ENERGY REDUCTION ACTION PLAN

for

The Town of Swampscott
Municipal and School Buildings and Facilities

In Support of an Application to Achieve Designation
In the Commonwealth of Massachusetts
As a

Green Community

Under

Chapter 169 of the Acts of 2008

AN ACT RELATIVE TO GREEN COMMUNITIES

May 6, 2010

TOWN OF SWAMPSCOTT
22 Monument Ave., Swampscott, MA 01907

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Executive Summary

The Town of Swampscott will reduce the amount of energy consumed by 20% from a baseline set at July 2008 – June 2009 at all of its municipal and school facilities by creating, implementing, and following this Energy Reduction Action Plan in the next five years. The objective of this plan is to guide the fiscally and environmentally responsible usage of energy while maintaining a level of services within the Town that residents have come to expect.

Key elements of the plan include:

- Execution of an Energy Services Contract (ESCo) with Johnson Controls, Inc. (JCI) utilizing the results of the Investment Grade Energy Audit completed in February, 2010 of all municipal and school buildings in Swampscott

- Construction of an Energy Efficiency Improvement project at the Town's wastewater pumping station, in collaboration with National Grid

- Continued efforts to evaluate, design, and implement renewable energy installations in Town.

- Accurate measurements and analysis of energy use including an annual review of trends and costs.

- Continuing operation of the Swampscott Renewable Energy Committee to keep residents involved.

- Applying energy efficient and sustainable building practices to the extent feasible in all major facility construction/renovation projects.

The energy baseline and reduction plan was developed with contributions from the following parties:

The Swampscott Renewable Energy Committee; Tara Gallagher (Chair), Dorothy Allen, Neal Duffy, Milton Fistel, Victoria Masone, Sydney Pierce, Wayne Spritz, and Brian Watson.

Terence Dansdill, former Swampscott Renewable Energy Committee member

Andrew W. Maylor, Town Administrator

Edward Cronin, Business Manager, Swampscott Public School District

Johnson Controls, Inc.

Woodard & Curran, Inc.

Letters Verifying Adoption of the Energy Reduction Action Plan

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May 10, 2010

Massachusetts Department of Energy Resources
Green Communities Division
100 Cambridge Street, 10^{th} Floor
Boston, MA 02114

To Whom It May Concern;

This letter serves as verification of adoption by the Town of Swampscott of the Energy Reduction Action Plan for the Town of Swampscott (Plan) dated May 6, 2010 and heretofore submitted by the Town of Swampscott.

As Town Administrator for the Town of Swampscott, I pledge commitment to the effort to reduce energy use in the Town facilities, beginning with execution of an Energy Services Contract (ESCo) in Spring 2010.

Please do not hesitate to contact me directly with any questions on the enclosed Plan, or on this adoption verification letter.

Sincerely,

Andrew W. Maylor
Town Administrator
Town of Swampscott

SWAMPSCOTT PUBLIC SCHOOLS
School Business Office

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May 10, 2010

Massachusetts Department of Energy Resources
Green Communities Division
100 Cambridge Street, 10^{th} Floor
Boston, MA 02114

To Whom It May Concern;

This letter serves as verification of adoption by the Swampscott School District of the Energy Reduction Action Plan for the Town of Swampscott (Plan) dated May 6, 2010 and heretofore submitted by the Town of Swampscott.

As Business Manager for the Town of Swampscott School District, I pledge commitment to the effort to reduce energy use in the school facilities, beginning with execution of an Energy Services Contract (ESCo) in Spring 2010.

Please do not hesitate to contact me directly with any questions on the enclosed Plan, or on this adoption verification letter.

Sincerely,

Edward Cronin
Business Manager
Town of Swampscott School District

I. Introduction

The Town of Swampscott is a seaside community of 14,600 residents located 15 miles northeast of Boston along the coastline of the Atlantic Ocean. The Town consists of 3 square miles, and is considered densely populated. Residents are served by three elementary schools, one Middle School and one High School. Municipal facilities include a Police Station, Fire Station, Department of Public Works (DPW) Garage, Wastewater Pumping Station, Town Hall, Public Library, and assorted recreational facilities. The Swampscott Senior Center is incorporated into the High School facility. Fuels consumed at the various facilities include electricity, natural gas, and fuel oil. The vehicle fleet for the Town includes 45 DPW vehicles, 15 Police vehicles, 7 Fire vehicles, 2 Council on Aging vehicles and 7 School vehicles. The entire fleet runs on either unleaded or diesel fuel.

The primary goals of the Town through this Energy Reduction Action Plan (Plan) is to achieve designation as a Green Community, and to help pursue greater energy efficiency, reduced energy costs and reduce greenhouse gas emissions.

The Swampscott Renewable Energy Committee (REC) has been tracking energy use at all school and municipal facilities since 2005. The energy use baseline for this Plan was determined with the help of Johnson Controls, Inc. (JCI), an Energy Service Company (ESCo) with whom the Town has contracted to design, construct and monitor energy efficiency measures Town-wide. The Assistant Engineer for the Town has since been trained on the MassEnergyInsight software, and intends to transition the existing utility data into that software for use in tracking energy reduction progress.

Goals and Strategies to be used in carrying out this Plan include close review of the Measurement and Verification Annual Report produced by JCI by the Town and by DOER, independent monitoring of energy use by the Town using MassEnergyInsight, and periodic updates to the School District and the Swampscott Board of Selectmen on our status, progress made to-date, and short-term goals.

II. Results of Energy use Baseline Inventory

1. Inventory Tool Used

The Swampscott Renewable Energy Committee (REC) has been tracking energy use at all school and municipal facilities since 2005 using direct downloads from the utility companies and Microsoft Excel® (MSExcel). The Assistant Engineer for the Town has since been trained in use of the MassEnergyInsight software and intends to transition all of the existing data into that tool for use into the future. Fuel use for the vehicle fleet is tracked in an independent fuel-dispensing software program in place at the fueling station at the DPW garage. This data must be manually entered into MassEnergyInsight. Street and traffic lighting is also tracked in MSExcel from direct downloads from the utilities. All of the utility data compiled by the Town was delivered to Johnson Controls, Inc. (JCI) at the inception of the ESCo project, and was used by JCI to establish our energy baseline. The period between **July 2008 - June 2009** was selected as our energy baseline since that data set was most complete and most representative of existing conditions with regard to building use.

2. Existing Municipal Energy Use

Municipal and School Buildings: Our baseline energy use was determined by JCI for ten school and town facilities listed below in Table 1.

Table 1 : Facilities Included in Baseline Determination and Energy Audit

Swampscott Town Buildings			
Building	**Address**	**Square Footage**	**Year Built**
Clarke School and Portables	100 Middlesex Ave.	28,912 1,500 (ports.)	1952
Stanley School	Whitman Road	38,400	1929
Hadley School	Redington Street	58,000	1911
Middle School	207 Forest Ave.	179,747	c. 1956
High School	200 Essex St.	197,000	2007
DPW Garage	200 Paradise Road	15,260	1950
Fire Station	76 Burrill St.	10,144	1960
Little League Complex including Concession Stand	207 Rear Forest Avenue	N/A	2008
Library	59 Burrill St.	18,500	1916, 1955, 1997
Town Hall	22 Monument Ave.	20,655	1950, 2008
Streetlights	Various	N/A	N/A

The Police Station was not considered because the Town is in the process of designing a new station and getting funds appropriated for construction. The Renewable Energy Committee attended a number of meetings with the architect and the Police Station Building Design Committee to ensure the new building is as energy efficient as practical. The Pumping Station was not considered by the ESCo because the Town is in the process of an energy efficiency upgrade at the station in collaboration with National Grid.

The baseline for these facilities was established using the protocol presented in **Attachment A, Energy Baseline Development.** The energy baseline for the period between July 2008 to June 2009 is presented in Table 2, which includes the wastewater Pumping Station, whose baseline was calculated by the Town.

Table 2 : Municipal and School Buildings, Energy Baseline for July 2008 – June 2009

Facility	Electric MMBTU	Natural Gas MMBTU	Total MMBTU
Clarke School	200	3,220	3,420
Stanley School	280	2,824	3,104
Middle School	2,199	9,563	11,762
High School	6,107	8,598	14,705
Hadley School	349	5,443	5,792
DPW Garage	83	819	903
Pumping Station	1,296	0	1,296
Police Station	188	0	188
Fire Station	251	689	940
Little League Complex	831	2,269	3,101
Library	321	679	1,000
Town Hall	573	1,530	2,104

Vehicles: The entire Town fleet fuels at a single fueling station located at the Department of Public Works garage. As such the fuel usage is easily tracked. Fuel use for the baseline period between July 2008 and June 2009 was as follows;

Vehicles	Unleaded gallons	Diesel gallons	Total MMBTU
Entire Town Fleet	35,184	6,003	4,788

Street and Traffic Lighting: The Town owns approximately one half of the streetlights in Town. The other half are owned by National Grid. As such, our control is limited to the lights that we own. JCI included our Town-Owned streetlights and traffic lights in their energy audit, and determined the energy baseline to be:

Facility	Electric MMBTU	Natural Gas MMBTU	Total MMBTU
Street & Traffic Lights	2,390	0	2,390

In 2006 the Town replaced all of its incandescent traffic lights (209 total) with LED technology. The total cost was $29,590 of which $13,090 was received by the utility in the form of a rebate, yielding a net cost to the Town of $16,500. The average life of an LED bulb is seven years while the average life of an incandescent bulb is one year. Also, a 12-inch LED signal uses 25 watts compared to 150-watts for an incandescent bulb in a comparable application. As a result of the 2006 conversion on our traffic lights, there is no work anticipated on the traffic lights in the near future.

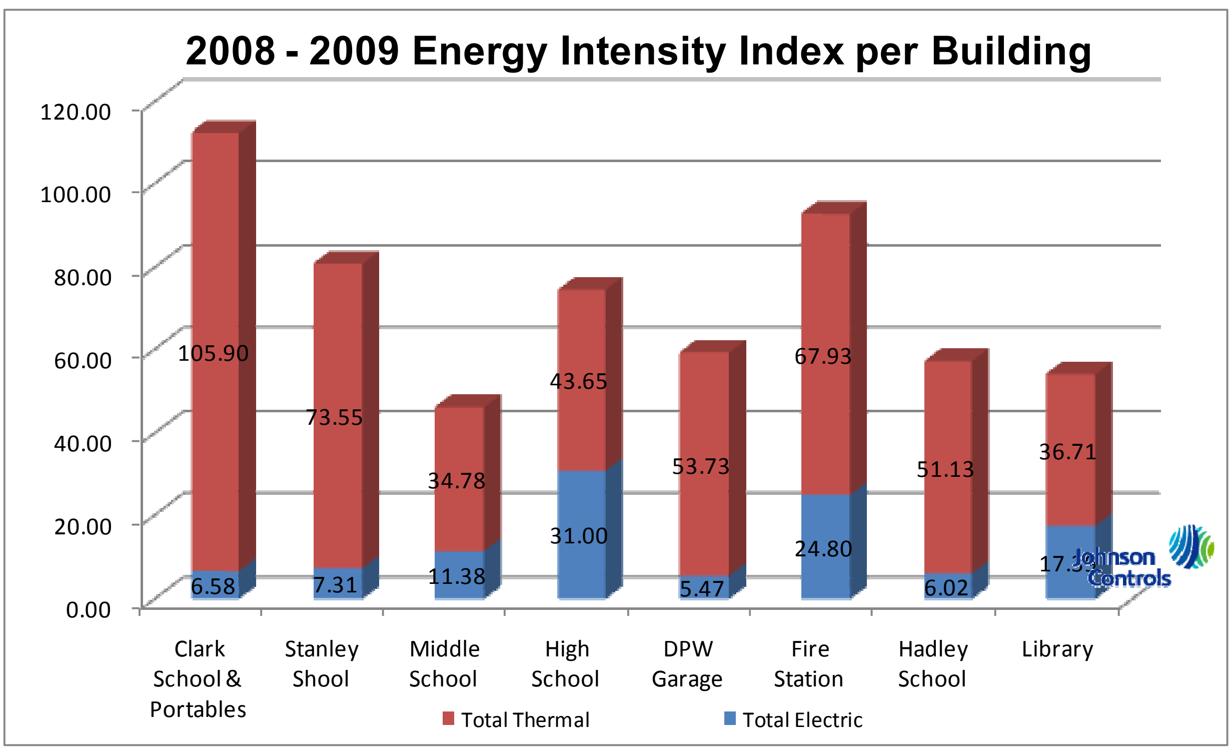
3. Existing Efficiency Measures Implemented in the Last 2 Years

The Town of Swampscott has implemented a number of energy efficiency measures within the School District in the last two years. Most notably, all of the windows were replaced at the Clarke Elementary School with EnergyStar® rated windows. Approximately one-third of the roof on the Middle School was replaced and the insulation increased from 2" foam insulation to 5" foam insulation. One-half of the windows in the Middle School have also been replaced, with the rest to follow in FY11 and FY12. On the municipal side, the historic Town Hall building underwent a $3M renovation in 2008 which included conversion of oil to natural gas heat, and installation of a climate management system whereby the building climate can be scheduled to accommodate weekends, evenings, and holidays. Exterior lighting around the Town Hall operates on new timers.

4. Areas of Least Efficiency / Greatest Waste

As part of the energy audit, JCI prepared a chart of Energy Intensity Index for each building to determine where the most opportunity exists for energy efficiency improvements. A summary of the most notable results are below in Figure 1.

<u>Figure 1 : Energy Intensity Index</u>



The highest energy index represents the facility with the most opportunity for energy efficiency improvements. Although all of the buildings and facilities were examined closely during the energy audit, Clarke School, Stanley School, the High School and the Fire Station were especially considered due to their relatively high energy intensity indices.

5. Areas That Can Most Easily Be Addressed

The priority improvements identified in the energy audit were those that can most easily be addressed and yield the most benefit. These improvements are referred to as "low-hanging fruit" and are primarily focused on lighting. These improvements will be addressed through the ESCo project.

III. Summary of Energy Audit

The Town & Schools of Swampscott have an objective of creating a comprehensive approach to energy efficiency for the Town & Schools. Johnson Controls, Inc. (hereinafter "JCI") was selected by the Town & Schools of Swampscott (hereinafter "Town & Schools") to conduct a detailed energy audit for five (5) School building and five (5) Town buildings. The goals of this study are to identify and quantify opportunities to improve the energy efficiency of the Town & Schools, improve the reliability of mechanical and electrical systems and to maintain or increase occupant comfort and well-being. This report provides the results of the Detailed Energy Audit conducted by JCI during mid-November, 2009–mid-January, 2010.

JCI wishes to thank Victoria Masone and Garrett Baker and the Town & Schools's staff for their invaluable assistance and generous time spent with the JCI team during this study effort. Their experience has provided valuable insight to the systems and operating parameters that has helped to formulate JCI's recommendations.

This report provides detailed findings including descriptions, savings, costs and specifications for the recommendations. JCI has also included a financing scenario which will assist The Town & Schools to implement the recommendations utilizing funds available to the Town & Schools that JCI has identified.
The following tasks were performed by JCI during the detailed energy audit:

- Collected utility data and create a one year historical baseline of usage and costs for electricity, natural gas and fuel.
- Analyzed facility drawings for design intent and equipment information.
- Interviewed Town & Schools staff to identify issues and opportunities at buildings.
- Conducted onsite engineering survey including combustion efficiency of boilers and data logging of facility conditions and equipment, including light levels, temperatures, and carbon dioxide levels.
- Performed a retro-commissioning study of the existing HVAC equipment at the Clarke, Hadley Middle and Stanley Schools to determine functionality and identify opportunities for improvement.
- Generated a list of recommendations with scope of work and specifications.
- Determined actual costs and guarantee savings for this facility and created a cash flow using available funding.

Financial Summary

Project Cost	**$3,506,289**
First Year Maintenance and Repair Savings	**$14,306**
First Year Guaranteed Energy Savings	**$259,024**

Findings

FIM MATRIX											
FIM #	Description of Measure	Middle School	Swampscott High School	Clarke School	Hadley School	Stanley School	Town Hall	Library	DPW	Fire Station	Little League Fields
FIM 1	Lighting - Fixture Retrofit	✓	✓	✓	✓	✓	✓		✓	✓	✓
FIM 2	Lighting - Fixture Controls	✓	✓	✓	✓	✓	✓	✓		✓	✓
FIM 3	Building Envelope - Weatherization	✓	✓	✓	✓	✓	✓	✓	✓	✓	
FIM 4	Energy Management System Upgrades	✓	✓	✓	✓	✓		✓			
FIM 6	Steam Distribution System - Steam Traps Replacement			✓	✓	✓					
FIM 7	Heating System Upgrade - Boiler / Burner Replacement			✓							
FIM 8	Heating System Upgrade - Boiler Controllers			✓		✓	✓			✓	
FIM 11	Building Envelope Improvements- Roof/Wall/Attic Insulation			✓						✓	
FIM 16	Kitchen Hood - VFD on Exhaust Fan		✓								
FIM 18	Water Conservation	✓		✓	✓	✓		✓		✓	
FIM 19	Vending Machine Controllers	✓	✓								
FIM 23	Street Lights										
FIM 26	Cogeneration		✓								
FIM 27	Refrigeration Upgrades	✓	✓								
FIM 28	Recommissioning	✓		✓	✓	✓					

Legend:
✓ Measure(s) Selected

The major findings of this study are as follows:

- There are many opportunities to reduce energy and operating costs within the own buildings. By implementing the recommendations outlined in this study, the Town & Schools could reduce energy costs by 27% based on the adjusted one year utility data established as the baseline period.
- The buildings boiler(s) and domestic hot water systems in general are in very fair condition, in many cases brand new. The boilers at the Clarke School are almost fifty (50) years old and well past their life cycle, however they are still quite functional. The boilers at the Hadley School are in disrepair but the configuration is such that they are still efficient.
- The HVAC systems are also in fair condition but opportunities exist for operational and energy efficiency improvements.
- Light levels were measured and found to be within the acceptable range in classrooms and hallways. Much of the existing lighting has already been upgraded to T8 lamps and electronic ballasts.
- The building envelope is in fair condition with the exception of the single pane windows at the DPW and some windows at the Library. Opportunity exists for improvement in those locations.
- There is opportunity to upgrade to the Metasys building automation system at the High School to an updated version of Metasys Extended Architecture. It is currently not compatible with newer revisions of the product.
- The plumbing fixtures in the Clarke, Hadley and Stanley Schools can be replaced with lower consumption fixtures.
- The High School is situated such that renewable photovoltaic energy systems may be installed on the roof.

IV. Summary of Fossil Fuel Reduction Measures

1. Overview of Short- and Long- Term Goals

The Town of Swampscott intends to take a three-pronged approach to reduce our fossil fuel consumption in the short-term.

The cornerstone of our efforts resides in the Energy Services Contract we are prepared to execute with Johnson Controls, Inc. Phase I of the project will be initiated in the summer of this year, and the entire project, to be completed within the next five years in a phased approach, will result in a reduction of 16.6% from our energy baseline in accordance with Table 3.

Table 3 : Energy Baseline Reduction Yielded by ESCo Project

	ELECTRIC MMBTU	NATURAL GAS MMBTU	TOTAL MMBTU
EXISTING MMBTU	16,713	42,740	59,454
POST MMBTU	12,650	36,907	49,558
		% Reduction	16.6%

The Town is also in the process of designing an energy efficiency improvement project at the main wastewater pumping station, located at 531 Humphrey Street. The pumping station receives all of the wastewater in town and conveys it to the Lynn Municipal Wastewater Treatment Facility via a 24-inch force main. The station contains three 250-hp centrifugal pumps with VFDs, and two grinders in the headworks building. The station was converted from a primary treatment plant to a pumping station in 1992, and therefore the age of the equipment is approximately 18 years old. In July 2009 Woodard & Curran, Inc. was hired by National Grid to prepare an Efficiency and Economics Study on the proposed improvements to determine our eligibility for a utility rebate. The project was subsequently approved by National Grid in December 2009 and will go to construction in the summer of 2010. The Study is included in this document as Attachment B, which shows a projected savings of 55,450 KWH per year or 174 MMBtu per year which will bring us up to a 17% reduction.

Long-term goals for reducing energy consumption in the Town of Swampscott include subsequent phases of the ESCo project, execution of the School District Master Plan which will include consolidation of schools, and continued outreach and education by the Renewable Energy Committee to residents, students, employees, and visitors to the Town.

2. Getting to 20%

Prioritized list of strategies to reduce fossil fuel usage: The Town's first priority in reducing energy usage is execution of the ESCo Contract with Johnson Controls, Inc. The project was approved by Town Meeting on May 3, 2010 and the contract is under negotiations as of this date. The project is expected to go to construction in the summer of 2010. Construction of the energy efficiency improvements at the Pumping Station is expected to occur parallel to the ESCo Contract. Sale of the vacant Town buildings is expected to occur within calendar year 2010.

Tools, Resources and Financial Incentives: Many of the Energy Conservation Measures (ECMs) proposed within the ESCo Contract are eligible for utility rebates. Pursuing these rebates, estimated to be close to $73,000 for Phase I, is within JCI's scope of work. The energy efficiency project at the Pumping Station has already been evaluated by National Grid, and is eligible for a $24,000 rebate from the utility.

Program Management Plan for Implementation, Monitoring and Oversight: Implementation of this Plan will be overseen primarily by the Town Administrator and the School Business Manager. Monitoring and oversight will be done by the Department of Public Works and the School Facilities Manager with assistance from the Renewable Energy Committee. As part of the ESCo Contract, JCI will be required to submit an annual report on our actual energy savings, in accordance with the M&V Guidelines: Measurement and Verification for Federal Energy Projects Version 3.0, developed for the U.S. Department of Energy. This report will be independently reviewed by the Massachusetts Department of Energy Resources (DOER), and representatives from the Town in order to measure the success of the ESCo's efforts. Energy tracking using MassEnergyInsight will occur concurrently, through the Swampscott Department of Public Works and the Renewable Energy Committee.

