Use volume To qualify as confidently estimated municipal use calculations/documentation for each estimated use must be attached to this ASR or mailed to MassDEP. If no documentation is provided, DEP will count the volumes as unaccounted for water. See ASR Instructions for more detail. Leak detection volumes are not counted as a confidently estimated municipal use. Optional Excel spreadsheets for calculating confidently estimated use can be found at the MADEP website at http://www.mass.gov/eea/agencies/massdep/water/approvals/drinking-water-forms.html#16

Confidently Estimated Municipal Use (CEMU)	Estimated million gallons per year
Fire protection & training	2.00
Hydrant/water main flushing/main construction	+ 1.49
Flow testing	+ 0.05
Bleeders/ Blow offs	+ 4.45
Tank overflow & drainage	+ 0.00
Sewer & stormwater system flushing	+ 0.00
Street cleaning	+ 0.05
Source meter calibration adjustments	+ 14.37
Major water main breaks (not leak detection)	+ 1.07
Total Confidently Estimated Municipal Use	= 23.48

YOU MUST PROVIDE DOCUMENTATION FOR ALL OF YOUR CEMU VOLUMES.

Massachusetts Department of Environmental Protection PWSID#: 3213000
Bureau of Water Resources (BWR) – Drinking Water Program
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Name: NORTH READING WATER DEPT.
City: NORTH READING
PWS Class: COM

Are you attaching electronic files to the eASR that document your CEMU volumes?

( ) Yes (•) No

Paper copies of CEMU volumes may be mailed to:
Mass DEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

Table DS-5 Unaccounted for Water To calculate UAW, subtract total metered use and confidently estimated municipal use volumes from the total volume of finished water entering your distribution system.

	Million Gallons/Year (MGY)	% of Total Water Available for Distribution
Total Finished Water Available for Distribution **(Total Net Finished Water from Production Form)**	516.738	100%
Total Metered Use **(System Total Metered Use from Table DS-3)**	- 429.925	- 83.2 %
Total Confidently Estimated Municipal Use **(Total from Table DS-4)**	- 23.48	- 4.5 %
Unaccounted for Water (UAW)	= 63.3	= 12.2 %

Table DS-6 Sources of Unaccounted for Water (Optional) Use this table to provide estimated volumes of your unaccounted for water.

Known or Suspected Source of Unaccounted for Water	Estimated Volume (MGY)
Leak Detection	24.6
Water Theft	15.502
Meter Malfunction/mis-registration	15.502
Other (specify): ASSUMES 3% FOR THEFT/DELIBERATE METER TAMPERING AND 3% FOR METER UNDER-REGISTRATION	
Other (specify): UNAVOIDABLE/UNRECOVERABLE LEAKAGE	5.00
Total:	60.604

RESIDENTIAL GALLONS PER CAPITA DAY (RGPCD)

RGPCD is a performance standard for public water suppliers serving municipalities and is a measure of the average amount of water a resident uses each day during the reporting period. High RGPCD values are associated with unrestricted outdoor water use, especially lawn watering. See ASR Instructions for further explanation and examples. There are two steps to determine your RGPCD number: Step 1: Determine the residential population served by your system (2 options to choose from). Step 2: Calculate RGPCD from population served and residential metered water volume.

RGPCD Step 1 - Choose one of two options to determine Population Served

Population Option 1: Accurate Count (census data): If your PWS serves an entire municipality, then use the most recent local or

Federal census number for the total residential population. Click Here for 2010 U.S. census populations for MA cities and towns. Partially served communities can use the most recent local or Federal census if private well users and/or those served by other PWS systems are subtracted out (attach documentation to this ASR). Communities with high seasonal fluctuations can pro-rate the population for the duration of the influx. See ASR Instructions for further detail and examples.

Population Option 2: Estimate from Households Served If your PWS serves a portion of one or more communities and you cannot obtain a reliable census, click on the following link to open an excel spreadsheet for estimating your population. Click Here. This estimate is calculated from the number of households connected to your distribution system and the average household size. Save the spreadsheet onto your computer for use in subsequent years' reporting. If you are using a spreadsheet from your assessor's office or planning board to estimate number of households served, attach the spreadsheet or mail it to DEP and report the population served on Table DS-7 below.

If mailing Population Calculations or documentation send to:
Mass DEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

Table DS-7 Residential Population Served

Community(ies) served by PWS is (are) :	Partially Served
Method of Determining Population Served:	Option 1(Census)
Census Type (Federal or Local):	Local
Census year:	2014
Population Served:	14700

RGPCD Step 2 – Calculate RGPCD

Table DS-8 Residential Gallons per Capita Day To determine RGPCD, your metered residential volume (million gallons/year) is divided by 365 days. The result in then divided by the population served and multiplied by 1,000,000 to obtain gallons per person per day. If you include Residential Institutions volume in your RGPCD volume, also include the Residential Institutions population. See ASR instructions

Residential Water Use (million gallons)	/ 365	/ Population Served	X 1,000,000	=	Residential Gallons per Capita Day (gallons/person/day)
373.175	/ 365	/ 14700	X1,000,000	=	70

Table DS-9: Use this table to provide comments or additional information regarding this section of the ASR. You may explain discrepancies, provide supplemental information, or provide any other information to assist MassDEP in processing the data in your ASR.

POPULATION SERVED IS CENSUS POPULATION LESS ESTIMATED 500 RESIDENTS SUPPLIED BY PRIVATE WELLS.

Water Management Act Annual Report - Basin Withdrawal

Instructions for completing Tables BW-1 through BW-4 are included in the ASR Instructions available at MassDEP's website. If you have any questions concerning completion of the Water Management Act Annual Report, please contact Richard Friend with the WMA Program at (617) 654-6522 or email him at richard.friend@state.ma.us

Table BW-1 Permit & Registration Information

River Basin (Watershed)	Registration Number	Permit Number
17-IPSWICH	31721301	

Water Withdrawal by Watershed

Calculation of Daily Average Withdrawal: Use Table BW-2 to document the reporting year withdrawal volume(s) by watershed. Table BW-3 compare's the reporting year actual withdrawal volume(s) to the volume(s) authorized under your WMA registration (s) and/or permit(s). The total volumes for each source and their respective watershed are reported in the Ground Water Sources and for Surface Water Sources report forms. Enter the total of all sources for each watershed in Table BW-2.

Enter volumes in million gallons per year(MGY). Example: If you pumped 400,512,000 gallons in the year, enter 400.512.

Table BW-2 Average Daily Withdrawal by Watershed

River Basin	Total Raw Water Pumped in the reporting year (mgy)	/ 365 =	Watershed Average Daily Withdrawal (mgd)
17-IPSWICH	184.207	/ 365 =	0.50

Table BW-3 WMA Authorized Volume vs. Actual Withdrawal Volume

River Basin	Registered Volume (mgd)	+	Permitted Volume (mgd)	=	WMA Authorized Withdrawal Volume (mgd)	-	Daily Avg. Water Use (mgd) (from Table BW-2 above)	=	Difference*
17-IPSWICH	0.96	+	0.25	=	1.21	-	0.50	=	0.71

*** A positive difference indicates that the volume withdrawn is less than the authorized volume. A negative value indicates that more water was pumped than is authorized and that your PWS may be out of compliance.**

Table BW-4 Permit Special Conditions

Review your WMA permit and list any Special Conditions of your WMA permit that require submission of an annual report to MassDEP. If the required report is being submitted with this ASR, please note in Table BW-4. If a required report was submitted earlier in the year, please provide the date submitted.

WMA Permit Special Condition Requiring Annual Report to MassDEP	Report Attached to ASR	If not attached, date submitted to MassDEP
	Yes No	(mm\dd\yyyy)

If mailing annual report, send to:
MADEP
1 Winter St.
Boston MA 02108
Attn: Water Management Act Program

Purchased Water Sources

Individual Purchased Water Source Statistics

Source ID:	3213000-01P
Source Name:	ANDOVER SUPPLY
Location:	MAIN STREET (ROUTE 28) AND CENTRAL STREET (GOULD ROAD)
Seller ID# (PWS ID):	3009000
Seller Name:	ANDOVER WATER DEPT
Status:	A
Source Availability:	ACTIVE

Withdrawal Units:	MG
January:	21.209000
February:	22.438000
March:	26.088000
April:	22.718000
May:	30.755000
June:	41.230000
July:	42.026000
August:	37.823000
September:	38.410000
October:	24.844000
November:	19.723000
December:	20.508000

Source Metered:	Yes	Total Amount Pumped:	347.772000
Date of Meter Installation:	10/1/1995	Total # of Days Pumped:	365
Type of water metered for source:	FINISHED	Maximum Single Day Pumped Volume:	1.536000
Last Meter Calibration:	8/17/2014	Date of Maximum Amount Pumped:	6/28/2014

Appendix E

Water Conservation status as of February 2, 2016

- Required by 1991 MA Water Resources Commission IBTA (water from Andover)
- Required for MWRA water supply (OP-10 for admission & OP-5 for emergency supply)
- Required by MA DEP for Water Management Act permits & for Conditioning of Well Registration

1. Comprehensive Planning & Drought Management Planning
    a. Drought Management Plan (DMP) completed November 2013
    b. Water Use Restrictions rules & regulations (R&R) updated October 2010, April 2012 and March 2014
    c. DPW enforcement authority approved @ Fall 2014 Town meeting
2. Water Audit
    a. Identify/ reduce unaccounted for water (UAW) **FY 17 Capital Improvement Plan (CIP) request - $50,000**
3. Leak Detection
    a. Requirement to do every 2 years, last done 2012-2013
    b. Consultant completed entire town 12/3/14, identified 25 leaking services & 11 leaking hydrants
    c. Completed repairs of leaks found in 2014 survey
4. Metering
    a. Master & Sub Master- 6 locations with 11 meters 6"+, **completed February 2016**
    b. Residential – majority >20 years old, possible annual loss of revenue $240,000. FY 16 CIP request approved- $1,700,000 for Advanced Metering Infrastructure (AMI) system- 7.9 year payback
    c. AMI systems have the ability to detect above normal water use
5. Pricing
    a. Existing increasing block rate promotes conservation
    b. Rates & usage reviewed annually - MWRA project impact incorporated into projections
6. Residential
    a. Water Efficient Plumbing Fixtures- required by MA Plumbing Code since 1992
    b. Consider residential water use audits – on line & home visits
    c. Consider incentives for installation of moisture based & rain shutoffs for irrigation systems
7. Public Sector
    a. Completed Audit of Public Building Water Use – December 2014
        i. Identified short and long term retrofit projects
        ii. FY 17 CIP request for Phase I - Town Buildings - $26,000
8. Industrial, Commercial, and Institutional & Agricultural - relatively low % of NR Water Use- action planned
    a. Conduct Water Audits
    b. Develop a Water Savings Strategy
9. Lawn & Landscape
    a. Developed seasonal demand management plan (i.e. Water Use Restrictions)
    b. Adopted Water Use Restriction Bylaw (191-6) and associated Rules & Regulations (see 1.b.)
    c. Enforce Water Use Restrictions- DPW enforcement authority approved Fall 2014 Town meeting
10. Public Education & Outreach
    a. **Develop Water Conservation Program Public Education plan-** (i.e. develop the message)
        i. Environmental benefits
        ii. Long term cost saving to users – both at home and town wide (i.e. avoid new water system construction)
    b. Implement Water Conservation Program Public Education plan
        i. Print media
        ii. Patch & Social Media
        iii. Town Website- Water Department & Town homepage
        iv. Elementary School programs
        v. Public speaking- Chamber of Commerce, Rotary, church groups, etc

North Reading Water Bill Calculator

To see how your water bill was calculated, enter the information from your water bill:

Previous Read Date:	1/1/16
Current Read Date:	2/1/16
Previous Meter Read:	1
Current Meter Read:	12,000

Based on the information you entered, the following information is calculated:

Water usage in gallons:	11,999
Number of days between meter readings:	31
Average daily water use in gallons per day:	387

You are allowed up to 10,000 gallons per quarter at the first tier rate. Water use above 10,000 gallons per quarter but below 22,500 gallons per quarter is billed at the second tier rate. Water use above 22,500 gallons per quarter is billed at the third tier rate.

Because your water use was greater than 10,000 gallons per day, but less than 22,500 gallons, your bill enters the first and second tiers.

First Tier Volume =			10,000	gallons
Second Tier Volume =			1,999	gallons
Third Tier Volume =				gallons
First Tier Charge =	10,000	gallons x $8.08/1,000 gallons =	$80.80	
Second Tier Charge =	1,999	gallons x $11.85/1,000 gallons =	$23.69	
Third Tier Charge =		gallons x $16.15/1,000 gallons =		
Service Charge = $5.00 per bill =			$5.00	
		Total Water Bill =	**$109.49**	

Check your water use: Studies have shown that the average American uses 65 gallons of water per day.

To see how your water usage compares, enter the number of people in your home: 4

For this bill, your water use averaged 96.8 gallons per person per day. Your use is **above** the 65 gallons per person per day average. The North Reading Water Department encourages you to explore the water conservation information on our web site to discover how you can save water.

Town of North Reading											
Public Building Water Use & Impact of Water Conservation Implementation										9/30/15	
					Water Cost/ Tier ($/ Tier)			Avoided O&M Cost		Rate of Return
	Water Savings	Capitol Cost	Annual Water Use	Use per quarter	First Tier $7.48/ 1000 gal	Second Tier $10.97/ 1000 gal	Third Tier $14.96/ 1000 gal	Annual	20 year	(Years)
Facility	(GPD)		(Gallons)	(Gallons)	0-10,000 gallons	10,000-22,500 gallons	>22,500 gallons			
Town Hall	394.5	$8,308	89,000	22,250	$74.80	$134.38	$0.00	$837	$16,735	9.9
Police Department	160	$614	50,000	12,500	$74.80	$27.43	$0.00	$409	$8,178	1.5
Fire Department	67.8	$2,404	160,000	40,000	$74.80	$137.13	$261.80	$1,895	$37,898	1.3
Flint Library	78.7	$8,953	73,000	18,250	$74.80	$90.50	$0.00	$661	$13,224	13.5
Damon Tavern	0	$0	8,000	2,000	$14.96	$0.00	$0.00	$60	$1,197	0.0
BoC	33	$1,823	80,000	20,000	$74.80	$109.70	$0.00	$738	$14,760	2.5
DPW Garage	10	$1,747	112,000	28,000	$74.80	$137.13	$82.28	$1,177	$23,536	1.5
subtotal	744	$23,848								
adjust for 2016 const - 2 yrs @ 3%		$1,431								
total		$25,279								
Batchelder School	2750	$23,058	310,000	77,500	$74.80	$137.13	$822.80	$4,139	$82,778	5.6
Little School	772	$8,298	308,000	77,000	$74.80	$137.13	$815.32	$4,109	$82,180	2.0
Hood School	2750	$18,755	300,000	75,000	$74.80	$137.13	$785.40	$3,989	$79,786	4.7
	6272	$50,110								
Middle School	0	$0	2014-15 construction- MA plumbing code compliant							
High School	0	$0	2014-15 construction- MA plumbing code compliant							

WATER USE RESTRICTION NOTICE – MAY 29, 2015

The Town of North Reading has declared a Stage I mandatory water conservation drought condition. The record setting dry weather in May (only 0.14 inches of precipitation) and the seasonal start of lawn watering have stressed the water system to its maximum capacity. This has resulted in a drop in the water levels in our water tanks. Keeping the water levels at 80% full or higher provides water for public safety needs such as a fire or a major water main break.

Under Town bylaw for a **Stage I Mandatory Water Drought Condition**, water use is restricted as follows:

Lawn watering is restricted to two (2) times per week between 7 PM and 7 AM as follows:

- **Residents with ODD numbered addresses may water lawns on Tuesday & Friday only.**
- **Residents with EVEN numbered addresses may water lawns on Wednesday & Saturday only.**

Residents with automatic sprinkler systems are advised to check their systems settings to ensure compliance, and to verify that system rain sensors are working. The Town suggests residents set their system to operate "as needed" between 4 AM - 7 AM or 7 PM to 10 PM. "As needed" may be as little as 30 minutes per zone.

Violation of the Stage I Water Use Restriction may result in penalties:

- 1st offense – Reminder Notice to home (documented)
- 2nd offense – $50 fine.
- 3rd offense – $100 fine (daily for each additional offense)

The Town reserves the right to shut off any water supply or service for disregard of water use restrictions in cases of a state of water supply conservation or state of water supply emergency.

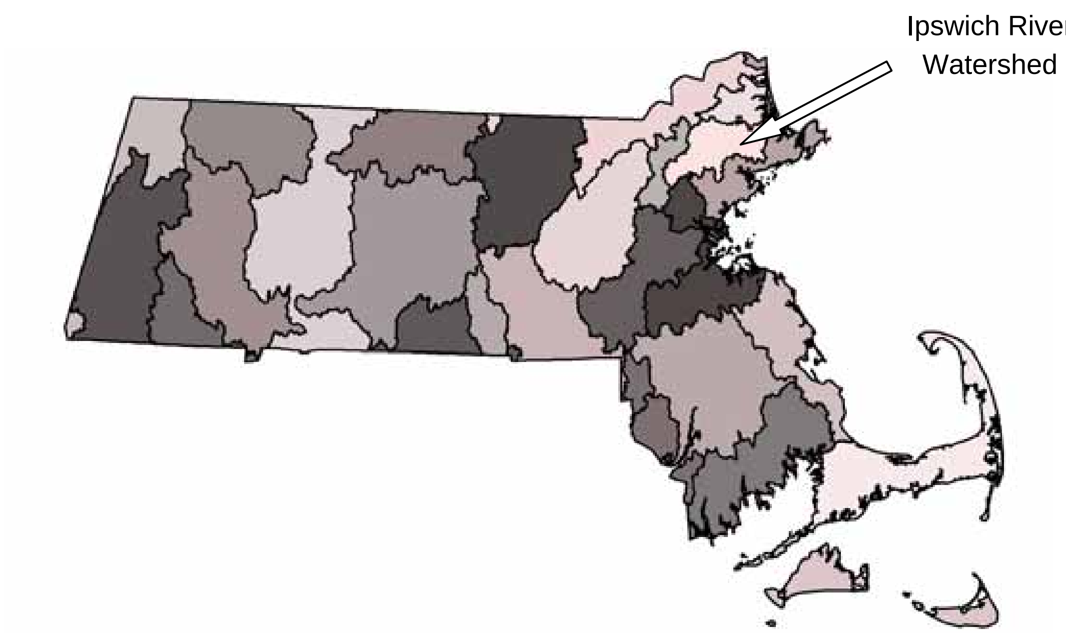
In addition to restricting lawn irrigation via sprinklers or automatic irrigation systems, the Town requests all non-essential outside water use be voluntarily minimized. This includes washing of vehicles, except in a commercial car wash; washing of exterior building surfaces, parking lots, driveways, etc.

Please contact the Department of Public Works at 978-664-6060 for further information. Thank you for your cooperation.

Appendix F

WRIGHT-PIERCE
Engineering a Better Environment

Draft Pathogen TMDL for the Ipswich River Watershed



Prepared as a cooperative effort by:

Massachusetts DEP
1 Winter Street
Boston, Massachusetts 02108

USEPA New England Region 1
1 Congress Street, Suite 1100
Boston, Massachusetts 02114

ENSR International
2 Technology Park Drive
Westford, MA 01886

NOTICE OF AVAILABILITY

Limited copies of this report are available at no cost by written request to:

Massachusetts Department of Environmental Protection (MADEP)
Division of Watershed Management
627 Main Street
Worcester, Massachusetts 01608

This report is also available from MADEP's home page on the World Wide Web.

A complete list of reports published since 1963 is updated annually and printed in July. This list, titled "Publications of the Massachusetts Division of Watershed Management (DWM) – Watershed Planning Program, 1963-(current year)", is also available by writing to the DWM in Worcester.

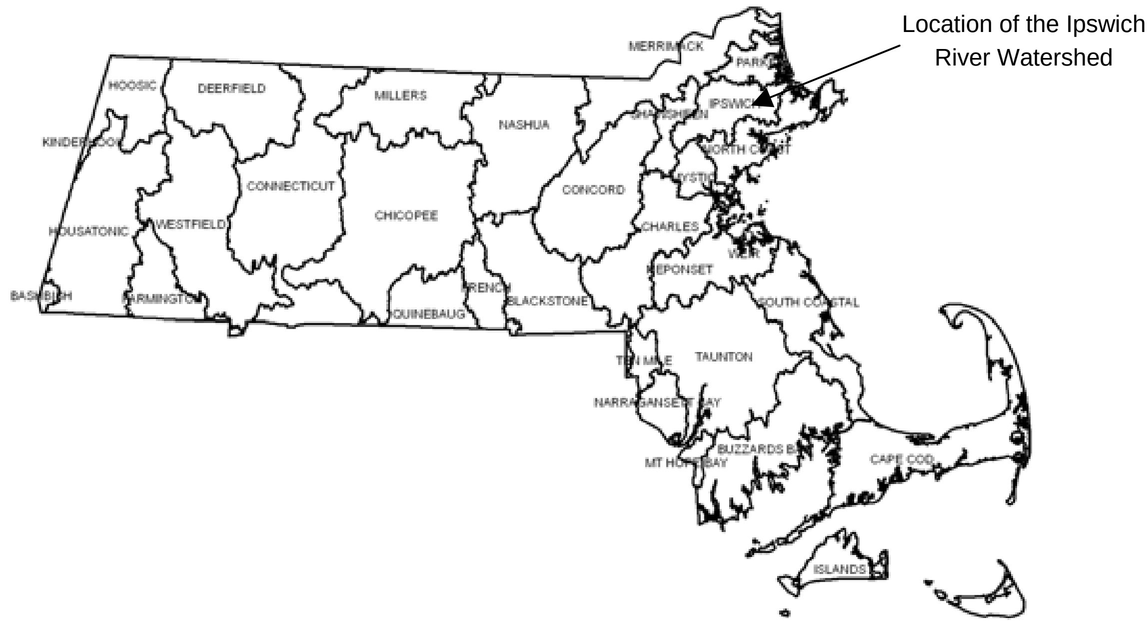
DISCLAIMER

References to trade names, commercial products, manufacturers, or distributors in this report constituted neither endorsement nor recommendations by the Division of Watershed Management for use.

Much of this document was prepared using text and general guidance from the previously approved Neponset River Basin and the Palmer River Basin Bacteria Total Maximum Daily Load documents.

Acknowledgement
This report was developed by ENSR through a partnership with Resource Triangle Institute (RTI) contracting with the United States Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection Agency under the National Watershed Protection Program.

Draft Total Maximum Daily Loads for Pathogens within the Ipswich River Watershed



Key Features: Pathogen TMDL for the Ipswich Watershed
Location: EPA Region 1
Land Type: New England Coastal

303(d) Listings: Pathogens

Martins Brook (MA92-08); Wills Brook (MA92-10);
Unnamed Tributary (MA92-12); Howlett Brook (MA92-17);
Miles River (MA92-03); Kimball Brook (MA92-21);
Ipswich River (MA92-02); Labor in Vain Creek (MA92-22); and
Unnamed Tributary (MA92-23).

Data Sources: MADEP 2004 "*Ipswich River Watershed 2000 Water Quality Assessment Report*"

Data Mechanism: Massachusetts Surface Water Quality Standards for Fecal Coliform; The Federal BEACH Act; Massachusetts Department of Public Health Bathing Beaches; Massachusetts Division of Marine Fisheries Shellfish Sanitation and Management; Massachusetts Coastal Zone Management

Monitoring Plan: Massachusetts Watershed Five-Year Cycle

Control Measures: Watershed Management; Storm Water Management (e.g., illicit discharge removals, public education/behavior modification); SSO Abatement; other BMPs; No Discharge Areas; By-laws; Ordinances; Septic System Maintenance/Upgrades

Executive Summary

Purpose and Intended Audience

This document provides a framework to address bacterial and other fecal-related pollution in surface waters of Massachusetts. Fecal contamination of our surface waters is most often a direct result of the improper management of human wastes, excrement from barnyard animals, pet feces and agricultural applications of manure. It can also result from large congregations of birds such as geese and gulls. Illicit discharges of boat waste are of particular concern in coastal areas. Inappropriate disposal of human and animal wastes can degrade aquatic ecosystems and negatively affect public health. Fecal contamination can also result in closures of shellfish beds, beaches, swimming holes and drinking water supplies. The closure of such important public resources can erode quality of life and diminish property values.

Who should read this document?

The following groups and individuals can benefit from the information in this report:

a) towns and municipalities, especially Phase I and Phase II storm water communities, that are required by law to address storm water and/or combined sewage overflows (CSOs) and other sources of contamination (e.g., broken sewerage pipes and illicit connections) that contribute to a waterbody's failure to meet Massachusetts Water Quality Standards for pathogens;

b) watershed groups that wish to pursue funding to identify and/or mitigate sources of pathogens in their watersheds;

c) harbormasters, public health officials and/or municipalities that are responsible for monitoring, enforcing or otherwise mitigating fecal contamination that results in beach and/or shellfish closures or results in the failure of other surface waters to meet Massachusetts standards for pathogens;

d) citizens that wish to become more aware of pollution issues and may be interested in helping build local support for funding remediation measures.

TMDL Overview

The Massachusetts Department of Environmental Protection (MADEP) is responsible for monitoring the waters of the Commonwealth, identifying those waters that are impaired, and developing a plan to bring them back into compliance with the Massachusetts Water Quality Standards (WQS). The list of impaired waters, better known as the "303d list" identifies problem lakes, coastal waters and specific segments of rivers and streams and the reason for impairment.

Once a water body is identified as impaired, the MADEP is required by the Federal Clean Water Act (CWA) to develop a “pollution budget” designed to restore the health of the impaired body of water. The process of developing this budget, generally referred to as a Total Maximum Daily Load (TMDL), includes identifying the source(s) of the pollutant from direct discharges (point sources) and indirect discharges (non-point sources), determining the maximum amount of the pollutant that can be discharged to a specific water body to meet water quality standards, and assigning pollutant load allocations to the sources. A plan to implement the necessary pollutant reductions is essential to the ultimate achievement of meeting the water quality standards.

Pathogen TMDL: This report represents a TMDL for pathogen indicators (e.g. fecal coliform, *E. coli*, and enterococcus bacteria) in the Ipswich River watershed. Certain bacteria, such as coliform, *E. coli*, and enterococcus bacteria, are indicators of contamination from sewage and/or the feces of warm-blooded wildlife (mammals and birds). Such contamination may pose a risk to human health. Therefore, in order to prevent further degradation in water quality and to ensure that waterbodies within the watershed meet state water quality standards, the TMDL establishes indicator bacteria limits and outlines corrective actions to achieve that goal.

Sources of indicator bacteria in the Ipswich River watershed were found to be many and varied. Most of the bacteria sources are believed to be storm water related. Table ES-1 provides a general compilation of likely bacteria sources in the Ipswich River watershed including failing septic systems, sanitary sewer overflows (SSO), sewer pipes connected to storm drains, certain recreational activities, wildlife including birds along with domestic pets and animals and direct overland storm water runoff. Note that bacteria from wildlife would be considered a natural condition unless some form of human inducement, such as feeding, is causing congregation of wild birds or animals. A discussion of pathogen related control measures and best management practices are provided in the companion document: “*Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts*”.

This TMDL applies to the nine pathogen impaired segments of the Ipswich River watershed that are currently listed on the CWA § 303(d) list of impaired waters. MADEP recommends however, that the information contained in this TMDL guide management activities for all other waters throughout the watershed to help maintain and protect existing water quality. For these non-impaired waters, Massachusetts is proposing “pollution prevention TMDLs” consistent with CWA § 303(d)(3).

The analyses conducted for the pathogen impaired segments in this TMDL would apply to the non-impaired segments, since the sources and their characteristics are equivalent. The waste load and/or load allocation for each source and designated use would be the same as specified herein. Therefore, the pollution prevention TMDLs would have identical waste load and load allocations based on the sources present and the designated use of the water body segment (see Table ES-1 and Table 6-1).

This Ipswich River watershed TMDL may, in appropriate circumstances, also apply to segments that are listed for pathogen impairment in subsequent Massachusetts CWA § 303(d) Integrated List of Waters. For such segments, this TMDL may apply if, after listing the waters for pathogen impairment and taking into account all relevant comments submitted on the CWA § 303(d) list, the Commonwealth determines with EPA approval of the CWA § 303(d) list that this TMDL should apply to future pathogen impaired segments.

Since accurate estimates of existing sources are generally unavailable, it is difficult to estimate the pollutant reductions for specific sources. For the illicit sources, the goal is complete elimination (100% reduction). However, overall wet weather indicator bacteria load reductions can be estimated using typical storm water bacteria concentrations. These data indicate that in general two to three orders of magnitude (i.e., greater than 90%) reductions in storm water fecal coliform loading will be necessary, especially in developed areas. This goal is expected to be accomplished through implementation of best management practices, such as those associated with the Phase II control program for storm water.

TMDL goals for each type of bacteria source are provided in Table ES-1. Municipalities are the primary responsible parties for eliminating many of these sources. TMDL implementation to achieve these goals should be an iterative process with selection and implementation of mitigation measures followed by monitoring to determine the extent of water quality improvement realized. Recommended TMDL implementation measures include identification and elimination of prohibited sources such as leaky or improperly connected sanitary sewer flows and best management practices to mitigate storm water runoff volume. Certain towns in the watershed are classified as Urban Areas by the United States Census Bureau and are subject to the Stormwater Phase II Final Rule that requires the development and implementation of an illicit discharge detection and elimination plan.

In most cases, authority to regulate non-point source pollution and thus successful implementation of this TMDL is limited to local government entities and will require cooperative support from local volunteers, watershed associations, and local officials in municipal government. Those activities can take the form of expanded education, obtaining and/or providing funding, and possibly local enforcement. In some cases, such as subsurface disposal of wastewater from homes, the Commonwealth provides the framework, but the administration occurs on the local level. Among federal and state funds to help implement this TMDL are, on a competitive basis, the Non-Point Source Control (CWA Section 319) Grants, Water Quality (CWA Section 604(b)) Grants, and the State Revolving (Loan) Fund Program (SRF). Most financial aid requires some local match as well. The programs mentioned are administered through the MADEP. Additional funding and resources available to assist local officials and community groups can be referenced within the Massachusetts Non-point Source Management Plan-Volume I Strategic Summary (2000) "Section VII Funding / Community Resources". This document is available on the MADEP's website at: www.state.ma.us/dep/brp/wm/wmpubs.htm, or by contacting the MADEP's Nonpoint Source Program at (508) 792-7470 to request a copy.

