

City of Milford



AGENDA

Council Meeting

July 25, 2011

Milford City Hall - Joseph Ronnie Rogers Council Chambers - 201 South Walnut Street, Milford, Delaware

7:00 p.m.

BOARD OF REVISION AND APPEAL—CANCELED

Fiscal year 2011-2012 General Assessment as Adjusted by Supplemental Assessments

PUBLIC HEARINGS

Zoning Code Amendment/Outdoor Woodburning Furnaces/Adoption of Ordinance 2011-5

Morris and Ritchie Associates, Incorporated on behalf of Griffin Realty, LLC—DEFERRED
(formerly known as Central Parke at Milford/Milford Ponds)

COUNCIL MEETING

Call to Order - Mayor Joseph Ronnie Rogers

Invocation

Pledge of Allegiance

Recognition

Communications

National Night Out

Unfinished Business

Adoption of Ordinance 2011-15/Amend 2008 Comprehensive Plan to Include Southeast Master Plan

URS Engineering Agreement

Planning Commission Vacancy

Planning Commission Reappointments/Replacements

Tyler Technology Agreement/Funding Approval/Electric Reserves

New Business

*Bid/Kubota Tractors & Snow Blade/Parks and Recreation

Introduction of Ordinance 2011-20/Readjustment of Ward Boundaries in the City of Milford

Executive Session-Pursuant to 29 Del. C. §10004(b)(9) Personnel matters in which the names, competency and abilities of individual employees or students are discussed

Executive Session Matter

Adjourn

SUPPORTING DOCUMENTS MUST BE SUBMITTED TO THE CITY CLERK IN ELECTRONIC FORMAT NO LATER THAN ONE WEEK PRIOR TO MEETING; NO PAPER DOCUMENTS WILL BE ACCEPTED OR DISTRIBUTED AFTER PACKET HAS BEEN POSTED ON THE CITY OF MILFORD WEBSITE.

This agenda shall be subject to change to include additional items including executive sessions or the deletion of items including executive sessions which arise at the time of the public body's meeting.

City of Milford



PUBLIC NOTICE

City of Milford Property Tax Appeals

****CANCELED****

Please be advised that on Monday, the 25th day of July 2011 at 7:00 p.m., the City Council of the City of Milford will sit in the Joseph Ronnie Rogers Council Chambers at Milford City Hall, 201 South Walnut Street, Milford, Delaware, as a Board of Revision and Appeal in regard to the 2011-2012 City of Milford General Property Assessment.

Property owners wishing to appeal the value of their property under the 2011-2012 General Assessment must contact John Darsney, Land Management Data Manager, City of Milford Public Works Facility at 302-424-3712 Extension 314 by 4:30 p.m. on Friday, July 8, 2011.

Copies of the 2011-2012 General Assessment are posted for public information at Milford City Hall, 201 South Walnut Street, Milford, Delaware and at the Milford Public Library, 11 Southeast Front Street, Milford, Delaware.

Issued this 13th day of June 2011 pursuant to Article 7 of the Charter of the City of Milford, Delaware.

David W. Baird
City Manager

*Posted 06/08/11 **CANCELED 07/01/11 DUE TO NO APPEALS (D. Williams)*

PUBLIC NOTICE
PLANNING COMMISSION & CITY COUNCIL PUBLIC HEARINGS
City of Milford Zoning Code Amendment
Ordinance 2011-5

NOTICE IS HEREBY GIVEN the Planning Commission of the City of Milford will hold a Public Hearing on an amendment to the City of Milford Zoning Code on Tuesday, July 19, 2011 at 7:00 p.m.

A FINAL PUBLIC HEARING is scheduled on Monday, July 25, 2011 at 7:00 p.m. before Milford City Council. Following the hearing, Ordinance 2011-5 may be adopted, with or without amendments.

NOW, THEREFORE, THE CITY OF MILFORD HEREBY ORDAINS:

ORDINANCE NO. 2011-5

Chapter 230: Zoning

It is generally recognized that the types of fuel used, and the scale and duration of burning by outdoor woodburning furnaces, creates noxious and hazardous smoke, soot, fumes, odors and air pollution, can be detrimental to citizens' health, and can deprive neighboring residents of the enjoyment of their property or premises. Therefore, with the adoption of this article, it is the intention of the City of Milford to establish and impose restrictions upon the construction and operation of outdoor woodburning furnaces within the limits of the city for the purpose of securing and promoting the public health, comfort, convenience, safety, welfare and prosperity of the city and its inhabitants.

Section 1.

An Ordinance to amend the Code of the City of Milford, Chapter 230, thereof, entitled, Zoning, by defining and regulating Outdoor Woodburning Furnaces in the City of Milford.

Section 2.

Amends Article I, General Provisions, §230-4, Definitions, by adding a definition for Outdoor Woodburning Furnace.

OUTDOOR WOODBURNING FURNACE-An accessory structure, designed and intended, through the burning of wood, for the purpose of heating the principal structure or any other site, building, or structure on the premises.

Section 3.

Amends Article I, General Provisions, §230-4, Definitions, by adding a definition for Firewood.

FIREWOOD-Trunks and branches of trees and bushes, but does not include leaves, needles, vines or brush smaller than three inches in diameter.

Section 4.

Amends Article I, General Provisions, §230-4, Definitions, by adding a definition for Stack or Chimney.

STACK or CHIMNEY-Any vertical structure enclosing a flue or flues that carry off smoke or exhaust from a solid fuel fired heating device or structure, including that part of the structure extending above a roof.

Section 5.

Amends Article VIII, Miscellaneous Provisions, §230-41, Accessory Uses, by adding a new paragraph (D) regulating Outdoor Woodburning Furnaces, to read as follows:

D. Outdoor Woodburning Furnaces

(1) Prohibited

(A) The construction and operation of outdoor woodburning furnaces is hereby prohibited within the City of Milford.

(2) Nonconforming Uses

(A) All woodburning furnaces operating within the City of Milford must be removed by the property owner from the subject premise no later than ~~April 30, 2012~~ AUGUST 31, 2011.

This will allow sufficient time for an alternate source of heat to be established. During the transition, such use shall conform with the following provisions:

(1) Only firewood and untreated lumber are permitted to be burned in any outdoor furnace.

(2) Wood must be stored in a neat pile no closer than five feet from side and rear property lines.

Section 6. Dates.

Introduction to City Council: 06/13/11

Planning Commission Hearing (Revisited): 07/19/11

City Council Hearing: 07/25/11

Effective Date: 08/31/11

Both hearings will be held in the Joseph Ronnie Rogers Council Chambers at Milford City Hall, 201 South Walnut Street, Milford, Delaware.

The public is invited to attend and encouraged to comment on the amendment to the Zoning Code. If unable to attend, written comments will be accepted but must be submitted to the City Clerk's Office one week prior to the hearing.

A complete copy of the Code of the City of Milford is available by request through the City Clerk's Office or by accessing the official website at cityofmilford.com.

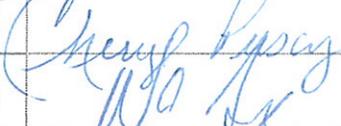
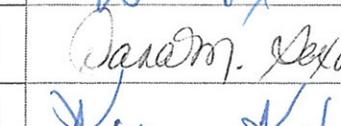
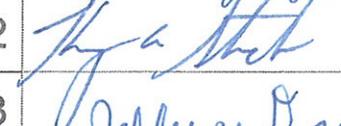
By: Terri K. Hudson, CMC

062311

I/We the undersigned support Ordinance Number 2011-05 which pertains to banning Outdoor Wood Burning Furnaces. We each have our concerns of the emissions of particulates and the odor that these type of furnaces produce. The smoke and smoke odor emitted from one that we have in our neighborhood has somewhat changed our life style, example of point; not opening our windows, for fear our residence will smell of smoke. We understand depending on the prevailing winds who is affected and any point in time.

	SIGNATURE	ADDRESS
1	Michael Wael	702 SE 2 ND STREET
2	John Webb	610 SE 2 ND ST
3	Chris Austin	610 S.E. 2 ND ST.
4	John Wain	606 S.E. 2 ND ST.
5	Shirley Thomas	204 Charles St.
6	Walter	606 SE 2 ND ST
7	Martha Filippi	607 SE 2 ND Street
8	Cheryl Olbrich	804 S.E. 2 ND ST
9	Phil Duncan	214 Charles
10	Wanda Duncan	214 Charles
11	Michael Bannip	200 Fishers AVE
12	John Cullen	217 Marshall St
13	Bill Sman	215 Marshall St
14	J. J. Will	208 Marshall St
15	Rami Strapp	305 MARSHALL ST
16	GARY McFEE	203 CHARLES STREET
17	Shaun Hill	203 Charles Street

I/We the undersigned support Ordinance Number 2011-05 which pertains to banning Outdoor Wood Burning Furnaces. We each have our concerns of the emissions of particulates and the odor that these type of furnaces produce. The smoke and smoke odor emitted from one that we have in our neighborhood has somewhat changed our life style, example of point; not opening our windows, for fear our residence will smell of smoke. We understand depending on the prevailing winds who is affected at any point in time.

	SIGNATURE	ADDRESS
1		800 SE 2nd St
2		800 SE 2nd St
3		611 SE 2nd St
4	Carole M. Nelson	611 S.E. 2 nd St.
5	Karen Kohut	202 Fisher Ave
6	Mike Brittingham	317 FISHER AVE.
7	Carol Brittingham	317 Fisher Ave.
8	Donnie Verberstie	704 S.E. 2nd Street
9	Doni Chandler	704 S.E. 2nd Street
10	George Zang	210 Charles St.
11	Karen Zang	210 Charles St.
12		207 Charles St.
13	Jeffrey Dye	701 Southeast 2nd St.
14	Robert Donovan	609 SE 2ND ST
15	Albert Sime	301 MARSHALL ST.
16		806 S.E. 2nd St
17		202 Charles st

Shirley E. Thoms
204 Charles Street
Milford, DE 19963

July 11, 2011

Mr. Gary Norris, AICP
City of Milford Planner
201 South Walnut St.
Milford, DE 19963

Re: Ordinance 2011-05

Dear Mr. Norris,

The following documents are enclosed with this letter, and are submitted in support of Ordinance 2011-05, a ban on the installation and use of Outdoor Woodburning Furnaces, also known as Outdoor Wood Boilers and Outdoor Wood Hydronic Heaters:

- Letter from DNREC and material related to outdoor woodburning furnaces sent to the town of Laurel, dated 09/08/09:
 - Outdoor Wood Boiler Photos (for illustrative purposes only)
 - OWB Position Paper – American Lung Assoc. of Indiana March 2007
 - OWB Fact Sheet Rev. March 2007
 - Information from the following websites –
 - Harford County, MD
 - Sussex County, NJ
 - Maryland Department of the Environment
- Title 7 Delaware Administrative Code, Section §1114 Visible Emissions;
- Environmental Fact Sheet from NH Department of Environmental Services;
- Photo of wood pile at 700 SE Second Street, taken from 204 Charles St. before fence installation;
- Photo of fence installed by me to screen view of wood pile and furnace;
- Google Earth photo of the property at 700 SE Second Street, to illustrate the quantity of wood typically “stored” during heating season

I spoke to people in the Division of Air Quality at DNREC; unfortunately they were not able to provide me with the number of complaints they have received regarding this issue because complaints received are logged in under the general category of Outdoor Burning.

September 8, 2009

Town of Laurel
201 Mechanic Street
Laurel, DE 19956

Subject: Outdoor Wood Burning Boilers (OWBs)

Dear Honorable Mayor Shwed and the Members of Town Council:

The Air Quality Management Section of the Delaware Department of Natural Resources and Environmental Control has been asked by a town citizen to comment on the use of outdoor wood burning boilers (OWBs) in non-rural settings.

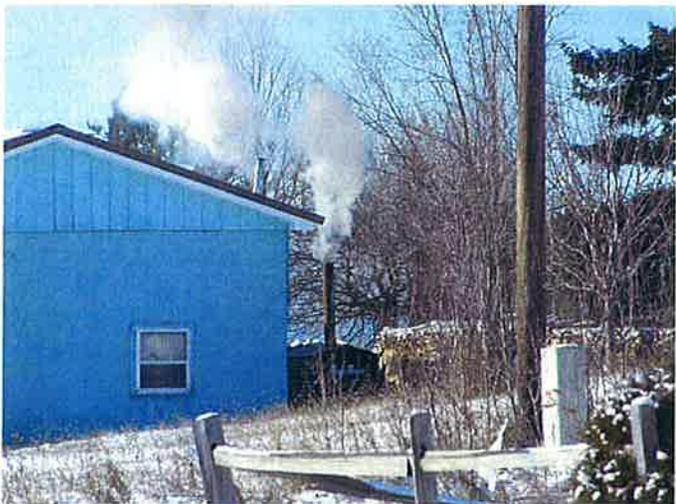
Although the State of Delaware has no specific regulation governing the operation of OWBs, all stationary sources of air pollution are required to meet the conditions of the **7 DE Admin Code Regulation 1114 - Visible Emissions**. This regulation establishes that, with a few industrial exceptions, no person shall cause the emission of visible air contaminants from a stationary source with opacity of more than 20% for an aggregate of three minutes in any one hour period or more than 15 minutes in any 24-hour period. Several states and the Environmental Protection Agency have reported that during normal operation, OWBs regularly emit visible smoke plumes. I am attaching some photographs from these units in operation.

OWBs are often employed in New England, New York, and the upper Midwest. The environmental regulatory agencies in these states report that OWBs are a source of particulate matter, creosote, and various unburned hydrocarbons. Exposure to these pollutants can trigger respiratory problems. The Department is particularly concerned with the generation of fine particulate matter as the State is under orders from the EPA to reduce the quantity of this pollutant in our air.

While the emission of smoke from an OWB may be mitigated by dispersion in the air and could present less of a health hazard in remote areas, they are not well-suited for suburban and urban settings. The close proximity of houses, schools, and other occupied buildings to an OWB as well as the short stack common on these units increases the chances of human exposure to its emissions and are a potential source of nuisance complaints.

Based on these facts, the Air Quality Management Section of the Delaware Department of Natural Resources and Environmental Control recommends that the Town of Laurel consider a ban on the erection and operation of outdoor wood burning boilers within the town limits. I am also including as an attachment position papers from American Lung Associations of Indiana and Maine as well as web information from States of Maryland, New Jersey and a very useful fact sheet from the State of Michigan.

Outdoor Wood Boiler photos – the smoke is not uncommon.



The design of OWBs also contributes to the problem. First, the boilers are built with a short stack, which results in the smoke staying in the lower atmosphere (3), the air we breathe everyday. Secondly, because the heat generated in the OWB has to travel through pipelines to get to the resident, the OWBs need to be constructed often within close range of the home/business so that the heat is not lost as it travels. This construction does not allow the smoke to disperse; therefore, it is present in dense quantities around the neighboring buildings (1). Thirdly, OWBs are burning all year long, which makes them a consistent issue (4). Finally, OWBs are also frequently used as incinerators for trash, commercial waste, other dirty fuels, etc. which should not be used in residential combustion (4).

What relevance does this have to Indiana?

In the northern counties of the Indiana, outdoor wood boilers are more commonly used. According to the American Lung Association's 2006 State of the Air Report, the counties of La Porte, Lake, and St. Joseph comparatively have some of the highest incidents of pediatric asthma, adult asthma, chronic bronchitis and emphysema in the state, especially in minors and those over 65 (5).

Lake, LaPorte and St. Joseph counties all received an "F" when grading the number of days that were "High Ozone". These three northern counties all had at least 22 days when the ozone level was in ranges declared unhealthy by the EPA. Lake County had such a high number of days in which the daily PM_{2.5} concentration was "unhealthy for sensitive groups" (those with lung/allergy issues) that they failed the annual evaluation (5). Clearly, the air quality in these counties is poor and using OWBs, which spread toxins in an already polluted environment, is exacerbating the quality of life for those who suffer from lung disease.

Concluding statements

The occurrence of lung health problems in the above listed counties (and in all counties in the state), in combination with the environmental conditions, demonstrate that there are serious issues affecting the well-being of Indiana residents. With all these negative factors working against the lung health of people throughout Indiana, measures must be taken to avoid further aggravating poor health and serious environmental conditions. Therefore, the American Lung Association of Indiana recommends that outdoor wood boilers not be used as an alternative heating source.

References:

- 1) Position Paper on Outdoor Wood Boilers. Air Toxics Advisory Committee, Maine, 2006. 1-20, 2 Mar, 2007 <<http://www.vtwoodsmoke.org/pdf/ME-ATAC-OWB-PositionVer720061201.pdf>>.
- 2) Blake, Uni, "Outdoor Wood Furnace and Boiler Pollution," Environmental Chemistry, 2006, 1 Mar, 2007 <<http://www.environmentalchemistry.com/yogi/environmental/200602outdoorwoodfurnaces.html>>.
- 3) "Outdoor Wood-Fired Boilers," 2006. Outdoor Wood-Fired Boilers. 28 Feb. 2007 <http://www.ecy.wa.gov/programs/air/AOP/Permits/Boiler/Outdoor_Boilers_home.html>.
- 4) "Outdoor Wood-Fired Boilers: Facts & Information." 2006, American Lung Association of Maine, 1 Mar, 2007 <<http://www.vtwoodsmoke.org/ME-hlth.html>>.
- 5) State of the Air: 2006. American Lung Association, 2006. 120-123. 28 Feb. 2007 <http://www.kintera.org/at/cf/{3E311E01-3496-43CF-9F99-DB1F427FAA0F}/SOTA06_Final.pdf>.



[Contacts](#) [Press Releases](#)

Harford County Health Department ~ 120 S. Hays Street ~ Bel Air, Maryland 21014 ~ Phone: 410.838.1500 ~ Fax: 410.638.4952

OUTDOOR WOOD BOILERS ILLEGAL TO OPERATE

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As fuel prices rise, people look for ways to save on the costs of heating their homes. Recently, using outdoor wood-fired boilers (OWB) has become increasingly popular. While there are no laws in Maryland that prevent these boilers from being sold, they are illegal to construct and operate.

OWB are illegal to use in Maryland, and other Northeast states, but there are no regulations prohibiting or controlling the sale of OWB in this state. Air regulations prohibit the construction of OWB in Maryland.

Maryland Department of the Environment (MDE) has been responding to an increase in nuisance complaints from communities about smoke from outdoor wood boilers (OWB). OWBs are found mostly in rural areas of Maryland where wood and wood waste are available as a primary fuel source.

OWBs are any furnace or boiler designed to burn wood where the unit is not located within a building intended for habitation by people or domestic animals. They typically look like sheds or small utility buildings with a smoke stack. People install OWBs on their property to heat their homes, outbuildings, and pools or to provide hot water.

The problem is they really do smoke, even when the owner is burning seasoned wood, there can be significant smoke.

During the winter, neighbors of people who have OWB, are more tolerant of the smoke because they understand that folks have to heat their homes. But some people use the boilers in the warmer months to heat their pools or provide hot water. People are less tolerant when the smoke comes into neighboring houses when the windows are open.

These units can produce thick smoke and creosote that can contain unhealthy levels of air pollutants, including significant amounts of particles. Exposure to these particles can trigger or aggravate respiratory problems such as asthma and emphysema or even cardiovascular problems. They can be so small that it behaves much like gases in that they can penetrate into homes even when windows and doors are closed. Since most OWBs are close to the homes they heat and have very short stacks, there is a greater risk for the smoke to pose a health hazard for those who live near them.

If the Health Department receives a valid complaint about one of these units, we will refer it to the Maryland Department of the Environment (MDE). Penalties of up to \$25,000 can be assessed if MDE takes the matter to court. If a unit is causing a problem MDE can issue an order to shut it down. There have also been private legal actions initiated between property owners.

If you would like more information concerning OWB, you may call MDE at 410 537-3215 or the Harford County Health Department at 443-643-0335.

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Health Center: September 08, 2009 3:35 PM Services

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What is an Outdoor Wood Boiler?

An outdoor wood boiler is a wood-fired water heater that is located outside. The fires in the large fire boxes heat water that is circulated through underground pipes into a building or home. The energy may be used to heat homes, domestic hot water, greenhouses, swimming pools, and more. The units produce dense smoke because they have short stacks that disperse smoke poorly. Since, these units are intended for use year around, they are constantly emitting smoke.

Negative Health Effects from Wood Smoke

According to the US Environmental Protection Agency (EPA), smoke is made up of a complex mixture of gases and fine particles produced when wood and other organic matter burn. The biggest health threat from smoke comes from fine particles (also called particulate matter or PM). These microscopic particles can get into your eyes and respiratory system, where they can cause health problems such as burning eyes, runny nose, and illnesses such as bronchitis.

Short-term exposures to fine particles can aggravate lung disease, causing asthma attacks and acute bronchitis, and may increase susceptibility to respiratory infections. Long-term exposures can also aggravate chronic heart and lung diseases, has been associated with reduced lung function and lung cancer, and in some cases, resulted in premature death for those with chronic illnesses.

What do I need to know?

Recently, there has been an increasing trend in the installation of outdoor wood boiler units in residential areas, likely due to the rising cost of heating fuel. The smoke emitted from these units has created a number of complaints from surrounding residents who feel this smoke emitted from outdoor wood boilers is a nuisance. In fact, this problem has become large enough that a compliance advisory warning has been issued by the State of New Jersey.

Residents should be informed that they will be in violation of the Air Pollution Control Regulations if they are observed emitting smoke for more than 3 minutes. Penalties associated with the new regulations start at \$300 for a first offense, but could quickly add up, resulting in

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Robert L. Ehrlich Governor
Michael S. Steele Lt. Governor
Kend P. Philbrick Secretary

Volume II, Number 4

August, 2006

The Truth About Outdoor Wood Boilers

By Bob Maddox, Air and Radiation Management Administration

Click on photo to view larger image



[To emdeHomepage](#)

Maryland Department of the Environment (MDE) has been responding to an increase in nuisance complaints from communities about smoke from outdoor wood boilers (OWB). OWBs are found mostly in rural areas of Western Maryland where wood and wood waste are available as a primary fuel source.

"There is some irony to how consumers purchase and install these boilers," said MDE Secretary Kendl P. Philbrick. "They are illegal to use in Maryland, as well as other Northeast states, but there are no regulations prohibiting or controlling the sale of outdoor wood boilers in this state. Air regulations prohibit the construction of outdoor wood boilers in Maryland."

OWBs are any furnace or boiler designed to burn wood where the unit is not located within a building intended for habitation by people or domestic animals. They typically look like sheds or small utility buildings with a smoke stack. People install OWBs on their property to heat their homes, outbuildings, and pools or to provide hot water.

"The problem is, they really do smoke," says Cathy Singer, an air quality compliance inspector with MDE's Western Maryland field office. "Even when the owner is burning seasoned wood, there can be significant smoke."

"There's a vendor who displays outdoor wood boilers every year at the Garrett County Fair," explains Ms. Singer. "These units are expensive, costing from three to 10 thousand dollars. During the winter, neighbors of people who have outdoor wood boilers, are more tolerant of the smoke because they understand that folks have to heat their homes. But some people use the boilers in the warmer months to heat their pools or provide hot water. People are less tolerant when the smoke comes into neighboring houses when the windows are open. We've responded to about 25 complaints during the past 12 months"

"It is illegal to construct and operate this equipment in Maryland," says Herb Janssen, of MDE's Air and Radiation Management Administration. "This equipment is regulated under Maryland's solid fuel-burning equipment regulations. Our policy for enforcement is to respond to nuisance complaints. If a unit is causing a big problem, we can issue an order to shut it down."

OWBs units burn wood or wood by-products to heat water that is pumped into a house through underground, insulated pipes to be used with an existing heating system. They are usually situated near the perimeter or fence-line of the property. Sometimes the location of the unit can impact an adjoining property when the wind causes the smoke to be blown into another home.

These units can produce thick smoke and creosote that can contain unhealthy levels of air pollutants, including significant amounts of particles. Exposure to these particles can trigger or aggravate respiratory or cardiovascular problems. They can be so small that it behaves much like gases in that they can penetrate into homes even when windows and doors are closed. Since most OWBs are close to the homes they heat and have very short stacks, there is a greater risk for the smoke to pose a health hazard for those who live near them.



TITLE 7 NATURAL RESOURCES & ENVIRONMENTAL CONTROL DELAWARE ADMINISTRATIVE CODE

1100 Air Quality Management Section

1114 Visible Emissions

07/17/1984

1.0 General Provisions

- 1.1 The purpose of this regulation is to control the emissions of visible air contaminants from all stationary sources except electric arc furnaces and their associated dust-handling equipment as set forth in 2.2 of this regulation.
- 1.2 Measurements of air contaminant visibility shall be in accordance with accepted practices of Ringelmann values or opacity percentages.
- 1.3 The provisions of this regulation shall not apply to the start-up and shutdown of equipment which operates continuously or in an extended steady state when emissions from such equipment during start-up and shutdown are governed by an operation permit issued pursuant to the provisions of 2.0 of 7 **DE Admin. Code** 1102.

2.0 Requirements

- 2.1 No person shall cause or allow the emission of visible air contaminants or smoke from a stationary or mobile source, the shade or appearance of which is greater than 20% opacity for an aggregate of more than three minutes in any one hour or more than 15 minutes in any 24 hour period. For guideline purposes only, Shade Number 1 of the Ringelmann Smoke Chart coincides with the regulatory limit of 20% opacity, when observing black smoke.
- 2.2 The requirements of 2.1 of this regulation shall not apply to electric arc furnaces, and their associated dust-handling equipment, with a capacity of more than 100 tons which are governed by 7 **DE Admin. Code** 1123.
- 2.3 The requirements of 2.1 of this regulation shall not apply to any existing Catalytic Cracking Unit. No person shall cause or allow the emission of visible air contaminants or smoke from any existing Catalytic Cracking Unit, the shade or appearance of which is greater than 50% opacity.

07/17/1984

3.0 Alternate Opacity Requirements

- 3.1 Whenever the Secretary determines that a source complies with an applicable mass emission standard and demonstrates that the opacity of the complying emissions is more restrictive than the requirements of 2.1 of this regulation, the Secretary will make an appropriate adjustment to the opacity standard for the affected source.
- 3.2 Whenever an owner or operator can establish compliance with an applicable mass emission standard and fails to comply with 2.1 of this regulation, the owner or operator may petition the Secretary setting forth the results of the emission testing or evaluation and request the Secretary to make an appropriate adjustment to the opacity standard for the affected source.
- 3.3 The Secretary may grant such a petition as outlined in 3.2 of this regulation upon a demonstration by the owner or operator that the affected source and associated air pollution control equipment was operated and maintained during the mass emission test in a manner to minimize the opacity of emissions during emission testing or evaluation that the mass emissions testing was performed in accordance with procedures approved by the Department;

ENVIRONMENTAL Fact Sheet



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ARD-40

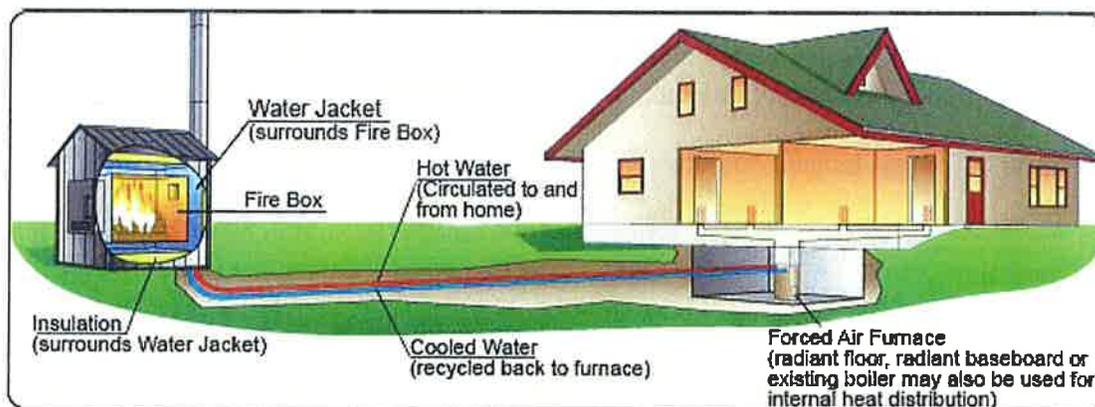
2010

Outdoor Wood-Fired Boilers and Air Quality *Considerations and Best Management Practices*

Background on Outdoor Wood-Fired Boilers

Outdoor wood-fired boilers (OWBs), also known as outdoor wood-fired hydronic heaters, are free-standing wood-burning devices that heat water, which is then pumped to one or more structures to provide heat. They resemble a small shed with a smokestack on top. OWBs may be used to heat homes and buildings, produce domestic hot water, heat swimming pools or hot tubs, and provide heat to agricultural operations such as greenhouses and dairies.

Many OWBs are used in rural, cold climates like New Hampshire's, where wood is readily available. Wood is a renewable resource and a valuable fuel source because it is "global warming neutral" when harvested in a sustainable manner. With rising fossil-fuel prices, these wood-burning devices can offer a viable alternative heat source, if the cleanest OWBs are purchased and they are installed and operated properly.



Source: Hearth, Patio and Barbeque Association (from US EPA website)

Air Quality Concerns Associated with OWBs

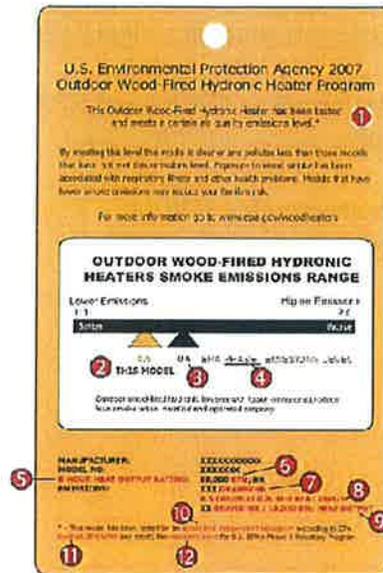
A concern associated with certain OWBs is the air pollution they may produce. Smoldering fires and short smokestacks may create heavy smoke close to the ground that sometimes causes a neighborhood nuisance or an adverse impact on public health and the environment. Smoke from OWBs can contain emissions of fine particle pollution, carbon monoxide, and other organic products, such as formaldehyde, benzene and aromatic hydrocarbons, which form from

- Non-Phase I or II units: Must be 200 feet from nearest abutting residence; stack height must be two feet higher than the peak of a residence or business not served by the unit, which is located within 300 feet.
- Permitted fuels: Clean wood and/or wood pellets made from clean wood are the only fuels that can be burned in these devices.
- Prohibited fuels: Burning other materials such as household trash, tires or construction debris is strictly prohibited.

Tips to Reduce Air Pollution from Outdoor Wood-Fired Boilers

If you plan to purchase an OWB, look for the cleanest models available that are labeled with the EPA voluntary program orange (Phase I) or white (Phase II) hang tags (see sample labels). Consider all alternatives and choose a heating system that is the most efficient and has the least adverse impacts to your family and neighbors.

If you already own an OWB, you should install, operate, and maintain it according to state law and the manufacturer's instructions.



A few recommended best management practices for all OWBs include:

- Have the unit installed by a professional.
- When determining where to locate the OWB, take into consideration how close it is to neighboring properties, especially residences. Become familiar with setback requirements from property lines or structures as specified by New Hampshire law or local ordinances, and be aware of the direction of prevailing winds and the contours of the land.
- Become familiar with manufacturers recommendations for installation and best management practices for operation, and be sure to comply with stack heights as specified by New Hampshire law.
- Never start a fire with gasoline, kerosene, charcoal starter, or a propane torch, unless the unit is designed with an auxiliary starting unit for this purpose.
- Burn only dry, well-seasoned wood that meets the definition of “clean” wood. Never burn wet, rotted, diseased or moldy wood.
- **NEVER** burn household garbage, cardboard or coated, painted, or pressure-treated wood – it’s against the law!
- Keep the doors of the unit closed unless you are loading or stoking the live fire.



View of wood Pile @ 700 SE 2nd
before fence installation

To see all the details that are visible on the screen, use the "Print" link next to the map.



Google Earth photo
700 SE 2nd St., Milford

Dear Mayor Rogers and City of Milford Council Members,

We are writing about the outdoor wood burning furnace. We live on the 200 block of Charles Street and the smoke affects us every day it is burning wood. In addition to the smoke coming in through open windows when the weather is nice, smoke coming in through the closed windows, smoke making the clothes on the clothesline smell bad, and making the house smell like it is on fire; our children's health is being affected by the wood smoke.

They both have asthma. Since the furnace has been put in we have noticed that their asthma has gotten worse. We are non-smokers and they are not around smokers when they go to their friends' houses. They can't even be safe in their own home because the smoke from the furnace affects their breathing. They can't even play outside when the furnace is on because they have trouble breathing. Our quality of life and especially their quality of life has been affected because of the furnace. Their doctor has told us that any smoke is detrimental to their health. She said it is especially important that children with asthma stay away from smoke and that includes wood smoke from the furnace. It seeps into our house and we are constantly breathing it so unfortunately there isn't any way to stay away from it. There is a place for outdoor furnaces but a neighborhood where the houses are so close together is not the place.

The picture that we have included is one that shows smoke blowing toward Charles Street. The smoke gets MUCH worse than this and blankets the houses close to the furnace.

Please read the information that we found on the internet that shows how harmful outdoor wood furnaces are to people. The furnaces cause both short-term and long-term health affects. One of the long-term affects is lung cancer. Please don't allow the people who live near the furnace to be harmed anymore by the smoke. Please ban all wood-burning furnaces in the City of Milford.

Sincerely,
George and Karen Zang

New study shows outdoor wood stoves unhealthy

When I was a kid my parents decided to take the cheapest route home heating and had a wood furnace installed in our basement. This decision might have been good for their pocket books, yet it wreaked havoc on my lungs and therefore my life.

Not only do wood stoves give off smoke that can irritate lungs, but all the wood stacked in the basement was filled with molds and fungus that are known allergens for me and many other chronic lungers. The smoke outside meant I couldn't play out there, and the mold and fungus inside made indoor life equally miserable.

My parents ultimately were told this was bad for me, and their response was to shut off the wood heating ducts to my room and turn on the gas just to heat my room. Yet little did they realize that while this effort was a good gesture, it was frivolous at best.

A new study reported by the Environment and Human Health Inc. as reported [here](#) reveals the following about outdoor wood furnaces (OWF):

* "Wood smoke contains many of the same toxic compounds that are found in cigarette smoke. Just a few of them include benzene, formaldehyde, and 1,3-butadiene, all three of which are carcinogenic."

* In fact, while indoor wood furnaces are a bad enough asthma trigger, "The Northeast States for Coordinated Air Use Management (NESCAUM) found that the average fine particle emissions from one OWF are equivalent to the emissions from 22 EPA-certified indoor wood stoves, 205 oil furnaces or as many as 8,000 natural gas furnaces."

The study also reported the following (PM stands for particulate matter, which is the particle size of the smoke measured):

- * A house 100 feet from an OWF had 14 times the levels of PM 2.5 as houses not near an outdoor wood furnace and 9 times the levels of the EPA air standards
 - A house 120 feet from an OWF had over 8 times the levels of PM 2.5 as the houses not near an outdoor wood furnace, and 6 times the levels of the EPA air standards.
 - A house 240 feet from OWF had 12 times the levels of PM 2.5 as the houses not near an outdoor wood furnace and 8 times the levels of the EPA air standards
 - A house as far away as 850 feet from OWF had 6 times the levels of PM 2.5 as the houses not near an outdoor wood furnace and 4 times the levels of the EPA air standards.
 - High levels were present in every 24-hour period tested inside homes neighboring outdoor wood furnaces
 - All houses tested had particulate exposures well above the EPA ambient air quality standard.
 - Levels of PM 2.5 that exceed the EPA standards are associated with asthma or chronic obstructive pulmonary disease (COPD) attacks and hospitalizations, and are also associated with increased risk of cardiac attacks.
- * Particles of wood smoke are so small that windows and doors cannot keep smoke out
 - A study by the University of Washington, Seattle, showed that 50 to 70 percent of outdoor wood smoke entered homes that were not burning wood.
- * Because wood smoke particles are so small, they are not filtered out by the nose or the upper respiratory system. Instead, these small particles end up deep in the lungs where they can cause structural damage and chemical changes.
- * Carcinogenic chemicals and wood smoke irritants adhere to the small particles and enter the deep, sensitive regions of the lungs where toxic injury is high.

* The short term, or "irritable" side effects of inhaling smoke from outdoor wood heaters include:

- Night time coughing
- Headaches
- Inability to catch breath (dyspnea)
- Burning throat

- Burning eyes
- Bronchitis
- Pneumonia
- Colds
- Increased respiratory infections (particularly in children)
- Missed days of work or school
- Emergency room visits

* The long term side effects of inhaling from outdoor wood heaters include:

- Increased risk for lung cancer
- Asthma
- COPD
- Cardiovascular problems
- Carbon monoxide poisoning

* In fact experts note that "Even episodes of short-term exposures to extreme levels of fine particulates from wood smoke and other sources, for periods as short as two hours, can produce significant adverse health effects."

* The particulates breathed in are not only linked with chronic lung disease but to lung cancer, as evidence shows the smoke inhaled also contains known carcinogens. So short-term exposure may result in either asthma, COPD, and long term exposure to those plus lung cancer.

* So smoke from indoor and outdoor wood furnaces have the same known harmful chemicals as cigarette smoke, smoke from outdoor wood stoves is thicker and more prevalent in the air, and is more "pervasive for those who live near them," said Dawn Mays-Hardy of the American Lung Association, New England.

* Likewise, "Resident of Environment and Human Health, Inc. Nancy Alderman says, "EHHI has now shown that wood smoke from outdoor wood furnaces enters neighboring houses in high enough amounts to cause serious health impacts to these families. States can no longer ignore this science and should ban outdoor wood furnaces until safer technologies are found."



att: Terry

To whom it may concern:

I attended the wood-burning discussion on Tuesday, July 19 at the town council meeting. I chose not to speak due to lack of proof but have concerns as to what is being burned and not so much the stove itself. There has been occasions when the smoke coming from the stove smells toxic as when burning salt-treated or varnished lumber. Aside from the fact that my wife is asthmatic and is currently under pulmonary observation, I myself have woken up with headaches after a night of smelling it.

Secondly, though irrelevant to the issue, Mr. Sam Wilkes of 213 Fisher, who spoke and is the son-in-law to the man in question, spoke of the police being called concerning his dogs. We only called because the dogs would yap nightly for weeks. Furthermore, we're aware that in this neighborhood of small children, he has dogs that he trains for fighting. Thank you for your time.

From: danadscard <danadscard@aol.com>

To: danadscard <danadscard@aol.com>

Subject: Outdoor furnace

Date: Wed, Jul 20, 2011 8:34 pm

To the Milford City Council:

I am writing to ask you to support the Ordinance to prohibit the use of all woodburning furnaces operating within the City of Milford.

A furnace is located across the street from my home. At times I have not been able to open my windows or hang clothes on the line because of the smoke coming from the outdoor furnace. The noxious smoke fumes and potentially hazardous burned bits of newspaper floating into my yard are beginning to concern me and my family.

Sincerely,

Dana M. Saxon
611 S. E. 2nd St.
Milford, DE



John Cannon <johnwcannon@gmail.com>

RE: Outdoor Wood Boilers

1 message

French Joanna (DNREC) <Joanna.French@state.de.us>

Wed, Jul 20, 2011 at 1:42 PM

To: John Cannon <johnwcannon@gmail.com>

Mr. Cannon,

Thank you for your request. Due to the size of these units, no permits are required from the Division of Air Quality. However, these units do need to comply with the visible emissions requirement of 7 **DE Admin. Code** 1114: Visible Emissions. This regulation requires that smoke from a source shall not exceed 20% opacity for an aggregate of more than three minutes in any one hour or more than 15 minutes in any 24 hour period. Basically dark, black smoke is not permitted from a unit for greater than 3 minutes in any hour or more than 15 minutes in any 24 hour period. If you do experience smoke from the unit, we recommend that you call our environmental complaint line at [1-800-662-8802](tel:1-800-662-8802). An Environmental Protection Officer may be dispatched to investigate the complaint. I would recommend that you share the complaint line number with your neighbors so that they may call when there is a problem also.

If you have any questions, please let me know.

Thanks,

Joanna

***** The Air Quality Management Section has moved. *****

***** We are now located at the Blue Hen Corporate Center, 655 S. Bay Road, Suite 5 N, Dover, DE 19901. *****

***** Our phone number remains [302-739-9402](tel:302-739-9402) *****

Joanna L. French, P.E.

Managing Engineer

DNREC - Division of Air Quality

655 S. Bay Road, Suite 5 N

Dover, DE 19901

[\(302\) 739-9402](tel:302-739-9402) (main number)[\(302\) 739-3106](tel:302-739-3106) (fax)

1100 Air Quality Management Section

1114 Visible Emissions

07/17/1984

1.0 General Provisions

- 1.1 The purpose of this regulation is to control the emissions of visible air contaminants from all stationary sources except electric arc furnaces and their associated dust-handling equipment as set forth in 2.2 of this regulation.
- 1.2 Measurements of air contaminant visibility shall be in accordance with accepted practices of Ringelmann values or opacity percentages.
- 1.3 The provisions of this regulation shall not apply to the start-up and shutdown of equipment which operates continuously or in an extended steady state when emissions from such equipment during start-up and shutdown are governed by an operation permit issued pursuant to the provisions of 2.0 of 7 **DE Admin. Code** 1102.

2.0 Requirements

- 2.1 No person shall cause or allow the emission of visible air contaminants or smoke from a stationary or mobile source, the shade or appearance of which is greater than 20% opacity for an aggregate of more than three minutes in any one hour or more than 15 minutes in any 24 hour period. For guideline purposes only, Shade Number 1 of the Ringelmann Smoke Chart coincides with the regulatory limit of 20% opacity, when observing black smoke.
- 2.2 The requirements of 2.1 of this regulation shall not apply to electric arc furnaces, and their associated dust-handling equipment, with a capacity of more than 100 tons which are governed by 7 **DE Admin. Code** 1123.
- 2.3 The requirements of 2.1 of this regulation shall not apply to any existing Catalytic Cracking Unit. No person shall cause or allow the emission of visible air contaminants or smoke from any existing Catalytic Cracking Unit, the shade or appearance of which is greater than 50% opacity.

07/17/1984

3.0 Alternate Opacity Requirements

- 3.1 Whenever the Secretary determines that a source complies with an applicable mass emission standard and demonstrates that the opacity of the complying emissions is more restrictive than the requirements of 2.1 of this regulation, the Secretary will make an appropriate adjustment to the opacity standard for the affected source.
- 3.2 Whenever an owner or operator can establish compliance with an applicable mass emission standard and fails to comply with 2.1 of this regulation, the owner or operator may petition the Secretary setting forth the results of the emission testing or evaluation and request the Secretary to make an appropriate adjustment to the opacity standard for the affected source.
- 3.3 The Secretary may grant such a petition as outlined in 3.2 of this regulation upon a demonstration by the owner or operator that the affected source and associated air pollution control equipment was operated and maintained during the mass emission test in a manner to minimize the opacity of emissions during emission testing or evaluation that the mass emissions testing was performed in accordance with procedures approved by the Department;

TITLE 7 NATURAL RESOURCES & ENVIRONMENTAL CONTROL
DELAWARE ADMINISTRATIVE CODE

and that the affected source and associated air pollution control equipment is incapable of continuously meeting applicable opacity standards as set forth in 2.1 of this regulation.

- 3.4 The Secretary may establish an opacity standard for the affected source at a level at which the source will be able to meet the adjusted opacity standard at all times during which the source is meeting the applicable mass emission rate standard. The Secretary will make the adjusted opacity standard a part of the operating permit in the form of an operating condition.
- 3.5 Any action by the Secretary pursuant to the provisions of 3.0 of this regulation shall be incorporated in the State Implementation Plan.

07/17/1984

4.0 Compliance with Opacity Standards

For purposes of this regulation, compliance with opacity standards shall be in accordance with 1.5.3 of 7 DE Admin. Code 1120.

12 DE Reg. 347 (09/01/08)



Assessment of Outdoor Wood-fired Boilers

Prepared
by
NESCAUM
(Northeast States for Coordinated Air Use Management)

March 2006
(revised June 2006)

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Executive Summary

This report was undertaken by NESCAUM (Northeast States for Coordinated Air Use Management) to provide policymakers with an assessment of concerns relating to the growing use of outdoor wood-fired boilers (OWB), also known as outdoor wood-fired hydronic heaters or outdoor wood-fired furnaces. The increased use of OWBs in populated areas represents a potential public health problem in the Northeast because of the severity of health effects associated with residential wood smoke inhalation.