V. Fossil Fuel Energy Reduction Measures

1. Short-term energy reduction goals – getting to 20% reduction in 5 years

Municipal Buildings (including schools): The majority of the short-term energy reduction goals are detailed in the Investment Grade Energy Audit prepared by Johnson Controls, Inc. (JCI). This section presents a summary of the projects to be implemented through the ESCo project, while the full audit document is available for review upon request due to file size. Projected savings and capital and operating costs associated with each of these energy conservation measures are included as Attachment C to this Plan. Phase I of these improvements are scheduled to occur in Summer of 2010 with the remaining phases to occur in FY12 and FY13. The full scope of the ESCo project will yield a 16.6% energy savings from our established baseline annually.

Lighting – Fixture Retrofit and Fixture Controls

Retrofit existing T8 lamp fixtures with Super T8 lamps without compromising light quality, replace HID fixtures with high output fluorescent and install occupancy sensors to ensure that lights are on only when required.

JCI performed a detailed survey of the interior spaces at all the Town & Schools buildings to find opportunities to capture energy savings, improve lighting quality and reduce maintenance costs. As a result of the survey and analysis, JCI has developed a high efficiency lighting upgrade project that will provide the Town & Schools with new energy efficient lighting fixtures, lighting sensors and day-light controls resulting in guaranteed annual energy savings and a reduction in electrical demand.

Building Envelope Improvements – Weatherization

Install caulking, weather-stripping and seal roof-wall joints to prevent infiltration and improve insulating properties and reduce infiltration.

JCI conducted a detailed visual inspection of all the buildings to verify suspected air leakage locations. There are a number of building envelope defects and deficiencies that are contributing to higher than necessary air infiltration or ex-filtration. The defects also accelerate the deterioration of building components and increase maintenance costs. The building envelope treatments to be implemented will increase the overall energy performance of the building. Beyond the energy saving opportunities, the measures will also improve the air quality by limiting ingress of contaminants from outside and moisture migration throughout the structures.

Building Controls Upgrades / Re-commissioning

Install a web-enabled Building Management System to update occupancy schedule and temperature set points. In addition, JCI will re-commission existing pneumatic building controls and equipment to enable more efficient operation through the application of building temperature setbacks and enhanced building control.

The High School has a Johnson Controls Metasys DDC system. The other four (4) school building's original temperature control systems are pneumatic. The control panel controls the day/night operation of each pneumatic zone and boiler operation using mechanical time clocks. The pneumatic control systems that are installed in the buildings are intended to automatically operate with day/night schedules. Manual operation does occur on some equipment including boilers. No school has trending capability to troubleshoot problem areas or overheating issues, which was made clear with interviews with school staff. This mode of control is not reliable for achieving energy savings. This measure proposes the installation of improved building controls to provide reliable temperature control with enhanced monitoring and trending capabilities.

Demand Control Ventilation

The Middle School is served by air-handling units that operate with a fixed outside air damper. By installing a CO2 sensor to determine occupancy levels, the outside air damper can be modulated to meet only the requirements of the actual level of occupancy.

The Outside Air (OA) Control uses data from CO2 sensors to adjust outside air dampers and the air handling units so that they maintain indoor air quality (specifically, CO2 levels) per ASHRAE Standard 62.1-2004. The primary advantage of installing OA controls is that they help ensure the quality of the air in the indoor environment, promoting a healthy work or living environment. In addition, by controlling system components (such as damper actuators) so that they bringing into a facility only the amount of outside air required to meet AHRAE standards, we can lower the amount of energy used and help reduce energy costs.

Steam Distribution System- Steam Trap Replacement

Johnson Controls will replace steam traps in schools that have extensive steam distribution systems. On average, a steam trap population can experience from 5-10% failure each year. Left unaddressed, steam traps that have failed open can leak significant quantities of steam with its attendant energy loss.

JCI conducted a detailed steam trap survey and also inspected some of the steam traps for failures. Trap failures that result in steam passing through the traps are a substantial financial loss that requires a steam trap program, which includes an audit and the necessary repairs.

Energy Efficient Boiler Replacement

Install a high efficiency steam boiler at the Clarke Elementary School as the existing boiler is original and well beyond its useful life.

Heating System Upgrade – Burner Upgrade / Burner Controls

Install boiler controllers that save boiler energy by increasing the cycle lengths and reducing pre and post-purge losses.

Typically, boiler burners are sized to accommodate the coldest days (5% of a yearly requirement). During these periods of maximum demand, the burner is constantly on and the boiler is operating at its maximum capacity. At all other times, the burner cycles on and off maintaining temperature or pressure in the boiler. It is during these periods of lesser demand, that the controller will learn the boiler make-up rate and efficiently manage the firing of the boiler. The load is directly related to the time it takes for water (or steam) in the boiler to drop from its high-limit temperature (or pressure) to its low-limit or “call” setting. When demand is high, these off-cycles are short and the on-cycles are longer. When demand is lower, off-cycles are longer and on-cycles are reduced.

Domestic Hot Water – Heat Recovery

There are opportunities to capture heat that is unused from other process, such as cooling, and use it to pre-heat domestic hot water. The walk in cooler and freezer refrigeration system at the High School offers an opportunity to capture the heat that system rejects to the outside and use it to pre-heat the domestic water used at the High School.

Building Envelope Improvements – Roof / Wall Insulation

Heat flows naturally from a warmer to a cooler space. In the winter, this heat flow moves directly from all heated living spaces to adjacent unheated attics, garages, and basements, or to the outdoors; or indirectly through interior ceilings, walls, and floors--wherever there is a difference in temperature. During the cooling season, heat flows from outdoors to the building interior. To maintain comfort, the heat lost in winter must be replaced by the heating system. Insulating ceilings, walls, and floors decreases this heat flow by providing an effective resistance to the flow of heat.

Building Envelope – Window Film

The conditioned areas of the High School are fitted with a large amount of double pane windows that allow infrared radiation heat gains in the summer and heat loss in the winter. This building is used extensively during the summer and has air conditioning units that maintain cooling set points. This measure proposes the installation of window film on the interior side of the windows to prevent energy loss during the winter and also will reduce cooling requirements during the summer.

Kitchen Hood – VFD on Exhaust Fan

The High School kitchen currently has an exhaust hood with a fan that runs at a constant speed throughout the day. The exhaust hood serves the ovens, ranges and fryers. The fan is being operated at a constant speed and controlled manually. The existing setup exhausts a constant volume of valuable conditioned air whether or not there is any cooking going on. There is a dedicated make up air (MUA) unit on the roof that supplies heated makeup air to the kitchen.

It is recommended that a Variable Frequency Drive (VFD) be installed on the exhaust fan and controlled by the heat of the exhaust.

Water Conservation

Upgrade standard flow fixtures to low flow fixtures will significantly lower the operating costs of the facility through utility savings.

All of the buildings were surveyed for the application of this measure. Sink retrofits offer good energy saving opportunities because any of these fixtures can be retrofitted with new low flow aerators to reduce the amount of water consumed per minute. Reducing sink water usage saves not only saves water but also energy that would otherwise be used to make hot water.

Vendmisers

The buildings throughout the Town are equipped with refrigerated beverage vending machines. This measure addresses the inefficient control system that is standard on all units. At present, all of these units run 24 hours a day throughout the year with the refrigeration compressors running 33 percent of the time irrespective of the facility or the equipment being occupied.

Johnson Controls proposes to install Vending Miser controls on all vending machines. Utilizing a custom passive infrared sensor, the controller powers down a vending machine when the area surrounding it is unoccupied and automatically re-powers the vending machine when the area is reoccupied. The intelligent controller develops optimal start-stop based upon the building occupancy, and modifies the time-out period accordingly.

Solar Photovoltaic System

JCI is currently developing a Power Purchase Agreement (PPA) for a solar PV system to be put on the High School. Further details will be provided in a separate document.

Streetlights

Replace existing High Pressure Sodium (HPS) street lights with induction light fixtures. Induction technology uses less electricity, provide better quality light and last longer than 100,000 hours.

Facility Performance Indexing

Facility Performance Indexing is a program that takes Metasys data and converts it into useful diagnostic information. This application would be most beneficial at the High School for optimizing operations considering the complexity of the systems there. FPI can also benefit operations at the other schools

Cogeneration

The electricity and natural gas costs at the High School are favorable for Cogeneration. The High School is used enough to make use of the energy (electricity and heat) generated from the

Refrigeration Upgrades

This FIM recommends refrigeration controllers on walk-in coolers and freezers and installing Electrically Commutated Motors (ECM) on evaporator fans. The controllers will reduce compressor and evaporator runtime by up to 10%. The ECM fans are 30% more efficient than the standard two pole motors. Energy savings will be realized by reducing the runtime of the compressors and evaporator fans and the reduction in kW load of the new fans.

Solar Thermal System – Evaluated but not included in scope at this time

JCI evaluated the use of a solar thermal system to provide energy for a portion of the domestic hot water load at the High School, this project did not have an attractive payback.

Pumping Station – The Town is in the process of designing an energy efficiency improvement project at the main wastewater pumping station, located at 531 Humphrey Street. The pumping station receives all of the wastewater in town and conveys it to the Lynn Municipal Wastewater Treatment Facility via a 24-inch force main. The station contains three 250-hp centrifugal pumps with VFDs, and two grinders in the headworks building. The station was converted from a primary treatment plant to a pumping station in 1992, and therefore the age of the equipment is approximately 18 years old. In July 2009 Woodard & Curran, Inc. was hired by National Grid to prepare an Efficiency and Economics Study on the proposed improvements to determine our eligibility for a utility rebate. The project was subsequently approved by National Grid in December 2009 and will go to construction in the summer of 2010. The project capital cost is expected to be $200,000 and we are expecting to receive a $24,000 rebate from the utility. The project will yield approximately $7,200 in savings annually or an additional <u>0.4% reduction</u> from our established baseline.

Vehicles (including schools): The Town of Swampscott owns and maintains a fleet of 45 DPW vehicles, 15 Police vehicles, 7 Fire vehicles, 2 Council on Aging vehicles and 7 School vehicles. The entire fleet runs on either unleaded or diesel fuel. In May 2010 the Town and the School District voted on and approved a new Fuel Efficient Vehicle Purchasing Policy which dictates the required fuel efficiency of future passenger vehicle purchases in the Town. This is not expected to reduce energy use substantially since new passenger vehicles are not purchased very often in Town. In the past five years the Town purchased one new passenger vehicle for the Fire Department.

The Town adopted a Fuel Efficient Vehicle Purchasing Policy in May 2010 which will dictate the passenger vehicles purchased in the future. Of our entire fleet, there are 27 vehicles that this will affect should they need to be replaced. As mentioned previously, vehicles are not purchased very often in Town so this is not expected to contribute significantly to our energy reduction efforts.

Street and traffic lighting: Street lighting is the second largest source of electrical energy demand (20%) in the Town of Swampscott, second only to the new High School (40%). As such, street lighting was closely examined in the energy audit conducted by Johnson Controls, Inc. (JCI). Phase I of the ESCo Contract includes retrofitting of 103 130-watt streetlight fixtures with 40-watt fixtures, 293 295-watt fixtures with 150-watt fixtures, 10 460-watt streetlight fixtures with 200-watt fixtures, and 2 455-watt fixtures with 200-watt fixtures. This project will be installed in the Summer of 2010, resulting in nearly instantaneous energy savings. The installed cost of the project is $68,675 and will be paid for out of future energy savings. The energy savings is expected to be $32,144 annually, for a payback period of just over 2 years. Phase II of the ESCo project will include retrofitting of 1008 95-watt streetlight fixtures with 40-watt fixtures. This was eliminated from the Phase I project because the utility does not have in place a rate structure to incentivize installation of the lower watt fixtures. The Town of Swampscott along with JCI intends to work with the utility in upcoming years to resolve this issue and make the retrofit financially viable for the Town. These percent reductions are included in the overall reduction through ESCo of 16.6%.

Municipally-Owned and -Operated Clean Renewable or Alternative Energy Installations: The Town of Swampscott has been actively pursuing renewable energy since the inception of the Renewable Energy Committee in 2006. The three technologies being pursued are wind power, solar photo-voltaic, and geothermal heating.

In March 2008, The UMass Renewable Energy Research Lab (RERL) conducted a site walk and subsequent fatal-flaw analysis to evaluate three potential wind turbine sites identified by the Town and the Renewable Energy Committee. Their report, <u>Wind Power in Swampscott: Siting Considerations for a Wind Turbine, March 18, 2008</u> is included as Attachment D to this Plan. RERL determined the Forest Avenue site to be the most viable, and so the Town retained a consultant and applied for a Feasibility Study grant through the Commonwealth Wind program in November 2009. The Town was denied during that grant round, and most recently applied for Block III of the Commonwealth Wind grant program in April 2010. The grant recipients have not yet been announced. Table 4 below summarizes the cost-benefit analysis of the two proposed alternatives for a wind turbine installation at the Forest Avenue site.

Table 4 : Wind Project Technical Information

Proposed Wind Project System Size	Annual Net Electricity Production Estimate (kWh) and Estimate of Behind the Meter Electricity Use:
600 kW AC (peak output) per manufacturers specifications	kW x CF x hrs/day x days/yr = kWh/yr Produced 600 x 0.30 x 24 x 365 = 1,566,288 1500 x 0.32 x 24 x 365 = 4,231,080
Estimated Installation Completion Date of Wind Energy Project: November, 2011	

Estimated Simple Payback of Wind Project without MassCEC Incentive (years):

Unit Rating kW	Total Cost Est.	Rate $/kWh	CF	hrs/yr	Save $/yr	Payback yrs
600	$2M	$0.13	0.30	8760	$224,256	10
1500	$4.1M	$0.13	0.32	8760	$605,371	8

Estimated Simple Payback of Wind Project with MassCEC Incentive (years):

Unit Rating kW	Total Cost Est. w/ Max Grant	Rate $/kWh	CF	hrs/yr	Save $/yr	Payback yrs
600	$1.7M	$0.13	0.30	8760	$224,256	9
1500	$3.8M	$0.13	0.32	8760	$605,371	7

If we are successful in obtaining grant funds for a Feasibility Study through Commonwealth Wind, the feasibility study yields favorable results, and we are successful in obtaining grant funds for Design and Construction through Commonwealth Wind, the turbine could be installed as early as November 2011. This project would offset 100% of the electrical energy use at the Middle School or 2,199 MMBtu or an additional 3.6% reduction from our baseline. This project is not guaranteed to be viable within the next five years due to uncertainties with grant funding, so it is not included in our short-term plan for energy reduction.

The Town is also pursuing a Solar Photovoltaic (Solar PV) array at the new High School and a portion of the Middle School where the roof was recently replaced. The project will be financed through a third party, and the Town will purchase power at a rate below retail from the third party financer. While this method is not as financially attractive to the Town as purchasing and installing the PV array ourselves, the lack of capital funds makes it the only viable option to getting solar power in Swampscott. The proposed project is a 200 kW array on the High School, and a to-be-determined array at the Middle School. The installation cost is $1.3M on the High School and the estimated production accounting for actual orientation and shading is 212,019 kWh. The Town applied for a grant through the Commonwealth Solar program in January 2010 and was consequently denied grant funding. We applied for Block II of the Commonwealth Solar funds in April 2010 and are waiting to hear the results of that application. Regardless of success in obtaining grant funds, the Town intends to move forward with installation of the project in Summer 2010. The High School array is anticipated to produce 220,850 KWH annually for a reduction in fossil fuel energy use of 754 MMBtu or an additional 1.2% reduction from our baseline.

Finally, the Town pursued installation of a geothermal heating system for the Swampscott Public Library. In December 2009 the Town applied for the Energy Efficiency and Conservation Block Grant through the Department of Energy Resources and was subsequently denied due to the payback period of the system without grant funds. The estimated cost of the project was $185,000 and the grant amount was $150,000. The system would have reduced our energy use at the Library by 6,642 kWh annually. It was scheduled to also be installed in Summer 2010. The Town intends to continue pursuing this opportunity through grants or other financing mechanisms. Although this project would be an exciting renewable energy effort, it would yield a less than 1% reduction in our energy baseline due to the relatively small size of the library compared to our other facilities.

Education and Outreach: The Town intends to continue its education and outreach efforts through the Renewable Energy Committee to residents, students, businesses and employees in the Town. Initiatives completed to date are presented in **Attachment E, Chronology of the Renewable Energy Committee** and include an "Ask The Energy Miser" column in the Swampscott Reporter, outreach forums on LEED buildings and on Geothermal Energy, tours for local officials of "green" elementary schools in Salem and in Beverly, a "Battle of the Bulb" competition with the Town of Marblehead to encourage residents to take a pledge to change a light bulb to a CFL (this contest included many outreach events at schools and local events), meeting with and financial support of the High School Physics Club's investigation of renewable energy technologies, an information-packed website, outreach sessions on the Stretch Energy code, and many other initiatives. The Renewable Energy Committee intends to continue with these efforts to achieve the remaining 1.8% reduction required to get Swampscott to 20%.

Total Projected Fossil Fuel Reduction:

Table 5 : Summary of Reductions Within Five Years

Energy Reduction Measure	Projected % Reduction Yielded
Municipal Buildings Through ESCo	16.6%
Streetlights / Traffic Lights	Included in ESCo number
Wastewater Pumping Station	0.4%
Solar PV on High School	1.2%
Education and Outreach	1.8%
TOTAL	**20%**

2. Measurement and Verification Plan for Projected Reductions

Measurement and Verification (M&V) will be conducted both by the ESCo and by the Town, independent of each other. The ESCo is required to produce an annual M&V report in accordance with M.G.L - Chapter 25A, Section 11i. The annual M&V report from the ESCo will be reviewed by both the Town and the Massachusetts Department of Energy Resources. M&V will be conducted in accordance with the U.S. Department of Energy's M&V Protocol.

The Town will continue to track energy data using the MassEnergyInsight software developed by DOER for Massachusetts cities and Towns. The Assistant Engineer has been trained in the software and will be in charge of compiling all of the data, creating tracking reports, and comparing actual vs. projected reductions proposed in this Plan.

3. Long-term energy reduction goals – Beyond 5 years

The Town is committed to continuing its energy reduction efforts beyond the five-year term of this Plan. A new Police Station and a new DPW complex are the next two municipal buildings anticipated to be constructed beyond the five-year period. Since the Town has adopted the Stretch Energy Code, we are assured the buildings will be constructed in an energy-efficient manner with consideration given to life-cycle costs of the facility.

The Town of Swampscott adopted a Fuel Efficient Vehicle Purchasing Policy as part of our effort to become a Green Community. With this policy in place we can be assured that future vehicle purchases will be made with consideration of fuel efficiency.

At the conclusion of our ESCo Contract we will have extracted all of the available energy savings from our street lighting in Town, and our traffic lights have already been converted to LED technology. Unless new, more energy efficient street and traffic lighting technology is developed, we do not see any future work on our street or traffic lights.

The Town intends to direct its efforts to Renewable Energy installations in the period beyond five years, including wind power at the Middle School, geothermal heating at the Library, and additional solar PV arrays on Town buildings, pending the success of our initial High School and Middle School installations.

VI. Conclusion

The Town of Swampscott is excited about this effort to reduce fossil fuel use in Town and School facilities by 20% in the next five years. This Plan, coupled with the existing efforts of the Town's Renewable Energy Committee, will help Swampscott in its long-term financial and environmental planning efforts, and help reduce greenhouse gas emissions. The Renewable Energy Committee maintains an active page on the Town's website with updated progress on energy initiatives, which can be reviewed at:

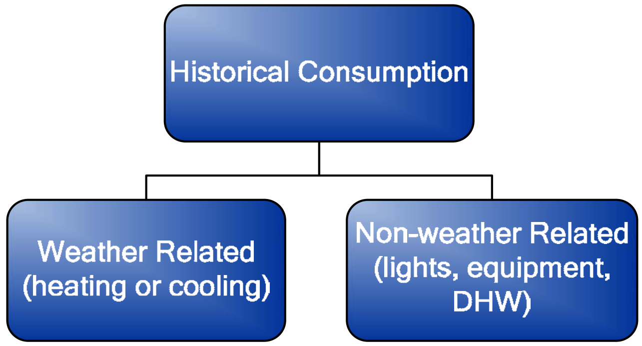
http://www.town.swampscott.ma.us/Public_Documents/SwampscottMA_BComm/energy1

Attachment A – Energy Baseline Development

Energy Baseline

This section presents the utility rates that were used to determine existing and post-retrofit estimated utility costs, and energy savings for each measure. These utility rates will also be used to determine actual energy savings following installation of the measures in accordance with the energy savings calculation methods and measurement and verification methodologies described for each measure. Energy baseline is essential for tracking effectiveness of the energy efficiency efforts and is required for guaranteeing energy savings.

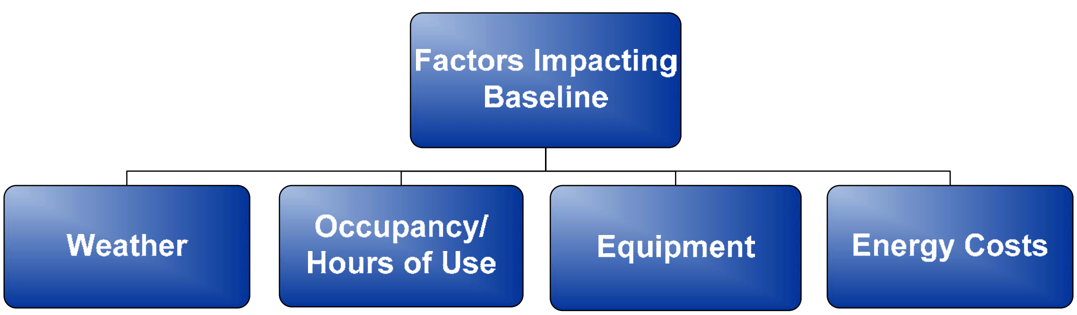
Two key elements comprise baseline data–weather-related usage and non-weather-related usage.



Baseline energy usage is compiled using one year historical utility data regarding the pre-retrofit energy usage and conditions that affect that usage, such as weather, occupancy patterns, and building use and equipment.

As conditions, equipment, and usage change, the baseline may need to be adjusted periodically to account for those variables. The guaranteed energy cost savings are based on a reduction in energy units consumed from the current baseline, under the existing conditions. Changes in price or the existing conditions can result in either reductions or increases on the baseline energy use.