Table ES-1. Sources and Expectations for Limiting Bacterial Contamination in the Ipswich River Watershed

Surface Water Classification	Pathogen Source	Waste Load Allocation Indicator Bacteria (CFU/100 mL)[1]	Load Allocation Indicator Bacteria (CFU/100 mL)[1]
A, B, SA	Illicit discharges to storm drains	0	N/A
A, B, SA	Leaking sanitary sewer lines	0	N/A
A, B, SA	Failing septic systems	N/A	0
A	NPDES – WWTP	Not to exceed an arithmetic mean of 20 organisms in any set of representative samples, nor shall 10% of the samples exceed 100 organisms[2]	N/A
A	Storm water runoff Phase I and II	Not to exceed an arithmetic mean of 20 organisms in any set of representative samples, nor shall 10% of the samples exceed 100 organisms[3]	N/A
A	Direct storm water runoff not regulated by NPDES and livestock, wildlife & pets	N/A	Not to exceed an arithmetic mean of 20 organisms in any set of representative samples, nor shall 10% of the samples exceed 100 organisms[3]
B & Not Designated for Shellfishing SA	NPDES – WWTP	Shall not exceed a geometric mean of 200 organisms in any set of representative samples, nor shall 10% of the samples exceed 400 organisms[2]	N/A
B & Not Designated for Shellfishing SA	Storm water runoff Phase I and II	Not to exceed a geometric mean of 200 organisms in any set of representative samples, nor shall 10% of the samples exceed 400 organisms[3]	N/A
B & Not Designated for Shellfishing SA	Direct storm water runoff not regulated by NPDES and livestock, wildlife & pets	N/A	Not to exceed a geometric mean of 200 organisms in any set of representative samples, nor shall 10% of the samples exceed 400 organisms[3]
SA Designated Shellfishing Areas	NPDES – WWTP	Not to exceed a geometric mean of 14 organisms in any set of representative samples, nor shall 10% of the samples exceed 43 organisms[2]	N/A

Surface Water Classification	Pathogen Source	Waste Load Allocation Indicator Bacteria (CFU/100 mL)[1]	Load Allocation Indicator Bacteria (CFU/100 mL)[1]
SA Designated Shellfishing Areas	Storm water Runoff Phase I and II	Not to exceed a geometric mean of 14 organisms in any set of representative samples, nor shall 10% of the samples exceed 43 organisms[3]	N/A
SA Designated Shellfishing Areas	Direct storm water runoff not regulated by NPDES and livestock, wildlife & pets	N/A	Not to exceed a geometric mean of 14 organisms in any set of representative samples, nor shall 10% of the samples exceed 43 organisms[3]
No Discharge Areas	Vessels – raw or treated sanitary waste	0	N/A
Marine Beaches[4]	All Sources	Enterococci not to exceed a geometric mean of 35 colonies in a statistically significant number of samples, nor shall any single sample exceed 104 colonies	Enterococci not to exceed a geometric mean of 35 colonies in a statistically significant number of samples, nor shall any single sample exceed 104 colonies
Fresh Water Beaches[5]	All Sources	Enterococci not to exceed a geometric mean of 33 colonies of the five most recent samples within the same bathing season, nor shall any single sample exceed 61 colonies OR *E. coli* not to exceed a geometric mean of 126 colonies of the five most recent samples within the same bathing season, nor shall any single sample exceed 235 colonies	Enterococci not to exceed a geometric mean of 33 colonies of the five most recent samples within the same bathing season, nor shall any single sample exceed 61 colonies OR *E. coli* not to exceed a geometric mean of 126 colonies of the five most recent samples within the same bathing season, nor shall any single sample exceed 235 colonies

N/A means not applicable

[1] Waste Load Allocation (WLA) and Load Allocation (LA) refer to fecal coliform densities unless specified in table.

[2] Or shall be consistent with the Waste Water Treatment Plant (WWTP) National Pollutant Discharge Elimination System (NPDES) permit.

[3]The expectation for WLAs and LAs for storm water discharges is that they will be achieved through the implementation of BMPs and other controls.

[4] Federal Beaches Environmental Assessment and Coastal Health Act of 2000 (BEACH Act) Water Quality Criteria

[5] Massachusetts Department of Public Health regulations (105 CMR Section 445)

Note: this table represents waste load and load reductions based on water quality standards current as of the publication date of these TMDLs, any future changes made to the Massachusetts water quality standards will become the governing water quality standards for these TMDLs.

Summary of Waterbody Assessment and TMDL Status in Massachusetts

North Reading, MA

ID	Waterbody Name	Watershed Name	Category	Acres In Town	Acres Total	Miles In Town	Miles Total	Cause Non-Pollutant(s)*/Pollutant(s	TMDL
MA92-06_2008	Ipswich River	Ipswich	5			4.3	20.4	Flow alteration* Metals Nutrients Organic enrichment/Low DO	
MA92-07_2008	Bear Meadow Brook	Ipswich	3			0.1	2.8		
MA92-08_2008	Martins Brook	Ipswich	5			3.2	4.6	Organic enrichment/Low DO Other habitat alterations* Pathogens	
MA92-09_2008	Unnamed Tributary	Ipswich	3			1.4	1.4		
MA92005_2008	Bradford Pond	Ipswich	3	14.17	14.17				
MA92016_2008	Eisenhaures Pond	Ipswich	3	11.98	11.98				
MA92021_2008	Emerson Brook Reservoir (Forest Str	Ipswich	3	3.07	195.43				

1) Adapted from Final Massachusetts Year 2008 Integrated List of Waters (CN 281.1, 12/2008); available at http://www.mass.gov/dep/water/resources/08list2.pdf
2) For additional information on TMDLs and to view reports, see: http://www.mass.gov/dep/water/resources/tmdls.htm
3) For Massachusetts Surface Water Quality Standards, and waterbody classes and uses, see: http://www.mass.gov/dep/service/regulations/314cmr04.pdf

Assessment of Waterbody Segment

Category 2 - Attaining some uses; other uses not assessed
Category 3 - Insufficient information to make assessments for any use
Category 4a - TMDL is completed
Category 4c - Impairment not caused by a pollutant
Category 5 - Impaired or threatened for one or more uses and requiring a TMDL

Note: The accuracy of mileage and acreage estimates is limited for waterbodies that serve as or span municipal boundaries

Summary of Waterbody Assessment and TMDL Status in Massachusetts

North Reading, MA

ID	Waterbody Name	Watershed Name	Category	Acres (In Town - Total)		Miles (In Town - Total)		Cause Non-Pollutant(s)*/Pollutant(s	TMDL
MA92038_2008	Martins Pond	Ipswich	5	89.01	89.01				
								Exotic species*	
								Mercury	NEHgTMDL
								Noxious aquatic plants	
								Turbidity	
MA92066_2008	Swan Pond	Ipswich	3	42.04	42.04				

1) Adapted from Final Massachusetts Year 2008 Integrated List of Waters
(CN 281.1, 12/2008); available at http://www.mass.gov/dep/water/resources/08list2.pdf
2) For additional information on TMDLs and to view reports, see:
http://www.mass.gov/dep/water/resources/tmdls.htm
3) For Massachusetts Surface Water Quality Standards, and waterbody classes and uses, see:
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Assessment of Waterbody Segment

Category 2 - Attaining some uses; other uses not assessed
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Category 5 - Impaired or threatened for one or more uses and requiring a TMDL

Note: The accuracy of mileage and acreage estimates is limited for waterbodies that serve as or span municipal boundaries

Appendix G

Engineering a Better Environment

COMPARISON OF COSTS

FOR

WASTEWATER MANAGEMENT SYSTEMS

APPLICABLE TO CAPE COD

Guidance to Cape Cod Towns Undertaking Comprehensive Wastewater Management Planning

Prepared for:
Association to Preserve Cape Cod
Cape Cod Business Roundtable
Cape Cod Water Protection Collaborative

Prepared by:
Barnstable County Wastewater Cost Task Force

April 2010

COMPARISON OF COSTS
FOR
WASTEWATER MANAGEMENT SYSTEMS
APPLICABLE TO CAPE COD

EXECUTIVE SUMMARY

The Barnstable County Wastewater Cost Task Force was established to compile and analyze current local information on the costs to build and operate wastewater systems in use on Cape Cod. Based on that information, the Task Force has developed cost estimates for a wide range of wastewater system sizes and types to help Cape Cod towns fairly compare available options. The application of the results will allow towns to identify which options are best for their circumstances and thus streamline their comprehensive wastewater management planning.

Data were compiled and cost estimates prepared for four types of wastewater systems:

- **Individual on-lot systems** with and without nitrogen removal.
- **Cluster systems** serving up to approximately 30 homes with aggregate wastewater flows less than 10,000 gallons per day (gpd).
- **Satellite systems** serving from 30 to 1,000 homes (wastewater flows between 10,000 gpd and 300,000 gpd), intended to treat and dispose of wastewater from one area of a town.
- **Centralized systems** which can provide for most or all of a town's wastewater management needs, and that might be suitable for serving portions of neighboring towns.

Cost estimates were prepared to be inclusive of all aspects of wastewater management: collection, treatment, and disposal. Costs were also included for conveyance between the collection system and the treatment site, and between the treatment and disposal sites if they cannot be co-located. Four measures of cost were considered:

- Capital cost---the cost to design, permit and build the facilities, including land costs.
- Operation and Maintenance (O&M) costs---the ongoing expenses for labor, power, chemicals, monitoring, sludge disposal, etc.
- Equivalent annual costs---a mathematical combination of O&M expenses and amortized capital costs.
- Costs per pound of nitrogen removed---the equivalent annual cost divided by the annual nitrogen load removed from the watershed of a nitrogen-sensitive embayment.

Actual cost information was obtained from over 30 existing wastewater treatment facilities, located largely in southeastern Massachusetts. The data were carefully reviewed to be sure they included all pertinent cost items. "Unit costs" were computed by dividing construction costs and O&M costs by the associated wastewater flows. Graphs of these unit costs show clear trends and demonstrate significant economies of scale, which are summarized here:

Capacity	Unit Construction Cost	Unit O&M Cost
10,000 gpd	$70 per gpd of capacity	$13 per gpd of average flow
100,000 gpd	$35 per gpd of capacity	$ 5 per gpd of average flow
1,000,000 gpd	$17 per gpd of capacity	$ 2 per gpd of average flow

Compared to a satellite facility of 100,000-gpd capacity, a central facility of 1.0-mgd (million gallons per day) capacity costs about 50% less to build and 60% less to operate on a per-gallon basis.

Fourteen scenarios were developed to combine capital and O&M costs for wastewater collection, transport, treatment and disposal and to compare those costs with the nitrogen removal that can be expected. Costs and performance were estimated both for Base Cases (with a uniform set of assumptions for all scenarios) and as part of a sensitivity analysis to determine how costs might change with assumptions that are either more or less favorable for each system size. The results are as follows, expressed as equivalent annual cost per pound of nitrogen removed:

	Low	Base Case	High
Individual N-removing systems	$550	$770	$830
Cluster systems, 8,800 gpd	$500	$710	$790
Satellite systems, 50,000 gpd	$480	$680	$720
Satellite systems, 200,000 gpd	$380	$510	$550
Centralized systems, 1.5 mgd	$250	$305	$319
Centralized systems, 3.0 mgd	$230	$285	$295

The sensitivity analysis allows the identification of the most important cost factors, which are:

- Economies of scale--large systems may be significantly less expensive per gallon treated because many of the cost components do not increase directly with the flow.
- Density of development--wastewater collection costs are the largest component of a complete system and they increase in direct proportion to the lot size served.
- Location of disposal facilities--an effluent disposal site within a nitrogen-sensitive watershed returns some of the collected nitrogen to the watershed in the from of the residual nitrogen remaining in the effluent. Compared to a disposal site that is not in a sensitive watershed, the in-watershed disposal option must be larger to eliminate more septic systems and to remove enough additional nitrogen to offset that returned in the effluent.
- Land costs--land suitable for wastewater management functions is scarce and expensive. Using town-owned parcels is cost-advantageous for any scenario, but particularly if multiple small systems are to be built, each with its own need for set-backs and buffer zones.

From this sensitivity analysis, conclusions can be drawn about the circumstances that favor one size of system over another.

- **Individual systems**. The applicability of these systems is limited by their relatively poor performance and the administrative hurdles associated with using them as the sole means of meeting watershed-wide nitrogen control targets. However, since they are located on the parcel where the wastewater is generated, they eliminate collection costs and should be considered as adjuncts to other options for remote, sparsely developed neighborhoods within watersheds with relatively low nitrogen removal requirements.

- **Cluster systems**. These systems should be considered for existing neighborhood with small lots that are remote from sewered areas and have publically-owned land nearby. They also are good options for new cluster developments where infrastructure can be installed by the developer and later turned over to the town, or for shore-front areas that may not be connected to larger-scale systems until later phases of a project.
- **Satellite systems**. Satellite facilities make the most economic sense in remote watersheds (more than 5 miles from the existing sewer system or other areas or need), with vacant publically-owned land nearby. These systems are also applicable in the case of an existing or proposed private facility that can be taken over by the town and expanded to provide wastewater service to existing nearby properties currently on septic systems, particularly if the town-wide system may be not be available for many years and the developer is prepared to proceed in the near future.
- **Centralized Systems**. This option is likely to be the most viable when:
    - dense development exists in nitrogen-sensitive watersheds;
    - suitable treatment and disposal sites (outside sensitive watersheds and Zone IIs) are available at no or low cost;
    - a high degree of nitrogen control is required;
    - areas of dense development in sensitive watersheds are within 3 miles of desirable effluent treatment and disposal sites; and
    - opportunities are available for cost reductions through regionalization.

While the cost estimates presented in this report are conceptual and based on a uniform set of assumptions, they are supported by a review of actual data for nine example projects. Those examples indicate costs ranging from about $300 per pound of nitrogen removed for centralized systems up to $700 or more for smaller systems.

One of the goals of this study is to help Cape Cod towns streamline their Comprehensive Wastewater Management Plans by identifying the circumstances that are most favorable for each type of system. For example, if a town owns a site suitable for both treatment and disposal, which is not within a sensitive watershed, and is located near the most densely developed areas needing nitrogen control, then economies of scale will make a centralized system the least expensive by a considerable margin. Nonetheless, this report is intended as general guidance, and specific local conditions must be evaluated to be sure that the most cost-effective solution is determined. The sensitivity analysis conducted in this study should help towns target the most appropriate cost factors.

The estimated costs presented in this report are based on a common set of assumptions about the density of development served by the various systems. Towns with less dense development will be faced with higher collection costs than shown here. Costs for collection systems can be very expensive and towns should investigate alternatives to traditional gravity systems. Cost savings associated with the use of those alternative collection systems may apply to any of the scenarios reviewed in this study and should not be attributed to one option and not another.

COMPARISON OF COSTS FOR WASTEWATER MANAGEMENT SYSTEMS APPLICABLE TO CAPE COD

PURPOSE

This report summarizes the methodology and results of an investigation of wastewater management costs that can be expected at public wastewater facilities on Cape Cod.

Wastewater management can be accomplished with relatively small-scale systems (serving single homes or neighborhoods of up to 30 homes), at moderate-sized facilities that might serve up to 1,000 properties, and/or in a central facility serving an entire town alone or with one or two neighboring towns.

This investigation addresses the costs to build and operate wastewater systems of various sizes and types. It identifies those circumstances where each type of system may be most applicable. The choice of wastewater management approach is an essential element of a town's Comprehensive Wastewater Management Plan (CWMP), and this report was prepared to provide general guidance to the towns who are preparing CWMPs.

DEFINITIONS

Wastewater systems have been considered in four categories as follows:

- **Individual system**--serving one property and located on the parcel where the wastewater is generated.
- **Cluster system**--serving nearby properties with an aggregate flow less than 10,000 gallons per day (gpd), roughly equivalent to 30 three-bedroom homes.
- **Satellite system**--serving an area of a town with an aggregate flow greater than 10,000 gpd (and thus requiring a DEP groundwater discharge permit), and as much as 300,000 gpd.
- **Centralized system**--a larger system that provides for most or all of a town's wastewater management needs, and could be regional.

Figure 1 illustrates these four types of wastewater systems.

Estimates have been prepared for two types of costs:

- **capital costs** --the costs to plan, design, permit and build wastewater facilities, including the purchase of land; and
- **operations and maintenance (O&M) costs**--the annual expenses to run the facilities.

FIGURE 1
TYPES OF WASTEWATER SYSTEMS

Wastewater management systems typically comprise the following elements, not all of which are needed in every instance:

- **Collection**, including sewers (of several types) and pumping stations needed to bring the collected wastewater to one point;
- **Transport from the collection area to the treatment site**, including pumping facilities and pipelines;
- **Treatment** to achieve effluent quality requirements as dictated by Title 5, by a DEP groundwater discharge permit, or by a nitrogen-based TMDL;
- **Transport from the treatment site to the effluent disposal site**, if the treatment and disposal functions cannot be co-located; and
- **Disposal**, which typically involves subsurface leaching or rapid infiltration, as well as monitoring wells, and may include effluent reuse.

These typical elements of a municipal wastewater system are shown conceptually in Figure 2. (While wastewater collection systems on Cape Cod are needed to eliminate Title 5 systems in the watersheds of nitrogen-sensitive embayments, it should be noted that the associated treatment and disposal facilities may be located either within or outside those watersheds.)

Wastewater facilities on Cape Cod are governed by three regulatory programs. The first is the state sanitary code, Title 5. A traditional on-site system consisting of a septic tank and leaching field is called a "Title 5 system". Title 5 systems may be appropriate for on-site wastewater management for many reasons, but their effluent contains significant amounts of nitrogen, the contaminant that is causing widespread water quality problems in Cape Cod's coastal waters. The second regulatory program is the DEP groundwater discharge permitting program that requires a permit (and significant nitrogen removal) for projects with wastewater flows exceeding 10,000 gpd. Most coastal embayments on Cape Cod are impacted by excess nitrogen loads resulting in ecological impairment. Under the Federal Clean Water Act, the third regulatory program has established Total Maximum Daily Loads (TMDLs) for these impaired embayments and has identified on-site wastewater disposal as the main contributor of nitrogen.

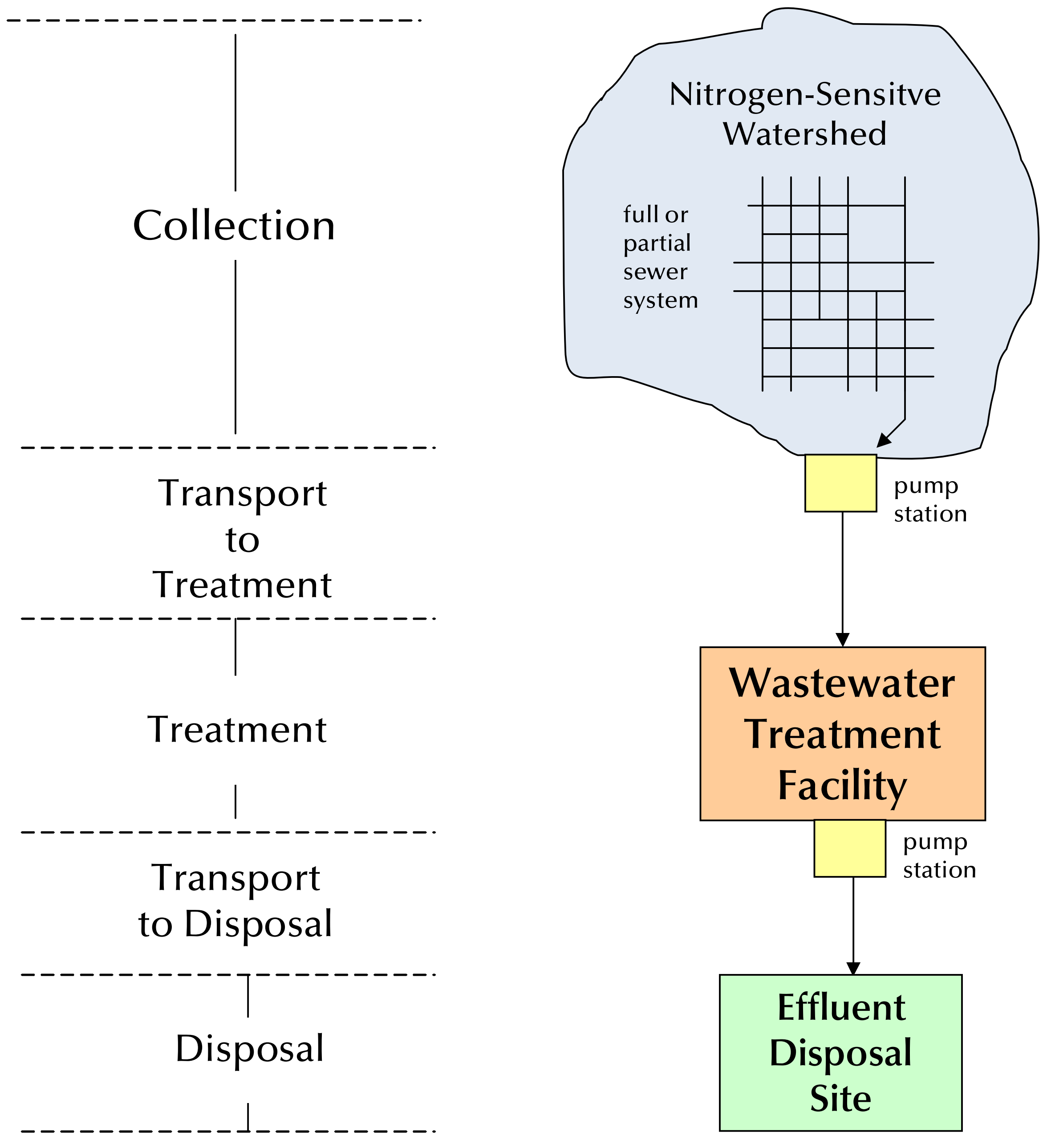
METHODOLOGY

Data Sources for Individual and Cluster Systems

Although many individual wastewater systems have been constructed on Cape Cod, both simple Title 5 systems and those with nitrogen-removal components, the purchasers of those systems are individual property owners and there is no readily accessible database on the costs to build and maintain these systems. Accordingly, data were obtained from the following sources for this study:

- Interviews with suppliers of treatment systems
- Discussions with construction contractors and developers
- Data available from the Massachusetts Alternative Septic System Test Center
- Reports from the New Jersey Pinelands Commission

The information from the Pinelands Commission is of interest because that organization has undertaken a formal program of tracking the cost and performance of nitrogen-removing systems



Notes: 1. Treatment and disposal may occur at a single site.
2. Treatment or disposal or both may occur within a nitrogen-sensitive watershed.

FIGURE 2

ELEMENTS OF TYPICAL WASTEWATER SYSTEM

installed within its jurisdiction, and data are available for four common technologies and approximately 180 individual systems. Although this database is not local to Cape Cod, there are many similarities in the soil types and groundwater regimes that allow its extrapolation to Cape Cod.

Data Sources for Satellite and Centralized Systems

There is considerable experience with satellite and centralized wastewater facilities on Cape Cod and in southeastern Massachusetts. Cost information from existing facilities was viewed as an important definitive database for this evaluation. Assembling an appropriate database was undertaken in the following steps:

1. Determine the actual costs to construct numerous wastewater facilities in southeastern Massachusetts in recent years.
2. Canvas existing wastewater facilities to determine actual O&M costs.
3. Adjust the capital and O&M costs to a common basis, both in time and in terms of included items.
4. Compute "unit costs" for construction (cost per daily gallon of capacity) and for O&M (cost per gallon treated) and develop graphical summaries to depict how those unit costs vary with facility size.

Cost Estimating Methodology

The costs to build and operate wastewater facilities were estimated for several wastewater management approaches, ranging from a single centralized facility down to multiple small facilities. For each approach, the cost estimates were prepared using a common set of assumptions to enable the results to be fairly compared.

The costs to design, permit and construct facilities (the capital costs) were estimated in the following steps:

1. Basic construction costs were estimated from data compiled from the surveys noted above. Costs were estimated for each of the elements shown in Figure 2.
2. An allowance was included for engineering planning and design costs, permitting costs, legal expenses and a contingency for unexpected construction items.
3. Land costs were estimated based on the nature and extent of the wastewater facilities.
4. Capital costs were computed as the sum of the three items above.

The costs to operate and maintain smaller wastewater facilities were prepared by estimating typical expenses for labor, power, chemicals, etc. For satellite and centralized facilities, the cost curves described above were applied based on the average flow treated.

As a final step, the assumptions for each scenario were systematically varied to estimate likely cost ranges for each management approach and to determine the circumstance where each type of system may be most favorable.

SURVEY RESULTS--INDIVIDUAL AND CLUSTER SYSTEMS

Construction Costs

From all of the sources available, it was determined that the costs to design, permit and build most conventional Title 5 septic systems fall in the range of $8,000 to $15,000. The low end of this range applies to new homes where the septic system is installed during home construction, sandy soils are available, and there is sufficient depth to groundwater. Higher costs pertain when the soils and groundwater conditions are less favorable, or when the system is built as a replacement and costs are incurred to restore site features that are disturbed. (There are documented cases of properties spending more than $30,000 for mounded systems that require influent pumping, significant site grading and restoration of landscaping.) For the purposes of this study, an average cost of $13,000 was used for a simple Title 5 system. Both lower and higher costs were considered as part of the sensitivity analysis.

Data from the Barnstable County Septic Loan Program were reviewed and found supportive of this estimate. For over 1,100 properties, owners borrowed an average of $11,000 (median of $8,500) to replace individual septic systems. These costs include some partial replacements (leaching field only) and some full replacements.

Nitrogen-removing systems typically add $9,000 to $15,000 to the cost of the basic septic tank and leaching field system, resulting in total costs of $17,000 to $30,000. The average cost for 180 homes in the Pinelands of New Jersey was $24,000, including $11,000 for the basic septic-tank-and-leaching-field components and $13,000 for the nitrogen-removing elements. This study has used $24,000 to $28,000 as the base case for new systems with nitrogen removal. The sensitivity analysis considered both lower and higher costs.

The $24,000 figure was used to characterize the current use of individual denitrifying systems on Cape Cod, where inexpensive construction and lack of oversight have resulted in less than optimum performance. (In the current DEP program under Title 5, systems are required to achieve effluent nitrogen of 19 mg/l and many do not perform that well.) It was assumed that a somewhat higher cost ($26,000) would best characterize a more rigorous design and better construction oversight as would be needed to achieve a lower effluent nitrogen concentration (13 mg/l), as demonstrated in the Pinelands program. If these systems are to be used for long-term, documented TMDL compliance, additional costs would be needed for a more robust and longer-lasting design and for more frequent testing of the effluent. A capital cost of $28,000 was assumed in this instance.

For cluster systems, data from several Cape Cod facilities were compiled and adjusted to a common basis. For the example 8,800-gpd systems, capital costs were estimated to be $250,000 for systems built under Title 5 (achieving 15 mg/l) and $360,000 for systems built under the DEP groundwater discharge permit program (achieving 8 mg/l). The higher figure reflects a separate denitrification process, chemical feed facilities, a small control building, monitoring wells and a smaller effluent disposal area. The $250,000 and $360,000 figures do not include effluent disposal, land or a collection system.

Operation and Maintenance Costs

Using data from all sources, a baseline O&M cost of $1,250 was computed for the typical individual denitrifying systems installed under current DEP program, and $2,000 for systems receiving more oversight and testing. (The average O&M cost for 180 systems in the Pinelands of New Jersey is $1,800, where somewhat lower labor costs prevail and where effluent testing is less rigorous than would be needed on Cape Cod. This figure was derived from discussions with participating vendors who charge approximately $9,000 for a 5-year contract for operation and maintenance.) Where TMDL compliance is to be documented, monitoring costs increase the annual total O&M expenses to $3,200.

By comparison, it is estimated that the typical Title 5 system would have an average O&M cost of $100, largely for once-in-four-year septage pumping.

SURVEY RESULTS--SATELLITE AND CENTRALIZED SYSTEMS

Construction Costs

To form a sound basis for predicting the construction costs of small-scale wastewater systems, contacts were established with the owners or builders of existing New England wastewater facilities to determine what was actually spent to construct them. To date, data have been obtained from 24 facilities, 14 of which are located in southeastern Massachusetts. Their design flows range from 15,000 gpd to 2.3 million gallons per day (mgd), and they were built over the last 13 years.

The surveyed facilities are largely satellite and centralized treatment plants that remove nitrogen and have groundwater discharge permits. About half are private facilities. A wide range of technologies is represented, including SBRs, RBCs, BioCleres, MBRs, and conventional activated sludge.

This segment of the survey has specifically focused on the costs of treatment, and not collection, transport or disposal. Many of the cost quotations required some analysis. Often the quoted construction cost includes both treatment and disposal; in those cases discussions were held with the developer or engineer to separately estimate the cost of the disposal system and subtract it from the quoted number. When the data received have included land, permitting or engineering costs, those items have been subtracted out to arrive at a pure construction cost. (The cost estimating procedure later adds a consistent allowance for non-construction aspects of the capital cost such as design, permitting, construction phase engineering services, legal expenses and land.)

The approximate bid date was obtained for all projects, and then the cost information was projected forward to late 2009 at an ENR cost index of 8600. (*Engineering News Record* is a construction industry publication that monthly reports a cost index that is a widely used to benchmark costs.)

For each facility, the date-adjusted construction cost was compared with the plant's design flow. For satellite and smaller facilities, the design flow is the Title 5 flow (which is typically viewed as a maximum-day or maximum-2-day flow.) For many of the larger plants, the quoted design flow is something other than the Title 5 flow, and a short-term peak flow was estimated so the data can be compared with facilities with Title 5 design flows. (For example, a facility with a maximum monthly design flow of 1.0 mgd might have a short-term peak flow of 1.3 mgd.) When the construction cost is divided by the design flow, the result is a metric expressed as "dollars per gpd of design flow". Those unit costs have been plotted using a logarithmic scale for the flow, and the results are shown in Figure 3.

Although there is significant scatter in the data, a trend line is evident. (Some scatter would be expected given the site-to-site variability among projects, the different treatment processes, varying degrees of conservatism in design, and the competitiveness of the bidding process.)

A mathematical curve-fitting approach was used to establish a line of central tendency. That line-of-best-fit yields the following points:

10,000 gpd	\$70 per gpd of design flow
100,000 gpd	\$35 per gpd of design flow
1,000,000 gpd	\$17 per gpd of design flow

Figure 3 is a good example of the concept of "economies-of-scale"; the larger the facility, the lower the cost to provide treatment for a daily gallon of capacity. These data indicate that, on a per-gallon basis, a 1.0-mgd plant can be built at 50% of the cost of a 100,000-gpd plant, and only 25% of the cost of a 10,000-gpd facility.

A tabulation of the assembled survey data is contained in Appendix A.

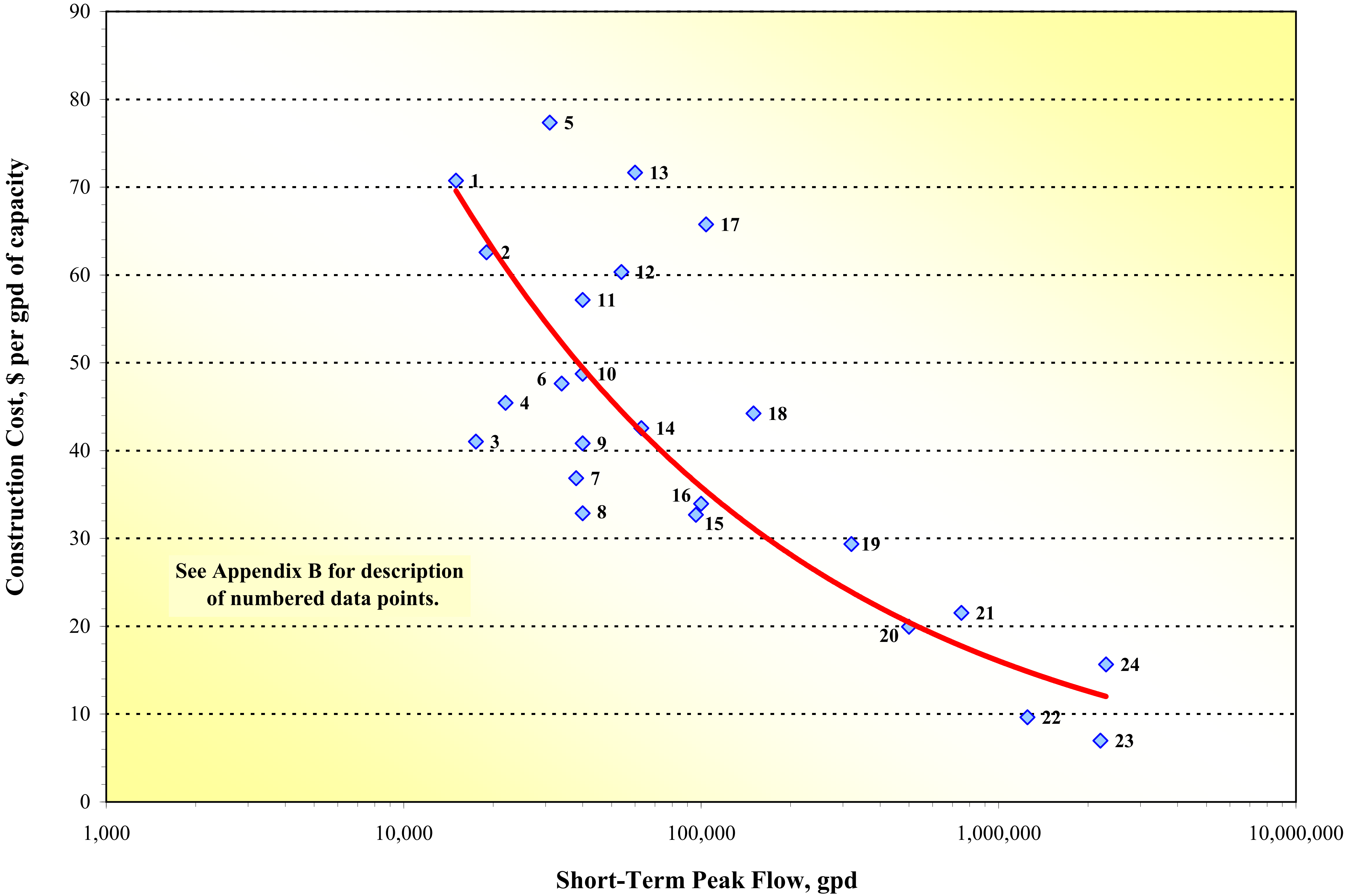
Operation and Maintenance Costs

A similar survey was conducted of existing New England wastewater facilities to determine actual O&M expenditures for collection, treatment and disposal. To date, 21 facilities have been contacted, 18 of which are in southeastern Massachusetts. Their design flows range from 17,000 gpd to 4.2 mgd. The surveyed facilities are largely satellite and centralized facilities that remove nitrogen and have groundwater discharge permits. A wide range of technologies is represented, including SBRs, RBCs, BioCleres, MBRs, and conventional activated sludge.