This report 1) overviews unique features of OWB appliances, 2) estimates OWB appliance sales trends, 3) assesses emission considerations and potential health concerns of residential wood smoke, 4) presents results of OWB ambient monitoring and stack testing conducted by NESCAUM, and 5) provides recommendations for regulatory action.

Findings from this study show that:

- OWBs, generally, do not use catalytic or non-catalytic emission control devices that other residential, wood-fired combustion devices, such as indoor wood stoves, commonly employ.
- OWB use has become more prevalent, commonly replacing indoor wood stoves, and continued increases in sales are likely.
- OWBs emit significantly more particulate matter than other residential wood burning devices and short term particulate matter spikes can be extremely high.
- OWBs could contribute almost 900,000 tons of particulate matter by 2010.
- Local populations are likely subject to elevated ambient particulate matter levels from OWB smoke.
- Current regulations do not provide surrounding areas with adequate protection from the use of OWBs in residential applications.
- There is a lack of information relating to air toxic emissions, such as polycyclic aromatic hydrocarbons (PAHs), polycyclic organic matter (POM) and dioxin.

OWBs present unique issues, unlike other residential wood burning devices, based on the following factors:

- **Year Round Operation** – OWBs are designed to provide heat and hot water year round. Owners often use them in the warmer months not only for domestic hot water but also to heat their swimming pools and/or spas.
- **Cyclic Operation** - The cyclic nature of OWB operations, unlike EPA certified wood stoves, does not allow for complete combustion and creates an environment conducive to increased toxic and particulate emissions.

- **Short Stack Heights** – Stacks from OWBs, as per manufacturer's installation instructions, are usually less than 12 feet from the ground, resulting in poor dispersion of smoke and are more likely to cause fumigation within surrounding areas.
- **Oversized Firebox** – An OWB's large firebox is built such that a user could burn a variety of inappropriate materials that could not be burned in wood stoves or fireplaces. Enforcement programs have discovered OWBs burning tires, large bags of refuse, and railroad ties. Even when used properly, overall OWBs emissions are greater than other residential wood burning devices.

With funding from the Massachusetts Executive Office of Environmental Affairs (EOEA), NESCAUM measured emissions from an OWB unit in the field under real world conditions. The test data indicate that the smallest OWB is likely to have an average in-use emission rate of approximately 161 grams of fine particulate matter per hour, which is twenty times higher than the average in-use emissions of an EPA certified wood stove. This report utilizes a gram per hour measurement in order to understand the potential ambient impacts and to make comparisons to other residential furnaces and heating units such as oil-fired furnaces, natural gas furnaces, and residential wood stoves. Furthermore, NESCAUM believes that given the health impacts associated with wood smoke and their use in residential locations (near at-risk populations such as children and the elderly), it is critical to assess particulate emissions from OWBs on a mass per unit time basis to fully understand potential health risks and appropriate protections.

Based on the test results in this report, the average fine particulate emissions from one OWB are equivalent to the emissions from 22 EPA certified wood stoves, 205 oil furnaces, or as many as 8,000 natural gas furnaces. To put these emissions into perspective, one OWB can emit as much fine particulate matter as four heavy duty diesel trucks on a grams per hour basis. Cumulatively, the smallest OWB has the potential to emit almost one and one-half tons of particulate matter every year. Based on sales estimates, OWBs could emit over 233,000 tons of fine particulate matter nationwide in 2005. Considering sales trends, NESCAUM estimates that there could be 500,000 OWBs in place nationwide by 2010. Based on that estimate, emissions from OWBs would reach 873,750 tons of fine particulate matter nationwide per year by 2010.

The cumulative impact of OWBs to ambient air quality is only one part of the problem. Because OWBs are used primarily in residential applications, they have the potential to emit fine particulate matter and air toxics at levels that could create elevated risk to nearby populations. A second pilot study conducted by NESCAUM measured ambient PM_{2.5} within 150 feet of an OWB device. Relative to background levels, the study documented high 15-second average values (>1,000 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)) with spikes greater than 8,000 $\mu\text{g}/\text{m}^3$ throughout the course of normal daily OWB operating modes. These data suggest that buildings located near OWBs can experience high PM_{2.5} levels during typical boiler operating conditions. Health studies have found associations of acute and chronic exposure to wood smoke with adverse health outcomes such as increases in respiratory symptoms, decreases in lung function, visits to emergency departments, and hospitalization.

States have requested several times that the U.S. Environmental Agency (EPA) develop federal regulations for OWBs but EPA has yet to act. Critical to the development of a federal emissions standard is the need to develop a technology forcing standard that would require manufacturers to employ wood combustion controls commonly employed by other residential and industrial wood-fired devices. In addition, the increasing use of OWBs necessitates that action be taken as quickly as possible. Federal action would likely take five to seven years to put protective measures into place.

In the absence of federal action, states will need to act on this emerging issue in a timely manner. Given the significant health effects OWB emissions may pose and the lack of action on the federal level, NESCAUM believes that states should take action immediately to control OWB emissions by establishing technology-forcing standards that will lead manufacturers to develop cleaner burning OWBs.

1. INTRODUCTION

As the price of home heating oil, natural gas and liquefied petroleum gas (LPG) increases, many households are looking for heating alternatives. Increasingly, people are turning to wood-burning devices to replace oil and gas heating.¹ Wood-fired devices include masonry heaters, indoor wood stoves, indoor wood furnaces, pellet stoves and outdoor wood-fired boilers. The recent increase in the use of outdoor wood-fired boilers (OWBs) are of particular concern to state environmental agencies because the cumulative stack emissions from these appliances are higher than other wood burning appliances and, unlike other wood burning devices, currently are unregulated. In the early 1990's, states became aware of OWBs, although their use at that time was primarily limited to rural settings. However, states have noted an increasing trend of OWB installation in suburban and urban neighborhoods to provide space heating, year-round heating of hot water, and heating of swimming pools, Jacuzzis, and hot tubs. Use of OWBs in commercial applications is also increasing beyond traditional use in agricultural operations.

1.1. OWB Description

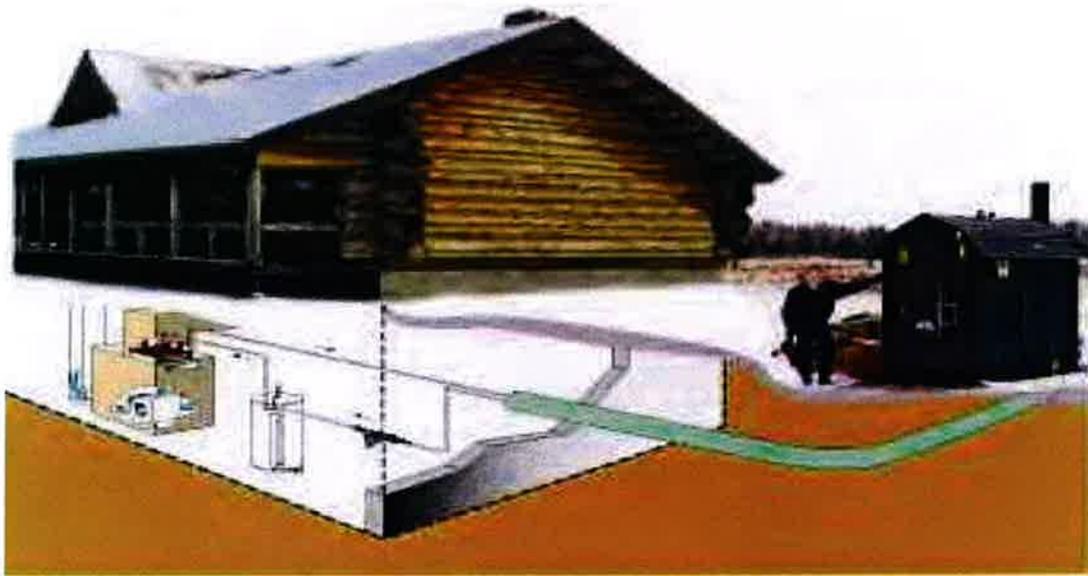
An OWB is a wood-fired furnace that is usually housed within a small insulated shed located some distance from a house. Manufacturers design OWBs to burn large amounts of wood over long periods of time.² OWBs vary in size ranging from 115,000 Btu/hr up to 3.2 million Btu/hr, although residential OWBs tend to be less than 1 million Btu/hr. According to sales data, the size of the most commonly sold unit is 500,000 Btu/hr. OWBs heat buildings ranging in size from 1,800 square feet to 20,000 square feet. Typically, the dimensions of an OWB are three to five feet wide, six to nine feet deep, and six to ten feet tall, including the height of the chimney. Inside the OWB is an oversized firebox that can accommodate extremely large loads. Firebox sizes will vary with each unit but tend to range in size from 20 cubic feet up to 150 cubic feet. Industry literature indicates that a commonly sized residential unit can easily accommodate wood pieces that are 30 inches in diameter and 72 inches long.³ Surrounding the firebox is a water jacket that can be heated to temperatures up to 190°F. The OWB cycles water through the jacket to deliver hot water to the building. Water pipes run underground to deliver hot water for both space heating and domestic use.

Figure 1-1 provides a schematic of an OWB installation. OWBs have a cyclical operating pattern; when the water temperature in the water jacket reaches a given temperature, an air damper closes off air to the unit until the temperature drops and the air damper opens, creating an on/off cycle.

¹ http://www.usatoday.com/news/nation/2005-11-13-woodburning-pollution_x.htm

² Schreiber, Judith et al. *Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State*. Office of the Attorney General; Albany, New York, 2005. Available at [http://www.oag.state.ny.us/press/2005/aug/August 2005.pdf](http://www.oag.state.ny.us/press/2005/aug/August%202005.pdf)

³ <http://www.centralboiler.com/eadvantage.php>

Figure 1-1. Schematic of an OWB Installation

Manufacturers advertise OWBs for operation with wood fuel, however, many states have found that users sometimes fuel OWBs with yard waste, packing materials, construction debris, and domestic wastes.⁴ While most manufacturers of OWBs instruct owners of OWBs to burn wood, anecdotal data suggest that distributors instruct purchasers of OWBs they can burn “whatever they want” -- even household garbage and tires.⁵

1.2. Report Overview

This report provides data on issues unique to OWBs, an analysis of sales and distribution of OWBs, an explanation of wood smoke pollutants and their associated public health risks, analysis of OWB emissions, an overview of regulatory options, and conclusions.

⁴ Conversations with representatives from enforcement staff at the New York Attorney General’s Office, Connecticut Department of Environmental Conservation, Maine Department of Environmental Protection, and Massachusetts Department of Environmental Protection.

⁵ Staff from a variety of environmental agencies have spoken with distributors at fairs and other distribution venues to gather information on the units.

2. ISSUES UNIQUE TO OWBS

While there are a variety of concerns surrounding wood burning devices, several issues make OWBs unique. The largest number of complaints voiced to Northeast state air quality enforcement programs relate to excessive smoke and nuisance conditions. These conditions arise due to the unique design and operating features of OWBs.

2.1. Unit Design

The smoke from OWBs appears to be greater than other wood burning appliances for several reasons. Primarily, it is because of the basic design of OWBs. Even when operated properly with seasoned wood, OWBs typically generate significant amounts of smoke. When an operator dampers down the unit, the lack of oxygen to support combustion creates a build up of materials such as creosote. When opening the damper, these materials burn and release immediately to the air. Excessive loading and/or low demand for heat further aggravates this problem. In addition, OWBs emit more pronounced smoke than wood stoves due to the short stack height, which does not disperse smoke above living spaces in neighboring homes. The addition of sophisticated combustion controls could address many of the smoke issues, however, the vast majority of units sold do not employ any catalytic or non-catalytic emission controls.

2.1.1. Combustion Cycle

The primary reason for the large amounts of smoke is the cyclic nature of the device. When an OWB is in the "off" cycle and does not need to generate heat, the air damper closes to cut off the air supply. This creates an oxygen-starved environment in which the fire smolders, creating smoke and creosote that condenses on the internal steel surfaces. When heat needs to be produced, the air damper opens and natural draft forces air into the firebox, pushing the smoke and air pollutants out the stack. Measured emissions peak when the unit has received a fresh load of fuel and the wood has not yet reached a charcoal stage. In the field test conducted by NESCAUM, the unit's internal stack temperature never reached levels that would have resulted in complete combustion (see Section 5.3).

2.1.2. Stack Height

Another contributing factor to OWB smoke is the short stack height of OWBs. Manufacturer installation literature specifies stack heights that are generally eight to twelve feet from the ground. Stack heights this short typically fail to disperse smoke adequately, resulting in excessive ground level smoke. Because OWBs rarely provide stovepipe fans to increase the upward velocity of the smoke, there is only limited vertical dispersion of OWB emissions. Certain weather conditions aggravate this situation, such as cold weather inversions when the smoke does not rise but stays close to the ground.

2.1.3. Combustion Design

Most OWBs do not have any combustion controls, such as catalytic devices and secondary combustion. Incorporating these features could significantly reduce particulate emissions. Almost all indoor wood stoves sold today use catalytic or secondary

combustion to reduce emissions. NESCAUM's review of OWB manufacturers' data finds that only a limited number of manufacturers utilize common wood burning combustion controls. Discussions with wood combustion experts indicate that these units could incorporate combustion controls into their design in a relatively short period of time, which would result in reduced emissions, increased efficiency and an overall improvement in OWB performance.

2.1.4. Efficiency

Review of available data indicates that the operating efficiencies of OWBs are extremely low, often half the efficiency of other residential wood burning devices such as wood stoves. Several manufacturers have made claims that their OWBs are up to 95 percent efficient. Review of the data, however, suggests that heating efficiencies range from as low as 28 percent to not higher than 55 percent.⁶ Test results obtained by Freedom of Information Act (FOIA) requests to EPA indicate that, in general, most units will have operating efficiencies in the range of 30 to 40 percent. A comparison with wood stove efficiencies finds that their efficiencies range from 60 to 80 percent efficient.⁷ Low efficiencies translate into increased amounts of wood burned to generate heat, which in turn increases emissions.

2.2. Use Patterns

Unlike indoor wood stoves and fireplaces, manufacturers design OWBs for use year round. OWBs not only heat space but provide domestic hot water and heat swimming pools and spas. In the summer months, the smoke may seem more apparent because the smoke may be less likely to disperse as the lower flue velocities from the stack may keep the smoke closer to the ground. NESCAUM observed this condition during its stack test conducted in June 2005.

Another critical difference in OWB operations from other wood burning devices relates to long burn times. Manufacturers instruct owners that they can completely fill the OWB firebox and leave it burning for as long as 96 hours. However, completely filling the combustion chamber creates a smoldering fire that burns inefficiently, especially when warm weather or a depressed thermostat during mid-day or nighttime hours reduces demand for heat. The lack of tending for long periods of time compounds the problem, leading to inefficient burning conditions over extended periods. In contrast, owners of conventional indoor wood stoves tend them more often to optimize combustion.

2.3. Fuel Quality

While most manufacturers provide OWB owners with best burn practices and instruct users that they should only burn dry seasoned wood, the design of the OWBs encourages burning of inappropriate materials. State agencies have documented the burning of wet, large, unsplit wood, wood waste, yard waste, refuse, tires and railroad

⁶ Schreiber, Judith et al. *Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State*. Office of the Attorney General; Albany, New York, 2005. Available at

<http://www.oag.state.ny.us/press/2005/aug/August%202005.pdf>.

⁷ <http://www.epa.gov/woodstoves/efficiently.html>.

ties. In fact some manufacturer's websites state the ability to burn green or scrap wood as one of the benefits of OWBs. For example, the Pacific Western website states that their unit, "easily burns junk wood including pallets."⁸

2.4. Application of Current Regulations to Address OWBs

Enforcement programs have attempted to use existing regulations to address OWB complaints. A detailed description of various regulatory options can be found in Section 6.1 of this report. This section provides a more general overview of the current efforts used by states to address OWBs.

2.4.1. Federal Regulation

While EPA requires indoor wood stoves, pellet stoves, and small wood-fired industrial boilers to adhere to federal air pollution standards of 7.5 g/hr for non-catalytic appliances and 4.1 g/hr for catalytic appliances, there are no federal standards for OWBs. To date EPA has received several requests from state agencies to develop federal standards. EPA has yet to act on these requests and a June 2005 letter sent by EPA to OWB manufacturers, and an EPA statement provided to the Clean Air Act Advisory Committee (CAAAC) on August 11, 2005, indicates that any action in the near-term is unlikely (see Appendix A). The August 11, 2005 statement to the CAAAC advised that EPA was reviewing the state petitions and did not expect a decision on action until spring 2006. In this same statement, EPA also indicated that it would take a minimum of five to seven years to develop and implement a federal standard.

2.4.2. State Regulations

In the absence of federal standards, the states have attempted to use several avenues to address OWB problems. Two states and several municipalities have attempted to address OWBs by adopting regulations limiting emissions or banning the sale of OWBs. Regulations in the state of Washington limit emissions from all solid fuel burning devices rated less than one million Btu/hr. Sales data obtained from manufacturers show that only a small number of OWBs have been sold in Washington. It is unlikely that the OWBs sold in Washington could meet the standard. Correspondence between Central Boiler and the Washington Department of Ecology indicates that the manufacturers dispute the application of Washington's regulation on OWBs (see Appendix A). In 1997, Vermont adopted regulations that require setback and stack height standards for OWBs. This regulation has not eliminated the OWB problem; and in fact the VT DEC continues to receive complaints.

Many states have opacity regulations that could apply to OWBs (a detailed explanation of opacity regulations can be found in Section 6.1.7.). Based on the experience of state enforcement staff, it is unlikely that an OWB could meet most states' opacity requirements even under ideal operating conditions. In fact, several states have attempted to work with homeowners to find methods to operate OWBs within state opacity limits but none to date have been able to comply. Given this scenario, the only solution is removal, which comes at great cost to the homeowner because it requires

⁸ <http://www.outdoorfurnaces.com/article/pacific-western-details-6.asp>.

removal of the OWB and installation of a new heating system. Opacity regulations place a significant burden on the homeowner who, often unwittingly, purchases a unit that cannot meet the state regulatory opacity requirements. Further compounding the problem is the limited ability of many state enforcement agencies to enforce against residential OWBs. Most state enforcement methods aim towards mitigating conditions at industrial facilities, leaving the states reticent and ill-equipped to enforce opacity requirements at residential OWBs.

3. OVERVIEW OF OWB INDUSTRY

NESCAUM has identified twenty-seven manufacturers of OWBs (see Appendix B). Manufacturers are located throughout the United States with eight in Minnesota, three in Pennsylvania, two in Wisconsin, two in North Carolina, and one each in Missouri, Nebraska, New Hampshire, New York, Tennessee, and Washington. In addition, NESCAUM identified six manufacturers based in Canada. These companies range in size from one to over 140 employees. Some of these manufacturers participate in the Hearth, Patio and Barbecue Association (HPBA), which is an industry trade association that represents wood stove, pellet stove and fireplace manufacturers as well.

The Northeast states have focused attention on OWBs since the late 1990's. Several states have attempted to work with manufacturers to address complaints and nuisance issues with little success. The New York State Department of Environmental Conservation held a meeting with manufacturers in 2003 to gain a better understanding of the industry and to determine the direction of manufacturers. At these meetings, manufacturers stated that cleaner OWBs would be on the market in the near future. Almost three years later, there has been little change in OWB design. In fact, recent statements from the largest producer of OWBs indicate that it does not believe that OWBs emit significant amounts of pollution. Testimony prepared by Central Boiler for the Vermont draft OWB regulations⁹ and statements by its vice-president Rodney Tolufsen declared that its OWBs pollute no more than EPA-certified wood stoves.¹⁰

3.1. OWB Costs and Distribution

The total cost to purchase and install the smallest OWB can range from \$8,000-\$10,000, with costs increasing with the size of the unit. The OWB itself costs approximately \$5,000, excluding installation. Installation usually includes laying a concrete foundation, putting in a power source, installing underground piping from the unit to the house, and other additional piping.

Commonly, manufacturers sell OWBs directly or through a national distribution network. Distribution venues commonly include hardware stores, fairs, and direct sales. Typically, stores that sell indoor wood stoves or fireplaces do not sell OWBs. Marketing literature from manufacturers typically claims that OWBs have many advantages over gas, oil and other wood burning devices, including:

- Eliminating heating bills
- Improving indoor air quality
- Reducing the incidence of asthma or allergies
- Benefiting the environment by reducing the greenhouse emissions
- Increasing safety of heating by removing the heating unit from the building
- Requiring less time to operate than other wood burning devices
- Reducing dependence of fossil fuels¹¹

⁹ Transcripts from public hearings on Vermont's proposed regulations.

¹⁰ <http://groups.yahoo.com/group/woodheat/message/6422>.

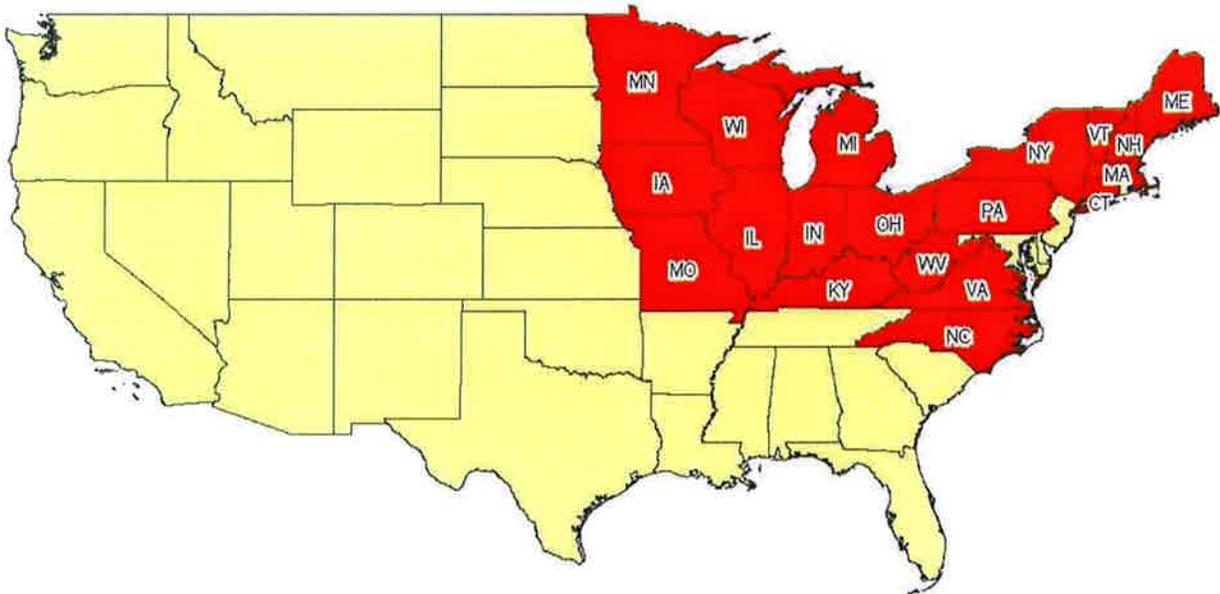
¹¹ <http://www.shol.com/mahoning/reason.HTM> and <http://www.centralboiler.com/eadvantage.php>.

In its review of emissions and efficiency data, NESCAUM found limited or no documentation to support manufacturers' claims. Manufacturers often claim that their OWBs have relatively high efficiency ratings. Some manufacturers have made claims that their units are up to 95 percent efficient. However, review of the data suggests that heating efficiencies range from 28 to 55 percent¹² (Section 2.1.4 contains a more detailed discussion of OWB efficiency).

3.2. Sales Trend Analysis

With the recent increase in the price of heating fuels, the use of wood for residential and commercial heating is on the rise.¹³ As part of this trend, there has been a rapid increase in the number of OWBs installed. Many of the OWB manufacturers began selling OWBs in the early 1980's but sales began to rise substantially after 1999. Using sales data gathered by the New York Attorney General's Office via subpoena of 21 manufacturers and by EPA from nine manufacturers via a Clean Air Act Section 114 request, NESCAUM estimates that over 155,000 OWBs have been sold nationwide since 1990 (see Table 3-1). Appendix C contains estimates of sales by state. Of the estimated 155,000 OWBs sold nationwide, 95% have been sold in nineteen states, as illustrated in Figure 3-1. These states include Connecticut, Indiana, Illinois, Iowa, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New York, North Carolina, Ohio, Pennsylvania, Vermont, Virginia, West Virginia, and Wisconsin.

Figure 3-1. States representing 95% of the OWBs sold



National sales have been growing in the past five years at rates of 30 to 128 percent. In October 2005, one manufacturer, Central Boiler, stated that its production

¹² Schreiber, Judith et al. *Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State*. Office of the Attorney General; Albany, New York, 2005. Available at <http://www.oag.state.ny.us/press/2005/aug/August%202005.pdf>.

¹³ http://www.usatoday.com/news/nation/2005-11-13-woodburning-pollution_x.htm.

was “double what it’s ever been before.”¹⁴ In December 2004, the same manufacturer stated its peak production at that time was 200 units a week, and it had the room to make 1,000 a week, which would mean a capacity to produce over 50,000 annually.¹⁵ The number of OWBs sold in 2003 and 2004 equals the number OWBs sold in the previous fourteen years. Given the continued rise in the cost of natural gas and petroleum fuels, it is likely that an increasing sales trend will continue. EPA has estimated that it would take a minimum of five years for rules to be put in place, at which time over 500,000 OWBs could be in place.

New construction uses OWBs as primary furnaces and OWBs are also replacing conventional indoor wood stoves and oil or gas-fired furnaces. To promote the use of EPA certified wood stoves through the Wood Stove Change Out Campaign, EPA is educating the public about the dangers of using old non-certified wood stoves. Many homeowners, however, may be choosing to install OWBs instead of certified indoor wood stoves. One manufacturer, Central Boiler, estimated that about 50% of the OWBs sold replace indoor wood stoves.¹⁶ Therefore, while EPA’s change out effort is important, it may be resulting in increased installation of OWBs due to the absence of education about OWBs relative to certified wood stoves. This will lead to greater wood smoke pollution if consumers erroneously believe OWBs are a cleaner option than non-certified indoor wood stoves.

Table 3-1. Estimated Sales of OWBs since 1990¹⁷

Year	US
1990	195
1991	278
1992	398
1993	568
1994	811
1995	1,159
1996	1,656
1997	2,366
1998	3,380
1999	4,828
2000	6,865
2001	15,330
2002	10,552
2003	15,342
2004	24,560
2005	67,546
Total	155,834

¹⁴ Rutledge, R. Milwaukee Journal Sentinel, *Burning to Save a Buck*, Oct. 7, 2005
<http://www.jsonline.com/news/gen/oct05/361678.asp>

¹⁵ Bakken, R. Grand Forks Herald, *Business Heats Up*, December 6, 2004.

¹⁶ *Ibid.*

¹⁷ Sales estimates derived from state specific sales data from nine manufacturers, national sales data from 21 manufacturers, and trend analysis to forecast 1990-1998 and 2005 data. Appendix C provides state specific sales estimates.

4. PUBLIC HEALTH CONCERNS

Wood smoke emissions represent a potential threat to the health of persons living in proximity to OWB devices. Scientific studies have found associations between the inhalation of wood smoke or wood smoke constituents and adverse health effects. These findings are of notable concern because a large fraction of the population is susceptible or at increased health risk from exposure to wood smoke. In addition, physical and operational factors unique to OWBs heighten the possibility that people are exposed to wood smoke in both outdoor and indoor environments.

4.1. Wood Smoke Composition

Wood smoke contains a complex mixture of particles and gases, many of which have been shown to produce acute and chronic biological effects, as well as deleterious physiologic responses in exposed humans. The abundance of fine particulates in wood smoke presents perhaps the most serious health risk to exposed populations, and will be discussed in more detail in the following section. Wood smoke also contains numerous gases, including carbon monoxide, nitrogen and sulfur oxides, volatile organic compounds (VOCs), PAHs, and chlorinated dioxins. Carbon monoxide can cause respiratory and cardiac distress because it competes with oxygen on the hemoglobin molecule, forming carboxyhemoglobin. Studies have associated exposure to nitrogen oxides with toxicological effects including pulmonary edema, bronchoconstriction, and increased infection rates. Studies have also associated VOCs, such as aldehydes, with upper airway irritation, headaches, and other neurophysiologic dysfunctions, and possibly cancer. Studies have shown that polycyclic aromatic hydrocarbons, such as benzo(a)pyrene, are carcinogenic in animals and may cause cancer in humans. Toxicologic evidence also suggests that certain dioxin congeners commonly found in wood smoke are human carcinogens.¹⁸

4.2. Particulate Matter Health Effects and Populations at Risk

The severity and variety of adverse health effects attributed to exposure to fine particulate matter suggests that the aerosol component of wood smoke plays a large role in the observed health effects associated with wood combustion. Because of its physical structure, PM_{2.5} can bypass conductive airways and deliver exogenous materials into the deep lung. These materials include reactive organic chemicals that adsorb onto the particle. Over the past 30 years, scientific evidence has found that short- (e.g., daily) and long-term (e.g., annual and multiyear) exposure to airborne PM is associated with

¹⁸ Pierson WE, Koenig JQ, Bardana Jr EJ. Potential adverse health effects of wood smoke. *West J Med* 1989; 151:1-6.

Larson TV, Koenig JQ. A summary of the emissions characterization and noncancer respiratory effects of wood smoke. EPA-453/R-93-036. U.S. EPA, Office of Air Quality Planning and Standards: Research Triangle Park, NC, 1993.

Maynard RL, Waller R. Carbon Monoxide. In: Holgate, ST, Samet, JM, Koren, HS, Maynard, RL, eds. *Air Pollution and Health*. Academic Press: New York, NY 1999; pp. 749-796.

Zelikoff JT, Chen LC, Cohen MD, Schlessinger RB. The toxicology of inhaled woodsmoke. *J Toxicol Environ Health* 2002; Part B,5:269-282.

Steenland K, Bertazzi P, Baccarelli A, Kogevinas M. Dioxin revisited: developments since the 1997 IARC classification of dioxin as a human carcinogen. *Environ Health Perspect* 2004; 112:1265-1268.

cardiopulmonary health effects, including increased respiratory and cardiac symptoms, hospital admissions and emergency room visits, and premature death. Other harmful health effects include aggravated asthma, decreased lung function, and chronic bronchitis. Recent studies suggest that chronic exposure to air pollution may actually result in the development of new cases of asthma and atopy.¹⁹ A review of adverse health effects of short-term exposure to particulate matter in study areas where residential wood combustion was considered a major source of ambient PM found higher health risk associations than those found in areas dominated by other sources of PM, especially for children.²⁰

Population subgroups susceptible or most affected by PM_{2.5} exposure comprise upwards of 50% of the general population, including children, asthmatics, persons with preexisting respiratory disease or cardiac problems, older adults, and healthy adults who work or exercise outdoors.²¹ Children's exposure to air pollution is of special concern because their immune system and lungs are not fully developed when exposure begins. For example, the number of alveoli in the human lung increases from 24 million at birth to 257 million at age four. As the lung epithelium is not fully developed, there is greater permeability of the epithelial layer in young children. Also, under normal breathing, children breathe 50% more air per kilogram of body weight than adults. In addition, children's high activity levels can result in increased ventilation, increasing exposure to air pollutants such as particulate matter. These factors suggest that there is a critical exposure time for children when air pollution may have long-term effects on respiratory health.²² However, PM exposure can adversely affect both susceptible and general populations, including healthy adults. The exact level where an individual might become ill or sensitized is unknown because of the inability of scientists to determine whether a threshold level exists or does not exist below which exposure to PM is safe.²³

Even hourly exposures to fine particulate matter may result in acute health responses within susceptible subgroups. Clinical and epidemiological evidence now suggests cardiac health effects, including increased risk of myocardial infarction and decreases in heart rate variability, which may be associated with PM exposures with

¹⁹ Pope CA, Burnett RT, Thurston GD, Thun MJ, Calle EE, Krewski D, Godleski JJ. Cardiovascular mortality and long-term exposure to particulate air pollution: epidemiological evidence of general pathophysiological pathways of disease. *Circulation* 2004;109:71-77.

Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information. EPA-452/R-05-005. U.S. EPA, Office of Air Quality Planning and Standards: Research Triangle Park, NC, 2005.

Peters JM, Avol E, Berhane K, Gauderman WJ, Gilliland F, Jerrett M, et al. 2004. Epidemiologic investigation to identify chronic effects of ambient air pollutants in southern California. Contract No. 94-331. Los Angeles, CA:University of Southern California.

²⁰ Boman BC, Forsberg AB, Järholm BG. Adverse health effects from ambient air pollution in relation to residential wood combustion in modern society. *Scand J Work Environ Health* 2003;29:251-260.

²¹ Johnson PRS, Graham JJ. Fine particulate matter National Ambient Air Quality Standards: public health impact on populations in the northeastern United States. *Environ Health Persp* 2005;113:1140-1147.

²² Schwartz J. Air pollution and children's health. *Pediatrics* 2004;113: 1037-1043.

²³ Daniels MJ, Dominici F, Zeger SL, Samet JM. 2004. The National Morbidity, Mortality, and Air Pollution Study, Part III: PM10 Concentration-Response Curves and Threshold for the 20 Largest US Cities. Research Report 94. Boston, MA:Health Effects Institute.

averaging times less than 24 hours (e.g., one to several hours).²⁴ These findings, in combination with associations between daily changes in PM and cardiovascular deaths and hospitalizations, indicate that short-duration exposures to wood smoke emissions could have serious health effects, especially for susceptible members of the population, such as those with preexisting heart disease and older persons.

While the above evidence regarding the severity of health effects and magnitude of populations affected by PM has led health scientists to conclude that exposure to wood smoke should be avoided,²⁵ residential wood combustion (RWC) remains one of the largest sources of PM_{2.5} emissions to the atmosphere in North America.²⁶ Studies in urban and rural areas have found that wintertime residential wood smoke contributes significantly to ambient concentrations of PM_{2.5} as well as VOCs.²⁷ This can be aggravated in areas subject to persistent temperature inversions, located in valleys, or which have a high percentage of wood burning households.²⁸ Wood smoke PM is dominated by particles with average mass diameters generally between 0.1 and 0.6 µm. Submicron particles readily penetrate residential structures as a result of the normal exchange of air.²⁹ Particles in wood smoke emitted from chimneys have been found to be a major source of indoor particles and thus a source of exposure to residents, even in homes without wood stoves.³⁰ Given the infiltration capacity of PM_{2.5}, exposure to wood

²⁴ Brook RD, Franklin B, Cascio W, Hong Y, Howard G, Lipsett, M. Air pollution and cardiovascular disease: a statement for healthcare professionals from the expert panel on population and prevention science of the American Heart Association. *Circulation* 2004;109: 2655-2671.

²⁵ Pierson WE, Koenig JQ, Bardana Jr EJ. Potential adverse health effects of wood smoke. *West J Med* 1989; 151:1-6.

Koenig JQ, Larson TV, Hanley QS, Rebolledo V, Dumler K, Checkoway H, et al. Pulmonary function changes in children associated with particulate matter air pollution in a wood burning community. *Environ Res* 1993;63;26-38.

Larson TV, Koenig JQ. Wood smoke: emissions and noncancer respiratory effects. *Annu Rev Public Health* 1994; 15:133-156.

Zelikoff JT, Chen LC, Cohen MD, Schlesinger RB. The toxicology of inhaled woodsmoke. *J Toxicol Environ Health* 2002; Part B,5:269-282.

Bates DV, Koenig J, Brauer M. Health and Air Quality 2002 – Phase I: Methods for Estimating and Applying Relationships between Air Pollution and Health Effects. Final Report. British Columbia Lung Association. May 2003.

²⁶ Fine PM, Cass GR, Simoneit BRT. Organic compounds in biomass smoke from residential wood combustion: emissions characterization at a continental scale. *J Geophys Res-Atmos* 2002; 107(D21):8349.

²⁷ Johansson LS, Tullin C, Leckner B, Sjövall P. Particle emissions from biomass combustion in small combustors. *Biomass Bioenerg* 2003; 25:435-446.

McDonald JD, Zielinska B, Fujita EM, Sagebiel JC, Chow JC, Watson JG. Fine particle and gaseous emission rates from residential wood combustion. *Environ Sci Technol* 2000; 34:2080-2091.

Polissar AV, Hopke PK, Poirot RL. Atmospheric aerosol over Vermont: chemical composition and sources. *Environ Sci Technol* 2001; 35:4604-4621.

²⁸ Sexton K, Spengler JD, Treitman RD, Turner WA. Winter air quality in a wood-burning community: a case study in Waterbury, Vermont. *Atmos Environ* 1984; 18:1357-1370.

²⁹ Boman BC, Forsberg AB, Järholm BG. Adverse health effects from ambient air pollution in relation to residential wood combustion in modern society. *Scand J Work Environ Health* 2003; 29:251-260.

Abt E, Suh HH, Catalano P, Koutrakis P. Relative contribution of outdoor and indoor particle sources to indoor concentrations. *Environ Sci Technol* 2000; 34:3579-3587.

³⁰ Anuszewski J, Larson TV, Koenig JQ. Simultaneous indoor and outdoor particle light-scattering measurements at nine homes using a portable nephelometer. *J Exposure Anal Environ Epidemiol* 1998; 8:483-493.

smoke indoors—where individuals typically spend the majority of their time—can occur across large residential areas.

4.3. Unique Factors Relating to OWB Emissions and Potential Public Health Threats

Outdoor wood boilers are a unique emission source with operational and design factors not typically found in other residential wood burning appliances. First, the design of OWBs is to operate intermittently following the heat load of a building. This design enables boilers to burn wood in low temperature and oxygen-starved conditions to prolong the fuel source. In general, PM_{2.5} mass concentration increases during unsatisfactory operating conditions, especially where lower excess air ratios or low-quality fuel can yield more condensable gas and organic condensation nuclei.³¹ Reduced combustion air supply favors the emission and formation of especially harmful pollutants, as inefficient smoldering conditions can result in high emissions of particles and unoxidized gaseous compounds, leading to the formation of particle-bound PAHs.³² Unlike EPA-certified residential wood stoves, the design of many OWBs do not provide for the oxidation of incomplete combustion vapors. As a result, these are available for formation of PM_{2.5} rich in relatively high molecular weight organic compounds.

Second, in addition to poor combustion properties, the relatively short stack height of OWBs creates dangerous dispersion conditions to nearby buildings, including an increased likelihood of worst-case emission scenarios such as fumigation and impingement. In contrast to indoor wood stove stacks that extend through the roof of a home to heights of 20 to 30 feet, OWBs come with short stacks typically between 8 to 10 feet tall. In addition, the regular use of OWBs further exacerbate the potential impact of their emissions on nearby buildings because the appliances supply hot water for domestic consumption and heating every day, all year long—not just during wintertime. In-field ambient PM_{2.5} monitoring recently conducted by NESCAUM illustrate the potential for OWBs to affect nearby ambient air quality as discussed in Section 5.2 of this report.

Finally, the use of OWBs for trash burning increases potential emission and public health problems related to these devices. The sizeable firebox capacity and large loading door dimensions characteristic of OWBs facilitate the loading and combustion of non-wood materials, such as household waste (e.g., paper, plastic, and packaging). The combustion of these materials in devices that have low stacks, lack emissions control systems, and operate under low temperature conditions creates the potential for generating hazardous air pollutants in close proximity to homes, schools, businesses and other areas where people spend significant amounts of time. Using OWBs without emission controls to burn trash is analogous to the use of burn barrels and burn piles,

³¹ Barrefors G, Petersson G. Volatile hydrocarbons from domestic wood burning. *Chemosphere* 1995; 30:1551-1556.

Johansson LS, Tullin C, Leckner B, Sjövall P. Particle emissions from biomass combustion in small combustors. *Biomass Bioenerg* 2003; 25:435-446.

³² Hueglin C, Gaegauf C, Kunzler S, Burtscher H. Characterization of wood combustion particles: morphology, mobility and photoelectric activity. *Environ Sci Technol* 1997; 31:3439-3447.

McDonald JD, Zielinska B, Fujita EM, Sagebiel JC, Chow JC, Watson JG. Fine particle and gaseous emission rates from residential wood combustion. *Environ Sci Technol* 2000; 34:2080-2091.

which many states and local governments have banned because they emit a variety of pollutants, including acidic gases, heavy metals, and dioxin. Inhaling these substances has the potential to cause health problems including eye and throat irritation, respiratory problems, and an increased risk of cancer.³³

4.4. Cause for Concern

Because OWBs are conducive to the formation of high PM emissions relative to background levels during routine operating conditions, OWBs may present a potential health risk to nearby populations. Should the use of OWBs become more prevalent in populated areas, OWB wood smoke particulate emissions could result in short- and long-term ambient and indoor air quality impacts on nearby neighbors, in light of the ability of fine aerosols to permeate readily into dwellings. These impacts likely would also affect populated areas subject to pollution loading arising from terrain and meteorological conditions favorable to inversion formation. This raises public health concerns because of the known health effects associated with exposure to PM, including a suite of respiratory and cardiac morbidity outcomes as well as premature mortality. Susceptible populations, such as the elderly, children, and persons with preexisting cardiopulmonary disease, may be at higher health risk and therefore disproportionately affected.

Consideration of operating and design features typical to OWBs that can influence emissions supports these public health concerns, including poor combustion design, low stack height and poor dispersion, four-season utility, large firebox chamber capacity, and the potential to burn trash. Currently, few field assessments of OWB ambient emissions have been conducted, thereby limiting regulatory efforts to evaluate this potential public health problem, especially within the context of whether 24-hr and annual PM standards are suitably protective in areas with heavy wood burning. It is reasonable and prudent to assume that OWBs can present a public health risk to populations in proximity to these devices.

³³ Lemieux PM. Evaluation of Emissions from the Open Burning of Household Waste in Barrels. EPA Project Summary. EPA/600/SR-97/134. U.S. Environmental Protection Agency, National Risk Management Research Laboratory: Cincinnati, OH, 1998.

5. EMISSIONS INFORMATION

This section reviews previous studies of OWB emissions and describes the results of two studies conducted by NESCAUM.

5.1. Previous Test Data

A search of available data revealed limited information on OWB emission characterizations. Below are the results of this review.

- EPA funded an OWB study conducted by Valenti and Clayton in 1998.³⁴ The comparisons detailed within this study primarily provide data based upon a heat input basis. For reasons cited earlier in this report, the data have been converted to grams per hour measurements where possible. The testing was performed using a modified Method 28 fueling protocol and a modified Method 5G for measuring particulate matter, PAHs, and POMs. The OWBs tested under this effort exhibited PM emission levels as high as 143.2 g/hr for high heat removal firing and 55.4 g/hr at low heat removal. The application of a prototype catalyst on one device lowered PM emissions to 53.8 and 37.8 g/hr respectively. Table 4-5 of the study compared PM emissions in milligrams PM per megajoules heat output for two OWB units; Furnace A produced 1,048 mg/MJ and Furnace B³⁵ produced 681 mg/MJ. Table 4-5 indicated that non-catalytic wood stoves built in the 1990's tested at 383 mg/MJ, catalytic stoves at 425 mg/MJ and pellet stoves at 110 mg/MJ.

Testing for total chromatographable organics (TCOs) showed emission rates as high as 5.4 g/hr at high heat removal to 8.31 g/hr for low heat removal. The PAH emissions were as high as 2.8 g/hr for high heat removal and 0.64 g/hr at low heat removal. Surprisingly, the catalyst runs generated substantially higher levels of TCO and PAH compounds. The study did not provide comparison data on a grams per hour basis for TCOs or PAHs, however, it provided comparison data in micrograms per megajoules input basis. This data showed that PAH emissions for Furnace A were 15.6 mg/MJ, Furnace B 16.1 mg/MJ, non-catalytic wood stoves 28 mg/MJ, catalytic stoves 24 mg/MJ and certified pellet stoves 0.082 mg/MJ. However, EPA caveated these data due to the different test methods, stating that only differences of an order of magnitude should be considered significant. The only publicly available data to compare PAH emissions on a grams per hour basis (total stack emissions) between OWBs and wood stoves is from an EPA wood stove field study on Phase 2 units in Klamath Falls and Portland, Oregon.³⁶ This study found that the average "in-use" PAH

³⁴ Valenti JC, Clayton RK. *Emissions from Outdoor Wood-Burning Residential Hot Water Furnaces. EPA Project Summary*, EPA/600/SR-98/017. U.S. EPA, National Risk Management Research Laboratory: Cincinnati, OH 1998.

³⁵ Furnace B is a Central Boiler Model CL 17 (letter from Robert C. McCrillis, EPA, to Rodney Tollefson, Central Boiler, November 23, 1998).