The projected energy savings are cost avoidance savings, and should not be viewed as an absolute reduction in the operating costs. Energy savings will be calculated as the reduction in energy usage attributable to the performance of equipment, controls or other ensures installed as part of this project. The potential adjustments to the baseline are illustrated below.



The baseline has been structured in the following manner:

Financial baseline	The average energy budget for the two most recent complete fiscal years will be assumed to be the minimum budget and all savings are calculated from those figures.
Weather baseline	The weather data corresponding to the same fiscal year shall be the minimum heating degree days and cooling degree days.
Consumption baseline	The energy consumption during the same fiscal year shall be the figures from which savings are calculated.
Occupancy baseline	The occupancy schedules (run hours, ventilation rates, personnel levels, existing equipment, etc.) shall be the minimum values for projecting savings.

In calculating an accurate baseline, JCI takes a "snapshot" of the facility as it operated during the most recent fiscal year. Because the Town & Schools had a budget that met these conditions, this budget is the Baseline Budget or Financial Baseline to be used.

If, during the period of the energy performance contract, the weather is more severe than during this "study" period, the total savings experienced may actually be greater than anticipated, but total energy cost will also be greater.

If the weather is less severe, resulting in an overall reduction in consumption, the savings may be adjusted to determine the level of savings that would have been achieved under "normal" or baseline weather conditions. The overall energy expense to the Town & Schools in this scenario should actually be less than projections for an average winter, so a possible reduction in actual achieved savings should not throw-off project lease repayments made from net energy budgets. The establishment of an agreeable baseline from which savings are calculated should effectively remove from consideration the effects of a more severe weather period relative to the calculation of energy savings achieved during such a period.

For non-weather sensitive measures, such as lighting, savings will be based on the current occupancy hours and the applied utility rates, even if the actual hours of operation change. This weather-neutral approach facilitates the normal operation of the facilities as the Town & Schools sees fit without jeopardizing normal operations or the savings guarantee. The annual utility data obtained from the Town & Schools is attached to the Appendix.

Developing the Baseline

In order to accurately assess performance of an FIM, it is necessary to be able to make comparisons of pre-retrofit and post-retrofit conditions of the facility under similar conditions. The pre-retrofit baseline has been established by documenting conditions (in terms of unit energy consumption, energy efficiency, or other performance parameters) over a defined time period. The baseline will thus provide a yardstick for the pre-retrofit operation of the facility in terms of hours of use on a daily/monthly/yearly basis and the corresponding energy consumption performance of the facility for those hours of use. When possible, a baseline may be created from already-established energy consumption information as well. A facility may have historically recorded annual utility data by end use and utility type, which may be adequate to establish a baseline. Alternatively, a baseline may be established by using utility billing data for a utility type and knowledge of the various end uses, if the agreed-upon data are representative of pre-retrofit physical and operational conditions.

In order to develop a baseline for a facility, we must gain an understanding of the various utility types (electricity, natural gas, oil, central steam, etc.) used at the facility; whether the various utilities are metered on more than one utility (billing) meter per utility type; and whether the facility in question is a single- or a multi-building facility. Typically, a baseline is established for each utility type. For example, in an existing facility that has a constant volume HVAC system and is being considered for an energy saving retrofit, if the HVAC system is heated and cooled by electricity, then a single baseline is used to define its pre-retrofit operation and performance. If the HVAC system uses electric cooling and gas heating, then two baselines are required to define its pre-retrofit operation and performance: one for its electricity use and one for its gas use. If the project being considered addresses building(s) with multiple electric meters, multiple baselines may be necessary. An "all electricity use" facility with one utility meter and multiple buildings may require multiple baselines to identify the individual energy use pattern of each building. When we establish the baselines, the given conditions of a particular project may be simulated to lessen the complexity of baseline determination.

A baseline is the set of agreed-upon operating conditions, including hours, load(s), and other related values. The performance measurement is the measured value(s) of the (post-retrofit) operating condition(s) affected by the retrofit implementation. Energy savings are the result of the agreed-upon energy savings calculation, which is based on the difference between the performance measurement(s) and its associated baseline value(s). Energy cost savings is determined by applying the appropriate unit cost to the calculated energy savings. Total Dollar Savings is the sum of the energy cost savings from each retrofit and any other savings as identified herein.

The schematic sequence of calculations, for each day of each month, is as follows:

1. Sensible hourly loads for all zones are calculated component by component:
   (a) Envelope loads are calculated using the Transfer Function Method.
   (b) The radiant portion of instantaneous heat gains from lighting, equipment, process, and occupant loads are converted to hourly cooling loads using Room Transfer Function
   (c) The convective portion of sensible instantaneous heat gains are calculated from instantaneous hourly values
   (d) The sensible loads from air infiltration are calculated from daily average values
   (e) Duct losses are computed from duct specifications and hot and cold supply temperatures and ambient temperatures.

2. Latent hourly loads for all zones are obtained directly from (a) the latent portion of convective heat gains from equipment, occupants, and process, and from (b) the latent load from air infiltration calculated on a daily average basis only; and from (c) latent duct losses computed from duct leakage and supply and ambient humidity ratios.

3. Where indoor temperature is not held constant, actual hourly Heat Extraction Rates are calculated from the sensible cooling loads in each zone, taking into account room air circulation and thermal mass of each zone. If indoor temperature is held constant, Heat Extraction Rates and Cooling Loads are assumed identical.

4. Hourly energy use for water heating is calculated by taking into account the actual usage schedules and storage effects during times of high demand. The energy requirements to meet water-heating loads can be modeled either through stand-alone water heaters or as part of a boiler plant that also meets space-heating loads.

5. System supply air requirements and cooling coil and heating coil loads are modeled next, as a function of occupancy ventilation needs; ventilation controls; hot and cold supply air controls, and thermostat or humidistat controls.
6. Heating and cooling energy to meet heating and cooling coil loads are simulated by using performance models of boilers, furnaces, chillers, DX-air equipment, air-air heat pumps and water-air heat pumps. Sensible and latent full-load capacities (total capacity only for heating equipment) are dependent on temperature and humidity ratio of ambient air and of the supply air stream at the coil. Wherever possible, manufacturer's data are used to characterize the capacity dependence on the applicable temperature and humidity conditions. Part-load performance of heating and cooling equipment is modeled using polynomial fits to part-load ratio. Wherever practical, functional forms and coefficient values are taken from DOE-2.1.
7. All energy requirements by auxiliary equipment (lighting, equipment, process, swimming pools) are separately calculated on an hourly basis and tabulated by fuel type.
8. After all hourly energy requirements are calculated, monthly consumption totals and demand are calculated and, if required, by the energy rates specified, broken down into appropriate time-of-use periods using the hourly profiles.
9. Energy rate calculations are performed on monthly data of consumption and demand (broken down by TOU for rates that so require). Virtually all types of commercial and industrial rates encountered in the U.S. and Canada can be modeled through a hierarchical rate classification scheme. Blended utility rates were used for calculation of cost reduction for the Swampscott projects.
10. Measure calculations are done, if measures were used to specify scenarios, to separate the individual contribution of each measure to the overall savings of the measure package that contains the measure.

Adjustments to the Baseline

The following is a summary of how a baseline can be developed using utility data and regression analysis techniques. In all cases, modifications will be documented and mutually agreed upon.

Select a Tuning Period. First, JCI will identify a pre-retrofit time period that is representative of physical and operational conditions within the premises.

Identify Relationships of Consumption to Independent Variables. We will then apply a regression analysis calculation to each individual utility item during the selected tuning period against one or more independent variables. The resultant relationship of utility consumption as a function of time, weather, and other independent variable is represented by the regression analysis calculation.

Make Modifications to the Baseline. A modification will be made up of a number of units to be applied, a time period to apply the units, and a description of why the modification is being applied.

Use Annual Periodic Modifications. JCI uses annual periodic modifications to adjust the baseline consumption for anomalies that may have occurred during the tuning period due to operational procedures or abnormal conditions. Such "out-of-line" consumption periods may cause the regression equation to over- or under-predict consumption. Modifications help to fit the equation's predicted value to the actual value that occurred during the tuning period. We can then predict future consumption with a high degree of confidence once the predicted and actual tuning period consumption is matched properly.

Make Additional Modifications. JCI may also make modifications to the baseline to account for physical or operational changes within the premises that are beyond the scope of the approved conditions.

Calculate Utility Consumption Savings. JCI calculates an adjusted baseline by performing the regression analysis and applying to it any necessary modifications for each time period being evaluated. This adjusted baseline represents the utility consumption that would have occurred if the retrofits had not been implemented. Utility consumption savings are derived from the difference between the adjusted baseline consumption and the actual post-retrofit consumption for the same period.

Calculate Utility Cost Savings. Utility cost savings will be determined by applying the appropriate utility unit costs to the consumption units. Total dollar savings is calculated from the sum of the utility cost savings from each utility type and any other savings as identified.

Miscellaneous Adjustments. JCI understands that during the life of the contract, changes may occur in the use, operation and/or maintenance of facilities, systems and equipment, in ways that impact the baseline or affect the calculation of savings. We also understand that utility rates and billing methods may be modified by utilities during the course of the contract. In such cases, JCI will work with the customer to achieve mutually agreeable adjustments, refunds, and rebates.

Facility Improvement Measure (FIM) Evaluation

A baseline will be developed for the Town & Schools utilizing the data collected. This baseline must be within two percent of the actual utility data. This establishes the "as built" energy performance of the building. Modifications are implemented, one FIM at a time, with a resultant new energy profile. The model calculates the difference in usage should that FIM be implemented. In addition, the cost to install that FIM is determined using industry-standard estimating methods.

At this level, each FIM will be considered independently, as if only that FIM were implemented. This will provide a fair evaluation of the economic impact of each FIM. Cost savings will be calculated using the unit costs provided by the customer. The following factors will determine whether or not to include a particular FIM in the final model:

- Energy cost impact and simple payback
- Useful life
- Effect on building maintenance and operation cost
- Implementation time
- The customer's priority list of improvements
- Positive effects on tenant comfort and system reliability

When selecting FIMs, evaluating each FIM independently does not reveal the bottom line energy savings that will occur if more than one FIM is implemented. Interaction between FIMs that will ultimately increase savings associated with each FIM. A final evaluation is performed, which includes all FIMs actually implemented so interactive energy savings can be calculated.

The interactions between FIMs can affect the actual energy savings, implementation costs and payback periods. For example, if a lighting retrofit and cooling system improvements are implemented in the same area, the lighting retrofit will reduce heat loads in the area and, therefore, increases the cooling savings. Our analysis will allow for the "cascading" of FIMs, namely recalculating the savings from the previous FIM results.

The final step in the detailed study is the preparation of a comprehensive report. All FIMs evaluated will be presented to the customer for consideration. The choosing of the project FIMs will be a joint effort between JCI and the customer. Different scenarios can be prepared to determine the most desirable and cost-effective solution. The final project installation will include those FIMs selected.

Baseline Rates (One Year utility Data: July 2008 – June 2009)

Building	Electric $/kW	Electric $/kWh	Nat Gas $/Therm	Oil $/Gallon	Water/Sewer $/kgal
Swampscott Middle School	-	$0.15	$1.37	-	$4.50 / $3.61
Swampscott High School	-	$0.12	$1.30	-	$4.50 / $3.61
Clarke School	-	$0.17	$1.40	-	$4.50 / $3.61
Hadley School	-	$0.17	$1.40	-	$4.50 / $3.61
Stanley School	-	$0.17	$1.41	-	$4.50 / $3.61
Fire Station	-	$0.17	$1.58	-	$4.50 / $3.61
Town Hall	-	$0.16	$1.49	-	$4.50 / $3.61
Dept. Public Works	-	$0.18	$1.48	-	$4.50 / $3.61
Library	-	$0.17	$1.47	-	$4.50 / $3.61
Street Lighting	-	$0.15	-	-	-

Factors that Necessitate Adjustment to the Baseline

During the initial energy baseline creation and during the ongoing performance management of the project, it may become necessary to adjust the energy baseline for factors or unique changes in the building's use, utility or for non-controllable variables. Common adjustments are for items such as:

- Additions or deletions of conditioned square footage.
- Major increases or decreases in building occupancy.
- Major changes in the weather.
- Major additions or deletions to the non-temperature sensitive loads in the facility such as computers, copiers, printers, etc.
- Changes resulting from the addition or replacement of equipment with more energy efficient equipment.
- Changes in production variables.
- Major changes in building operations outside of the energy baseline parameters.

Approach. JCI's approach to energy baseline adjustments is to apply adjustments where required. Our approach is not to claim savings for consumption or demand reduction that did not result from JCI or the energy conservation measures. nor reduce savings by changes outside of the scope of the project. Our assured performance guarantee is designed for modifications versus cancellation. The assured performance guarantee will never be canceled due to changes but rather modified to reflect the adjustments to which our customers and JCI agree.

Methodology. JCI's methodology to adjust our energy baseline for one or all of the above variables is accomplished as follows:

Calculate the Impact: JCI models the change(s) to calculate the impact on the energy baseline.

- If a Utility Bill Comparison Savings Calculation Method was utilized on the project, then JCI takes advantage of the advanced features of the Metrix software to simulate the energy baseline change as a result of the interplay of the occupancy +/-, weather +/- and usage +/- changes. This method will not be used for determining energy avings for the Swampscott project.
- If a Measure Specific Comparison Savings Method was utilized on the project, then JCI computes the energy baseline calculation utilizing the changed variables and compares this with the actual measured calculation to determine the impact of the change(s).
- If a Stipulated Performance Measure was utilized, no change to the energy baseline is computed, as stipulated energy savings are agreed, upon contract signing, to have been considered achieved.

Customer Approval. Once JCI has computed the impact of all adjustments to the energy baseline, this information is then provided to and reviewed with our customers. Our customers then either accept or reject our proposed adjustments. If our customer accepts the proposed adjustments, the energy baseline is adjusted accordingly and savings are computed and reported based upon the adjusted baseline. If our customer rejects the proposed adjustments, then JCI and our customer agree to a proposed course of action to resolve the adjustment issue. Upon such direction, JCI then computes the energy baseline utilizing the agreed upon adjustments and report savings accordingly.

During the detailed audit, JCI discovered that the majority of exhaust fans located at the Hadley School and Middle School were not operational. In addition to the exhaust fans, about 20~30% of the unit ventilators required some repair. These two factors have led to lower operating costs at the High School and middle School.

To calculate the adjustment to the baseline energy usage, JCI calculated the additional electric and thermal costs associated with the equipment, operating at design conditions. To calculate the additional electric consumption, JCI took the motor (hp) ratings of the exhaust fans, and calculated the kWh consumption based upon an 8,760 (hour) runtime at the Hadley School and Middle School. To calculate the additional thermal use, JCI took the minimum outside air requirement for the unit ventilators and the air handling units from equipment schedules, and based upon occupied runtime/bin temps; calculated the additional MMBtu's that would be required to condition the air in the heating months.

The following formulas were used in calculating the adjustment to the baseline.
kWh = HP x 0.746 x Annual Hours x 60% Load Factor
MMBtu = 450 x OA CFM x ($Enthalpy_{outdoors}$–$Enthalpy_{indoors}$) x No of Hours in Bin / 1,000,000

Facilities Evaluated as part of this audit

1. Swampscott High School - 197,000 square feet
2. Swampscott Middle School - 179,474 square feet
3. Clarke Elementary School - 30,412 square feet
4. Hadley Elementary School - 58,000 square feet
5. Stanley Elementary School - 38,400 square feet
6. Town Hall - 20,655 square feet
7. Fire Station - 10,144 square feet
8. Department of Public Works - 15,260 square feet
9. Library - 18,500 square feet
10. Little League Park - 1,000 square feet

Attachment B – Swampscott Wastewater Pumping Station, Efficiency and Economics Study

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WOODARD
&CURRAN

July 20, 2009

Mr. Bruce Dyas
National Grid USA
170 Medford Street
Malden, MA 02148

DRAFT

Re: Swampscott Wastewater Pumping Station
Efficiency and Economics Study

Dear Mr. Dyas:

Woodard & Curran has performed a preliminary evaluation of the anticipated power savings at the above facility with the addition of a low flow pony pump. The pony pump would operate between the average annual minimum flow and the average annual average daily flow, and provide better control and lower overall power consumption than the present wastewater pumps running at reduced speed.

The existing pumps are Fairbanks-Morse Model 10-B5415 dry-pit centrifugal pumps with extended shafts. The pumps are driven by 460-volt 3-phase electric motors rated at 1185-rpm and 250-BHP, and are controlled by variable frequency drives. At a reduced speed of 720-rpm, the pumps are capable of delivering approximately 2400-gpm against a head of 61-feet, and draw approximately 52-BHP, exclusive of losses between the power supply and the motor.

The proposed pony pump is a Fairbanks-Morse Model 8-5444S close coupled dry-pit centrifugal pump. The pump is driven by a 50-BHP 1185-rpm electric motor controlled through a VFD. The design point for the pump is 2400-gpm at 61-feet, with a power consumption of approximately 44-BHP.

Figure 1 represents the head/capacity curves for the existing pumps, proposed pony pump, and the maximum system curve for the existing forcemain.

Figure 2 presents three years of flow data for the wastewater pump station, and indicates the monthly maximum daily flow, average monthly daily flow, and minimum monthly daily flow. The maximum daily flow is dramatically impacted by storm events; however, the minimum and average flow track fairly closely. Over the three year period, the average of the average daily flow is 1.85-MGD (1300-gpm), and the average minimum flow is 1.30-MGD (900-gpm). The proposed pony pump will be capable of handling flows to approximately 2400-gpm. Presently, the three wastewater pumps are limited to approximately 710-rpm and 2.8-MGD (1950-gpm). The existing pumps could be run down to 50-percent of speed (600-rpm) however the efficiency would drop off significantly.

A review of wastewater flow charts and NGrid power consumption data indicates that the base load for the facility (without the pumps operating) averages between 20 and 25 KW. Figure 3 is NGrid's Load Distribution Curve for the facility with the approximate demand for various pumping rates superimposed. The pony pump, operating between 0 and 2400-gpm represents approximately 70-percent of the usage time (95% less 25%). The KWs shown in the flow boxes approximate the BHP demand of the pumps, based on affinity laws, plus the approximate base load of the facility. Again, the BHP is for the pump motor and does not allow for additional loss between the power supply and motor.

Table 1 presents the anticipated power savings resulting from the installation of a pony pump, and an anticipated pay back period of six (6) years. The cost of power is based on NGrid's billings to Swampscott, based on the total cost divided by the recorded KWh used. The table has columns to adjust the BHP/KW for motor efficiency and VFD efficiency at the operating speed, and KW draw represents the potential difference in the pony pump operating near full speed, and the existing pumps operating near 60-percent of speed. The shop drawings for the existing motors indicate a full-load power factor of 83.5 % and a half-load power factor of 70.2%, which hasn't been factored into the power demand of the station.

We trust that the above information will allow National Grid to determine if Swampscott is eligible for Technical Assistance under the 2000Plus program. Some additional power savings may be realized by converting the existing motors to premium efficiency and by installing new VFD units on at least two of the pumps (the third pump has a new soft-start controller).

If you have any questions concerning this letter or the data contained herein, please contact us.

DRAFT

Sincerely,

WOODARD & CURRAN INC.