Care was taken to document what is included in the cost quotations that were received, to be sure that at least the following items are included:

- Labor
- Electricity
- Chemicals
- Laboratory analysis
- Repairs and equipment replacement
- Administrative costs including insurance
- Sludge disposal

FIGURE 3
RESULTS OF CONSTRUCTION COST SURVEY



When the data received did not include all of these cost items, discussions were undertaken with the owner, operator or DPW staff person to make the estimate more complete. In all cases, it was determined that no debt service costs or depreciation are included.

The private satellite system costs include only a small amount for operating and maintaining the collection system, because the facility is often located on the same property where the wastewater is generated. Public systems include significant collection system O&M costs. Therefore the private plant costs may understate what the O&M cost would be for a similarly-sized public satellite system. Partially offsetting that factor is the DEP annual compliance fee that is paid by private plants but waived for public plants. (That fee is $7,000 or $12,500 depending on whether the facility is smaller or larger than 40,000 gpd.)

For each facility, the annual O&M cost was compared with the estimated annual average flow. When the cost is divided by the flow, the result is a cost measure expressed as "dollars per year per gpd of actual flow". That unit cost was plotted on a graph with a logarithmic scale for the flow; see Figure 4. There is some scatter in the data, but less than with construction costs. A line of central tendency through all the data yields the following points:

10,000 gpd	$13 per year per gpd of actual flow
100,000 gpd	$ 5 per year per gpd of actual flow
1,000,000 gpd	$ 2 per year per gpd of actual flow

The apparent economies-of-scale are significant, perhaps stronger than with construction costs. These data indicate that a 1.0-mgd plant can treat one gallon of wastewater at 40% of the cost of a 100,000-gpd plant, and only 15% of the cost of a 10,000-gpd facility.

Appendix B contains a tabular summary of the data from this survey.

COSTS FOR COLLECTION SYSTEMS

Construction costs for wastewater collection systems were estimated by compiling typical unit costs for gravity pipe, pressure pipe, grinder pumps, and pumping stations of various sizes. It was assumed that 5% of the properties would require grinder pumps to access the sewer, and that one pumping station would be needed on average for every one hundred properties. Figure 5 illustrates the results of that analysis, and shows how construction costs for collection systems are significantly affected by the distance between individual connections. The construction costs vary directly with the average length of pipe needed to serve one connection.

BASIS FOR EVALUATION OF SCENARIOS

Description of Baseline Scenarios

Baseline scenarios were developed to portray typical circumstances on Cape Cod and to serve as the basis for a sensitivity analysis. Table 1 summarizes the assumptions included in the "base case" for each type of wastewater management system. A total of 14 scenarios were considered:

FIGURE 4
RESULTS OF O&M COST SURVEY

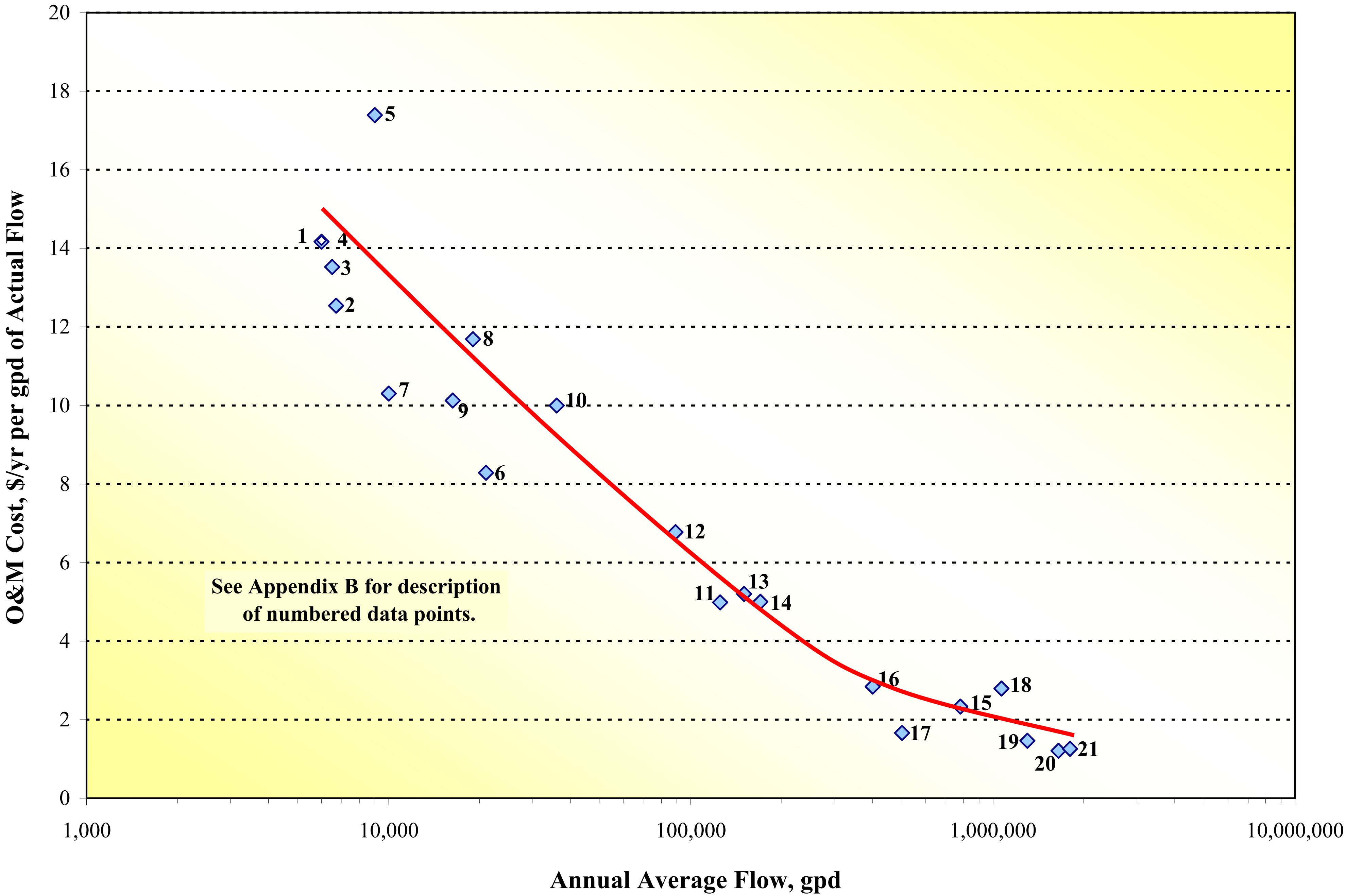


FIGURE 5
RELATIONSHIP BETWEEN COLLECTION COSTS AND DEVELOPMENT DENSITY

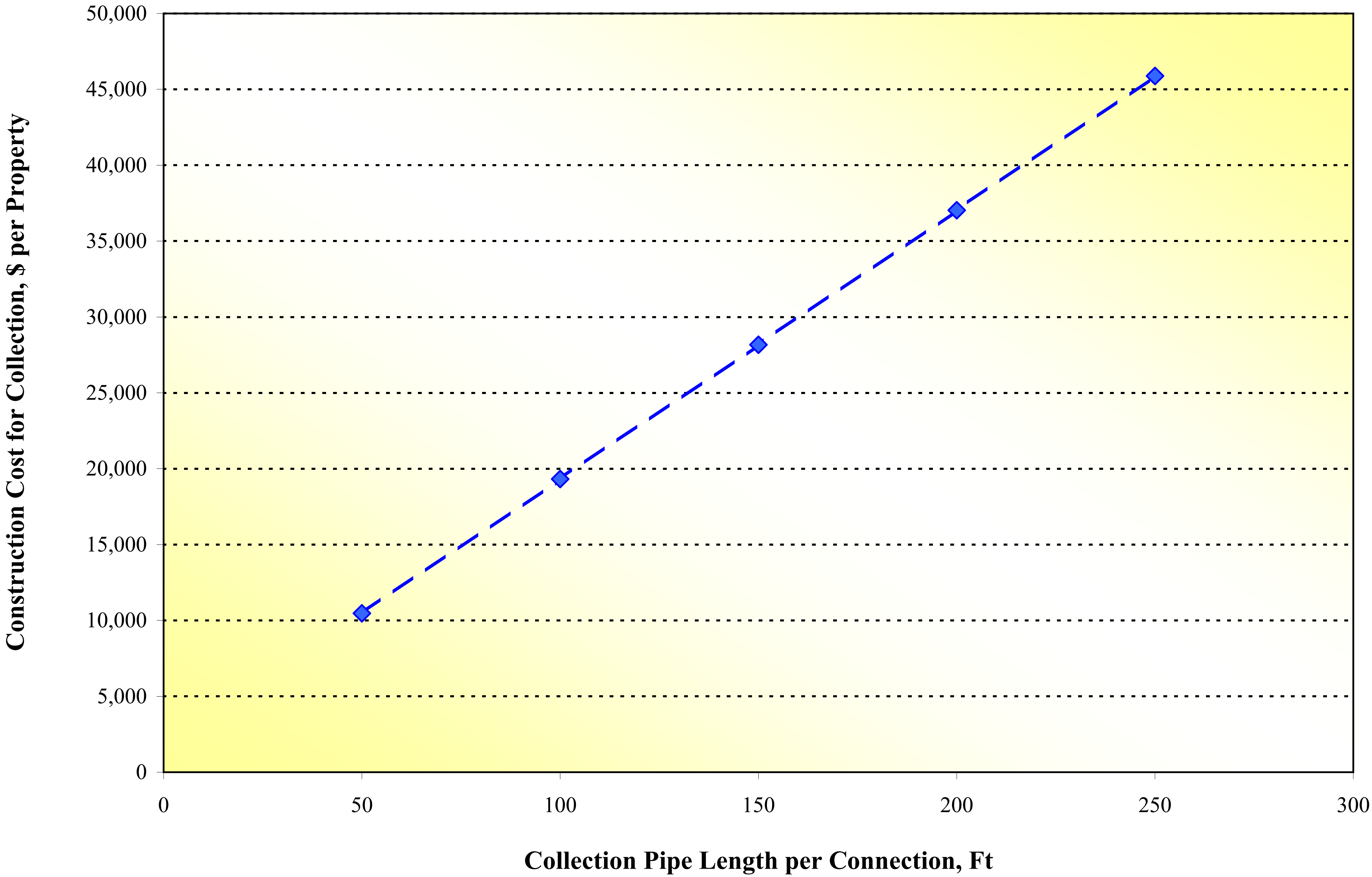


TABLE 1
DESCRIPTION OF "BASE CASE" CONDITIONS

		Individual N-Removing Systems		Cluster Systems			
	Title 5 System	Enhanced Current Practice	For TMDL Compliance	Current Practice	For TMDL Compliance	Satellite Systems	Centralized Systems
Groundwater Discharge Permit Needed?	No	No	No	No	Yes	Yes	Yes
Facilities Procured Publically?	No	No	No	Yes	Yes	Yes	Yes
Collection System Needed?	No	No	No	Yes	Yes	Yes	Yes
Collection System Elements							
Length of pipe per connection, ft	N/A	N/A	N/A	75	75	100	100
Grinder pumps per 100 properties served	N/A	N/A	N/A	5	5	5	5
Pump stations per 100 properties served	N/A	N/A	N/A	1	1	1	1
Overall construction cost per property	N/A	N/A	N/A	$17,000	$17,000	$20,000	$20,000
Wastewater Flows							
Design (see Note 1)	350 gpd	350 gpd	350 gpd	8,800 gpd	8,800 gpd	25,000 gpd to 300,000 gpd	1.5 mgd and 3.0 mgd
Annual average	175 gpd	175 gpd	175 gpd	4,400 gpd	4,400 gpd	45% of design	45% of design
Land costs, $/acre	none	none	none	$250,000	$250,000	$250,000	$200,000
Transport Distances, feet							
Collection to treatment	0	0	0	200	200	250 to 750	3,000 to 7,000
Treatment to disposal	0	0	0	100	100	200 to 500	2,000 to 4,000
Disposal in N-Sensitive Watershed?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Effluent Nitrogen Concentration, mg/l	26	13	13	15	8	6 to 8	5
Time Value of Money, interest rate, term	5%, 20 Yr	5%, 20 Yr	5%, 20 Yr	5%, 20 Yr	5%, 20 Yr	5%, 20 Yr	5%, 20 Yr

Note: For individual systems, estimates are based on a mix of 3-bedroom (80%) and 4-bedroom (20%) homes, consistent with an average of 3.2 bedrooms per home.

Individual systems (4 scenarios)

1. Conventional Title 5. These systems produce an average nitrogen concentration of 26 mg/l reaching the groundwater, as documented in the work of the Massachusetts Estuaries Project. This scenario is presented only as a benchmark and is not a viable alternative as the sole solution in nitrogen-sensitive watersheds.
2. Individual denitrifying systems as currently installed and operated, estimated to produce an effluent nitrogen concentration of 19 mg/l. Although these systems are capable of better performance, their success has been hindered by the driving forces of reducing initial cost and minimizing ongoing expense. Costs are reported here only to illustrate a full accounting of typical current practices, based on a $24,000 first cost and $1,250 in annual O&M costs. This scenario has been termed "current practice" in the exhibits that follow.
3. Individual denitrifying systems enhanced over current practice to achieve an average nitrogen concentration of 13 mg/l. This scenario assumes per-property capital costs of $26,000 and an annual O&M cost of $2,000. Costs and performance at this level have been demonstrated in the Pinelands of New Jersey. In the tables and figures that follow, this scenario has been termed "enhanced current practice".
4. Individual denitrifying systems, enhanced over current practice to achieve an average nitrogen concentration of 13 mg/l and monitored to document the level of nitrogen removal. When part of a comprehensive plan aimed at complying with a TMDL, the capital costs would be $28,000 and the O&M costs would be $3,200, reflecting a more robust long-term design and more oversight and monitoring. This scenario is been termed "for TMDL compliance" in the exhibits that follow. This nomenclature is used with the understanding that achieving only 13 mg/l effluent nitrogen precludes this approach as the sole means for TMDL compliance where more than 50% of the septic nitrogen load must be eliminated.

Cluster Systems (2 scenarios)

1. Cluster systems with single-stage treatment facilities producing an effluent nitrogen concentration of 15 mg/l. These systems are now in place serving commercial facilities and some residential developments, and are governed by Title 5. They generally rely on the recycle of effluent to the septic tank to provide partial denitrification. They perform somewhat better than individual denitrifying systems due to the benefits of more uniform flow and waste characteristics. In subsequent exhibits, this scenario is termed "current practice".
2. Cluster systems with two-stage treatment facilities producing an effluent nitrogen concentration of 8 mg/l. This scenario assumes that the treatment system will have separate processes for nitrification and denitrification, chemical feed facilities and a standby generator housed in a small control building, and groundwater monitor wells. Capital and O&M costs reflect the DEP position that these systems must be built and operated under the same conditions as the groundwater discharge permit program, including influent, effluent and groundwater monitoring. For simplicity, this scenario is called "for TMDL compliance" in the tables and figures that follow.

Satellite Systems (6 scenarios). Costs have been prepared for six design capacities (25,000 gpd, 50,000 gpd, 75,000 gpd, 100,000 gpd, 200,000 gpd and 300,000 gpd). In all cases, the standard provisions of the DEP groundwater discharge permit apply. Effluent quality is estimated to fall between 6 and 8 mg/l in the Base Case, with the larger facilities producing the better effluent. For simplicity, only 4 of these scenarios are reported in the some of the exhibits that follow.

Centralized Systems (2 scenarios). Costs have been prepared for two design capacities (1.5 mgd and 3.0 mgd). In all cases, the standard provisions of the DEP groundwater discharge permit program apply. Due to the quantities of wastewater to be treated and disposed of, much larger transport distances are included in this analysis compared with other scenarios, because of the presumed difficulty in finding sites of sufficient size near the collection area. The size of these facilities and the level of operational oversight justify the use of 5 mg/l as the baseline effluent quality for these scenarios.

Basis for Reporting of Costs and Performance

The fundamental elements of the cost analysis are capital cost and O&M cost. To be able to compare hypothetical Option #1 (that costs a lot to build but little to operate) with a low-capital-high-O&M alternative (hypothetical Option #2), the "equivalent annual cost" (EAC) of each scenario has been computed. The equivalent annual cost is the sum of the O&M cost and the amortized capital cost. For example, one could take a bank loan to offset a $31 million capital cost, and pay $2.5 million per year back to the bank over 20 years, assuming interest at 5%. If the operation and maintenance costs were $500,000 per year, the equivalent annual cost would be $3.0 million ($2.5 million in amortized capital plus $0.5 million in O&M). This one number reflects the combined impact of the capital and O&M costs, and it allows a consistent comparison with other alternatives.

Each of the treatment systems under consideration has a different ability to remove nitrogen, the driving force for wastewater management in most places on Cape Cod. To factor in the effectiveness of a given treatment system, the equivalent annual cost has been compared with the annual nitrogen removal effected by that option. The result can be converted to dollars per pound of nitrogen removed. In the example above, assume that the treatment system can remove 8,700 pounds of nitrogen per year. The unit cost for nitrogen removal would be $350 per pound ($3.0 million of equivalent annual cost divided by an annual removal of 8,700 pounds).

Figure 6 illustrates, in diagrammatic form, the computation of this measure of wastewater treatment cost effectiveness. Actual calculations are illustrated in Appendix C for two cases.

Each of the evaluated treatment systems was compared to the basic option of allowing individual properties to continue to use individual on-site septic systems. Based on the methodology of the Massachusetts Estuaries Project, individual septic systems are assumed to have 26 mg/l of nitrogen remaining in the system effluent. If a more sophisticated nitrogen-removing option can produce an effluent with, say, 6 mg/l of nitrogen, and provide for effluent disposal within the watershed, then that option "removes" 20 mg/l from the watershed. (If the untreated wastewater entering the treatment system is at 50 mg/l, the system actually removes about 44 mg/l from the

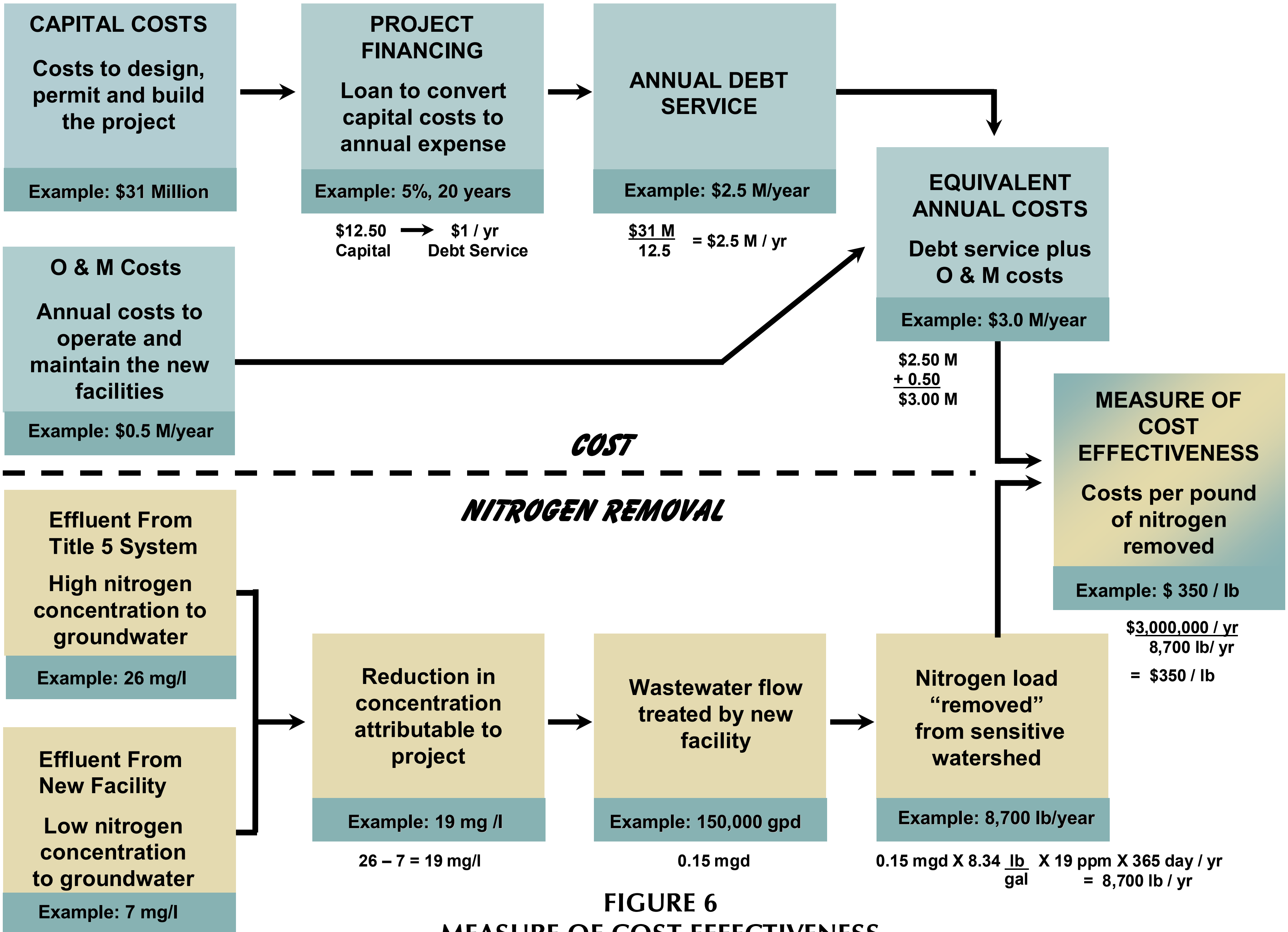


FIGURE 6
MEASURE OF COST EFFECTIVENESS

wastewater. However the removal quantity reported herein is "removed from the watershed", not "removed from the wastewater".) If the nitrogen removing system discharges outside the watershed, it removes all of the 26 mg/l that would otherwise be discharged on site through a Title 5 system.

EVALUATION RESULTS

Results of Base Cases

Table 2 summarizes the cost estimates prepared for the Base Cases. These estimates relate directly to the assumptions shown in Table 1. These costs cover all pertinent elements of a municipal wastewater system, including collection (all but individual systems), treatment, transport, and disposal.

The first column of Table 2 reports the estimated capital costs for each scenario and includes construction, engineering, permitting, legal, land, and contingencies. These costs are expressed on a per-property basis to allow comparison across scenarios that serve different numbers of properties. The estimated costs range from $24,000 to $55,000 per property, compared with the estimated $13,000 for a simple Title 5 system. These costs do not reflect actual betterment charges that a town may levy; towns may chose to spread some of these costs across the entire tax base.

Estimates of O&M costs are tabulated in the second column of Table 2. They range from $400 to $3,200, compared with $110 for a Title 5 system. The O&M costs are also expressed on a per-property basis to allow comparison among scenarios that serve different numbers of parcels.

In general, the individual systems have a lower capital cost and the centralized options have a smaller O&M cost. Combining capital costs and O&M expenses into an equivalent annual cost provides a methodical way to approximate total life-cycle costs, and this measure is reported in the third column of Table 2. Equivalent annual costs range from $3,200 to $6,900 per property, compared with $1,150 for the simple Title 5 system.

The data are further refined by incorporating an estimate of the nitrogen removed from the watershed. The fourth column of Table 2 presents the equivalent annual cost divided by the nitrogen removal, on a dollar-per-pound basis (see Figure 6 for a depiction of this computation approach.) These estimates range from about $300 for centralized systems to over $800 for some of the smaller-scale scenarios.

Figure 7 summarizes the costs for the Base Case scenarios, in the form of four sets of bar charts. The heights of the bars represent either the capital cost per property served (Fig. 7A), the O&M cost per property (Fig. 7B), the equivalent annual cost per property (Fig. 7C) or the cost per pound of nitrogen removed (Fig. 7D). The cost estimates are presented on a per-property-served basis to account for the fact that the various systems all serve a different number of properties. The reader should carefully review the discussion in a later section of this report related to the need to consider both the average per-property costs and the number of properties that must be served.

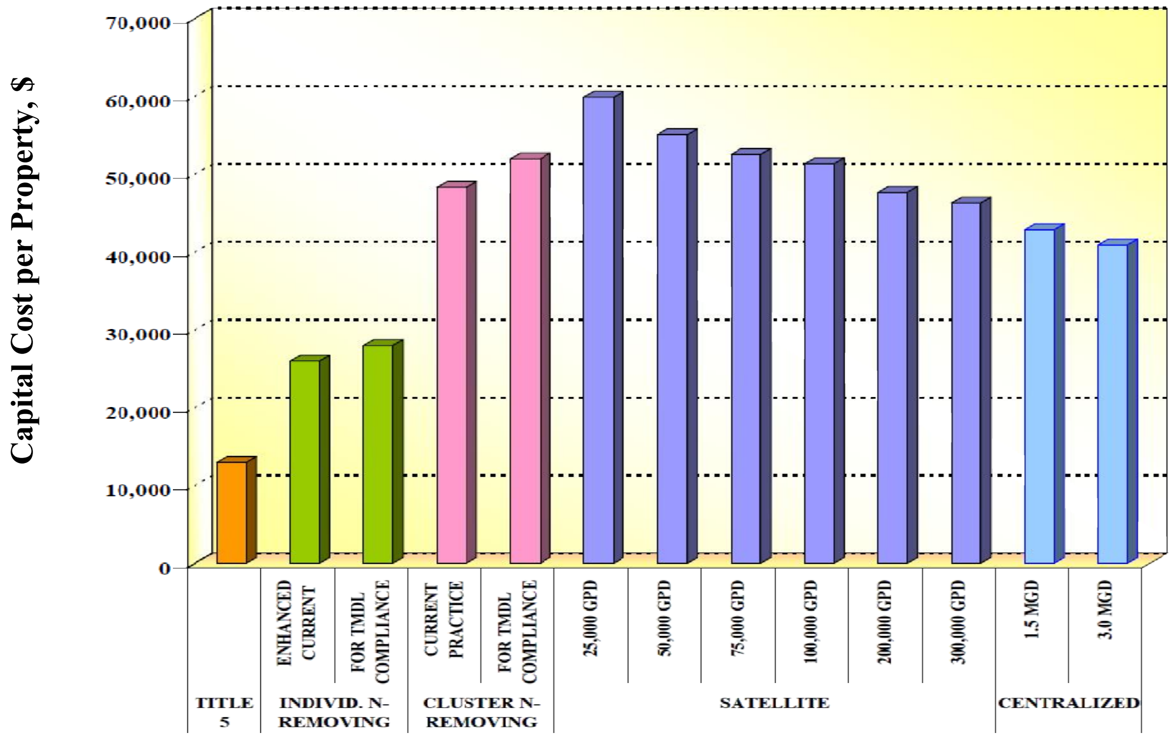
TABLE 2
SUMMARY OF COST ESTIMATES

	Estimated Cost per Property Served			**Equivalent Annual Cost per Pound of Nitrogen Removed**	
	Capital Cost	Annual O&M Cost	Equivalent Annual Cost	$/Lb N	Premium over 3.0-mgd Centralized System
Individual Systems					
Title 5	$13,000	$ 110	$1,150	N/A	Not Applicable
Nitrogen-removing --current practice	$24,000	$1,250	$3,180	$820	187%
Nitrogen-removing--enhanced current practice	$26,000	$2,000	$4,090	$580	102%
Nitrogen-removing --for TMDL compliance	$28,000	$3,200	$5,450	$770	169%
Cluster Systems					
Current practice	$48,300	$1,050	$4,920	$820	186%
For TMDL compliance	$52,000	$2,800	$6,940	$710	149%
Satellite Systems					
50,000 gpd	$55,100	$1,670	$6,080	$680	138%
100,000 gpd	$51,300	$1,360	$5,480	$590	109%
200,000 gpd	$47,700	$1,030	$4,860	$510	79%
300,000 gpd	$46,300	$860	$4,570	$470	64%
Centralized Systems					
1.5 mgd	$42,900	$ 500	$3,940	$305	7%
3.0 mgd	$40,900	$ 400	$3,680	$285	----

Notes: Equivalent annual costs are based on 5%, 20-year financing.
Watershed-wide costs must consider the number of properties served and the average cost per property; see Figure 9 and text.