³⁶ Fisher, L, Houck, J, Tiegs, P. *Long Term Performance of EPA Phase 2 Woodstoves, Klamath Falls and Portland, Oregon, 1998/1999*. EPA NRMRL RTP-195 (R3-27-00).

emissions for Phase 2 wood stoves, which had been in-use for over five years, was 0.149 g/hr for non-catalytic stoves and 0.165 g/hr for catalytic stoves. Based upon these data, OWBs may emit 4.3 to 18.8 times more PAHs than non-catalytic wood stoves and 3.9 to 16.9 times more than catalytic wood stoves.

- Vermont Department of Environmental Conservation (VT DEC) determined, pursuant to litigation, that a unit produced by Central Boiler (Model CL-7260) had an “adjusted emission rate” of 93.76 g/hr for PM. This number was derived by state review of laboratory testing conducted by the manufacturer. Central Boiler claims in their submission of the tests that the actual rate was 3.6 g/hr. However, after thorough review, the Vermont DEC Air Pollution Control Agency concluded that Central Boiler incorrectly interpreted the data and believes that the state’s calculations of 93.76 g/hr are accurate.
- US EPA and the New York Attorney General’s Office have obtained sales and emissions data from manufacturers. Table 5-1 contains emissions data made public by the New York Attorney General’s Office. OWB manufacturers have claimed that these data are Confidential Business Information and therefore NESCAUM has not been able to review the test reports or underlying test procedures³⁷ and therefore cannot confirm the test results nor determine the amount of emissions that may not have been measured in the condensable portion of the emissions. However, the data do show high emission rates and indicate that manufacturers are aware of these high emission rates from their OWBs.

Table 5-1. Unevaluated OWB Emissions Data³⁸

Unit	PM Emissions g/hr	PAH Emissions g/hr	Heating Efficiency	Number of Test Runs
OWB 1*	84	Not Available	30%	5
OWB 2*	60	Not Available	37%	4
OWB 3*	108	Not Available	28%	2
OWB 4*	18	Not Available	31%	2
OWB 5*	49	Not Available	55%	7
OWB 6*	33	Not Available	37%	2
OWB 7**	147	Not Available	55%	2
OWB 8**	118	Not Available	53%	2
OWB 9***	179	Not Available	45%	
OWB 10***	269	Not Available	46%	

* Intertek Laboratories 2004

** Omni Laboratories 2004

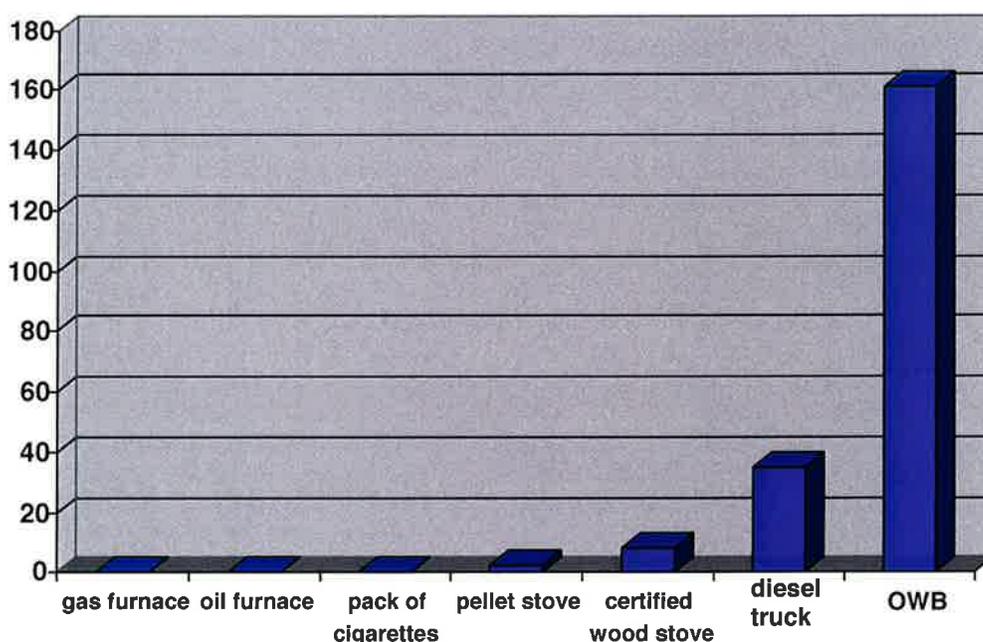
*** Intertek Laboratories 2004 from ASTM subcommittee, older model not currently being sold.

³⁷ Correspondence with EPA Region 1 in response to NESCAUM’s FOIA request of data submitted to EPA as a result of a Section 114 action.

³⁸ Schreiber, Judith et al. *Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State*. Office of the Attorney General; Albany, New York, 2005. Available at <http://www.oag.state.ny.us/press/2005/aug/August%202005.pdf>

While there is only limited data at this time, the data show that PM emissions from OWBs are very high. One study concluded that OWB emissions are 10 to 20 times higher than certified indoor wood stoves.³⁹ Such high emissions result from low efficiency and incomplete combustion of fuel. The Connecticut Department of Environmental Protection completed a comparison of homes heated with natural gas, oil, and OWBs, and concluded that emissions from one OWB are equivalent to emissions from four non-certified wood stoves, 18 certified wood stoves, 205 oil furnaces or 3,000 to 8,000 natural gas furnaces.⁴⁰ To put these emissions into perspective, one OWB can emit as much PM as four heavy duty diesel trucks. Figure 5-1 provides a chart comparing particulate emissions from various sources.⁴¹

Figure 5-1. PM Emission Comparison (g/hr)



³⁹ Schreiber, Judith et al. *Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State*. Office of the Attorney General; Albany, New York, 2005. Available at <http://www.oag.state.ny.us/press/2005/aug/August%202005.pdf>.

⁴⁰ CTDEP. Connecticut Department of Environmental Protection. Connecticut DEP Fact Sheet: Outdoor Wood Burning Furnaces. State of Connecticut, Connecticut Department of Environmental Protection. July 2004; available at: <http://www.dep.state.ct.us/air2/consumer/index.htm>; accessed June 14, 2005.

⁴¹ Based upon an average emission rate of 36 g/hr for diesel trucks; <http://www.burningissues.org/comp-emmis-part-sources.htm>.

5.2. Near-Source Ambient Emission Field Monitoring

Currently, few assessments exist of OWB impacts to ambient air quality, limiting regulatory efforts to evaluate exposure conditions and the potential health risks posed to nearby populations.⁴² In order to characterize ambient PM_{2.5} emissions near an OWB, NESCAUM performed a screening level evaluation in March 2005.

Pilot field monitoring was conducted in Central New York State at a site within 50-150 feet of a Hardy H5-1-07 "Economy" boiler.⁴³ The device had a fire chamber 22.6 cubic feet in size, maximum capacity of 180,000 Btu/hr, and stack height of about 10 feet. Fuel usage during monitoring was a mix of green oak logged 11/01/04 and split 12/04 (stored dry) and maple/cherry/other hardwood seasoned about one-year (stored dry). The PM_{2.5} monitoring interval was a 15-second averaging time in order to capture high temporal resolution during different boiler operating modes and fuel loads. A Thermo Electron DataRAM 4000 performed the monitoring of PM_{2.5}. This is a portable nephelometric monitor that employs light scattering to measure the fine particle fraction of airborne pollutants. The DataRAM has the ability to estimate particle size below PM_{2.5} and is an ideal instrument for portable and highly time-resolved applications.

Results indicate that areas within 150 feet of an OWB can experience high PM_{2.5} concentrations relative to background levels. Continuous sampling recorded periodic values >1,000 µg/m³ and frequent values >400 µg/m³ throughout the course of routine OWB operating conditions, including damper open (oxygen rich) and damper closed (oxygen starved) modes and within about 1 hour and 24 hours after fuel loading. The monitor found high PM_{2.5} levels at all sampled distances, recording values upwards of 4,000 µg/m³ over distances of 50, 100, and 150 ft. The monitor observed a peak value of 8,880 µg/m³ at 50 ft.

The time-series plotted in Figures 5-2 and 5-3 show selected results. Figure 5-2 displays fine particle values that the monitor obtained about 24 hours after the OWB had been loaded with a wheelbarrow of wood fuel. (Wind was calm and variable/southerly, temperature about 8 °C, and relative humidity about 44% with light snow.) As shown in Figure 5-3, the study also conducted PM_{2.5} monitoring before and within 1 hour after OWB loading with ½ wheelbarrow of wood fuel. (Wind was calm and variable/southerly, temperature about 6 °C, and relative humidity about 50% with light snow.) In both figures, the monitor recorded high PM_{2.5} readings during both damper open and damper closed modes at all distances along the monitoring transect. It found the highest values within 1 hour after fuel loading, with damper open. General observations of wind direction and speed indicate that changes in monitored PM_{2.5} concentrations occurred when the measurement device was directly downwind or not directly downwind of the OWB plume.

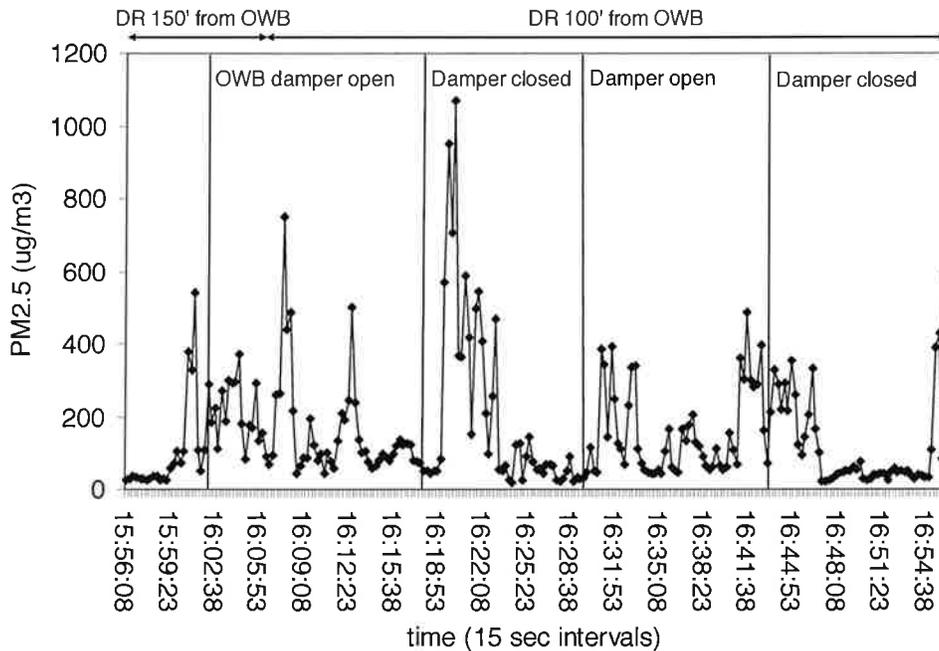
While this screening level pilot study was not intended to quantify 24-hour or longer-term average exposures (e.g., a complete heating season), such information would be useful to collect in order to compare typical ambient OWB PM levels to current 24-

⁴² The Michigan Department of Environmental Quality modeled the impacts of an OWB based on theoretical emissions (see Appendix D).

⁴³ A detailed presentation of findings has been submitted for peer-reviewed publication to the Journal of Health and Ecological Risk Assessment by Philip RS Johnson, NESCAUM.

hour or annual PM national ambient air quality standards. There are no health-based benchmarks for PM_{2.5} for 15-second averaging times. However, the high PM_{2.5} 15-second concentrations observed in this study could indicate the potential for elevated 24-hour average concentrations relative to current health-based standards.⁴⁴ EPA's current national ambient air quality 24-hr and annual PM_{2.5} standards are 65 µg/m³ (98th percentile form) and 15 µg/m³, respectively. EPA recently proposed a revised 24-hr PM_{2.5} standard of 35 µg/m³ (98th percentile form) with no proposed revision of the annual standard.⁴⁵ Canada's more stringent PM_{2.5} 24-hr objective is 30 µg/m³.⁴⁶ Because of this study's findings of high PM_{2.5} concentrations in proximity to an OWB under routine operating conditions, NESCAUM recommends further research to quantify the nature and magnitude of OWB ambient emissions in populated areas.

Figure 5-2. Field measurements of PM_{2.5} near outdoor wood boiler



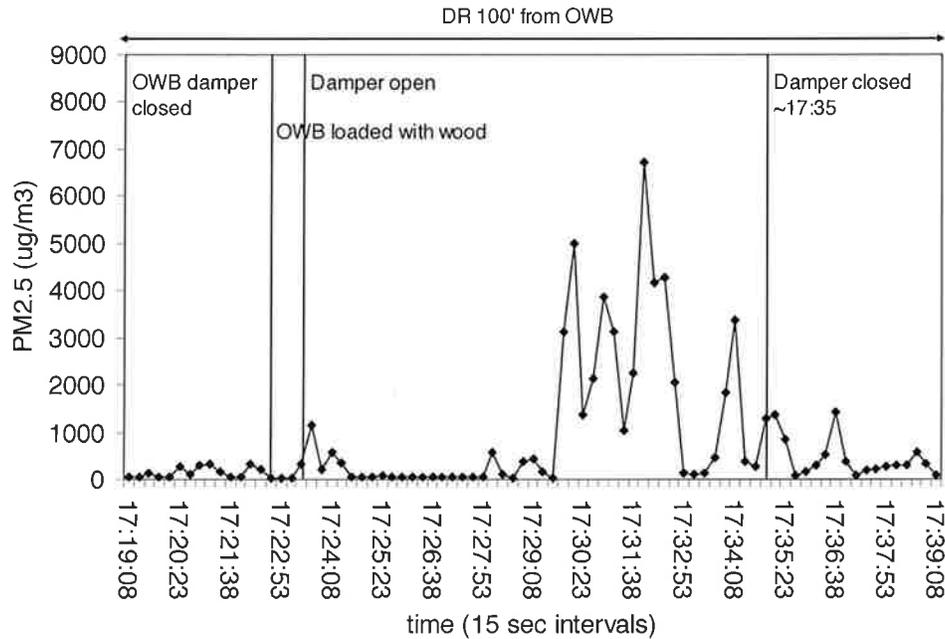
⁴⁴ Because the monitored data NESCAUM obtained was from an economy-sized OWB (180,000 Btu/hr), there is the potential that other OWB devices emit higher PM_{2.5} concentrations; OWB models can range from about 115,000 to 3,200,000 maximum Btu/hr output.

⁴⁵ US Environmental Protection Agency. Revisions to the National Ambient Air Quality Standards for particulate matter. Final rule. Fed. Reg. 1997;62:38652-38760.

Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information. EPA-452/R-05-005. Office of Air Quality Planning and Standards, US Environmental Protection Agency: Research Triangle Park, NC, 2005.

US Environmental Protection Agency. National Ambient Air Quality Standards for particulate matter. Proposed rule. Fed. Reg. 2006;71:2620-2708.

⁴⁶ Canadian Council of Ministers of the Environment. Human Health Effects of Fine Particulate Matter: Update in Support of the Canada-wide Standards for Particulate Matter and Ozone. Health Canada: Ottawa, Canada, 2004. URL for CWS is www.ccme.ca/publications/.

Figure 5-3. Field measurements of PM_{2.5} near outdoor wood boiler

5.3. Results of NESCAUM OWB “In Use” Stack Test

In June 2005, NESCAUM completed stack testing on a 250,000 Btu/hr Central Boiler unit to gain a better understanding of OWB operations. NESCAUM made pilot measurements on an "in-use" (field, not laboratory) residential OWB to determine emission rates for different burn scenarios using real-time measures and short duration filter samples. In addition, the test also obtained data on particle size, stack temperature and flue velocity. The results from these measurements are anecdotal in nature because NESCAUM tested only a single furnace and wood type. Nevertheless, combined with other laboratory emissions data, these tests provide a better understanding of the potential impact of these sources on air quality. The experience gained from these tests in how to better characterize the real-world emissions from OWBs will be useful in guiding the design of future testing programs.

5.3.1. Testing Methods

NESCAUM performed testing in June 2005 on an OWB, Central Boiler CL-17, rated at 250,000 Btu/hr that was installed in 2000 to heat a residence, provide hot water, and heat a swimming pool. For this test, the heat load was the swimming pool; the damper was manually controlled to simulate moderate heating loads observed in NESCAUM's previous test. The wood used was from the furnace owner's wood pile. The wood consisted of mixed hardwoods with moisture contents ranging from 20 to 40%. Appendix E contains information on the moisture content along with opacity readings taken by USEPA Method 9-certified staff from the VT DEC. On day one of testing, the OWB received an initial load of wood with no coal bed that was not disturbed until the end of the test runs that day. On day two, the OWB started with a full load of wood on a bed of coals. The loading door was opened once during the second day of testing to

check the load and rake the coals. Nothing else was done to the wood load in the OWB during the testing period.

A Thermo Electron DataRAM 4000 made continuous stack PM concentration measurements using light scattering to estimate PM_{2.5} concentrations. The OWB stack sample was diluted with ambient air by a factor that varied between approximately ten to twenty times (the actual dilution ratio was repeatedly measured and applied to the reported data). The dilution air was added within the stack to minimize water vapor condensation problems. The sample train provided sufficient residence time (several seconds) and near-ambient temperatures to allow organic gases in the sample to condense to particle phase. Thus, this method should be considered to be measuring both the “hot” and “cold” (condensed organic vapor) fractions of the stack PM emissions. Observed stack PM concentrations were five to ten times higher than expected, so there were some problems with the continuous PM measurements. The inlet probe clogged (partially or completely) several times, and concentrations exceeded the DataRAM’s useful range a significant amount of the time. Data from these periods have been excluded from this report, with the exception of a few brief periods that are noted as “saturated” on the continuous data plots. The continuous PM data have been converted into emission rate data (grams per hour) based on the average dry flow for each of the two burn modes (idle fire or damper closed mode and full fire or damper open mode). For the scatter plot comparing data from the DataRAM continuous PM method with the filter gravimetric method (see below), mass concentrations of PM in the stack are used. The DataRAM also reports a semi-quantitative measurement of the volume (mass) median particle diameter (an approximate estimate of particle size).

A modified EPA Method 17 sampling system (using 0.3 μm pore-size glass fiber filters) collected short-term (3 to 20 minute) filter gravimetric PM samples. The stainless steel filter holders were preheated to 275° F prior to sampling, but were outside the stack and unheated during sampling (no hot-box was used), so the actual temperature of the filter varied with the furnace burn mode resulting in a substantial variation in the amount of “condensable” (semi-volatile organic) PM collected on the filters. “Full fire” mode (damper open) stack temperatures were usually above 400°F; this resulted in substantial under-measurement of PM due to the inability to measure the condensable PM. “Idle fire” mode stack temperatures were as low as 130°F, and much of the condensable PM was collected under these conditions even though the filter holders were preheated.

5.3.2. Results and Discussion

The following sections provide specific details on the testing results using the DataRam and filter test methods.

Results from DataRam Measurements

Figures 5-4a through 5-4e are time series plots of continuous PM emission data, particle mass median diameter, and stack temperature. Times and values of gravimetric filter sampling are also indicated on these plots. Missing time periods are when the DataRAM data are invalid for various reasons as noted above.

The continuous PM emission data demonstrate the short-term dynamics of emission rates in more detail than filter sample data. In some cases, changes in emission rates can be related to changes in burn conditions (damper state changed), but often the rates change dramatically for no obvious reason. One possible explanation is settling of the wood load inside the furnace, but this could not be observed without interrupting the testing process. The wide range of PM emission rates even under similar conditions demonstrates the need for more extensive testing to properly characterize sources. The mean emission rate from the continuous monitor was 161 g/hr.⁴⁷ This rate does not include start up emissions (worst case scenario) and represents mid-range emissions, operating through several operating cycles. This rate is higher than the mean of filter emission rates for either mode (93 g/hr for full fire mode and 64 g/hr for idle fire mode), which is likely due to the filter sampling method's inability to measure condensibles.

Results from filter samples

Table 5-2 gives a summary of filter test results for damper open or full fire, and Table 5-3 gives results for damper closed or idle fire. The mean PM emission rate for all full fire filter runs is 93 grams per hour (g/hr) with a range of 13 to 237 g/hr. For idle fire conditions, the mean is 64 g/hr with a range of 13 to 148 g/hr. To put these emissions into a hypothetical ambient PM concentration context, if the maximum rate of 237 g/hr were emitted into a totally stagnant air mass of 100 cubic meters (for example, an area of 100x100 meters and a height of 100 meters), the ambient PM concentration would be 237 $\mu\text{g}/\text{m}^3$ after one hour.

We must note that caution should be taken in making relative comparisons of emission rates from the two burn modes based on the filter data. These data imply that on average, full fire PM emission rates are approximately 50% higher than idle burn rates. As noted above, and discussed in detail below, the filter data from full fire samples is likely to be biased low by a large factor because of the loss of condensable PM from the hot filter. This implies that the actual full fire emission rate is much higher than the idle rate. An additional uncertainty in calculation of idle fire emission rates is the stack flow measurement; the flows were very low in that mode and thus difficult to measure accurately.

Comparison of two testing methods

To assess the comparability of the two PM measurement methods used (continuous and filter-based), Figure 5-5 shows scatter plots of matching time periods when collecting both filters and valid continuous PM data. Data from the two burn modes are compared separately because of the substantial difference in how much condensable PM was presumably collected with the filter method between the two modes. Table 5-4 presents the data used in Figure 5-5. Note that Table 5-4 presents these data as concentrations (grams per cubic meter) rather than emission rates.

The difference in both numerical agreement and correlation between the two PM measurement methods between the two burn modes is consistent with the differences in

⁴⁷ This measurement came from a mostly contiguous 3.5 hour period on day two of testing after two initial modulations of the unit running a period beginning 2.5 hours after the fuel charge and ending six hours after fuel charge.

filter temperature between the two modes. In the idle burn (damper closed) mode, stack (and therefore filter) temperatures are relatively low, allowing collection of much of the condensable organic PM. In this mode, the two methods correlate well and the mean PM is within 30%. In the full burn (damper open) mode, the stack (and filter) temperatures are much higher, so the filter is not collecting much of the condensable PM. In this mode, the two measurement methods do not correlate, and the filter PM data are much lower than the continuous PM data. In the damper open mode, the continuous data range is approximately a factor of 10; the filter data range for this mode is small, with five of the six samples between 0.13 and 0.21 g/m³. The mean of the continuous DataRAM PM is nearly seven times higher than the mean of the filter PM for this sample subset period. These differences between the two PM methods are not unexpected, because the modified method 17 used for the filter measurements does not attempt to efficiently collect the condensable organic PM fraction.

Stack Conditions

Stack temperatures varied widely, from as low as 130°F (idle burn) to 600°F (full burn). Median particle size also varied widely, from 0.1 to over 1 μm in diameter. Smaller sizes were generally associated with full (hot) burn modes, with larger sizes during idle (cooler) burns. This is consistent with what could be expected; hotter burns would have less organic carbon material because the higher temperatures combust more of the organic carbon.

Conclusions

While it would be reasonable to assume that a “fresh” load of burning wood in the OWB would result in higher emission rates compared to an “aged” load that is more charcoal-like, this was not the case. The idle burn mode filter test results were insufficient to show this and the full burn mode tests would not be appropriate to use because the filter measurements did not capture the majority of PM emissions. Idle burn filter PM data from June 21 were too limited (2 samples, both 2-3 hours after loading) for this assessment. On June 22, six idle-fire filter measurements were made from about ½ hour after the OWB was loaded to almost 6 hours after. The successive idle burn filter PM emission rates were 51, 83, 109, 148, 27, and 13 grams/hour. Although the two lowest PM emission rates were at the end of the test sequence, the highest value of 148 g/hr occurred almost five hours after the wood was loaded. Thus, no clear conclusion from these limited data can be made regarding emissions and age of load.

Table 5-2. Filter Measurements Idle Burn Mode

Test Run	3	5	7	10	12	14	16	17	
Date	6/21/2005	6/21/2005	6/22/2005	6/22/2005	6/22/2005	6/22/2005	6/22/2005	6/22/2005	
Clock Time (24 hour)	15:08 – 15:23	16:15 – 16:31	10:03 – 10:22	11:21 – 11:40	12:47 – 12:50	14:18 – 14:21	15:08 – 15:11	15:18 – 15:21	
Test Duration (minutes)	15	16	19	19	3	3	3	3	
Sample Volume (dscf)	4.583	4.838	6.09	5.416	0.865	0.862	0.862	1.014	
Test Measurements									
									Means
Isokinetics (%)	88.9	87.9	92.2	82.1	101.6	95.5	91.6	97.8	92.2
Moisture Content (%)	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Temperature (F)	200	200	200	200	356	280	250	140	228.25
Gas Composition – CO ₂ (%)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
O ₂ (%)	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
CO (%)	0	0	0	0	0	0	0	0	0
N ₂ (%)	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3
Gas Velocity (fps)	2.4	2.4	2.4	2.4	2.6	2.5	2.5	2.3	2.4375
Gas Volumetric Flow (dscfm)	37	37	37	37	32	34	36	39	36.125
(acfm)	50	50	50	50	54	52	52	48	50.75
PM Emission Determinations									
Concentration (grains/dscf)	0.268	0.2705	0.354	0.5804	0.8778	1.1171	0.1933	0.0852	0.468288
Emission Rate (lbs/hr)	0.08	0.09	0.11	0.18	0.24	0.33	0.06	0.03	0.14
Concentration (grams/meter ³)	0.614	0.619	0.811	1.329	2.010	2.558	0.443	0.195	1.072378
Emission Rate (grams/hour)	38.56	38.92	50.93	83.50	109.22	147.69	27.06	12.92	63.60

Table 5-3. Filter Measurement Full Burn Mode

Test Run	1	2	4	6	8	9	11	13	15	
Date	6/21/2005	6/21/2005	6/21/2005	6/22/2005	6/22/2005	6/22/2005	6/22/2005	6/22/2005	6/22/2005	
Clock Time (24 hour)	14:11 – 14:19	14:38 – 14:45	15:37 – 15:56	09:44 – 09:49	10:43 – 10:50	10:59 – 11:00:30	12:16 – 12:31	13:50 – 14:06	14:39 – 14:55	
Test Duration (minutes)	8	7	19	5	7	1.5	15	16	16	
Sample Volume (dscf)	2.583	3.701	4.662	1.586	1.946	0.36	4.06	4.223	4.198	
Test Measurements										
Isokinetics (%)	134	95.3	99.3	133.4	116.7	193.4	102.3	101.6	101.1	Means 119.6778
Moisture Content (%)	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7
Temperature (F)	450	590	630	360	455	455	478	500	500	490.8889
Gas Composition – CO2 (%)	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
O2 (%)	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
CO (%)	0	0	0	0	0	0	0	0	0	0
N2 (%)	79.9	79.9	79.9	79.9	79.9	79.9	79.9	79.9	79.9	79.9
Gas Velocity (fps)	6.4	6.9	7	6	6.4	6.4	6.5	6.5	6.5	6.511111
Gas Volumetric Flow (dscfm)	60	56	55	63	60	60	60	58	58	58.88889
(acfm)	134	144	147	126	130	134	136	136	136	135.8889
PM Emission Determinations										
Concentration (grains/dscf)	0.9965	0.0763	0.0755	0.9691	0.2244	0.9774	0.0908	0.0771	0.0588	0.393989
Emission Rate (lbs/hr)	0.51	0.04	0.04	0.52	0.12	0.06	0.05	0.04	0.03	0.156667
Concentration (grams/meter ³)	2.282	0.175	0.173	2.219	0.514	2.238	0.208	0.177	0.135	0.902235
Emission Rate (grams/hour)	232.49	16.61	16.15	237.40	52.35	228.03	21.18	17.39	13.26	92.76336

Table 5-4. Comparison of Filter Data and DataRam

Full Burn Data						
	6/21/2005	6/21/2005	6/22/2005	6/22/2005	6/22/2005	6/22/2005
	14:38 – 14:45	15:37 – 15:56	10:43 – 10:50	12:16 – 12:31	13:50 – 14:06	14:39 – 14:55
PM Concentration, g/m ³						
DR	3.070	0.340	1.355	1.174	1.900	1.532
Idle Burn Data						
	6/21/2005	6/22/2005	6/22/2005	6/22/2005	6/22/2005	
	16:15 – 16:31	12:47 – 12:50	14:18 -14:21	15:08 – 15:11	15:18 – 15:21	
PM Concentration, g/m ³						
DR	0.661	2.586	2.956	1.269	0.501	
Filter	0.619	2.010	2.558	0.443	0.195	

Figure 5-4a. VT Outdoor Wood Furnace Stack Sampling
Continuous PM (Data RAM) 21-June 2005

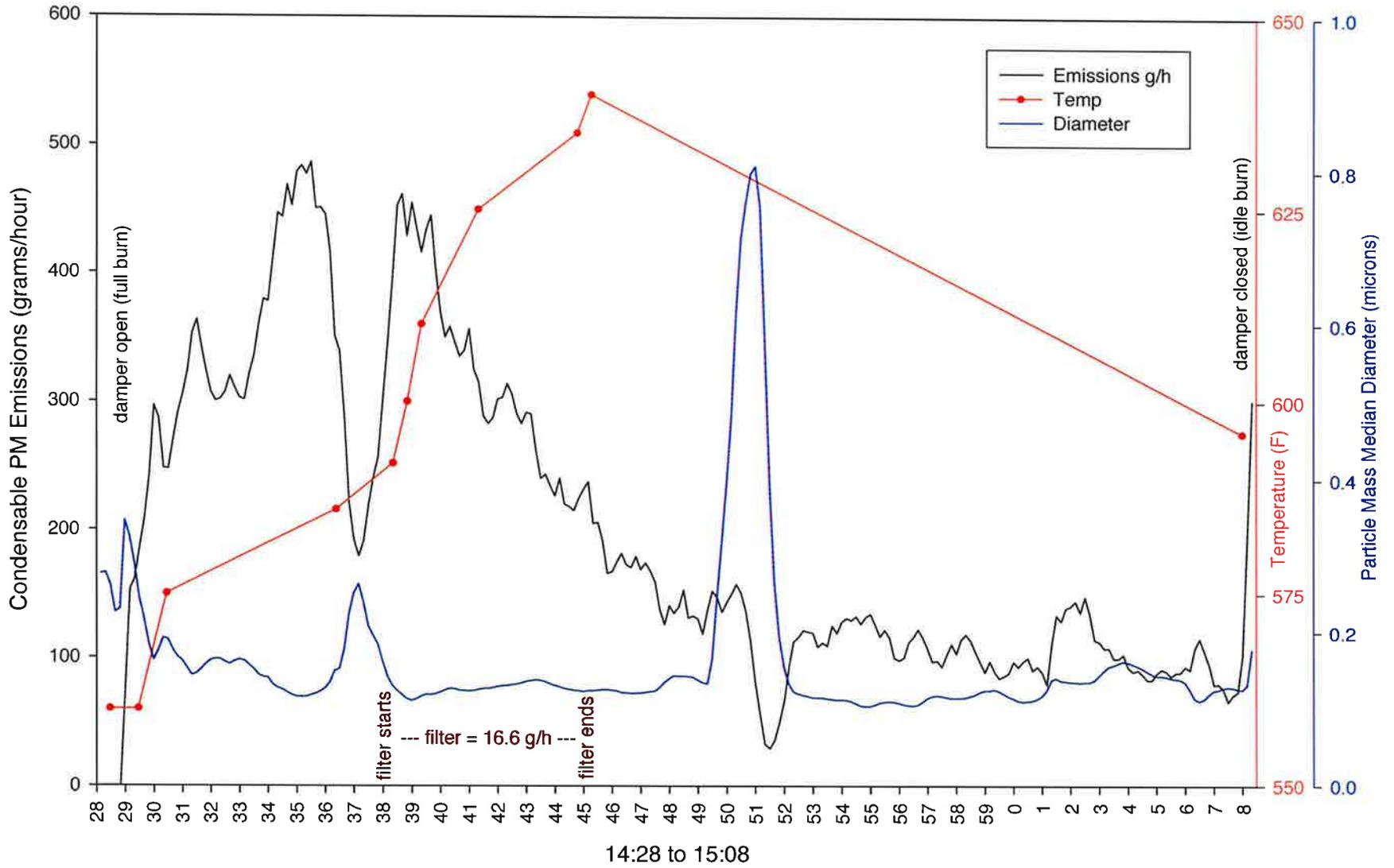


Figure 5-4b. VT Outdoor Wood Furnace Stack Sampling
 Continuous PM (Data RAM) 21-June 2005

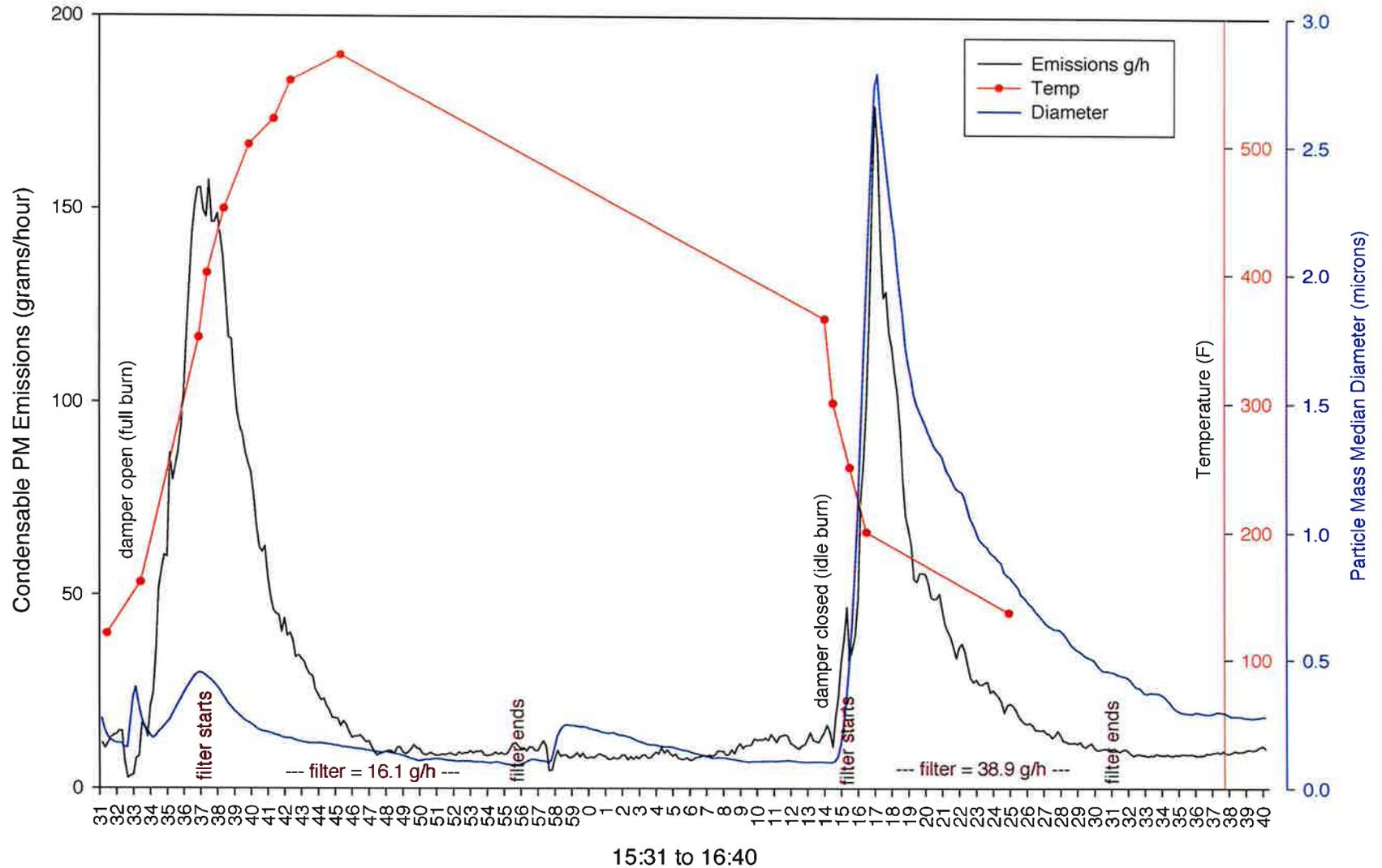


Figure 5-4c. VT Outdoor Wood Furnace Stack Sampling
 Continuous PM (Data RAM) 22-June 2005

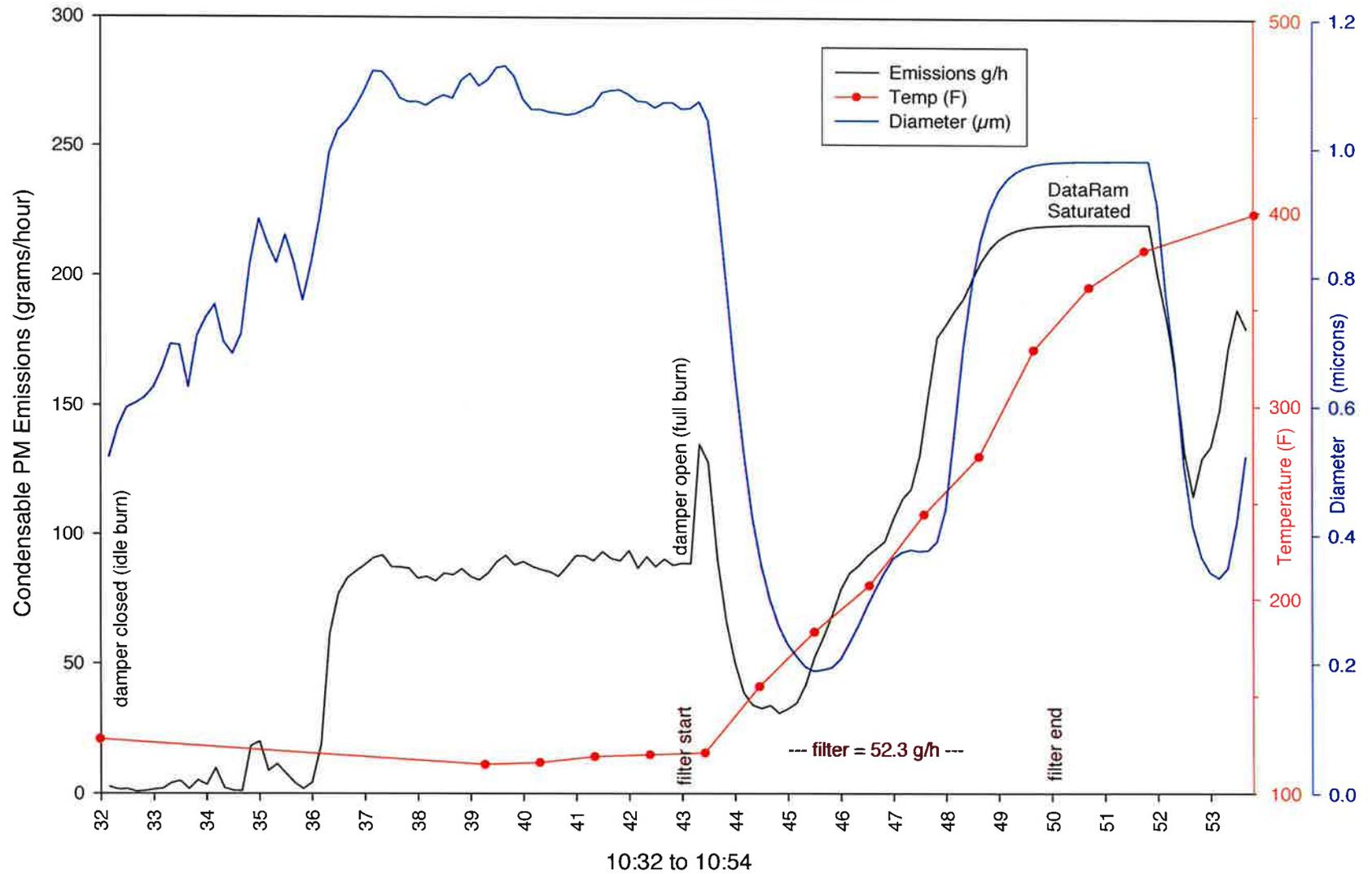


Figure 5-4d. VT Outdoor Wood Furnace Stack Sampling
Continuous PM (Data RAM) 22-June 2005

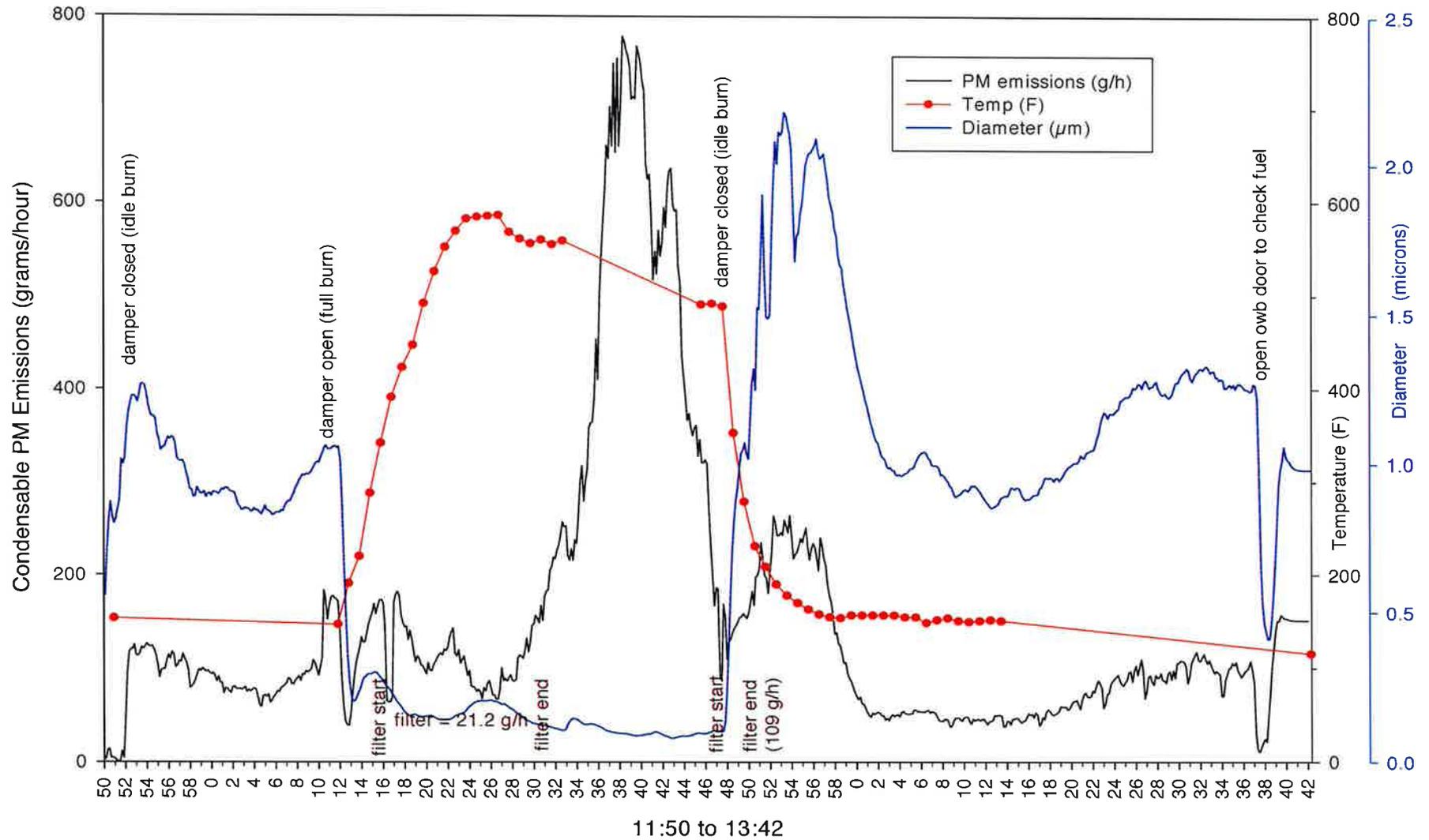
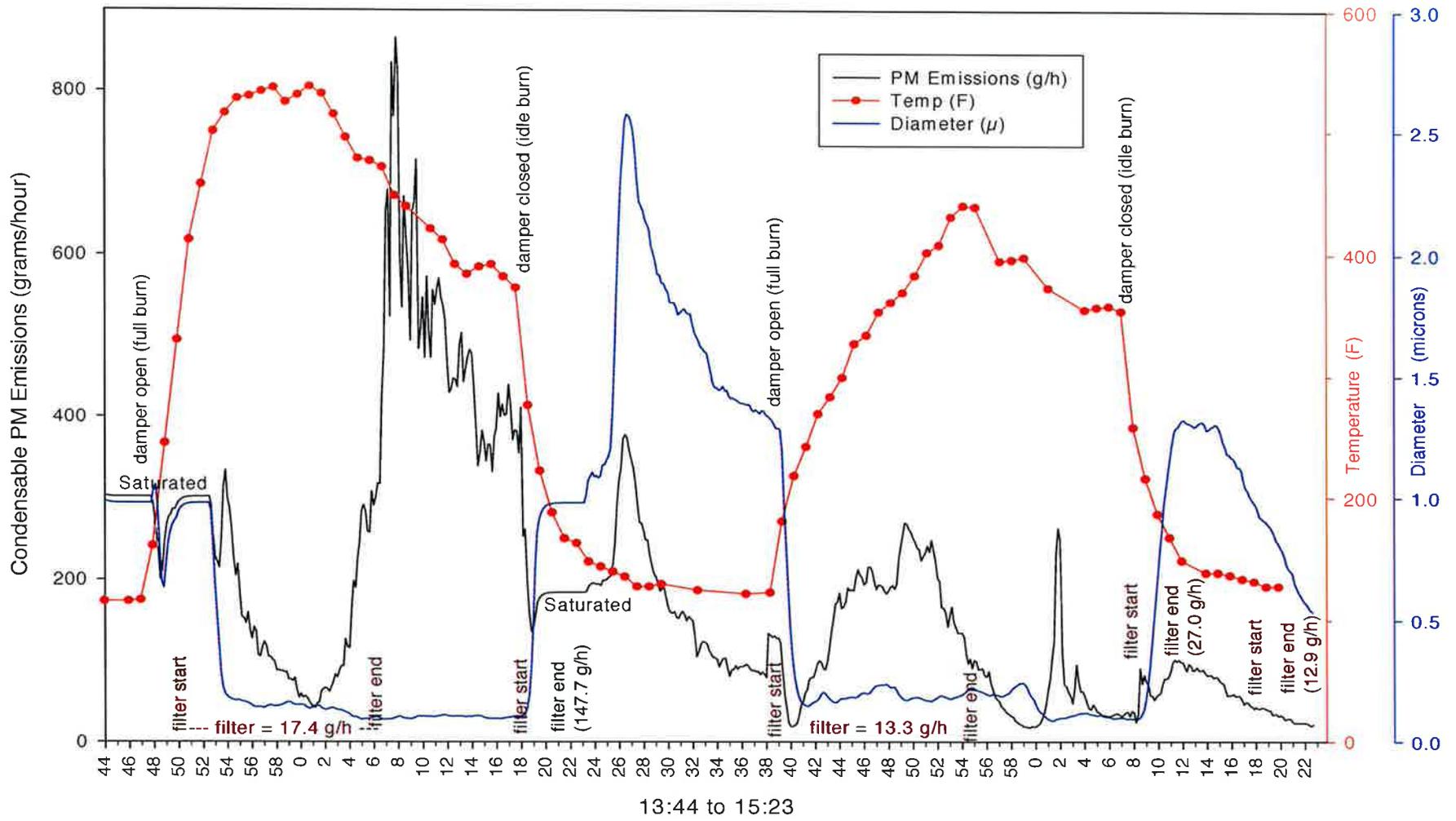


Figure 5-4e. VT Outdoor Wood Furnace Stack Sampling
 Continuous PM (Data RAM) 22-June 2005



5.4. ASTM Test Protocol

In June 2004, the ASTM sub-committee was formed to develop a standardized, replicable laboratory method to measure particulate emissions from OWBs. The goal of this process is to develop a laboratory-based test method that evaluates emissions between different OWBs and measures particulate emissions and delivered heating efficiency at a minimum of four heat output rates. This will provide accurate and reliable data on the performance of OWBs as an aid in developing cleaner technology. There are currently thirty voting members on the committee; nineteen are manufacturers, three are from OWB testing companies, two are from state environmental agencies, one is from a state attorney general's office, one is a consultant, one is a coordinator for the HPBA trade association, one is from a state economic development agency, one is from Environment Canada, and one is from EPA.⁴⁸

5.5. Conclusions on Emissions Testing

Both the ambient and stack testing conducted by NESCAUM on smaller OWBs burning appropriately seasoned hardwood showed high PM_{2.5} emissions, suggesting that people living near OWBs may be affected by unhealthy levels of PM_{2.5}. Because manufacturers are selling OWBs primarily for use in residential settings, NESCAUM believes a single PM emission limit expressed in grams per hour should be developed to reduce emissions and assure public health protections.