Peter Knowlton, P.E.
Senior Project Engineer

Enclosure(s): Figure 1, Primary Wastewater Pumps-Variable Speed
Figure 2, Daily Flow – Month
Figure 3, Load Duration Curve
Table 1, Estimated Power Savings

cc: James Finegan, P.E., Woodard & Curran
Gary Tibbets, National Grid

WOODARD &CURRAN

Figure 1
Primary Wastewater Pumps
Variable Speed

DRAFT

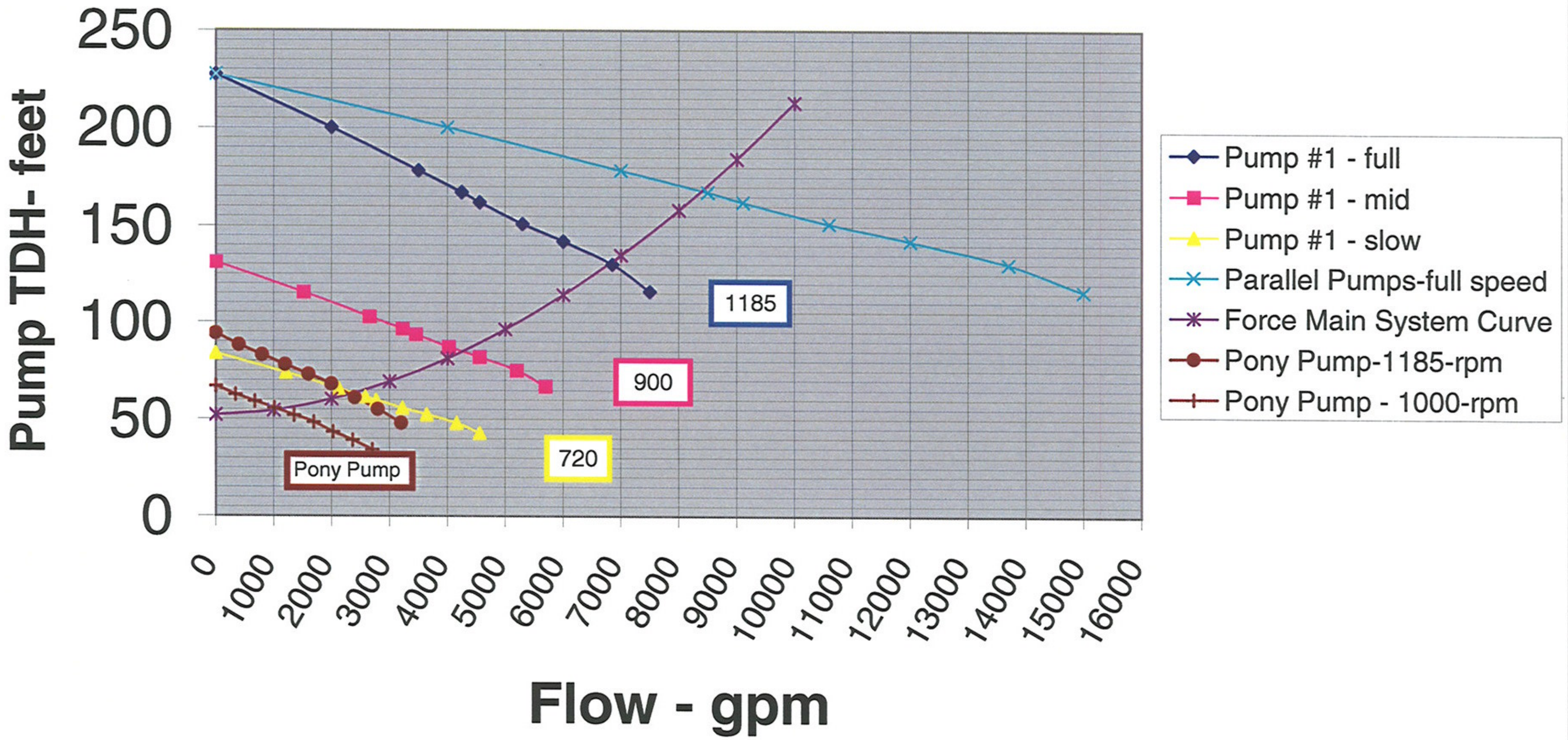
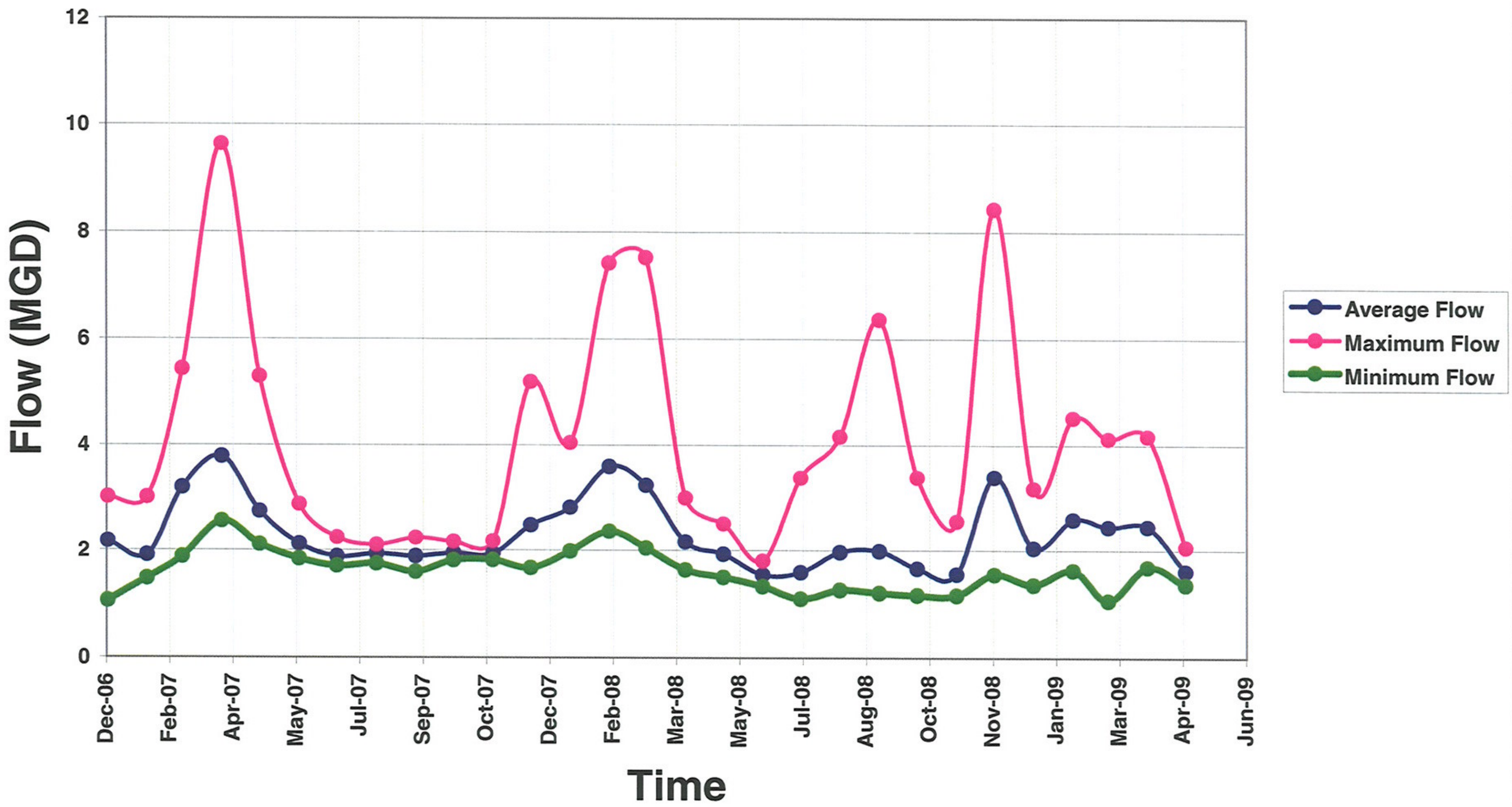


Figure 2
Daily Flow by Month



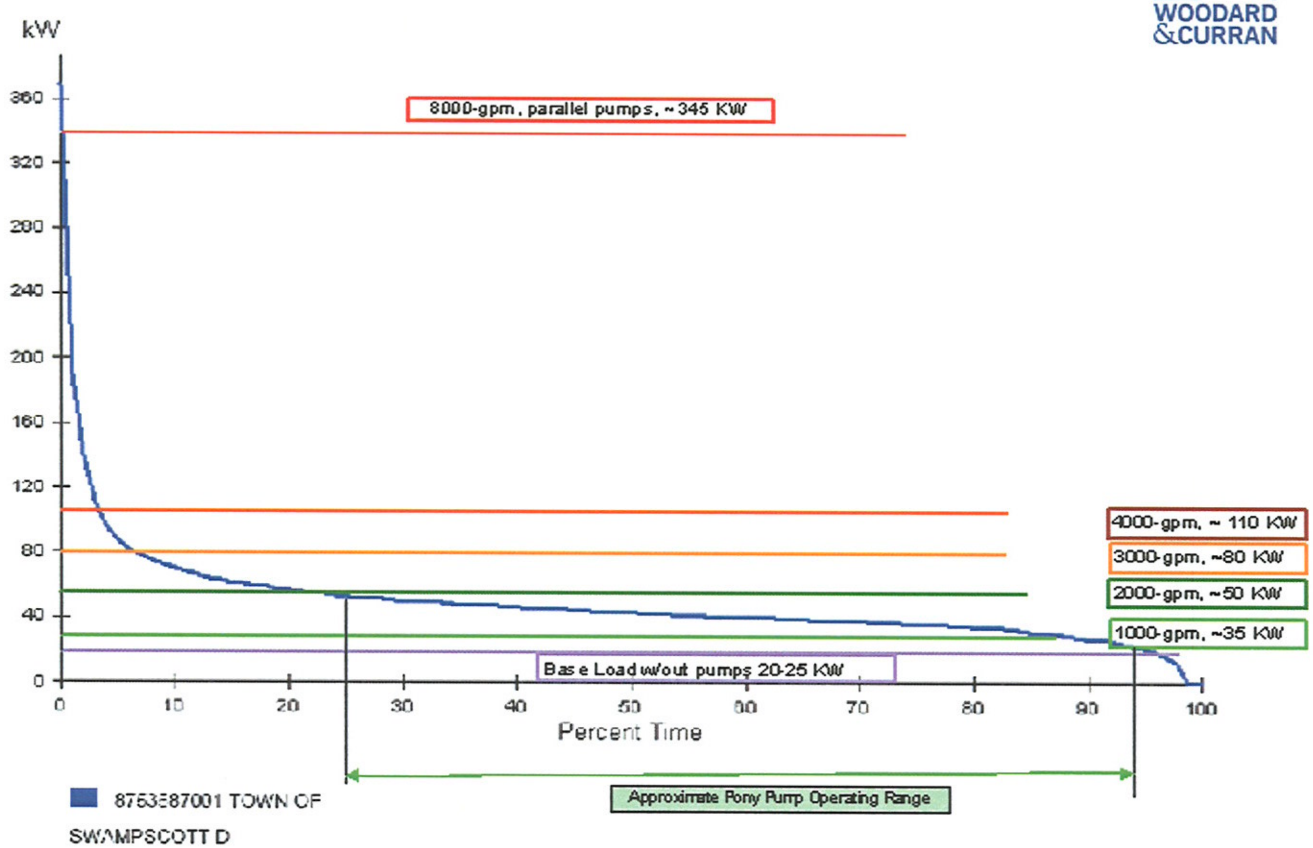
nationalgrid

Load duration curve for 12/01/2003 - 01/30/2008

Load Duration Curve

DRAFT

FIGURE 3



Selected Date Range Monday, December 01, 2003 Through Wednesday, January 30, 2008

WOODARD &CURRAN

DRAFT

Table 1

Anticipated Power Savings with Low Flow Pony Pump

	Speed rpm	Flow gpm	Head ft	Rated BHP$^{(1)}$	KW Demand$^{(2)}$	Motor Eff.$^{(3)}$	VFD Eff.$^{(3)}$	KW Draw	
Main Pump	720	2400	61	52	38.8	0.93	0.93	44.9	Current Standard Eff. Motor @ 60% speed
Pony Pump	1180	2400	61	44	32.8	0.945	0.97	35.8	Premium Eff. Motor @ full speed
Difference				8	6.0			9.0	

Hrs/year	8760		
% operation	70		Based on Ngrid Load Duration Curve and Daily Flow graphs
Operating hrs	6132	55,450	KWh/year saved @ draw difference
Power Cost/KWh	0.17	$9,427	cost from billing summary KWh and total cost.
Pony Pump Cost		$60,000	Estimated installation cost with VFD
Pay Back Period-years		**6**	

(1) Based on Fairbanks-Morse pump curves and affinity laws
(2) KW demand calculated from pump BHP, exclusive of associated system losses.
(3) Motor Eff. based on Reliableplant.com data, VFD Eff. based on Motor Tip Sheet #11-USDOE, June 2008

Attachment C – Economics of Energy Conservations Measures Through ESCo

All Buildings

PROPOSED MEASUES	Electricity Savings kW	kWh/yr	$/yr	Thermal MMBtu/yr	$/yr	Water kgal/yr	$/yr	Total Savings $/yr
Lighting - Fixture Retrofit	62.3	185,874	$ 26,579.2	0.0	0.0	0.0	0.0	26,579.2
Lighting - Fixture Controls	0.0	150,040	$ 22,941.3	0.0	0.0	0.0	0.0	22,941.3
Building Envelope - Weatherization	0.0	918	$ 133.8	1,255.8	17,356.4	0.0	0.0	17,490.2
Energy Management System - Temperature Setback	0.0	9,984	$ 1,737.6	2,619.5	36,439.6	0.0	0.0	38,177.2
EMS - Demand Controlled Ventilation (Incl. in FIM 4)	0.0	0	$ -	0.0	0.0	0.0	0.0	0.0
Steam Distribution System - Steam Traps Replacement	0.0	0	$ -	1,172.2	16,456.0	0.0	0.0	16,456.0
Heating System Upgrade - Boiler Replacement	0.0	0	$ -	385.0	5,408.4	0.0	0.0	5,408.4
Heating System Upgrade - Boiler Controllers	0.0	0	$ -	273.5	3,929.0	0.0	0.0	3,929.0
Domestic Hot Water System - Heat Recovery	0.0	0	$ -	123.2	1,596.1	0.0	0.0	1,596.1
Building Envelope - Window Film	0.0	53,748	$ 7,176.5	(417.2)	(5,453.9)	0.0	0.0	1,722.6
Building Envelope - Roof/Wall/Attic Insulation	0.0	721	$ 123.9	400.3	5,827.4	0.0	0.0	5,951.4
Motors - Energy Efficient Motor Replacement	0.0	0	$ -	0.0	0.0	0.0	0.0	0.0
Kitchen Hood - VFD on Exhaust Fan	0.0	6,088	$ 795.0	363.5	4,709.5	0.0	0.0	5,504.5
Computer Management System	0.0	0	$ -	0.0	0.0	0.0	0.0	0.0
Water Conservation	0.0	0	$ -	150.0	2,186.0	1,025.0	8,311.2	10,497.2
Vending Machine Controllers	0.0	5,103	$ 673.5	0.0	0.0	0.0	0.0	673.5
Streetlights	80.1	350,685	$ 52,602.8	0.0	0.0	0.0	0.0	52,602.8
Refrigeration Controls	0.0	26,313	$ 3,514.9	0.0	0.0	0.0	0.0	3,514.9
Cogeneration	0.0	356,431	$ 46,540.8	(710.4)	(9,203.0)	0.0	0.0	37,337.8
Facility Performance Indexing	0.0	44,587	$ 5,821.9	217.9	2,822.9	0.0	0.0	8,644.8
Condition A Repairs	0.0	0	$ -	0.0	0.0	0.0	0.0	0.0
TOTALS	**142.4**	**1,190,492**	**$168,641**	**5,833**	**$82,074**	**1,025**	**$8,311**	**$259,027**

PRE AND POST EUI SUMMARY	TOTAL SQ FT	ELECTRIC MBTU	NATURAL GAS MBTU	OIL MBTU	TOTAL FUEL MBTU	TOTAL MBTU
EXISTING MBTU	568,026	16,713,577	42,740,835		42,740,835	59,454,412
POST MBTU	568,026	12,650,428	36,907,588	0	36,907,588	49,558,016

EUI: Energy Use Index

Swampscott High School

PROPOSED MEASURES	Electricity Savings			Thermal		Water		Total Savings
	kW	kWh/yr	$/yr	MMBtu/yr	$/yr	kgal/yr	$/yr	$/yr
Lighting - Fixture Retrofit	18	63,025	$8,229	0	$0	0	$0	$8,229
Lighting - Fixture Controls	0	41,742	$5,450	0	$0	0	$0	$5,450
Building Envelope - Weatherization	0	122	$16	255	$3,305	0	$0	$3,321
Domestic Hot Water System - Heat Recovery				123	$1,596	0	$0	$1,596
Building Envelope - Window Film		50,104	$6,542	(390)	($5,055)	0	$0	$1,487
Kitchen Hood - VFD on Exhaust Fan		6,088	$795	364	$4,710	0	$0	$5,504
Vending Machine Controllers		3,476	$454	0	$0	0	$0	$454
Refrigeration Controls	0	8,555	$1,117	0	$0	0	$0	$1,117
Cogeneration	0	356,431	$46,541	(710)	($9,203)	0	$0	$37,338
Facility Performance Indexing	0	44,587	$5,822	218	$2,823	0	$0	$8,645
TOTALS	**18**	**574,130**	**$74,967**	**(141)**	**($1,824)**	**0**	**$0**	**$73,143**

PRE AND POST EUI SUMMARY	TOTAL SQ FT	ELECTRIC MBTU	NATURAL GAS MBTU	OIL MBTU	TOTAL FUEL MBTU	TOTAL MBTU
EXISTING MBTU	197,000	6,107,564	8,598,100		8,598,100	14,705,664
POST MBTU	197,000	4,148,058	8,738,895	0	8,738,895	12,886,953

EUI: Energy Use Index

Swampscott Middle Scool

PROPOSED MEASUES	Electricity Savings			Thermal		Water		Total Savings
	kW	kWh/yr	$/yr	MMBtu/yr	$/yr	kgal/yr	$/yr	$/yr
Lighting - Fixture Retrofit	28	76,462	$10,325	0	$0	0	$0	$10,325
Lighting - Fixture Controls	0	29,041	$3,921	0	$0	0	$0	$3,921
Building Envelope - Weatherization	0	522	$70	549	$7,532	0	$0	$7,603
Energy Management System - Temperature Setback	0	0	$0	1,384	$18,981	0	$0	$18,981
Water Conservation		0	$0	43	$594	273	$2,212	$2,806
Vending Machine Controllers		1,627	$220	0	$0	0	$0	$220
Refrigeration Controls		17,758	$2,398	0	$0	0	$0	$2,398
Condition A Repairs	0	0	$0	0	$0	0	$0	$0
TOTALS	**28**	**125,409**	**$16,934**	**1,977**	**$27,107**	**273**	**$2,212**	**$46,253**

PRE AND POST EUI SUMMARY	TOTAL SQ FT	ELECTRIC MBTU	NATURAL GAS MBTU	OIL MBTU	TOTAL FUEL MBTU	TOTAL MBTU
EXISTING MBTU	179,747	2,199,023	9,563,000		9,563,000	11,762,023
POST MBTU	179,747	1,771,001	7,586,475	0	7,586,475	9,357,476

EUI: Energy Use Index

Clarke Elementary

PROPOSED MEASUES	Electricity Savings			Thermal		Water		Total Savings
	kW	kWh/yr	$/yr	MMBtu/yr	$/yr	kgal/yr	$/yr	$/yr
Lighting - Fixture Retrofit	2.9	8,001	$1,383	0	$0	0	$0	$1,383
Lighting - Fixture Controls	0.0	5,057	$874	0	$0	0	$0	$874
Building Envelope - Weatherization	0.0	0	$0	62	$872	0	$0	$872
Energy Management System - Temperature Setback	0.0	0	$0	234	$3,292	0	$0	$3,292
Steam Distribution System - Steam Traps Replacement	0.0	0	$0	377	$5,301	0	$0	$5,301
Heating System Upgrade - Boiler/Burner Replacement	0.0	0	$0	385	$5,408	0	$0	$5,408
Heating System Upgrade - Boiler Controllers				95	$1,337			$1,337
Building Envelope - Roof/Wall/Attic Insulation	0.0	0	$0	287	$4,033	0	$0	$4,033
Water Conservation	0	0	$0	0	$0	207	$1,675	$1,675
Condition A Repairs	0.0	0	$0	0	$0	0	$0	$0
TOTALS	**2.9**	**13,057**	**$2,257**	**1,441**	**$20,243**	**207**	**1,675**	**$24,175**

PRE AND POST EUI SUMMARY	TOTAL SQ FT	ELECTRIC MBTU	NATURAL GAS MBTU	OIL MBTU	TOTAL FUEL MBTU	TOTAL MBTU
EXISTING MBTU	30,320	200,138	3,220,700		3,220,700	3,420,838
POST MBTU	30,320	155,574	1,779,912	0	1,779,912	1,935,486

EUI: Energy Use Index

Hadley School

PROPOSED MEASUES	Electricity Savings			Thermal		Water		Total Savings
	kW	kWh/yr	$/yr	MMBtu/yr	$/yr	kgal/yr	$/yr	$/yr
Lighting - Fixture Retrofit	4.2	10,909	$1,876	0	$0			$1,876
Lighting - Fixture Controls	0.0	12,955	$2,228	0	$0	0	$0	$2,228
Building Envelope - Weatherization	0.0	0	$0	132	$1,854	0	$0	$1,854
Energy Management System - Temperature Setback	0.0	0	$0	426	$5,970	0	$0	$5,970
Steam Distribution System - Steam Traps Replacement				342	$4,793	0	$0	$4,793
Water Conservation				34	$472	251	$2,033	$2,505
Condition A Repairs	0.0	0	$0	0	$0	0	$0	$0
TOTALS	**4.2**	**23,864**	**$4,104**	**935**	**$13,089**	**251**	**$2,033**	**$19,226**

PRE AND POST EUI SUMMARY	TOTAL SQ FT	ELECTRIC MBTU	NATURAL GAS MBTU	OIL MBTU	TOTAL FUEL MBTU	TOTAL MBTU
EXISTING MBTU	58,000	349,355	5,443,600		5,443,600	5,792,955
POST MBTU	58,000	267,907	4,509,041	0	4,509,041	4,776,948

EUI: Energy Use Index

Stanley Elementary

PROPOSED MEASUES	Electricity Savings			Thermal		Water		Total Savings
	kW	kWh/yr	$/yr	MMBtu/yr	$/yr	kgal/yr	$/yr	$/yr
Lighting - Fixture Retrofit	4	8,921	$1,542	0	$0	0	$0	$1,542
Lighting - Fixture Controls	0	5,675	$981	0	$0	0	$0	$981
Building Envelope - Weatherization	0	0	$0	79	$1,104	0	$0	$1,104
Energy Management System - Temperature Setback	0	0	$0	405	$5,692	0	$0	$5,692
Steam Distribution System - Steam Traps Replacement				453	$6,362	0	$0	$6,362
Heating System Upgrade - Boiler Controllers				104	$1,467	0	$0	$1,467
Water Conservation				5	$67	146	$1,183	$1,250
Condition A Repairs	0.0	0	$0	0	$0	0	$0	$0
TOTALS	**4**	**14,596**	**$2,522**	**1,045**	**$14,692**	**146**	**$1,183**	**$18,397**

PRE AND POST EUI SUMMARY	TOTAL SQ FT	ELECTRIC MBTU	NATURAL GAS MBTU	OIL MBTU	TOTAL FUEL MBTU	TOTAL MBTU
EXISTING MBTU	38,400	280,685	2,824,300		2,824,300	3,104,985
POST MBTU	38,400	230,870	1,778,835	0	1,778,835	2,009,705

EUI: Energy Use Index

Swampscott DPW

PROPOSED MEASUES	Electricity Savings			Thermal		Water		Total Savings
	kW	kWh/yr	$/yr	MMBtu/yr	$/yr	kgal/yr	$/yr	$/yr
Lighting - Fixture Retrofit	2	6,176	$1,099	0	$0	0	$0	$1,099
Lighting - Fixture Controls	0	340	$60	0	$0	0	$0	$60
Building Envelope - Weatherization	0	0	$0	75	$1,114	0	$0	$1,114
TOTALS	**2**	**6,515**	**$1,160**	**75**	**$1,114**	**0**	**$0**	**$2,274**