FIGURE 7
SUMMARY OF COST ESTIMATES

A – COMPARISON OF CAPITAL COSTS PER PROPERTY SERVED



B – COMPARISON OF O&M COSTS PER PROPERTY SERVED

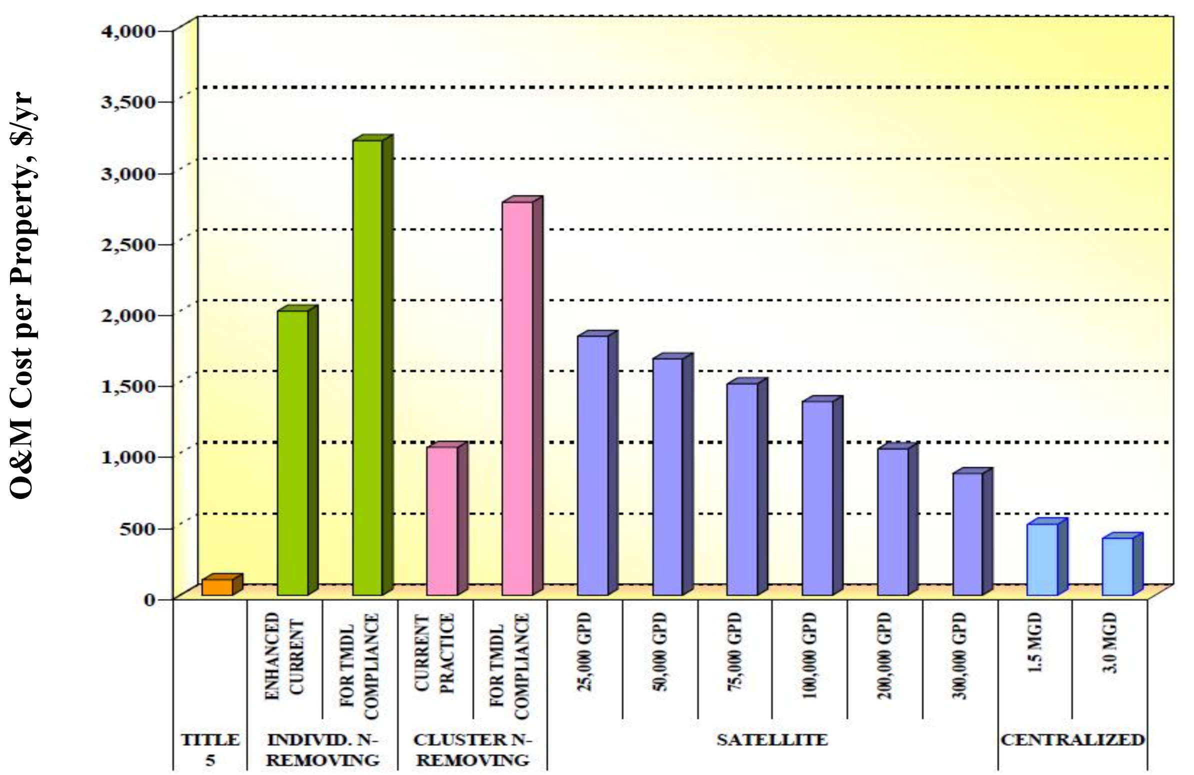
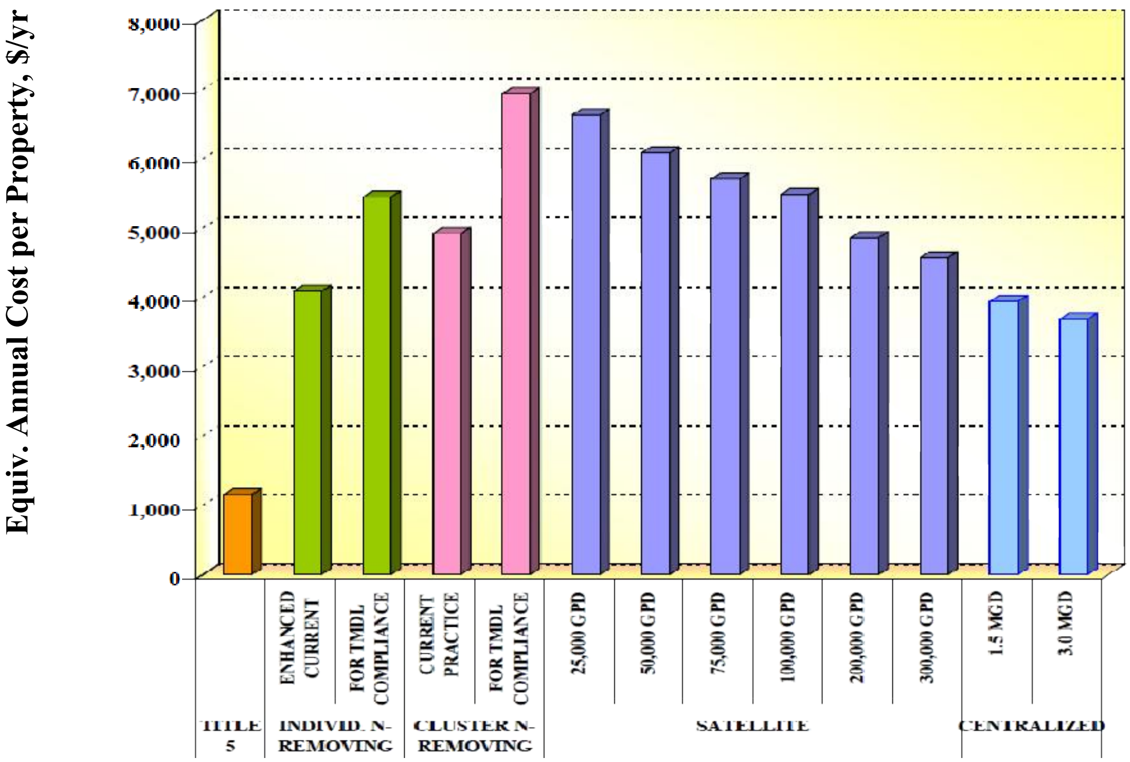
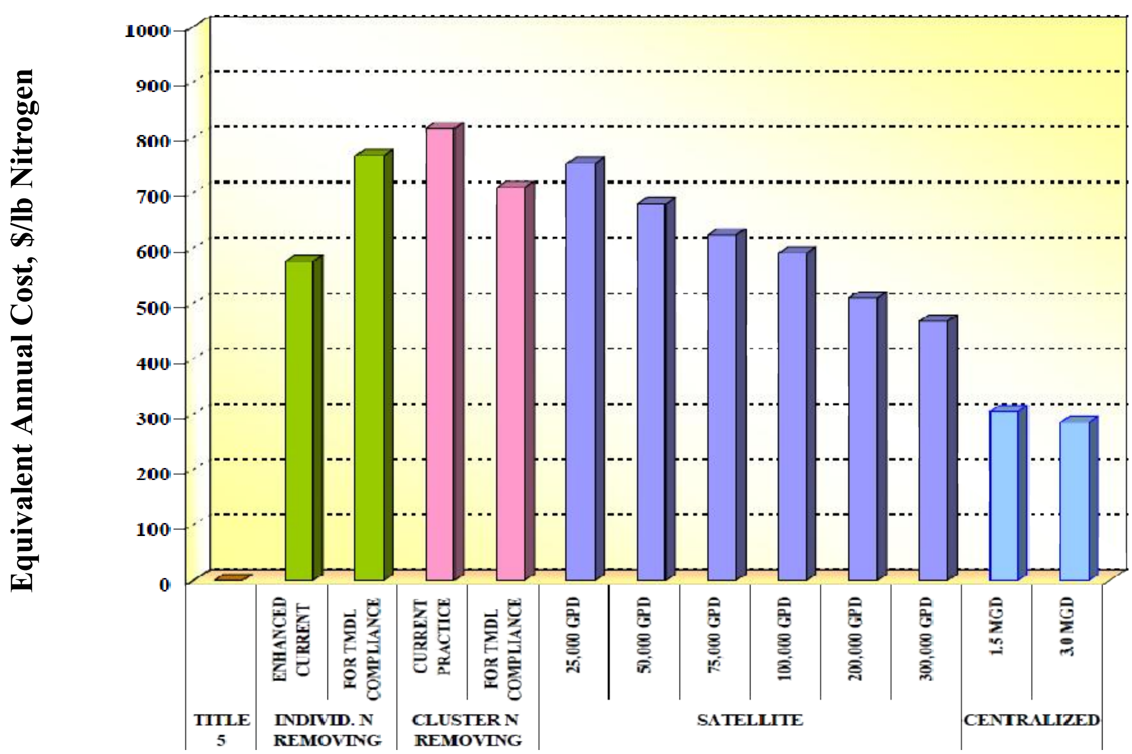


FIGURE 7 (CONT'D)
SUMMARY OF COST ESTIMATES

C – COMPARISON OF EQUIVALENT ANNUAL COST PER PROPERTY SEWERED



D – COMPARISON OF COSTS PER POUND OF NITROGEN REMOVED



Conclusions Related to the "Base Case"

Figure 7 allows some general conclusions to be drawn, specific to the assumptions of the Base Cases:

1. Individual denitrifying systems have the lowest capital cost, primarily because they avoid the need for a wastewater collection system. Cluster and small satellite systems have the highest capital cost per property served, in part because they benefit little from economies of scale.
2. With respect to O&M cost per property, centralized and large satellite systems are the least expensive, along with cluster systems designed for small amounts of nitrogen removal. Cluster systems designed for lower levels of effluent nitrogen have the highest per-property O&M costs, as do individual denitrifying systems.
3. When both capital cost and O&M expenses are combined into an equivalent annual cost per property, the centralized systems have a cost advantage.
4. When nitrogen removal capability is included in the analysis, centralized systems are clearly the lowest cost. The individual, cluster and small satellite systems are considerably more expensive in terms of equivalent annual cost per pound of nitrogen removed.

These conclusions are specific to the assumptions that form the basis for the Base Cases (see Table 1). To gauge how important the assumptions are to the conclusions, a sensitivity analysis was conducted. Appendix C contains illustrations of the computational procedure and descriptions of the assumptions used in the sensitivity analyses.

Sensitivity Analysis for Individual Denitrifying Systems

For the Base Case, individual nitrogen-removing systems were evaluated at 19 mg/l (approximating the current practice) and at 13 mg/l (assuming more rigorous design and operational oversight and, also with added monitoring to demonstrate TMDL compliance). The principal cost parameters were estimated as follows, with the lower capital and O&M costs typically pertaining to the 19 mg/l scenario:

Capital cost per property	$24,000 to $28,000
O&M cost per property	$1,250 to $3,200
Equiv. annual cost (EAC) per property	$3,200/yr to $5,400/yr
EAC per pound of N removed	$580 (13 mg/l) to $820 (19 mg/l)

The sensitivity analysis considered the impact of reusing existing Title 5 systems by adding new denitrifying equipment, a more conservative estimate of site restoration costs, possible reductions in monitoring requirements, added costs for municipal procurement and oversight, higher or lower effluent nitrogen concentrations, and the potential for future cost reductions related to advances in technology. The results are presented below, expressed as equivalent annual cost (EAC) per pound, and as a percentage reduction from the Base Case.

Individual Nitrogen-Removing Systems		Enhanced Current Practice	For TMDL Compliance
	Base case	**$580**	**$770**
A	Adding $4,000 for site restoration	$620	$810
	(Change from base case)	(+8%)	(+6%)
B	Municipal procurement (+20%)	$630	$830
	(Change from base case)	(+10%)	(+8%)
C	Municipal oversight of operations	$600	$790
	(Change from base case)	(+4%)	(+3%)
D	Reusing 50% of existing systems	$520	$710
	(Change from base case)	(-10%)	(-7%)
E	Dropping BOD and TSS sampling	$550	$700
	(Change from base case)	(-4%)	(-8%)
F	Reducing the effluent N by 3 mg/l	$470	$630
	(Change from base case)	(-19%)	(-18%)
G	Reducing effluent to 5 mg/l	$430	$550
	(Change from base case)	(-26%)	(-28%)

This evaluation has considered a scenario where individual nitrogen-removing systems are designed, constructed and operated to be more effective than is the current situation on Cape Cod, on the premise that such steps would be necessary to enable these systems to be part of a town's plan for TMDL compliance. While there may be circumstances where individual systems are competitive with other options, there are two very important points to consider:

- DEP has stated that complete reliance on individual denitrifying systems may not be an acceptable means to achieve TMDL compliance, from an administrative and regulatory perspective; and
- If these systems can reliably achieve only 13 mg/l (the base case assumption here), then they would be applicable as the sole approach only in circumstances where less than 50% removal of the septic load in an embayment is needed.

Nonetheless, individual nitrogen-removing systems have been evaluated here because they may have some limited applicability moving forward, and there needs to be a better understanding of their relatively high cost among the planning boards, boards of health and conservation commissions that routinely require them.

A comparison of the first two scenarios for individual nitrogen-removing system (see Table 2) shows that by building a better treatment system and providing more oversight, the costs per pound of nitrogen decrease from $820 to $580. The improved performance (from 19 to 13 mg/l) more than offsets the added costs. However, the substantial increase in costs for monitoring to document that improved nitrogen removal causes the costs per pound to increase to $770.

Sensitivity Analysis for Cluster Systems

For the Base Case, cluster systems were evaluated for two scenarios. In the first approach, the systems would be developed under Title 5, as is standard for most or all cluster systems in operation today, with an estimated effluent quality of 15 mg/l nitrogen. In the second approach, the cluster system would be designed, permitted and operated under the groundwater discharge permitting program of DEP. The second approach would entail more costs for construction and operation, but would attain a lower effluent nitrogen concentration (8 mg/l assumed in the Base Case). With a groundwater discharge permit, the cluster system would cost more to build and to operate, but might be approvable by DEP as part of a TMDL compliance plan. One additional advantage of the second approach is a smaller effluent disposal system, because the groundwater permitting program allows higher loading rates than under Title 5. The principal cost parameters were estimated as follows, with the lower capital and O&M costs typically pertaining to the 15 mg/l (Title 5) scenario:

Capital cost per property	\$48,000 to \$52,000
O&M cost per property	\$1,000 to \$2,800
Equiv. annual cost per property	\$4,900 to \$6,900
EAC per pound of N removed	\$710 (8 mg/l) to \$820 (15 mg/l)

In this case, the added expense of construction, operation and monitoring are more than offset by the demonstrated reduction in nitrogen load, resulting in a substantial decline in cost per pound removed.

The sensitivity analysis considered the impact of using town-owned parcels to avoid land costs, serving only dense development of small lots to reduce collection costs, achieving lower effluent nitrogen concentrations, the potential for future cost reductions related to advances in technology, and possible reductions in labor costs assuming use of remote sensing capabilities. The results are presented below, expressed as EAC per pound, and as a percentage reduction from the Base Case.

	Cluster Systems	**Under Current Program**	**For TMDL Compliance**
	Base Case	**\$820**	**\$710**
A	Serving one-third seasonal homes	\$910	\$790
	(change from base case)	(+11%)	(+11%)
B	Eliminating land costs	\$680	\$660
	(change from base case)	(-16%)	(-7%)
C	Serving only denser developments	\$750	\$670
	(change from base case)	(-8%)	(-6%)
D	Reducing treatment costs by 20%	\$790	\$690
	(change from base case)	(-3%)	(-3%)
E	Reducing on-site operator time by 20%	\$790	\$670
	(change from base case)	(-3%)	(-6%)
F	Discharging outside sensitive watersheds	\$350	\$500
	(change from base case)	(-57%)	(-31%)
G	Reducing the effluent N by 2 mg/l	\$690	\$640
	(change from base case)	(-15%)	(-10%)
H	Reducing effluent to 5 mg/l	\$440	\$630
	(change from base case)	(-46%)	(-11%)

This sensitivity analysis establishes a wide range of costs for cluster systems. The equivalent annual costs per pound of nitrogen removed fall in the following broad ranges for the two scenarios:

Current Practice	\$350 to \$910
For TMDL Compliance	\$500 to \$790

The greatest reductions in cost per pound result from eliminating land costs, discharging outside sensitive watersheds, and reducing effluent nitrogen concentrations.

Sensitivity Analysis for Satellite Systems

For the Base Case, satellite systems were evaluated at 25,000 gpd, 50,000 gpd, 75,000 gpd, 100,000 gpd, 200,000 gpd, and 300,000 gpd. The principal cost parameters were estimated as follows, with the higher end of the range typically pertaining to the smaller facilities:

Capital cost per property	\$46,000 to \$60,000
O&M cost per property	\$860 to \$1,800
Equiv. annual cost per property	\$4,600 to \$6,600
EAC per pound of N removed	\$470 to \$750

The sensitivity analysis considered the impact of land costs, the transport distances to treatment and disposal sites, the location of the effluent disposal site inside or outside the watershed of a nitrogen-sensitive embayment, higher or lower effluent nitrogen concentrations, and the potential for future cost reductions related to advances in technology. The results are presented below, expressed as EAC per pound, and as a percentage reduction from the Base Case.

	Satellite Systems	**50,000 gpd**	**100,000 gpd**	**200,000 gpd**
	Base case	**\$680**	**\$590**	**\$510**
A	Tripling the transport distances	\$700	\$600	\$520
	(change from base case)	(+3%)	(+2%)	(+2%)
B	Discharging in Zone II	\$720	\$630	\$550
	(change from base case)	(+5%)	(+7%)	(+8%)
C	Reducing the land cost to zero	\$650	\$560	\$480
	(change from base case)	(-5%)	(-5%)	(-5%)
D	Discharging outside sensitive watersheds	\$480	\$430	\$380
	(change from base case)	(-29%)	(-27%)	(-25%)
E	Reducing the effluent N by 2 mg/l	\$610	\$540	\$460
	(change from base case)	(-10%)	(-9%)	(-9%)
F	Reducing effluent N to 5 mg/l	\$590	\$540	\$470
	(change from base case)	(-13%)	(-10%)	(-7%)
G	Reducing capital costs by 20%	\$580	\$500	\$430
	(change from base case)	(-15%)	(-15%)	(-16%)

This sensitivity analysis establishes a range of costs for satellite systems. The equivalent annual costs per pound of nitrogen removed fall in the following ranges for these two sizes of satellite systems:

50,000 gpd	\$480 to \$720
200,000 gpd	\$380 to \$550

It is also possible to combine multiple variables in this analysis. For example, if land costs could be eliminated and effluent disposal could be outside sensitive watersheds, then the cost would be \$460 and \$360 for the 50,000 gpd and 200,000 gpd examples, a reduction of 28% to 33% from the Base Case. Discharge outside sensitive watersheds is the largest single factor reducing costs.

Sensitivity Analysis For Centralized Systems

For the Base Case, centralized systems were evaluated at 0.5 mgd, 1.5 mgd and 3.0 mgd. The principal cost parameters were estimated as follows, with the higher end of the range typically pertaining to the smaller facility:

Capital cost per property	\$41,000 to \$48,000
O&M cost per property	\$400 to \$800
Equiv. annual cost per property	\$3,700 to \$4,700
EAC per pound of N removed	\$285 to \$360

The sensitivity analysis considered the impact of land costs, the transport distances to treatment and disposal sites, the location of the effluent disposal site inside or outside the watershed of a sensitive embayment or a water supply Zone II, higher or lower effluent nitrogen concentrations, and the potential for cost reductions related to regionalization. The results are presented below, expressed as EAC per pound, and as a percentage reduction from the Base Case.

Centralized Systems		**1.5 mgd**	**3.0 mgd**
	Base case	**\$305**	**\$285**
A	Tripling the transport distances	\$315	\$292
	(change from base case)	(+3%)	(+2%)
B	Discharging in Zone II	\$319	\$295
	(change from base case)	(+5%)	(+4%)
C	Reducing the land cost to zero	\$293	\$274
	(change from base case)	(-4%)	(-4%)
D	Discharging outside sensitive watersheds	\$250	\$230
	(change from base case)	(-19%)	(-19%)
E	Reducing effluent to 3 mg/l	\$278	\$260
	(change from base case)	(-9%)	(-9%)
F	Reducing costs by 10% by regionalization	\$294	\$276
	(change from base case)	(-4%)	(-3%)

This sensitivity analysis establishes a range of costs for central systems. The equivalent annual costs per pound of nitrogen removed fall in the following ranges for two sizes of central systems:

1.5 mgd	$250 to $319
3.0 mgd	$230 to $292

It is also possible to combine multiple variables in this analysis. For example, if transport costs were tripled and effluent disposal could only occur in a Zone II, then the cost would be $329 and $302 for the 1.5 mgd and 3.0 mgd examples, an increase of 6% to 8% over the Base Case.

Figure 8 illustrates the results of this sensitivity analysis, in graphical form. The horizontal bar represents the range of costs developed from the sensitivity evaluation, and the vertical red bar denotes the Base Case for each type of system. The letters on each bar refer to the individual sensitivity analyses as noted above.

DISCUSSION OF RESULTS

There are two general purposes of this evaluation. The first is to make an "apples-to-apples" comparison of treatment systems in these categories. The second is to identify the circumstances under which each type of system is most cost-effective.

One striking feature of Figure 8 is the very broad range of costs for these systems, indicating the importance of many variables. Another important observation from Figure 8 is the fact that even the most favorable scenarios for TMDL-compliant individual, cluster and satellite systems all cost measurably more than the least favorable scenarios for the centralized systems. The most favorable case evaluated for satellite systems costs $380 per pound, while the least favorable centralized scenario has a cost of $330 per pound, a difference of about 15%.

For the assumptions of the Base Cases, the 3.0-mgd centralized system has the least cost when capital costs, O&M expenses and nitrogen removal capability are all considered. One way to view these data is to consider the "premium" associated with all other options compared to that low-cost alternative. The last column of Table 2 shows that premium as a percentage over the larger centralized option. Considering both cost and performance, the individual denitrifying systems are at least twice as expensive as the 3.0-mgd scenario, and the cluster systems are at least 150% more expensive. The satellite systems are 60% to 140% more expensive.

The first three columns of Table 2 list average per-property costs, without considering the fact that some scenarios require more properties to be served that other. The use of the dollar-per-pound-removed metric provides a more meaningful measure, because it accounts for the variable number of parcels that must be served among the scenarios.

The Base Cases were developed to provide a fair comparison of options under a uniform set of conditions as a tool to help guide more detailed analyses. If a town is faced with conditions similar to the Base Case, it is likely to find that centralized systems are the most cost-effective. However, a town should closely review these sensitivity analyses to see if conditions exist that warrant a detailed review of the other options. The ranges of costs depicted in

FIGURE 8

SUMMARY OF ESTIMATED COSTS PER POUND OF NITROGEN REMOVED

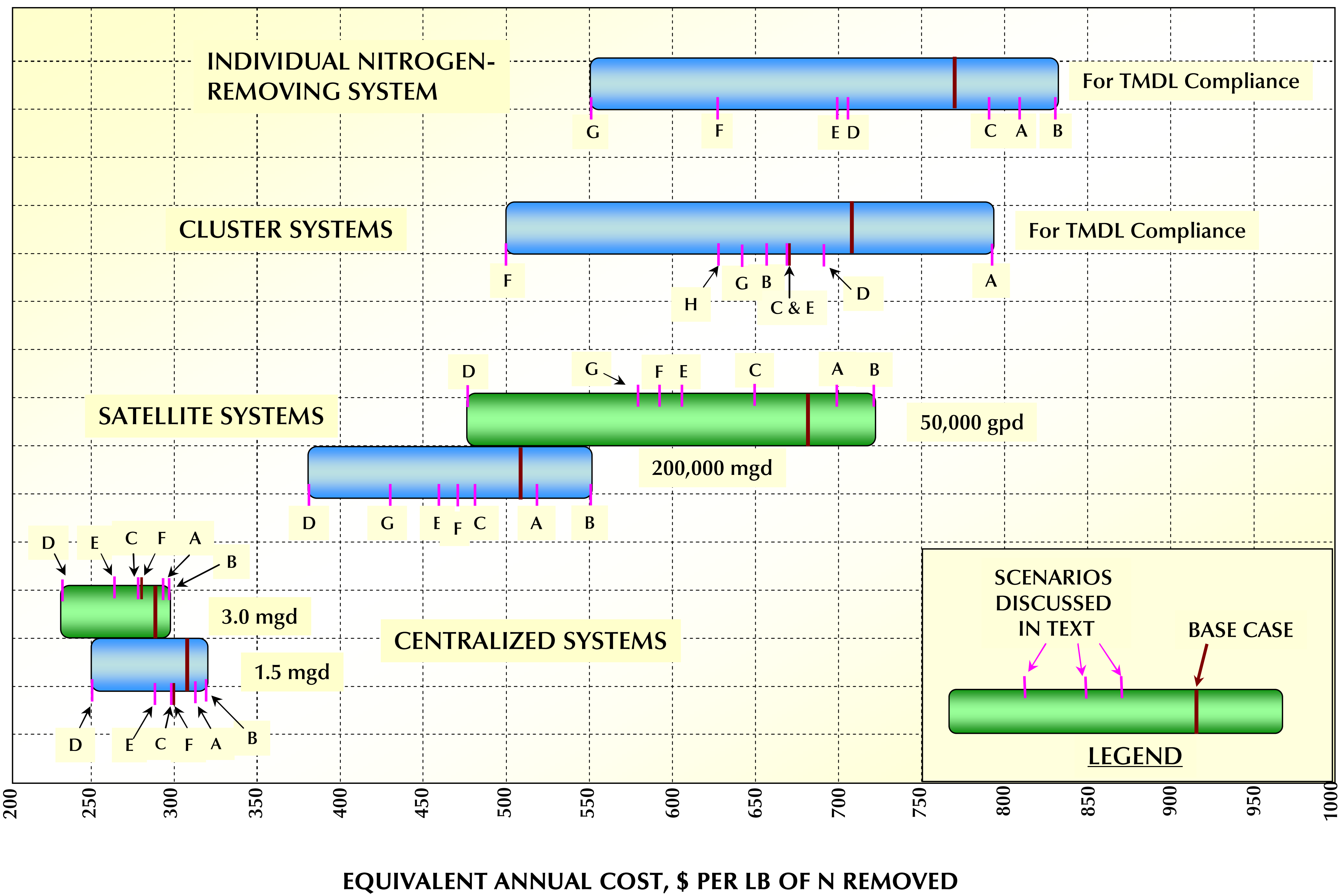


Figure 8 can be used to judge the importance of many factors that impact cost. If circumstances exist that reduce the cost of the smaller-scale options and increase the cost of the larger-scale alternatives, the cost premiums may be significantly less than show in Table 2.

Example Project Costs

The cost estimates presented above are the result of the application of a generic cost model to a prescribed set of circumstances, where every effort was made to use a common set of assumptions. To help illustrate that these hypothetical costs are realistic, several "real-life" projects were analyzed to compute their equivalent cost per pound of nitrogen removed. Table 3 is the result of that analysis. Nine projects, with design capacities ranging from 8,000 gpd to 2.3 mgd, were evaluated as to capital costs, O&M costs and actual annual nitrogen removal.

The computed costs per pound of nitrogen removed are shown at the bottom of Table 3, based on reported costs. The first set of unit costs (in bold print) represents direct calculations from the data in Table 3. The second set of unit costs reflects an adjustment to the collection costs to make them consistent with the density of sewered area (100 feet of collector pipe per connection) used in the hypothetical costs reported earlier. This adjustment was made to equalize a significant cost factor and aid in the understanding of the differences among the projects.

A third estimate of unit costs is included for the Brackett Landing project and the proposed Orleans project. The Brackett Landing project's current oversight and monitoring costs do not reflect the DEP requirements that would pertain if such a facility were to be used in a municipal setting with sufficient documentation to demonstrate TMDL compliance. The last adjusted unit cost for Brackett Landing ($723 per pound) is intended to approximate compliance with those DEP requirements. Table 3 also includes the costs for the proposed Orleans wastewater system, based on the CWMP. Those data are included in Table 3 to illustrate the results of the Town's evaluation of regionalization opportunities. A recent detailed study showed that Orleans could reduce the cost of its wastewater project by about 10% by expanding it to include capacity for wastewater from portions of Eastham and Brewster.

Appendix D is a summary of the sources of data and assumptions and adjustments used to compile Table 3.

These examples show that the costs for small systems can be over $700 per pound, versus larger systems at less than $300 per pound. These are the same conclusions that can be drawn from the hypothetical estimates presented above. The data in Table 3 also show the importance of reducing costs by focusing sewer systems on densely developed areas. The example projects that have only 50 to 70 feet of collection pipe per connection have costs that are over $100 per pound less than would be predicted for the 100-foot assumption in the conceptual analysis. The Brackett Landing example also illustrates that increased oversight and testing (as would be required by DEP to demonstrate TMDL compliance) increases costs by more than $100 per pound at this small scale, even with the very high level of treatment that has been demonstrated at that project.

TABLE 3
COSTS FOR EXAMPLE PROJECTS

Example Projects	Brackett Landing, Eastham	Camp Jewell, Colebrook Conn.	New Silver Beach, Falmouth	Mashpee Commons	West Island, Fairhaven	Tisbury	Province-town	Orleans CWMP	Chatham
Wastewater flows, gpd									
Design	8,230	19,000	60,000	80,000	100,000	104,000	575,000	1,440,000	2,300,000
Annual average	3,300	6,700	25,000	18,900	25,100	37,000	150,000	504,000	1,011,000
Groundwater Discharge Permit?	No	No	Yes	Yes	Yes	Yes	Yes	N/A	Yes
Public Procurement?	No	No	Yes	No	Yes	Yes	Yes	N/A	Yes
Treatment Technology	SeptiTech and Nitrex	BioClere	SBR	RBC	RBC	SBR	SBR	Bardenpho	Oxidation Ditch
Collector Length per Connection, ft	58	---	50	--	68	68	64	138	82
Capital Cost, $M	0.98	1.49	8.55	2.37	8.9	12.2	35	152	210
O&M Cost, $1000/yr	25.5	83.9	151	222	165	360	780	1,200	1,900
Equivalent Annual Cost (5%, 20 yr), $1000/yr	104	203	837	412	880	1,340	3,560	13,400	18,800
Nitrogen Load Removed, lb/yr	228	331	1,240	1,220	1,470	2,400	12,000	40,300	75,110
Unit Cost, $/lb N removed									
Based on data above	**455**	**613**	**677**	**337**	**596**	**560**	**297**	**333**	**250**
Adjusted for collection	551	953	852	754	704		328	296	265
Other computations (Basis)	723 (For TMDL Compliance)							270 (Regional-ization)	

Note: See Appendix D for sources, notes and assumptions.

Cost Impacts of Effluent Disposal within a Nitrogen-Sensitive Watershed

Caution is warranted in reviewing the estimated per-property capital costs presented above. Two alternative solutions with approximately the same per-property capital costs may have significantly different costs watershed-wide. This concept is illustrated in Figure 9, which contrasts a solution using a disposal site within a nitrogen-sensitive watershed (on the right) with one using out-of-watershed disposal (on the left) In this example, 44% more septic systems must be eliminated in the case of in-watershed-disposal to account for the nitrogen in the treatment plant effluent that remains in the watershed. Disposal of that residual nitrogen in a non-sensitive watershed allows fewer properties to be connected to the collection system. Figure 8 is based on an assumed 8 mg/l in the treatment plant effluent. The added burden of in-watershed disposal varies with the quality of the treatment plant effluent, as follows:

In-watershed effluent disposal at 13 mg/l	100% more parcels served
In-watershed effluent disposal at 10 mg/l	62% more parcels served
In-watershed effluent disposal at 8 mg/l	44% more parcels served
In-watershed effluent disposal at 5 mg/l	23% more parcels served

It is clear that the watershed-wide cost must consider both the average cost per property served and the total number of properties whose septic systems would be eliminated to meet a TMDL. That consideration is inherently incorporated in the dollar-per-pound measure of cost-effectiveness reported here, and therefore that cost measure should be the one given most consideration in CWMPs.

Applicability of Title 5 Systems

The inability of traditional septic-tank-and-leaching-field systems to control nitrogen and phosphorus is at the heart of the wastewater management problem on Cape Cod. Nonetheless, Title 5 systems are a very cost-effective way to deal with basic sanitary needs of wastewater disposal. This evaluation shows that the typical cost of a Title 5 system is only about a third that of centralized system and a much smaller percentage of other options that involve nitrogen removal. Therefore, towns should develop wastewater plans that allow maximum use of Title 5 systems. In a nitrogen-sensitive watershed, the lowest cost plan for nitrogen control will involve two parts:

- a sewer system to collect wastewater that will be treated and disposed of in the most economical way, and
- Title 5 systems for everyone else in the watershed.

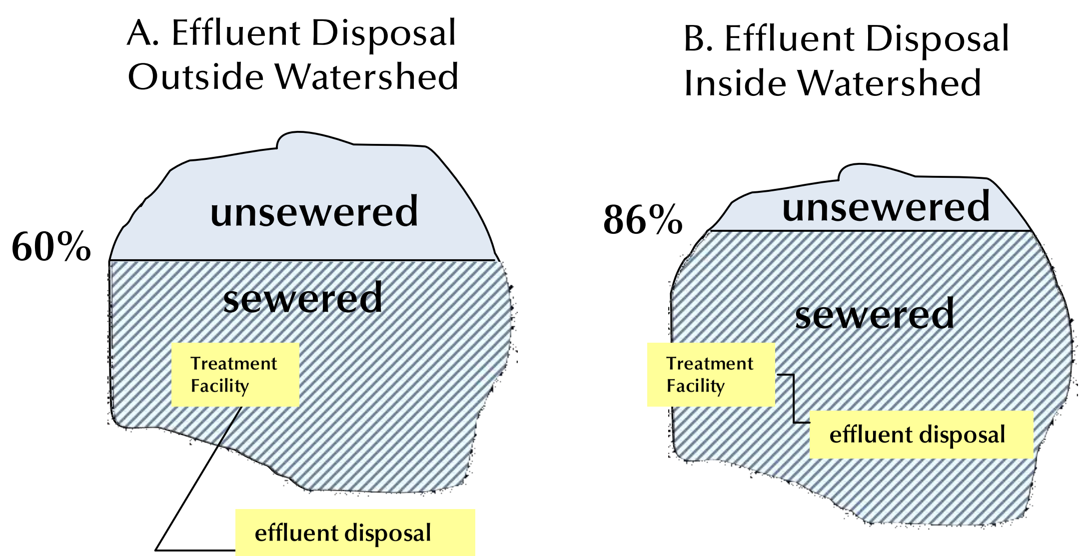
There are other reasons to eliminate or supplement Title 5 systems, such as to correct unsanitary conditions, avoid unsightly mounded systems, reduce the costs of frequent septage pumping, etc. Those reasons should be determined in a definitive needs assessment during the development of the CWMP. The most cost-effective wastewater plan will maximize the use of Title 5 systems (consistent with nitrogen control and all other needs) and efficiently deal with the wastewater collected to meet those overall needs.