NESCAUM also concludes that it may be appropriate to use newer, continuous PM measurement methods to measure emissions from OWBs and other wood burning devices. In order to accurately quantify emissions for OWBs, the testing method must have the capability to provide accurate results given the likelihood of filter loading and excessive moisture content. In addition, it is critical that any robust measurement of OWB emissions be capable of measuring the condensable fraction of PM because the majority of wood smoke emissions are in the condensable fraction. Traditional "back-end" techniques (such as method 202) are not designed for wood smoke and may not efficiently capture the condensable fraction. Unlike power plant stack aerosols, wood smoke is not water soluble, and the small particle sizes generated in full fire mode are difficult to collect using inertial techniques. Therefore, the use of alternative technologies and test methods such as continuous PM measurement may be more appropriate for OWBs. Such alternatives already exist and EPA has conditionally approved them as alternatives to traditional Method 5 testing. Continuous PM monitors allow for PM measurement throughout the burn cycle rather than averaging several runs in a burn cycle. These methods would allow for accurate, continuous measurements in both low and high firing modes throughout the entire fuel charge, resulting in an accurate average emission rate for an entire burn cycle. Second, these methods overcome many

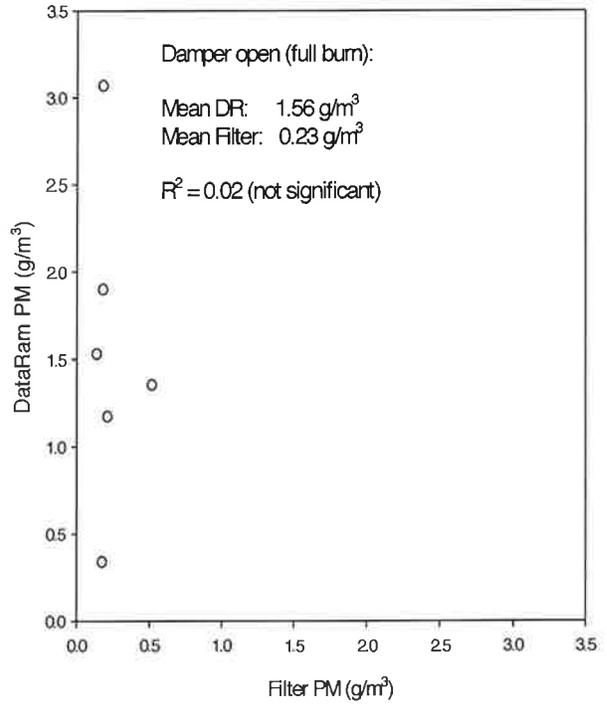
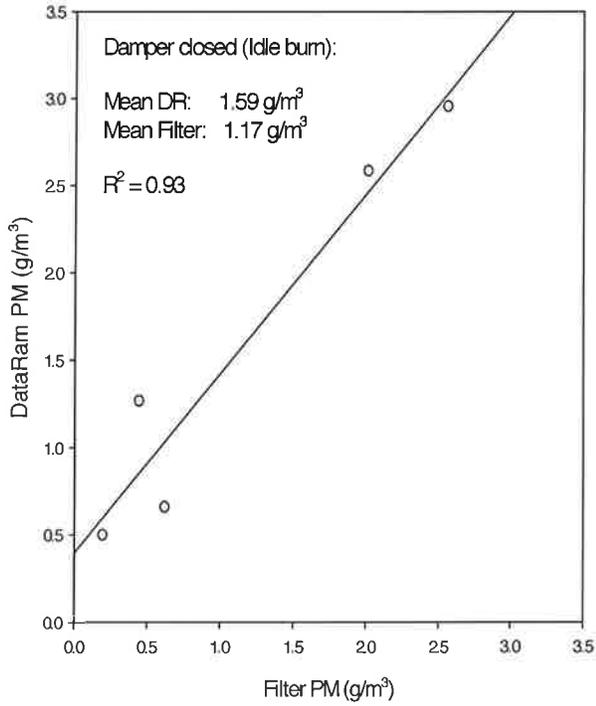
⁴⁸ Information regarding the ASTM work can be found at <http://www.astm.org/cgi-bin/SoftCart.exe/DATABASE.CART/WORKITEMS/WK5982.htm?L+mystore+klm0898>.

of the issues associated with filter-based testing including filter loading, excessive moisture content and condensable losses.

Figure 5-5. VT Outdoor Wood Furnace Stack Sampling Continuous PM (Data RAM) vs. Filter PM 21-22 June 2005

Both methods measuring most of condensables (filter T is ~120 to 180 F)

Dataram measuring most of condensables; filter is losing most (filter T is ~300 to 550 F)



6. OWB CONTROL STRATEGIES

Policy makers often face challenges in determining emission control and exposure reduction requirements with uncertain and often conflicting scientific and toxicological opinions before them. However, there is mounting evidence to support the need for action to reduce emissions from OWBs in order to maintain public health protections. The options government agencies should consider are to rely on existing regulations, adopt new requirements, or invest in voluntary initiatives. This section outlines these options and provides an overview of relevant judicial rulings and enforcement actions.

6.1. Regulatory Action

Regulatory agencies can institute one or more strategies to address emissions from OWBs. These strategies include setting emission standards for OWBs, requiring permits for OWB installation, requiring the removal of non-certified appliances, establishing no burn days, instituting and implementing nuisance rules and/or opacity rules, and developing standards for fuels. The following section provides a brief overview of the options available to regulatory agencies.

6.1.1. Ban/Removal of OWBs

One strategy would ban the sale of all new OWBs and establish a timeline for removal of all existing OWBs. This strategy would address the installation of new OWBs by placing an immediate ban on the sale of new OWBs, and would address existing OWBs by establishing a timeline to remove them. Several states and municipalities have attempted to put bans into effect but only a few municipalities have succeeded. In 2004, Connecticut considered legislation that would ban the sale of OWBs until a federal emission standard had been adopted but this legislation was defeated under strong lobbying efforts from OWB manufacturers. A similar strategy would prohibit the sale of OWBs until clean burning units come to the market. These strategies are the only avenue that would immediately address emissions from all OWBs.

6.1.2. Emission Standards

Another strategy would create a PM emission limit for OWBs and prohibit the sale or installation of any unit that did not meet the standard. There are three potential approaches to creating a standard for OWBs:

- a simple mass emission rate limit (grams/hour) regardless of an OWB's rated output or actual thermal output,
- an emission rate limit that is tied to an OWB's rated output or actual average thermal output (grams of PM/Btu/hr or mg PM/megajoule), or
- a limit on the concentration of the PM in an OWB's stack (grams/cubic meter or grains/cubic foot of exhaust gas).

Although all three of these approaches could reduce PM emissions from OWBs, only the first approach (grams/hour) specifically addresses both the regional and local aspect of OWB smoke. If the goal of a standard is in part to protect against local (50 to 1000 feet from source) high PM concentrations, then the total PM emitted from a given

stack must be controlled without regard to OWB size. The second and third approaches above would not accomplish this because they allow a unit's overall emissions to increase as the unit's output increases.

Both the second and third approaches address PM emissions from a relative efficiency perspective (PM emissions per unit heat produced). The second approach creates additional hurdles when developing and implementing a test protocol. First, it requires a clear definition on how to define Btu/hr – heat input, heat output as it leaves the OWB or heat output as it reaches the area to be heated. In addition, it will require that the testing precisely measure this additional feature. Another disadvantage to this method is that measurement would allow for dilution to minimize emissions when OWBs are tested in a laboratory setting. In addition, this method does not normalize with different fuel sources. The third approach, a grain loading standard, is similar to measurement based on heat ratings. However, a grain loading standard with a correction for carbon dioxide would ensure that the measurements in the testing are not diluted to reduce emissions. Furthermore the grain loading measurement that mandates a correction for carbon dioxide levels minimizes variability that may arise due to inconsistency in the fuel source.

The state of Washington has adopted a mass emission rate regulation that requires all solid fuel burning devices, including OWBs, to meet an emission limit of 4.5 g/hr PM for non-catalytic appliances and 2.5 g/hr for catalytic appliances. The state of Vermont has proposed a regulation based on the third approach. The proposed Vermont standard would limit OWB emissions to 0.20 grains per dry standard cubic foot of exhaust gas corrected to 12% CO₂. Calculations based on testing data estimate that the mass emission limit for smaller OWBs would approximate 22-36 g/hr PM, assuming a 50% duty cycle. Because the Vermont standard is a concentration-based standard, a residential wood boiler larger than the 250,000 Btu/hr used for these tests could have higher PM emission rates (assuming similar duty cycles). Appendix F includes copies of the Vermont and Washington regulations.

Establishing an OWB emission standard would reduce PM emissions from new OWBs and place the burden for reductions on manufacturers rather than homeowners. This option would allow the sale of clean burning OWBs while prohibiting the sale of dirty units. This strategy, however, would not address existing installations, but when combined with another strategy to address existing OWBs, it could present the best option to address OWB emissions.

6.1.3. Fuel Requirements

Another strategy would require that all wood burning devices burn seasoned wood and eliminate any state loopholes that would allow the burning of trash, yard waste or other waste materials. Several municipalities in Colorado, California, Washington, and Canada have this type of regulation. However, this strategy has several disadvantages. First, even under ideal conditions, burning seasoned cordwood, OWBs emit extremely high levels of particulate matter and air toxics. Second, enforcement of this rule would be a challenge. Finally, using wood that is too dry, such as pallets, may also cause excessive smoke and air emissions due to the increased likelihood of explosive incineration.

6.1.4. Mandatory Removal

Mandatory removal requires removal of any wood burning appliance that is not certified by a certain date and/or rendered permanently inoperable by a certain date. This strategy would reduce emissions from the older, dirtier OWBs and significantly reduce particulate emissions from these devices. However, it also would encumber the homeowner with substantial costs and require extensive enforcement.

6.1.5. No Burn Days

No Burn Days would prohibit the use of any wood burning device during episodes when the likelihood exists for high PM levels. New Mexico and municipalities in Alaska, California, Colorado, Oregon, South Dakota, Utah, and Washington have instituted a no burn day program. This strategy would address high emission events but would not address the day to day contribution of pollution from OWBs to ambient air quality. In addition, it does not address the severe local impacts that may occur. It also could be difficult to implement and enforce statewide no burn days.

6.1.6. Nuisance Rules

Nuisance rules would establish new regulations or more aggressively enforce existing regulations that limit or prohibit actions from causing or contributing to a nuisance condition. Many states have such regulations, however, using these rules to protect neighboring properties have proven difficult. Connecticut's rule calls any visible emission crossing the property line at ground level a nuisance violation. Once the agency documents a violation, it issues a notice of violation (NOV) giving the OWB owner thirty days to remedy the violation. In the past, OWB owners have attempted to burn smaller loads, use dry wood, raise the stack height of the unit and install baffles without resolution of the underlying problem. Connecticut DEP has issued several NOVs for nuisance situations where the conditions causing the nuisance were not mitigated but none has resulted in the elimination of the issue. After many attempts to modify fuel use (using seasoned wood), add-on equipment (catalysts or baffles) and limit use, enforcement programs have indicated that shutting down or limiting OWB operation are the only viable remedies for nuisance and odor issues.

6.1.7. Opacity Rules

Many states, including Massachusetts, have requirements establishing smoke opacity limits. There is mounting evidence that suggests that OWBs cannot meet current opacity standards.⁴⁹ A strategy to ensure that OWB's comply with opacity regulations could require a permit to install and/or operate an OWB and require a demonstration that the unit meets the opacity limit before it can commence operation. This strategy would ensure that only clean OWBs are installed, but the burden of proof would be placed on the homeowner rather than the manufacturer. Furthermore, testing could only commence once the OWB owner had already invested in the purchase and installation of a unit. Experiences within the NESCAUM states have shown that once a unit is installed, it is very difficult for the state to remove the unit or prohibit operation. Therefore, even with

⁴⁹ During NESCAUM's stack testing, a certified smoke reader recorded opacity readings. Appendix E includes a copy of the field report.

opacity regulations in place, states still face a high hurdle to enforce against OWBs based on opacity regulations.

The following lists are the opacity regulations for the NESCAUM states:

- Connecticut's air regulations (RCSA Section 22a-174-18) limit opacity (except for periods of startup, shutdown, and malfunction) to 20% during any six-minute block average or to 40% during any one-minute block average.
- Maine's regulations (ME DEP Chapter 101) limit visible emissions from any wood-waste or biomass unit to 30% opacity on a six-minute block average basis, except for no more than two six-minute block averages in a three-hour period.
- Massachusetts' regulations [310 CMR 7.06(1)] limit opacity to 20% for a period or aggregate period of time in excess of two minutes during any one hour, with a maximum of 40% at any time.
- New Hampshire's air regulations (Env-A 2002.02) limit average opacity from fuel-burning devices installed after May 13, 1970 to 20% for any continuous 6-minute period, except for periods of startup, shutdown, malfunction, soot blowing, grate cleaning, and cleaning of fires.
- New York's air regulations (NYCRR Section 211.3) require that no person shall cause or allow any air contamination source to emit any material having an opacity equal to or greater than 20% (six minute average) except for one continuous six minute period per hour of not more than 57% opacity.
- Rhode Island DEM's Air Pollution Control Regulation No. 1 states that no person shall emit into the atmosphere from any source any air contaminant for a period or periods aggregating more than three minutes in any one hour which is greater than or equal to 20% opacity.
- Vermont's regulation (Section 5-211) limits opacity to 20% for an aggregate period of six minutes during any one hour with a maximum of 60% opacity for any two minute average; however the Vermont regulation exempts any wood-fuel burning equipment with a rated output of less than 40 horsepower (1 boiler hp = 34,500 Btu/hr).

6.1.8. Removal Prior to Sale or Transfer of Property

Another strategy would require a certification prior to the completion of a sale or transfer of any real property on or after a certain date, that all wood burning appliances that are not certified would be required to be replaced, removed or rendered permanently inoperable. This would require an investment from the homeowner as would the mandatory removal. This strategy relies on the strength of the real estate market and the thoroughness of the home inspector. Enforcement of the program could be implemented via the building inspection process.

6.1.9. Zoning Regulations

Another strategy would establish property line setbacks for OWBs to protect neighboring properties from nuisance smoke and odors. Vermont and Connecticut both have such regulations. Connecticut's rule requires a 200 foot setback and stack heights greater than the roofline of the neighboring properties. This rule was adopted in spring 2005 and therefore there is no experience to estimate the efficacy of this rule. Vermont adopted a "zoning" type regulation in 1997 that sets minimum setbacks, stack heights, and requires that purchasers of OWBs be notified about the Vermont rule requirements. Vermont has experienced many problems with this rule and has found that it has not addressed the underlying public health, nuisance and odor conditions created by OWBs. Setbacks and stack height requirements do not address the overall emissions from OWBs. In August 2005, Vermont proposed a new regulation that would establish an OWB emission standard.

6.2. Voluntary Programs

Voluntary programs rely on the consumer to purchase cleaner burning units or the manufacturer to make cleaner units. The section below overviews two voluntary strategies.

6.2.1. Change-out Programs

This strategy eliminates the use of old, dirty burning appliances by providing incentives for the public to purchase new, clean burning equipment. This strategy addresses PM_{2.5} emissions generated by wood burning appliances and eliminates older, dirtier OWBs. Because the program is voluntary in nature, the program needs significant participation and a large amount of resources to be successful. It is likely that a change-out program will have a better chance of success if it is supported by a rule prohibiting the installation of wood-burning appliances that do not meet specified standards for low emissions.

6.2.2. Voluntary Industry Actions

Another strategy would rely on manufacturers to voluntarily commit to developing cleaner OWBs. In 2001, New York held a meeting where manufacturers stated that they had plans to redesign their OWBs. Manufacturers once again made this claim to the Connecticut legislature during their regulatory process in June 2004. In June 2005, EPA unsuccessfully asked for a meeting with manufacturers. To date none of these efforts have led to cleaner burning OWBs. Appendix A includes a copy of EPA's request and a response from one of the largest OWB manufacturers.

6.3. Court Actions

NESCAUM has identified six lawsuits in the Northeast relating to OWBs. In every case, the end result has been the removal of, or prohibition to operate, the offending OWBs. In many cases, this has been the only option for neighboring properties to find adequate resolution to the nuisances created by OWBs.

In Connecticut, five civil suits have been brought under Connecticut's General Nuisance Laws. In every case, the outcome has been in the complainant's favor. In at

least three of the Connecticut cases, the OWB manufacturer provided an attorney at no cost to the OWB owner. In only one case did the OWB owner go to trial; the other cases were settled out of court, and required confidentiality of the settlement. In all cases the OWB was either removed or prohibited from operating so long as the complainant resides in the neighborhood.

In Stamford, Vermont, a landscape company that had improperly installed an OWB filed suit against the distributor and manufacturer (Central Boiler) of the OWB. In this case, the owner placed the unit within 200 feet of a neighboring residence, in violation of the Vermont OWB regulation. The OWB owner claimed that he had not been informed about the notification and setback requirements. The unit was eventually removed, and the details are not available because the case was settled out of court.

In Grafton, Massachusetts, a resident made numerous complaints to the Massachusetts DEP about his neighbor's OWB. The smoke from the OWB was coming directly into the complainant's house causing him to have chronic bronchitis for the first time in his life. The Town of Grafton Board of Health issued a cease and desist order until the unit had been inspected and had the proper permits issued. The complainant ultimately took his neighbor to Housing Court and won. The owner of the OWB is no longer allowed to use it in the summer, had to increase the stack height, adjust the air flow, and change burning practices.

While individuals have been successful in bringing these suits under nuisance laws, it seems unreasonable to expect that all affected individuals have the financial resources and other wherewithal to pursue such actions for the vast majority of potential OWB nuisances. In addition, public health harm can arise from the collective impact of emissions from many OWBs even if no individual OWB can be identified as causing unique harm to a specific person, as may be required under nuisance law. Therefore, it may not be an option available to all members of the public nor broadly covering OWBs.

6.4. Enforcement Actions

Several states have issued Notices of Violations (NOVs) for OWBs, however, enforcement actions against residential OWBs tend to be resource intensive and difficult to resolve. The following provides an overview of the available data.

6.4.1. Connecticut

Connecticut has issued approximately fifteen NOVs; none of these have resulted in assessed penalties, OWBs removed, or consent orders. OWBs complaints continue to increase. Implementation of Connecticut's new rule requiring setback distances and stack heights has not eliminated complaints but has increased enforcement efforts and resources to address improperly installed units.

6.4.2. Massachusetts

An overview of fourteen actions taken by Massachusetts against OWBs:

- A residential property owner installed an OWB in the spring of 2005 for heat and hot water. The smoke from the unit impacted the nearest residential neighbor. The neighbor complained of smoke infiltrating the house and

resulting health issues. The complainant also alleged that the smoke in their yard was so thick that it is like fog and even filled up the garage and car. The Board of Health told the owner of the OWB to shut the unit down for the summer. Before the unit can be restarted, the owner must change the air mixture, increase the stack height, and change his wood burning practices. If these measures do not improve the excessive smoke, the unit will have to be closed down.

- Massachusetts DEP staff observed large amounts of smoke from the highway in Auburn, MA. They traced the smoke to an OWB operating at Brady Sunroom. The facility was burning glued boards in the unit for heat recovery. The facility entered into a consent order with penalty and removed the unit.
- A company in Auburn, MA uses an OWB to heat their facility. When the unit was first put in operation, the fire department received many complaints about the unit. A trailer home park is located directly behind the company. The Massachusetts DEP staff have driven by this company on numerous occasions to try to verify excess smoke from this unit. The fire department has agreed to call the DEP this upcoming heating season if the unit is still causing a problem.
- Massachusetts DEP received anonymous complaints about smoke and odors from an OWB. A daytime drive by on a cold day showed an OWB operating on a small farm but no opacity was observed. The Fire Department worries that the unit is burning large amounts of cardboard. The Fire Department will continue to monitor the OWB and wait for further complaints.
- A residential property owner installed an OWB approximately six years ago and the neighbor has been having problems with smoke from that unit since the date of installation. The unit releases a great deal of smoke that goes all over the property and into their home. The homeowners have expressed concern about the health effects, difficulty in breathing by the neighbor, the inability of their daughter to visit them due to the smoke, and their inability to use their yard. The homeowner worked with the Board of Health to try to resolve the situation but was informed that he would need to hire an attorney.
- A residential property owner installed an OWB to heat their home, pool and Jacuzzi. The large amounts of smoke from the unit were impacting the nearest neighbor who has two daughters with asthma. The smoke from the OWB was coming directly into their home and yard allegedly causing the children to have increased asthma attacks. The Board of Health required the owner of the OWB to cease using the unit during the summer.
- A residential property owner installed an OWB to heat their home and provide hot water. Residents several miles downwind were getting smoke coming into their homes in the middle of the night, thus waking them up and giving them

headaches. The neighbors traced the source of smoke and odor to the OWB. The Board of Health and the Groton Fire Department investigated the matter and have met with the owner of the OWB several times but no formal action to date has been taken.

- In summer of 2003, a resident began complaining about smoke from an OWB unit. A member of the town Board of Selectman was in the process of building a new home adjacent to the resident's house and installed an OWB. The resident claimed that the owner of the OWB was also using the unit as an incinerator to burn construction debris. The resident complained about the large amounts of smoke coming from the OWB, the inability to use his lakeside property, and the inability to feed the numerous song birds that no longer come to his house. The resident was 84 years old, and reported that he had severe health issues. The resident has many photos of the OWB smoking. Visits by the Massachusetts DEP confirmed the presence of the OWB but did not observe it operating. The Board of Health took the lead in the matter.
- One municipality received numerous residential complaints about an OWB located at a manufacturing facility. The facility purchased the OWB to burn pallets in order to reduce disposal costs and provide building heat. The Board of Health and fire department made many visits to the facility and witnessed excessive smoke from the OWB. The town eventually requested that the Massachusetts DEP provide some assistance in shutting down the unit. The DEP conducted an unannounced inspection and found the unit to be operating with excessive smoke while burning pallets. It issued a notice of noncompliance to the company, which removed the unit.
- In another municipality, residents contacted the Massachusetts DEP and the town's Board of Health regarding smoke complaints from their neighbor's residential OWB. The unit was located in a historical district and operated without any town permit. The unit smoked so much that it obscured visibility several times on Main Street. The local paper even documented and published one of these instances. The complainant's wife has had numerous respiratory problems due to the operation of the OWB. The town's historical commission had the owner remove the unit. It is currently in the owner's backyard and not hooked up. The town's Board of Health contacted the Massachusetts DEP about guidance on regulations to restrict the location and operation of OWBs. The town has held two of three public meetings on a proposed regulation.
- A residential property owner installed an OWB to heat the home and provide hot water. Five neighbors have complained to the Board of Health and fire department that the smell from the OWB forces them to keep their windows shut at all times. Even so, the odor still seems to seep through into their homes. The owner of the OWB was burning green pine in the unit. The Board of Health and fire department worked with the owner to improve the

smoke from this unit. Massachusetts DEP worked with the town in an advisory capacity.

- While visiting a facility, a Massachusetts DEP inspector observed large amounts of smoke coming out of an OWB located at a land clearing company. The company burns waste wood to heat their building. At the time of the inspection, a 2.5 diameter by 3 foot long unsplit log was being burned in the unit. The Department issued a Notice of Non-Compliance (NON) requiring the source to stop the excessive smoke. The company could not meet the requirements in the NON and agreed to cease use of the unit.
- A residential property owner installed an OWB to heat his home and provide hot water. The smoke from the unit impacted several of his neighbors. The neighbors called the Board of Health and Massachusetts DEP to complain about how the smoke was harming them (i.e., could not use yards, had to keep windows closed on beautiful days, etc.). The Board of Health required the owner of the OWB to cease using it for the summer.

6.4.3. Vermont

Vermont has taken action against one unit not related to their zoning regulation in Brandon, VT. In this instance, the Vermont Department of Environmental Conservation (VT DEC) determined that a nuisance condition existed and required the owner to not to operate the OWB during the summer months and to increase the OWB stack height.

Vermont has taken enforcement actions against dealers and owners who have violated their setback and notification regulation. These actions have led to the shutdown or removal of six OWBs. In other instances, it required the unit owner to raise the stack height of the OWB. Currently, Vermont has four pending OWB violations.

7. CONCLUSIONS/RECOMMENDATIONS

There is mounting evidence that supports the need for action to reduce emissions from OWBs. Based upon the data, NESCAUM has reached the following conclusions:

- Sales of OWBs continue to increase by 25-50 percent annually. NESCAUM estimates that there are over 155,000 OWBs nationally. Recent manufacturer statements indicate that sales in 2005 increased by 200 to 350 percent. If sales trends continue, there is the possibility that there will be almost 5,000 OWBs in Massachusetts and 500,000 OWBs nationally by 2010.
- State experience suggests that manufacturers are unlikely to voluntarily improve OWB performance.
- EPA is unlikely to develop a federal standard and even if it were to act immediately, it would take a minimum of five to seven years to enact a standard.
- EPA's focus on wood stove change-outs could result in an increase in installation rates for OWBs.
- Without aggressive public policy to limit fine particle and air toxic emissions from OWB sources, the number of potentially exposed at-risk individuals will continue to grow.
- Emissions from OWBs are 22 to 40 times greater than EPA certified indoor wood stoves.
- Near-source ambient monitoring indicates that OWB emissions have the potential to create significant public health concerns.
- Existing state regulations are inadequate to address OWBs and state environmental agencies lack the tools to effectively enforce against residential OWBs. Currently, the only viable route in some states to address OWB complaints is via state opacity requirements that are resource intensive to investigate and civil legal action, but this may not be equitable or broadly applicable.
- Complaints and enforcement actions against OWBs continue to increase, draining both state and local agency resources.

Based on these conclusions, NESCAUM recommends the following:

- Given that federal action is unlikely to take effect in the near term, states should move quickly to address OWB emissions.
- States should adopt regulations that establish emission limits for OWBs, similar to those of other residential woodburning units, because this is the best strategy for addressing the elevated emissions of fine particles (and the cancer-causing substances associated with particles) from OWBs.

- Because OWBs are most often used in residential settings and vary greatly in size, states should base an emission standard on a grams per hour basis to adequately protect public health.
- Additional studies should be conducted to assess impacts and determine acceptable exposure levels.
- EPA should support additional testing to gain a better understanding of the overall emissions profile of OWBs, specifically particulate matter and toxics.
- EPA should develop tools to assist states in addressing OWBs. Tools could include model regulations, outreach materials, SIP credit, and research data.

Appendix A: Outdoor Wood-fired Boiler Correspondence



Connecticut Bureau of Air Management, Anne Gobin, Acting
Maine Bureau of Air Quality Control, James Brooks
Massachusetts Bureau of Waste Prevention, Barbara Kwetz
New Hampshire Air Resources Division, Robert Scott
New Jersey Division of Air Quality, William O'Sullivan
New York Division of Air Resources, David Shaw
Rhode Island Office of Air Resources, Stephen Majkut
Vermont Air Pollution Control Division, Richard Valentinetti

July 29, 2004

Jeffrey R. Holmstead
Assistant Administrator for Air and Radiation
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N. W.
Washington, DC 20460

Re: Outdoor Wood Boilers

Dear Mr. Holmstead:

Over the past several years, a number of state air pollution control programs, as well as municipalities, have experienced a marked increase in the number of complaints related to Outdoor Wood Boilers (OWBs). The Northeast States for Coordinated Air Use Management (NESCAUM) believe the growing use of OWBs is a serious problem and are therefore exploring ways to take immediate action to prevent the continued proliferation of these sources until the units can be re-designed to ensure they meet stringent emissions standards. Concurrently, we would like to work with EPA because OWBs are sold nationwide and numerous states are facing similar problems with them. We believe a national regulatory approach is warranted, and we respectfully request that your office consider adopting a national strategy to regulate OWBs. Inasmuch as we have been collaborating with other states on this issue, you may receive similar correspondence from them.

With recent increases in the price of heating fuels, the use of wood for residential and commercial heating is on the rise and the number of OWBs has increased to the point that they constitute a significant compliance issue. While the nuisance smoke and odor problem associated with OWBs is well documented, limited emission testing demonstrates that OWBs are also large generators of fine particulate matter. Exposure to particles can lead to a variety of adverse respiratory and cardiac health effects, especially among people with heart or lung diseases who comprise a substantial percentage of the population. Moreover, testing for Hazardous Air Pollutants may demonstrate that OWBs pose an additional threat to human health, suggesting a need to regulate these sources under an area source MACT.

For a number of reasons, OWBs present problems not normally observed with indoor wood stoves, wood furnaces, or fireplaces. An OWB has a very short stack which emits

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smoke near the ground and allows for little dispersion. The majority of units are designed to provide long burn times and be loaded once a day, or less frequently. The large fuel capacities and automatic damper controls, typically combined with primitive combustion design, frequently result in poor combustion, heavy smoke, noxious odors, and high concentrations of fine particulate and other air pollutants associated with low temperature combustion of wood fuel. Because they are also used to provide hot water for heating swimming pools, many OWBs are operated during summer months, when windows in nearby residences are open.

Emission testing performed under the direction of the U.S. Environmental Protection Agency in 1997 found particulate emissions from two common OWBs ranged from 1.5 – 3.1 pounds/mmBTU heat input. These tests were conducted on new units operating under controlled conditions, at a fraction of rated capacity, while burning seasoned firewood. In practical application, particulate emissions are likely to be much higher. However, OWBs were exempted from compliance with the national “Standards of Performance for New Residential Wood Heaters” (40 CFR Part 60, Subpart AAA) and are currently regulated by only a few state and local governments. Therefore, we feel that it is critical that EPA take immediate action to regulate these sources.

Thank you for your consideration of this timely and important concern.

Sincerely,



Kenneth A. Colburn
Executive Director

cc: John DuPree, EPA Headquarters
Fred Weeks, EPA Region 1
Denny Dart, EPA Region 1
Gil Wood, EPA OAQPS
Vinson Hellwig, Michigan DEQ



STATE OF NEW YORK
OFFICE OF THE ATTORNEY GENERAL

ELIOT SPITZER
Attorney General

DIVISION OF PUBLIC ADVOCACY
ENVIRONMENTAL PROTECTION BUREAU

August 11, 2005

VIA OVERNIGHT MAIL

The Honorable Stephen L. Johnson
Administrator, Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Re: Petition for rulemaking under 42 U.S.C. § 7411(b)(1)
Regarding Outdoor Wood Boilers

Dear Administrator Johnson:

The States of New York, Connecticut, Maryland, Massachusetts, Michigan, New Jersey and Vermont, and the Northeast States for Coordinated Air Use Management (NESCAUM) hereby petition the U.S. Environmental Protection Agency (EPA) to use its authority under section 111(b)(1) of the Clean Air Act (the "Act"), 42 U.S.C. § 7411(b)(1), to list outdoor wood boilers (OWBs) as a category of stationary sources under section 111(b)(1)(A) and to promulgate standards of performance for OWBs under 42 U.S.C. § 7411(b)(1)(B). In the alternative, after listing OWBs as a category of stationary sources under section 111(b)(1)(A), EPA could revise the existing standards for residential wood heaters, at 40 CFR §§ 60.530-60.539b, to include standards for OWBs.

As explained in the attached report of the New York Attorney General's Office, Environmental Protection Bureau, entitled, *Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State* (the "New York Report"), OWBs are becoming increasingly common in rural and suburban towns and villages throughout much of the nation. Emissions of fine particulate matter (particulate matter with a diameter less than 2.5 microns [PM 2.5]) and toxic materials from OWBs exceed those from indoor wood stoves (called wood heaters by EPA), both on a per-device basis and in proportion to the energy created. Despite polluting at a significantly higher rate than residential wood heaters, OWBs are exempt from the standard applicable to residential wood heaters and are not required to meet any testing, performance, or emission standards.

Petition to EPA by NY, CT, MD, MA, MI, NJ, VT and NESCAUM
August 11, 2005

Notable findings of the New York Report include:

- While advertised as a clean economical way to heat one's house and water, OWBs may be among the dirtiest and least economical modes of residential heating, especially when improperly used;
- Even when used properly, OWBs emit, on an average per hour basis, about 4 times as much PM 2.5 as conventional wood stoves, about 12 times as much PM 2.5 as EPA-certified wood stoves, 1000 times more PM 2.5 than oil furnaces, and 1800 times more PM 2.5 than gas furnaces;
- When OWBs are used improperly to burn wet or treated wood, scrap, or garbage, they generate even more smoke and emit additional toxic chemicals;
- The pollutants emitted by OWBs can cause or contribute to short-term health harms such as eye, nose, throat, and lung irritation, coughing and shortness of breath, and long-term health effects such as asthma, heart and lung disease, and cancer;
- The generally short chimneys and reduced draft of OWBs fail to disperse emissions adequately and can cause smoky conditions at or near ground level;
- OWBs are generally more expensive to install than comparable heating sources using oil, or gas, or indoor wood stoves, and may be more expensive to operate depending on the availability and price of dry seasoned wood;
- OWBs do not currently have to meet federal or state performance emission standards;
- The absence of any federal regulations has led to various state and local efforts to regulate OWBs.

Since the problems associated with OWBs are widespread and exist across much of the northern U.S., it is sensible for the federal government to enact federal standards of performance, as it has with respect to indoor wood heaters, so as to avoid the development of a patchwork of state and local regulations.

Section 111(b)(1)(A) requires EPA to include in the listing of categories of stationary sources under section 111 a category that "causes, or contributes significantly to, air pollution which may reasonably be anticipated to endanger public health and welfare." The findings in the New York Report establish that OWBs should be listed. Accordingly, the EPA should promulgate regulations for OWBs under section 111(b)(1)(B), establishing standards of performance that reflect the degree of emission limitation achievable through the best system of emission reduction that has been adequately demonstrated. 42 U.S.C. § 7411(a)(1). Consistent with the general framework of the Act, such federal regulations should serve as a "floor," allowing states or municipalities to enact more stringent regulations as necessary to combat particularized local air quality problems.

Petition to EPA by NY, CT, MD, MA, MI, NJ, VT and NESCAUM
August 11, 2005

The time has come for EPA to regulate emissions from OWBs in order to protect public health and the environment. Therefore, please consider this letter to be a formal request pursuant to the Administrative Procedure Act, 5 U.S.C. § 553(e), for a rulemaking to list OWBs as a category of stationary sources and to establish standards for emissions from new OWBs.

Sincerely,

A handwritten signature in black ink, appearing to read 'Eliot Spitzer', with a stylized flourish at the end.

ELIOT SPITZER
Attorney General
State of New York

On behalf of:

RICHARD BLUMENTHAL
Attorney General
State of Connecticut

THOMAS F. REILLY
Attorney General
Commonwealth of Massachusetts

STEVEN E. CHESTER
Director
Michigan Department of Environmental Quality

JOHN J. FARMER, JR.
Attorney General
State of New Jersey

WILLIAM H. SORRELL
Attorney General
State of Vermont

ARTHUR N. MARIN
Executive Director
Northeast States for Coordinated Air Use
Management (NESCAUM)

New York State Department of Environmental Conservation

Division of Air Resources

Bureau of Stationary Sources, 2nd Floor

625 Broadway, Albany, New York 12233-3254

Phone: (518) 402-8403 • FAX: (518) 402-9035

Website: www.dec.state.ny.us



May 14, 2003

Mr. Dennis T. Brazier
Central Boiler, Inc.
20502 160th Street
Greenbush, MN 56726

Dear Mr. Brazier:

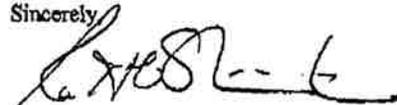
The New York State Department of Environmental Conservation (Department) is responsible for responding to air pollution complaints in New York State and for ensuring compliance with New York State air pollution laws and regulations. As such, this letter is to notify you that the Department has received an increasing amount of complaints arising out of the operation of wood fired outdoor furnaces, and to provide you with information regarding the manner in which New York State air pollution regulations apply to your customers' use of these products.

New York State Regulation, at 6 NYCRR Part 211.2, prohibits any person (defined as an individual, corporation, partnership, association, or other legal entity) from causing or allowing emissions of air contaminants that unreasonably interfere with the comfortable enjoyment of life or property. The complaints the Department has received reflect that the quantity and nature of smoke emissions that result from the operation of outdoor wood furnaces have violated this provision, by interfering with the enjoyment of neighboring properties and surrounding areas. In addition, 6 NYCRR Part 227-1.3(a) limits opacity from stationary combustion installations to not greater than 20 percent (six minute average) except for one six minute average per hour not to exceed 27 percent. The Department has documented the violation of this standard in responding to complaints in several cases, and will continue to assess compliance with this standard when addressing other nuisance complaints arising out of emissions from outdoor furnaces. You should also be aware that if any material other than clean wood or fossil fuels is burned in the stove, then the device is considered an illegally operating incinerator.

The Department has sought and will continue to seek to prevent the operation of any wood fired outdoor furnaces that violate New York State air pollution control laws and regulations. In cases to date where the Department has issued tickets or notices of violation, the furnace owner/operator has been cited for noncompliance with the law. The Department is concerned, however, that these products are not designed or manufactured in a manner necessary to operate them in compliance with New York State regulations. As such, the Department is exploring whether the sale and use of wood fired outdoor furnaces in New York also violates New York State air pollution control laws and regulations.

In the interim, and in the interest of reaching an amicable resolution to the potential for nuisance caused by wood fired outdoor furnaces, the Department would like to meet with you and other manufacturers to evaluate your ability to manufacture and sell outdoor furnace products that comply with the above laws. We are also interested in discussing technical solutions to the problem that exists with the operation of devices that have already been sold in this State. Please contact our Director's office at 518-402-8452 at your earliest convenience, to schedule a meeting with Department staff. Thank you for your anticipated cooperation.

Sincerely,

A handwritten signature in black ink, appearing to read "R. Sliwinski", written over a horizontal line.

Robert G. Sliwinski
Acting Director
Bureau of Stationary Sources
Division of Air Resources



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

JUN 10 2005

Mr. Dennis T. Brazier, President
Central Boiler Company
20502 160th Street
Greenbush, MN 56726

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

Dear Mr. Brazier:

The purpose of this letter is to invite you to discuss air pollution concerns resulting from outdoor wood-fired hydronic heaters (OWHH) used to provide heat for residences and businesses. My office has received several inquiries from the public, State and local environmental protection agencies, and elected officials regarding the health and environmental impacts of OWHH. Many of these stakeholders are urging the Environmental Protection Agency (EPA) to take actions to limit the emissions from these units.

EPA is not at this time considering any specific regulatory actions. Instead, we want to work cooperatively with your sector of the wood heating industry to develop cleaner burning products. I am very interested in learning more about specific short- and long-term actions you may be considering to address the concerns raised by the general public and others. Members of my staff have advised me of efforts by your industry to characterize the emissions of air pollutants from OWHH through the American Society for Testing and Materials. I am encouraged to know that consensus standards may eventually evolve from this work. In addition, I am interested in characterizations of emissions from your company's products, and any plans you may have to build and sell OWHH with emissions lower than those exhibited by currently available models.

I have asked Scott Mathias of my staff to follow up with you to discuss the issues above and any others you might wish to raise.

Thank you in advance for considering the concerns raised in this letter. I look forward to hearing from you or your representative as we address this important matter.

Sincerely,

A handwritten signature in black ink that reads "Stephen D. Page".

Stephen D. Page
Director
Office of Air Quality Planning
and Standards

OAQPS/ITPID/PIRG/DPainter:cja:919-541-5515:RTP:MC-E143-02
CONTROL No. OAR-05-000-6598

Identical Letters were sent to the Following:

Mr. Frank Moore, President
Hardy Manufacturing Co., Inc.
12345 Road #505
Philadelphia, MS 39350

Mr. Ron Taylor
Taylor Manufacturing Company
P.O. Box 518
Elizabethtown, NC 28337

Mr. John Kehrwald, General Mgr.
Heatmor Inc.
105 Industrial Park Court, NE
P. O. Box 787
Warroad, MN 56763

Mr. David Laursen, Pres.
Aqua-Therm
48301 State Highway 55
Brroten, MN 56316

Ms. Robin E. Weaver, Pres.
Mahoning Outdoor Furnaces, Inc.
208 Whiskey Run Road
Mahaffey, PA 15757

Mr. Trevor Guentor, President
Pro-Fab Industries Inc
Box 112
Arborg, Manitoba R0C 0A0
Canada

Mr. Chuck Gagner
Northwest Manufacturing
600 Polk Avenue, SW
Red Lake Falls, MN 56750 -0124

Mr. Martin Lunde
Dectra Corporation
3425 33rd Avenue, NE
St. Anthony, MN 55418



United States Environmental Protection Agency
Research Triangle Park, North Carolina 27711
Office of Quality Planning and Standards
Stephen Page, Director

June 27, 2005

Dear Mr. Page:

We are in receipt of your letter of invite concerning outdoor wood-fired hydroic heaters, (OWHH). Central Boiler looks forward to addressing these concerns.