PRE AND POST EUI SUMMARY	TOTAL SQ FT	ELECTRIC MBTU	NATURAL GAS MBTU	OIL MBTU	TOTAL FUEL MBTU	TOTAL MBTU
EXISTING MBTU	15,260	83,434	819,900		819,900	903,334
POST MBTU	15,260	61,197	744,488	0	744,488	805,685

EUI: Energy Use Index

Fire Station

PROPOSED MEASUES	Electricity Savings			Thermal		Water		Total Savings
	kW	kWh/yr	$/yr	MMBtu/yr	$/yr	kgal/yr	$/yr	$/yr
Lighting - Fixture Retrofit	1	5,511	$947	0	$0	0	$0	$947
Lighting - Fixture Controls	0	1,989	$342	0	$0	0	$0	$342
Building Envelope - Weatherization	0	80	$14	47	$739	0	$0	$753
Heating System Upgrade - Boiler Controllers				25	$393	0	$0	$393
Building Envelope - Roof/Wall/Attic Insulation		721	$124	113	$1,794	0	$0	$1,918
Water Conservation				42	$668	69	$560	$1,228
TOTALS	**1**	**8,301**	**$1,426**	**227**	**$3,594**	**69**	**$560**	**$5,580**

PRE AND POST EUI SUMMARY	TOTAL SQ FT	ELECTRIC MBTU	NATURAL GAS MBTU	OIL MBTU	TOTAL FUEL MBTU	TOTAL MBTU
EXISTING MBTU	10,144	251,606	689,100		689,100	940,706
POST MBTU	10,144	223,276	462,331	0	462,331	685,607

EUI: Energy Use Index

Library

PROPOSED MEASUES	Electricity Savings			Thermal		Water		Total Savings
	kW	kWh/yr	$/yr	MMBtu/yr	$/yr	kgal/yr	$/yr	$/yr
Lighting - Fixture Controls	0	7,464	$1,299	0	$0	0	$0	$1,299
Building Envelope - Weatherization	0	160	$28	35	$523	0	$0	$551
Energy Management System - Temperature Setback	0	9,984	$1,738	170	$2,505	0	$0	$4,243
Building Envelope - Window Film		3,644	$634	(27)	($399)			$235
Water Conservation				26	$385	80	$649	$1,034
TOTALS	**0**	**21,252**	**$3,699**	**204**	**$3,015**	**80**	**$649**	**$7,362**

PRE AND POST EUI SUMMARY	TOTAL SQ FT	ELECTRIC MBTU	NATURAL GAS MBTU	OIL MBTU	TOTAL FUEL MBTU	TOTAL MBTU
EXISTING MBTU	18,500	321,641	679,100		679,100	1,000,741
POST MBTU	18,500	249,108	474,706	0	474,706	723,814

EUI: Energy Use Index

Town Hall

PROPOSED MEASUES	Electricity Savings			Thermal		Water		Total Savings
	kW	kWh/yr	$/yr	MMBtu/yr	$/yr	kgal/yr	$/yr	$/yr
Lighting - Fixture Retrofit	3	6,007	$1,031	0	$0	0	$0	$1,031
Lighting - Fixture Controls	0	1,794	$308	0	$0	0	$0	$308
Building Envelope - Weatherization	0	34	$6	21	$312	0	$0	$318
Heating System Upgrade - Boiler Controllers				49	$732	0	$0	$732
TOTALS	**3**	**7,835**	**$1,345**	**70**	**$1,044**	**0**	**$0**	**$2,389**

PRE AND POST EUI SUMMARY	TOTAL SQ FT	ELECTRIC MBTU	NATURAL GAS MBTU	OIL MBTU	TOTAL FUEL MBTU	TOTAL MBTU
EXISTING MBTU	20,655	573,930	1,530,251		1,530,251	2,104,181
POST MBTU	20,655	547,191	1,460,122	0	1,460,122	2,007,312

EUI: Energy Use Index

LL Fields

PROPOSED MEASUES	Electricity Savings			Thermal		Water		Total Savings
	kW	kWh/yr	$/yr	MMBtu/yr	$/yr	kgal/yr	$/yr	$/yr
Lighting - Fixture Retrofit		863	$147					$147
Lighting - Fixture Controls		43,985	$7,477					$7,477
TOTALS	**0**	**44,848**	**$7,624**	**0**	**$0**	**0**	**$0**	**$7,624**

PRE AND POST EUI SUMMARY	TOTAL SQ FT	ELECTRIC MBTU	NATURAL GAS MBTU	OIL MBTU	TOTAL FUEL MBTU	TOTAL MBTU
EXISTING MBTU	0	831,680	2,269,948		2,269,948	3,101,628
POST MBTU	0	678,614	2,269,948	0	2,269,948	2,948,562

EUI: Energy Use Index

Attachment D – Wind Power in Swampscott: Siting Considerations for a Wind Turbine

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University of Massachusetts
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Amherst, MA 01003-9265
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www.ceere.org/rerl
rerl@ecs.umass.edu

Wind Power in Swampscott:
Siting Considerations for a Wind Turbine

Charles E. McClelland & Mary Knipe

Report date: 14 March 2008 (Updated: 8 October 2008)

Site visit date: 5 March 2008

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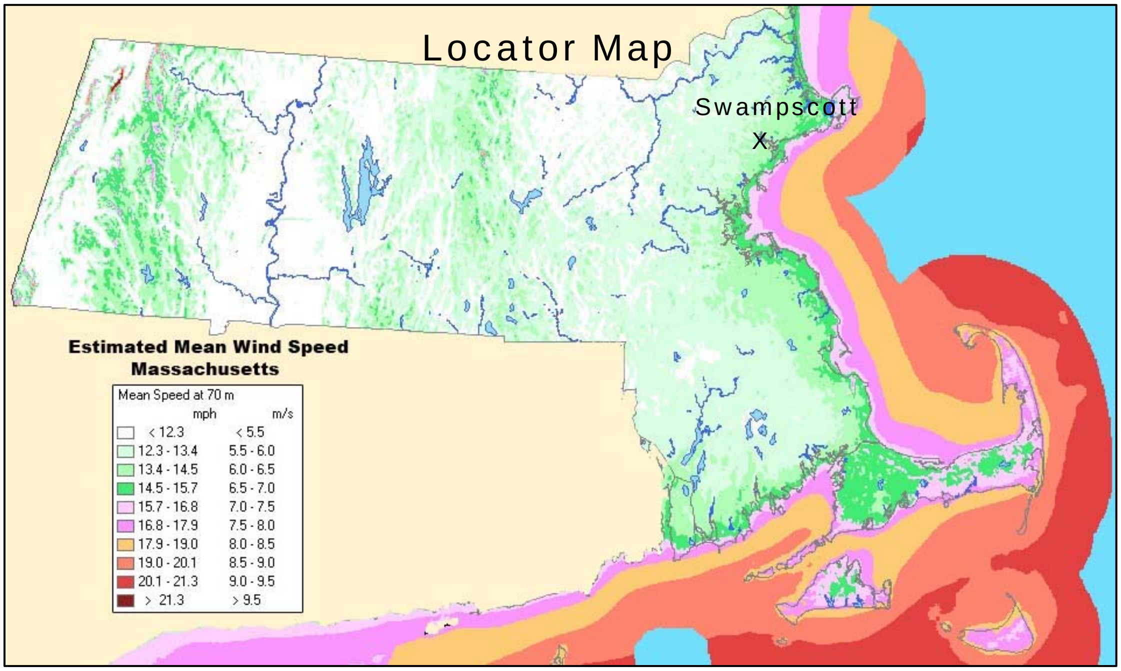
Discussion
- I. Introduction
- II. Sites Considered
- III. Wind Turbine Siting Considerations
  - A. Predicted Wind Resource
  - B. Wind Turbine Component Transportation & Access
  - C. Noise
  - D. Environmental Issues and Permitting
  - E. Proximity to Nearby Airports
  - F. Distance to Transmission/Distribution Lines for Power Distribution
  - G. Net Metering
  - H. Production Estimates for Selected Turbines
- IV. Conclusions

Appendix A Site Survey Data
Appendix B Wind Monitoring Logistics
Appendix C Maps, Photos, & Figures



I. Introduction

At the request of the Massachusetts Technology Collaborative, Charles McClelland, Mary Knipe, and Fred Letson of the Renewable Energy Research Laboratory (RERL) visited four proposed sites in the town of Swampscott, Massachusetts in order to evaluate their suitability for utility-scale wind turbines.

The report is in the form of a broad "fatal flaw" analysis, which is designed to determine whether the town should move forward in considering a utility-scale wind power project. Many factors are discussed in this report, not all of which present major influence at these sites; at the end of the report, the factors most significant for each site are summarized.

The "Locator Map" on the previous page is an AWS-TrueWind map of the estimated mean wind speeds in Massachusetts at 70 meters height. Areas of primary interest for utility-scale wind power have estimated mean wind speeds of 6.5 m/s or greater (dark green or more). On this map, the town of Swampscott is marked with an "X".

Appendix A provides details related to each site in tabular form.

Appendix B focuses on siting considerations for wind-monitoring towers (met towers) in Swampscott. Wind monitoring is an important aspect in determining feasibility.

Appendix C provides wind resource maps, topographic maps, ortho (aerial) photos, and figures for the site.

For more background information

This report assumes some familiarity with wind resource assessment, wind power siting, and other issues that arise with wind power technology. For an introduction to these areas, please refer to RERL's Community Wind Fact Sheets, which are available on the web at: http://www.ceere.org/rerl/about_wind/.

These sheets include information on the following subjects:

- Wind Technology Today
- Performance, Integration, & Economics
- Capacity Factor, Intermittency, and what happens when the wind doesn't blow?
- An Introduction to Major Factors that Influence Community Wind Economics
- Impacts & Issues
- Siting in Communities
- Resource Assessment
- Interpreting Your Wind Resource Data
- Permitting in Your Community

More information on wind turbine technology, policy, and general information can be found at these websites:

- American Wind Energy Association, www.awea.org
- Danish Wind Industry Association, www.windpower.org

II. Site Considered

Representatives of the town requested that four parcels of town property be evaluated for their suitability for wind power projects. The four sites, along with brief descriptions, are listed below:

1. **Forest Avenue –** Comprised of several baseball diamonds north of the Swampscott Middle School. The site lays adjacent to The Tedesco Country Club in a residential community.
2. **Phillips Park –** Comprised of several playing fields and a parking lot. This site is located approximately 300 meters from the coast in a residential area.
3. **Jackson Park –** Comprised of a densely wooded park adjacent the Swampscott high school, in a residential community.
4. **Swampscott Quarry –** Comprised of a small, elevated gravel platform surrounded by brush, located to the south of the quarry near a residential community.

None of the sites feature fatal flaws to wind development. Noise considerations are likely to prevent the development of large, utility-scale projects at all sites; however, medium scale projects may be possible at several of the sites. A more detailed discussion related to noise issues is presented in **Section C**.

Details related to each site are located in **Appendix A**. The primary constraints are listed on line 28. For aerial photos, see **Appendix C**.

III. Wind Turbine Siting Considerations

Purpose

The purpose of this section is to consider whether there are any "fatal flaws" to siting a wind turbine at the proposed locations. A site characteristic that is described as a fatal flaw is almost sure to prevent medium or utility-scale wind development. For this discussion, we examine the potential for a "utility-" or "commercial-scale" (600 – 2,500 kW) turbine. The blade-tip heights of these turbines range between 250 and 450 feet. A medium-sized (250 kW or similar) turbine is also considered; these have blade-tip heights ranging from 150 to 250 feet.

The following characteristics are important in considering a wind turbine site, and are examined in this report:

- **A.** Predicted Wind Resource
- **B.** Wind Turbine Component Transportation & Access
- **C.** Noise
- **D.** Environmental Issues and Permitting
- **E.** Proximity to Airports
- **F.** Distance to Transmission/Distribution Lines for Power Distribution
- **G.** Net Metering
- **H.** Production Estimates for Selected Turbines

Each section below briefly describes why the characteristic is important in general and then discusses it in particular for these sites. Site information is also presented in tabular form in **Appendix A**. The locations of data within the table are noted in parentheses next to section sub-headings. For example, data presented in the subsection titled "TrueWind estimates of annual average wind speed" can also be found in lines 8-12 of the table.

A. Predicted Wind Resource

About wind resource in general

The economics of wind power at a given site depend on many factors; one of the most important is wind speed. Understanding wind speed and turbulence is critical to estimating the energy that can be produced at a given site. The power in wind is related to its speed, and small changes or inaccuracies in estimated wind speed can mean big changes in annual energy production. For these reasons, wind speed is the first criterion to examine when considering a wind power project.

The primary motivation for investigating the winds at a proposed wind power site is to gain an improved understanding of project feasibility and returns, and thus a lowering of investment risk. Better, longer, and more site-specific data can help to minimize this risk. Additional information regarding the monitoring of wind resources can be found in **Appendix B**.

Wind speeds increase with elevation, so wind speeds are always given at a specific height. For first-pass production estimates, the mean wind speed at the proposed hub-height is used:

- For utility-scale turbines, refer to mean wind speeds at a height of 70 meters, which falls between common hub-heights of 65 and 80 meters.
- For medium-scale wind turbines, consider 50 meters.

When considering wind resource at this screening stage, we look at several factors:

TrueWind estimates: An initial site screening can use estimated wind speeds based on computer models by AWS TrueWind; for more detail, the wind is monitored on site. Wind monitoring logistics are discussed in **Appendix B.**

Existing wind data: High-quality wind data from nearby locations can be useful, primarily for correlation with on-site data. Concurrent, long-term, nearby data is most useful. Wind resource data collected by RERL are available on the web: http://www.ceere.org/rerl/publications/resource_data/.

Obstacles to wind: Obstacles cause both turbulence and slowing of the wind. If the surrounding landscape is built up, forested, or otherwise rough, turbulence will increase. These are important factors in site selection for a wind turbine because they affect its power production and longevity, and may affect the type of turbine that can function reliably at the site.

TrueWind estimates of annual average wind speed (Lines 8-12)

The following table displays the AWS TrueWind estimates of annual average wind speeds at 70 meters (for large-scale turbines), 50 meters (for medium-scale turbines), and 30 meters (small-scale turbines).

TrueWind Estimates of Annual Average Wind Speed at Proposed Sites (m/s)			
	70 meters	**50 meters**	**30 meters**
Phillips Park	7.0	6.6	6.0
Forest Avenue	6.9	6.5	5.9
Jackson Park	6.6	6.1	5.6
Swampscott Quarry	6.6	6.1	5.5

Other available wind data (Line 13)

RERL has monitored the wind resource in the towns of Lynn and Marblehead, which are approximately two to three miles from the proposed sites. RERL is also currently monitoring the wind resource in Salem during the spring and summer of 2008. Data from these sites could be used as reasonable approximation of the wind resource at the Swampscott sites; however, the reliability of wind data diminishes with distance. Wind characteristics are dependent upon any land formations, trees, and structures in the local vicinity; therefore, for the most accurate assessment of project feasibility, on site wind monitoring is advisable.

Obstacles to wind flow (Lines 18-19)

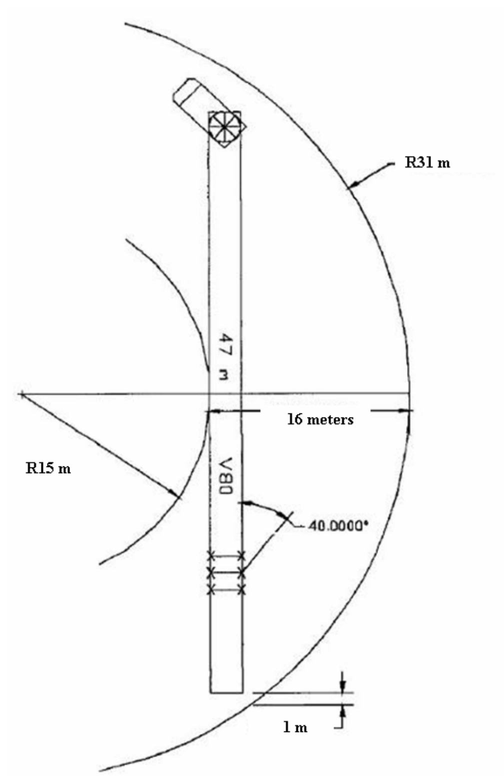
AWS indicates that obstacle interference occurs downwind at a distance of about 10-20 times the obstacle height, up to a height of about twice that of the obstacle itself. Obstacle interference would become a siting constraint particularly if small- or medium-scale turbines are considered, which typically have hub heights in the range of 150 to 250 feet. The Jackson Park site features a large, elevated grove of mature trees ranging from 20 to 70 feet in height, located directly south of the track. Additionally, the presence of the high school, which sits to the east of the track, increases the likelihood of obstruction or turbulence at this site.

Wind shear, which is defined as the difference in wind speed and direction over a relatively short distance in the atmosphere, often occurs over areas featuring severe changes in elevation. Excessive wind shear can upset the normal operation of a wind turbine, and may decrease the turbine's lifetime. The presence of wind shear may present significant challenges to a wind power project at the Swampscott Quarry, Forest Avenue, and Jackson Park sites. If the town is interested in pursuing a wind project at one of these sites, on-site wind monitoring is strongly advised.

B. Wind Turbine Component Transportation & Access

About transportation and access in general

With blades up to 130 feet long, modern wind turbines require transportation on roads with fairly large turning radii and only small changes in slope. The example at right shows the set of turning radii (in meters) required for transporting one of the 47-meter turbine blades of a Vestas V80, a 1.8 MW machine. Transportation accessibility for turbine installation is an important consideration for a potential wind turbine site.



Transportation and access to the Swampscott sites (Line 17)

Each of the sites would pose some logistical challenges to transporting wind turbine components to the sites, especially for large, utility-scale wind turbines.

The Forest Avenue, Jackson Park and Quarry sites would require on-site road improvements, and possibly improvement of the roads leading to the site.

While access does not appear to be a fatal flaw for any of the sites, road construction and/or improvements could add significant costs to a wind power project in Swampscott. If the town decides to pursue a project at one of the sites, it is advisable that an access plan, which includes detailed cost estimates, be completed as a next step.

C. Noise

About Noise in general

Noise considerations generally take two forms, state regulatory compliance and nuisance levels at nearby residences:

A. *Regulatory compliance:* Massachusetts State regulations do not allow a rise of 10 dB or greater above background levels at a property boundary (Massachusetts Air Pollution Control Regulations, Regulation 310 CMR 7.10). Regulatory compliance will rarely impose a siting constraint on a large modern wind turbine, since in most cases modern turbines are quiet enough to meet these criteria easily.

B. *Human annoyance:* Aside from Massachusetts regulations, residences should also be taken into consideration. Any eventual wind turbine would be sited such that it would be minimally audible at the nearest residences. At this stage, to check for fatal flaws, the following rule of thumb can be used to minimize possible noise: Site wind turbines at least three times the blade-tip height from residences. Distances from mixed-use areas may be shorter. Note that noise considerations can influence not only siting, but also sizing decisions.

For example, this first-pass rule of thumb tells us that a turbine with a 77-meter rotor diameter on a 60-meter tower should be about 300 meters (60 + 77/2 = 98.5, times 3 comes to ~300 m or ~1000 feet) from residences. Other turbine sizes would suggest other distances. Note that many factors affect the transmission of sound and that this is a rule of thumb only.

The three-times-blade-tip height suggestion is not an inflexible rule; wind turbines can be and often are positioned closer to residences. This initial recommendation is meant to be the beginning of a conversation among project stakeholders. The town’s decision to site a wind turbine must take into consideration the community’s needs and priorities. If the town would like to consider a site closer than this distance, then a more detailed sound study could be performed that takes into account the actual ambient levels and terrain; this site-specific information would then supersede the rough rule of thumb. This could be performed in conjunction with full-feasibility study.

Noise at the Swampscott sites (Lines 20-21)

Swampscott is a built-up community and noise will be a siting consideration for a wind turbine at all of the proposed sites. Consideration of the neighbors will be an important factor in siting and sizing wind turbines for the Swampscott sites. From a noise perspective, the “three times blade-tip height” guideline suggests that a large, utility-scale wind turbine (1 MW or greater) would most likely present a nuisance at all four proposed sites. See **Figure 3** in **Appendix C** related to Residential Buffer Zones for a map depicting residences, buffer zones, and town boundaries in Swampscott.

Recommendations are made with respect to the largest turbine sizes that would be appropriate for each site. The maximum blade-tip-heights that a site can support correspond to approximately one-third of the site’s distance to the nearest residence (essentially, a restatement of the “three times blade-tip height” rule).

A medium-scale turbine (~660kW) may be possible at the Forest Avenue and Swampscott Quarry sites, subject to careful micro-siting. However, space considerations at Phillips Park and Jackson Park would likely limit turbine size to 250 kW. In the event that a turbine project is pursued at any of the proposed sites, a detailed noise study would be completed as part of the full feasibility analysis.

Alternatively, the town might consider an agreement with the town of Salem to jointly develop the area north of the quarry, where adequate space exists for at least one utility-scale wind turbine.

Note: these recommendations are not "hard" rules, but rather first pass estimates based upon the "three time blade-tip height" guideline. If the town pursues a wind project at one of the proposed sites, it is advisable to complete a detailed noise study which takes into account actual ambient sound levels at the sites. This study would supersede the rule of thumb.

See **Appendix C** for photos depicting these locations.

D. Environmental Issues and Permitting

Environmental permitting in general

At this early stage, the following items are reviewed:

- State designations of Natural Heritage & Endangered Species Program (NHESP), Open Space, Wetlands, and other land-use designations or restrictions
- Massachusetts Audubon Society Important Bird Areas (IBA)
- Current or former landfill

The permitting implications of these designations are not clear-cut in all cases. For instance, a "Core Habitat" designation may require a filing with the NHESP, but does not eliminate the possibility of a wind turbine installation. Compatibility of some land-use restrictions with wind power has not yet been determined.

Please note that this report is based on publicly available information and conversations with town representatives. There may, however, be other land-use restrictions, unregistered wetlands, etc. of which RERL is not aware. It is the town's responsibility to ensure the environmental appropriateness of the chosen site.