FIGURE 9

IMPACT OF IN-WATERSHED DISPOSAL ON THE EXTENT OF SEWERS

Example Watershed

- 1,000 homes on septic systems
- Septic nitrogen load = 10,000 lb/yr
- TMDL = 4,000 lb/yr
- Required septic load removal = 60%



	A. Effluent Disposal Outside Watershed	B. Effluent Disposal Inside Watershed
Nitrogen from unsewered parcels (26 mg/l)	4,000 lb/yr	1,400 lb/yr
Nitrogen from effluent disposal in watershed (8mg/l)	0	2,600
Total wastewater-related load	4,000 lb/yr	4,000 lb/yr
Parcels sewered	**600**	**860** (44% more)

Applicability of Individual Nitrogen-Removing Systems

It is currently the opinion of DEP that these systems may not be suitable as the sole means of TMDL compliance, given the difficulty faced by a municipality to build them on large numbers of private parcels, monitor their nitrogen removal capabilities and provide for long-term operation and maintenance. Even in the absence of these concerns, the current capability of these systems to provide significant nitrogen removal restricts their applicability to watersheds where the necessary septic nitrogen removals are less than about 50%. However, there are circumstances where individual denitrifying systems can be a valuable adjunct to other options.

Conditions Most Favorable. The greatest benefit of individual denitrifying systems is the avoidance of a collection system, since they provide for treatment and disposal on the same parcel where the wastewater is generated. In neighborhoods where the average length of collection pipe per property served would exceed 200 feet, the substantial cost of wastewater collection may make other systems more expensive. In these circumstances, individual systems should be evaluated, considering all costs as well as the administrative issues related to property access and TMDL compliance.

Conditions Least Favorable. Where septic nitrogen control needs exceed 50%, these systems are not applicable. (This percentage may rise over time as technology improvements results in better routine nitrogen removal.) Even in those watersheds where relatively small percentages of nitrogen removal are needed, the very high cost per pound of nitrogen removed (greater than $550 per pound) should preclude their consideration if the collection system requires less than 150 feet per connection. Unless larger-scale systems must include very large transport distances to available treatment/disposal sites, and effluent disposal must occur in very sensitive watersheds or in water supply Zone IIs, these systems need not be evaluated in detail except for serving isolated areas.

Applicability of Cluster Systems

Wastewater treatment systems smaller than 10,000 gpd suffer significantly from "dis-economies of scale", but there are circumstances where they can be applicable. DEP is not inclined to allow a series of cluster systems as the primary means of TMDL compliance (for many reasons similar to the issues related to individual systems), but those DEP concerns may be addressed by developing cluster systems under the groundwater discharge permit program. It is for this reasons that two types of cluster systems were evaluated in this analysis.

Conditions Most Favorable. Cluster systems may be viable components of a CWMP in these circumstances:

- Existing neighborhoods of small lots (and therefore low collection costs) that are remote from proposed sewered areas, and that have publically-owned vacant land nearby;
- New cluster developments where the developer can install alternative collection systems at the time of construction and later turn the project's wastewater infrastructure over to the town; and

- Shore-front neighborhoods near small, poorly-flushed embayments where the cluster system can provide an early benefit of nitrogen control, and later be converted to a pumping station in later phases of a centralized system.

Non-cost factors should also be considered, such as the need to maintain water balance within watersheds.

Conditions Least Favorable. Given their high cost per pound of nitrogen removed (greater than $500 per pound), cluster systems do not warrant detailed consideration unless larger-scale systems must include very large transport distances to available treatment/disposal sites, and effluent disposal must occur in very sensitive watersheds or in water supply Zone IIs.

Applicability of Satellite Systems

Satellite systems, by definition, are designed to serve portions of a town or large individual developments. There are more than 50 such systems on Cape Cod, most privately developed. Most of the publically-owned satellite plants serve schools, but the New Silver Beach facility in Falmouth is a good example of a municipal system serving a specific portion of a town.

Conditions Most Favorable. Satellite systems may be viable components of a CWMP in these circumstances:

- A remote watershed in need of nitrogen control that is more than 5 miles from the existing sewer system or other areas or need, and that has publically-owned vacant land nearby;
- New large-scale residential or commercial developments where the developer can install collection, treatment and disposal facilities at the time of construction and later turn the project's wastewater infrastructure over to the town; and
- An existing or proposed private facility that can be taken over by the town and expanded to provide wastewater service to existing nearby properties currently on septic systems, particularly if the town-wide system may be available for many years and the developer is prepared to proceed in the near future.

Satellite systems of 150,000 gpd or larger have a distinct cost advantage over those 50,000 gpd and smaller.

Conditions Least Favorable. Given their high cost per pound of nitrogen removed (greater than $500 per pound), satellite systems smaller than 100,000 gpd have limited applicability unless they serve areas particularly remote from larger-scale wastewater infrastructure. If centralized facilities exist or can be developed within 5 miles, satellite facilities do not warrant detailed consideration. If regionalization is possible and desirable, satellite options have an added disadvantage.

Applicability of Centralized Systems

Wastewater infrastructure that relies on a single treatment plant and effluent disposal system has both advantages and disadvantages. From a cost perspective, the "best" and "worst" circumstances are as follows:

Conditions Most Favorable. Centralized systems are likely to be the most viable wastewater systems where:

- Dense development exists in nitrogen-sensitive watersheds;
- Suitable treatment and disposal sites (outside sensitive watersheds and Zone IIs) are available at no or low cost;
- A high degrees of nitrogen control is required, placing a cost premium on small-scale systems that discharge in sensitive watersheds;
- Areas of dense development in sensitive watersheds are within 3 miles of desirable effluent treatment and disposal sites;
- Opportunities are available for cost reductions through regionalization.

Conditions Least Favorable. Smaller-scale systems should be closely considered as alternatives to centralized systems where:

- Development in nitrogen-sensitive watersheds is relatively sparse; and
- Available effluent disposal site are remote, costly, and located in water supply Zone IIs or nitrogen-sensitive watersheds; and
- Only small amounts of nitrogen must be removed, allowing individual denitrifying systems to be applicable; and
- Water balance considerations favor local disposal.
- Otherwise favorable sites are poorly located with respect to nearby development or have unacceptable impacts on natural resources.

Figure 8 is a graphical comparison of the range of costs estimated herein for all of the technologies. It shows that centralized systems are generally much less expensive, although there are certain circumstances where smaller-scale systems are cost competitive.

Identification of Most Important Cost Factors

This evaluation of large and small wastewater systems, including this sensitivity analysis, reveals some important points with respect minimizing costs for wastewater infrastructure. The most important cost factors facing any town are as follows, in approximate order of importance (most important first):

1. **Economies of scale**. One 1.5-mgd centralized facility can cost less than half the aggregate cost of 10 facilities each 150,000 gpd in size, other things being equal.

2. **Density of development**. Wastewater collection costs are often more than 50% of the cost of the overall wastewater system. Collection costs for neighborhoods of lots with 75-foot frontage cost only about half as much as those with average 150-foot frontage.

Towns should make every effort to identify those portions of sensitive watersheds with the least amount of collection pipe required per pound of nitrogen collected.

3. **Location of effluent disposal.** Significant cost advantages accrue to towns that can locate their effluent discharges within watersheds leading to the open ocean or to coastal systems with adequate nitrogen-assimilative capacity. For a 1.5-mgd centralized system, the ideal effluent disposal site offers a 20% to 25% benefit, in terms of cost per pound of nitrogen removed. For discharges to nitrogen-sensitive watersheds or water supply Zone IIs, a premium must be paid for both a higher level of wastewater treatment and an expanded sewer system to account for the effluent nitrogen that remains in the watershed.

4. **Land costs**. While land costs may vary substantially across a town, use of town-owned land (or land that can be obtained at low cost) is, in general, a significant cost factor. In a decentralized plan with multiple treatment or disposal sites, more land is needed than in the comparable single-site alternative because of the buffer zones and set-backs needed at each site. Further, the chances for neighbor opposition increases, along with potential costs for delays, litigation and perhaps even eminent domain proceedings. (A countervailing factor is the potential for smaller sites, such as town parks, to be more readily available than larger sites.)

The sensitivity analysis reported herein indicates that projects that benefit from cost advantages in all four of these categories will be significantly less expensive than other options.

Readers should be cautioned to carefully consider the role of the efficiency of the wastewater treatment in overall system economics. While treatment System A that produces 5 mg/l effluent nitrogen may seem to be "twice as good" as System B treating to 10 mg/l, System A eliminates 21 of the 26 mg/l otherwise discharged from a septic system, while System B eliminates 16 mg/l. If Systems A and B cost the same to build and operate, System A will have a cost per pound of nitrogen removed that is 24% lower, not 50% lower. That cost advantage is largely eliminated if System A discharges within a sensitive watershed and System B discharges in a non-sensitive area.

OTHER ISSUES OF NOTE

Role of Collection System Costs in this Analysis

Except for individual denitrifying systems, which do not need a public collection system, collection system costs are a significant component of the overall cost of a public wastewater system. For this analysis, collection costs have been held constant among the satellite and centralized options, and clusters systems include a somewhat reduced collection cost. It was assumed that the density of development tributary to any of the satellite and centralized options would require 100 feet of collector pipe per property served (75 feet for cluster systems), and that 5% of the properties would require grinder pumps to access the sewer. On average, one pumping station was assumed for every one hundred properties. These assumptions lead to an estimated construction cost of $20,000 per property served for satellite and centralized systems ($17,000 for cluster options), and these fixed amounts were included in all of the cost estimates, except for the individual on-lot systems. The collection system for a 200,000 gpd satellite system accounts for $250 of the $510 per pound figure reported here for the Base Case.

There are alternative collection approaches, such as low-pressure systems and septic-tank-effluent-pump systems, which also can be used to reduce collection cost in certain circumstances. When those favorable circumstances present themselves, it is assumed that these alternative collection systems would be implemented, regardless of the size of the treatment facility receiving the collected wastewater. Any cost reductions associated with these alternative collection systems should not be attributed to one scenario and not another.

Many communities may be faced with higher costs than presented herein due to the density of the sewered area. Whereas 75 to 100 feet of collector pipe per connection was assumed for this analysis, there may be areas of Cape Cod where 150 feet or more are needed, increasing the capital costs of any option requiring public sewers. The collection costs for neighborhoods requiring 150 feet of collector pipe per connection would translate to an extra $100 per pound of nitrogen compared to the base case of 100 feet per connection.

Including collection costs in this analysis provides a more appropriate comparison among alternatives, and allows these figures to be compared with actual costs that have been incurred in some communities. However, the inclusion of a constant cost factor tends to mask the differences in treatment costs among the options. If the costs in Table 2 did not include collection costs, the percentage premiums for the small-scale options would be larger than those shown.

Optimizing Town Expenditures for Comprehensive Wastewater Management Planning

The Base Cases evaluated in this report represent one set of typical circumstances, but those circumstances may not reflect the situation that exists in any one town on Cape Cod. Towns embarking on comprehensive wastewater management planning should review this evaluation of the both the Base Cases and the sensitivity analysis to determine how its circumstances compare. Then that town can focus on the types of wastewater management systems that are likely be best for its circumstances, and avoid expensive analyses of systems that can be determined from this evaluation to have limited applicability. For example, a town with large lots, moderate nitrogen control needs and available public lands for local systems should plan to conduct an intensive evaluation of small-scale systems. Conversely, a town with publically-owned sites near collection areas and outside sensitive watersheds or Zone IIs can plan to focus its planning budget on centralized systems and minimize time and expense in evaluation smaller-scale systems.

Use of Individual Denitrifying Systems for Other Purposes

In most Cape Cod towns, individual nitrogen-removing systems are routinely required by Town boards and commissions to address real or perceived environmental or public health impacts unrelated to nitrogen. This analysis shows how such systems can be expensive and ineffective for nitrogen control. Boards and commissions should focus on the particular environmental issue of concern and be cautious in requiring individual denitrifying systems.

Water Balance Considerations

Smaller-scale systems provide a benefit with respect to maintaining the water balance between watersheds. In some circumstances, this relocation of water that otherwise would be recharged locally is a significant factor; in other areas it is not. Each town should closely consider water balances to be sure that this factor is appropriately addressed.

Applying These Costs to Specific Properties

In translating these cost estimates to specific amounts that might be paid by specific properties in sewered areas, the following factors should be considered:

- Towns must decide how to apportion capital costs between betterments (paid only by property owners served by the public infrastructure) and property taxes (paid by property owners town-wide). Amounts allocated to property taxes reduce the costs to properties that are served by the system.
- Betterments may be separately applied to collection costs and treatment costs, and collection system betterments may rely on one or more property features (such a total lot area or parcel frontage).
- The County Septic Loan Program may reduce costs for some property owners, although funding for this program is unlikely to be sufficient for widespread application.
- No consideration has been given here to possible increases in property values for parcels connected to public sewers.

Need for Treatment Capability for Septage and Other Trucked Wastes

For the smaller-scale systems considered in this evaluation, it was assumed that sludge would be removed periodically and transported by truck to a regional septage facility, such as the Yarmouth-Dennis plant in Yarmouth, or the Tri-Town facility in Orleans. Separate sludge dewatering equipment is not warranted at these small-scale systems. Costs for centralized systems include facilities for handling septage from unsewered areas of the town. The ability of a town to reduce its wastewater-related expenses by providing septage or liquid sludge handling services to nearby towns has not been accounted for in this cost analysis.

Importance of Low-Interest Loans

This analysis of costs has been based on the traditional debt service assumptions of 5% interest over a 20-year loan period. Alternative assumptions were also evaluated to reflect the current favorable municipal bond market, and the availability of low interest loans under the State Revolving Fund (SRF). Using the Base Case for a 200,000-gpd satellite system as an example, costs were computed (expressed as equivalent annual costs per pound of nitrogen removal) for several interest rates over 20 years, with the following results:

5% (basis for costs reported in this report)	$510 per lb
4% (current municipal rate)	$477 per lb (6% less than 5% loan)
2% (SRF rate for most projects)	$414 per lb (19% less than 5% loan)
0% (SRF rate under some circumstances)	$359 per lb (30% less than 5% loan)

The equivalent annual cost is reduced with a lower interest rate because the annual debt service costs are lower; O&M costs are unaffected. By availing themselves of the SRF loans, towns can save 18% to 28% of the cost reported in this document for the traditional 5%, 20-year loan. For this example, the savings in debt service expenses with a zero-percent loan are slightly greater than the total O&M cost; that is, the savings in debt service are enough to pay for all of the O&M costs for 20 years.

BARNSTABLE COUNTY WASTEWATER COST TASK FORCE

This report was prepared by a task force that was established to compile and evaluate information on the costs of various wastewater management options that are applicable to Cape Cod. Members of the Wastewater Cost Task Force were selected based on their experience and expertise with a wide variety of technologies and system sizes. They are:

- **Thomas Cambareri.** A hydrogeologist and planner, Mr. Cambareri is the Water Resources Program Manager for the Cape Cod Commission. He and his staff review all Comprehensive Wastewater Management Plans prepared on Cape Cod, as well as the wastewater facilities implemented in Developments of Regional Impact. He was one of the principal authors of the 2003 Cape Cod Comprehensive Regional Wastewater Management Strategy report and the 2010 Cape Cod Regional Wastewater Management Plan.
- **Brian Dudley.** Mr. Dudley is an environmental engineer and the senior staff member at the Hyannis Office of the Massachusetts Department of Environmental. He is also DEP's manager of the Massachusetts Estuaries Project. Mr. Dudley overseas the issuance of groundwater discharge permits on Cape Cod, and has reviewed the design and operation of over one hundred projects involving most applicable wastewater technologies. Prior to joining DEP, he worked in the private sector designing small wastewater treatment plants and developing innovative treatment systems.
- **Michael Giggey**. Mr. Giggey is a registered professional engineer and Senior Vice President of Wright-Pierce. He was the principal author of the 2004 report "Enhancing Wastewater Management on Cape Cod: Planning, Administrative and Legal Tools", and continues to advise the Cape Cod Commission on wastewater planning issues. He has designed or provided peer review for several dozen small-scale wastewater systems in the region, and is a well-known advocate for new and appropriate technology.
- **George Heufelder.** As director of the Barnstable County Department of Health and Environment, Mr. Heufelder oversees the County's water quality laboratory, the community septic loan program and other public health initiatives. He is also the director of the Massachusetts Alternative Septic System Test Center, and in that capacity has installed and operated many new wastewater treatment technologies. Mr. Heufelder is a registered sanitarian and member of the Falmouth Board of Health. He is the author of several publications related to the performance of small-scale wastewater treatment systems.
- **Susan Rask**. Ms. Rask is a registered sanitarian and former member of the Barnstable Board of Health. As Environmental Health Specialist for the Barnstable County Department of Health and Environment, she manages the County's internet-based

reporting system that compiles operating data for over 1,400 small wastewater systems in 14 towns. She was the principal author of the 2007 report "Projected Use of Innovative/Alternative On-site Sewage Treatment Systems in Eastham" and served as project manager for the "Sewers and Smart Growth" project completed in 2009.

Funding for the Task Force's work was provided by Barnstable County and by grants to the Association to Preserve Cape Cod from the Cape Cod Five Charitable Trust Foundation and the Horizon Foundation. This report was developed with the assistance of the GIS and technical staff of the Cape Cod Commission.

APPENDIX A
Survey of Construction Costs for Wastewater Treatment Facilities

APPENDIX A
SURVEY OF CONSTRUCTION COSTS FOR WASTEWATER TREATMENT FACILITIES

FACILITY	#	TOWN	DESIGN FLOW, gpd	CONSTRUCTION COST PRIOR YEAR	CONSTRUCTION COST 2009	UNIT COST, $/gpd	SOURCES AND NOTES
				Variable ENR	*ENR, 2009*		
Anonymous (residential)	1	E. Bridgewater	15,000	970,000 *7,864*	1,061,000 *8,600*	70.7	Wright-Pierce preconstr. estimate
Camp Jewell	2	Western Conn.	19,000	1,010,000 *7,308*	1,189,000 *8,600*	62.6	Wright-Pierce includes upgrade
Anonymous (school)	3	So. New England	17,500	648,000 *7,763*	718,000 *8,600*	41.0	Aquapoint
Cotuit Stop n Shop	4	Barnstable	22,000	760,000 *6,538*	1,000,000 *8,600*	45.5	VHB
Mass. Correct. Fac.	5	Plymouth	31,000	*2,300,000* *8,250*	2,398,000 *8,600*	77.4	Horsley-Witten
Harvard Ridge	6	Boxborough	34,000	1,250,000 *6,635*	1,620,000 *8,600*	47.6	EarthTech
Anonymous (residential)	7	Cohasset	38,000	1,280,000 *7,856*	1,401,000 *8,600*	36.9	RH White
Berkshire School	8	W. Mass.	40,000	1,000,000 *6,538*	1,315,000 *8,600*	32.9	Zenon
Camp Beckett	9	W. Mass.	40,000	1,500,000 *7,900*	1,633,000 *8,600*	40.8	CDM
Bolton Municipal	10	Bolton	40,000	1,800,000 *7,940*	1,950,000 *8,600*	48.8	Tata & Howard
Anonymous (residential)	11	Weston	40,000	2,100,000 *7,900*	2,286,000 *8,600*	57.2	RH White
Shops at Derby Street	12	Hingham	54,000	2,500,000 *6,600*	3,258,000 *8,600*	60.3	Martinage Eng. Assoc.
New Silver Beach	13	Falmouth	60,000	4,000,000 *8,000*	4,300,000 *8,600*	71.7	Town of Falmouth
Anonymous (residential)	14	No. Reading	63,000	2,400,000 *7,700*	2,681,000 *8,600*	42.6	RH White
Anonymous (residential)	15	Acton	96,000	2,879,000 *7,888*	3,139,000 *8,600*	32.7	Developer
West Island	16	Fairhaven	100,000	2,300,000 *5,825*	3,396,000 *8,600*	34.0	Town of Fairhaven

FACILITY	#	TOWN	DESIGN FLOW, gpd	CONSTRUCTION COST PRIOR YEAR	CONSTRUCTION COST 2009	UNIT COST, $/gpd	SOURCES AND NOTES
Tisbury Municip.	17	Tisbury	104,000	5,170,000 *6,500*	6,840,000 *8,600*	65.8	Town of Tisbury
Pine Hills	18	Plymouth	150,000	4,800,000 *6,222*	6,635,000 *8,600*	44.2	Wright-Pierce Phase 1 only
Oak Bluffs Municip.	19	Oak Bluffs	320,000	6,800,000 *6,222*	9,399,000 *8,600*	29.4	Wright-Pierce
Provincetown Mun.	20	Provincetown	500,000	7,420,000 *6,400*	9,971,000 *8,600*	19.9	Town of Provincetown Phase 1 only
Edgartown Mun.	21	Edgartown	750,000	12,200,000 *6,500*	16,142,000 *8,600*	21.5	Town of Edgartown
Jaffrey Municip.	22	Jaffrey, NH	1,250,000	11,000,000 *7,850*	12,051,000 *8,600*	9.6	Wright-Pierce
Falmouth Municip.	23	Falmouth	2,200,000	12,500,000 *7,000*	15,357,000 *8,600*	7.0	Town of Falmouth
Chatham Municip.	24	Chatham	2,300,000	36,000,000 *8,600*	36,000,000 *8,600*	15.7	Town of Chatham some existing facil.

April 16, 2010

APPENDIX B
Survey of O&M Costs for Wastewater Treatment Facilities

APPENDIX B

SURVEY OF O&M COSTS FOR WASTEWATER TREATMENT FACILITIES

FACILITY	#	TOWN	FLOWS, gpd DESIGN	ANNUAL AVG	O&M COST, $/yr	UNIT COST, $/yr/gpd	SOURCES AND NOTES
Patriot Square	1	Dennis	17,000	6,000	85,000	14.2	Coastal Engineering
Camp Jewell	2	Western Conn.	19,000	6,700	84,000	12.5	Owner
Comm. of Jesus	3	Orleans	21,700	6,500	87,900	13.5	Owner
Skaket Corner	4	Orleans	22,000	6,000	85,200	14.2	Coastal Engineering
Martha's Vineyard Airport	5	Edgartown	37,000	9,000	156,500	17.4	Dukes County
Anonymous (residential)	6	Cohasset	38,000	21,000	174,000	8.3	Weston & Sampson projected future
Horace Mann School	7	Barnstable	42,000	10,000	103,000	10.3	Town of Barnstable
Mashpee Commons	8	Mashpee	80,000	19,000	222,000	11.7	Owner
West Island	9	Fairhaven	100,000	16,300	165,000	10.1	Town of Fairhaven
Tisbury Municipal	10	Tisbury	104,000	36,000	360,000	10.0	Town of Tisbury
Pine Hills	11	Plymouth	300,000	125,000	623,000	5.0	Veolia
Oak Bluffs Municipal	12	Oak Bluffs	320,000	89,000	603,000	6.8	Town of Oak Bluffs
Provincetown Mun.	13	Provincetown	575,000	150,000	780,000	5.2	Town of Provincetown
Edgartown Municipal	14	Edgartown	750,000	170,000	850,000	5.0	Town of Edgartown
Spencer Municipal	15	Spencer	1,080,000	780,000	1,820,000	2.3	Town of Spencer
Falmouth Municipal	16	Falmouth	1,200,000	400,000	1,137,000	2.8	Town of Falmouth
Jaffrey Municipal	17	Jaffrey, NH	1,250,000	500,000	832,000	1.7	Town of Jaffrey
Wareham Municipal	18	Wareham	1,560,000	1,067,000	2,980,600	2.8	Town of Wareham
Chatham Municipal	19	Chatham	2,300,000	1,300,000	1,900,000	1.5	Town fo Chatham projected future
Plymouth Municipal	20	Plymouth	3,000,000	1,650,000	1,996,000	1.2	Veolia
Hyannis Municipal	21	Barnstable	4,200,000	1,800,000	2,265,000	1.3	Town of Barnstable

APPENDIX C
Example Calculations and Assumptions for Sensitivity Analyses

BARNSTABLE COUNTY WASTEWATER COST TASK FORCE

Sample Calculations

Base Case for 100,000-gpd Satellite and 1.5-mgd Centralized Systems

	Satellite: 100,000 gpd	Centralized: 1.5 mgd
Wastewater Flow		
Number of homes/properties	284	3,375
Number of bedrooms/home	3.2	
Number of bedrooms	909	
Title 5 flow, gpd	99,990	
Short-term peak flow, gpd		1,500,000
Annual average flow		
Percent of Title 5	45	45
Actual, gpd	45,000	675,000
Capital Costs		
Collection		
Sewer length per connection	100	100
Cost per property	20,000	20,000
Number of properties	284	3,375
Construction cost	5,681,000	67,500,000
Transport to treatment		
Distance, 1000 ft	0.40	5.00
Cost per foot	200	250
Construction cost	80,000	1,250,000
Treatment		
Cost per unit flow	34	16
Flow, gpd	100,000	1,500,000
Construction cost	3,400,000	24,000,000
Transport to disposal		
Distance, 1000 ft	0.35	3.00
Cost per foot	200	250
Construction cost	70,000	750,000
Disposal		
Construction cost	520,000	5,250,000
Total construction cost		
Cost	9,751,000	98,750,000

	Satellite: 100,000 gpd	Centralized: 1.5 mgd
Construction contingencies, legal, engineering, permitting, etc.		
Percentage of construction	40	40
Cost	3,900,000	39,500,000
Land		
Treatment area, acres	1.10	8
Disposal area, acres	2.65	24
Total area	3.75	32
Cost per acre	250,000	200,000
Cost	935,000	6,400,000
Total capital cost	14,586,000	144,650,000
Capital costs summary	14,586,000	144,650,000
O&M Costs		
Annual average flow, gpd	45,000	675,000
Unit cost, $/yr per gpd	8.6	2.5
O&M cost, $/yr	387,000	1,687,500
O&M Cost summary	387,000	1,687,500
Present Worth		
Period, yr 20		
Interest rate, ' 5		
PW Factor 12.46		
Capital cost	14,586,000	144,650,000
O&M cost	387,000	1,687,500
PW of O&M	5,047,000	21,030,000
Total present worth	19,633,000	165,680,000
Equivalent Annual Cost, $/yr		
Amortized capital cost	1,170,000	11,607,000
O&M cost	387,000	1,688,000
Total EAC	1,557,000	13,295,000

	Satellite: 100,000 gpd	Centralized: 1.5 mgd
Nitrogen removal (compared with Title 5)		
Title 5 effluent N conc., mg/l	26.25	26.25
Satellite effluent N conc., mg/l	7	5
Conc removed, mg/l	19.25	21.25
Load removed, lb/yr		
In-watershed disposal	2,637	43,600
Out-of-watershed disposal	3,596	53,900
Cost of N removal--in-watershed disposal		
EAC, $/lb	**590**	**305**
Cost of N removal--out-of--watershed disposal		
EAC, $/lb	433	247
Costs per property		
Capital	51,300	42,900
O&M	1,360	500
EAC	5,480	3,940

April 16, 2010

ASSUMPTIONS INCLUDED IN SENSITIVITY ANALYSES

Individual Denitrifying Systems

Base Case--see Table 1

A. Additional site restoration--capital costs increased by $4,000 to reflect possible greater disruption of decks, patios and landscaping at currently developed properties, and/or for pumping.
B. Municipal procurement--capital costs increased by 20% to reflect public bidding requirements and prevailing wages.
C. Municipal oversight of operation--O&M costs increased by $150 per year to account for possible town staff overseeing the contract operations of these systems.
D. Reuse of existing on-site system components--one half of properties would incur reduced capital cost by reusing septic tank and leaching field. New construction would be limited to denitrifying system for one half of properties.
E. Reduced effluent sampling--BOD and TSS tests eliminated from suite of effluent testing.
F. Improved effluent quality--effluent nitrogen concentration reduced by 3 mg/l (to 16 mg/l for "current practice", and to 10 mg/l for "enhanced current practice" and "TMDL compliance").
G. Further improved effluent quality--effluent nitrogen concentration reduced to 5 mg/l for all scenarios.

Cluster Systems

Base Case--see Table 1

A. Seasonal nature of service area--annual average flow (and therefore annual nitrogen load reduction) decreased by 10% to approximate a neighborhood with one-third seasonal homes.
B. Reduced land costs--land for treatment and disposal assumed to be available at no cost to project.
C. More densely-developed service area--construction costs for collection reduced by 20% to reflect serving a neighborhood with smaller lots.
D. Reduced treatment costs--construction costs for treatment system reduced by 20% to anticipate possible future technology breakthroughs.
E. Reduced operator oversight--use of remote sensing of treatment system performance to reduce operator time by 20%.
F. Discharge outside sensitive watersheds--effluent disposal site located in watershed with adequate assimilative capacity.
G. Improved effluent quality--effluent nitrogen concentration reduced by 2 mg/l (to 13 mg/l for "current practice", and to 6 mg/l for "TMDL compliance").
H. Further improved effluent quality-- effluent nitrogen concentration reduced to 5 mg/l for all scenarios.

Satellite Systems

Base Case--see Table 1

A. Increasing the transport distances--both the distance from the collection area to the treatment plant site and the distance between the treatment and disposal sites are increased by a factor of 3.0.
B. Discharging within a water supply zone II--construction costs for treatment are increased by 35% to address the requirements of the groundwater discharge permitting program, and O&M costs are increased by 40%. The effluent nitrogen concentration is reduced to 5 mg/l.
C. Reduced land costs--land for treatment and disposal assumed to be available at no cost to project.
D. Discharge outside sensitive watersheds--effluent disposal site is located in watershed with adequate assimilative capacity.
E. Improved effluent quality--effluent nitrogen concentration reduced by 2 mg/l.
F. Further improved effluent quality-- effluent nitrogen concentration reduced to 5 mg/l for all scenarios.
G. Reduced treatment costs--construction costs for treatment system reduced by 20% to anticipate possible future technology breakthroughs.

Centralized Systems

Base Case--see Table 1

A. Increasing the transport distances--both the distance from the collection area to the treatment plant site and the distance between the treatment and disposal sites are increased by a factor of 3.0.
B. Discharging within a water supply zone II--construction costs for treatment are increased by 35% to address the requirements of the groundwater discharge permitting program, and O&M costs are increased by 40%. The effluent nitrogen concentration is reduced to 5 mg/l.
C. Reduced land costs--land for treatment and disposal assumed to be available at no cost to project.
D. Discharge outside sensitive watersheds--effluent disposal site is located in watershed with adequate assimilative capacity.
E. Improved effluent quality--effluent nitrogen concentration reduced to 3 mg/l for all scenarios.
F. Regionalization--construction and O&M costs for treatment system reduced by 10% to account for economies of scale in a regional system.

APPENDIX D
Sources of Data and Summary of Adjustments and Assumptions for Example Projects

APPENDIX D

SOURCES OF DATA
AND
SUMMARY OF ADJUSTMENTS AND ASSUMPTIONS
FOR
EXAMPLE PROJECTS

BRACKETT LANDING, EASTHAM

Sources

McShane Construction and SeptiTech

Adjustments and Assumptions--"Current Practice" Scenario

Capital cost. McShane Construction quoted a cost of $530,000 for the wastewater facilities that were completed in early 2006. To this figure was added 10% for engineering, legal and permitting, and $300,000 for land (estimated 1.2 acres at $250,000 per acre). This project was not subject to public procurement requirements.

Operation and Maintenance Costs. McShane quoted $12,000 for the operator and for testing. Added to this figure were: $2,600 for electricity, $5,400 for sludge disposal, $3,500 for administrative costs including engineering and insurance, and $2,000 for equipment repair and replacement.

Flow. Current annual average flows are approximately 1,600 gpd, reflecting less than full development of the project. This analysis is based on an estimated flow at project completion of 3,300 gpd, approximately 40% of the design flow, consistent with other example projects.

Nitrogen Load. Load is based on 3.5 mg/l average effluent quality (as reported by Barnstable County) and in-watershed disposal.

Adjustments and Assumptions--"For TMDL Compliance" Scenario

Operation and Maintenance Costs. Based on DEP input on the level of oversight and testing associated with this scenario (see text), upward adjustments were made to the "current practice" costs to a revised total of $64,500. Labor costs were increased to $41,600 to reflect 10-hour-per-week oversight at $80 per hour. Testing costs were increased to $6,900 for monthly testing of influent and effluent and quarterly testing of monitoring wells. An allowance of $1,000 was added for chemicals (alkalinity). Also added were $1,000 for additional engineering, and $500 for additional equipment repair and replacement.

CAMP JEWELL, COLEBROOK CONNECTICUT

Sources

Greater Hartford YMCA and Wright-Pierce

Adjustments and Assumptions

Capital cost. Costs are based on amounts paid to the construction contractor for Phase 1 and on the engineer's estimates for a proposed upgrading. To these figures was added

25% for engineering, legal and permitting expenses. No land costs or collection costs are included. This project was not subject to municipal procurement requirements.