It is our understanding that the inquiries you have received from the state and local agencies are a result of their need to address nuisance complaint issues. We have worked with several state and local agencies concerning the OWHH and have found that all complaints have been a result of nuisance issues caused by improperly installed and/or operated OWHH. Complaints from new installations have been dramatically reduced as a result of proper training of dealers and end users of correct installation and operation.

Currently, test methodology is not well established or internationally recognized to accurately characterize emissions or efficiency for OWHH.

We have current projects and initial testing showing potential for a cleaner more efficient OWHH. Upon completion of an internationally recognized (ASTM) standard, Central Boiler will be able to allocate sufficient resources to bring a cleaner furnace to production levels for distribution to the consumer with confidence that there will be a measurable difference for the environment.

We look forward to EPA's assistance in working with the ASTM committee to proficiently develop and complete the OWHH ASTM standard so new products can be tested and proven to be better for the environment.

Please contact us if you have any questions or feel that we may be of any assistance to you.

Sincerely,

Rodney Tollefson

Vice President

Central Boiler, Inc.

218-782-2575

rodney@centralboiler.com



COPY

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
TTY 711 or 800-833-6388 (For the Speech or Hearing Impaired)

May 12, 2005

Central Boiler, Inc.
20502 160th Street
Greenbush, MN 56726

Dear Wood Furnace Manufacturer/Distributor:

The purpose of this letter is to clarify Washington State's solid fuel burning device regulations, as they pertain to the sale of wood furnaces, and point out the differences between Washington's requirements and federal EPA requirements.

Effective January 1, 1995, Washington regulations required that all solid fuel burning devices offered for sale in Washington meet Emission Performance Standards described in Washington Administrative Code 173-433-100 (3). These standards limit particulate matter emissions to:

- two and one-half grams per hour for catalytic woodstoves, and
- four and one-half grams per hour for all other solid fuel burning devices.

A solid fuel burning device is any device that burns wood, coal, or any other non-gaseous or non-liquid solid fuels for aesthetic or space-heating purposes in a private residence or commercial establishment, which has a heat input less than one million British thermal units (Btu) per hour. Therefore, by state definition, a wood furnace is a solid fuel burning device, and therefore must meet the particulate matter emission standard of four and one-half grams per hour before it may be offered for sale in Washington.

The Washington state standards differ from EPA New Source Performance Standards (NSPS) for Wood Heaters in the following ways:

- Washington's particulate emission limits are more stringent than those specified in the federal NSPS, and
- Washington's particulate emission limits apply to all solid fuel burning devices, including wood furnaces.

While EPA regulations still exempt certain devices from testing and/or certification requirements, Washington regulations require that all devices be tested and certified to comply with the more stringent Washington particulate emission limits.



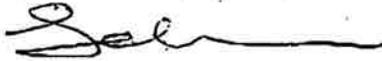
Therefore, wood furnaces with heat inputs of less than one million Btu may not be sold anywhere within the state of Washington unless the Department of Ecology has determined that the furnace meets state emission standards. Any retailer, wholesaler or distributor offering for sale or selling a non-compliant device may be subject to formal enforcement action.

Wood furnaces with heat inputs of one million Btu per hour or more, while not subject to solid fuel burning device standards, upon operation, must not exceed the visible emission standard of 20% opacity for more than three minutes in any one hour, contained in WAC 173-400-040(1). In addition, some local air authorities may require a demonstration that the units meet specific grain loading standards, as measured by EPA method 5 test in Appendix A to 40 CFR Part 60.

Complete text of the Washington state solid fuel burning device rule can be found at <http://www.ecy.wa.gov/pubs/wac173433.pdf>.

If you have any questions, please call Tom Todd at (360) 407-7528.

Sincerely,



Sarah Roes
Program Development Section Manager
Air Quality Program



June 8, 2005

Sarah Rees
Program Development Section Manager
Air Quality Program
Department of Ecology
State of Washington
PO Box 47600
Olympia, WA 98504-7600

Dear Ms. Rees:

We are in receipt of your letter, dated May 12, 2005, stating that outdoor furnaces cannot be sold in the state of Washington. We have communicated in the past and provided information to the Washington Department of Ecology (DOE) that showed the emission levels of Central Boiler outdoor wood furnaces comply with Washington emission standards and should be approved for sale in the State of Washington.

Central Boiler is well aware, as is the DOE, there is no test standard or protocol for testing outdoor wood furnaces. Your letter refers to an emission standard determined by the DOE as being more stringent than those contained in the EPA New Source Performance Standard (NSPS).

To quote: Washington Administrative Code 173-433-100 (3), [WAC 173-433-030 Definitions. (2) "Certified" means that a woodstove meets emission performance standards when tested by an accredited independent laboratory and labeled according to procedures specified by the EPA in "40 CFR 60 Subpart AAA - Standards of Performance for Residential Wood Heaters" as amended through July 1, 1990.] A "wood stove" is very specifically defined by size, burn rate, weight, etc. in the NSPS. The USEPA does not allow appliances that fall outside of the definition of "wood stoves" to be certified to the NSPS. Attempts to test other solid fuel burning devices to this standard would not provide meaningful emission data that could be used for rating such devices.

You are suggesting a 4.5 g/h level that must be met by an appliance that does not have a standard (testing protocol) that allows the furnace to be tested and rated. As we are aware, the NSPS certification process consists of four test burns. The EPA certification rating that is determined by this testing process is a weighted average of those four test burns. The certification rating (hang-tag) is not equivalent to the emissions level produced when the wood stove is being operated.

20502 160th Street, Greenbush, MN 56726

Central Boiler

www.centralboiler.com

Phone: 218-782-2575 Fax: 218-782-2580

The 4.5 g/h WAC "emission number" is merely a number without a standard (test protocol). The appliances that fall outside of the definition of "wood stoves" can easily meet a 4.5 g/h emission level by operating within parameters that would generate such emission levels. Without test protocol that determines burn rates, fuel crib and other crucial criteria, a 4.5 number is meaningless.

We have previously provided information to Mr. Tapas K. Das P.E., Quality Air Program of the Washington Department of Ecology on July 18, 2003. We are also aware of communications between Spokane County and the State of Washington concerning emissions data provided by Central Boiler. Neither office could determine that Central Boiler outdoor wood furnaces do not meet a 4.5 g/h emission level. Central Boiler believes the data provided illustrates Central Boiler outdoor wood burning furnaces do comply with the 4.5 g/h Washington Emission Performance "Standard", WAC Code 173-433.

Central Boiler understands by state and federal laws when a regulation does not provide criteria to determine compliance or noncompliance such a regulation is not enforceable. Central Boiler has requested, from the DOE, the criteria needed to determine compliance and the DOE has not provided an established test standard or a statistically reliable conversion factor.

Sincerely,



Rodney Tollefson
Vice President

Cc: John Adrian - CB Sales, LLC

Appendix B: Outdoor Wood-fired Boiler Manufacturers

Alternate Heating Systems, Inc
2395 Little Egypt Road
Harrisonville, PA 17228
<http://www.alternateheatingsystems.com/>

Aqua-Therm LLC
48301 State Hwy 55
Brooten, MN 56316
www.aqua-therm.com

Alpha American
10 Industrial Blvd
Palisade, MN 56469
<http://www.yukon-eagle.com>

Central Boiler, Inc.
20502 160th Street
Greenbush, MN 56726
www.centralboiler.com

Charmaster Products, Inc.
2307 Highway 2 West
Grand Rapids, MN 55744
www.charmaster.com

Dectra Corporation
3425 33rd Ave NE
St Anthony, MN 55418
www.dectra.net/garn

Freedom Outdoor Furnace
7958 Curwensville Tyrone Hwy
Olanta, PA 16863
www.freedomoutdoorfurnace.com

Global Hydronics
Box 717
Winkler, Manitoba, CANADA R6W 4A1
www.globalhydronics.com

Hardy Manufacturing
12345 Road 505
Philadelphia, MS 39350
www.hardyheater.com

Heatmor Inc.
105 Industrial Park Court NE
Warroad, MN 56763
www.heatmor.com

Heat Innovations
499 Manitoba Road
PO Box 989
Winkler, Manitoba, R6W 4B1
CANADA

Heatsource 1
2201 Ridgeview Drive
Beatrice, NE 68310
www.heatsource1.com

Hicks Waterstoves and Solar Systems
2541 South Main Street
Mount Airy, NC 27030

Horstmann Industries, Inc.
301 Second Street
Elroy, WI 53929
www.royalfurnace.com

Innotech Developments
2015 James Street South
Thunder Bay, Ontario P7J1G6
CANADA
www.outdoorfurnaces.com

Johnson Manufacturing
PO Box 345, 8187 State Rte 12
Barneveld, NY 13304
www.hud-son.com/woodfurnaces.htm

Mahoning Outdoor Furnace
RD #1 Box 250
Mahaffey, PA 15754
www.shol.com/mahoning

Taylor Manufacturing, Inc.
1585 US HWY 701 South
Elizabethtown, NC 28337
www.taylormfg.com

Noonan's Welding and Heating
105 1st Street South
Keewatin, MN 55753
www.northlandoutdoorwoodfurnace.com

Timber Ridge, Inc.
2020 Highway 11-E
Jonesborough, TN 37659
www.freeheatmachine.com

Northwest Manufacturing
600 Polk Ave SW
Red Lake Falls, MN 56750
www.woodmaster.com

Turbo Burn, Inc.
4225 E Joseph
Spokane, WA 99217
www.turboburn.net

Outside Heating Systems – Wood Doctor
Box 567
Stewiacke, Nova Scotia B0N2J0
CANADA
www.wooddoctorfurnace.com

Pacific Western
Box 267
Atikokan, Ontario P0T 1C0 CANADA

Pro-Fab Industries Inc./Empyre/Cozeburn
Box 112
Arborg, Manitoba R0C 0A0 CANADA
<http://www.burnsbest.com> or
www.profab.org

SFC Industries
2219 County Highway G
Rhineland, WI 54501

TARM USA, Inc.
Main Street Box 285
Lyme, NH 03768
www.woodboilers.com

Appendix C: Estimated National Sales of OWBs

State	Estimated number of OWBs sold since 1990
Alabama	74
Alaska	185
Arizona	24
Arkansas	574
California	182
Colorado	271
Connecticut	1,538
Delaware	77
District of Columbia	13
Florida	32
Georgia	50
Hawaii	0
Idaho	401
Illinois	4,798
Indiana	7,518
Iowa	2,762
Kansas	515
Kentucky	1,148
Louisiana	3
Maine	1,968
Maryland	872
Massachusetts	1,308
Michigan	29,568
Minnesota	13,936
Mississippi	0
Missouri	4041
Montana	350
Nebraska	190
Nevada	1
New Hampshire	1,981
New Jersey	215
New Mexico	12
New York	13,182
North Carolina	2,561
North Dakota	87
Ohio	13,605
Oklahoma	76
Oregon	555
Pennsylvania	11,836
Rhode Island	206
South Carolina	124
South Dakota	40
Tennessee	573
Texas	16
Utah	38
Vermont	2,033
Virginia	4,658
Washington	393
West Virginia	3,725
Wisconsin	27,452
Wyoming	66
US Total	155,834

Appendix D: Michigan DEQ Modeling

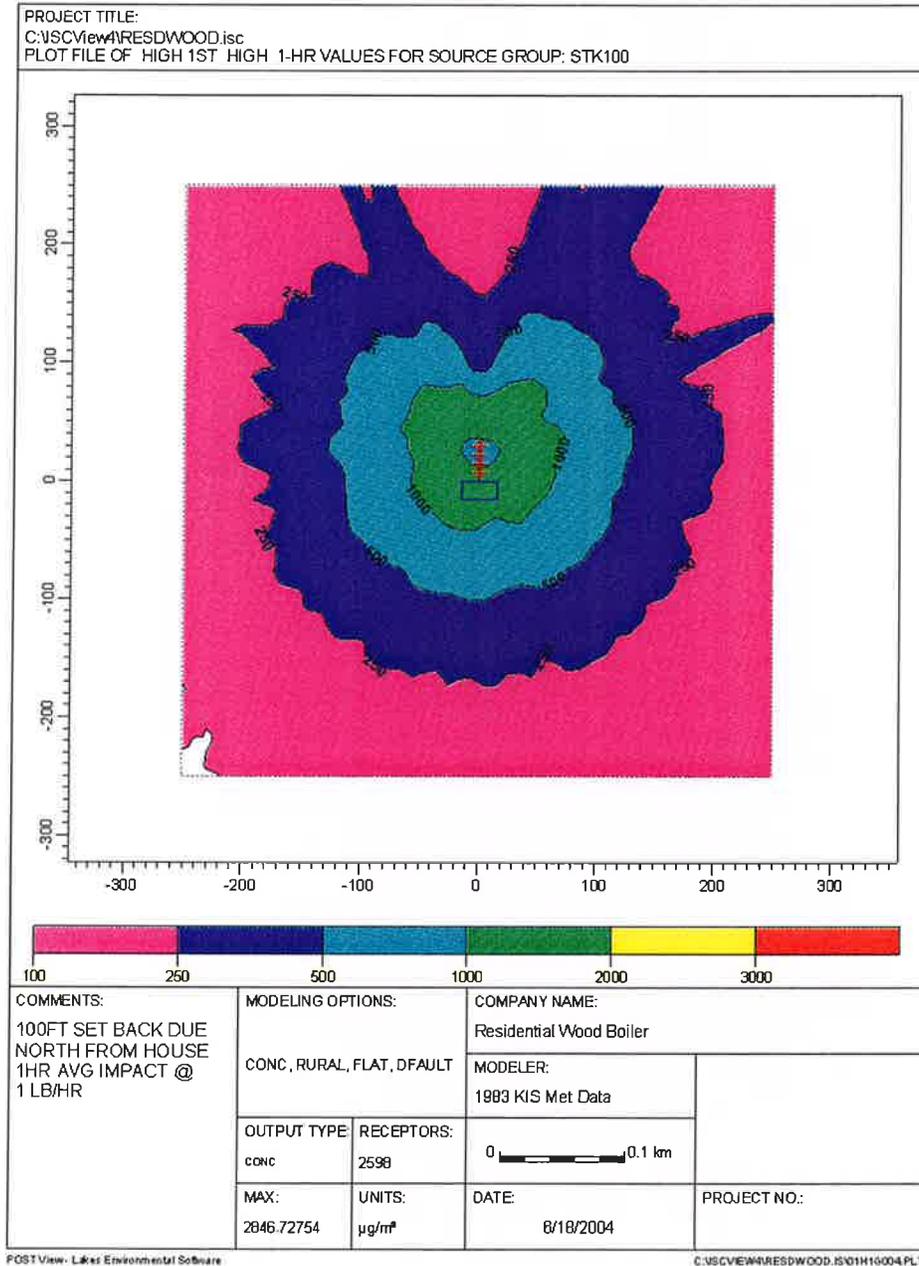
Residential Wood Boiler Study

MAXIMUM PREDICTED 1-HR AVG CONCENTRATIONS

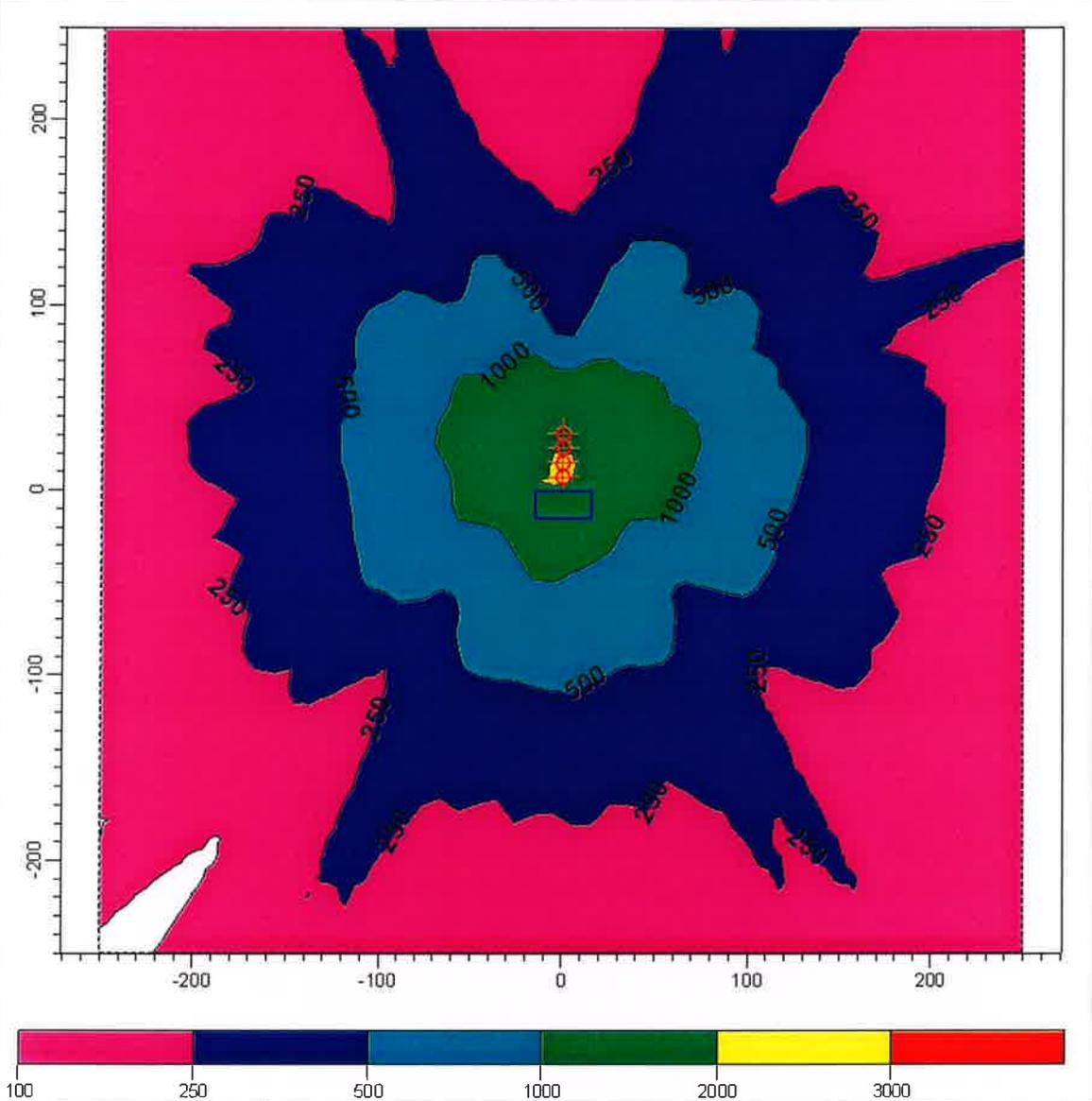
Four contour plots of the max 1-hr concentration at an emission rate of 1lb/hr. Since its 1 stack, the impacts can be scaled (linear relationship) to a different emission rate. Modeling is based on the following:

stack height = 8'
 temperature = 250F
 vel=1.5 m/s
 diameter = 6"
 50' x 100' bldg 22' high

Ran 25', 50', 75', and 100' set back distances from the bldg due north using 1983 KIS met data.

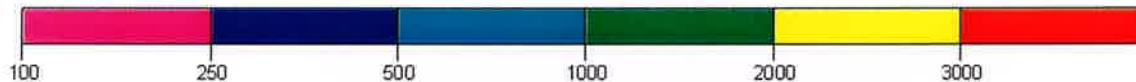
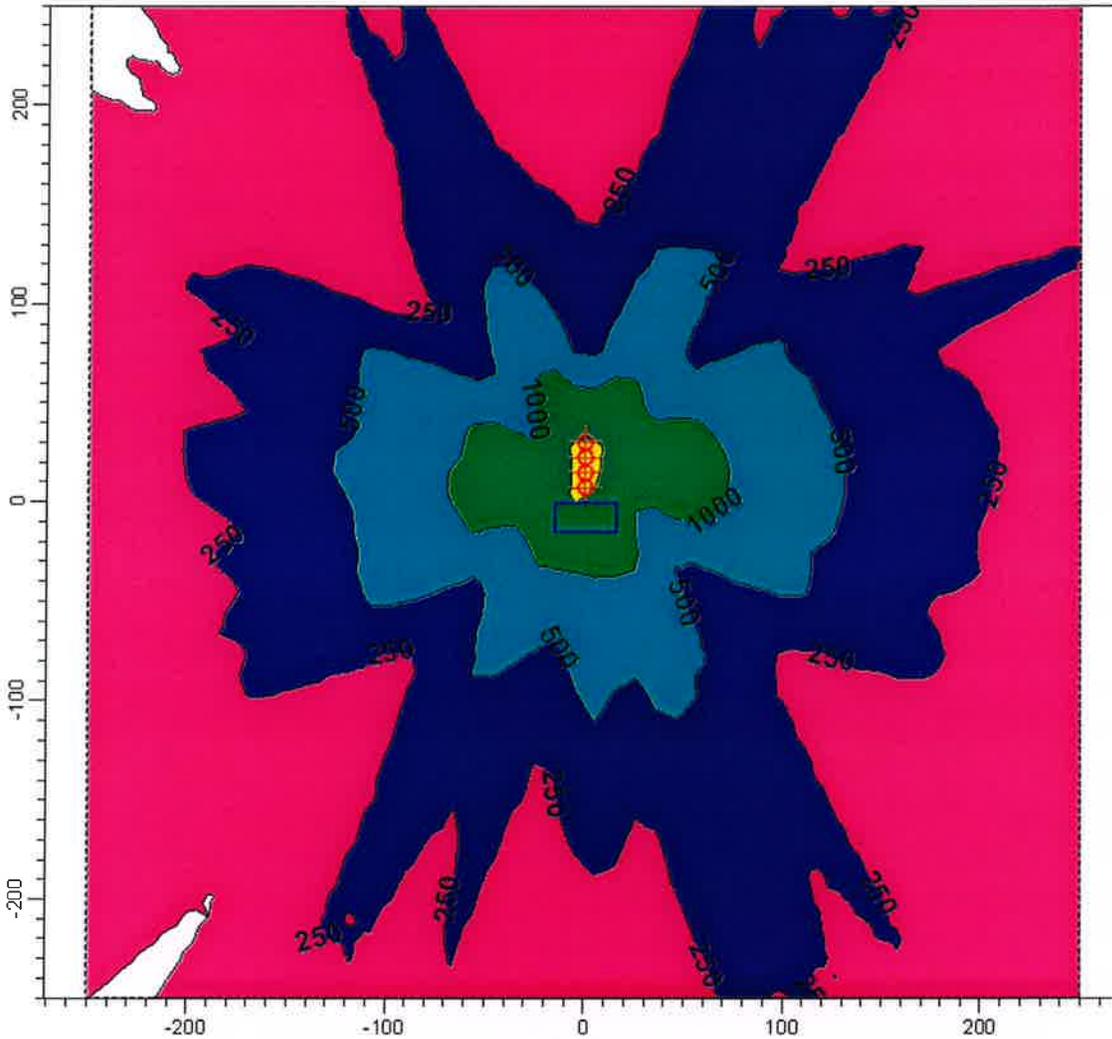


PROJECT TITLE:
 C:\ISCVIEW4\RESWOOD.isc
 PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: STK75



COMMENTS: 75FT SET BACK DUE NORTH FROM HOUSE 1HR AVG IMPACT @ 1 LB/HR	MODELING OPTIONS:		COMPANY NAME:	
	CONC, RURAL, FLAT, DFAULT		Residential Wood Boiler	
	OUTPUT TYPE:	RECEPTORS:	MODELER:	
	CONC	2598	1983 KIS Met Data	
MAX:	UNITS:	DATE:	PROJECT NO.:	
4361.85889	$\mu\text{g}/\text{m}^3$	6/18/2004		

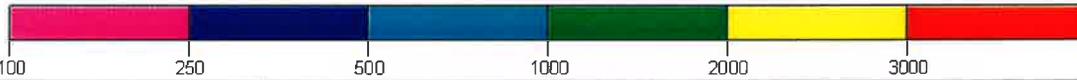
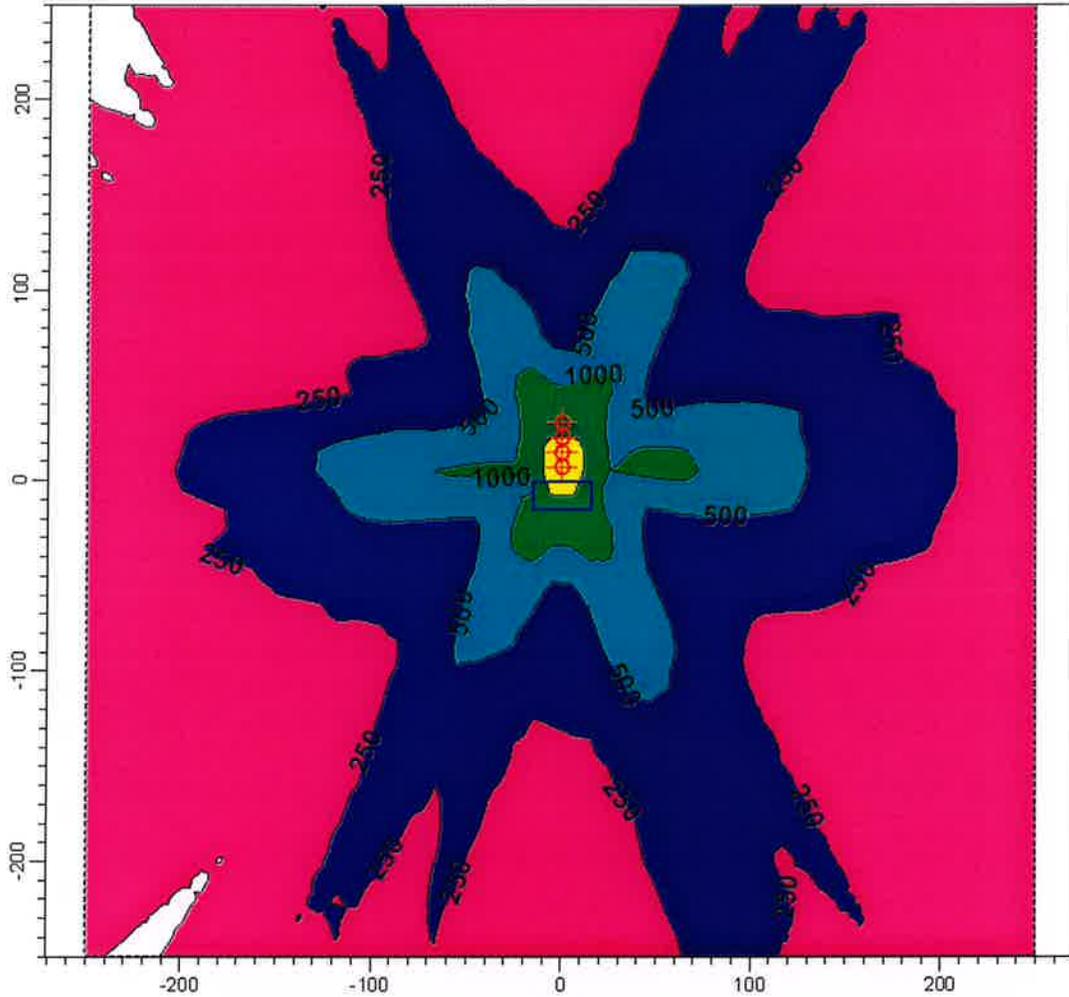
PROJECT TITLE:
 C:\ISCView4\RESWOOD.isc
 PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: STK50



COMMENTS: 50 FT SET BACK DUE NORTH FROM HOUSE 1HR AVG IMPACT @ 1LB/HR	MODELING OPTIONS:		COMPANY NAME:	
	CONC, RURAL, FLAT, DFAULT		Residential Wood Boiler	
	OUTPUT TYPE:	RECEPTORS:	MODELER:	
	CONC	2598	1983 KIS Met Data	
MAX:	UNITS:	DATE:		PROJECT NO.:
4306.479	$\mu\text{g}/\text{m}^3$	6/18/2004		



PROJECT TITLE:
 C:\ISCView4\RESWOOD.isc
 PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: STK25



COMMENTS:
 25 FT SET BACK DUE
 NORTH OF HOUSE
 1-HR AVG IMPACT @
 1 LB/HR

MODELING OPTIONS:
 CONC, RURAL, FLAT, DFAULT

COMPANY NAME:
 Residential Wood Boiler

MODELER:
 1983 KIS Met Data

OUTPUT TYPE: CONC
 RECEPTORS: 2598



MAX: 6761.25586
 UNITS: $\mu\text{g}/\text{m}^3$

DATE:
 6/18/2004

PROJECT NO.:

Appendix E: Field Report on Moisture Readings and Opacity

Vermont Department of Environmental Conservation
Air Pollution Control Division



AIR POLLUTION TRIP REPORT

PROPERTY: Confidential **DATES OF SITE VISIT:** June 21 & 22, 2005

PURPOSE OF VISIT: To observe/assist with testing of an outdoor wood boiler.

LOCATION OF SITE: Vermont

PEOPLE PRESENT: Lisa Rector, NESCAUM
George Allen, NESCAUM
John Jasko, Air Quality Technical Services
Chris Jones, Vermont DEC (6/21/05)
Philip Etter, Vermont DEC

WEATHER: Temperature: Highs generally 80s°F
Wind: 0-15 mph, Direction variable
Cloud Cover: Clear to Partly Cloudy
Precipitation: None

INVESTIGATOR: Philip L. Etter, Environmental Analyst

We attended the emissions testing of an outdoor wood boiler (OWB) to assist with the testing and observe the operation of the OWB unit. While on site I made some measurements of the moisture content of the wood fuel being used during the test using a Delmhorst moisture meter and conducted some visible emissions observations for general informational purposes. I also took numerous digital photos during the testing on 6/22/05.

Wood Moisture Measurements

All wood moisture measurements were done on 6/22/05. The wood supply consisted of mixed hardwoods but mainly maple and red oak in two to three foot lengths. Most of the wood had been split, but some of the wood was in the round. The wood was uncovered and stacked in a semi sunny location. I checked the moisture content of three pieces of maple and two of red oak. One of the maple pieces was round but all the others had been split. I tried to choose pieces of larger size from various places in the small pile that had been designated as the fuel for the test. Using wedges and a sledge hammer, I

split each piece roughly in the center just before taking measurements. I then took three measurements on the inside split surface, one in the center and one on either side of center roughly halfway from the center to the ends of the piece. The upper moisture content limit of the meter is 40%. Moisture readings above this limit were recorded as greater than 40%, but were treated as 40% when calculating averages. Readings are documented in the following table.

PERCENT MOISTURE IN WOOD FUEL					
Species	Rough Size (inches)	Reading 1 %	Reading 2 %	Reading 3 %	Average %M
Maple	5" split	26.8	29.3	24.3	26.8
Maple	5" round	28.5	28.5	25.6	27.5
Maple	7" x 4" split	30.5	27.7	32.6	30.3
Red Oak	5" split	>40	37.5	>40	>39.2
Red Oak	8" x 3" split	>40	>40	>40	>40

Note that the moisture content measurements were done for general information only. No attempt was made to weigh the fuel charged to the unit or to count the chunks of various species of wood being charged. Some of the wood charged on the second day was taken from another part of the pile that had been recently rained on. Overall, the moisture content appeared to be fairly high. Oak generally takes longer to dry than many other hardwood species but the history of particular pieces of wood is unknown so it may be that the oak was cut later than the maple.

Visible Emissions

In an attempt to determine how the visible emissions vary over time and the burn mode cycling of the OWB, I evaluated visible emissions for 24 minutes on 6/21/05 and for nearly two hours on 6/22/05 (see attached VE evaluation forms). These observations were purely informational. Currently, OWBs are exempt from Vermont's visible emissions standards due to their small size. The green foliage of the woods behind the OWB provided a good contrasting background for the light colored smoke. The sun was always well within appropriate angles for Method 9 observations. I ceased making observations on 6/22/05 at about 1140 hours as the sun's vertical angle was becoming potentially inappropriate. During midday hours in late June, the vertical angle of the sun is inappropriate for observations in most situations. Observations were made difficult by the highly variable wind speed and direction, the plume often down washing, looping or blowing away from the observer making proper readings impossible.

The nature of the plumes also made VE evaluation more difficult. Much of the time, especially during the open damper mode, the plume appeared to be largely condensed organics; with the densest part of the plume a few to several feet beyond the top of the stack. On 6/21 I tended to read the plume a couple feet above the stack before the densest smoke formed. On 6/22/05 I was reading the opacity in the densest part of the plume, a few to several feet above the stack. I did not notice any indications of a

condensed water vapor component in the plume although I can't rule-out with absolute certainty that some moisture condensation was occurring. Meteorological conditions would have caused any condensed water vapor in the plume to rapidly dissipate leaving a less dense trailing particulate plume. This was not apparent during the test burns as the dense plumes carried for a considerable distance, gradually dispersing.

I also found evaluating the opacity during the idle mode to be difficult due to the very low gas flows emanating from the stack. Often the plume seemed to narrow beyond the top of the stack perhaps causing the plume to appear denser than if it were spread over the full width of the stack. The idle mode plumes appeared to be fully condensed as they exited the stack, which isn't surprising given the very low stack gas temperatures recorded during the idle mode.

The observations on the morning of 6/22/05 represent the worst case, as they were made during the beginning of the burn cycle. The OWB was loaded before the beginning of the test in the morning but not later. Although I didn't conduct formal observations later in the day during the charcoal stage of the burn cycle, informal observations indicated that visible emissions were greatly reduced with opacities more in the 40-50% range during the charcoal stage operating modes rather than the 90-100% opacities near the beginning of the burn cycle. The observations done on 6/21/05 were later in the day but I am uncertain how long it had been since the OWB was charged.

Summary

These visible emissions observations indicate that the smoke from this OWB was densest during the first hours of the burn cycle and less dense during the latter charcoal phase burning. The opacities and total volume of visible smoke (i.e. the overall size or volume of the plumes) were also heaviest following the opening of the damper. Opacities and total smoke volume were much reduced during the idle mode and were greatly reduced as the duration of the idle mode increased probably due to the cooling of the fire greatly reducing combustion gas production. Opacities also seemed to decrease somewhat as the stack temperatures increased with the length of the open damper operating mode.

VISIBLE EMISSIONS EVALUATION FORM

VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION AIR POLLUTION CONTROL DIVISION 103 SOUTH MAIN STREET WATERBURY, VERMONT				OBSERVATION DATE 6/21/05		START TIME 1531		STOP TIME 1555										
				SEC MIN	0	15	30	45	SEC MIN	0	15	30	45					
SOURCE NAME OWB				1	0	0	0	0	31									
ADDRESS				2	0	0	0	0	32									
CITY	STATE VT	ZIP		3	0	0	0	10	33									
PHONE		SOURCE ID NUMBER		4	10	20	25	30	34									
PROCESS EQUIPMENT Outdoor Wood boiler		OPERATING MODE		5	35	40	40	35	35									
CONTROL EQUIPMENT None		OPERATING MODE		6	35	40	40	45	36									
DESCRIBE EMISSION POINT Metal Stack				7	40	40	45	45	37									
HEIGHT ABOVE GROUND LEVEL ~9'		HEIGHT RELATIVE TO OBSERVER ~9'		8	45	40	40	40	38									
DISTANCE FROM OBSERVER		DIRECTION FROM OBSERVER		9	~	45	45	40	39									
DESCRIBE EMISSIONS Smoke				10	40	40	40	~	40									
EMISSION COLOR White		PLUME TYPE CONTINUOUS <input type="checkbox"/> FUGITIVE <input type="checkbox"/> INTERMITTENT <input type="checkbox"/>		11	45	40	30	35	41									
"STEAM" PLUME PRESENT NO YES <input type="checkbox"/>		IF "STEAM" PLUME ATTACHED <input type="checkbox"/> DETACHED <input type="checkbox"/>		12	35	30	30	30	42									
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED ~2 ft. above stack				13	~	20	25	30	43									
DESCRIBE BACKGROUND Hardwood foliage				14	30	25	30	30	44									
BACKGROUND COLOR Green		SKY CONDITIONS Clear		15	30	25	20	20	45									
WIND SPEED		WIND DIRECTION		16	25	20	20	25	46									
AMBIENT TEMP 80's		PRECIPITATION/FOG None		17	20	15	15	15	47									
SOURCE LAYOUT SKETCH 				18	15	15	15	~	48									
				MINUTES > 20% OPACITY							19	15	15	10	15	49		
				MINUTES > 40% OPACITY							20	10	15	10	15	50		
				MINUTES > 60% OPACITY							21	15	15	10	10	51		
				OFFICIAL INTERVIEWED							22	5	10	5	10	52		
				TITLE							23	5	5	10	10	53		
				OBSERVER'S NAME (PRINT) Philip Etter							24	10	10	5	5	54		
				OBSERVER'S SIGNATURE <i>Philip Etter</i>							25					55		
				DATE 6/21/05							26					56		
				COMMENTS							27					57		
							28					58						
							29					59						
							30					60						

MISSING DATA SYMBOLS: ~ LOOPING/BLOWING PLUME; X INTERFERENCE; - OTHER

VISIBLE EMISSIONS EVALUATION FORM

VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION AIR POLLUTION CONTROL DIVISION 103 SOUTH MAIN STREET WATERBURY, VERMONT				OBSERVATION DATE		START TIME		STOP TIME																																																																																																																																																																																																																																																																																																													
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ADDRESS				1	2	3	4	5	6																																																																																																																																																																																																																																																																																																												
CITY				7	8	9	10	11	12																																																																																																																																																																																																																																																																																																												
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ZIP				19	20	21	22	23	24																																																																																																																																																																																																																																																																																																												
PHONE				25	26	27	28	29	30																																																																																																																																																																																																																																																																																																												
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CONTROL EQUIPMENT		OPERATING MODE		49	50	51	52	53	54																																																																																																																																																																																																																																																																																																												
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MISSING DATA SYMBOLS: ~ LOOPING/BLOWING PLUME; X INTERFERENCE; - OTHER

VISIBLE EMISSIONS EVALUATION FORM

VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION AIR POLLUTION CONTROL DIVISION 103 SOUTH MAIN STREET WATERBURY, VERMONT				OBSERVATION DATE 6/22/05				START TIME 10:37				STOP TIME				
SEC		MIN		SEC		MIN		SEC		MIN		SEC		MIN		
0	15	30	45	0	15	30	45	0	15	30	45	0	15	30	45	
1	25	25	20	N	31	N	35	35	30							
2	N	25	N	25	32	90	N	N	N							
3	25	20	20	N	33	N	N	35	45							
4	25	20	N	N	34	N	N	N	30							
5	N	30	25	25	35	30	30	N	30							
6	25	N	N	25	36	75	75	75	30							
7	25	25	40	25	37	80	75	75	70							
8	35	30	35	40	38	75	75	75	-							
9	N	N	45	40	39	70	70	75	75							
10	40	45	45	45	40	N	75	75	75							
11	45	50	50	55	41	75	70	75	75							
12	60	65	N	75	42	75	70	70	65							
13	75	80	80	N	43	60	60	N	55							
14	N	75	90	75	44	55	50	55	50							
15	85	90	100	85	45	50	50	40	50							
16	95	N	N	75	46	35	N	40	50							
17	-	95	N	100	47	60	45	45	45							
18	95	-	100	N	48	50	45	40	35							
19	N	100	90	100	49	30	30	N	30							
20	100	100	90	90	50	25	30	25	30							
21	95	100	95	-	51	25	25	25	20							
22	100	90	90	90	52	20	15	15	15							
23	90	N	N	100	53	15	15	15	15							
24	85	85	90	95	54	N	15	15	20							
25	90	N	N	100	55	15	15	20	N							
26	90	N	90	35	56	15	15	15	15							
27	N	N	35	90	57	15	10	N	10							
28	90	85	100	90	58	10	15	10	15							
29	90	95	90	90	59	15	N	15	10							
30	85	85	85	N	60	10	10	N	10							
MINUTES > 20% OPACITY				61	15	10	15	15								
MINUTES > 40% OPACITY				62	10	N	15	N								
MINUTES > 60% OPACITY																
OFFICIAL INTERVIEWED																
TITLE																
OBSERVER'S NAME (PRINT) Philip Ester																
OBSERVER'S SIGNATURE <i>Philip Ester</i> DATE 6/22/05																
COMMENTS																

SOURCE NAME: *OWB Test*

ADDRESS:

CITY: STATE: *VT* ZIP:

PHONE: SOURCE ID NUMBER:

PROCESS EQUIPMENT: *Outdoor Wood Boiler* OPERATING MODE: *Variable*

CONTROL EQUIPMENT: *NA* OPERATING MODE:

DESCRIBE EMISSION POINT: *Metal Stack*

HEIGHT ABOVE GROUND LEVEL: *~9'* HEIGHT RELATIVE TO OBSERVER: *~9'*

DISTANCE FROM OBSERVER: *40'* DIRECTION FROM OBSERVER: *West*

DESCRIBE EMISSIONS:

EMISSION COLOR: *white/grey* PLUME TYPE CONTINUOUS FUGITIVE INTERMITTENT

"STEAM" PLUME PRESENT: NO YES IF "STEAM" PLUME ATTACHED DETACHED

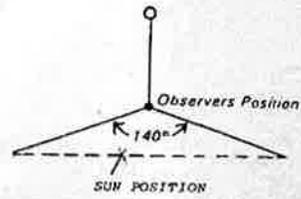
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: *3-6 ft. beyond stack (opening made)*

DESCRIBE BACKGROUND: *Foliage*

BACKGROUND COLOR: *Green* SKY CONDITIONS: *clear*

WIND SPEED: *10-15 mph* WIND DIRECTION: *W*

AMBIENT TEMP: *~30* PRECIPITATION/FOG: *None*



10:43:13
Open D

11:21:30
D closed
↓
low flow!

MISSING DATA SYMBOLS: ~ LOOPING/BLOWING PLUME; X INTERFERENCE; - OTHER

Appendix F: Outdoor Wood-fired Boiler Regulations

AGENCY OF NATURAL RESOURCES
Waterbury, Vermont

ENVIRONMENTAL PROTECTION REGULATIONS

CHAPTER 5

AIR POLLUTION CONTROL

Subchapter II. Prohibitions

5-204 SITING AND STACK HEIGHT STANDARDS FOR OUTDOOR WATERSTOVES WOOD FIRED BOILERS; NOTIFICATION TO PURCHASERS

(a) Applicability.

~~(1) This section shall apply to all outdoor waterstoves installed after October 1, 1997 except outdoor waterstoves with weighted average particulate matter emissions of less than 4.1 grams per hour. Compliance with this standard shall be determined in accordance with federal test method 28 for establishing test conditions and weighted emission values and federal test methods 5G or 5H for determining particulate emission concentrations (40 CFR Part 60, Appendix A), or other methods approved by the Air Pollution Control Officer.~~

This section shall apply to each outdoor wood-fired boiler installed after October 1, 1997, except those outdoor wood-fired boilers that are subject to and compliant with Section 5-205 herein.

(b) Definitions. For the purpose of this section and Section 5-205 herein, the following definitions apply, in addition to those of Section 5-101 of this chapter.

~~"Outdoor Waterstove" means any individual hand-fed furnace designed to burn wood and used for the purpose of heating water where the furnace is located outside the structure into which the hot water produced thereby is piped.~~

"Outdoor Wood-Fired Boiler" means a fuel burning device designed: (1) to burn primarily wood by hand-firing; (2) not to be located inside structures ordinarily occupied by humans; and, (3) to heat spaces or water by the distribution through pipes of a fluid heated in the device, typically water. Examples of common uses of outdoor wood-fired boilers include: residential or commercial space heating, heating of domestic hot water, and heating of water for swimming pools, hot tubs or whirlpool baths.

(c) Prohibition.

No person shall install or allow the installation of an outdoor waterstove wood-fired boiler subject to the requirements of this section unless the outdoor waterstove wood-fired boiler:

- (1) Is located more than 200 feet from any residence other than a residence served by the outdoor ~~waterstove~~ wood-fired boiler or owned by the owner or lessee of the outdoor ~~waterstove~~ wood-fired boiler;
- (2) Has an attached permanent stack extending higher than the ~~roof line~~ peak of the roof of the structure(s) being served by the outdoor ~~waterstove~~ wood-fired boiler, if any residence is located more than 200 but less than 500 feet from the outdoor ~~waterstove~~ wood-fired boiler other than a residence owned by the owner or lessee of such outdoor ~~waterstove~~ wood-fired boiler; and,
- (3) Complies with all applicable laws, including but not limited to local ordinances, but excluding Section 5-205 of this chapter, and its operation does not create a public nuisance.