Environmental permitting at the Swampscott site (Lines 22-26)

Phillips Park is categorized as Protected Open Space (limited). The Forest Avenue and Jackson Park sites are categorized under Chapter 61 regulations. Jackson Park is also categorized under Article 97 laws with portions of the surrounding area designated as wetlands. The quarry is categorized as a mining area, with portions designated as wetlands. Areas north of the quarry are designated as Priority Habitats of Rare and Endangered Species. The town should investigate the applicable environmental designations in the event that one of the sites is chosen for a wind turbine project. Environmental permitting is not expected to be a fatal flaw for any of the sites.

E. Nearby Airports

About airspace in general

The form "7460-1 - Notice Of Proposed Construction or Alteration" must be filed with the Federal Aviation Administration (FAA) before construction of any structure over 200 feet (i.e. all utility-scale wind turbines). The corresponding form for the Massachusetts Aeronautics Commission (MAC form E10, Request for Airspace Review) must also be filed.

These filings are reviewed by the FAA and the Department of Defense (DOD) for any potential obstruction or interference with air traffic, aircraft navigation/communication systems, military RADAR, etc. This process typically takes about three months for a first response. We recommend that these filings, or a detailed analysis of airspace issues, be undertaken as soon as possible if a site is seriously being considered for a wind turbine.

The U.S. Air Force recently published a policy to "contest … windmill farms within radar line of sight of the national Air Defense and Homeland Security Radars." In Massachusetts, these include the Long Range Radar Sites in North Truro, Boston, and in the foothills of the Berkshires.* Nevertheless, wind projects have been approved within 60 nautical miles of these long-range radar sites.

While we cannot predict the FAA or DOD response, most sites that are not within about 3-5 miles (5-8 kilometers) of a public or military airport are not considered a hazard to air traffic. At this preliminary stage, we look for fatal flaws by considering the distance to public and military runways.

Note that the FAA requires that any structure over 200' be lit. All utility-scale wind power installations are lit.

Airspace at the Swampscott site (Line 27)

There are no airports within 8 kilometers of the proposed sites; however, Logan International Airport is located approximately 8.5 miles to the southwest of the proposed sites. A detailed airspace review could be completed if the Town moves forward with a particular site.

While there are no military airports in the vicinity, nearly all of Massachusetts is within 60 miles of a Long Range Radar Site. Any potential impacts on the Long Range Radar system will be reviewed as part of the 7460-1 process.

If any of the sites are considered for a wind turbine project, then early filing of the FAA 7460-1 form is recommended.

F. Distance to Transmission/Distribution Lines for Power Distribution

About power distribution in general

The power generated by any installed wind turbine must be transported to adequately sized lines, either on the "load side" of a meter, or out to transmission or distribution lines. Proximity to utility distribution or transmission lines is an important cost consideration for a wind turbine project.

Power distribution at the Swampscott sites (Line 16)

All four proposed sites are within 200 meters of distribution lines. Whether or not these lines would be in need of upgrading depends upon the size of the intended wind project. Still, interconnection would, in most cases, add significant costs to a wind project in Swampscott, with the amounts varying in proportion to a given site's distance to existent power lines. In the cases where on-site loads are present, a further feasibility study would weigh the cost and benefits of using the power to offset onsite loads. Doing so could dramatically reduce the payback period of a wind power project. Load offsetting is discussed in further detail in the following section.

G. Net Metering

Massachusetts regulations allow customer-sited wind projects of up to 2 MW in size to qualify for net-metering. In this manner, towns are able to offset the retail cost of electricity consumed at municipal sites with power produced by a wind project. Any net excess generation would then be credited towards the town's energy bill during the following month. Further, "virtual" net-metering provisions allow

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* The FAA offers a "Long Range Radar Tool" that displays these 60 nm radius areas. See their Obstruction Evaluation/Airport Airspace Analysis (OE/AAA) website: https://oeaaa.faa.gov/oeaaa/external/gisTools/gisAction.jsp?action=showLongRangeRadarToolForm

towns to aggregate and offset multiple municipal loads with power produced by a single wind project, so long as their meters are under the same distribution company and located in the same ISO-NE load zone. Recoverable electricity costs include associated default service, transmission, transition, and distribution kWh charges. Other specifics will be spelled out in the forthcoming rulemaking process by appropriate regulatory authorities.

H. Production Estimates for Selected Turbines

The following tables are intended to provide rough estimates of energy production at the proposed sites for wind turbines in the range of 100 to 660 kW. This range of turbine sizes has been chosen with respect to the noise issues discussed in **Section C** of this report. The turbine models presented below are representative of common turbine sizes on the market; the exact model may not necessarily be commercially available. Precise turbine selection would follow a full feasibility study.

The following assumptions were employed:

- TrueWind estimated mean wind speeds at given hub heights,
- Uniform wind speed over swept area,
- Rayleigh wind speed distribution,
- Standard air density, and
- 10% reduction of energy production due to availability, electrical losses, etc.

Table 1 presents estimated energy production at the Forest Avenue and Phillips Park sites, which have similar estimated wind speeds. Keep in mind that AWS estimates are slightly higher at the Phillips Park site, a difference which could potentially translate into higher annual production figures. At first pass, Phillips Park appears too close to residences to accommodate turbines with ratings exceeding 250 kW.

Table 1: Estimated Annual Energy Production of Selected Turbines at Phillips Park and Forest Ave.

Wind Turbine (rated power)	Hub Height (meters)	Estimated Annual Mean Wind Speed at Hub Height (m/s)	Estimated Annual Energy Production (kWh/year)	Site Potential
Fuhrländer 100 kW	35	5.9*	211,202	Forest Avenue Phillips Park
Fuhrländer 250 kW	50	6.5	482,963	Forest Avenue Phillips Park
Vestas V47 (660 kW)	50	6.5	1,550,000	Forest Avenue

*Estimated Annual Mean Wind Speed at 35 meters height was unavailable at the time of this report; 30 meter estimate used.

Table 2 presents estimated annual energy production associated with the Jackson Park and Swampscott Quarry sites, which also have roughly identical estimated wind speeds. At first pass, Jackson Park appears too close to residences to accommodate turbines with ratings exceeding 250 kW.

Table 2: Estimated Annual Energy Production of Selected Turbines at Jackson Park and Quarry

Wind Turbine (rated power)	Hub Height (meters)	Estimated Annual Mean Wind Speed at Hub Height (m/s)	Estimated Annual Energy Production (kWh/year)	Siting Potential Based on Noise
Fuhrländer 100 kW	35	5.5*	177,761	Jackson Park, Quarry
Fuhrländer 250 kW	50	6.1	422,000	Jackson Park, Quarry
Vestas V47 (660 kW)	50	6.1	1,360,000	Quarry

*Estimated Annual Mean Wind Speed at 35 meters height was unavailable at the time of this report; 30 meter estimate used.

A more detailed analysis at a later date would provide estimates for the payback period corresponding to each of these scenarios.

IV. Conclusions

The town of Swampscott is interested in a wind power project at four locations on town property. From a noise perspective, the Swampscott Quarry and Forest Avenue sites are feasible for medium-scale wind projects (660 kW to 850 kW). The estimated mean wind speeds at these sites are fair and good, respectively, for utility-scale wind power. Project proponents should keep in mind that smaller projects tend to have longer payback periods, and so an economic analysis would be warranted if the Town pursues a medium-scale project.

With careful micrositing, the Phillips Park and Jackson Park sites may support a smaller scale wind turbine (~250 kW). The Jackson Park site, in addition, presents challenges with regards to tree clearing, road access, and obstacles to wind flow.

If the town is interested in installing a large, utility-scale turbine (1 MW or greater) in Swampscott, it is advisable that a more suitable site be identified than those considered in this report. One option would be to consider the possibility of accessing near or offshore wind resources, as the town of Hull is currently doing. Another option would be to consider a joint development with the town of Salem on property to the north of the Swampscott Quarry.

For any wind power project, the Town of Swampscott will need to balance the costs and benefits of its investment.

Next steps (Line 29)

After deciding whether to pursue a wind project at the Swampscott sites, establishing full feasibility (which may include wind resource monitoring) is an important next step. The wind monitoring process and siting considerations are discussed in **Appendix B**. In addition to wind monitoring and public outreach, these site-specific items related to pursuing wind power at the sites should be explored:

- File FAA form 7460-1
- Check on local ordinances related to structure heights
- Investigate logistics and costs of transporting turbine components and installing equipment
- Conduct noise and electrical interconnection studies

A preliminary economic analysis is also important to help the town of Swampscott decide whether a wind power project at any of the proposed sites is practical. For an introduction to economic issues, please visit the RERL's Community Wind Fact Sheet related to community wind economics:

An Introduction to Major Factors that Influence Community Wind Economics

Appendix A: Site Survey Data

Key:

Green shading: Particularly **positive** aspect that distinguishes this site from the others.

Yellow shading: Significant **constraints**: these items may force micrositing choices, or may make the site difficult.

Red shading: Fatal flaws: these make placement **impossible** at this site.

Refer to the report "Wind Power in Swampscott: Siting Considerations for a Wind Turbine" for a discussion of these data.

Swampscott, MA					
		Forest Avenue	**Phillips Park**	**Jackson Park**	**Swampscott Quarry**
Site Overview					
1	Description, current land use	Adjacent to ball fields and golf course, partly wooded with nearby residential areas.	Recreational park, several playing fields, near coast, residential area.	High School track, residential area, heavily wooded.	Unused lot south of quarry, atop small hill, neighboring woods and nearby residences.
2	Address	207 Forest Avenue Swampscott, MA 01907	565 Humphrey Street Swampscott, MA 01907	200 Essex Street Swampscott, MA 01907	Swampscott Road Swampscott, MA 01907
3	Owner	Town of Swampscott	Town of Swampscott	Town of Swampscott	Aggregate Industries
Location					
4	NAD 83, lat & long	42° 28.573'N	42° 27.989'N	42° 28.816'N	42° 28.976'N
		70° 54.077'W	70° 54.063'W	70° 55.328'W	70° 55.146'W
5	Degree, Minute, Second	42°28'34.24"N	42°27'59.36"N	42°28'48.96"N	42°28'58.53"N
		70°54'4.63"W	70°54'3.75"W	70°55'19.69"W	70°55'8.73"W
6	Elevation (feet)	84	7	128	134
7	Notes	Zoned Residential A-2 Property Easements on nearby privately owned properties needed.	Zoned Residential A-2	Zoned Residential A-2	Zoned B-2 District Property Easements on nearby privately owned properties needed.
Wind Speeds					

Swampscott, MA					
		Forest Avenue	**Phillips Park**	**Jackson Park**	**Swampscott Quarry**
Estimated Mean Speeds* in m/s **(to convert m/s to mph, multiply by 2.24)**					
8	At height of 100 m	7.4	7.5	7.1	7.1
9	At height of 70 m	6.9	7.0	6.6	6.6
10	At height of 50 m	6.5	6.6	6.1	6.1
11	At height of 30 m	5.9	6.0	5.6	5.5
12	Wind Speed Summary (poor, fair, good, very good):	good	good	fair	fair
13	Existing wind data	RERL has monitored wind in Marblehead and Lynn and is currently monitoring wind in Salem.			
Wind Turbine Considerations:					
Economic					
14	On-site Electric Loads	Swampscott Middle School	Pump house	Swampscott High School	Quarry
15	Electric Loads, kWh/year	800,00 kWh/yr	438,600 kWh/yr	1,970,000 kWh/yr	2,100,000 kWh/yr
16	Distance to Distribution/ Transmission lines**	~200 meters	~200 meters	~200 meters	~200 meters
17	Access for blade transportation**	Fair, on-site improvements needed	Good	Fair, on-site improvements needed	Fair, on-site improvements needed
Obstructions to wind					
18	Terrain	Hill top	Flat, low-lying area	Heavily wooded hill	Hill top
19	Obstacles to wind	Trees	Low lying buildings, few trees	High school to east, trees	Trees, quarry walls

		Swampscott, MA			
		Forest Avenue	**Phillips Park**	**Jackson Park**	**Swampscott Quarry**
Noise					
20	Nearby residential areas:	Yes	Yes	Yes	Yes
21	Radius to residences: (m): (ideally >~300m for utility scale‡)	~ 220 meters	~ 150 meters	~ 150 meters	~ 220 meters
Environmental Permitting †					
22	Designated by the Natural Heritage & Endangered Species Program as a Core Habitat or a Supporting Natural Landscape?	No	No	No	No
23	Designated by the DEP as Wetlands?	No	No	Portions	Portions
24	Designated by the Massachusetts Audubon Society as an Important Bird Area (IBA)?	No	No	No	No
25	Is the site a current or former land-fill? *(RERL does not install met towers on landfills)*	No	No	No	No
26	Other land-use restrictions? (e.g. Article 97†, etc.)	Chapter 61 (F)	Open Space Level of Protection: Limited	Open Space Level of Protection: Limited Article 97	Mining Area
Other permitting					
27	Distance to airport(s)	No airports within 8 kilometers.	No airports within 8 kilometers.	No airports within 8 kilometers.	No airports within 8 kilometers.

		Forest Avenue	Phillips Park	Jackson Park	Swampscott Quarry
Swampscott, MA					
Wind Turbine: Conclusions					
28	***Primary constraint(s):*** *If this site is of interest for a utility-scale wind turbine, what factors will most affect feasibility and/or micrositing?*	- Nearby residences - Road Access - Space Availability - Possible Wind Shear	- Nearby residences - Space Availability	- Nearby residences - Space Availability - Marginal Wind Speeds - Article 97	- Nearby residences - Marginal wind speeds - Wind Shear
29	***Next step / To be determined*** *To pursue wind power at this site, these items should be explored first (along with wind monitoring and public outreach):*	- Investigate town noise and structure height ordinances - Economic analysis - File FAA form 7460-1for the desired turbine height - Investigate logistics of transporting turbine components and installation equipment to site - Electrical Interconnection study - Noise study (See Discussion)	- Investigate town noise and structure height ordinances\- - Economic analysis - File FAA form 7460-1for the desired turbine height - Investigate logistics of transporting turbine components and installation equipment to site - Electrical Interconnection study - Noise study (See Discussion)	- Investigate town noise and structure height ordinances - Economic analysis - File FAA form 7460-1for the desired turbine height - Investigate logistics of transporting turbine components and installation equipment to site - Electrical Interconnection study - Noise study (See Discussion)	- Investigate town noise and structure height ordinances. - Economic analysis - File FAA form 7460-1for the desired turbine height - Investigate logistics of transporting turbine components and installation equipment to site - Investigate local wind shear - Electrical Interconnection study (See Discussion)
30	***Recommendation*** *Should the town consider this site for a utility-scale wind turbine?*	Possibly	No	No	Possibly

		Swampscott, MA			
		Forest Avenue	**Phillips Park**	**Jackson Park**	**Swampscott Quarry**
	For a smaller wind turbine? ***See also the discussion section.***	Possibly	Possibly	Possibly	Possibly
31	***Multiple Turbines*** *If the town is interested in installing more than one utility-scale turbine, how many could fit at this site?*	-	-	-	-
Met Tower: Siting Factors					
32	Space availability & level terrain	Perhaps, see discussion	Perhaps, see discussion	Perhaps, see discussion	No
33	Power lines or other obstructions to met tower. *(Met tower must be set at least 1.5 x the tower height away from power lines.)*	Border fence between fields and golf course	Utility pole (lighting), fence	Space is confined by trees, fence, and playing field	Yes, power lines
34	Obstacles to wind	Trees to the north and east.	Low lying buildings, few trees	Densely wooded, hill	-
35	Clearing requirements	Yes	No	Yes	-
36	Soil quality – for met tower anchors	Soils not tested	Soils not tested	Soils not tested	-
37	Road Access – for met tower installation	No	Yes	Yes	-
38	Security	Poor, nearby residential community, middle school	Poor, nearby residential community	Poor, nearby residential community, high school	-

	Swampscott, MA				
		Forest Avenue	**Phillips Park**	**Jackson Park**	**Swampscott Quarry**
39	Existing towers on or near site	No	No	No	-
40	Distance to AC power if lighting is required	~200 meters	~200 meters	~200 meters	-
41	Compatibility: If this site were chosen for a wind turbine but not a met tower, where else could wind be monitored?	Phillips Park, Jackson Park	Forest Avenue, Jackson Park	Forest Avenue, Phillips Park	Forest Avenue, Phillips Park, Jackson Park
Met Tower: Primary Constraint					
42	What factors will most affect feasibility and/or siting of a met tower here?	Road Access, Structure Permitting	Road Access, Structure Permitting, Ball Field Usage Considerations (see discussion)	Obstruction, Clearing, Structure Permitting	Power lines, space
Met Tower: Recommendation					
43	Recommended site:	Perhaps, see discussion	Perhaps, see discussion	Perhaps, see discussion	No
44	Recommended met tower height (meters)	50	50	50	-

Notes:

* Estimated Mean Annual Wind speeds, in m/s, based on the AWS-TrueWind computer models.

‡ Note that this will vary based on location, turbine size, terrain, ambient noise, etc.

** These items can have significant impacts on installation costs. The intention of this report is not to estimate the costs of these items, but only looks for indications of fatal flaws. However, if one appears to be an issue for the chosen site, it may be advisable to study it further relatively early in the project.

† Please note that this report is based on publicly available information and conversations with site owner representatives. There may, however, be other land-use restrictions, unregistered wetlands, etc. of which RERL is not aware. It is the town's responsibility to ensure the environmental appropriateness of the chosen site.

Appendix B: Wind-Monitoring Logistics

Traditionally, wind is monitored for about a year with a met tower. Some sites may be suitable for other types of monitoring in addition to a met tower. This section will concentrate on the siting of a met tower. Figure 1 in **Appendix C** is a schematic of a met tower.

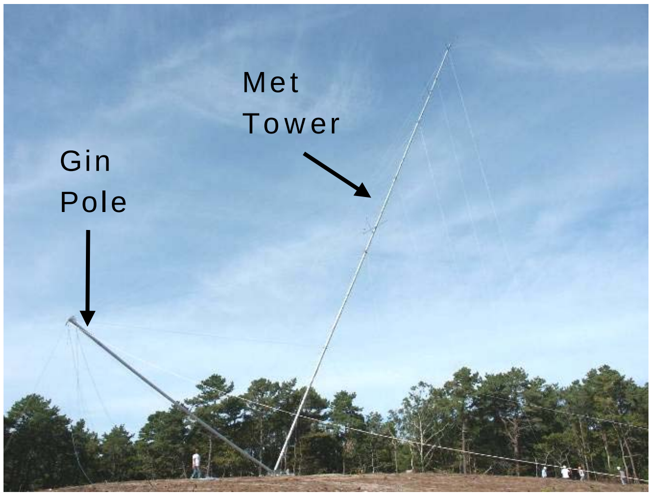
About met towers

Most met towers are temporary structures that do not require a foundation and are supported by guy wires in 4 directions. Towers are usually 40 meters (131') or 50 meters (164') tall. In most cases, standard utility anchors are used to anchor the guy wires. The number and type of anchors required depends on the particular site. They will be proof-tested at installation to make sure they can hold enough load.

The tower is raised using a winch; no crane is required. The tower consists of a set of 6" diameter pipes that stack together; the whole set-up can be brought in on a pick-up truck.

The pictures on this page give an idea of what this equipment looks like.

A met tower base-plate sits directly on the ground.



In the process of raising a met tower, the "gin pole" gives the winch leverage to lift the tower.

Typical 6-foot-long utility screw-in anchor

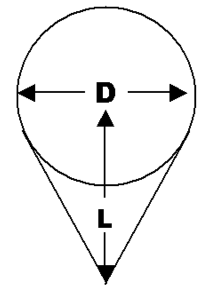
RERL's truck loaded with the sections of a 50-meter met tower

An anchor, installed, with 2 guy wires attached

Space required for a met tower

Clearing is necessary both for met tower installation and to reduce ground effect disturbance during data collection. The cleared area is shaped like a circle for the guy wires, with an additional "wedge" in which the tower is assembled before being raised. An additional buffer is then cleared around that area to leave some area to work. The **minimum** cleared areas for guyed towers are:

Tower Height	**D** **(Guy Diam.)**	**L** **(Space to lay the tower down)**	**Approximate total envelope to be cleared**
40 meter (131')	160 feet	135 feet	240 x 190 feet
50 meter (164')	240 feet	165 feet	310 x 270 feet
Dimensions of a football field, for comparison:			*300 x 160 feet*



In general, a larger cleared area reduces the disturbances seen by the instruments, and improves data quality. Therefore, **a cleared area larger than the minimum size is preferred**.

While it is not necessary to pull stumps, removing as much obstruction and underbrush as possible will facilitate the raising of the tower. Guy-wires will be pulled across this field, and any obstacles that entangle the wires make the job more difficult.

It is also essential that there not be any electric or telephone wires within 1.5 times the height of the tower, i.e. 200 feet of a 40 m tower, or 250 feet of a 50 m tower.

Trees must be cleared at least the height of the trees away from the anchors to eliminate the danger of a falling tree hitting the guys. For example, a 50-foot-tall tree within less than 50 feet of an anchor must be cut down.

Note that it is possible to use some of this cleared area after the met tower has been installed; in other words, after installation, the space is left largely open.

Met Tower Siting Considerations

Generally speaking, wind speed and turbulence should be monitored at, or as close as possible to, the preferred wind turbine site. However, met tower siting involves certain additional considerations, and it may not always be possible to monitor wind at the proposed turbine site. This section provides an overview of the feasibility of placing a met tower in Swampscott.

Space Availability at the Swampscott sites (Line 32-34)

Phillips Park: There is adequate space for a met tower at this site. However, the guy wires supporting the met tower would prevent the use of one or more ball fields at the site for the duration of wind monitoring, or about one year. For safety reasons, the RERL will not install a met tower with guy wires straddling the road leading to the parking lot.

Forest Avenue: There is insufficient space at this site for a met tower, unless a portion of the golf course property were cleared and utilized for one or more anchors. In addition, the unlevel terrain would present significant challenges to raising a met tower at this site.

Jackson Park: If the track is used for the met tower, then adequate space exists at this site. However, the track would remain unusable for the duration of wind monitoring, or about one year. In addition, the tree grove would impact the quality and reliability of collected wind data. If the town does not wish to occupy the track with a met tower, then an area approximately the size of the track would need to be cleared of trees.