Operation and Maintenance Costs. The YMCA's quoted costs were increased by $3,000 for power and $500 for engineering. Recent repair costs were assumed to represent once-in-three-year expenditures.

Nitrogen Load. Load is based on the expected 10 mg/l average effluent quality (after upgrading) and in-watershed disposal.

NEW SILVER BEACH, FALMOUTH

Sources

Falmouth Department of Public Works

Adjustments and Assumptions

Capital cost. Costs are based on amounts paid to contractors for construction of collection, treatment and disposal facilities. To these figure was added 25% for engineering, legal and permitting expenses. No land costs are included.

Flow. Connections are still being made to this system. This analysis is based on the expected flow of 25,000 gpd, approximately 40% of the design flow, consistent with other example projects.

Nitrogen Load. Since the plant is in the start-up phase, the load is based on an expected 10 mg/l average effluent quality and in-watershed disposal.

MASHPEE COMMONS, MASHPEE

Sources

Cornish LP

Adjustments and Assumptions

Capital cost. Costs include construction, engineering, permitting and legal expenses, and land. No collection costs are included. Municipal procurement requirements did not apply.

Nitrogen Load. Load is based on 5 mg/l average effluent quality and in-watershed disposal.

WEST ISLAND, FAIRHAVEN

Sources

Fairhaven Department of Public Works

Adjustments and Assumptions

Capital cost. Costs are based on amounts paid to contractors for the original construction plus 25% for engineering, legal, permitting and land acquisition expenses.

Operation and Maintenance Costs. The DPW's quoted costs were increased by $30,000 for labor, $15,000 for sludge handling and $4,000 for administrative and engineering cost.

Nitrogen Load. Load is based on 7 mg/l average effluent quality and in-watershed disposal.

TISBURY MUNICIPAL FACILITIES

Sources

Tisbury Department of Public Works

Adjustments and Assumptions

Capital cost. Costs are based on actual amounts paid to contractors and engineers for the original construction. No land costs are included; treatment and disposal sites were Town-owned.

Nitrogen Load. Load is based on 5 mg/l average effluent quality and in-watershed disposal.

PROVINCETOWN MUNICIPAL FACILITIES

Sources

Provincetown Department of Public Works

Adjustments and Assumptions

Capital cost. Costs are based on amounts paid to contractors for the Phases 1 and 2 of construction plus 20% for engineering, legal, permitting, land acquisition and DBO procurement expenses.

Nitrogen Load. Load is based on out-of-watershed disposal.

PROPOSED ORLEANS MUNICIPAL FACILITIES

Sources

Orleans Comprehensive Wastewater Management Plan, April 2009

Adjustments and Assumptions

Capital cost. Costs are based on CWMP estimates and include construction, land, engineering, legal and contingencies. Costs for proposed supplemental cluster systems are not included. The proposed treatment and disposal sites are town-owned.

Operation and Maintenance Costs. Costs are based on CWMP estimates for all standard expenses, and exclude costs for treatment of out-of-town septage.

Nitrogen Load. Load is based on out-of-watershed disposal.

Regionalization. Cost advantages of regionalization are based on 2009 Wastewater Regionalization Study, assuming participation by Orleans, Eastham and Brewster.

CHATHAM MUNICIPAL FACILITIES

Sources

Chatham Department of Health and Environment and Stearns & Wheler

Adjustments and Assumptions

Capital cost. Costs are based on CWMP estimates for Phase 1 facilities updated for construction bids received in early 2010. Costs for proposed Phase 2 facilities are not included. Treatment and disposal site is town-owned.

Operation and Maintenance Costs. Costs are based on CWMP estimates for all standard expenses and exclude Phase 2 O&M costs.

Nitrogen Load. Load is based on out-of-watershed disposal.

Appendix H

Wright-Pierce
Engineering a Better Environment

Report

Town of

North Reading, MA

Comprehensive Wastewater Management Plan

Phase 1

Preliminary Hydrogeological Assessment

September 2000

3.0 DATA REVIEW, FIELD ACTIVITIES, AND ANALYSIS

3.1 Environmentally Sensitive Areas

Based on the MassGIS information, there are no public water supply sources (wells or surface water) within a mile radius of the proposed leachfield at the DPW site. The Berry site is located in the Zone II of two public supply wells. Based on MassGIS data mapping of wetlands and sensitive receptors (Figure 4), there are no sensitive receptors identified within a half-mile radius of either site.

3.2 Regional Geology

The United States Geological Survey (USGS) Water-Supply Paper Number 1826, reported that bedrock formations in the Ipswich River Basin consist of igneous and metamorphic rocks (diorite, granite, gabbro, gneiss, and quartzite) ranging in age from Precambrian to Triassic. The rocks have been folded, fractured, and faulted, and they show evidence of a northeast – southwest structural trend. Bedrock is exposed principally on hills and ridges, but also outcrops from place to place in the valleys and along the coastal marshes. Over most of the area, the irregular, knobby bedrock surface is overlain by unconsolidated deposits.

The USGS Water-Supply Paper states that unconsolidated deposits in the lower Ipswich River Basin are composed largely of debris remaining from the passage of the area of one or more ice sheets during the Pleistocene Epoch. The glacial drift includes deposits of till and stratified drift. There are also minor amounts of wind-laid deposits of Pleistocene age, and swamp deposits and alluvium of recent age.

Till overlies the bedrock surface throughout New England. Till is exposed in approximately half the area of the Ipswich River Basin, and is buried by younger unconsolidated deposits in the valleys and along the flanks of many hills. The till is composed of soil and rock that was transported and spread over the land surface by ice of the Wisconsin glacial advance. Till is characterized by a wide range of particle size and little or no sorting. It is, for the most part,

extremely dense. The matrix of most till in the basin is fine grained and compact; it commonly contains more than 50 percent silt and clay.

The local overburden consists of sand and gravel at the Berry site, and fine grained deposits at the DPW site. Regionally there is also floodplain alluvium adjacent to the Ipswich River. The regional geology of the DPW and Berry sites is shown in Figure 2; local geology is shown in Figure 3 for both sites.

3.3 Hydrogeology

According to USGS Water-Supply Paper Number 1694, the principal groundwater reservoirs in the North Reading area are the stratified drift deposits that fill many of the valleys of the pre-glacial Ipswich River and its tributaries. The saturated thickness of the stratified drift is estimated conservatively to average at least 30 feet but is substantially greater along the bottoms of the buried valleys. The maximum known thickness of stratified drift, obtained from well data, is 102 feet.

Generally, groundwater in the stratified drift occurs under unconfined water table conditions. Locally, however, where the more permeable materials, such as sand and gravel, are interbedded with or overlain by less permeable materials, such as silt or clay, the water in the more permeable materials may be confined or semi-confined.

Depths to water are shallow in the North Reading region. In wetlands, the water table is at or near the land surface throughout the year. In many of the areas mapped as outwash, depth to water is less than ten feet, and in many places, less than five feet. In many of the areas mapped as ice contact deposits, the depth to water usually is less than 20 feet. Levels of water in streams or wetlands provide an approximation of the groundwater levels to be expected in adjacent ice contact deposits or outwash.

Under natural conditions the range of seasonal fluctuations of the water table in the stratified drift is small, usually less than five feet.

The area underlain by the aquifer is traversed by the Ipswich River and its tributaries, and about half the area of the aquifer is overlain by a cover of semi-permeable swamp deposits.

Groundwater in the North Reading area is derived from precipitation within the area, principally by the direct infiltration of rain or snowmelt, and partly by the infiltration of surface water. Groundwater is discharged naturally through springs and by evaporation, transpiration, and discharge to streams and rivers.

Groundwater levels can exhibit marked seasonal fluctuations, though in New England, precipitation remains fairly constant throughout the year. In September and October the water table usually is at its lowest position during the year. By November, precipitation begins to replenish the groundwater. Throughout the winter months the water table may remain high, with recharge and discharge roughly in balance. During cold winters, however, most precipitation is stored as snow and the water table may decline.

In general, the water table is at its highest position in late winter or early spring. Beginning in the spring and throughout the summer, water use by plants is at a peak, which captures normal recharge and in turn causes the water table to decline. In the fall, the water table begins to rise and this cycle repeats.

3.3.1 Hydrogeology of the DPW Site

The DPW site is ringed on three sides by Bear Meadow Brook and by the Ipswich River (Figure 1). Assuming groundwater drainage patterns follow approximately the land surface topography, groundwater flow is approximately radial towards these two surface water bodies. There are also extensive wetlands bordering located 500 to 1,000 feet to the north and southwest of the proposed site.

3.3.2 Hydrogeology of the Berry Site

According to Figure 1, surface water flow in the Berry site drainage basin is to the north. Assuming that groundwater drainage patterns are approximately coincident with land surface topography, groundwater in this sub-basin will also flow to the north towards a large wetland located approximately 500 feet northeast of the site.

3.4 Field Methods

Between June 4, 1999, and January 4, 2000, Weston & Sampson conducted a subsurface investigation. The primary purpose of the field investigation was to characterize the geology soils and measure groundwater elevations at the site.

Weston & Sampson chose sites for five monitoring wells at the Berry site, six monitoring wells at the DPW site, and ten test pits at each site. The DPW site map (Figure 5) and the Berry site map (Figure 6), show the locations of test pits, monitoring wells, percolation tests, and double ring infiltrometer tests.

3.4.1 Test Pits

Test pits were excavated by the town on November 15, 1999 at the DPW site and November 18,1999 at the Berry site. Weston & Sampson personnel, including a certified soil evaluator (CSE), were on site to examine and document the soils. The soil evaluation forms are included in Appendix B. Test pits were excavated to a minimum depth of 10 feet to evaluate the soil horizons and the shallow surficial geology of the site.

In five of the test pits at each site (TP-2, TP-4, TP-6, TP-7, and TP-10 at the DPW site, and TP-2, TP-5, TP-6, TP-7, and TP-10 at the Berry site), Weston & Sampson installed a 1.5-inch piezometer to record groundwater elevations. The piezometers consisted of five feet of 0.010-slot polyvinyl chloride (PVC) screen attached to a PVC riser pipe. None of the piezometers encountered groundwater.

3.4.2 Percolation Testing

On November 16, 1999 at the DPW site and November 19,1999 at the Berry site, a Weston & Sampson certified soil evaluator (CSE) conducted three percolation tests at each site (near TP-1, TP-8, and TP-10 at the DPW site, and near TP-2, MW-B4, and TP-8 at the Berry site). A representative from the Town of North Reading Board of Health, and a representative from the DEP–NERO was present for the test pits and percolation tests. These tests were conducted in accordance with the procedures outlined in 310 CMR 15.104 and 15.105 with the locations chosen as representative of the range of field conditions encountered in the test pits. Data sheets from each percolation test are included in Appendix B.

3.4.3 Soil Sampling and Sieve Analysis

Soil samples were collected from approximately nine feet below ground surface. Samples from TP-4, TP–5 and TP-8 (DPW site) and TP-2, TP-7, and TP–10 (Berry site) were sent to a laboratory for a sieve analysis. The samples selected were representative of the shallow soils from each site. These soil samples were chosen because they appeared to have the lowest, average, and highest percentage of sand and gravel, based on field observation.

Sieve analyses were performed by Haley and Aldrich of Charlestown, Massachusetts in accordance with ASTM D421 and D422. The grain size distributions are shown in Appendix C.

3.4.4 Double-Ring Infiltrometer Testing

Double ring infiltrometer tests were completed at both the DPW (near TP-1, TP-8, and TP-10) and the Berry Sites (near TP-2, MW-B4, and TP-8) at approximately the same locations that the percolation tests were completed. This method is an alternative method to percolation testing that measures the vertical infiltration of water through natural soils. Double ring tests can be conducted at the ground surface or at depth in pits. In this case the tests were completed at the same elevation as the percolation tests were completed, in the c-horizon soils.

Double-ring infiltrometer tests were completed in accordance with ASTM D3385-94. The data collected during each test are included in Appendix B.

3.4.5 Drilling Activities

Drilling was performed by American Drilling Services (ADS) of Westminster, Massachusetts. All drilling was performed in accordance with the DEP-approved scope of work and were overseen by a Weston & Sampson hydrogeologist. The six boring/well locations (MW-1 through MW-6) from the DPW site are shown on Figure 5, and the five boring/well locations (MW-B1 through MW-B5) from the Berry site are shown on Figure 6. Weston & Sampson and ADS recorded independent drill logs, and these logs were compared on completion of the drilling.

3.4.5.1 Soil Borings

Between December 13 and December 17, 1999, soil borings were advanced using hollow stem augers. At the DPW site, boring MW-1 was advanced to 52 feet below ground surface, MW-6 was advanced to approximately 42 feet below ground surface, and MW-2 through MW-5 were all advanced to approximately 32 feet below ground surface. At the Berry site, MW-B1 and MW-B2 were advanced to approximately 52 feet below ground surface, MW-B3 and MW-B4 were advanced to approximately 32 feet below ground surface, and MW-B5 was advanced to approximately 42 feet below ground surface.

Soil samples were taken from all borings at five-foot intervals using a two-foot stainless steel split-spoon sampler per ASTM Method 1586-67. Boring logs are shown in Appendix D.

Figures 7 and 8 show geologic cross sections which were generated from these boring logs and soil samples for the DPW site, and Figure 9 is a geologic cross section for the Berry site.

3.4.5.2 Monitoring Wells

Groundwater observation wells were installed in all of the borings described above (Appendix D). The wells were constructed of 2.0-inch interior diamter schedule 40 PVC screen and riser pipe. The annular space around the well screen was backfilled with filter sand to approximately one or two feet above the top of the screen. Approximately 1.5 feet of bentonite chips were used as a seal above the sand. Native material was used to fill the remaining annular space above the seal to approximately one-foot below grade followed by a one-foot cement surface seal. All wells were finished with a protective casing and lock. Monitoring well construction diagrams are shown in Appendix D.

3.4.5.3 Survey

On December 22, 1999, Weston & Sampson personnel conducted an elevation survey of all the piezometers, wells, and test pit locations. Elevations were surveyed with respect survey stakes preset at DPW for the Reading Municipal Light Department substation and ductbank construction and to a granite Nation Geodetic Vertical Datum (NGVD) bound at the Berry site. The elevation of the survey stake at the DPW site is assumed to be 82.63 feet. Results of this survey are shown in Appendix E.

3.4.5.4 Water Level Measurements

On January 4, 2000, water level measurements were made at all piezometers and monitoring wells. The water levels and elevations are shown in Table 1. Figure 10 is a groundwater contour map for the DPW site, and Figure 11 shows groundwater contours at the Berry site.

3.5 Hydraulic Conductivity Estimates

Weston & Sampson estimated hydraulic conductivity based on sieve analysis, double-ring infiltrometry, and slug testing. For hydraulic conductivity analysis based on sieve analysis, Weston & Sampson used the Fair-Hatch Equation (Todd, 1959) to estimate hydraulic conductivity and intrinsic permeability (see Appendix C):

Where:

$$\kappa = \left[m \left[\frac{(1-\alpha)^2}{\alpha^3} \left(\frac{\theta}{100} \Sigma \frac{P}{dm} \right)^2 \right] \right]^{-1}$$

κ	is the intrinsic permeability, mm^2
m	is the packing factor (=5), dimensionless
θ	is the sand shape factor ranging from 6.0 to 7.7 as angularity increases, dimensionless
α	porosity, dimensionless
P	is the percentage of sand held between adjacent sieves
dm	is the geometric mean of rated sizes of adjacent sieves, mm

Hydraulic conductivity was calculated based on the following equation:

$$K = k * \rho * g * \mu^{-1}$$

Where:

K	is the hydraulic conductivity, cm/s
k	is the intrinsic permeability, cm^2
ρ	is the density of water, g/cm^3
g	acceleration due to gravity, cm/s^2
μ	dynamic viscosity of water, g/(s*cm)

In accordance with the DEP approved work plan, Weston & Sampson performed numerous percolation tests and estimated vertical and/or horizontal hydraulic conductivity from these tests. However, the results of these tests are not believed to be an accurate measure of hydraulic conductivity, as the values for hydraulic conductivity were anomalously high or low relative to estimates from more reliable sieve analysis and double ring infiltrometry tests (see Table 2). Results of percolation tests were therefore not factored into the mounding model described below.

3.6 Seasonal High Water Table Calculations

Weston & Sampson used the Frimpter Method to estimate seasonal high groundwater. This method is detailed in the 1981 USGS Water-Resources Investigations Open-File Report 80-1205 entitled "Probable High Ground-Water Levels in Massachusetts." The Frimpter Method estimates the seasonal high water level of a site by solving the proportion in which the ratio of the potential water level rise at a test site to the potential water level rise at an observation well is equal to the ratio of the water level range at the site to the historic water level range at an observation well in a similar hydrogeological environment.

The equation used to calculate probable seasonal high water table level is as follows (all units are in feet):

$$S_h = S_c - \frac{S_r}{OW_r}(OW_c - OW_{max})$$

Where:

- S_h is the estimated depth to probable high water level at the site
- S_c is the measured depth to water at the site
- S_r is the range of water level where the site is located. Values of range with varying exceedance probabilities may be selected for this parameter.
- OW_r is the recorded upper limit of annual range of water level at the observation well which is used to correlate with water levels at the site.
- OW_c is the measured depth to water in the observation well which is used to correlate with the water levels at the site.
- OW_{max} is the depth to recorded maximum water level at the observation well which is used to correlate with the water levels at the site.

Weston & Sampson calculated the 80 percent probable seasonal groundwater high by using a value of 3.7 for S_r, which was obtained from Figure 12 in the Frimpter methodology. The percent probability is the percentage of similar sites at which the water-level range is equaled or exceeded. The 80 percent probable seasonal groundwater high thus gives a probability of 80 percent that the calculated water level will not be exceeded. For OW_r and OW_{max}, Weston & Sampson used data from Wakefield, MA, which has recorded water levels from 1965 to the present. The results of these calculations for both sites are included in Appendix F. Based on these calculations the estimated seasonal high groundwater at each site is 2.2 feet above the water levels measured on January 4, 2000.

3.7 Mounding Calculations

A conceptual model of the subsurface conditions was developed to calculate groundwater mounding beneath the site of each proposed leachfield. The basic assumptions required for the conceptual and analytical (as described below) model were as follows:

- Due to the constraints of the mounding model, Weston & Sampson assumed the lower layer was essentially impermeable. Weston & Sampson therefore disregarded the lower layer. The hydrogeology of the analyzed layer is assumed uniform.
- The geology outside the study area is not known for certain, however for modeling purposes, it has been assumed that the geology outside the study area is the same as observed in the study area.
- No significant subsurface barriers occur near the study area.
- Discharge boundaries, i.e., edge of surface water, are included in the model.

The groundwater mounding estimate was completed using "Hydraulic Mounding of Groundwater Under Axisymmetric Recharge" by D. Allen of the Water Resource Research Center, University of New Hampshire Research Report No. 24. Mounding calculations were conducted using the following equations:

$$H_a^2 = D^2 + \frac{Q\,(\ln(L/R)+0.5)}{K*\pi}$$

$$H_b^2 = D^2 + \frac{Q\,(\ln(L/r))}{K*\pi}$$

Where

H_a	is the mound height above static at bed center (feet)
H_b	is the mound height at a distance of interest (feet)
D	is the saturated thickness (feet)
Q	is the flow to bed ($feet^3$ per day)
K	is the hydraulic conductivity (feet per day)
L	is the distance to a discharge boundary from bed center (feet)
R	is the bed radius (feet)
r	is the distance of interest (feet)

3.7.1 DPW Site Mounding Calculations

To estimate the maximum disposal capacity of each site, Weston & Sampson simulated circular recharge areas to represent wastewater infiltration beds (Figure12). The mounding was assumed to occur on top of the seasonal high groundwater elevation. The mounded depth was added to the estimated seasonal high groundwater elevation to compute a conservative estimate of maximum mounding. The rate at which each circular recharge area receives water was increased while maintaining a minimum of four feet of unsaturated zone between the existing ground surface and the mounded water levels. Figure 12 illustrates the locations of circular recharge areas at the DPW site, and cross-sections are shown in Figures 13 and 14. Based on field investigations and discharge requirements, the following values were used for the variables:

	D	K	L	R	Q
Circular Recharge Area No.	Saturated Thickness (feet)	Hydraulic Conductivity (feet per day)	Distance to Surface Water Body (feet)	Radius of Injection Basin (feet)	Flow (gallons per day)
1	1	70	225	200	35,000
2	1	70	500	300	23,000
3	1	70	285	200	67,000
				Total:	125,000

Once completed, Weston & Sampson created cross-sections that graphically described the mounded water table levels. Based on the topography of the site, it was reasonable to assume that the edge of each circular recharge area was close to a discharge boundary, the wetlands. Therefore, it is assumed that there is little interference between the three recharge areas.

3.7.2 Berry Site Mounding Calculations

Weston & Sampson also simulated the circular recharge areas at the Berry site to maximize the capacity while allowing at least 4 feet of unsaturated zone relative to the 80 percent probable seasonal high water table (Appendix F).

At the Berry site, Weston & Sampson also considered the sloping land surface of areas to the north and south of the proposed leachfield location, especially along Route 62, which is located approximately 300 feet from the proposed recharge areas.

Figure 15 shows the location of circular recharge areas at the Berry site. Based on field investigations and discharge requirements, the following values were used for the variables:

	D	K	L	R	Q
Circular Recharge Area No.	Saturated Thickness (feet)	Hydraulic Conductivity (feet per day)	Distance to Surface Water Body (feet)	Radius of Injection Basin (feet)	Flow (gallons per day)
1	1	40	600	150	100,000
2	1	40	600	150	100,000
				Total:	200,000

As was the case with the DPW model, Weston & Sampson used a trial-and-error method of calculating the maximum capacity of each circular recharge area at the Berry site. Weston & Sampson then superimposed the interference of both recharge areas in the sections where overlap occurred. If the minimum 4 feet of unsaturated zone relative to the 80 percent probable seasonal groundwater high was exceeded, Weston & Sampson reduced the discharge to each basin so as to estimate maximum capacity without exceeding the limits of the unsaturated zone.

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4.0 RESULTS OF THE INVESTIGATION

4.1 DPW Site

4.1.1 Local Geology

There are two distinct layers at the DPW site. From the land surface to a depth of approximately ten feet, there is a uniform layer of medium sand with traces of gravel and cobbles. From ten feet to fifty feet, there is a uniform layer of fine sand with a trace to some inorganic silt.

Using the soils information collected at the soil borings and the test pits, Weston & Sampson constructed two cross-sections for the DPW site (Figures 7 and 8). Figure 5 shows the locations of the cross-sections.

4.1.2 Hydrogeology

Figure 10 shows the groundwater levels and contours as measured on January 4, 2000. Groundwater level and elevation measurements are tabulated in Table 1. Groundwater discharges along three sides of this property at Bear Meadow Brook and the Ipswich River.

Based on the sieve analyses, and double ring infiltrometer tests, hydraulic conductivity in the upper layer at the DPW site was calculated to range from 19 to 254 feet per day (Table 2). The estimated average hydraulic conductivity of the upper sand and gravel layer was 70 feet per day.

4.1.3 Probable Seasonal High Groundwater

The 80 percent probable seasonal high groundwater table levels calculations for the DPW site are shown in Appendix F. At the DPW site, the 80 percent probable seasonal high water table is 8.41 feet below land surface.

4.1.4 Mounding Calculations Results and Discussion

Preliminary calculations show the DPW site is capable of accommodating 125,000 – 175,000 gpd of wastewater. Weston & Sampson calculated the capacity of this site to accommodate effluent discharge based on field measurements, discharge requirements, and the equations cited in Section 3.5. The groundwater mounding of wastewater discharge was held to 4 or more feet below the ground surface at the DPW site.

Mounding computations for each circular recharge area are shown in Appendix G. Figures 13 and 14 show cross-sectional diagrams of mounding at the DPW site, and Figure 12 shows the location of these cross-sections.

4.2 Berry Site

4.2.1 Local Geology

At the Berry site, the same two-layered geology as the DPW site exists, though there is a more gradual change from medium sand to fine sand with a trace to some silt. From the land surface to approximately ten feet depth, there is a layer of medium sand with a trace of gravel and cobble. The medium sand grades into fine sand with a trace of inorganic silt. In a few locations, small silt lenses were observed.

Using the soils information collected at the soil borings and the test pits, a cross-section was developed for the Berry site (Figure 9), and Figure 6 shows the location of this cross-section.

4.2.2 Hydrogeology

Figure 11 shows the groundwater levels and contours as measured on January 4, 2000. Groundwater level and elevation measurements are tabulated in Tables 1 and 2. At the Berry site, the general direction of groundwater flow is to the north. The land surface slopes off to the south at this site, so there is likely a slight groundwater mound or divide in the center of the property. Based on the sieve analyses, and double ring infiltrometer tests, hydraulic conductivity in the upper layer at the Berry site was estimated at range between 6 and 85 feet per day. A value of 40 feet per day was chosen as representative of the upper layer of sand and gravel; this value was used for computations.

4.2.3 Probable Seasonal High Groundwater

The 80 percent probable seasonal high groundwater level calculations for the Berry site are shown in Appendix F. At the Berry site, seasonal high water table is estimated to be 24.48 feet below land surface for the 80 percent probability level. Soil coloration noted above 24 feet in the test pits at this site is not judged to represent seasonal high groundwater.

4.2.4 Mounding Calculations Results and Discussion

Preliminary calculations show the Berry site is capable of accommodating 150,000 – 250,000 gpd of wastewater. Weston & Sampson calculated the capacity of this site to accommodate effluent discharge based on field measurements, discharge requirements, and equations cited in Section 3.5.

Mounding computations for each circular recharge area are shown in Appendix G. Locations of circular recharge areas and cross-section locations are shown in Figure 15. Figure 16 shows mounding in cross-section at the Berry site.

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5.0 SUMMARY AND RECOMMENDATIONS

5.1 Summary

The mounding analysis at the DPW site assumed a set of three circular recharge areas with a combined maximum daily input of 125,000 - 175,000 gallons per day (see Figures 12, 13 and 14). The combined rate was divided over the three recharge areas such that the depth to water at the center of each circular recharge area (where mounding is greatest) is at a minimum 4.0 feet below ground surface.

Mounding analysis at the Berry site assumed a conservative set of two circular recharge areas with a combined maximum daily input of between 150,000 and 250,000 gallons per day (Figure 15 and 16). The maximum mounding estimated is 13.2 feet at the center of each bed. Current seasonal high groundwater at the center of the proposed leachfield is approximately 24.5 feet. With 13.2 feet of mounding at each circular recharge area, depth to water at the center of each circular recharge area would be at least 12.3 feet below ground surface.

Weston & Sampson did not factor a significant reserve area into the two site wastewater disposal estimates. The assumption that the lower layer is essentially impermeable is excessively conservative. Future attempts to refine the mounding calculations may enable a reduction in the diameter of the circular recharge areas and inclusion of a reserve area.

5.2 Recommendations

Based on the findings of this report, Weston & Sampson recommends the following:

<u>5.2.1 DPW Site</u>

- Further investigations are needed to refine the preliminary estimates of 125,000 - 175,000 gallons per day capacity.
- The extent of mounding that will occur should be further investigated.
- Additional monitoring wells should be installed on the site, and these wells should be developed to obtain more accurate groundwater and hydrogeological characteristics.

- Additional slug testing should be performed in the lower layer at this site. This will better characterize values of hydraulic conductivity for the lower layer.
- A more precise digital model should be developed to further refine the geology, matrix properties, geologic layering, and additional capacities of the site. Weston & Sampson recommends using the software package MODFLOW to three-dimensionally simulate the groundwater mounds of the circular recharge areas. MODFLOW will allow for the input of the heterogeneity of the two layers at this site, which will greatly refine the approximate capacity reported.
- Further investigations and modeling are needed to evaluate the reserve area for this site. This task will be accomplished with the digital model described above.
- The DPW site is located adjacent to a property owned by the Reading Municipal Light Department. A substation and ductbank is being constructed on their property. An Earth Tech Report dated March 1999 concluded that groundwater control and foundation subgrade preparation, protection, and monitoring are an important consideration during design and construction. If the DPW site is selected for development of a leachfield, meetings should be scheduled with Reading Municipal Light Department to discuss possible ramifications of subsurface wastewater disposal on the substation and ductbank project.

5.2.2 Berry Site

- Further investigations are needed to refine the preliminary estimates of 150,000 - 250,000 gallons per day capacity.
- The extent of mounding that will occur should be further investigated.
- Additional monitoring wells should be installed on the site, and these wells should be developed to obtain more accurate groundwater and hydrogeological characteristics.
- Additional slug testing should be performed in the lower layer at this site. This will allow for better characterization of the hydraulic conductivity of the lower layer.
- A more precise digital model should be developed to further refine the geology, matrix properties, geologic layering, and additional capacities of the site. Weston & Sampson recommends using the software package MODFLOW to three-dimensionally simulate the

groundwater mounds of the circular recharge areas. MODFLOW will allow for the input of the heterogeneity of the two layers at this site, which will greatly refine the approximate capacity reported herein.

- Further investigations and modeling are needed to evaluate the reserve area for this site. This task will be accomplished with the digital model described above.
- The Berry site is located in a Zone II, which may have restrictions on injecting wastewater. If the Berry site is selected for development of a leachfield, further discussions with DEP-NERO should be sought, to evaluate whether wastewater discharge on this site can be permitted.
- Since the Berry site is located in a Zone II, if the site is still under consideration, nitrogen mass balance calculations should be prepared to insure drinking water regulations would be met.
- Additional investigations may be required to develop this site, since it is located in a Zone II.
- Travel-time calculations should also be completed to assure a minimum 2-year travel time from the circular recharge area to the drinking water well would be attained.
- A study of the fate of the treated wastewater should be undertaken to determine whether the water would end up in the wetlands to the north of the site.
- The Berry site should undergo more rigorous investigation as to the mounding from the proposed leachfield in order to be certain that Route 62 will not be negatively impacted by a groundwater mound.

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6.0 REFERENCES

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Appendix I

Wright-Pierce
Engineering a Better Environment

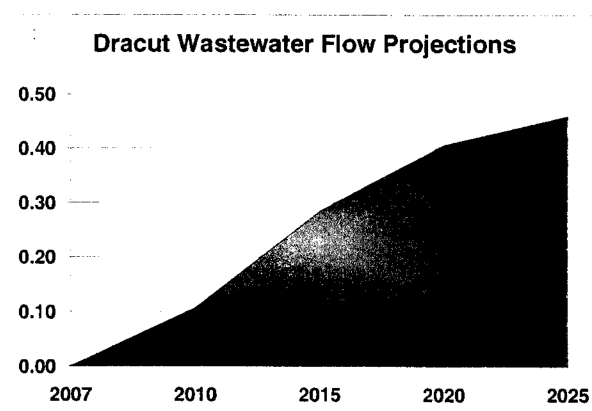
City of Methuen / Town of Dracut
Inter-Municipal Agreement for the Conveyance of Wastewater
Basis of Agreement

A proposed inter-municipal agreement (IMA) between the City of Methuen (Methuen) and the Town of Dracut (Dracut) will provide significant benefit to both communities, as wastewater flow from defined areas of eastern Dracut will be conveyed to Methuen and, in turn, to the Greater Lawrence Sanitary District (District) for treatment and disposal. In exchange for this use of Methuen infrastructure, Dracut will pay for the construction of significant wastewater infrastructure (estimated value of approximately $7.6 million, including project financing costs) within Methuen and, upon completion of construction, transfer ownership of this infrastructure to Methuen for its permanent use and benefit. Additionally, Dracut will share the cost of any future upgrades or equipment refurbishments required at the Bolduc Street and Burnham Road sewerage pumping stations and pay $1.2 million towards the identification and removal of inflow and infiltration from existing sewers in areas tributary to these pump stations.

The purpose of this document is to summarize the major elements of this proposed IMA, including the benefits to Methuen resulting from execution of this IMA. It is also noted that a separate IMA has been negotiated between Dracut and the District, and that this IMA is expected to receive final approval and be executed at a District Board of Commissioners meeting on January 30, 2008.