(d) Notice to Buyers.

- (1) No outdoor ~~waterstove~~ wood-fired boiler subject to the requirements of this section shall be sold or offered for retail sale or lease within the State unless prior to any sales or lease agreement, the seller or dealer provides the prospective buyer or lessee with written notice stating that:
 - (i) Only untreated natural wood may be burned in an outdoor ~~waterstove~~ wood-fired boiler;
 - (ii) Installation of the outdoor ~~waterstove~~ wood-fired boiler is subject to the distance and stack height requirements provided in this section. [Each notice shall expressly disclose each such requirement];
 - (iii) Use of an outdoor ~~waterstove~~ wood-fired boiler that meets the distance and stack height requirements provided in this section is not appropriate in some areas due to terrain that could render the operation of an outdoor ~~waterstove~~ wood-fired boiler to be a nuisance or a public health hazard.
- (2) The written notice specified above shall be signed by the prospective buyer or lessee to indicate receipt of notification of the requirements of this section. Prior to making delivery of an outdoor ~~waterstove~~ wood-fired boiler into the possession of any buyer or lessee, the seller or dealer shall mail or otherwise provide a copy of the signed notice specified above to the:

Air Pollution Control Division
103 South Main Street
Building 3 South
Waterbury, Vermont 05671-0402.

Said notice shall contain the name, address and telephone number of both the seller or dealer and the buyer or lessee, the location where the outdoor ~~waterstove~~ wood-fired boiler will be installed and the make and model of the outdoor ~~waterstove~~ wood-fired boiler.

5-205 CONTROL OF PARTICULATE MATTER FROM NEW OUTDOOR WOOD-FIRED BOILERS(a) Applicability

This section shall apply to any outdoor wood-fired boiler that is distributed or sold in Vermont or for installation in Vermont on or after January 1, 2006, except that this section does not apply to any outdoor wood-fired boiler that: (1) is or has been owned by an individual for his or her own personal use and is distributed or sold to another for his or her own personal use; or (2) was purchased and received by any person other than the manufacturer before January 1, 2006.

(b) Definitions. For the purposes of this section, the following definitions apply, in addition to those of Sections 5-101 and 5-204 of this chapter.

"Distribute or Sell" means to distribute, sell, advertise for sale, offer for sale, hold for sale, ship, deliver for shipment, release for shipment, or receive and (having so received) deliver or offer to deliver. This term also includes conditional sales and long-term leases. This term does not include the distribution or sale by a manufacturer of an outdoor wood-fired boiler that is installed outside Vermont.

"Manufacturer" means any person who constructs or imports an outdoor wood-fired boiler.

"Model line" means all outdoor wood-fired boilers offered for distribution or sale by a single manufacturer that, in the judgment of the Air Pollution Control Officer, are similar in all material respects.

(c) Standard for Particulate Matter; Certification

- (1) No person shall distribute or sell an outdoor wood-fired boiler in Vermont or for installation in Vermont unless the Air Pollution Control Officer has issued a certification to the manufacturer that the boiler, or the boiler model line to which it belongs, complies with the following particulate matter emission limit: An outdoor wood-fired boiler shall not emit, or cause or allow to be emitted, any gases that contain particulate matter in excess of 0.20 grains per dry standard cubic foot of exhaust gas corrected to 12% CO₂, as determined in accordance with the test methods and procedures in subsection (d) of this section.
- (2) Unless revoked sooner by the Air Pollution Control Officer, a certification issued under this subsection shall be valid for five years from the date of issuance.
- (3) The distribution or sale of each outdoor wood-fired boiler subject to this section that has not been certified by the Air Pollution Control Officer as meeting the particulate matter emission limit in this subsection shall constitute a separate violation and be subject to civil or criminal penalties as provided in 10 V.S.A. Chapters 201 and 211, or 10 V.S.A. §568.

(d) Emission Test Methods and Procedures

- (1) In order to obtain certification of an outdoor wood-fired boiler under subsection (c) of this section, the manufacturer of any such boiler shall have emission test(s) conducted to determine compliance with the particulate matter emission limit under subsection (c) of this section and furnish the Air Pollution Control Officer a written report of the results of such tests, including a detailed description of the operating conditions of the boiler during the tests. Said written report shall contain such documentation and other information and follow such format as may be specified by the Air Pollution Control Officer. In the discretion of the Air Pollution Control Officer, a manufacturer of an outdoor wood-fired boiler subject to this section may have emission testing conducted of a representative boiler within a model line of outdoor wood-fired boilers and may use those tests to demonstrate compliance of all units manufactured in that model line.
- (2) All emission testing required under this section shall be conducted by independent testing consultants who have no conflict of interest and receive no financial benefit from the outcome of the testing. Manufacturers of outdoor wood-fired boilers shall not involve themselves in the conduct of any emission testing under this section nor in the operation of the unit being tested, once actual sampling has begun.
- (3) Emission tests shall be conducted and data reduced in accordance with 40 CFR Part 60, Appendix A, Test Methods 1 through 5, and 40 CFR Part 51, Appendix M, Test Method 202, or alternative methods approved by the Air Pollution Control Officer. All tests shall be conducted in accordance with Vermont's "Source Emission Testing Guidelines" (January 2002 revision, as amended) and under a test protocol which has received the prior approval of the Air Pollution Control Officer. Emission tests shall be conducted under such conditions as the Air Pollution Control Officer shall specify, based on representative performance of the outdoor wood-fired boiler under actual field operating conditions.
- (4) The manufacturer of the outdoor wood-fired boiler shall provide the Air Pollution Control Officer with at least 30 days prior notice of any emission test to afford the Air Pollution Control Officer the opportunity to have an observer present. The manufacturer of an outdoor wood-fired boiler(s) being tested as required by this section shall reimburse the state of Vermont for the reasonable expenses incurred by any such Agency observer for out-of-state travel to observe such testing, including among other items the costs of transportation, lodging and meals.

(e) Notification by Manufacturers

- (1) By March 1st of each year and as necessary when an outdoor wood-fired boiler is certified, each outdoor wood-fired boiler manufacturer shall provide the following information in writing to any person to whom the manufacturer has distributed or sold, intends to distribute or sell, or actually distributes or sells

outdoor wood-fired boilers in Vermont or for installation in Vermont:

- (i) A list of all the models of outdoor wood-fired boilers it manufactures; and
 - (ii) An identification of which, if any, of said models or boilers has received a certification of compliance under subsection (c) of this section and thus may be distributed or sold in Vermont or for installation in Vermont.
- (2) By March 15th of each year, a copy of all written information provided to comply with paragraph (1) of this subsection and a list of persons to whom it was provided shall be submitted to the Air Pollution Control Officer.

Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State



Eliot Spitzer
Attorney General of New York State
Environmental Protection Bureau
August 2005

**Smoke Gets in Your Lungs:
Outdoor Wood Boilers in New York State**

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ACRONYMS USED IN THIS REPORT

ASTM	-	Association for Standards and Testing Materials
BTU	-	British Thermal Unit
CDDs	-	Chlorinated dibenzo-p-dioxins
DEC	-	New York State Department of Environmental Conservation
DOH	-	New York State Department of Health
ECL	-	Environmental Conservation Law
EPA	-	United States Environmental Protection Agency
HPBA	-	Hearth, Patio, and Barbecue Association
NYCRR	-	New York Code of Rules and Regulations
OAG	-	New York State Office of the Attorney General
OWB	-	Outdoor Wood Boiler
PAH	-	Polycyclic Aromatic Hydrocarbon
PCBs	-	Polychlorinated biphenyls
PM	-	Particulate Matter

Executive Summary

Homeowners, especially in rural communities, are increasingly turning to wood burning units installed outside the home, known as outdoor wood boilers (OWBs), to heat their homes. OWB sales have tripled in New York since 1999, with over 7,000 OWBs sold from 1999 to 2004.

The New York State Office of the Attorney General (OAG) Environmental Protection Bureau reviewed information on OWBs and analyzed the manufacture, distribution, testing, and sales of OWBs in New York State. We found that while OWBs are advertised as a clean and economical way to heat one's house and water, OWBs may be among the dirtiest and least economical modes of heating, especially when improperly used. Even when used properly, OWBs emit, on an average per hour basis, about four times as much fine particulate matter pollution as conventional wood stoves, about 12 times as much fine particle pollution as EPA-certified wood stoves, 1000 times more than oil furnaces, and 1800 times more than gas furnaces. Such emissions are significant because fine particulate matter pollution has both short-term and long-term health effects.

Currently, neither federal nor New York State regulations address the proper use of, or limit the pollution from, OWBs. Unlike indoor woodstoves and other heating devices, OWBs do not have to meet safety or performance standards. In the absence of such regulations, some local governments have imposed sensible limits on OWBs, which are described in this report.

We recommend that comprehensive testing protocols and emission limitations be enacted. We also suggest practical steps that owners and neighbors can take to mitigate environmental and health problems associated with OWBs.

I. Introduction: The Increasing Use of OWBs

In the 1980s, as the cost of oil and natural gas rose and as Americans attempted to reduce their heating expenses, the prevalence of residential wood burning stoves and furnaces increased. As of 1998, nine percent of the homes in the United States used residential wood combustion units (including wood stoves, fireplaces, pellet stoves, masonry heaters and wood-fired furnaces) for at least a portion of their heating needs.¹ The United States Environmental Protection Agency (EPA) established emissions standards in 1988 for indoor residential wood stoves in an effort to decrease people's exposure to particulate matter, carbon monoxide, and other pollutants.² Consequently, all new residential wood stoves sold in the United States since 1992 require EPA certification and pollution controls.³ OWBs, however, which were rare in 1988, are not covered by the EPA residential wood stove regulations.

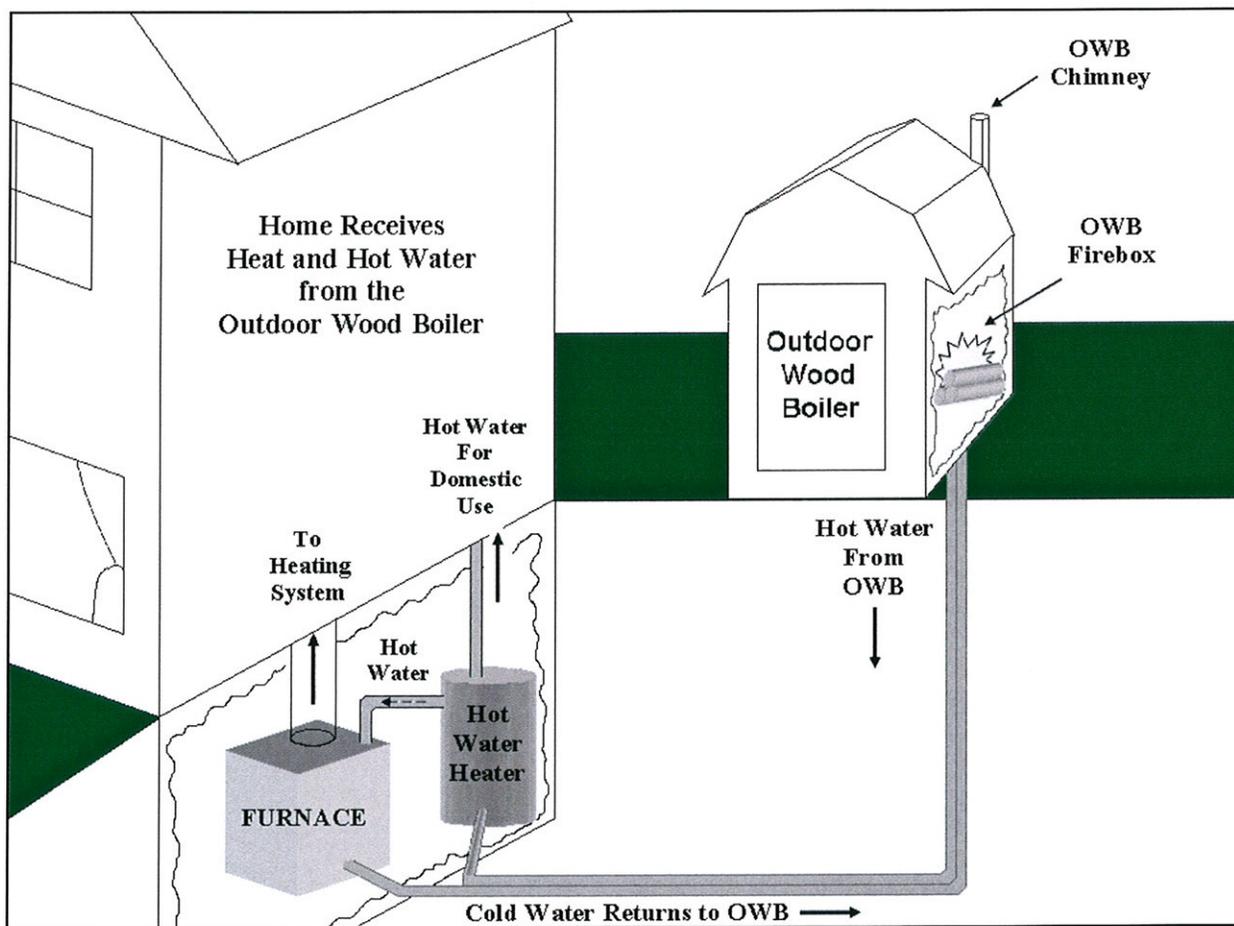
¹ Houck, J., et al., *Air Emissions from Residential Heating: The Wood Heating Option Put into Environmental Perspective*, Proceedings of a U.S. EPA and Air Waste Management Association Conference. Emission Inventory: Living in a Global Environment, V.1, pp. 373-384 (1998).

² Standards of Performance for New Residential Wood Heaters, 40 CFR §§ 60.530-60.539b.

³ A list of EPA approved wood stoves can be found on the EPA website, *available at* www.epa.gov/compliance/resources/publications/monitoring/programs/woodstoves/certifiedwood.pdf (last accessed May 31, 2005).

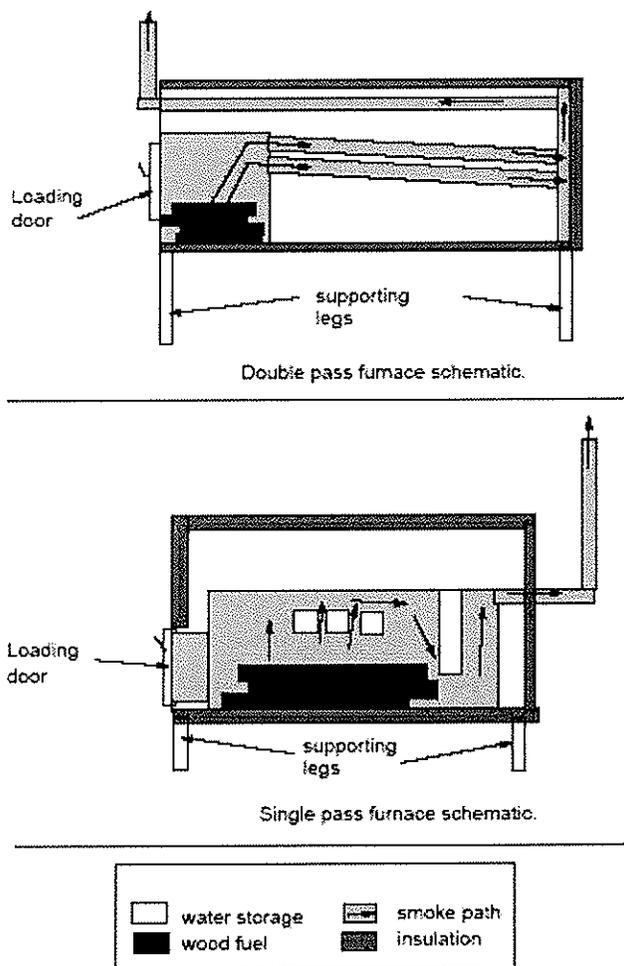
An OWB is a freestanding combustion unit located outside the home or structure to be heated (see Figure 1) that consists of a firebox surrounded by a water reservoir (see Figure 2). While designs vary by manufacturer, a typical OWB resembles a small shed with a short chimney to release combustion gases and an oversized firebox, built to accommodate unsplit logs up to five feet in length. OWBs vary in size, but are typically three to five feet wide, six to nine feet deep, and six to ten feet tall, including the height of the chimney.

Figure 1: Schematic of OWB and Home



OWBs are designed to accommodate large wood loads which can burn for many hours without tending. Wood is placed in the firebox (combustion chamber) by the OWB operator and is ignited. The water in the reservoir surrounding the firebox is heated when hot combustion gases from the firebox pass, via pipes, through the reservoir to the exhaust stack (see Figure 2). The heated water is pumped through insulated underground pipes from the OWB to the home or building where it is circulated through the home's heating system. Wood in the firebox continues to burn until the temperature in the home reaches the desired level. A thermostat in the home controls the burn rate of the fuel by varying the amount of air that is supplied to the firebox for wood combustion. When the thermostat temperature is reached, the firebox is deprived of oxygen, leaving the wood smoldering, until more heat is needed.

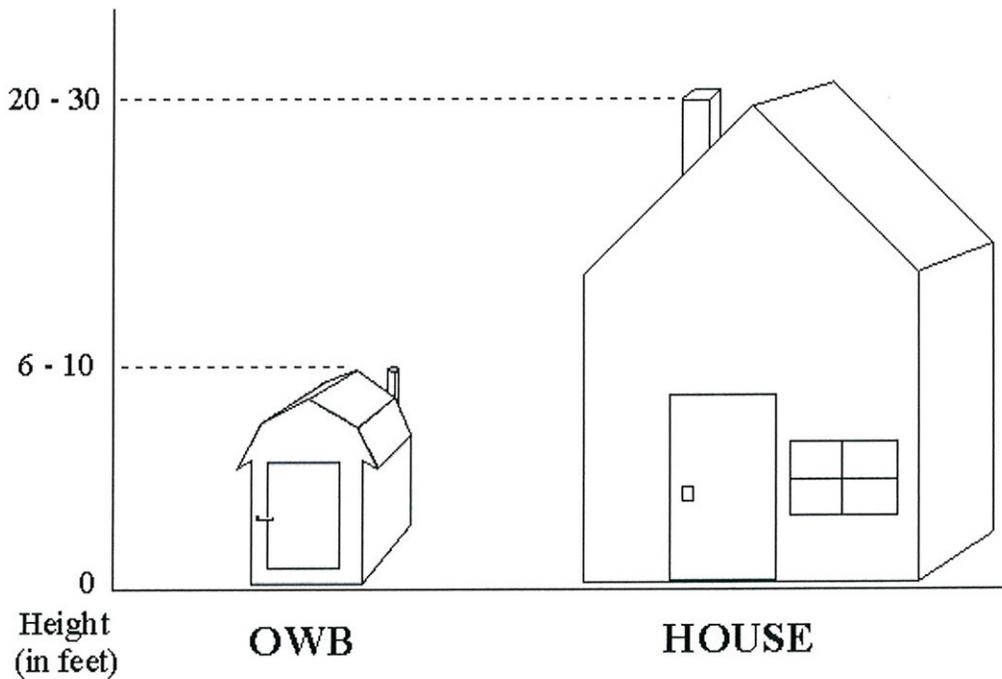
Figure 2: Schematic of Inside OWB ⁴



In contrast to indoor wood stoves, which feature chimneys located above the building's roof line, smoke is released from the OWB via a short chimney, typically at a height of approximately six to ten feet (see Figure 3). Chimney extensions are sometimes added to increase the height.

⁴ Adapted from Valenti, J. and Clayton, R., *Emissions from Outdoor Wood-Burning Residential Hot Water Furnaces*, EPA-600/R-98-017 (February 1998).

Figure 3: Comparison of Chimney Heights



OWBs are increasingly becoming a primary method of heating homes in winter and providing hot water year-round. The number of OWBs sold annually in New York State has tripled from approximately 600 units in 1999 to 1,880 units in 2004. Sales across the United States have similarly increased, from about 4,800 in 1999 to over 15,000 in 2003. Based on partial data for 2004, it is estimated that 24,500 OWBs were sold across the U.S. in 2004. Since 1999, of the 77,500 units sold nationwide, nearly 7,500 OWBs have been sold in New York State (see Table 1).

Table 1: Number of OWBs Sold in NYS and Nationwide, 1999 to 2004

	1999	2000	2001	2002	2003	2004*	TOTAL
NY State	606	1037	1721	947	1272	1880	7463
U.S.	4828	6865	15330	10552	15340	24560	77475

*Estimated based on partial data for 2004 and assuming continued rate of growth

There are at least 23 manufacturers of OWBs that sell units in the United States (see Appendix E for names and contact information). Manufacturers typically sell OWBs to customers both directly and through more than 300 distributors and local dealers in New York State. One manufacturer accounts for approximately one-third of the United States sales since 1999.

II. OWB Pollution

State health and environmental agencies have received a growing number of complaints from owners and neighbors that OWBs produce thick, acrid, foul smoke that permeates buildings and homes, causing not only a nuisance, but also environmental degradation and health problems. Even when operated using clean seasoned wood, OWBs can emit significant pollution because the basic design of the OWB causes fuel to burn incompletely, or smolder, resulting in thick smoke and high particulate emissions. The problem is aggravated when other materials, such as wet wood, processed wood, and garbage are burned. The short OWB chimney and reduced draft often fail to disperse the smoke, resulting in more concentrated pollution at lower heights reaching residents and neighbors. Exposure to this smoke, like other pollutants, can cause or contribute to short-term health harms such as eye, nose, throat, and lung irritation, coughing and shortness of breath, and may exacerbate asthma or trigger asthma attacks. Chronic exposure to smoke can cause long-term effects such as asthma, heart and lung disease, and cancer.



A. OWB Operation and Smoke

Wood smoke is one of the primary contributors to certain types of air pollution in the United States,⁵ especially in rural areas. Even though wood combustion accounts for only about nine percent of the nation's home heating needs, it accounts for an estimated forty-five percent of the total fine particulate matter directly released by all fuel combustion used for residential heating.⁶

To obtain the most efficient – and thus cleanest – burn from a wood combustion device, dry wood should be burned in a manner that allows airflow and oxygen to the greatest amount of surface area. OWBs create smoldering conditions which in turn produce excess smoke. An efficient fire should produce clear exhaust during warmer months, and white exhaust (steam) during colder months. An inefficient fire produces gray, black, or thick smoke and releases much more harmful particulate matter. Because OWBs are designed to respond to the thermostatic setting by smoldering when less heat is required, they produce heavy smoke emissions more often than most other wood combustion devices.

Smoke from OWBs becomes more problematic when the owner burns items other than dry seasoned wood. Burning wet, damp, or green wood reduces the efficiency and heat output of any wood combustion device and increases particulate emissions.⁷ The energy that could be released in the form of heat is instead used to boil off the water content of the wood, which in freshly cut, green wood can be as much as fifty percent of the total weight. Thus, to generate the same amount of heat, more wood must be burned, increasing emissions of carbon dioxide – the most important pollutant responsible for global warming. In addition, when energy is expended to change water into steam, the temperature of the fire is decreased leading to incomplete combustion of the wood fuel. When that happens, increased amounts of unburned particulates will be emitted with the steam and combustion gases.⁸ Finally, all wood combustion, but particularly incomplete combustion such as in OWBs, produces a variety of toxic

⁵ Fisher, L., et al., *Long-Term Performance of EPA-Certified Phase 2 Woodstoves, Klamath Falls and Portland, Oregon: 1998/1999*, EPA/600/SR-00/100 (2000); McDonald, J., et al., *Fine Particle and Gaseous Emission Rates from Residential Wood Combustion*, Environmental Science and Technology 34(11): 2080-2091(2000).

⁶ EPA, *National Air Quality and Emissions Trends Report, 2003 Special Studies Edition*, Office of Air Quality Planning and Standards, EPA 454/R-03-005 (September 2003); Houck, J., et al., *Air Emissions from Residential Heating: The Wood Heating Option Put into Environmental Perspective*, Proceedings of the U.S. EPA and Air Waste Management Association Conference. Emissions Inventory: Living in a Global Environment, V.1, pp. 373-384 (1998). While wood accounts for nine percent of residential heating, fossil fuels – most burned in a home furnace but some burned in a power plant to produce electricity – are used for most US residential heating. Electricity-generating power plants emit the majority of their pollution as gases that are, in part, converted in the atmosphere to fine particles so that their overall contribution to fine particulate pollution in the ambient air is greater than that of wood combustion.

⁷ EPA, *Reducing Air Toxics in Your Community*, EPA-453/F-03-001 (October 2004); American Lung Association, *Woodburning* (April 2000).

⁸ Burning wet wood will result in creosote build-up inside the firebox and chimney. Creosote is a flammable sticky tar-like substance that is often responsible for chimney fires if it is allowed to accumulate from an initial gray powdery dusting into a thick crystalized build-up. Cleaning the firebox and chimney regularly will increase air flow in the wood heater, thereby reducing the rate of creosote build-up.

emissions including carbon monoxide, formaldehyde, benzene, naphthalene, and polycyclic aromatic hydrocarbons.⁹

When construction materials, packaging crates, and home garbage (which often includes plastics, rubber, batteries, electronics, and other materials unsuited for disposal by backyard combustion) are burned, the emission of harmful pollutants increases.¹⁰ While emissions from OWBs that burn household items have not been studied, studies of backyard burning of garbage have found that emissions include, but are not limited to, carbon monoxide, hydrogen chloride, hydrogen cyanide, benzene, styrene, formaldehyde, arsenic, lead, chromium, benzopyrene, dioxins, furans, and PCBs. According to a study conducted by EPA, the New York State Department of Health (DOH), and the New York State Department of Environmental Conservation (DEC), burning approximately ten pounds of household trash in a burn barrel releases as much air pollution as a modern, well-controlled municipal waste incinerator burning 400,000 pounds of trash.¹¹

Although OWBs have not been subjected to extensive testing, limited testing (shown in Table 2 and Appendix A) has indicated that emissions of fine particulate matter (defined as particulates smaller than 2.5 millionths of a meter in diameter, and referred to as PM 2.5) from burning wood in OWBs are about four to 12 times higher than the emissions from indoor woodstoves.¹² Conventional wood stoves manufactured prior to 1992, which were not airtight and had no pollution controls, generated an average of 18.5 grams PM 2.5 per hour, whereas the newer EPA-certified wood stoves averaged about six grams per hour.¹³ In similar tests, OWB emissions ranged from 18 to 147 grams PM 2.5 per hour and averaged

⁹ Larson, R. and Koenig, J., *Summary of the Emissions Characterization and Noncancer Respiratory Effects of Wood Smoke*, EPA-453/R-93-036 (1993); Washington State Department of Ecology, *Health Effects of Wood Smoke* (March 1997).

¹⁰ Not surprisingly, for this reason the Hearth, Patio, and Barbecue Association advises homeowners to never use the following: trash, plastics, gasoline, rubber, naphtha, household garbage, material treated with petroleum products (particle-board, railroad ties, pressure treated wood), leaves, paper products, and cardboard. Hearth, Patio, and Barbecue Association, *Smoke Troubleshooting Checklist for Outdoor Furnaces*, (April 2004), available at www.hpba.org/govrelations/troubleshootingGuidelines.pdf (last accessed May 31, 2005).

¹¹ Lemieux, P., *Project Summary. Evaluation of Emissions from the Open Burning of Household Waste in Barrels (with Errata)*, EPA/600/SR-97/134 (October 2003).

¹² Particulate pollution is typically measured using EPA Test Method 5 which collects PM as small as 0.3 microns. An additional test can then be used to distinguish between particles larger or smaller than 2.5 microns. Studies have shown that nearly all of the PM emitted in woodsmoke is PM2.5 or smaller. Houck, J., and Tiegs, P., *Residential Wood Combustion – PM2.5 Emissions*, WESTAR PM2.5 Workshop, Reno, Nevada (July 1998) (93% of the particulate emissions from wood combustion is PM2.5). In its assessment, The Mid-Atlantic Regional Air Management Association assumes that 100 percent of PM emissions from wood combustion is PM2.5 or smaller. See *Technical Memorandum No. 6: MANE-VU Residential Wood Combustion Emission Inventory*, Mid-Atlantic Regional Air Management Association (April 30, 2004).

¹³ Valenti, J. and Clayton, R., *Emissions from Outdoor Wood-Burning Residential Hot Water Furnaces* EPA-600/R-98-017 (February 1998). EPA has established emission limits on indoor wood stoves, distinguishing between those with catalysts (through which the smoke passes, causing additional combustion) and those without catalysts. The EPA limits are 4.1 and 7.5 grams PM 2.5 per hour respectively. As can be seen in Table 2, however, testing indicates that many catalytic stoves are not, in fact, meeting the legal limit.

about 72 grams per hour.¹⁴ In comparison to other emission sources, one OWB produces approximately as much PM 2.5 per hour as two heavy duty diesel trucks, 45 passenger cars, 1000 oil furnaces, or 1800 gas furnaces.¹⁵ A comparison of PM 2.5 emissions from various home heating devices is shown in Figure 4. (Coal, while used extensively for electricity production, is not used extensively in New York for home heating.)

Table 2: Comparison of Emissions from Various Wood Combustion Units

Type of Wood Combustion Unit	Particulate Matter, Average (grams per hour)	Polycyclic Aromatic Hydrocarbons, Average (grams per hour)
OWB	71.6 ⁱⁱ	0.96 ⁱⁱ
Conventional (non-EPA Certified) Wood Stove ⁱ	18.5 ⁱⁱⁱ	0.36 ^{iv}
EPA Certified Catalytic Wood Stove ⁱ	6.2 ⁱⁱⁱ	0.15 ^{iv}
EPA Certified Non-Catalytic Wood Stove ⁱ	6.0 ⁱⁱⁱ	0.14 ^{iv}
EPA Phase-II Certified Woodstove ^v	4.1: EPA limit for catalytic woodstoves 7.5: EPA limit for non-catalytic woodstoves	Not Available

ⁱ Assumes 1.0 kg/hr burn rate.

ⁱⁱ Appendix A.

ⁱⁱⁱ Houck, J. and Tiegs, P., *Residential Wood Combustion Technology Review, Volume 1. Technical Report*, EPA-600/R-98-174a. (1998).

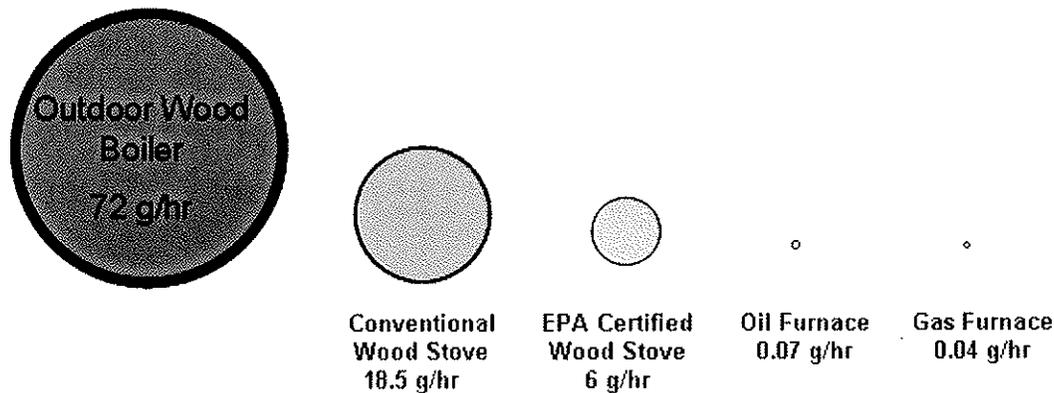
^{iv} Fisher, L., et al., *Long-Term Performance of EPA-Certified Phase 2 Woodstoves, Klamath Falls and Portland Oregon: 1998/1999*. EPA-600/SR-00-100 (2000).

^v Subpart AAA-Standards of Performance for New Residential Wood Heaters, 40 CFR §§ 60.530-60.539b.

¹⁴ These tests were conducted either by EPA or laboratories on behalf of manufacturers. See Appendix A.

¹⁵ OWB, conventional wood stove, and EPA certified wood stove emission rates from Table 2; emission rates of 0.07 g/hr and 0.04 g/hr from *EPA Emission Factors AP-42*, Fifth Edition, Volume 1, available at www.epa.gov/ttn/chief/ap42/ch01/index.html (last accessed May 31, 2005); EPA, *Emission Standards Reference Guide of Heavy-Duty and Nonroad Engines*, EPA 420-F-97-014 (September, 1997); EPA, *Federal Certification Exhaust Emission Standards for Light-duty Vehicles (Passenger Cars) and Light-duty Trucks: Federal Test Procedure (FTP), Cold CO, and Highway and Idle Tests*, EPA 420-B-00-001 (February, 2000).

Figure 4: Relative Emissions of Fine Particulate Matter From Home Heating Devices



B. Human Health Impacts of OWB Smoke

Exposure to various components of wood smoke and the contaminants found in wood smoke has been associated with adverse human health impacts, as discussed below. The likelihood of health effects depends on many factors, such as the amount of smoke to which one is exposed, the frequency and duration of exposure, and the sensitivity of the individual exposed.

Fine Particulate Matter (PM 2.5)

Exposure to PM 2.5 can cause short-term health effects such as eye, nose, throat, and lung irritation, coughing, sneezing, runny nose, and shortness of breath and can also affect lung function and worsen medical conditions such as asthma and heart disease. While the upper respiratory system will filter out particles larger than ten millionths of a meter (or microns), PM 2.5 can bypass the body's natural filtering mechanisms to lodge deep in the lungs.¹⁶ Scientific studies have linked increases in daily PM 2.5 exposure with increased respiratory and cardiovascular hospital admissions, emergency department visits and deaths. Recent studies suggest that long-term exposure to PM 2.5 may be associated with increased rates of bronchitis and reduced lung function, and increased cancer risk. People with breathing problems (such as asthma, bronchitis, emphysema, or pneumonia) and/or heart problems, and certain members of

¹⁶ EPA, *EPA Announces Final Designations for First Fine Particulate Standard*, Press Release (Dec. 17, 2004), available at www.epa.gov/pmdesignations (last accessed May 31, 2005).

the general population (such as children and the elderly) may be particularly sensitive to PM 2.5.¹⁷ More than 60,000 deaths each year in the United States can be attributed to exposure to air polluted with PM 2.5.¹⁸

Respiratory and cardiovascular diseases have been associated directly with wood smoke emissions.¹⁹ For example, a Seattle area study noted increases in asthma and other respiratory disease and declines in lung function among children exposed to wood smoke.²⁰ Long term exposure to wood smoke, like other emissions containing PM 2.5, can lead to chronic bronchitis, obstructive lung disease, and an increased risk of cancer.²¹

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are a group of chemicals that are formed during the incomplete combustion of coal, oil, gas, wood, garbage, and other organic substances such as tobacco. PAHs generally occur as complex mixtures often containing hundreds of different PAHs. Tests on mice show that exposure to PAHs during pregnancy results in higher rates of birth defects, lower birth weights, and difficulty reproducing. Animal studies have also shown that both short-term and long-term exposure to PAHs can inhibit the body's ability to fight disease. Some PAHs have been categorized as probable human carcinogens (cancer causing chemicals) by the U.S. Department of Health and Human Services, and by the International Agency for Research on Cancer.²²

¹⁷ New York State Department of Health Fact Sheet, *Fine Particles (PM 2.5) Questions and Answers* (Feb 2003, revised July 2004), available at www.health.state.ny.us/nysdoh/indoor/pmq_a.htm (last accessed May 31, 2005).

¹⁸ Washington State Department of Ecology, Air Quality Program, *Health Effects of Wood Smoke* (March 1997, updated August 2004).

¹⁹ Zelikoff, J., et al., *The Toxicology of Inhaled Woodsmoke*, J. Toxicology and Environmental Health, Part B, 5: 269-282 (2002).

²⁰ Koenig, J., et al., *Pulmonary Function Changes in Children Associated with Fine Particulate Air Pollution*, Environmental Research 63(1): 26-38 (1993); Larson, R. and Koenig, J., *Wood Smoke: Emissions and Noncancer Respiratory Effects*. Annu. Rev. Public Health 15: 133-56 (1994).

²¹ American Lung Association, *Wood Smoke Affects Your Health* (1990); Ammann, H., *Summary Overview of Health Effects Associated with Residential Wood Combustion: Health Effects Issue Assessment*, Internal Report, EPA, Research Triangle Park, NC (1986); Larson, T., et al., *Urban Air Toxics Mitigation Study: Phase I*, University of Washington report submitted to the Puget Sound Air Pollution Control Authority (1988); Morris, K., et al., *Wood Burning Stoves and Lower Respiratory Tract Infections in American Indian Children*, American Journal of Diseases of Children 144: 105-108 (1990); Stevens, R., et al., *Sources of Mutagenic Activity in Urban Fine Particles*, Toxicol. Industrial Health 6: 81-94 (1990).

²² Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Polycyclic Aromatic Hydrocarbons* (August 1995).

Carbon Monoxide

At low concentrations, carbon monoxide can cause fatigue in healthy people and chest pain in people with heart disease. At higher concentrations, it can cause impaired vision and coordination, headaches, angina, dizziness, confusion, and nausea. Exposure can cause flu-like symptoms that stop after exposure ends. It can also be fatal at very high concentrations, due to the formation of carboxyhemoglobin in the blood, which inhibits oxygen uptake.²³

Benzene

Exposure to benzene can cause both short and long term health effects. At high concentrations, exposure to benzene can cause drowsiness, dizziness, rapid heart rate, headaches and tremors. Long term exposure to lower levels are associated with adverse effects in the blood and bone marrow (leukemia), the immune system, the reproductive system, and increased cancer risk.²⁴

Chlorinated Dioxins

Chlorinated dibenzo-p-dioxins (CDDs) are a family of 75 different compounds with varying harmful effects. CDDs are released to the environment during combustion of fossil fuels (coal, oil, natural gas) and wood, and during incineration processes. Burning materials that may contain chlorine, such as plastics, wood treated with pentachlorophenol, pesticides, polychlorinated biphenyls (PCBs), and even bleached paper can produce CDDs. Exposure to CDDs generally occurs through breathing contaminated air, or through skin contact with materials containing CDDs. Effects of exposure depend on the amount, but can range from skin disease, changes in blood, urine, and liver chemistry, as well as potential reproductive or developmental effects. Certain CDDs have been determined to be likely carcinogens.²⁵

Other Chemicals

Wood smoke contains inorganic and organic irritants such as formaldehyde and other aldehydes, nitrogen oxides and sulfur oxides. Inhalation of wood smoke containing irritants can lead to inflammation and swelling of the lung tissue and can contribute to respiratory distress. Irritants can interfere with the normal flow of mucus that removes particles from the respiratory tract, thereby increasing the amounts of particulate matter entering the lungs. These irritants can also contribute to allergic reactions.²⁶

C. Neighborhood Problems Created by OWB Smoke

²³ EPA, *Indoor Air Quality Tools for Schools Kit*, IAQ Coordinator's Guide, available at www.epa.gov/iaq/schools/tfs/guidee.html (last accessed May 31, 2005).

²⁴ Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Benzene*, Public Health Statement (September 1997).

²⁵ Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Chlorinated Dibenzo-p-Dioxins*, Public Health Statement (December 1998).

²⁶ Agency for Toxic Substances and Disease Registry, *TOXFAQs for Formaldehyde* (June 1999), *Sulfur Dioxide* (June 1999), and *Nitrogen Oxide* (April 2002).

During summer months and calm winter days, wood smoke is slow to rise and disperse. With OWB chimneys not high enough to carry the smoke past the heights of surrounding homes and local terrain, wood smoke, soot, and toxins may enter homes and yards of owners and neighbors who are situated close to OWBs. Wood smoke particulates, due to their small size, can remain suspended in the air for long periods of time, can cause a smokey haze, and can easily enter homes through air intakes, cracks, doors and windows. Effects on neighbors are especially apparent when OWBs are installed at the outermost limit of the owner's property, and in close proximity to structures on adjacent properties.

The OAG has received more than 50 complaints from individuals who are affected by OWB-generated smoke and odors.²⁷ The complaints filed with the OAG note the following:

1. Smoke from OWBs has led to a variety of symptoms including upset stomach, headaches, dizziness, respiratory effects, and throat and eye irritation.
2. Smoke from OWBs has prevented residents from enjoying activities inside and around their homes. Residents have been unable to use their porches and backyards or conduct normal activities such as walking the dog, gardening, or hanging laundry outside. Some residents do not allow their children to play outside because of the smoke.
3. Smoke from OWBs has forced residents to close their windows, doors, and air conditioning units, in an effort to keep the smoke and smoke odors from entering their homes. Residents have complained of wood smoke odors on items inside the home, such as clothing, curtains and upholstery. Smoky conditions indoors have sometimes set off carbon monoxide detectors.
4. Materials besides natural wood are burned in the OWBs, producing even greater amounts of noxious smoke and odors.
5. In a few cases, the unhealthy and nuisance conditions created by OWBs have caused complainants to sell their homes.

²⁷ Complaints have been received from people in the following counties: Broome, Cattaraugus, Chautauqua, Chemung, Chenango, Clinton, Dutchess, Franklin, Jefferson, Onondaga, Saratoga, St. Lawrence, Suffolk, Tioga, Ulster, Warren, and Wyoming. One OWB was adjacent to a public school.

III. OWB Efficiency, Costs, and Performance

According to the EPA, since OWBs are “designed to be installed outside of the home, and to heat by an indirect method, they are exempt from the EPA regulation(s)”²⁸ that cover indoor wood stoves. Currently, no standard test methods are available to evaluate the performance of OWBs. Approached by the Hearth, Patio, and Barbecue Association (HPBA) in an effort to make test data on OWBs comparable, the Association for Standards and Testing Materials (ASTM) established a committee to develop a consensus-based standard testing method for OWBs.²⁹

Until a test method is established, it is impossible to assess with precision the claims of manufacturers regarding efficiency and costs of OWBs. Some limited testing information, however, suggests that OWBs may be not only less environmentally sound but may also be less efficient and economical than other common heating sources, such as indoor wood stoves, and gas- or oil-fueled furnaces.

A. Heating Efficiency

Heating efficiency is a measure of heat output relative to the input value of the fuel – the actual heat output in comparison to the potential heat output of the fuel. The EPA has found heating efficiencies of about 54 percent for conventional wood stoves, and 68 to 72 percent for EPA-certified wood stoves.³⁰ In comparison, data obtained from manufacturers on tests conducted on OWBs found that they have heating efficiencies ranging from 28 to 55 percent, with an average of 43 percent (see Appendix B).

B. Costs

One of the benefits of OWBs, as advertised by some manufacturers, is that customers will save thousands of dollars in heating costs over the course of a year. One manufacturer, for example, claims: “Over a ten-year period, a homeowner or business may save \$10,000 to \$50,000 dollars or more on heating costs.”³¹ Another advertises that one can “save 69 to 78% on your heating costs,” and “you will save up to 90% on your heating and hot water bills.”³² However, these claims of cost savings may not withstand scrutiny. The initial cost of OWBs is significantly higher than that of other heating devices such as gas and oil furnaces (see Table 3), many of which will already be installed in the home. In addition, OWB

²⁸ Excerpted language is from an EPA exemption letter provided to an OWB manufacturer in response to a request for determination of exempt status in 1999. Letter from EPA Office of Enforcement and Compliance, Energy and Transportation Division, J. Rasnic, Director, dated November 30, 1999.

²⁹ ASTM, *E06.54.08, Task Group on Outdoor Wood-Fired Hydronic Heaters*, Sheraton Hotel and Convention Center, Madison Wisconsin, December 1-2, 2004. The committee, with representatives from OWB manufacturers, and state and federal governments, is in the process of developing testing methods that can be applied to OWBs. While generally agreeing that a standard test method should be adopted, committee members are deliberating the quantity, quality, moisture content, and stacking position of the wood for the test burns. Ideally the adopted test method will be realistic and reproducible, to enable “factory-tested” comparable results among OWBs.

³⁰ EPA, *Residential Wood Combustion Technology Review*, Volume I. Technical Report. EPA-600/R-98-174a. (December 1998).

³¹ Central Boiler, Inc., available at www.centralboiler.com (last accessed Feb. 18, 2005).

³² Taylor Manufacturing, Inc., available at www.taylormfg.com (last accessed Feb. 23, 2005).

manufacturers' claims apparently do not take into account the cost of purchasing or harvesting wood fuel. When the latter cost is accounted for, any savings may vanish (see Table 4).