Swampscott Quarry: The proposed site south of the quarry is not large enough to accommodate a met tower. Power lines at the site also prohibit the RERL from installing a met tower at this location. Wind monitoring at this site will not be discussed further.

Clearing requirements (Line 35)

A met tower requires a cleared area approximately the size of a football field.

Phillips Park: Minimal clearing may be necessary at the Phillips Park site, depending upon micro siting decisions.

Forest Avenue: Significant clearing would be necessary for a met tower installation; further, part of the golf course property adjacent the site would also need to be cleared to accommodate one or more anchor placements.

Jackson Park: If the track is used for the met tower, then minimal clearing would be necessary. If the tree grove is chosen, extensive clearing of mature trees would be necessary.

Soil quality & anchor requirements (Line 36)

The soils at the sites were not tested; however soil quality for anchor placement is not expected to be a fatal flaw for any of the sites at this time. The anchors would be tested at the time of installation.

Accessibility for met tower installation (Line 37)

Phillips Park: This site offers sufficient access for the RERL's pick up truck.

Forest Avenue: The site is not immediately accessible by road. At the very least, fences and trees would need to be removed in order to allow for the RERL's pick up truck to access the site.

Jackson Park: If the track is chosen for a met tower installation, the site could be accessed from the road leading from the high school to the track. If the tree grove adjacent the track was chosen, the site could be accessed from Foster Road; however, extensive clearing would be needed as the area is heavily wooded.

Permitting: Local approval process

Some local permits may be required for the temporary met tower, such as building permits, zoning variances, DigSafe, etc**.**

Nearby airports & FAA restrictions for met towers

Most met towers are shorter than 200 feet and do not require registration with the FAA.

Lighting

The FAA does not require met tower lighting at these sites.

Proximity of anemometry & turbine (Line 41)

While wind resource assessment directly on the proposed turbine site is preferred, it is not required. If wind data are collected in one spot, but a site for a wind turbine is later chosen in another nearby location, then a computer model that considers the wind data and terrain can be used to extrapolate the data from one location to the other. As the two sites become farther apart, however, the level of certainty in the data goes down, and thus the amount of risk in the investment goes up. It is difficult to predict the rate at which the certainty changes with distance and this can only be estimated on a site-specific basis. Thus, an understanding of preferred turbine spots is necessary to choosing a met tower site.

All sites proposed in this report are within two miles of one another; thus, data collected at one site could be used to evaluate wind speeds at any of the other proposed sites. However, as previously noted, accuracy diminishes as the distance between the turbine and monitoring locations increases. For instance, the difference in wind characteristics between the Phillips Park and Quarry sites is likely to be significantly greater, given both their surrounding environments and respective distances from the coast, than between the Phillips Park and Forest Avenue sites.

If the Town elects to monitor winds speeds at one site for the purposes of predicting wind characteristics at another site, than the aforementioned caveats should be given careful consideration. The most-accurate and site-specific data would be provided through monitoring at the exact location of interest.

Met tower size recommendation (Line 43-44)

There are usually two size options for met towers: 40-meter and 50-meter. The choice of a met tower depends on the site. If wind monitoring were pursued at any of the proposed sites, a 50-meter met tower would be recommended.

Conclusion: met tower siting recommendations

Wind-monitoring options should be discussed further depending on the site and the turbine size considered. If the town is interested in installing a medium or utility-scale wind turbine in Swampscott, then on-site wind monitoring is recommended.

If the town decides to monitor wind speeds at Phillips Park, then a 50-meter tower would be recommended. The town should keep in mind that a met tower installation at this site would render one or more of the playing fields unusable for the duration of wind monitoring, or about one year.

If the town decides to monitor wind speeds at Forest Avenue, then a 50-meter tower would be recommended. However, due to the clearing, access, and topographical challenges that this site presents, the town might consider alternative means of wind speed measurement, including SODAR and LIDAR, which require neither extensive clearing nor a large, relatively flat area. The Town of Swampscott could explore these options in consultation with the MTC if a full feasibility study is pursued at one of the proposed sites.

If the town decides to monitor wind speeds at Jackson Park, then a 50-meter tower would be recommended. The town should keep in mind that a met tower installation at the this site would either render the playing field unusable for one year or would require that a large number of the mature trees in Jackson Park be removed.

The town should also keep in mind that RERL plans to monitor the wind resource in the town of Salem during the spring and summer of this year.

If smaller scale turbine sizes (less than 600 kW) are considered, wind monitoring is beneficial but may not be essential.

Appendix C: Maps, Photos, and Figures

Refer to the report "Wind Power in Swampscott: Siting Considerations for a Wind Turbine" for a discussion of these maps, photos, and figures.

Source for base maps

Ortho (aerial) photographs are from the MassGIS website, www.mass.gov/mgis/dwn-imgs.htm. The entire commonwealth was photographed in April 2005, when deciduous trees were mostly bare and the ground was generally free of snow.

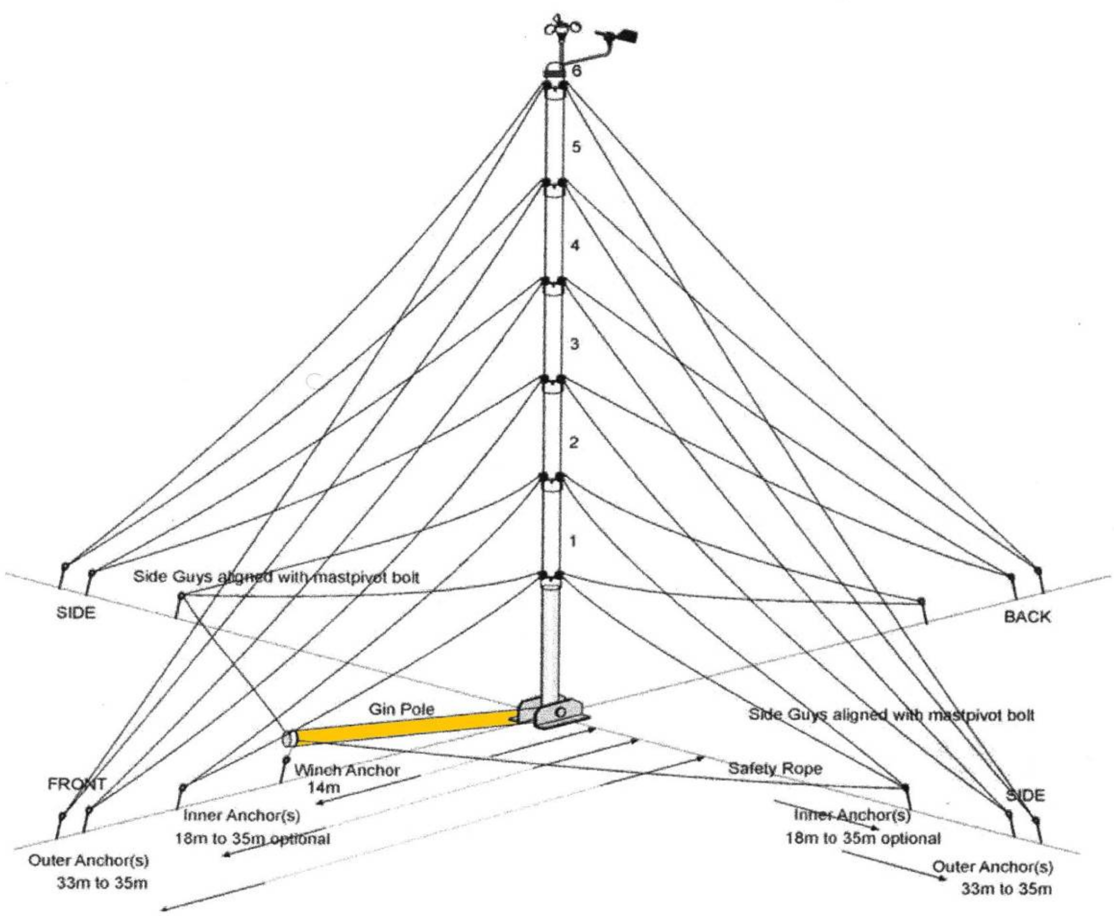
Topographic maps, roads, and town boundaries are also from MassGIS.

Mean wind speeds are AWS-Truewind's estimates for New England, 2003.

Notes regarding residential buffer zones (Figures 5 - 8)

Orthophotographs at each site were overlaid with residential buffer rings corresponding to the suggested "three times blade tip height guideline." According to this guideline, a 100 kW turbine could be sited outside the navy blue zone, whereas a 250 kW turbine would be sited outside both the navy blue and lime green zones.

Figure 1: Guy line layout for a 50-meter met tower from Second Wind, Inc.



Swampscott, MA

Estimated Wind Resource at 70 meters

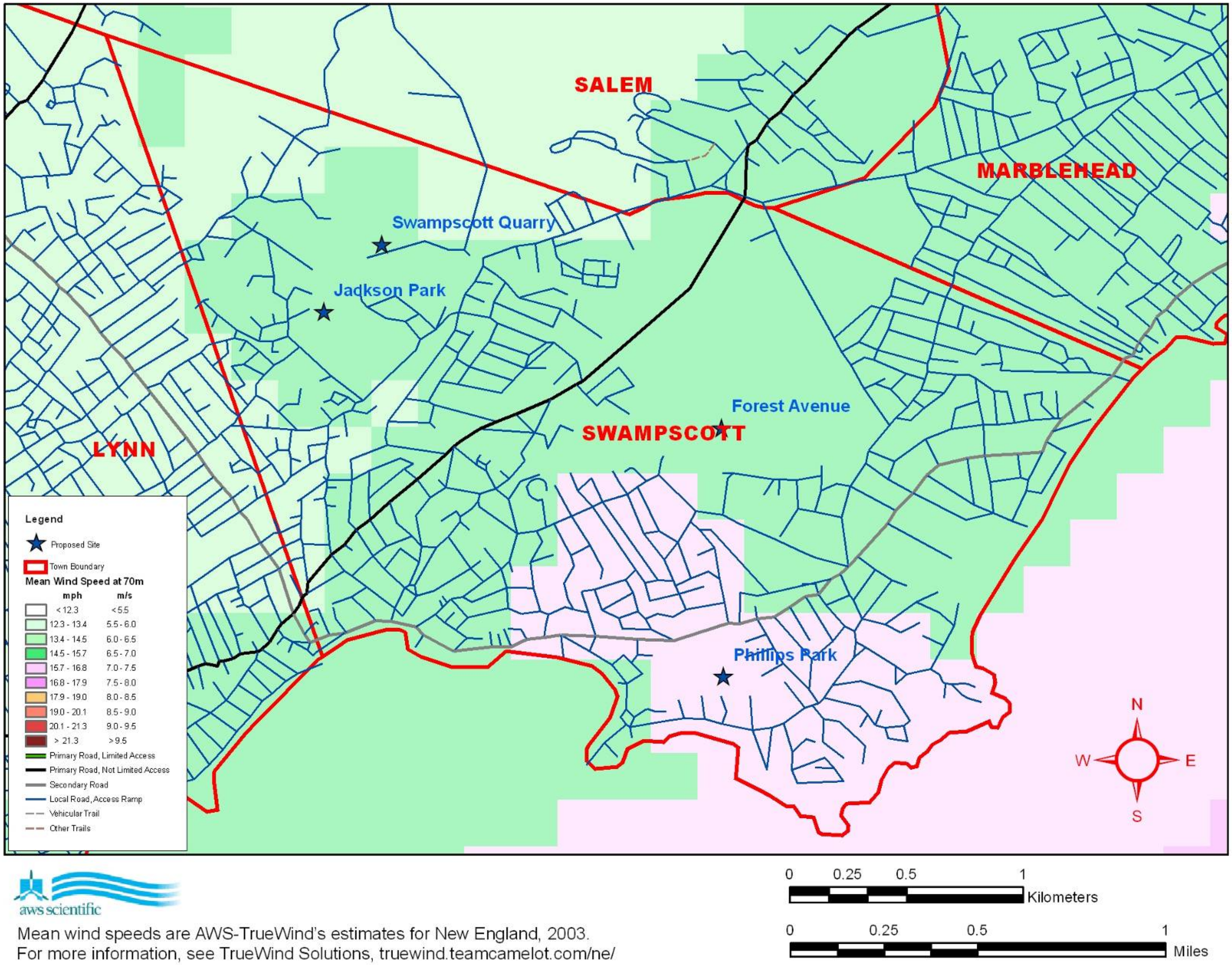


Figure 2: This map depicts wind speeds at 70 meters, approximately the hub-height of utility-scale wind turbines (~1.0 MW or greater). The sites described in this report are too close to residences to accommodate utility scale wind projects.

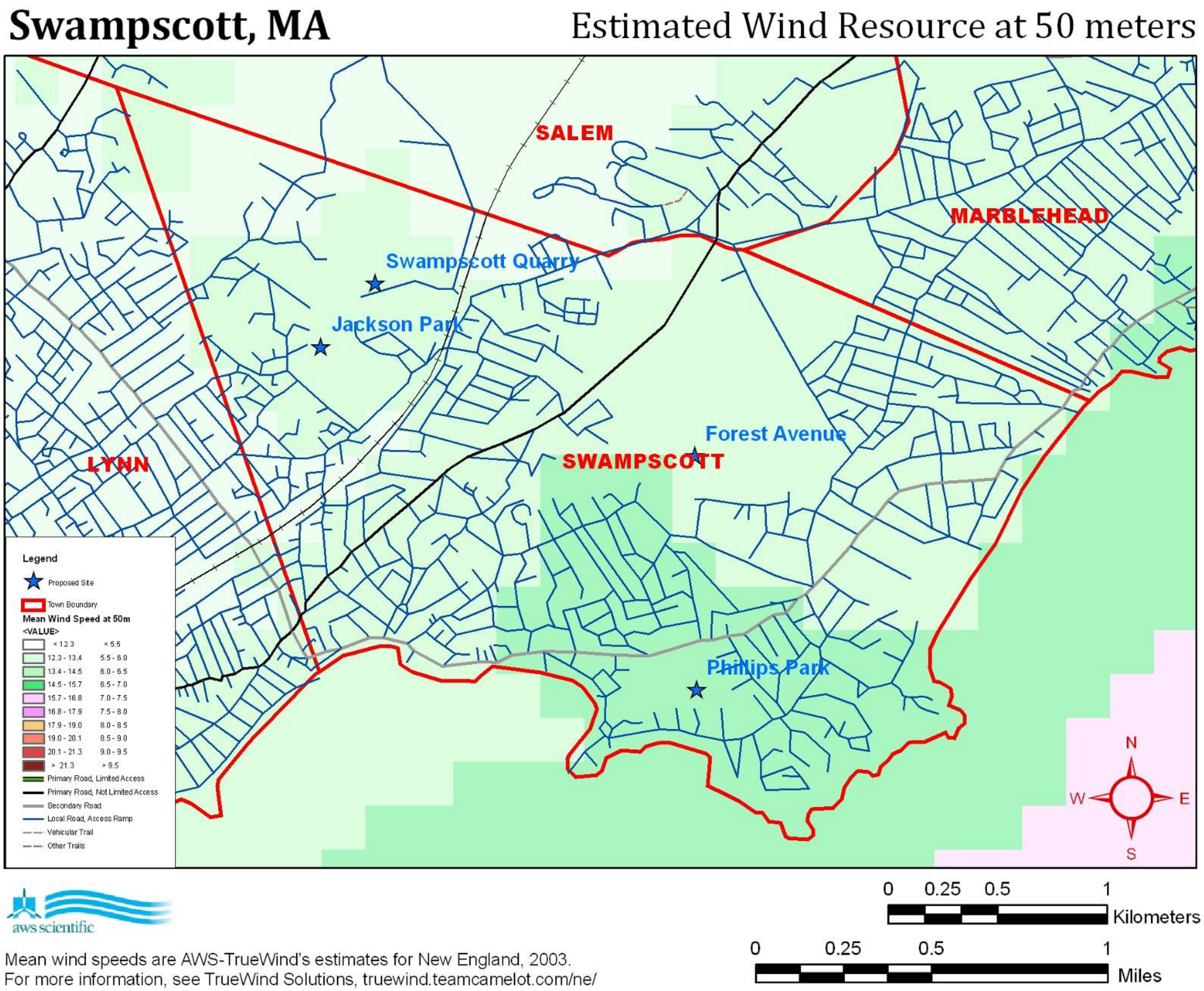


Figure 3: This map depicts wind speeds at 50 meters, approximately the hub-height of medium-scale wind turbines (~660 kW). From a first pass estimate, the Forest Avenue and Swampscott Quarry sites appear to feature sufficient space for this scale of wind turbine.

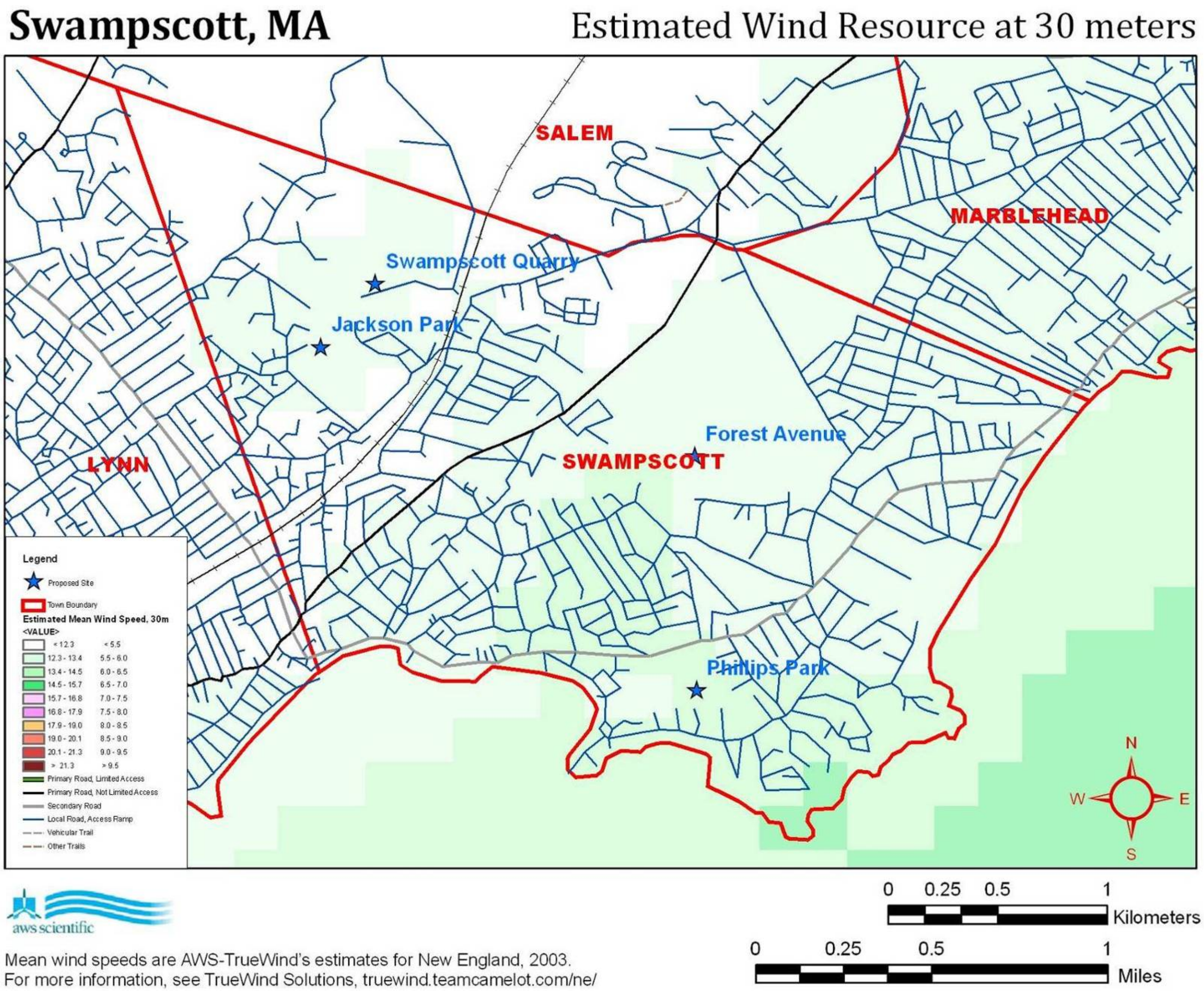


Figure 4: This map depicts wind speeds at 30 meters, approximately the hub-height of small to medium-scale wind turbines (~250 kW or less). The Phillips Park and Jackson Park sites could potentially accommodate turbines in this range.