Part One – Conveyance Infrastructure

Methuen owns sewer infrastructure consisting of the Bolduc Street and Burnham Road sewerage pumping stations and interceptor sewers and force mains in Lowell Street, Riverside Drive and within the City of Lawrence that can benefit Dracut. Methuen will grant capacity in this sewer infrastructure to Dracut for conveyance of up to 0.5 million gallons per day (mgd) of wastewater flow on an average-day basis. It is anticipated that conveyance of Dracut flow would begin slowly and, over a 20-year period, eventually increase to between 0.4 mgd to 0.45 mgd, as shown in the figure to the right.

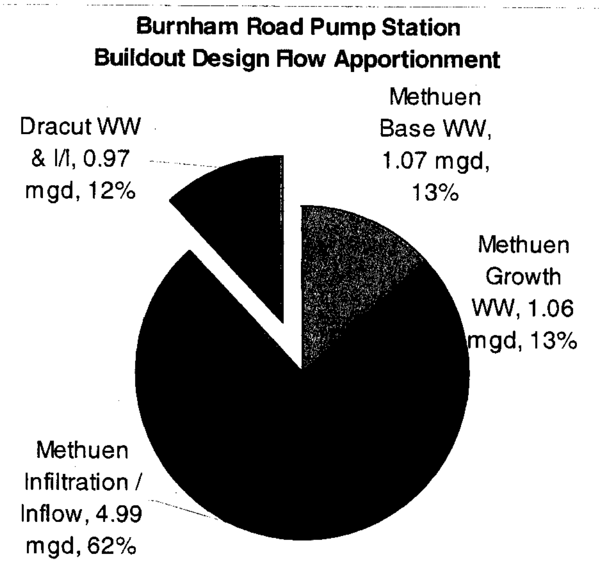


Dracut will fund the construction of a new sewer system consisting of gravity collection sewer within North Lowell Street in Methuen flowing toward Dracut, a sewage pump station in Dracut, a force main within North Lowell Street, and gravity interceptor sewer in Methuen discharging to the existing interceptor on Lowell Street. This new sewer system will be designed to accommodate projected flows from specified tributary areas in both Methuen and Dracut, and therefore will benefit both municipalities. Upon completion of construction, Dracut will grant ownership of all gravity and force mains within Methuen to Methuen. Dracut will also reserve capacity at the new pump station within Dracut for Methuen flows originating from the gravity sewer in North Lowell Street. This conveyance of new infrastructure and reservation of capacity will be considered compensation to Methuen for the granting of capacity to existing infrastructure within Methuen.

Much of the equipment, structure and appurtenances associated with both the Bolduc Street and Burnham Road pump stations will reach the end of their design lifespan within the next twenty years. Moreover, extreme flood events have resulted in excessive flows over-tasking the pumping capabilities of the stations. Therefore, it can reasonably be assumed that these stations will require upgrades within the life of this agreement. When those efforts are undertaken, Dracut will share in the project costs as a function of the ratio of Dracut's actual contributory flows to total design capacities at the time of the upgrades.

Part Two – Infiltration and Inflow Investigation and Remediation

Infiltration and Inflow (I/I), broadly defined as groundwater, rainwater or other non-sanitary water entering a sewer system, is an increasing concern for municipalities as regulators are placing pressure to eliminate the undesirable sources of additional flow to treatment works. Flood events in 2001 and 2006 caused excessive flows to reach the Burnham Road pump station in particular. As illustrated to the right, in the absence of I/I remediation efforts, similar events would require significant upgrades to simply accommodate I/I. As such, it is to the mutual benefit of Methuen and Dracut to partner and attempt to find and eliminate the current sources of I/I in Methuen.



Under the terms of the IMA, Dracut will work cooperatively with Methuen and provide $1.2 million in funding to investigate and remediate I/I problems within the areas tributary to the Bolduc Street and Burnham Road pump stations – much of this work will be completed between 2008 and 2012, during which time Dracut's wastewater flows will be minimal. The first year of the program will consist of an extensive evaluation of the sewer system and the development of a phased remediation program to cost-effectively eliminate sources of I/I. Subsequent years will involve remediation efforts, including the sealing of manholes, lining of pipes, construction of new drains and redirection of sump pumps away from the sanitary system. This removal of I/I flow from the Methuen system will, to a large degree, offset the addition of new wastewater flow from Dracut to Methuen, and will help satisfy growing regulatory demands for funding and implementation of aggressive I/I removal programs by Massachusetts municipalities.

City of Methuen / Town of Dracut
Inter-Municipal Agreement for the Conveyance of Wastewater
Basis of Agreement

Summary of IMA Benefits to Methuen

Benefits to Methuen resulting from execution of this IMA with Dracut include:

1. Dracut will construct and transfer ownership to Methuen of new wastewater conveyance infrastructure valued at approximately $7.6 million, including project financing costs. This new infrastructure will allow approximately 40 existing homes along North Lowell Street to receive sewer service and, at Methuen's discretion, allow for further expansion of sewer service in this area of the City. In addition to construction costs, Dracut will pay all design, permitting, and project financing costs, with virtually no capital-related costs incurred by Methuen.

2. It is anticipated that upgrade and/or refurbishment of the Bolduc Street and Burnham Road pump stations will be required within the next twenty years. The IMA will make Dracut a partner in these upgrades, thereby providing for a sharing of costs that otherwise would be borne solely by Methuen.

3. Dracut will pay $1.2 million towards the investigation and removal of excessive I/I within the areas tributary to the Bolduc Street and Burnham Road pump stations, thereby improving the quality and operational efficiency of Methuen's existing infrastructure and addressing an area of growing regulatory concern. Additionally, a reduction in I/I will reduce the volume of Methuen wastewater flow conveyed to the Greater Lawrence Sanitary District for treatment and disposal, thereby reducing Methuen's share of costs for operation and maintenance of District facilities.

4. Under the terms of a separate IMA between Dracut and the District, Dracut will pay a connection fee of $1.52 million to the District for the right to convey wastewater flow (via Methuen) to District facilities for treatment and disposal. As a member community, Methuen will benefit directly from this connection fee payment, in accordance with direction provided by the District Board of Commissioners.

5. The construction of new wastewater infrastructure within Methuen will, in addition to providing for conveyance of wastewater, provide secondary benefits to residents of west Methuen such as the possible replacement of deficient culverts and road surface improvements resulting from paving of the streets following pipeline construction.

Appendix J

NEW ENGLAND CIVIL ENGINEERING CORP.
120 WASHINGTON STREET, SUITE 202E, P.O. BOX 3026, SALEM, MA 01970
PH: 978.741.7401 - FAX: 978.741.7402 – WWW.ENGINEERINGCORPORATION.COM

North Reading, MA
Drainage Infrastructure Mapping Project
Interim Report Phase 1

Town of North Reading, MA

September 2013

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ATTACHMENTS

NEW ENGLAND CIVIL ENGINEERING CORP.
120 WASHINGTON STREET, SUITE 202E, P.O. BOX 3026, SALEM, MA 01970
PH: 978.741.7401 - FAX: 978.741.7402 – WWW.ENGINEERINGCORPORATION.COM

September 6, 2013

Mr. Richard Carnevale
Director of Public Works
235 North Street
North Reading, MA 01864

Re: Interim Report: North Reading Drainage Infrastructure Mapping Project Phase 1

Dear Mr. Carnevale,

Please find the enclosed three (3) copies of the Interim Report: North Reading Drainage Infrastructure Mapping Project Phase 1, September 2013 report which describes the results of our investigations and mapping of the drainage infrastructure within all Town roadways.

As described in the report, we identified the number and location of all drainage infrastructure within Town roadways and prepared tables and maps to summarize and illustrate the results of the data, including:

- Areas of interest or further investigations
- Infrastructure material inventory and condition assessment
- Capital and maintenance recommendations

The attached Tables A and B summarize the number, type, and location of capital and maintenance recommendations identified in the Interim (Phase 1) report and provide an estimate of probable project costs to address these recommendations and continue with subsequent phases of the drainage infrastructure mapping project.

If you have any questions or require additional information, please do not hesitate to contact me at any time on my cell phone at (978)767-5415 or at my Salem office at (978)741-7401. We thank you for the opportunity to work with the Town of North Reading and look forward to building on our successful and rewarding partnership moving forward.

Sincerely,

William M. Ross, P.E.
Project Manager/Principal Engineer
New England Civil Engineering Corp.

-attachments

Table A
All Structures Requiring Maintenance or Repair

Location or Street Address	GIS Object ID	Description of Maintenance
Anthony Rd (9)	191	Catchbasin requires corbel and wall repair
Abbott Rd (11)	319	Catchbasin grate needs replacement
Abbott Rd (14)	318	Catchbasin requires wall repair
Abbott Rd (Rear of 12 Lowell Rd)	323	Catchbasin grate needs replacement
Adrian Drive (6)	544	Unable to open manhole cover.
Agatha Way	2026	Catchbasin requires cleaning
Angel Rd	779	Catchbasin requires cleaning
Angel Rd	780	Catchbasin requires cleaning
Angel Rd	781	Catchbasin requires cleaning
Anthony Rd (23)	183	Catchbasin requires corbel repair
Anthony Rd (30)	172	Catchbasin requires corbel and wall repair
Anthony Rd (39)	1698	Catchbasin requires corbel and wall repair
Anthony Rd (4)	194	Catchbasin requires corbel repair
Anthony St (10)	192	Catchbasin requires corbel repair
Anthony St (11)	193	Catchbasin requires corbel repair
Ashwood Dr (15)	1129	Unable to open manhole cover.
Aspen Rd	226	Catchbasin requires cleaning
Aspen Rd (18)	218	Catchbasin requires corbel repair
Aspen Rd (4)	229	Catchbasin requires corbel repair
Bingham Rd (11)	356	Catchbasin requires corbel repair
Bishop Way (2)	288	Unable to open manhole cover.
Bow St (3)	903	Catchbasin requires wall repair
Bow St (5)	905	Catchbasin requires corbel and wall repair
Bow St at island	903	Catchbasin grate needs replacement
Boxwood Rd	1194	Manhole requires cleaning
Boxwood Rd (2)	1181	Catchbasin requires corbel and wall repair
Boxwood Rd (5)	1504	Catchbasin requires corbel repair
Boxwood Rd (9)	300	Unable to open manhole cover.
Boxwood Rd (9)	302	Unable to open manhole cover.
Burnham Dr (4)	993	Catchbasin requires corbel repair
Carriage Way	401	Catchbasin requires cleaning
Carriage Way (9)	74	Unable to open manhole cover.
Castle Rd (7)	501	Unable to open manhole cover.
Central St	108	Catchbasin requires cleaning
Central St	468	Catchbasin requires cleaning
Central St	476	Catchbasin requires cleaning
Central St	914	Manhole requires cleaning
Central St (138)	1172	Catchbasin requires corbel and wall repair
Central St (52)	614	Catchbasin requires wall repair
Chestnut St	367	Catchbasin requires cleaning
Chestnut St	2166	Catchbasin requires cleaning
Chestnut St	2432	Catchbasin requires cleaning
Chestnut St (22)	367	Catchbasin requires corbel repair
Chestnut St (48)	2432	Catchbasin requires corbel repair

Location or Street Address	GIS Object ID	Description of Maintenance
Chestnut St (60)	364	Catchbasin requires wall repair
Colonial Hill Dr	1380	Catchbasin requires cleaning
Concord St (12)	835	Catchbasin requires wall repair
Concord St (15)	834	Catchbasin grate needs replacement
Concord St (21)	837	Catchbasin requires corbel and wall repair
Concord St (65)	816	Catchbasin grate needs replacement
Concord St (65)	817	Catchbasin requires corbel repair
Concord St (65)	817	Catchbasin grate needs replacement
Concord St (80)	812	Catchbasin requires wall repair
Concord St (95)	803	Catchbasin requires wall repair
Country Club Rd Culvert	438	Catchbasin requires corbel repair
Crestwood Rd	936	Manhole requires cleaning
Crestwood Rd	940	Manhole requires cleaning
Crestwood Rd	1206	Catchbasin requires cleaning
Crestwood Rd	1872	Catchbasin requires cleaning
Crestwood Rd	1873	Catchbasin requires cleaning
Darrell Dr (13)	1012	Unable to open manhole cover.
Deer Run Drive	1228	Manhole requires cleaning
Deerfield Pl	579	Manhole requires cleaning
Duane Dr	572	Catchbasin requires cleaning
Eisenhaure Ln (4)	705	Catchbasin requires corbel repair
Elm St	1612	Catchbasin requires cleaning
Elm St	1656	Catchbasin requires cleaning
Elm St	1675	Catchbasin requires cleaning
Elm St (40)	1675	Catchbasin requires corbel repair
Elm St (99)	1665	Catchbasin requires corbel and wall repair
Erwin Rd	1917	Catchbasin requires cleaning
Erwin Road	532	Manhole requires cleaning
Eugley Park Culvert	2418	Catchbasin requires wall repair
Fairview St	1665	Catchbasin requires cleaning
Fairview St (2)	430	Unable to open manhole cover.
Foley Rd	576	Catchbasin requires cleaning
Freedom Dr (20)	47	Unable to open manhole cover.
Green Meadow Dr (4)	955	Catchbasin grate needs replacement
Greene St (15)	1213	Unable to open manhole cover.
Greene St (8)	2108	Catchbasin grate needs replacement
Haverhill St	485	Manhole requires cleaning
Haverhill St	533	Catchbasin requires cleaning
Haverhill St	540	Catchbasin requires cleaning
Haverhill St	547	Catchbasin requires cleaning
Haverhill St	586	Catchbasin requires cleaning
Haverhill St	1150	Catchbasin requires cleaning
Haverhill St	1151	Catchbasin requires cleaning
Haverhill St	1152	Catchbasin requires cleaning
Haverhill St	1589	Catchbasin requires cleaning
Haverhill St	1786	Catchbasin requires cleaning
Haverhill St	2428	Catchbasin requires cleaning

Location or Street Address	GIS Object ID	Description of Maintenance
Haverhill St	2429	Catchbasin requires cleaning
Haverhill St	2430	Catchbasin requires cleaning
Haverhill St (166)	1067	Unable to open manhole cover.
Haverhill St (190)	583	Catchbasin requires corbel repair
Hemlock Rd	175	Manhole requires cleaning
Heritage Way	1356	Catchbasin requires cleaning
Heritage Way (1)	1351	Catchbasin requires corbel repair
Heritage Way (14)	546	Manhole requires corbel repair
Heritage Way (28)	548	Manhole requires corbel repair
Heritage Way (34)	1363	Catchbasin requires corbel or wall repair
Heritage Way (5)	989	Manhole requires corbel repair
Heritage Way (7)	988	Manhole requires corbel repair
Heritage Way (7)	1357	Catchbasin requires corbel repair
Heritage Way (7)	1358	Catchbasin requires corbel repair
Heritage Way (8)	1359	Catchbasin requires corbel repair
Heritage Way (8)	1360	Catchbasin requires corbel or wall repair
Heritage Way (North of 34)	987	Manhole requires corbel repair
Hickory Ln	258	Manhole requires cleaning
Hickory Ln	372	Catchbasin requires cleaning
Hickory Ln	378	Catchbasin requires cleaning
Hickory Ln (11 Laurel Rd)	378	Catchbasin grate needs replacement
Hickory Ln (15)	372	Catchbasin requires corbel or wall repair
Hickory Ln (18)	373	Catchbasin requires corbel or wall repair
Hickory Ln (22)	374	Catchbasin requires corbel or wall repair
Hickory Ln (30)	1189	Catchbasin requires corbel or wall repair
James Millen Rd (3)	1122	Unable to open manhole cover.
James Millen Rd (3)	1123	Unable to open manhole cover.
Joanne Ter	1892	Catchbasin requires cleaning
John Bickford Way	1188	Manhole requires cleaning
Joseph Ln (1)	606	Catchbasin requires wall repair
King Row	1473	Catchbasin requires cleaning
Kings Row	275	Manhole requires cleaning
Kings Row	276	Manhole requires cleaning
Kings Row	1472	Catchbasin requires cleaning
Kings Row (12)	277	Unable to open manhole cover.
Kings Row (30)	279	Unable to open manhole cover.
Kings Row (4)	274	Unable to open manhole cover.
Kings Row (40)	282	Unable to open manhole cover.
Ladyslipper Ln (1)	1700	Catchbasin requires corbel repair
Ladyslipper Ln (2)	1703	Catchbasin requires corbel repair
Laurel Rd (6)	380	Catchbasin requires corbel repair
Lindor Rd	108	Manhole requires cleaning
Lindor Rd	565	Catchbasin requires cleaning
Linwood Ave	1103	Manhole requires cleaning
Lowell Rd	890	Manhole requires cleaning
Marblehead St	251	Catchbasin requires cleaning
Marblehead St	252	Catchbasin requires cleaning

Location or Street Address	GIS Object ID	Description of Maintenance
Marblehead St	256	Catchbasin requires cleaning
Marblehead St	269	Manhole requires cleaning
Marblehead St	1082	Manhole requires cleaning
Marblehead St	1458	Catchbasin requires cleaning
Marblehead St	1459	Catchbasin requires cleaning
Marblehead St (33)	1962	Catchbasin requires corbel and wall repair
Marblehead St (6)	887	Manhole requires corbel repair
Marblehead St (73)	255	Catchbasin requires corbel and wall repair
Marshall Dr (27)	1875	Catchbasin requires wall repair
Marshall St	1195	Manhole requires cleaning
Meade Rd (8)	122	Unable to open manhole cover.
Memory Ln (2)	972	Unable to open manhole cover.
Mt Vernon St (29)	2434	Catchbasin requires corbel and wall repair
Nichols St	332	Catchbasin requires cleaning
North Hill Dr (1)	1194	Catchbasin requires corbel repair
North St	81	Catchbasin requires cleaning
North St	83	Catchbasin requires cleaning
North St	124	Catchbasin requires cleaning
North St	157	Catchbasin requires cleaning
North St	838	Manhole requires cleaning
North St	1224	Manhole requires cleaning
North St (140)	82	Catchbasin requires corbel repair
North St (146)	83	Catchbasin requires corbel and wall repair
North St (206)	61	Catchbasin requires corbel repair
North St (237)	2063	Catchbasin requires corbel and wall repair
North St (63)	136	Catchbasin requires corbel and wall repair
Nutter Rd	1798	Catchbasin requires cleaning
Oak Knoll Ave	95	Manhole requires cleaning
Oakdale Rd	586	Manhole requires cleaning
Oakdale Rd (15)	637	Catchbasin requires corbel and wall repair
Old Andover Rd (80)	2	Catchbasin requires corbel or wall repair
Olde Coach Rd	1973	Catchbasin requires cleaning
Orchard Dr	602	Catchbasin requires cleaning
Orchard Dr (255 Elm St)	1928	Catchbasin grate needs replacement
Orchard Dr (side of 249 Elm St)	542	Unable to open manhole cover.
Oscar's Way (1)	994	Unable to open manhole cover.
Oscar's Way (1)	995	Unable to open manhole cover.
Oscar's Way (7)	997	Unable to open manhole cover.
Palomino Dr	1384	Catchbasin requires cleaning
Park St	264	Manhole requires cleaning
Park St	1055	Catchbasin requires cleaning
Park St	1590	Catchbasin requires cleaning
Park St	2074	Catchbasin requires cleaning
Park St (101)	906	Catchbasin requires corbel repair
Park St (105)	908	Catchbasin requires corbel repair
Park St (116)	2436	Catchbasin requires corbel and wall repair
Park St (122)	2446	Catchbasin requires corbel repair

Location or Street Address	GIS Object ID	Description of Maintenance
Park St (128)	1604	Catchbasin requires corbel repair
Park St (160)	1586	Catchbasin requires corbel and wall repair
Park St (350)	876	Catchbasin requires wall repair
Park St (350)	878	Catchbasin grate needs replacement
Park St (51)	927	Catchbasin requires wall repair
Parker Dr	908	Manhole requires cleaning
Parsonage Ln	1408	Catchbasin requires cleaning
Peabody St	2013	Catchbasin requires cleaning
Peter Rd	861	Manhole requires cleaning
Peter Rd (22)	178	Catchbasin requires corbel repair
Peter Rd (24)	857	Unable to open manhole cover.
Peter Rd (25)	177	Catchbasin requires corbel repair
Peter Rd (3)	196	Catchbasin requires corbel and wall repair
Peter Rd (4)	859	Unable to open manhole cover.
Peter Rd (8)	187	Catchbasin requires corbel repair
Peter Rd (8)	860	Unable to open manhole cover.
Pickard Ln (3)	2484	Catchbasin requires corbel and wall repair
Pine Glen Dr (20)	457	Catchbasin requires corbel repair
Pine Ridge Rd	125	Catchbasin requires cleaning
Pine Ridge Rd (23)	120	Catchbasin requires corbel and wall repair
Pine Ridge Rd (25)	119	Catchbasin requires corbel and wall repair
Pleasant St	537	Manhole requires cleaning
Pleasant St	755	Catchbasin requires cleaning
Pleasant St (19)	748	Catchbasin requires corbel or wall repair
Pleasant St (24)	1920	Catchbasin grate needs replacement
Pleasant St (8)	753	Catchbasin requires corbel and wall repair
Rust Ln (8)	1193	Catchbasin grate needs replacement
Samuel Phelps Way	1899	Catchbasin requires cleaning
Shady Hill Dr	163	Catchbasin requires cleaning
Shady Hill Dr (20)	166	Catchbasin requires corbel repair
Shasta Dr	1446	Catchbasin requires cleaning
Shasta Dr (2)	1445	Catchbasin requires corbel repair
Shasta Dr (22)	1447	Catchbasin grate needs replacement
Shasta Dr (3)	1442	Catchbasin requires corbel repair
Shore Rd	1765	Catchbasin requires cleaning
Snowcrest Run	1438	Catchbasin requires cleaning
Snowcrest Run (2)	1438	Catchbasin requires corbel repair
Spruce Rd (52)	16	Unable to open manhole cover.
Stonecleave Rd (1)	2	Unable to open manhole cover.
Stonecleave Rd (1)	1218	Catchbasin requires corbel repair
Stonecleave Rd (1)	1220	Catchbasin requires corbel repair
Stonecleave Rd (1)	1221	Catchbasin requires corbel repair
Stonecleave Rd (3)	1217	Catchbasin requires corbel repair
Strawberry Ln	155	Manhole requires cleaning
Strawberry Ln	1924	Catchbasin requires cleaning
Sullivan Rd	67	Manhole requires cleaning
Sumner St (9)	409	Catchbasin grate needs replacement

Location or Street Address	GIS Object ID	Description of Maintenance
Sunset Ave (3)	139	Catchbasin requires corbel and wall repair
Susan Dr	722	Catchbasin requires cleaning
Swan Pond Rd (42)	785	Catchbasin requires corbel repair
Swan Pond Rd (42)	787	Catchbasin requires corbel repair
Tacoma Cir (2)	1871	Catchbasin requires corbel repair
Tarbox Ln	331	Manhole requires cleaning
Ten Rod Way	1196	Manhole requires cleaning
Timber Ln (8)	1187	Catchbasin requires wall repair
Tower Hill Rd (21)	133	Unable to open manhole cover.
Traveled Way	1055	Manhole requires cleaning
Turner Dr	157	Manhole requires cleaning
Turner Dr	170	Manhole requires cleaning
Turner Dr	764	Catchbasin requires cleaning
Valley Rd	605	Manhole requires cleaning
Virginia Road	1914	Catchbasin requires cleaning
Wagon Dr	1337	Catchbasin requires cleaning
Wagon Dr	1339	Catchbasin requires cleaning
Wagon Dr (2)	975	Unable to open manhole cover.
Wagon Dr (side of 11 Sunset Ave)	976	Unable to open manhole cover.
Westchester Dr (2)	205	Catchbasin requires corbel repair
Westward Circle (21)	867	Unable to open manhole cover.
Westward Circle (24)	207	Catchbasin requires wall repair
Westward Circle (26)	865	Manhole requires corbel repair
Westward Circle (30)	211	Catchbasin requires corbel repair
Westward Circle (9)	198	Catchbasin requires corbel and wall repair
Whitcomb Way	1422	Catchbasin requires cleaning
Williams Rd (1)	916	Catchbasin requires corbel and wall repair
Wilson Ave (11)	426	Catchbasin requires wall repair
Winter St	2181	Catchbasin requires cleaning
Winter St	2292	Catchbasin requires cleaning
Woodland Dr (19)	898	Catchbasin requires corbel and wall repair
Woodland Dr (8)	900	Catchbasin requires corbel and wall repair
Wren Circle (4)	85	Unable to open manhole cover.

TABLE B
Interim Report: North Reading Drainage Infrastructure Mapping Project Phase 1:
Estimates of probable project costs for subsequent phases.
September 30, 2013

Phase	Task	(assumed unit cost)	Engineering Cost	Material Cost	Contractor Cost	Total Cost
1A	Areas Requiring Further Investigation-Pipe Conductivity (29 intersections)		$ 29,000		$ 15,000	$ 44,000
	(cleaning and CCTV inspections, dye testing, edit database, revise report)					
	(Assume 10 days with contractor and NECE)*					
1A	CBs Requiring New Grates (15)			$ 7,500	$ 7,500	$ 15,000
1A	MHs Buried/ Broken/Frozen (34)			$ 7,500	$ 7,500	$ 15,000
	Further Investigations, Survey, Mapping		$ 3,000			$ 3,000
	*					
1B	Drainage Report, Capital and Maintenance Needs		$ 17,000			$ 17,000
	(prepare and upate tables, maps, report after subsequent phases)					
1C	Areas Requiring Maintenance					
	Concord Street MH Outlet (1)	$ 500			$ 500	$ 500
	Duane Street Outlet Hood (9)	$ 400		$ 1,800	$ 1,800	$ 3,600
	Repair 105 Structures					
	CB Corbels (62)	$ 250		$ 6,200	$ 9,300	$ 15,500
	CB Wall Repair (18)	$ 500		$ 1,800	$ 7,200	$ 9,000
	CB Wall & Corbel Repair (18)	$ 500		$ 1,800	$ 7,200	$ 9,000
	MH Corbel (7)	$ 250		$ 700	$ 1,050	$ 1,750
1D	Structures & Pipes Needing Cleaning					
	MH (52)					
	CB (64)					
	(Assume 3 days with contractor and NECE) *		$ 4,000		$ 5,000	$ 9,000
1D	Structures Needing Cleaning					
	MH (35)					
	CB (77)					
	(Assume 3 days with contractor and NECE) *		$ 3,000		$ 5,000	$ 8,000
1E	Bow Street CB Repair & Cleaning		$ 5,000	$ 2,000	$ 4,500	$ 11,500
	and Haverhill Street (2 culverts) Rehab./Replacement *				$ 40,000	$ 40,000
	Central Street Culvert		TBD		TBD	
2	Complete CB/MH Inspections & XC Infrastructure Inspections		$ 24,400			$ 24,400
	(culverts, potential addtl. outfall investigation/mapping)					
3	Outfall Inspections		$ 80,000			$ 80,000
	**					
4	Suspected Illicit Discharge to Investigate (18)		$ 15,000			$ 15,000
	*					
			$ 180,400	**$ 29,300**	**$ 111,550**	**$ 321,250**

* Contingency: Cleaning and inspections will likely result in additional investigation needs and capital/maintenance needs following identification of additional buried covers or suspected/potential illicit discharges.
** Contingency: Outfall inspections will likely result in additional investigtion needs due to observations of additional suspected/potential illicit discharges.
*** Police detail costs not considered in budget estimates.

EXECUTIVE SUMMARY

Background and Project Understanding

The Town of North Reading DPW (DPW) is responsible for the operations and maintenance of drainage infrastructure within Town roadways and easements. The DPW maintains a GIS map and geodatabase identifying the locations and properties of drainage structures, pipes, and outfalls. The pre-existing GIS map, developed by Malcolm Pirnie (MP), included “features” such as manholes, catchbasins, and outfalls as well as a schematic plan of drainage piping.

Over the past three years, New England Civil Engineering (NECE) has completed drainage investigations in several areas and identified inconsistencies and inaccuracies between the MP geodatabase and field observations. At the request of the Town, NECE conducted a town-wide “windshield survey” and inventory of all drainage structures observed within Town roadways and municipal parking lots. During this survey, NECE edited the MP database (developed a new database) that more accurately represents the limits and extent of the drainage system and the quantity and location of drainage infrastructure. As a result of this process, several hundred structures were added to the geodatabase and several hundred other structures were removed after determining they did not exist.

For the “2013 Drainage Infrastructure Mapping Project”, the DPW wants to improve the accuracy of the drainage mapping to include the location, condition, and connectivity of all drainage infrastructure within the DPW responsibility including catch basins, manholes, pipes, outfalls, and culverts. The resulting “2013” map will facilitate improved operations and maintenance of the drainage infrastructure and will prepare the DPW for the next round of NPDES MS4 stormwater permitting which will require complete and accurate drainage mapping in addition to drain outfall screening data.

Project Approach – 2013 Drainage Infrastructure Mapping Project

Due to the large scale of the 2013 project, the scope of work will be completed in phases:

Phase 1 includes surface inspections and mapping of all accessible drain manholes and catch basins within Town roadways and updating the drainage geodatabase to incorporate the results. Phase 1 of the 2013 mapping project is complete and summarized in this letter report.

Phase 1A will include additional field investigations as required to complete the mapping of the drainage infrastructure within Town roadways including:

- Coordinate with DPW to locate and raise suspected buried drain structures
- Coordinate with DPW to open and/or replace broken or frozen drain structures that could not be previously observed
    - (As of the date of this report, 34 structures are suspected to be buried or were broken/frozen and could not be opened.)
- Complete additional field investigations to establish connectivity of drain piping between mapped drain structures including wet weather flow observations, dye testing, and CCTV pipeline inspections.
    - (As of the date of this report, 29 intersections have been identified that require additional investigation to establish connectivity between multiple drainage structures.)

Phase 1B will include preparation of capital and maintenance needs report to address the findings and deficiencies observed during field investigations and mapping including:

- Updated drainage infrastructure mapping and inventory following completion of Phase 1A field investigations.
- Identification of the number and location of drainage outfalls, including the existing mapped outfall features and potential additional unmapped outfall features based on the drainage infrastructure mapping.
- Identification of the number and location of suspected illicit sanitary discharges to the drain.

- Identification of the number, type, and location of capital and maintenance needs to clean, repair, or replace structures based on field observations.
- Identification of other capital and maintenance needs identified during the Phase 1 mapping activities and specific requests by DPW including surface flooding and lack of drainage, sinkholes and culvert deterioration, and future concerns including corrugated metal pipe or other materials.

Phase 2 will include additional field investigations as required to complete the mapping of the drainage infrastructure outside Town roadways, including:

- Field observations and mapping of cross-country drainage infrastructure identified in existing database (previously unobserved) and in areas where Phase 1 GIS drainage layer connectivity review identify potential additional cross-country drainage infrastructure.
- GIS drainage layer connectivity review to identify potential additional (previously unmapped) drainage outfalls based on lack of connectivity and/or lack of nearby outfalls.
- Field observations and to determine existence and mapping if applicable of potential additional (previously unmapped) drainage outfalls.
- Field observations and mapping of stand-alone culverts (culverts not connected to MS4 drainage infrastructure) and field observations and mapping of drainage outfalls.

Phase 3 will include drainage outfall observations, screening and documentation, and dry-weather sampling where applicable in preparation for the next phase of NPDES MS4 permitting requirements.

Phase 4 will include follow-up investigations of the drainage infrastructure tributary to outfalls with obvious or suspected illicit discharge connections to the drain, including implementation of the Illicit Discharge Detection and Elimination (IDDE) program submitted to EPA as part of the existing NPDES MS4 permit requirements.
(As of the date of this report, 15 manholes were observed with evidence of suspected illicit sanitary discharge connection)

Field Investigation Results

During the Phase 1 field investigations, NECE conducted a surface inspections of 948 drain manholes and 1,772 catchbasins located within the Town of North Reading roadways and municipal parking lots. Manhole inspections recorded condition and connectivity data including: cover size, shape, text, condition; rim to invert depth of all connecting pipes, rim to sump depth if applicable; manhole size, shape, material, and condition; evidence of debris, surcharge, or infiltration; and size, material, and direction of all connecting pipes. Catchbasin inspections recorded condition and connectivity data including: grate size, shape and condition; depth to water, debris, or sump; depth to invert and direction of inlet and outlet pipes if visible; and the presence of a hooded outlet.