Table 3: Initial Cost of Various Heating Systems

Type of Heating System	Average Cost ⁱ
Outdoor Wood Boiler ⁱⁱ (43% Efficient)	\$5500
Indoor Wood Stove ⁱⁱⁱ Non-catalytic (68% Efficiency) Catalytic (72% Efficiency)	\$2075 \$2425
Gas or Oil Fueled Forced Air Furnace ^{iv} (80% Efficient)	\$1860
Gas or Oil Fueled Forced Air Furnace ^{iv} (90% Efficient)	\$2690
Gas or Oil Hot Water Radiator ^{iv} (80% Efficient)	\$3320
Gas or Oil Hot Water Radiator ^{iv} (90% Efficient)	\$4260

ⁱ Costs are estimated based on average cost of unit plus installation. Does not include cost of internal home piping or duct work. Actual costs may vary widely based on manufacturer, efficiency, and region of the United States.

ⁱⁱ The estimated initial cost of an OWB is the average of the minimum unit cost of the five largest manufacturers plus the average cost of installation materials, based on information obtained by OAG from manufacturers.

ⁱⁱⁱ Houck, J. and Tiegs, P., *Residential Wood Combustion—PM 2.5 Emissions*, OMNI Environmental Services, Inc., Emission Inventory Workshop, Reno, Nevada (July 1998).

^{iv} The average costs of the gas and oil systems are based on surveys conducted by the Consumer Energy Council of America, reported in March 2001 in a report entitled, "*Oil, Gas, or...? An Evaluation of the Economics of Fuel Switching Versus Home Energy Conservation*," available at www.cecarf.org/Publications/MiscPub/FuelSwitchingReport.pdf.

Table 4: Fuel Costs for Various Heating Systems

Type of Fuel	Fuel Price ⁱ	Price per million BTU (Dollars)	Efficiency ⁱⁱ	Price per mmBTU adjusted for efficiency (Dollars)	Total Household Energy Cost per year (Dollars) ⁱⁱⁱ
Wood (for use in OWB)	\$170 per cord	\$8.50	43%	\$19.77	\$1,977 (or less if not all purchased)
Wood (for use in catalytic indoor wood stove)	\$170 per cord	\$8.50	72%	\$11.81	\$1,181 (or less if not all purchased)
Wood (for use in non-catalytic indoor wood stove)	\$170 per cord	\$8.50	68%	\$12.50	\$1,250 (or less if not all purchased)
Oil	\$1.99 per gallon	\$14.35	78%	\$18.40	\$1,840
Gas	\$1.13 per therm	\$11.30	78%	\$14.49	\$1,449
Electricity	\$0.094 per kilowatt hour	\$27.46	97%	\$28.31	\$2,831

ⁱ Average efficiencies and price per million BTU for oil, gas, and electricity based on calculations by the Energy Information Administration, United States Department of Energy. "How do I compare Heating Fuels" (April 7, 2005), available at www.eia.doe.gov/neic/experts/expertanswers.html (last accessed May 31, 2005). We note that wood prices may vary widely compared to oil, gas and electricity. The heating fuel comparison calculator (Rev H-c 4/21/05) is available for download in Microsoft Excel format, available at www.eia.doe.gov/neic/experts/heatcalc.xls.

ⁱⁱ Average wood efficiency based on OWB efficiency testing provided in Appendix B of this report, and EPA, *Residential Wood Combustion Technology Review, Volume I. Technical Report*. EPA-600/R-98-174a. (December 1998).

ⁱⁱⁱ The assumed approximate household energy consumption per year (100 million BTU) is based on the 2003 Annual Energy Review by the Energy Information Administration of the United States Department of Energy, available at www.eia.doe.gov/emeu/aer/consump.html (last accessed April 22, 2005).

C. Environmental Performance

OWB manufacturers have made a variety of claims regarding environmental performance, which do not have technical or scientific basis. One OWB manufacturer claims that its devices are smokeless and create “no creosote, no smoke, and no waste.”³³ Another manufacturer claims that “the tangible proof of complete combustion is no visible smoke.”³⁴ However, any combustion device will create gaseous and particulate emissions³⁵ and all wood combustion will create ash requiring disposal.

In addition, certain claims regarding potential fuels may not be entirely accurate. For example, some manufacturers claim erroneously that wood with high moisture content will create an efficient fire. One manufacturer claims that its OWB “doesn’t smolder, it either burns hot or shuts down. Hotter fire will burn almost any material – even green wood.”³⁶ Another states without basis that “we burn up to ½ less wood and emit up to ½ less smoke.”³⁷ Additionally, some manufacturers, distributors, and dealers of OWBs advise their customers, both in print and verbally, that the stove will burn almost anything, including rotten wood, freshly cut and green wood, old building scraps, wood scraps (including nails), newspapers, corrugated cardboard boxes, pine cones, grass, yard trimmings, and sawdust.³⁸ One manufacturer claims that “our injection air furnace burns any type and quality of wood, wet or dry, unsplit and in lengths of up to 72 inches. The burn time average can reach 48 hours or more per fill.”³⁹ One manufacturer claims that its device can help control allergies, stating, “many people suffer from allergies. With the furnace outside, smoke, fuel odors, and fumes are kept outside.”⁴⁰ Manufacturers and dealers also claim that OWBs will heat large structures while “eliminating waste,” without making clear that household waste should not be burned in the OWB.

IV. Current Regulation of OWBs

³³ Dectra Corporation, *available at* www.dectra.net/garn (last accessed May 24, 2005).

³⁴ Turbo Burn, Inc., *available at* www.turboburn.net (last accessed Feb 25, 2005).

³⁵ One claimed benefit of burning wood in OWBs (and wood stoves) is that wood combustion has the potential to contribute less to global warming than the combustion of fossil fuels if the wood burned is replaced by new trees, which remove carbon from the atmosphere. However, the absence of particulate controls on OWBs may negate any such benefit because the black carbon soot emitted by OWBs also contributes to global warming.

³⁶ Aqua-Therm, LLC., *available at* www.aqua-therm.com (last accessed Feb 18, 2005).

³⁷ Heatmor, Inc., *available at* www.heatmor.com (last accessed May 27, 2005), and OWB owner’s manual, page 25.

³⁸ Mahoning Outdoor Furnace, Inc., *available at* www.shol.com/mahoning (last accessed Feb 25, 2005); Taylor Manufacturing, Inc., *available at* www.taylormfg.com (last accessed May 31, 2005) and OWB sales brochure; Innotech Developments, *available at* www.outdoorfurnaces.com (last accessed Feb 23, 2005).

³⁹ Outside Heating Systems, *available at* www.wooddoctorfurnace.com (last accessed May 26, 2005).

⁴⁰ Freedom Outdoor Furnace, OWB sales brochure.

A. Federal and State Regulations

The EPA does not currently regulate the manufacture, sale, or efficiency claims of OWBs. OWBs are not subject to the federal regulations governing indoor stoves and fireplaces, which are tested and regulated by the EPA for safety, emissions, and efficiency. Any new residential wood stove sold in the United States after July 1, 1992 must be “Phase 2” certified, meaning that it does not emit more than 4.1 grams of particulate matter per hour for catalytic stoves and 7.5 grams of particulate matter per hour for noncatalytic stoves.⁴¹ All of the OWB units tested to date for PM (see Table 2 and Appendix A) far exceed the PM limits that apply to EPA-certified wood stoves.

In New York State, there are no regulations directed particularly at OWBs. DEC regulations provide that “no person shall cause or allow emissions of air contaminants to the outdoor atmosphere of such quantity, characteristic or duration which are injurious to human, plant, or animal life or to property, or which unreasonably interfere with the comfortable enjoyment of life or property.”⁴² Operation of OWBs may also violate the DEC smoke regulation which states, in part, that “no person shall operate a stationary combustion installation which exhibits greater than twenty percent opacity, except for one six-minute period per hour of not more than twenty-seven percent opacity.”⁴³ DEC has taken enforcement actions involving OWB owners on several occasions based on these regulations.

The states of Vermont and Washington do regulate OWBs. The Vermont regulations⁴⁴ include the following provisions:

- (1) Installation of an OWB must be at least 200 feet from the nearest neighboring residence;
- (2) The stack on the furnace must be higher than the roof line if the furnace is between 200 feet and 500 feet from the nearest neighboring home;
- (3) The OWB must comply with local ordinances and its operation must not create a nuisance;
- (4) Dealers and sellers of OWBs must provide buyers with a legal notice stating that: only untreated natural wood may be burned; installation is subject to the distance and stack height requirements stated above; and that the OWB, even if meeting the above requirements, may not be used if the terrain is inappropriate and renders the OWB to be a nuisance or public health hazard. This legal notice must be signed by both the buyer and seller and filed with the Air Pollution Control Division of Vermont prior to delivery of the OWB to the buyer.

⁴¹ Fisher, L., et al., *Long-Term Performance of EPA-Certified Phase 2 Woodstoves, Klamath Falls and Portland, Oregon: 1998/1999*, EPA/600/SR-00/100 (2000); see also, Subpart AAA - Standards of Performance for New Residential Wood Heaters, 40 CFR §§ 60.530-60.539b.

⁴² 6 NYCRR § 211.2.

⁴³ 6 NYCRR § 227-1.3. Opacity is defined as: “The degree to which emissions other than water reduce the transmission of light and obscure the view of an object in the background.” 6 NYCRR§200.1(ay). The generally applicable opacity limit of twenty percent is roughly equivalent to a light grey smoke.

⁴⁴ Vermont Air Pollution Regulation, section 5-204, Outdoor Waterstoves (September 1997).

The Washington regulation⁴⁵ establishes emission standards, certification standards and procedures, curtailment rules, and fuel restrictions for solid fuel burning devices. OWBs are considered solid wood burning devices, which, after January 1, 1995, must be shown to comply with an emission standard of 4.5 grams PM per hour before they can be offered for sale in the State of Washington. Prohibited fuels include garbage, treated wood, plastic and plastic products, rubber products, animal carcasses, asphaltic products, waste petroleum products, paints and chemicals, and any substance that normally emits dense smoke or obnoxious odors. OWBs, like other solid fuel burning devices, must comply with an opacity standard not to exceed an average of 20 percent opacity for six consecutive minutes in any one-hour period. Retailers must provide information on the proper operation of the unit, including information that opacity levels of ten percent or less are attainable through proper operation.

B. Local Requirements

Some local governments in New York State have deemed OWBs a nuisance because of smoke and toxic emissions. Several towns and villages have placed restrictions on OWBs ranging from meeting certain requirements for setback distances, chimney height, terrain, population density and other factors, to outright bans. These municipal requirements are shown in Table 5.



⁴⁵ Washington Administrative Code 173-433-100 (3), Solid Fuel Burning Devices (January 1995).

Table 5: Municipalities with Requirements Pertaining to OWBs

Town / Village and County	Date	Regulate*	Ban
Barneveld, Village of (Oneida County)	Apr 2005		X
Camden, Village of (Oneida County)	June 1999		X
Canton, Town of (St. Lawrence County)	Dec 2003		X
Edwards, Village of (St. Lawrence County)	June 2003		X
Heuvelton, Village of (St. Lawrence County)	Nov 2003		X
Holland Patent, Village of (Oneida County)	Apr 2005		X
Kingsbury, Town of (Washington County)	Sep 2004	X	
Lowville, Village of (Lewis County)	Dec 2001		X
Marcellus, Village of (Onondaga County)	Jan 2004		X
Moreau, Town of (Saratoga County) (proposed)	Oct 2004	X	
Otego, Village of (Otsego County)	Mar 2001	X	X
Prospect, Village of (Oneida County)	Mar 2005		X
Queensbury, Town of (Warren County)	May 2004	X	
South Glens Falls, Village of (Saratoga County)	Dec 2003	X	
Watertown, City of (Jefferson County)	Oct 2003		X

* See Box on following page for further details on requirements.

Specific Requirements of New York State Municipalities Regarding OWBs.

Town of Kingsbury - Installation of an OWB requires a permit and must meet the following requirements: (a) installed, operated, and maintained according to manufacturer instructions, (b) fueled with natural untreated woods, (c) set back at least 25 feet from nearest property line, and (d) minimum chimney height of 15 feet.

Town of Moreau (proposed) - A permit, issued by the Town Building Inspector or Code Enforcement Officer, is required for operation of an OWB and must meet the following requirements: (a) only firewood and untreated lumber may be burned, (b) may be installed only in permitted zones, (c) must be installed on a lot of three acres or more, (d) must be set back at least 500 feet from nearest lot line, (e) may only be operated between September 1st and May 31st, and (f) must be equipped with a properly functioning spark arrester.

Village of Otego - The construction and operation of OWBs are prohibited with the exception of OWBs already in operation. No OWB already in operation may be extended, enlarged, or restored beyond 75% of its value, and/or re-established after use is discontinued for more than seven months.

Town of Queensbury - A permit is required for operation of an OWB and must meet the following requirements: (a) only firewood and untreated lumber may be burned, (b) may be installed only in permitted zones, (c) must be installed on a lot of three acres or more, (d) must be set back at least 200 feet from nearest lot line, (e) may only be operated between September 1st and May 31st, and (f) must be equipped with a properly functioning spark arrester.

Village of South Glens Falls - Installation of any OWB must meet the following requirements: (a) smokestack must exceed four feet and be higher than any adjacent structure within 50 feet of the furnace, (b) must be installed at least 200 feet from the closest residential property line, (c) may only burn wood, and (d) may not be used as a waste incinerator.

V. Recommendations

A. Develop Federal and State Regulations

The adoption of federal regulations is the best way to address effectively the problems identified in this report. Ideally, such regulations would require emissions testing, performance standards, and control technologies to ensure that OWBs are environmentally sound and do not pose a health hazard to users and neighbors. Given the complexities of establishing testing protocols and emission limits, there are significant advantages to manufacturers of federal regulation, instead of a multitude of state and local limits. Consistent with all other Clean Air Act programs, however, it must be clear that any federal regulations only set a floor for health protections, and that states are free to enact stricter protections.

In the absence of federal regulations, DEC could fill the regulatory void by developing an air quality regulatory program that would effectively address OWB problems across the state. DEC could establish siting, operation, and disclosure standards and perhaps emission limits. A DEC rulemaking would offer the additional advantage of providing interested affected parties with the opportunity to shape policy through submission of comments and participation in rulemaking hearings.

B. Adopt Local Requirements

Towns and villages can evaluate the suitability of OWB operation in their jurisdictions. Just as local zoning codes can address activities that create nuisances and require permits or establish conditions for certain activities, communities can consider requiring permits before installation of an OWB, especially in more densely settled areas. In evaluating permit applications, determinations can be made whether local conditions such as setback distances, terrain, and sensitive neighbors such as schools, hospitals and residences are compatible with OWB operation.

Local requirements could limit acceptable fuel to dry, natural, and untreated wood. A document acknowledging that limitation, signed by the OWB purchaser, could be filed with the local code officer, thereby becoming an enforceable condition of the usage of the OWB. The Town of Queensbury's ordinance is shown in Appendix D, as an example.

C. Improve Performance of and Information About OWBs

Even in the absence of regulation, manufacturers can take steps to reduce OWB emissions by adding pollution control devices such as catalytic converters, installing taller stacks for smoke dispersal, or re-designing OWB units to minimize the smoldering and smoke that are inherent in the majority of the OWBs currently on the market.

Even before OWBs are improved, manufacturers should ensure that their advertising and marketing materials reflect the basis for any claims about efficiency, cost, and environmental performance and that handling instructions make clear that only dry seasoned wood be burned. Retailers should help prospective customers assess the suitability of an OWB in light of the customer's property, taking into account such factors as proximity of neighboring residences, terrain, and nearby property uses (residential, commercial, industrial, size of OWB, etc.).

Finally, OWB manufacturers and distributors should commit to provide technical assistance in the event that an OWB creates a smoke nuisance for an OWB owner or neighbors, or is not working as advertised. The manufacturer or distributor, by phone or personal visit, should evaluate the situation and recommend technical solutions, such as extending the smoke stack to a height that is greater than the height of the neighboring roof line or the installation of a control apparatus, such as a catalytic device.

D. Increase Consumer Awareness

Before purchasing an OWB, potential buyers should consider the size and location of their property, their heating needs, and suitable wood availability in addition to local laws and regulations. Consumers should carefully scrutinize manufacturer claims.

For people who have already purchased an OWB or who live near an OWB that is creating smoky conditions, these steps may help resolve the situation:

- (1) OWB owners should make sure they are operating the OWB only with suitable materials. If smoky conditions persist despite burning of proper materials, contact the manufacturer or distributor of the OWB unit. The manufacturer may be able to assess, adjust, and/or retrofit the unit to reduce the smoke or emissions problem by, for example, installing a taller smoke stack and/or catalytic device.
- (2) If the manufacturer or distributor cannot or will not provide assistance, or if the OWB operator will not contact the manufacturer or distributor, contact the regional DEC office that serves the county. The DEC may be able to assist in evaluating the smoke opacity to determine whether excessive smoke is present and may be able to suggest ways to improve the situation. Contact information for local officials, regional offices of the DEC, and county health departments is listed in Appendix C.
- (3) OWBs should not be used to burn pressure treated wood, painted wood, household garbage or other waste materials. Local zoning or building code officers, local fire officials, a regional DEC office, or county health departments should be called for assistance.
- (4) If experiencing conditions detrimental to health (smoke in the home causing respiratory difficulties, for example), contact the public health department that serves the county (See contact list in Appendix C). The county or state DOH may be able to assist in evaluating the situation to determine if a condition exists that is detrimental to life or health.
- (5) If neither DEC nor DOH is able to assist, contact the Environmental Protection Bureau at the New York State Office of the Attorney General for further advice and assistance at 1-518-474-8096 or 1-800-771-7755.

APPENDIX A: EMISSIONS FROM OUTDOOR WOOD BOILERS AS DETERMINED IN EPA OR LABORATORY TESTS ⁱ

OWB	Particulate Matter (grams per hour)	Polycyclic Aromatic Hydrocarbons (grams per hour)	Number of Tests
OWB A ⁱⁱ	73	1.2	4
OWB B ⁱⁱ	26	0.72	4
OWB C ⁱⁱⁱ	84	NA	5
OWB D ⁱⁱⁱ	60	NA	4
OWB E ⁱⁱⁱ	108	NA	2
OWB F ⁱⁱⁱ	18	NA	2
OWB G ⁱⁱⁱ	49	NA	7
OWB H ⁱⁱⁱ	33	NA	2
OWB I ^{iv}	147	NA	2
OWB J ^{iv}	118	NA	2
OWB K ^v	179	NA	1 cordwood
OWB L ^v	269	NA	1 lumber
Average ^{vi}	71.6	0.96	

ⁱ The results from Intertek and Omni laboratories were provided to the OAG by the manufacturers. Note that due to the current lack of an established test methodology, the tests used may have differed. Thus, the results should be considered as a whole; comparisons between boilers may not be appropriate. For this reason, manufacturers' names are omitted.

ⁱⁱ Valenti, J. and Clayton, R., *Emissions from Outdoor Wood-Burning Residential Hot Water Furnaces*, EPA-600/R-98-017 (February 1998); names of OWB manufacturer 'A' and 'B' not provided in report.

ⁱⁱⁱ Intertek Laboratories 2004.

^{iv} Omni Laboratories 2004.

^v Intertek Laboratories 2004. Data provided on behalf of ASTM Committee to develop testing methods, using old 'nameless' OWB; data excluded from calculation of average.

^{vi} Average of OWB units A through J; data excluded for OWB units K and L.

APPENDIX B: HEATING EFFICIENCY OF OUTDOOR WOOD BOILERSⁱ

OWB	Heating Efficiency	Number of Tests
OWB A ⁱⁱ	45%	4
OWB B ⁱⁱ	55%	4
OWB C ⁱⁱⁱ	30%	5
OWB D ⁱⁱⁱ	37%	4
OWB E ⁱⁱⁱ	28%	2
OWB F ⁱⁱⁱ	31%	2
OWB G ⁱⁱⁱ	55%	7
OWB H ⁱⁱⁱ	37%	2
OWB I ^{iv}	55%	2
OWB J ^{iv}	53%	2
OWB K ^v	45%	1 cordwood
OWB L ^v	46%	1 lumber
Average^{vi}	43%	

ⁱ The results from Intertek and Omni Laboratories were provided to the OAG by the manufacturers. Note that due to the current lack of an established test methodology, the tests used may have differed. Thus, the results should be considered as a whole; comparisons between boilers may not be appropriate. For this reason, manufacturers' names are omitted.

ⁱⁱ Valenti, J. and Clayton, R., *Emissions from Outdoor Wood-Burning Residential Hot Water Furnaces*, EPA-600/R-98-017 (February 1998); names of OWB manufacturer 'A' and 'B' not provided in report.

ⁱⁱⁱ Intertek Laboratories 2004.

^{iv} Omni Laboratories 2004.

^v Intertek Laboratories 2004. Data provided on behalf of ASTM Committee to develop testing methods, using old 'nameless' OWB; data excluded from calculation of average.

^{vi} Average of OWB units A through J; data excluded for OWB units K and L.

APPENDIX C: NEW YORK STATE CONTACTS FOR OWB PROBLEMS

(1) Local Zoning, Health, and Code Enforcement Officials

New York State County, City, Town, and Village Contact Information is available in local telephone directories or is *available at*

www.nysgov.com/citguide.cfm?context=citguide&content=munibycounty1

(2) Regional Department of Environmental Conservation (DEC) Offices

Region	County	DEC Regional Office
1	Nassau and Suffolk	631-444-0205
2	Bronx, Brooklyn, Manhattan, Queens, and Staten Island	718-482-4944
3	Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, and Westchester	845-256-3045
4	Albany, Columbia, Delaware, Greene, Montgomery, Otsego, Rensselaer, Schoharie, and Schenectady	518-357-2350
5	Clinton, Essex, Franklin, Fulton, Hamilton, Saratoga, Warren, and Washington	518-623-1212
6	Herkimer, Jefferson, Lewis, Oneida, and St. Lawrence	315-785-2513
7	Broome, Cayuga, Chenango, Cortland, Madison, Onondaga, Oswego, Tioga, and Tompkins	315-426-7552
8	Chemung, Genesee, Livingston, Monroe, Ontario, Orleans, Schuyler, Seneca, Steuben, Wayne, and Yates	585-226-5311
9	Allegany, Cattaraugus, Chautauqua, Erie, Niagara, and Wyoming	716-851-7130

(3) County Health Department

County	Health Department	County	Health Department
Albany	518-447-4620	Niagara	716-439-7444
Allegany	585-268-9250	Oneida	315-798-5064
Bronx (NYC)	212-268-7185	Onondaga	315-435-6623
Broome	607-778-2887	Ontario	315-789-3030
Cattaraugus	716-373-8050	Orange	845-291-2331
Cayuga	315-253-1405	Orleans	585-589-3272
Chautauqua	716-753-4481	Oswego	315-349-3564
Chemung	607-737-2019	Otsego	607-432-3911
Chenango	607-337-1673	Putnam	845-278-6130
Clinton	518-565-4870	Queens (NYC)	212-268-7185
Columbia	518-828-3358	Rensselaer	518-270-2674
Cortland	607-753-5035	Richmond (NYC)	212-268-7185
Delaware	607-432-3911	Rockland	845-364-2608
Dutchess	845-486-3404	St. Lawrence	315-386-1040
Erie	716-858-7677	Saratoga	518-793-3893
Essex	518-891-1800	Schenectady	518-386-2818
Franklin	518-891-1800	Schoharie	518-295-8382
Fulton	315-866-6879	Schuyler	607-324-8371
Genesee	585-344-8506	Seneca	315-539-1945
Greene	607-432-3911	Steuben	607-324-8371
Hamilton	518-891-1800	Suffolk	631-853-3058
Herkimer	315-866-6879	Sullivan	845-794-2045
Jefferson	315-785-2277	Tioga	607-687-8566
Kings (NYC)	212-268-7185	Tompkins	607-274-6688
Lewis	315-785-2277	Ulster	845-340-3150
Livingston	585-243-7280	Warren	518-793-3893
Madison	315-366-2526	Washington	518-793-3893
Monroe	585-274-6067	Wayne	315-789-3030
Montgomery	315-866-6879	Westchester	914-813-5000
Nassau	516-571-3410	Wyoming	585-786-8894
New York (NYC)	212-268-7185	Yates	315-789-3030

(4) New York State Office of the Attorney General
 Environmental Protection Bureau: 800-771-7755

APPENDIX D: TOWN OF QUEENSBURY ORDINANCE

LOCAL LAW NO.: ___ OF 2004

A LOCAL LAW TO AMEND THE QUEENSBURY TOWN CODE BY REPLACING CHAPTER 119 ENTITLED "OUTDOOR FURNACES" WITH A NEW CHAPTER 119 REGULATING THE USE OF OUTDOOR FURNACES IN THE TOWN OF QUEENSBURY.

BE IT ENACTED BY THE TOWN BOARD OF THE TOWN OF QUEENSBURY AS FOLLOWS:

1. **Title and Authority** – This Local Law shall be known as the Town of Queensbury Outdoor Furnace Local Law. It is adopted pursuant to Municipal Home Rule Law § 10.

2. **Legislative Intent** – Although outdoor furnaces may provide an economical alternative to conventional heating systems, concerns have been raised regarding the safety and environmental impacts of these heating devices, particularly the production of offensive odors and potential health effects of uncontrolled emissions. This Local Law is intended to ensure that outdoor furnaces are utilized in a manner that does not create a nuisance and is not detrimental to the health, safety and general welfare of the residents of the Town.

3. **Definitions** – "Outdoor Furnace" means any equipment, device or apparatus, or any part thereof, which is installed, affixed or situated outdoors for the primary purpose of combustion of fuel to produce heat or energy used as a component of a heating system providing heat for any interior space.

"Untreated Lumber" means dry wood which has been milled and dried but which has not been treated or combined with any petroleum product, chemical, preservative, glue, adhesive, stain, paint or other substance.

"Firewood" means trunks and branches of trees and bushes but does not include leaves, needles, vines or brush smaller than three inches (3") in diameter.

4. **Permit Required** – No person shall cause, allow or maintain the use of an Outdoor Furnace within the Town of Queensbury without first having obtained a permit from the Town Fire Marshal. Application for permit shall be made to the Fire Marshal on the forms provided.

5. **Existing Outdoor Furnaces** – Any Outdoor Furnace in existence on the effective date of this Local Law shall be permitted to remain provided that the owner applies for and receives a permit from the Town Fire Marshal within one (1) year of such effective date; provided, however, that upon the effective date of this Local Law all the provisions hereof except paragraphs 6(B), (C) and (D) shall immediately apply to existing Outdoor Furnaces. All of the provisions of this Local Law shall continue to apply to existing Outdoor Furnaces which receive permits except paragraphs 6(B), (C) and (D). If the owner of an existing Outdoor Furnace does not receive a permit within one (1) year of the effective date of this Local Law, the Outdoor Furnace shall be removed. "Existing" or "in existence" means that the Outdoor Furnace is in place on the site.

6. **Specific Requirements** –

A. **Permitted Fuel** – Only Firewood and Untreated Lumber are permitted to be burned in any Outdoor Furnace. Burning of any and all other materials in an Outdoor Furnace is prohibited.

B. Permitted Zones – Outdoor Furnaces shall be permitted only in the LC-10A, LC-42A, RR-5A zoning districts as shown on the Town’s Zoning Map.

C. Minimum Lot Size – Outdoor Furnaces shall be permitted only on lots of three (3) acres or more.

D. Setbacks – Outdoor Furnaces shall be set back not less than 200 feet (200’) from the nearest lot line.

E. Months of Operation – Outdoor Furnaces shall be operated only between September 1st and May 31st.

F. Spark Arrestors – All Outdoor Furnaces shall be equipped with properly functioning spark arrestors.

7. **Suspension of Permit** – A permit issued pursuant to this Local Law may be suspended as the Fire Marshal may determine to be necessary to protect the public health, safety and welfare of the residents of the Town of Queensbury if any of the following conditions occurs:

A. Emissions from the Outdoor Furnace exhibit greater than 20 percent (20%) opacity (six minute average), except for one continuous six-minute period per hour of not more than 27 percent (27%) opacity, which shall be determined as provided in 6 NYCRR 227-1.3(b);

B. Malodorous air contaminants from the Outdoor Furnace are detectable outside the property of the person on whose land the Outdoor Furnace is located;

C. The emissions from the Outdoor Furnace interfere with the reasonable enjoyment of life or property;

D. The emissions from the Outdoor Furnace cause damage to vegetation or property; or

E. The emissions from the Outdoor Furnace are or may be harmful to human or animal health.

A suspended permit may be reinstated once the condition which resulted in suspension is remedied and reasonable assurances are given that such condition will not recur. Recurrence of a condition which has previously resulted in suspension of a permit shall be considered a violation of this Local Law subject to the penalties provided in paragraph 9 hereof.

8. **Waivers; Board of Health Ratification** – Where the Town Board of Health finds that extraordinary and unnecessary hardships may result from strict compliance with this Local Law, it may vary the regulations so that substantial justice may be done and the public interest secured, provided that such variations will not have the effect of nullifying the intent and purpose of this Local Law or of jeopardizing the health, safety or welfare of the public. In varying any regulations, the Board of Health may impose such conditions and requirements as it deems reasonable and prudent. The Board of Health may, at its discretion, hold a public hearing as part of its review. If the Board of Health grants the waiver, a permit shall be issued for the Outdoor Furnace. If the Board of Health denies the waiver, the Outdoor Furnace must either be brought into compliance with this Local Law or removed. If the Board of Health does not take any action with respect to the waiver within sixty (60) days from its receipt of an

application for waiver, the waiver shall be deemed denied.

9. Enforcement; Revocation of Permit – Failure to comply with any of the provisions of this Local Law shall be a violation and, upon conviction thereof, shall be punishable by a fine of not more than \$500 or imprisonment for a period of not more than ten (10) days, or both, for the first offense. Any subsequent offense shall be punishable by a fine of not more than \$1,000 or imprisonment for a period of not more than thirty (30) days, or both. In addition, any permit issued pursuant to this Local Law shall be revoked upon conviction of a second offense and the subject Outdoor Furnace shall not be eligible for another permit. Each day that a violation occurs shall constitute a separate offense. The owners of premises upon which prohibited acts occur shall be jointly and severally liable for violations of this Local Law. Any fine imposed hereunder shall constitute a lien upon the real property where the Outdoor Furnace is located until paid.

10. Effect of Other Regulations – Nothing contained herein shall authorize or allow burning which is prohibited by codes, laws, rules or regulations promulgated by the United States Environmental Protection Agency, New York State Department of Environmental Conservation, Adirondack Park Agency, Lake George Park Commission any other federal, state, regional or local agency. Outdoor Furnaces, and any electrical, plumbing or other apparatus or device used in connection with an Outdoor Furnace, shall be installed, operated and maintained in conformity with the manufacturer’s specifications and any and all local, State and Federal codes, laws, rules and regulations. In case of a conflict between any provision of this Local Law and any applicable Federal, State or local ordinances, codes, laws, rules or regulations, the more restrictive or stringent provision or requirement shall prevail.

11. Severability – The invalidity of any clause, sentence, paragraph or provision of this Local Law shall not invalidate any other clause, sentence, paragraph or part thereof.

12. Repealer – All Local Laws or ordinances or parts of Local Laws or ordinances in conflict with any part of this Local law are hereby repealed.

13. Effective Date – This Local Law shall take effect upon filing in the office of the New York State Secretary of State or as otherwise provided by law.

APPENDIX E: REFERENCES AND ADDITIONAL INFORMATION

American Lung Association, *Wood Smoke Affects your Health* (September 1990).

Bascom, R., *Health effects of outdoor air pollution*, Am J Respir Crit Care Med 153:477-498 (1996).

Brook, R., et al., American Heart Association, *AHA Scientific Statement: Air Pollution and Cardiovascular Disease. A statement for Healthcare Professionals from the Expert Panel on Population and Prevention Science of the American Heart Association*, 109: 2655-2671 (June 1, 2004), available at <http://circ.ahajournals.org/cgi/reprint/109/21/2655>

Consumer Energy Council of America. "Oil, Gas, or...? An Evaluation of the Economics of Fuel Switching Versus Home Energy Conservation." Final Report (March 2001), available at www.cecacr.org/Publications/MiscPub/FuelSwitchingReport.pdf

Dockery, D. and Pope, C., *Acute respiratory effects of particulate air pollution*, Annu Rev Public Health 15: 107-132 (1994).

Energy Information Administration, United States Department of Energy. Heating Fuel Cost Comparison Calculator, available at www.eia.doe.gov/neic/experts/heatcalc.xls

Fairley, D., *The relationship of daily mortality to suspended particulates in Santa Clara County, 1980-1986*, Environ Health Perspect 89: 159-168 (1990).

Ostro, B., *Fine particulate air pollution and mortality in two Southern California counties*, Environ Res 70: 98-104 (1995).

Pope, C., et al., *Daily mortality and PM10 pollution in Utah Valley*, Arch Environ Health 47: 211-217 (1992).

Pope, C., et al., *Particulate air pollution and daily mortality on Utah's Wasatch Front*, Environ Health Perspect 107: 567-573 (1999).

Samet, J., et al., *Fine particulate air pollution and mortality in 20 U.S. cities, 1987-1994*, New England Journal of Medicine 343: 1742-1749 (2000).

Schwartz, J., *Air pollution and daily mortality in Birmingham, Alabama*, Am J Epidemiol 137: 1136-1146 (1993).

Schwartz, J., *What are people dying of on high air pollution days?* Environ Res 64: 26-35 (1994).

Schwartz, J., et al., *Is daily mortality associated specifically with fine particles?*, J Air Waste Manag Assoc 46: 927-939 (1996).

Tesfaigzi, Y., et al., *Health effects of subchronic exposure to low levels of wood smoke in rats*, Toxicological Sciences 65: 115-125 (2002).

Vedel S., *Ambient particles and health: lines that divide*, J Air Waste Manag Assoc 47: 551-581(1997).

Wordley, J., et al., *Short term variations in hospital admissions and mortality and particulate air pollution*, *Occup Environ Med* 54: 108-116 (1997).

Zelikoff, J., et al., *The toxicology of inhaled woodsmoke*, *J Toxicology and Environmental Health, Part B*, 5: 269-282 (2002).

Select Websites for More Information

American Lung Association, available at www.lungusa.org

Woodburning, available at www.lungusa.org/site/pp.asp?c=dvLUK900E&b=23354

Clean Air Revival, Inc. Burning Issues, available at www.BurningIssues.com

Department of Environmental Conservation, New York State, available at www.dec.state.ny.us

Environmental Protection Agency, United States.

Main Web Page, available at www.epa.gov

Fine Particulate Matter, available at www.epa.gov/pmdesignations/index.htm

Puget Sound Clean Air Agency, available at www.psecleanair.org

Hearth, Patio, and Barbecue Association, available at www.hpba.org

Smoke Troubleshooting Checklist for OWBs, available at

www.hpba.org/govrelations/troubleshootingGuidelines.pdf

Office of the Attorney General, New York State, available at www.oag.state.ny.us

Washington State Department of Ecology

Outdoor Burning, available at www.ecy.wa.gov/pubs/9204.pdf

Health Effects of Wood Smoke, available at www.ecy.wa.gov/biblio/92046.html

OWB Manufacturers

Alternate Heating Systems, Inc.

2395 Little Egypt Road

Harrisonville, PA 17228

www.alternateheatingsystems.com

Aqua-Therm LLC

48301 State Hwy 55

Brooten, MN 56316

www.aqua-therm.com

Central Boiler, Inc.

20502 160th Street

Greenbush, MN 56726

www.centralboiler.com

Charmaster Products, Inc.

2307 Highway 2 West

Grand Rapids, MN 55744

www.charmaster.com

Dectra Corporation

3425 33rd Ave NE

St. Anthony, MN 55418

www.dectra.net/garn

Freedom Outdoor Furnace

7958 Curwensville Tryone Hwy

Olanta, PA 16863

www.freedomoutdoorfurnace.com/

Global Hydronics
Box 717
Winkler, Manitoba CANADA R6W 4A1
www.globalhydronics.com

Heatmor Inc.
105 Industrial Park Court NE
Warroad, MN 56763
www.heatmor.com

Heatsource1
2201 Ridgeview Drive
Beatrice, NE 68310
www.heatsource1.com

Horstmann Industries, Inc.
301 Second Street
Elroy, WI 53929
www.royalfurnace.com

Johnson Manufacturing
N5499 County E
Ogdensburg, WI 54962
www.hud-son.com/woodfurnaces.htm

Noonan's Welding & Heating
105 1st Street South
Keewatin, MN 55753
www.northlandoutdoorwoodfurnace.com

Outside Heating Systems - Wood Doctor
Box 567
Stewiacke, NS
B0N 2J0 Canada
www.wooddoctorfurnace.com

Tarm USA, Inc.
Main Street Box 285
Lyme, NH 03768
www.woodboilers.com

Timber Ridge, Inc.
2020 Highway 11-E
Jonesborough, TN 37659
www.freeheatmachine.com

Hardy Manufacturing
12345 Road 505
Philadelphia, MS 39350
www.hardyheater.com

Heat Innovations
499 Manitoba Road
P.O. Box 989
Winkler, MB R6W 4B1
www.heatinn.com

Hicks Waterstoves and Solar Systems
2541 South Main Street
Mount Airy, NC 27030

Innotech Developments
2015 James Street South
Thunder Bay, ON P7J1G6
www.outdoorfurnaces.com

Mahoning Outdoor Furnace
RD #1 Box 250
Mahaffey, PA 15754
www.shol.com/mahoning

Northwest Manufacturing
600 Polk Ave SW
Red Lake Falls, MN 56750
www.woodmaster.com

Pro-Fab Industries/Cozeburn
Box 112
Arborg, Manitoba, Canada ROC OAO
www.profab.org

Taylor Manufacturing, Inc.
1585 US HWY 701 South
Elizabethtown, NC 28337
www.taylormfg.com

Turbo Burn, Inc.
4225 E Joseph
Spokane, WA 99217
www.turboburn.net

Air Quality

[Air Quality](#) > Outdoor Wood-Fired Boilers

Outdoor Wood-Fired Boilers

Outdoor wood-fired hydronic heaters, also called outdoor wood-fired boilers, are not allowed in the state of Washington at this time. This site is designed to help you get the facts before purchasing a wood-fired boiler. If you have any questions about outdoor wood-fired boilers, please [contact us](#).

With rising energy costs, more Washington residents are using wood as a source of heat and hot water. But not all wood heat is the same. EPA tests and certifies indoor wood stoves for emissions, but does not test or certify outdoor wood-fired boilers. Because outdoor wood-fired boilers are used year-round, they burn much more wood than wood stoves do. They can emit nearly twice as much smoke per hour as an EPA-certified wood stove. The air pollutants in this smoke are bad for your health and that of your family and neighbors. They also harm the environment.



- [What are outdoor wood-fired boilers?](#)
- [Are any outdoor wood-fired boilers legal in Washington?](#)
- [What causes outdoor wood-fired boilers to smoke?](#)
- [How can smoke from natural wood burning be harmful?](#)
- [If I want to burn wood, what should I do?](#)
- [Learn more about the health effects of wood smoke pollution](#)

What are outdoor wood-fired boilers?

Outdoor wood-fired boilers are wood-fired water heaters that are located outdoors or are separated from the space being heated. The fires in the large fire boxes heat water that is circulated into the home through underground pipes. The energy may be used to heat houses, shops, domestic hot water, greenhouses, swimming pools and spas.

Indoor wood-fired boilers are subject to the same regulations as outdoor wood-fired boilers.

Are any outdoor wood-fired boilers legal in Washington?

Not at this time. However, Ecology is willing to consider allowing outdoor wood-fired boilers to be sold in Washington if the manufacturers can show they meet Washington's standards. To show an outdoor wood-fired boiler meets Washington's standards, a manufacturer must:

- have the device tested using a test method that Ecology considers adequate and acceptable; and
- submit test results to Ecology showing the device emits no more than 4.5 grams of fine particles per hour.

To date, no manufacturers have shown they meet these requirements.

Ecology also wants to be sure that stack height and setbacks are sufficient to protect the health of people in the neighborhood.

EPA has a voluntary program for manufacturers of outdoor wood-fired boilers. Boilers that are accepted into this program meet stricter guidelines and pollute less than older models. However, test results for this program have been achieved using a hardwood (oak) test fuel, which may under-report the amount of smoke emitted. Manufacturers need to provide test results using Douglas fir, which is the standard test fuel used for wood stoves and other wood burning devices.

Get more information about [EPA's voluntary program](#).

What causes outdoor wood-fired boilers to smoke?

Manufacturers continue to work on improving the efficiency of outdoor wood-fired boilers. Early models use very primitive combustion technology that cuts the air supply to the firebox when a set temperature is reached. This causes large amounts of smoke. Most of the smoke emitted is fine condensed organic material that does not burn under cool, low-oxygen conditions. Burning wood that is too wet can also cause poor combustion and heavy smoke. (State law says wood to be burned must have less than 20 percent moisture content.)

How can smoke from burning natural wood be harmful?

Wood smoke from wood stoves and wood-fired boilers is harmful because it contains very fine particles. These particles are so small they can be carried deep into the lungs where they cause significant health problems such as asthma, lung diseases, heart diseases and death. These particles can also increase the risks of certain types of cancer. Breathing smoke is especially harmful for children, the elderly, and people with heart and lung problems. It is estimated that fine particle air pollution costs citizens of Washington hundreds of millions of dollars each year in health care costs and lost productivity due to illness.

If I want to burn wood, what should I do?

- Buy a wood burning device that is certified by EPA, and that is as clean and efficient as possible.

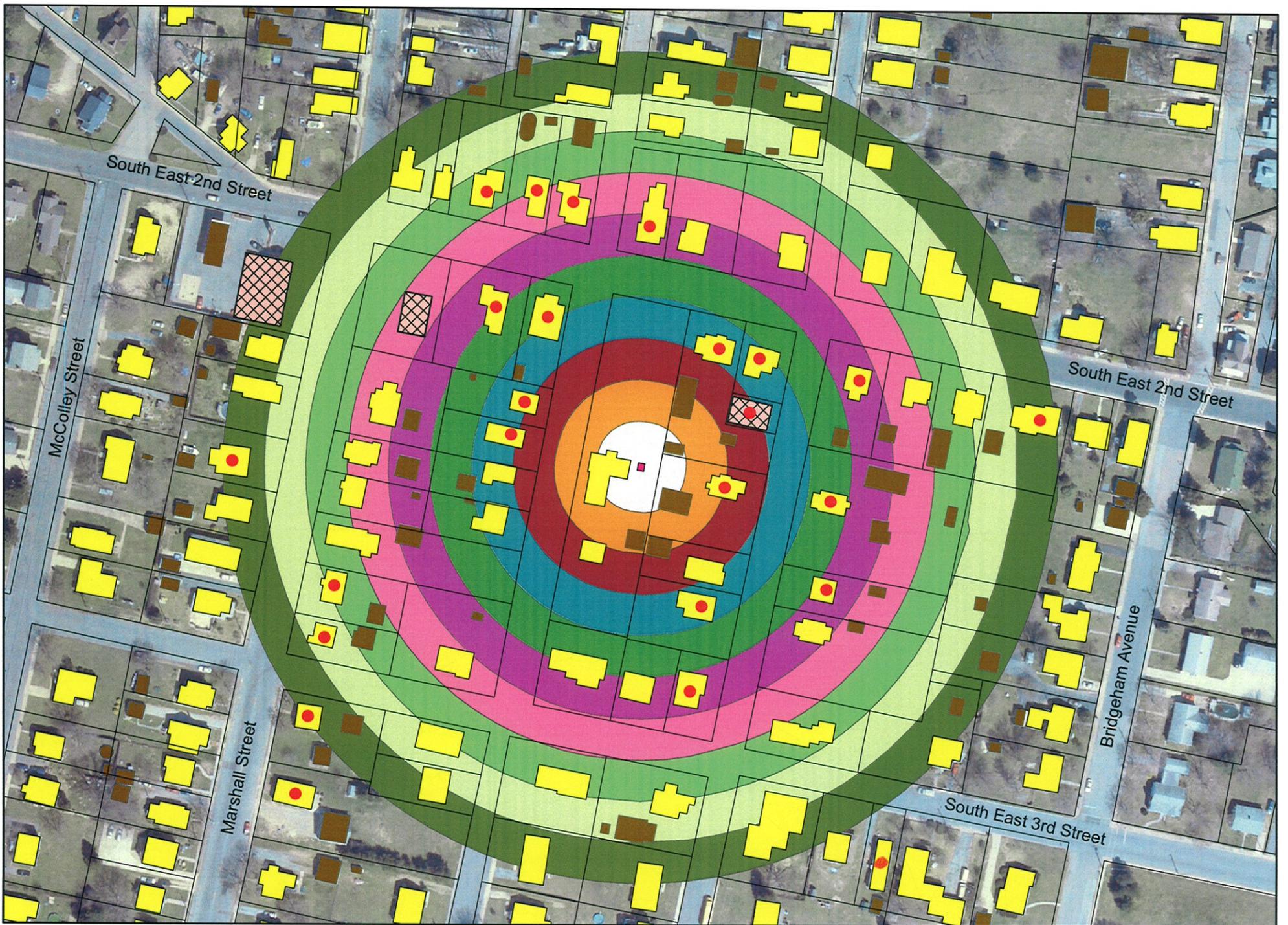
- Consider your neighbors. Burning wood in dense residential neighborhoods may never be a good idea, but it is especially bad during temperature “inversions,” when the air is still and cold.
- Have an energy expert inspect your home. You may find that more insulation or other energy saving improvements may be a better investment than an expensive wood heating device.