Swampscott, MA: Forest Avenue

Residential Buffer Zones for Medium-Scale Turbines

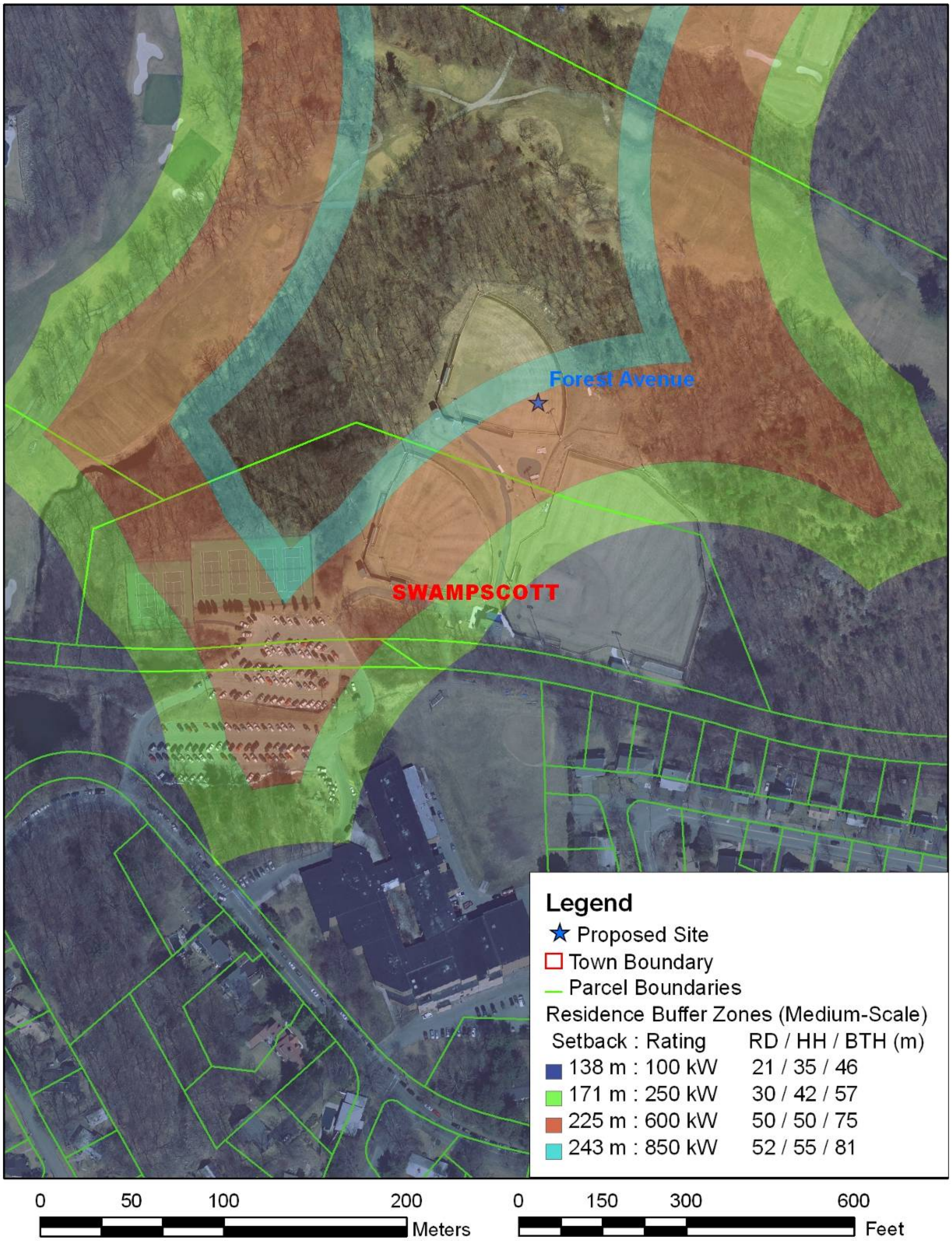


Figure 5: This aerial photo displays residential buffer zones at the Forest Avenue Site. A 600 kW turbine would be sited outside the orange region, towards the center of the photo. A slightly larger turbine (~850 kW) might also be possible beyond the teal ring buffer ring.

Swampscott, MA: Phillips Park

Residential Buffer Zones for Medium-Scale Turbines

Figure 6: This aerial photo displays residential buffer zones in at the Phillips Park site. A 250 kW turbine could potentially be sited in the orange region in the center of the photo, according to the "three times blade tip height" rule of thumb.

Swampscott, MA: Swampscott Quarry

Residential Buffer Zones for Medium-Scale Turbines

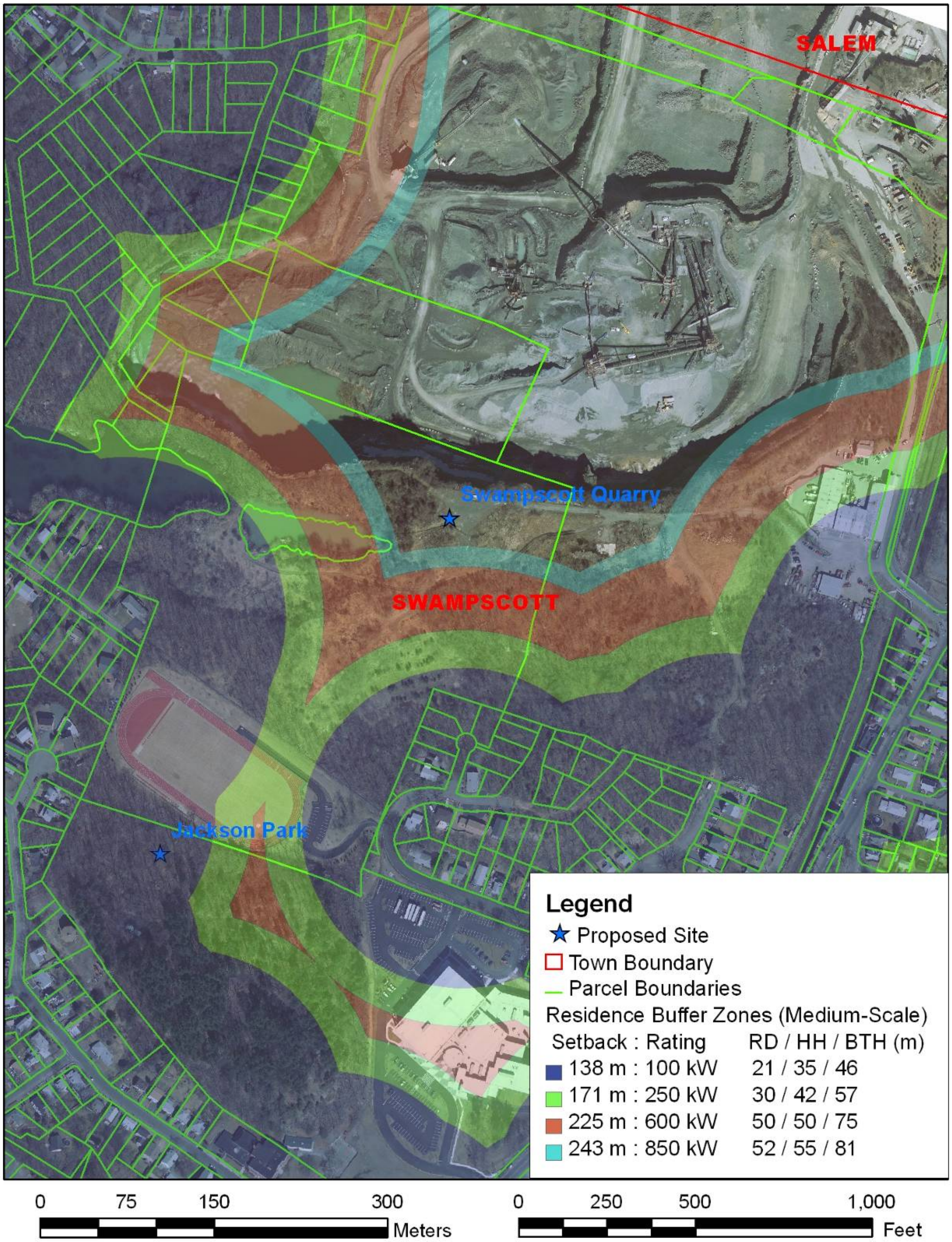


Figure 7: This aerial photo depicts residential buffer zones at the Swampscott Quarry. Jackson Park can also be seen in the lower portion of the photo.

Swampscott, MA: Jackson Park

Residential Buffer Zones for Medium-Scale Turbines

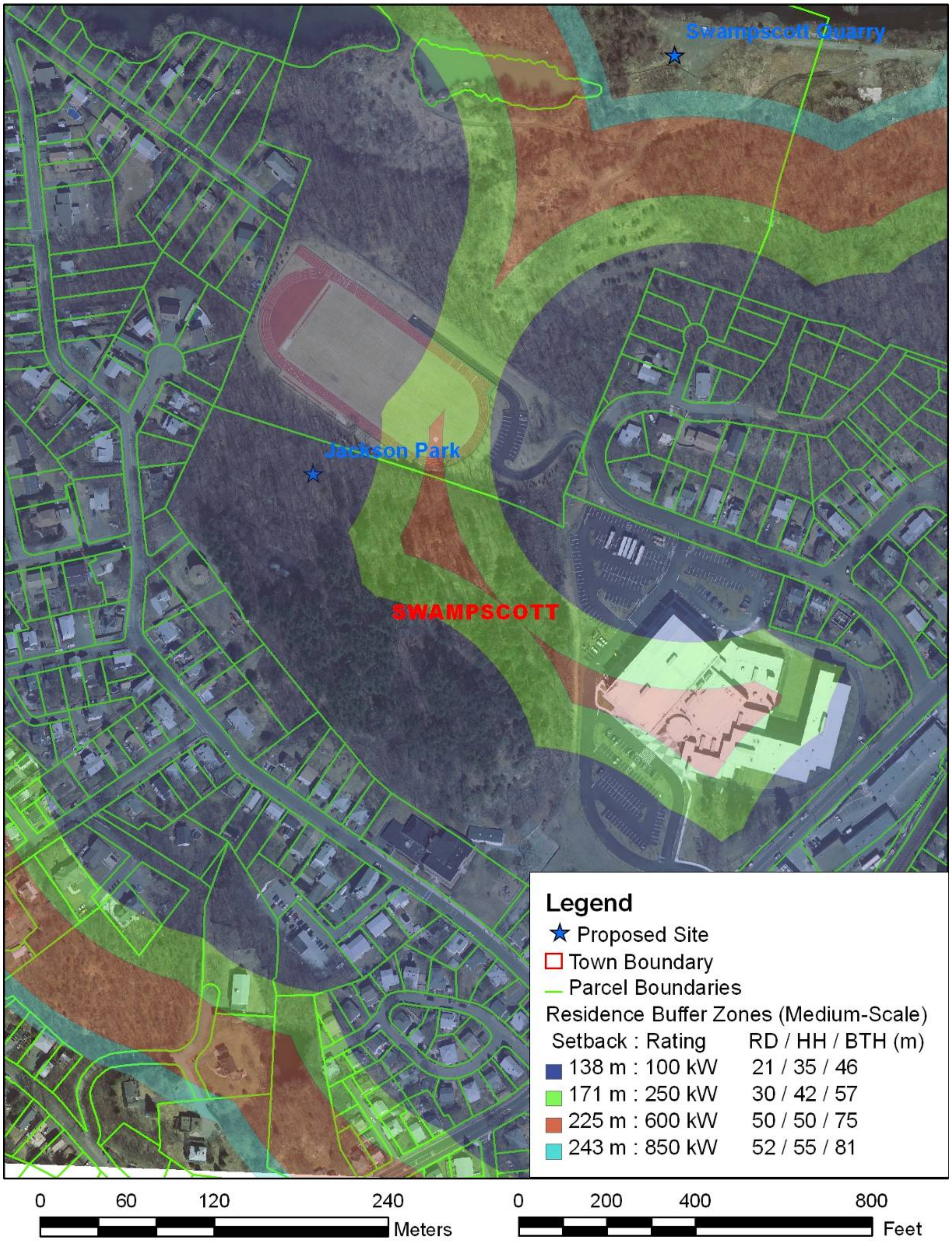


Figure 8: This aerial photo depicts residential buffer zones at Jackson Park. With careful micrositing, the site could potentially support a 250 kW turbine in the orange region near the track or school facility.

Swampscott, MA

Environmental Designations, Jackson Park & Quarry

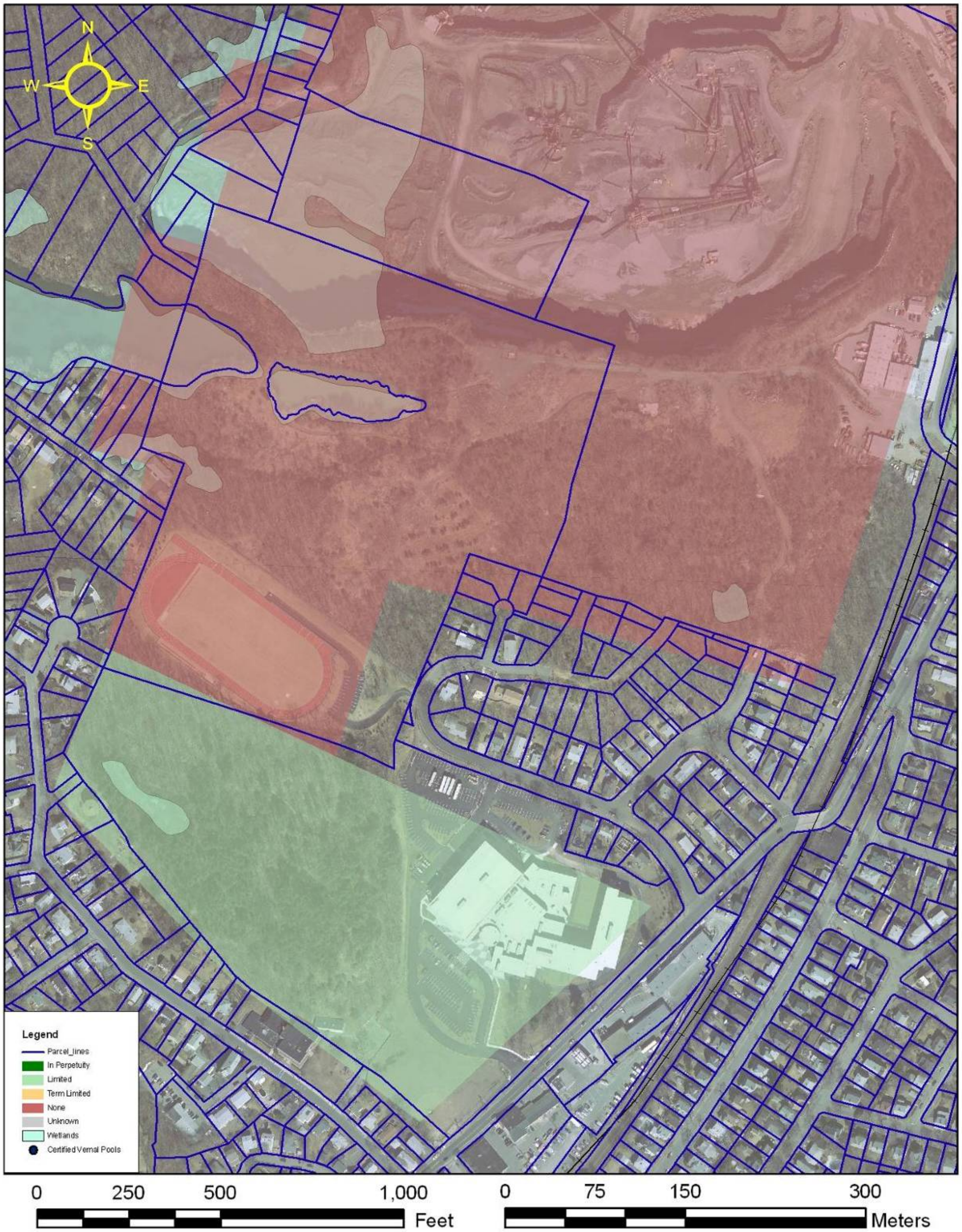


Figure 9: This aerial photo depicts environmental designations around the Swampscott Quarry and Jackson Park. The red overlay on the quarry indicates a mining area. Jackson Park is designated as protected open space. The amorphous teal overlays indicate areas of wetlands.

Figure 10: This is an aerial photograph of Phillips Park. There is adequate space for a met tower, however a met tower installation would leave one or more playing fields unusable for the duration of wind monitoring, or about one year.

Figure 11: This is a recent aerial photograph of the Forest Avenue site. Adequate space for a met tower exists to the northeast of the playing fields, provided that several trees are cleared on both school and golf course property. The uneven terrain at this site would present challenges to raising a met tower.

Figure 12 (above): This is an aerial photograph of the proposed Jackson Park site. One possibility is to place the met tower on the track, rendering it unusable for about one year. Alternatively, the town might consider clearing a space roughly equal to the size of the track in the tree grove located in the center of the photo.

Figure 13 (below): This is an aerial photograph of the Swampscott Quarry. The proposed site, labeled by the red marker, is not large enough for a met tower. There are also power lines located at this site, making it infeasible for a met tower installation.

Attachment E – Chronology of the Renewable Energy Committee

Chronology of the Swampscott Renewable Energy Committee
(and other energy initiatives supported by the Swampscott DPW or School District)

More information is available on the Renewable Energy Committee's website at http://www.town.swampscott.ma.us/Public_Documents/SwampscottMA_BComm/energy1.

May 14, 2010. Submitted Designation Form to become a Green Community.

May 12, 2010. Fuel-Efficient Vehicle Policy Adopted by School Committee

May 11, 2010. Fuel-Efficient Vehicle Policy Adopted by Board of Selectmen

May 4, 2010 Commonwealth Wind Feasibility Grant Submitted to CEC. This grant is for $85,000.

May 3, 2010 Town Meeting: Four energy related articles passed; stretch energy code was adopted; bonding for a $940,616 Energy Services Contract passed; and two zoning articles allowing "Renewable and Alternative Research and Development Facilities" in the town's Industrial Zone passed. These four articles support the town's efforts to become a Green Community.

April 28, 2010 Public Information Session on Stretch Energy Code.

April 28, 2010 Public Hearing on Proposed Zoning Bylaw Changes**.**

April 12, 2010. "Ask the Energy Miser" column in the Swampscott Reporter on the Green Communities Act, the stretch energy code and the rebates for homeowners interested in energy efficiency and solar energy.

March, 2010. DPW employee attended MassEnergy Insight training. Town plans to adopt this energy data tracking method.

March 2, 2010 Joint Builders' Forum with Salem's Renewable Energy Task Force to discuss the stretch energy code.

February, 2010 Commonwealth Solar Grant application submitted to CEC. This grant for $162,000 would have supported solar panels on the High School. *Not funded.*

February 11, 2010. Joint Meeting with Salem Renewable Energy Task Force.

February, 2010. ESCO Investment Grade Audit Completed**.** Johnson Controls submitted an audit showing $3.5 million in improvements. This scope was reduced to $2.4 million due to limitations at the utility relating to the street lights. The scope was further reduced to $940,616 by the School District and the Town Administrator.

January, 2010. National Grid awarded us $24,000 to pursue energy efficiency at the pumping station.

December, 2009 EECBG Grant for $150,000 submitted. This was for a geothermal system at the Town Library. *Not funded.*

November 17, 2009 Commonwealth Wind Feasibility Grant Submitted to CEC**.** $85,000 **-** *Not funded.*

Fall, 2009. Coordinated with Police Station Building Committee to ensure energy-efficiency (LEED silver) is integrated into new police station.

October, 2009. Signed a Project Development Agreement with Johnson Controls, Inc. for an Investment Grade Audit on eleven Town and School Buildings.

September 21, 2009. "Ask the Energy Miser" column in the Swampscott Reporter promoting International Walk to School Day.

September, 2009. Voted to award remaining Clean Energy Choice program money ($9559.89) to the High School Physics Club to support their innovative examination of renewable energy technologies. Clean Energy Choice program ended forcing us to commit the remaining money by the end of the month.

September, 2009. Awarded DOER joint planning grant (with the City of Salem) to receive assistance in becoming a Green Community.

March, 2009. Issued a Request for Qualifications for Energy Management Services in accordance with M.G.L. c.25A, Sec. 11i.

November 13, 2008. "Ask the Energy Miser" column in the Swampscott Reporter on the Green Communities Act.

September 11, 2008. "Ask the Energy Miser" column in the Swampscott Reporter on the visit to Carlton Elementary School in Salem that the Renewable Energy Committee sponsored for local officials.

May 16, 2008. "Ask the Energy Miser" column in the Swampscott Reporter on LEED buildings.

April 2008. Utility audit of new high school.

March 5, 2008. Site visit by UMASS Renewable Energy Research Laboratory to investigate potential wind energy sites in Swampscott. Report Mary 14, 2008. Updated October 8, 2008.

March 2008. Hosted community forum on Leadership in Environmental and Energy Design (LEED) standards. Program was presented by SEA Consultants.

January 17, 2008. "Ask the Energy Miser" column in the Swampscott Reporter on the High School lights being on all night. This column ushered in a new phase of lighting reduction at the High School.

January 10, 2008. "Ask the Energy Miser" column in the Swampscott Reporter on opportunities for businesses to improve energy efficiency.

January 3, 2008. "Ask the Energy Miser" column in the Swampscott Reporter on the town's energy resolution, greenhouse gases, carbon offsets and the town's efforts to win solar panels through the Clean Energy Choice program.

June 2007. Town installed a "Big Belly" solar-powered trash compacter at King's Beach (subsequently moved to the playground at Clarke School). This was purchased partly with Clean Energy Choice funding.

February 27, 2007. "Ask the Energy Miser" column in the Swampscott Reporter on the Clean Energy Choice program.

March 15, 2007. "Ask the Energy Miser" column in the Swampscott Reporter on the Clean Energy Choice program and our efforts to win a free solar panel.

March 2007. KeySpan Audit of town buildings.

November 8, 2007. "Ask the Energy Miser" column in the Swampscott Reporter on "vampire" energy use.

November 11, 2007. "Ask the Energy Miser" column in the Swampscott Reporter on recycling computer equipment and other items.

December 18, 2007. Board of Selectmen pass an Energy Resolution to reduce the town's Greenhouse Gas Emissions by 12% by 2014 and by 20% by 2020, measured from a 2005 benchmark.

December 13, 2007. "Ask the Energy Miser" column in the Swampscott Reporter on efforts to win free solar panels through the Clean Energy Choice program.

Fall, 2006. "Battle of the Bulb". Swampscott and Marblehead participated in a competition to see which town could get more residents to take a pledge to switch to change a light bulb to an energy-efficient Compact Fluorescent Bulb (CFL). We exceeded our goal of obtaining 350 pledges with 581 pledges. Outreach was conducted at the schools, in the Swampscott Reporter and at various events around town. Marblehead won the contest with 961 pledges.

October 2, 2006. "Ask the Energy Miser" column in the Swampscott Reporter on the Light Bulb contest.

September 7, 2006. “Ask the Energy Miser” column in the Swampscott Reporter on reducing water use.

August 2006. Hosted well-attended community forum on geothermal energy at the Public Library.

July 27, 2006. “Ask the Energy Miser” column in the Swampscott Reporter on energy efficiency.

June 15, 2006. “Ask the Energy Miser” column in the Swampscott Reporter established. First column address ways to get better gas mileage from your car.

February 2006. National Grid audit of town buildings.

2005. Swampscott Board of Selectmen establishes Renewable Energy Committee.