In addition to DPW drainage structures inspected as part of the Phase 1 project, a number of other drainage structures were observed and/or mapped including suspected buried structures, MDOT structures, and private structures. Table 1 summarizes the number and type of drainage structures included in the Phase 1, 2013 Drainage Mapping geodatabase:

Table 1

	Drain Manholes	Catchbasins
Survey Complete	948	1,772
Observed	36	65
Cannot Locate	83	111
Mass DOT	74	100
Private	93	335
Total	1,234	2,383

Refer to Map 1 of this Executive Summary for updated drainage map based on Phase 1 drainage mapping activities.

Throughout the project, NECE identified capital and maintenance needs including structural repairs and cleaning, culvert repairs, and areas requiring further investigation such as potential illicit connections and areas where connectivity could not be established. NECE also improved the geodatabase to allow the sorting and displaying of data.

Areas Requiring Further Mapping Investigation

Following completion of the Phase 1 drainage structure mapping project, the drainage mapping is still incomplete because surface manhole and catchbasin inspections proved insufficient to determine the connectivity between structures in all areas, including multiple single structures in isolated areas and 29 intersections with connectivity questions involving several structures. To confirm connectivity in these areas, additional field investigations are required including flow observation during wet weather, performing dye tests, and conducting CCTV pipeline investigations. Some of these areas may ultimately be resolved once the buried structures are raise and frozen covers opened.

Refer to Map 2 of this Executive Summary for approximate locations of intersections requiring additional field investigations and mapping.

Drainage Structures Requiring Raising or Opening/Replacement to Allow Observation

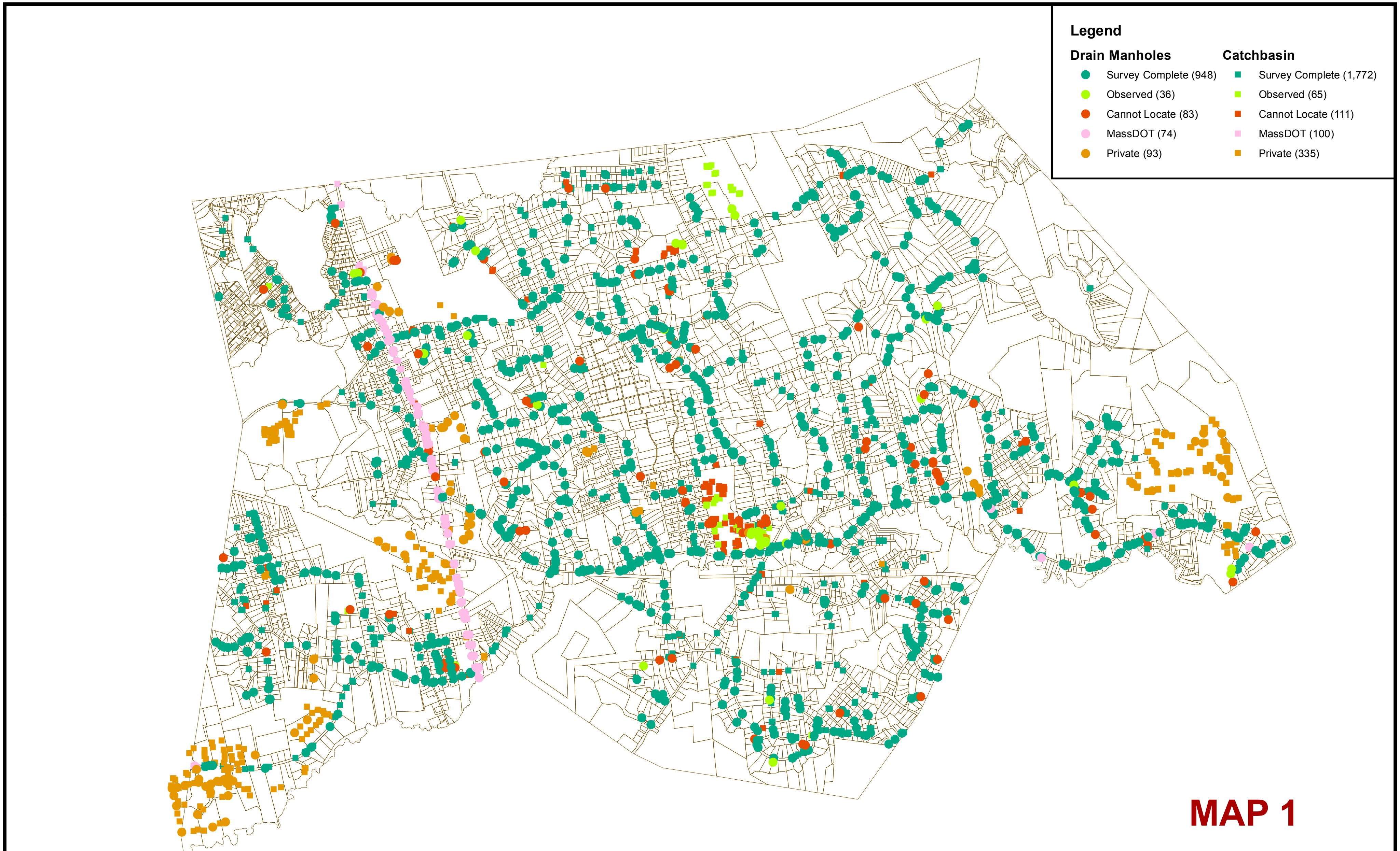
A total of 34 structures were identified as being potentially buried or had broken/frozen frames which prevented observation.

Refer to Map 3 of this Executive Summary for approximate locations of potentially buried or broken/frozen drainage structures requiring additional field investigations and mapping.

Suspected Illicit Sanitary Discharge Connections

To date, 18 areas displayed signs of an illicit sewer or septic connection to the drainage system.

Refer to Map 4 of this Executive Summary for approximate locations of suspected illicit discharge connections.



Town of North Reading, Massachusetts

Drainage Mapping Project

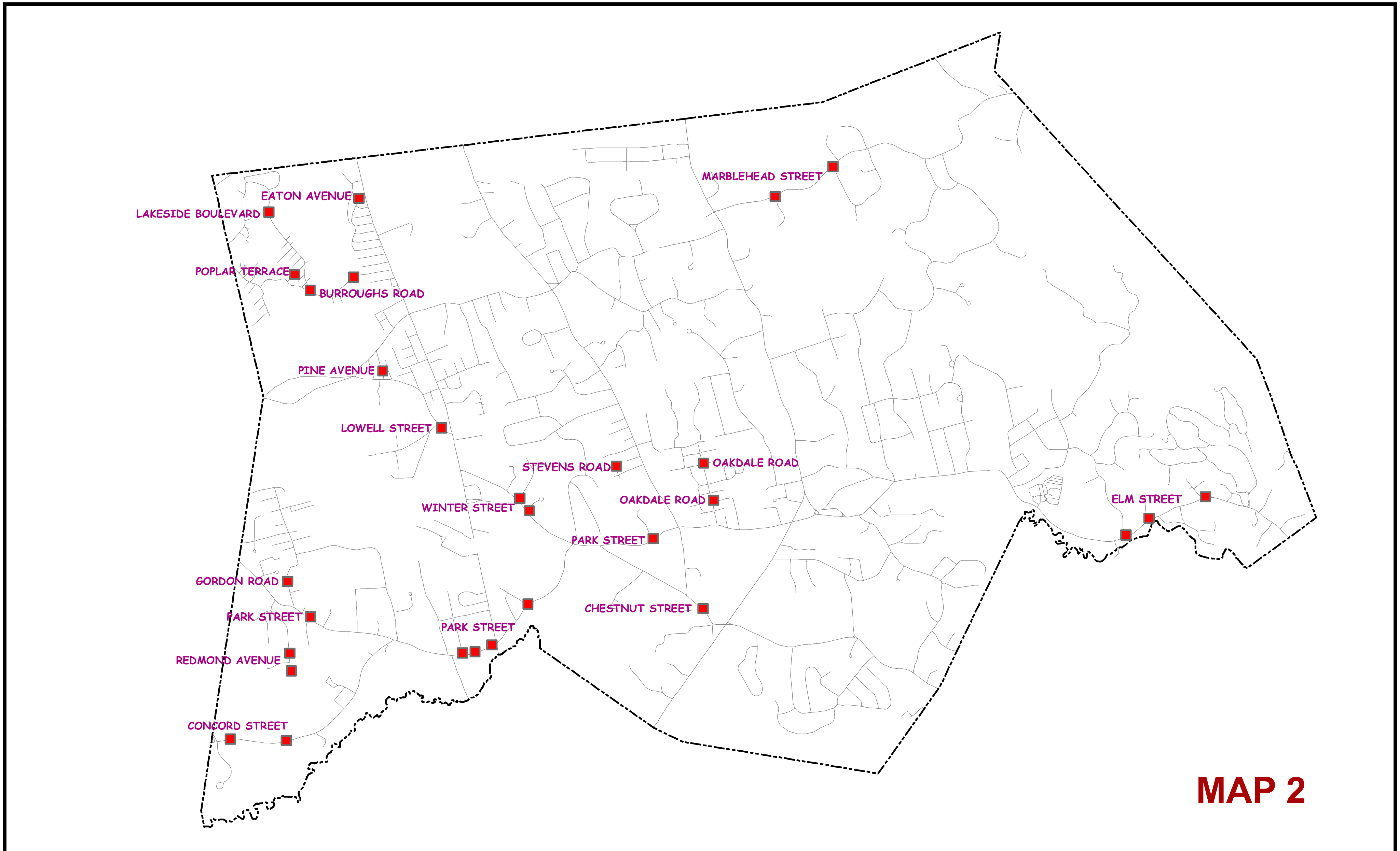
July 24, 2013

NEW ENGLAND CIVIL ENGINEERING SALEM, MA

1 in = 0.65 miles

Note: Map is for illustration purposes only.

...Drainage Investigations\GPS Progress Maps\Progress Map for Drainage Mapping Project_6-06-13.pdf



Town of North Reading, Massachusetts

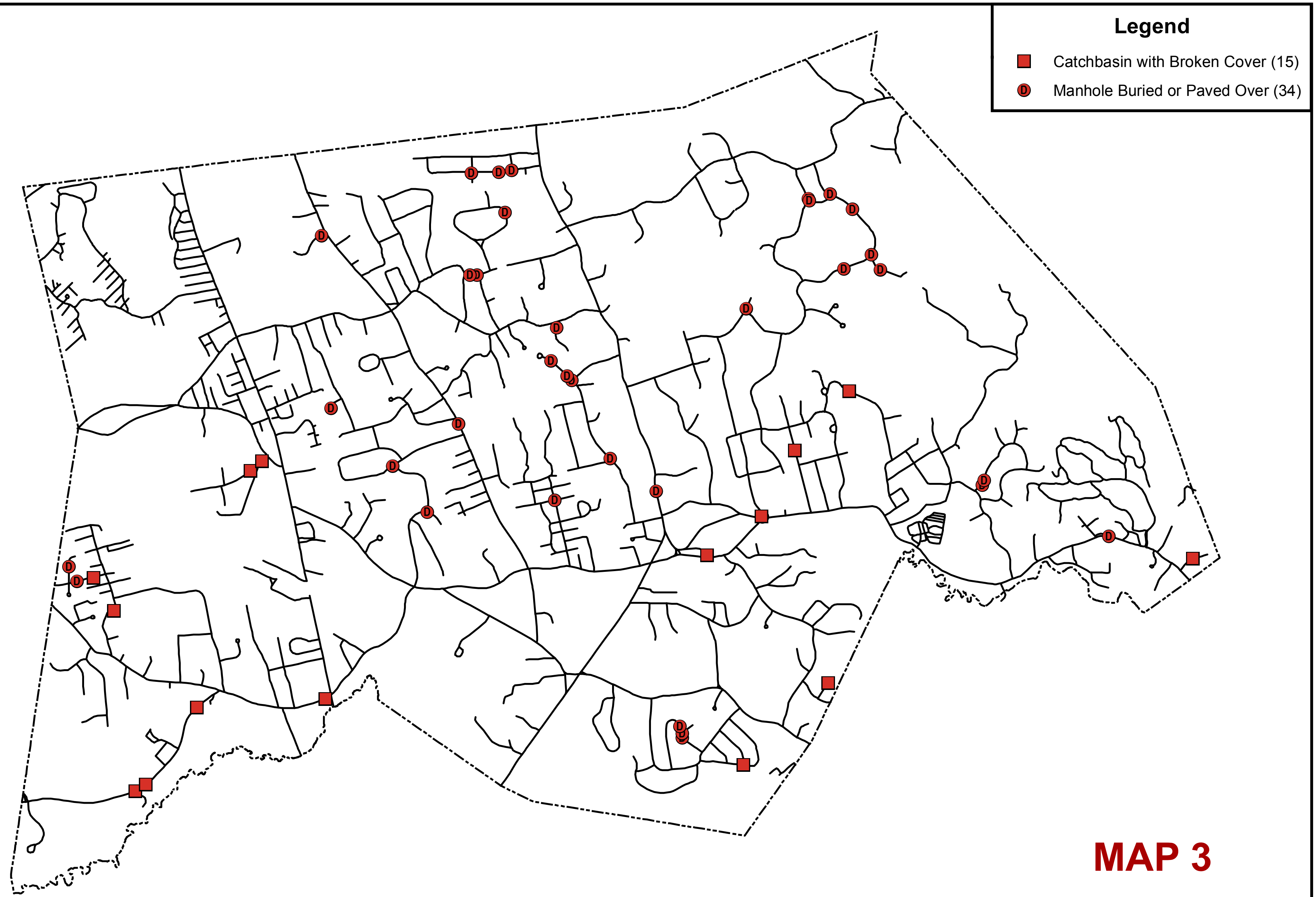
Areas Requiring Further Mapping Investigation

July 24, 2013

1 in = 0.65 miles

Note: Map is for illustration purposes only.

H:\Clients\North Reading\Drainage Investigations\Maps of Further Investigation Locations



Town of North Reading, Massachusetts

Broken Catchbasin Covers and Buried or Paved Over Manholes

July 24, 2013

NECE
NEW ENGLAND CIVIL ENGINEERING
SALEM, MA

1 in = 0.65 miles

Note: Map is for illustration purposes only.

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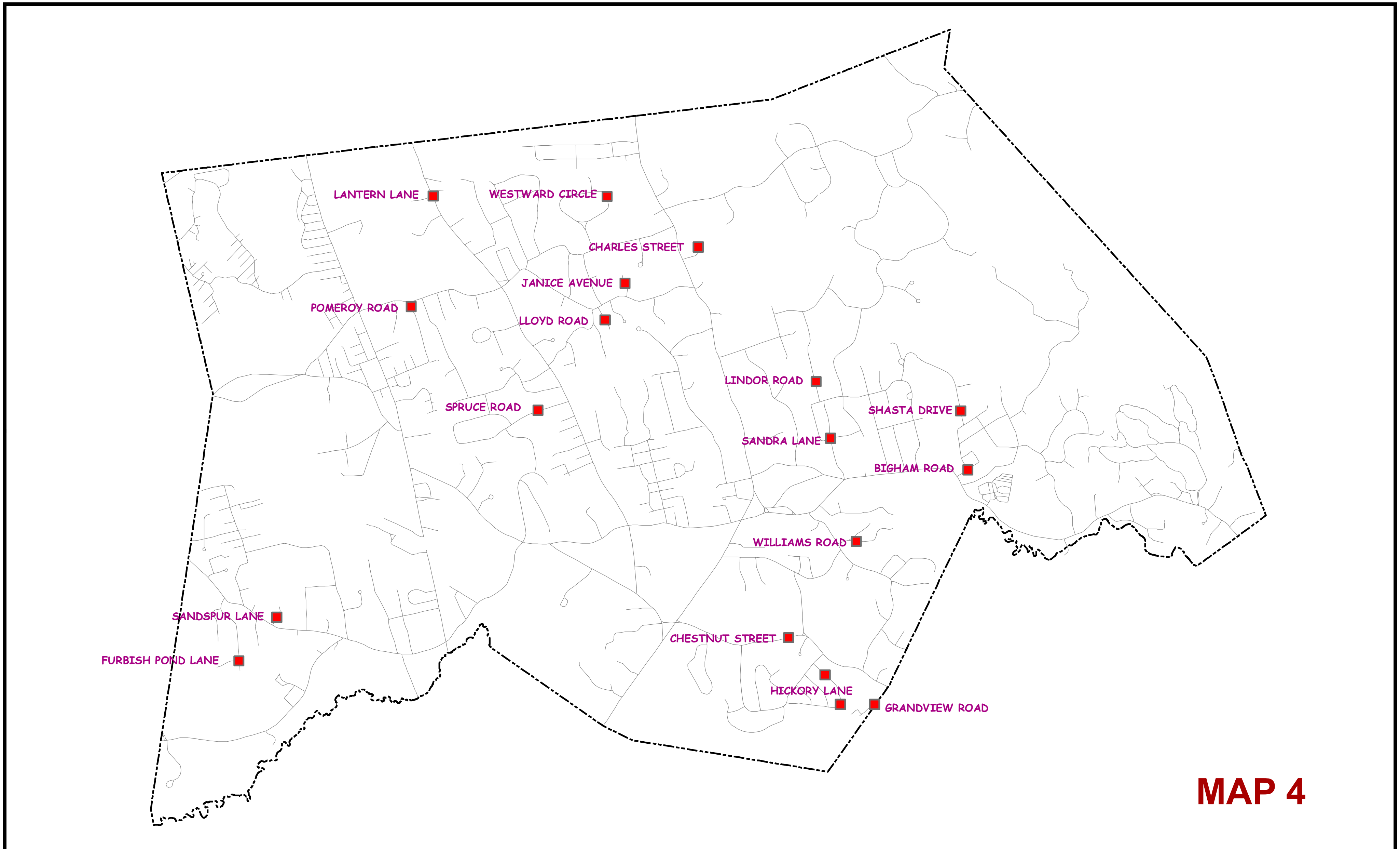

Town of North Reading, Massachusetts

Potential Illicit Sanitary Discharge Connection Locations

July 24, 2013

1 in = 0.65 miles

Note: Map is for illustration purposes only.

H:\Clients\North Reading\Drainage Investigations\Maps of Further Investigation Locations

Field Investigation Results

During the Phase 1 field investigations, NECE conducted a surface inspections of 948 drain manholes and 1,772 catchbasins located within the Town of North Reading roadways and municipal parking lots. Manhole inspections recorded condition and connectivity data including: cover size, shape, text, condition; rim to invert depth of all connecting pipes, rim to sump depth if applicable; manhole size, shape, material, and condition; evidence of debris, surcharge, or infiltration; and size, material, and direction of all connecting pipes. Catchbasin inspections recorded condition and connectivity data including: grate size, shape and condition; depth to water, debris, or sump; depth to invert and direction of inlet and outlet pipes if visible; and the presence of a hooded outlet.

In addition to DPW drainage structures inspected as part of the Phase 1 project, a number of other drainage structures were observed and/or mapped including suspected buried structures, MDOT structures, and private structures. Table 1 summarizes the number and type of drainage structures included in the Phase 1, 2013 Drainage Mapping geodatabase:

Table 1

	Drain Manholes	Catchbasins
Survey Complete (GPS)	948	1,772
Observed (during windshield survey)	36	65
Cannot Locate (buried/easements)	83	111
Mass DOT	74	100
Private	93	335
Total	1,234	2,383

Refer to Map 1 of the Executive Summary for updated drainage map based on Phase 1 drainage mapping activities.

Throughout the project, NECE identified capital and maintenance needs including structural repairs and cleaning, culvert repairs, and areas requiring further investigation such as potential illicit connections and areas where connectivity could not be established. NECE also improved the geodatabase to allow the sorting and displaying of data.

Areas Requiring Further Mapping Investigation

Following completion of the Phase 1 drainage structure mapping project, the drainage mapping is still incomplete because surface manhole and catchbasin inspections proved insufficient to determine the connectivity between structures in all areas, including multiple single structures in isolated areas and 29 intersections with connectivity questions involving several structures. To confirm connectivity in these areas, additional field investigations are required including flow observation during wet weather, performing dye tests, and conducting CCTV pipeline investigations. Some of these areas may ultimately be resolved once the buried structures are raise and frozen covers opened.

The following areas requiring further investigation have been flagged as bookmarks in the GIS database and can be viewed on **MapKK of Appendix F**:

1. Concord Street near Fordham Road (Map II)
2. 80 Concord Street (Map JJ)
3. Redmond Avenue near Furbish Pond Lane (Map KK)
4. The end of Redmond Avenue (Map KK)
5. Park Street at Surrey Lane (Map LL)
6. 18 Gordon Road (Map MM)
7. Park Street at Burditt Road (Map NN)
8. Park Street at Eames Street (Map NN)
9. Park Street near Main Street (Map NN)
10. Park Street at Damon Street (Map OO)
11. Winter Street at Old Farm Lane (Map PP)
12. Winter Street at Baldwin Lane (Map PP)
13. Lowell Street at Main Street (Map QQ)
14. 4 Pine Avenue (Map RR)
15. 29 Burroughs Road (Map SS)

16. Burroughs Road at Lakeside Boulevard (Map TT)
17. 4 Poplar Terrace (Map TT)
18. Lakeside Boulevard near the water facility (Map UU)
19. Eaton Avenue and Hillside Road (Map VV)
20. Stevens Road at Gage Road (Map WW)
21. Park Street at Aldersgate Way (Map XX)
22. Chestnut Street at Upton Avenue (Map YY)
23. Oakdale Road and Dodge Road (Map ZZ)
24. Oakdale Road at Meade Road (Map ZZ)
25. Marblehead Street near Olde Coach Road (Map AAA)
26. Marblehead Street at Deerfield Place (Map AAA)
27. Elm Street near MacIntyre (Map BBB)
28. Elm Street near Fairview Street (Map BBB)
29. Elm Street and Lisa Lane (Map CCC)

<u>Drainage Structures Requiring Raising or Opening/Replacement to Allow Observation</u>

Catchbasins Requiring New Grates and Buried Manholes (refer to Map V of Appendix B and Tables 1 and 2 of Appendix B)

- A total of 15 catchbasin grates require replacement throughout the Town. **Please see Table 1 of Appendix B.**
- Of these 15 grates requiring replacement, 14 are square single grates while 1 is a square double grate.
- These grates identified as poor or failing have damage that affects the structural integrity of grate.
- A total of 34 structures were identified as being potentially buried or had broken/frozen frames which prevented observation. **Please refer to Table 2 of Appendix B.**
- Bookmarks in GIS **Map V of Appendix B** have been set up to display each occurrence.

Suspected Illicit Sanitary Discharge Connections

- To date, 18 areas displayed signs of an illicit sewer or septic connection to the drainage system. See Appendix E for photo explanation of white bacteria observed in drain lines as described by the Center for Watershed Protection's Illicit Discharge and Elimination: A Guidance Manual. **The areas have been flagged as bookmarks in the GIS database and can be viewed on Map 4 ES.**
- **Areas Where Sampling is Required (refer to Maps B-S of Appendix A and Photos 1-20 of Appendix E)**
    1. Suds and laundry odor were observed in catchbasin #1444 near 1 Shasta Drive. **Please see Map B of Appendix A and Photo 1 of Appendix E.**
    2. A strong sanitary sewer odor and white bacteria growth was observed in catchbasin #210 near 21 Westward Circle. **Please see Map C of Appendix A and Photo 2 of Appendix E.**
    3. White bacteria growth was observed in a pipe in drain manhole #66 near 2 Lantern Lane. **Please see Map D of Appendix A and Photo 3 of Appendix E.**
    4. Bacteria growth was observed in inlet #2 of catchbasin #240 on Charles Street. **Please see Map E of Appendix A and Photo 4 of Appendix E.**
    5. Bacteria growth was observed in drain manhole #489 on Furbish Pond Lane. **See Map F of Appendix A and Photo 5 of Appendix E.**
    6. Bacteria growth was observed on the walls of catchbasin #2487 on Grandview Road. **See Map G of Appendix A and Photo 6 of Appendix E.**
    7. White bacteria growth was observed in catchbasin #368 on Hickory Lane. **See Map H of Appendix A and Photo 7 of Appendix E.**
    8. White bacteria growth was observed in the pipes of catchbasin #156 on Janice Avenue. **See Map I of Appendix A and Photo 8 of Appendix E.**
    9. An odor of sewage and white bacteria growth was observed in catchbasin #567 on Lindor Road. **Please see Map J of Appendix A and Photo 9 of Appendix E.**
    10. An odor of sewage was observed in manhole #114 on Sandra Lane. **Refer to Map K of Appendix A and Photo 10 Appendix of E.**

11. Bacteria was observed in manhole #192 on Sandspur Lane. **Refer to Map L of Appendix A and Photo 11 of Appendix E.**
12. A white bacteria stripe was observed in the invert in one of the pipes of manhole #1211 on Spruce Road. **See Map M of Appendix A and Photo 12 of Appendix E.**
13. Bacteria was observed in catchbasin #917 on Williams Road. **See Map N of Appendix A and Photo 13 of Appendix E.**
14. White bacteria was observed in the pipes and structure of manhole #1252 on Bigham Road. **Refer to Map O of Appendix A and Photo 14 of Appendix E.**

- **Areas Where Orangeburg Pipe Must Be Investigated With Sampling**
  1. White bacteria was observed in the orangeburg inlet pipe of manhole #902 on Hickory Lane. **Please see Map P of Appendix A and Photo 15 of Appendix E.**
  2. White bacteria was observed in the orangeburg inlet pipe of catchbasin #769 on Lloyd Road. **Refer to Map Q of Appendix A and Photo 16 of Appendix E.**
- **Areas Where A CCTV Inspection Should Be Conducted**
  1. Suds and white bacteria were observed in multiple structures on Pomeroy Road. These structures include catchbasins #71 and #72 as well as manhole #820. A CCTV inspection should be conducted to establish connectivity and to locate the illicit connection. **Please see Map R of Appendix A and Photos 17, 18, and 19 Appendix of E.**
- **Areas Where Action Has Already Been Taken**
  1. It is evident that a septic system from 60 Chestnut St. is connected to catchbasin #364. The Health Department has been notified of the connection. **Please see Map S of Appendix A and Photo 20 of Appendix E.**

Maps of Areas Requiring Maintenance

Concord Street Outlet Unavailable (refer to Map T of Appendix B and Photo 21 of Appendix E)

- This manhole has two catchbasins draining into it and no outlet.
- There is an unbroken RC pipe that runs through the bottom of the manhole.

- There is evidence of surcharge on the top step of the manhole.

Duane Drive Hood Outlets

- Nine hood outlets located on Duane Drive are broken or have fallen off the outlet and thus are not functioning as designed. **Please reference Map U of Appendix B.**

Catchbasins Requiring New Grates and Buried Manholes (refer to Map V of Appendix B and Tables 1 and 2 of Appendix B)

- A total of 15 catchbasin grates require replacement throughout the Town. **Please see Table 1 of Appendix B.**
- Of these 15 grates requiring replacement, 14 are square single grates while 1 is a square double grate.
- These grates identified as poor or failing have damage that affects the structural integrity of grate.
- A total of 34 structures were identified as being potentially buried or had broken/frozen frames which prevented observation. **Please refer to Table 2 of Appendix B.**
- **The areas have been flagged as bookmarks in the GIS database and can be viewed on Map 4 ES.**
- Bookmarks in GIS **Map V of Appendix B** have been set up to display each occurrence.

Catchbasins and Manholes That Require Structural Repair (refer to Map W of Appendix B, Tables 3 and 4 of Appendix B, and Photos 22 and 23 of Appendix E)

- A total of 105 structures require some form of repair.
- Of these 105 structures,
  - 62 are catchbasins requiring corbel repair.
  - 18 are catchbasins requiring wall repair.
  - 18 are catchbasins requiring wall and corbel repair.
  - 7 are manholes requiring corbel repair.
- Manholes and Catchbasins requiring repair were flagged as having poor or failing walls or corbels during the field investigation.
- Many of these structures are heavily deteriorated or are in some form of collapse.

- It is recommended that all structures having poor or failing walls or corbels be repaired to ensure the structural and functional integrity of the structure.
- Bookmarks in GIS **Map W of Appendix B** have been set up to display each occurrence.

Structures Requiring Structure and Pipe Cleaning (refer to Map X of Appendix B, Tables 5 and 6 of Appendix B, and Photos 24 and 25 of Appendix E)

- These structures have debris in both the structure as well as in the surrounding pipes.
- These structures appear to need more frequent cleaning and are currently full of debris.
- A total of 52 drain manholes require structure and pipe cleaning while 64 catchbasins require structure and pipe cleaning.
- Bookmarks in **GIS Map X of Appendix B** have been set up to display each occurrence.

Structures Requiring Cleaning (refer to Map Y of Appendix B, Tables 7 and 8 of Appendix B, and Photos 26 and 27 of Appendix E)

- These structures requiring cleaning have debris in only the structure itself.
- A total of 35 drain manholes and 77 catchbasins require cleaning.
- These structures appear to need more frequent cleaning and are currently full of debris.
- Bookmarks in GIS **Map Y of Appendix B** have been set up to display each occurrence.

Bow Street Catchbasins (refer to Map Z of Appendix B and Photos 28-30 of Appendix E)

While conducting the drainage survey, the field team observed that the area of Bow Street should be of particular concern. The DPW is planning to repair or rebuild these structures on Bow Street. Based on our observations, it is advisable to clear obstructions from surrounding pipes simultaneously with the structure repair as there are likely blockages that prevent proper drainage. As a result, a separate Letter Proposal was provided to the Town Engineer to provide engineering assistance to observe and coordinate drain structure and pipe cleaning and CCTV inspection services and prepare a summary of recommendations to address the drainage deficiencies observed on Bow Street.

Maps of Culverts of Interest

Culvert Investigations (refer to Maps AA, BB, CC of Appendix C and Photos 31- 36 of Appendix E)

At the request of the town, select culverts were also investigated during this phase of the project. These culverts are located at Central Street near Benevento Memorial Park, 201 Haverhill Street, and Haverhill Street at Eisenhaure Lane. The culvert located at Central Street and seen on Map L, has deficiencies created by corrosion which is visible in Photo #31. These deficiencies lead to the creation of sinkholes that damage the paved surface above as visible in Photo #32. The general structure of the culvert located on Central Street is also in a general state of disrepair as seen in Photos #33 and 34. The DPW is also planning to repave Haverhill Street and is considering the installation of additional catchbasins to improve the drainage prior to paving. Prior to repaving, the deficiencies created by corrosion in both culverts located at Haverhill Street should be addressed. These culverts, location on Maps M and N have corrosion that is visible in Photos # 35 and 36. As a result of these observations, a separate Letter Proposal was provided to the Town Engineer to provide engineering assistance to observe and coordinate drain structure and pipe cleaning and CCTV inspection services and prepare a summary of recommendations to address the drainage deficiencies observed on Central and Haverhill Streets.

Observations and Current Conditions

Corrugated Metal Piping (refer to Map DD of Appendix D, Table 9 of Appendix D, and Photo 37 of Appendix E)

- Throughout the field investigation, approximately 40,000 feet of corrugated metal piping was recorded.
- Much of the corrugated metal piping observed was in deteriorated condition and should be monitored in the future.
- The failure of corrugated metal pipes in the future could lead to drainage problems as well as the formation of sinkholes.

Catchbasins with a Sump of Less Than One Foot (refer to Map EE of Appendix D, Table 10 of Appendix D, and Photo 38 of Appendix E)

- Throughout the field investigation, a total of 330 catchbasins with a sump of less than one foot were observed.
- These structures will require more frequent cleaning as there is no reservoir for debris and sediment to collect. The lack of sediment collection also increases the likelihood of pipes clogging downstream.
- These structures also fail to provide any form of treatment before discharging the stormwater at a nearby outfall. Catchbasins with a sump allow sediment and debris to settle out before reaching the outfall.

Heritage Way Hood Outlets (refer to Map FF)

- Five hood outlets located on Heritage Way were observed to be located in the drain manholes and not in the catchbasins. It is important to note the location of these hoods because the drain manholes will have to be cleaned instead of the catchbasins.

Manholes with Animal Scat Observed (refer to Map GG, Table 11 of Appendix D, and Photo 39 of Appendix E)

- A total of 32 manholes were observed that contain animal scat.
- Animal scat may explain high bacteria levels during future outfall sampling.

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