References

- [EPA outdoor wood-fired boiler sites](#)
- [Massachusetts wood-fired boilers web site](#)
- [Vermont's wood-fired boilers web site](#)
- [Wisconsin's wood-fired boilers web site](#)
- [Air pollution and health information](#)

[Contact us](#)

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Radius in 50' Increments

SIGNATURE LOCATIONS



Furnace



Residential



Commercial



Accessory Structure





208

ADOPT
A
HIGHWAY
IN MEMORY OF
SAM & GLADYS GILLESPIE

444 EB
0000 9

3









Milford Police Departments Annual Night Out



When: Tuesday, August 2nd

Where: Bicentennial Park

Time: 6 p.m. till 8 p.m.

The purpose of this event is to heighten awareness of our services and crime prevention, but more importantly to continue to build a strong relationship with the Milford Community. Please come out and support your local police department in this community event. There will be music, free food, drinks, and emergency vehicles on display. Also, representatives from the following agencies will have displays available;

Delaware Dept. of Highway Safety

CrimeStoppers

Delaware Division of Fish and Wildlife Enforcement

Delaware Red Cross

Carlisle Fire Dept.

University of Delaware Safety Extension

Delaware Attorney General's Office Child Predator Task Force

Delaware Emergency Management Agency

City of Milford

Southeast Neighborhood Master Plan

Presentation Prepared by:

Gary Norris, AICP
City Planner, City of Milford

David Edgell, AICP
Principal Planner, Office of State Planning



SE Master Plan

Background & History

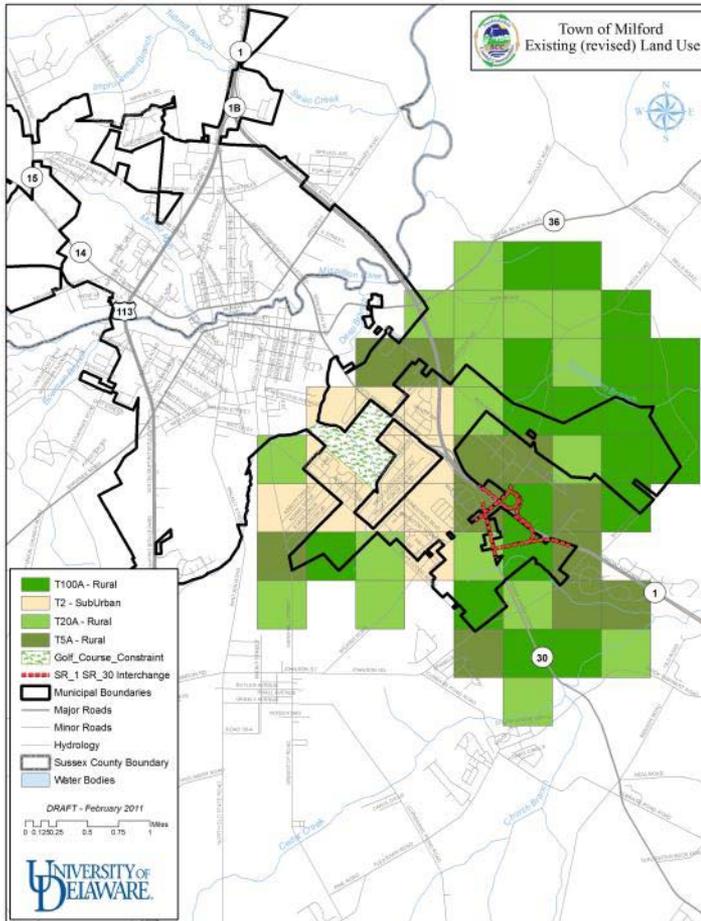
- Prior to 2008, the City was concerned about proposed residential development happening east of Rt 1.
- In 2008, a Memorandum of Agreement was signed by the City and the Office of State Planning which required a Comprehensive Master Plan for the SE Neighborhood be developed.
- State of Delaware and it's agencies formed a unique partnership with the City of Milford
 - Office of State Planning Coordination
 - Delaware Department of Transportation
 - Delaware Department of Natural Resources and Environmental Control
 - Delaware Department of Agriculture
 - Other agencies contributed
- Three public meetings were held in fall of 2009, encouraging the public's input on the end product east of Rt 1 and the overall SE Neighborhood.
- One option was selected out of three scenarios.

Land Use Modeling

- The City and State Agencies partners were assisted greatly by the University of Delaware, Sustainable Coastal Community Initiative.
- UD SCCI assisted us with their land use model for Sussex County, which is based on computer software called CommunityViz[®]



Existing Land Use (2010)



Dwelling Units	1,900
Residents	4,700
Nonresidential Floor Area	0
Employees	260

Existing Land Use Profile

- Predominantly rural landscape
- Approximately 20% of neighborhood comprised of low density residential villages offering single family (SF) and multi-family (MF) villa-type homes with golf course/open space connected to Milford City Center
- Multijurisdictional with intermingled incorporated lands (City of Milford) and unincorporated lands from Sussex County; borders Kent County at northern edge
- Over 80% of community agricultural along with environmentally sensitive riverine lands to north, east and south
- Scenic highway corridor (SR 1) provides opportunity for transportation-oriented development and retail center at SR 30 Interchange

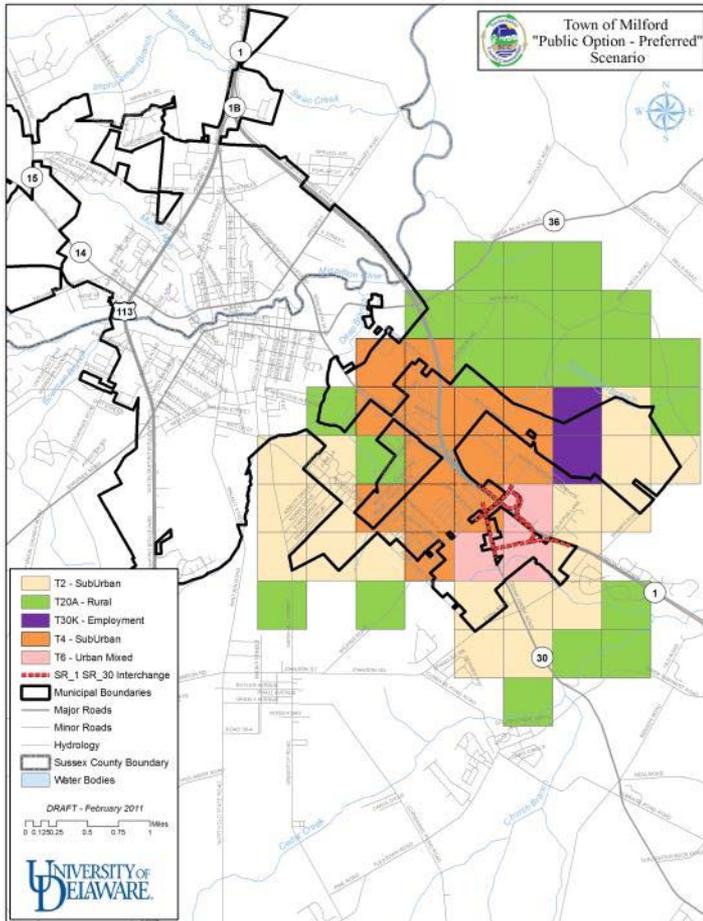
Growth Opportunities and Challenges

- Maintain rural and village character
- Development of Transfer of Development Rights (TDR) Program to preserve sensitive riverine lands and agricultural economy
- Expansion of highway corridor into overpass and **Regional Center**
- Cost of annexation to City (expanded public services, utilities, and infrastructure) to support growth; challenging in economic downturn

Existing Land Use Density Visualization



Public Preferred Option



Dwelling Units	7,600
Residents	19,500
Nonresidential Floor Area	995,000
Employees	2,500

Public Preferred Option Profile

- Community predominately residential, accommodating growth adjacent to Milford City Center and at new **Town Center Hub**. Moderate density residential adjacent to City Center fans out to surrounding low density residential subdivisions to south and east
- Green space and agricultural acreage to north, east, and south (DNREC-cited Cedar Creek, Swiggetts and Cabbage Ponds) preserve rural riverine lands and agricultural base
- New, well-defined mixed use hub at expanded SR1/SR30 Interchange and adjacent 200 A Employment Center provide new public-envisioned “Town Center” with retail centers and localized compact mixed housing

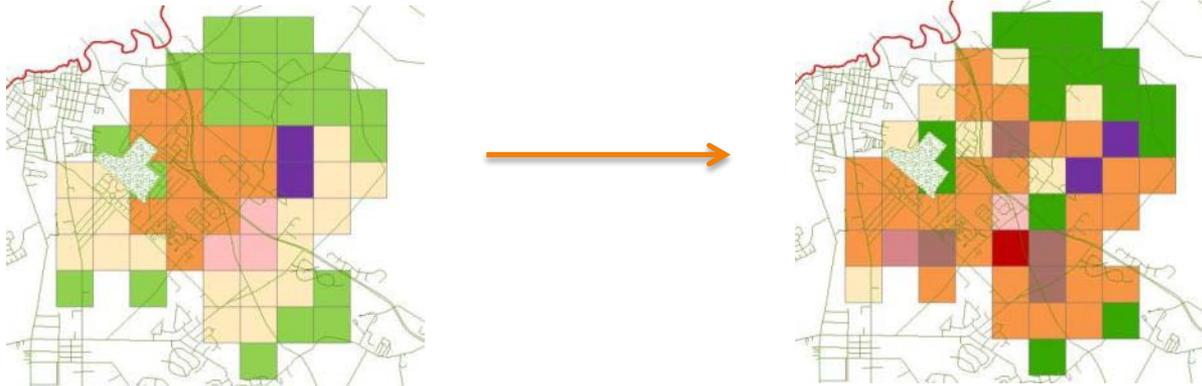
Growth Opportunities and Challenges

- Residential growth plan, while half of Milford Comprehensive Plan for SE Neighborhood, quadruples number of residents from Existing Land Use and provides previously nonexistent economic growth opportunities
- Pattern of Growth supports sustainable development principles while preserving much of the rural character. Offers localized multiple housing types and potential transit-oriented development for economically growing community
- TDR Program required to preserve sensitive riverine lands and agricultural economy
- Funding needed for annexation to City (expanded public services, utilities, and infrastructure) to support growth challenging in economic downturn

Public Preferred Option Density Visualization

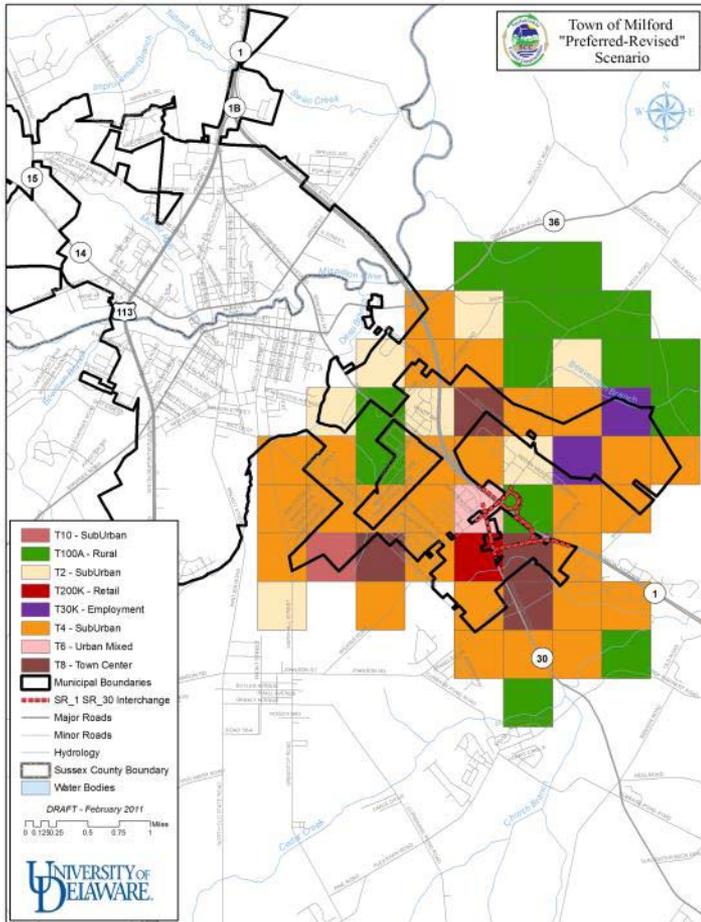
Public Preferred Option-Revised Profile

- The original Public Preferred Option was amended based on the type of development that is actually occurring in the SE Neighborhood and existing zoning for the City.
- Additional input was received from DeIDOT, DNREC, Department of Agriculture, Office of State Planning and University of Delaware anticipating transformations in this area of Milford.
- **Key Points**
 - Proposed Transfer of Development Rights Program (DDA)
 - Preservation of Environmental Areas (DNREC)
 - Transportation Improvements (DeIDOT)



Public Preferred Option-Revised Density Visualization

Master Plan



Dwelling Units	11,800
Residents	30,700
Nonresidential Floor Area	3,000,000
Employees	4,900

Master Plan Profile

- Master Plan assumes annexation of the SE Neighborhood into the City of Milford
- Area becomes a mix of medium to high density residential communities consistent with City of Milford zoning; both SF and MF housing options. Higher density mixed use areas dot the landscape.
- New Regional Commercial Center is surrounded by multifamily and/or mixed use neighborhoods, with hub at enhanced SR1/SR30 Interchange and new public-envisioned Town Center. 200-Acre Employment Center adjacent to interchange hub
- TDR Receiving Areas identified in three mixed use hubs around Commercial Center
- Agricultural lands to northeast and TDR Sending Areas identified for preservation purposes

Growth Opportunities and Challenges

- Higher density residential replaces Public Option's low density residential communities. Opportunity for residential growth 75% of Comprehensive Plan; 1.5 times Public Option. Promotes compact, diverse housing types and mixed use growth principles
- Potential for transit-oriented development and new local employment opportunities
- Funding for infrastructure & services required for annexation challenging in economic downturn
- Plan based more on current zoning regulations – may limit long-term vision
- DNREC-cited environmentally sensitive lands not directly protected by land use designation

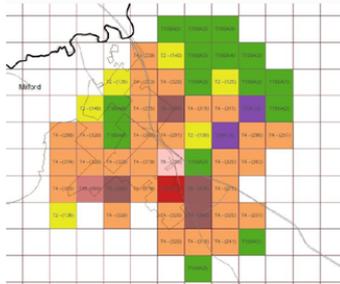
Master Plan Density Visualization



Milford Southeast Neighborhood Master Plan

Milford South East Neighborhood Master Plan

Public Review DRAFT – May 6, 2011



Adopted and Certified as an Amendment to the
City of Milford Comprehensive Plan
DATE, 2011

Prepared by:

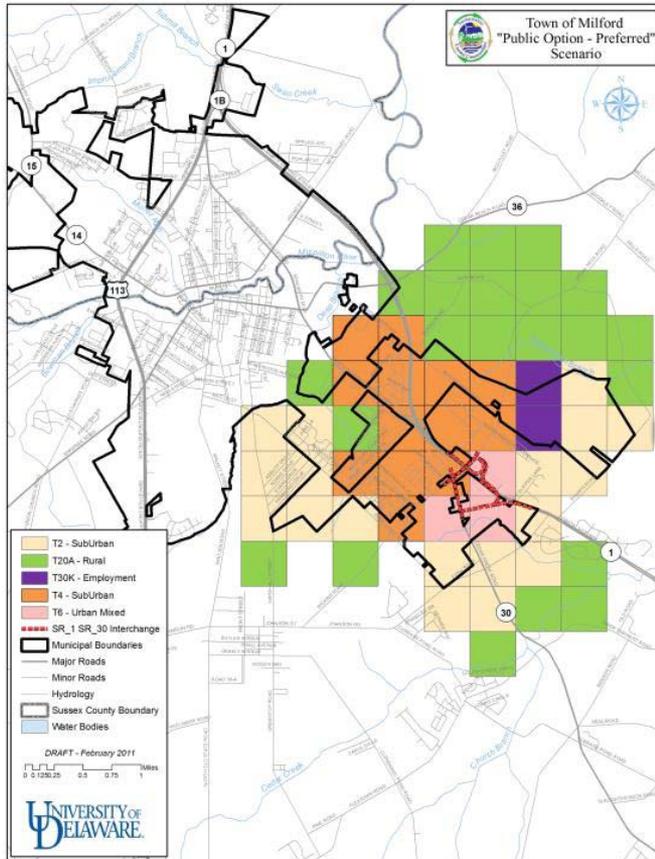
The City of Milford, Delaware

In conjunction with:

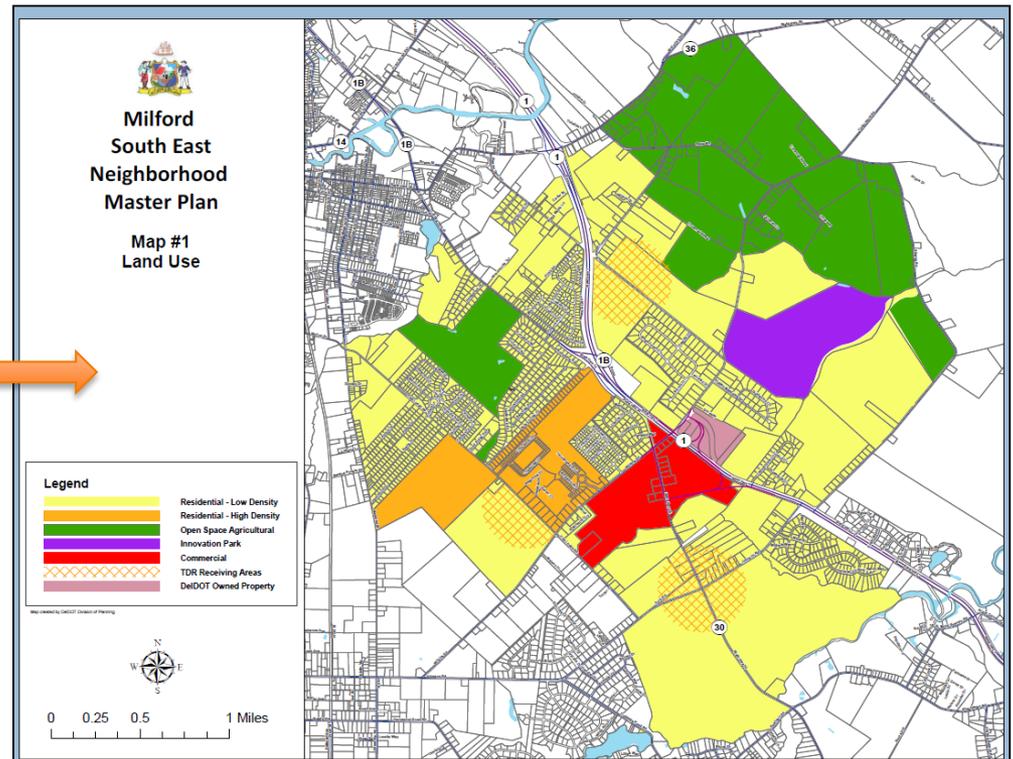
The State of Delaware

- Master Plan Model from CommunityViz® was refined into a detailed plan document and map series to guide future growth and preservation
- City and State Agencies each contributed to the Master Plan document
- City and State Agencies will continue their partnership to implement Master Plan after adoption

Land Use Plan (City of Milford)

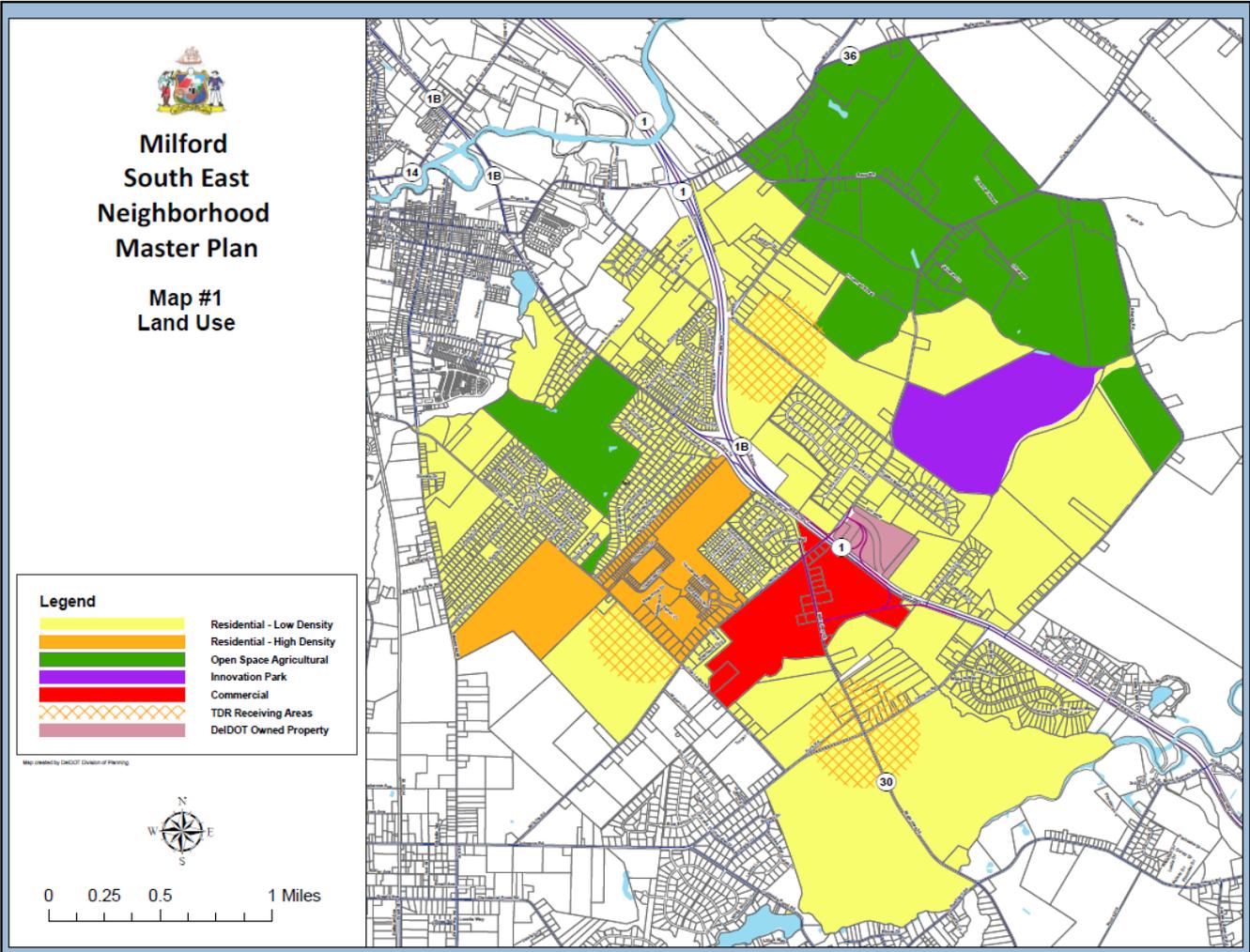


Land Use Model maps created by UD using CommunityViz®

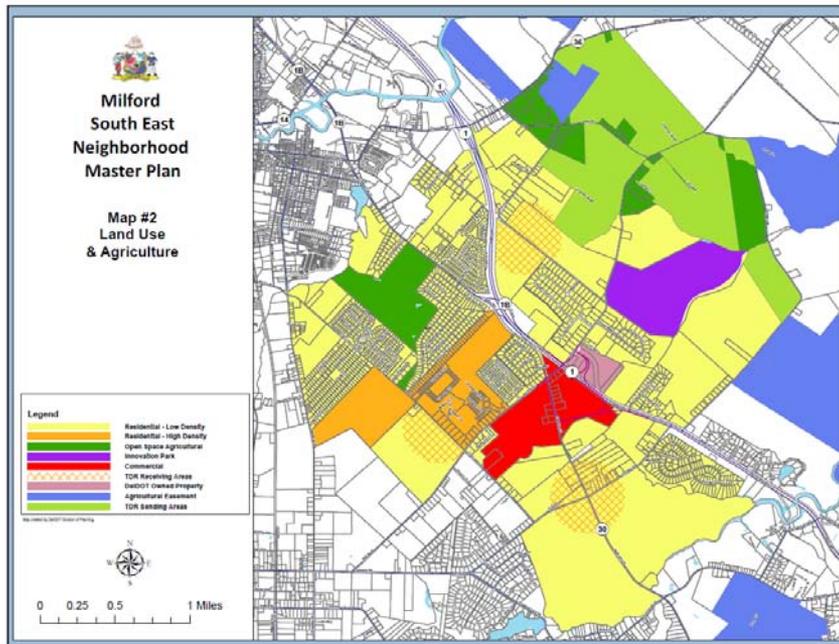


Master Plan maps created by Bruce Allen of DeIDOT using ArcGIS

Land Use Plan (City of Milford)

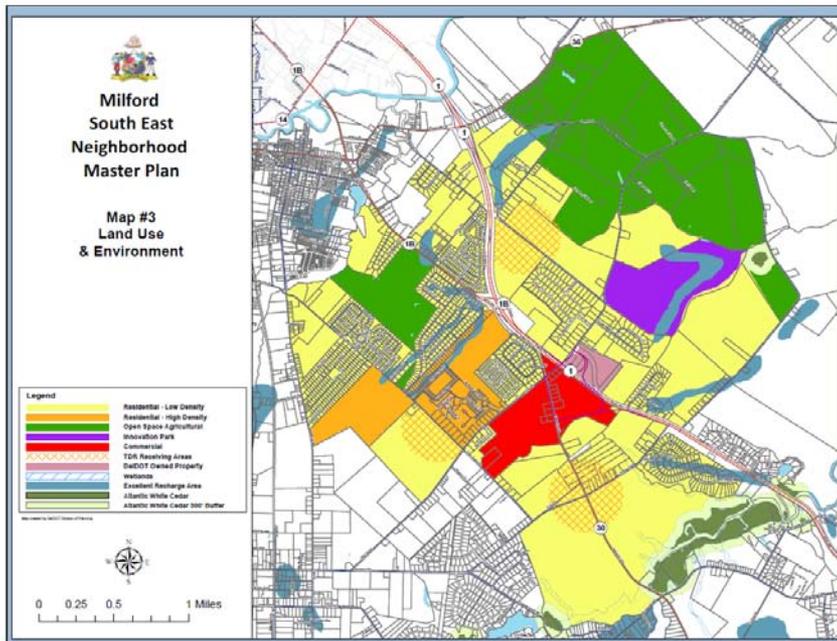


Agricultural Preservation Plan (Delaware Department of Agriculture)



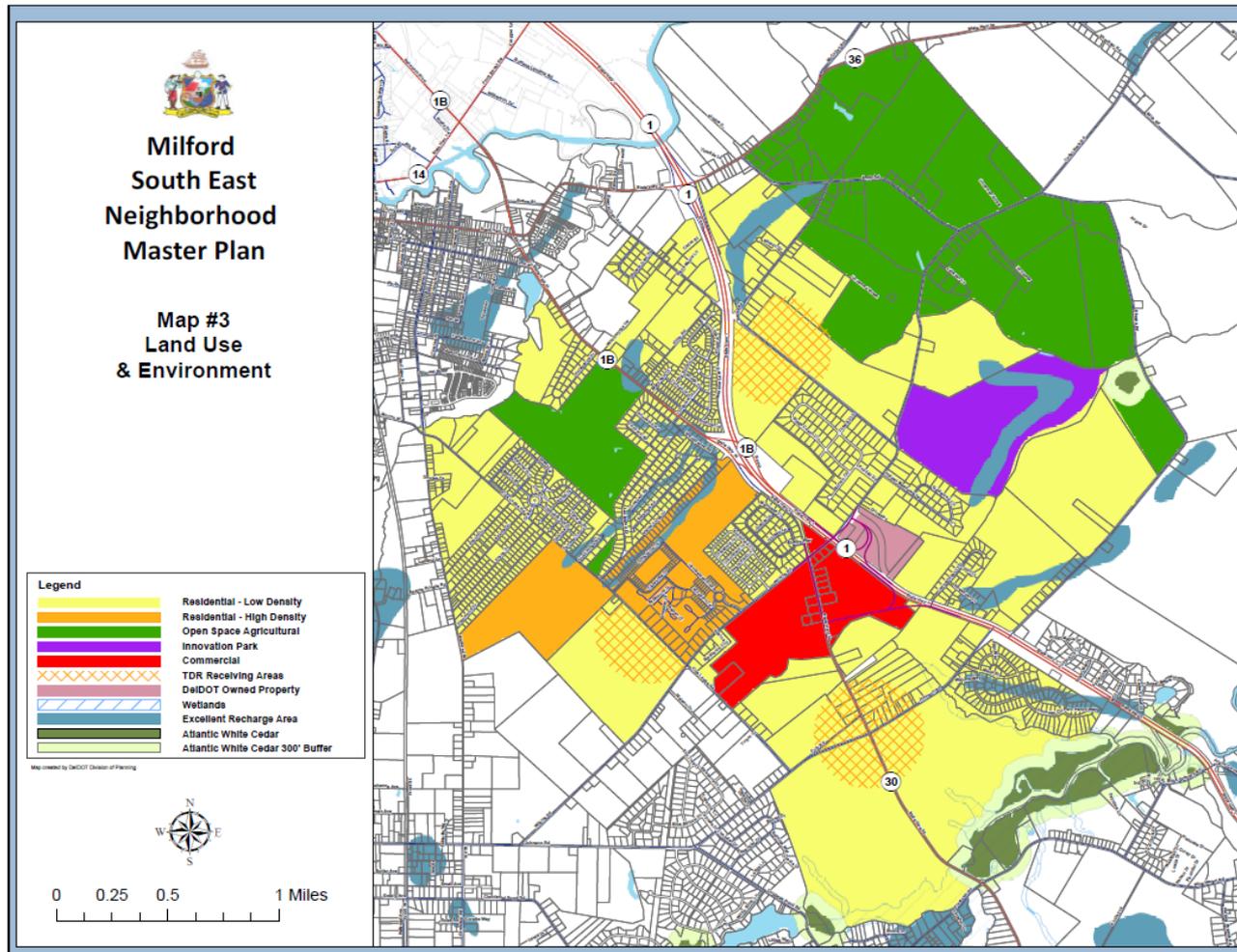
- Agricultural Lands to be preserved to the east in “open space” area
- Transfer of Development Rights Program proposed
- Development rights may be sent to the “receiving areas”

Environmental Protection Plan (Delaware Department of Natural Resources and Environmental Control)



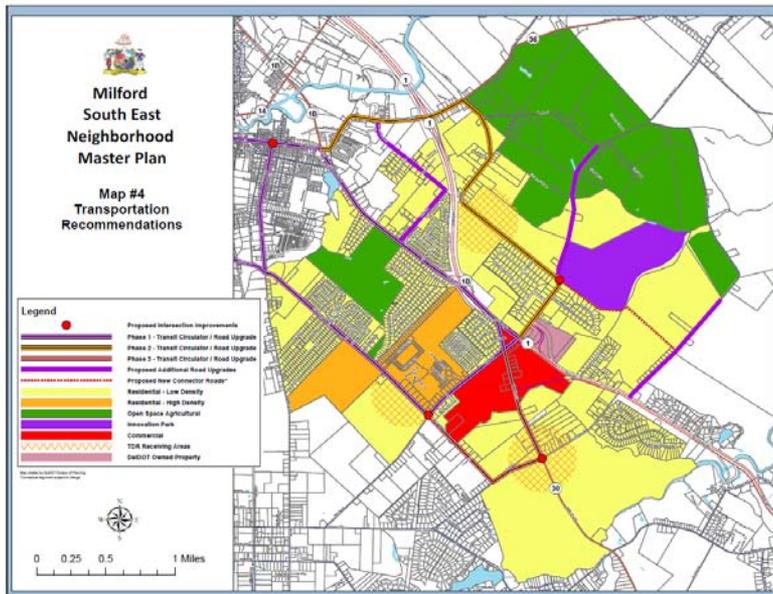
- Identified sensitive natural features and strategies to protect them
- Excellent recharge areas
- Wetlands and stream corridors
- Woodlands, especially Atlantic White Cedars
- Low Impact Stormwater

Environmental Protection Plan (Delaware Department of Natural Resources and Environmental Control)

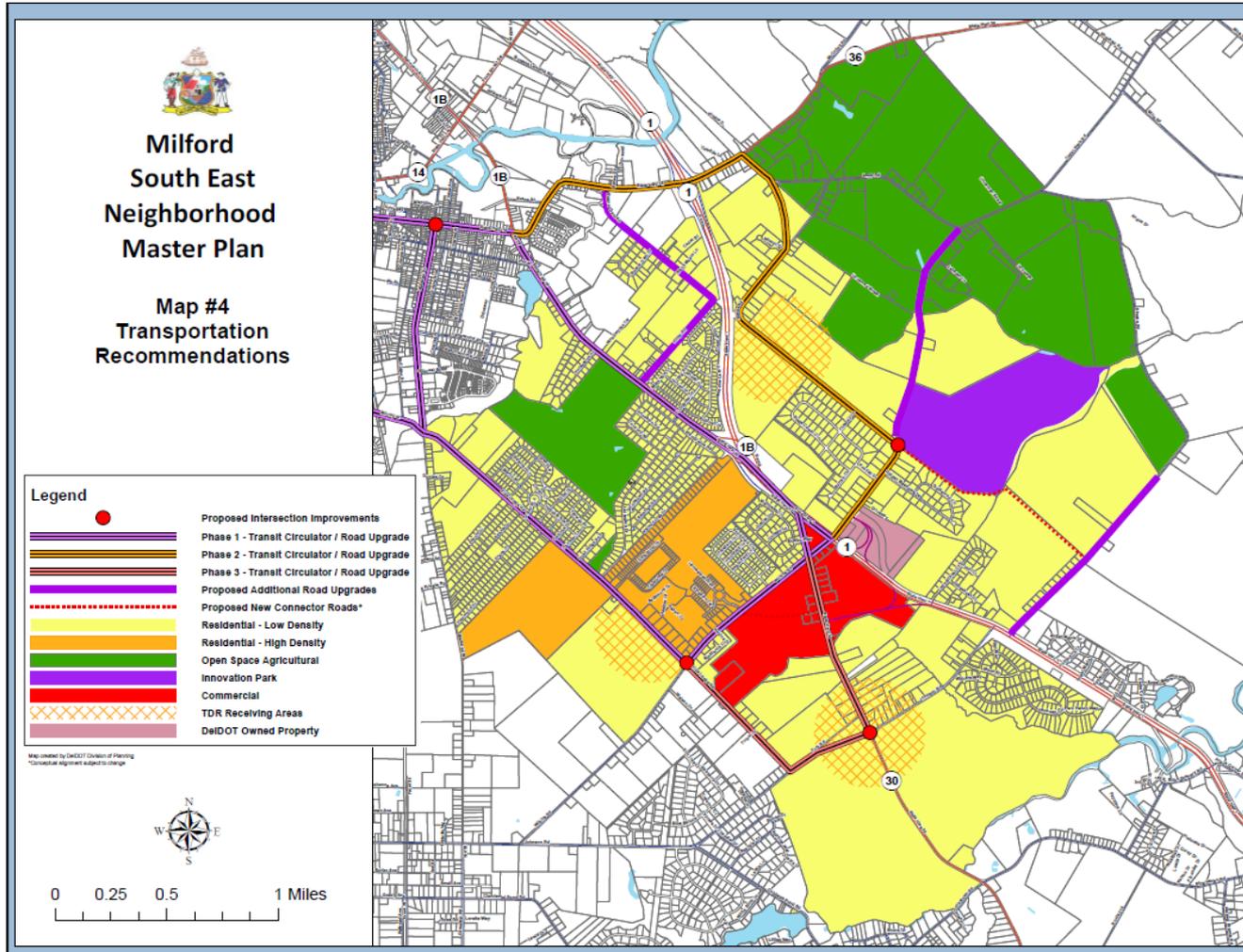


Transportation Plan (Delaware Department of Transportation)

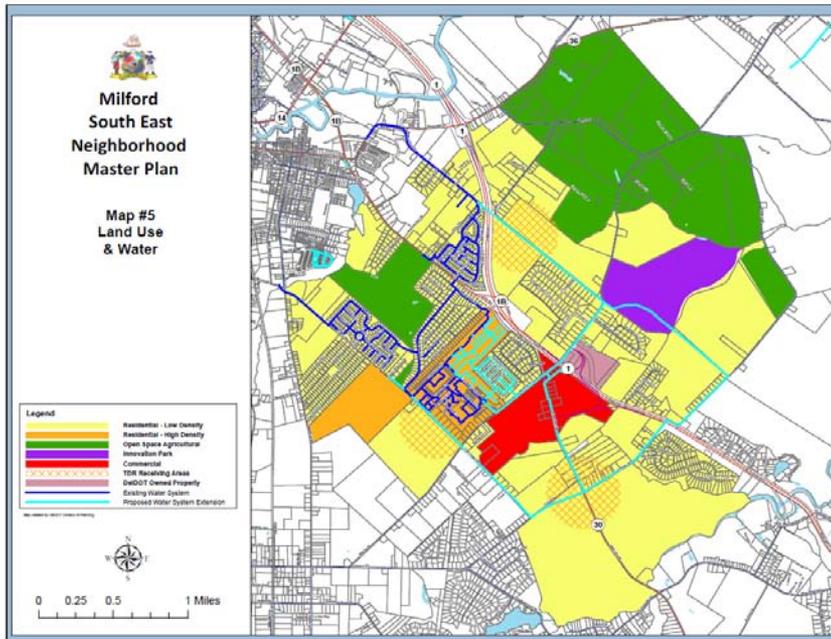
- **Grade Separated Intersection at Rts. 30 and 1 (2012-2013)**
- **Road and Intersection Upgrades**
- **Transit Loops (transit ready)**
- **Receiving Areas located for transit access**
- **Complete Streets**



Transportation Plan (Delaware Department of Transportation)



Public Utilities (City of Milford)



- **Water**
 - Water tower and main extension currently underway
- **Sewer**
 - City intends to design and permit
- **Electric**
 - Extend lines to new area

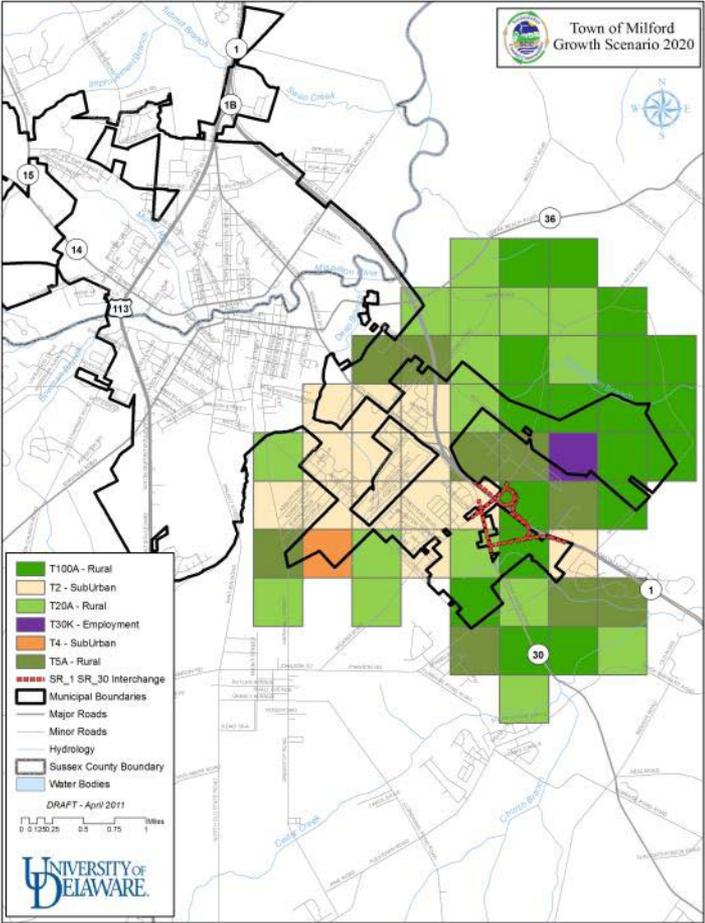
Year 2020 & 2030 Profile

- Depicts 10 and 20-year growth of SE Neighborhood assuming 1) 2% per year growth rate; 2) implementation of SE Neighborhood Master Plan; and 3) annexation into the City of Milford
- Two of Master Plan areas are “built-out” while almost 90% of the rural landscape remains (agriculture, villages, and low density subdivisions)
 - **20-Year Profile:** Development of 500 residential units and 160,000 square feet of nonresidential in existing neighborhood. Hearthstone II subdivision is underway, building to nearly 400 of the 900 expected SF/MF residential units. 100 acres of the new Employment Center (medical/professional park) is operational
 - **2030 Profile:** Adds 500 more residential units adjacent to Employment Center and new Planned Town Center with mixed use. Regional Shopping Center at enhanced Interchange is built and Medical/Professional Employment Center is complete. Total square footage climbs to over 1,000,000 square feet

Growth Opportunities and Challenges

- 20-Year Profile: Plan implements new “town center” as envisioned by Public Option scenario. Adds retail, commercial, and professional economic opportunities to neighborhood
- 20-Year Profile: Plan doesn’t show implementation of TDR program, therefore potentially jeopardizes identified agricultural preserve areas by development
- New infrastructure funding more feasible as growth areas predominately in City bounds

Year 2020

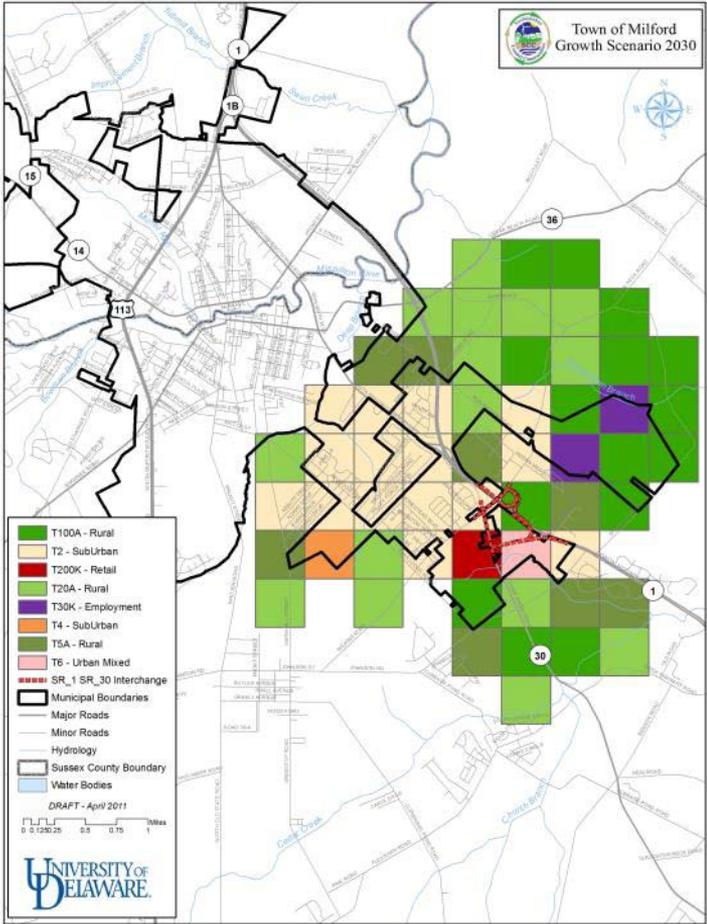


Dwelling Units	2,400
Residents	6,000
Nonresidential Floor Area	160,000
Employees	700

Year 2020 Density Visualization

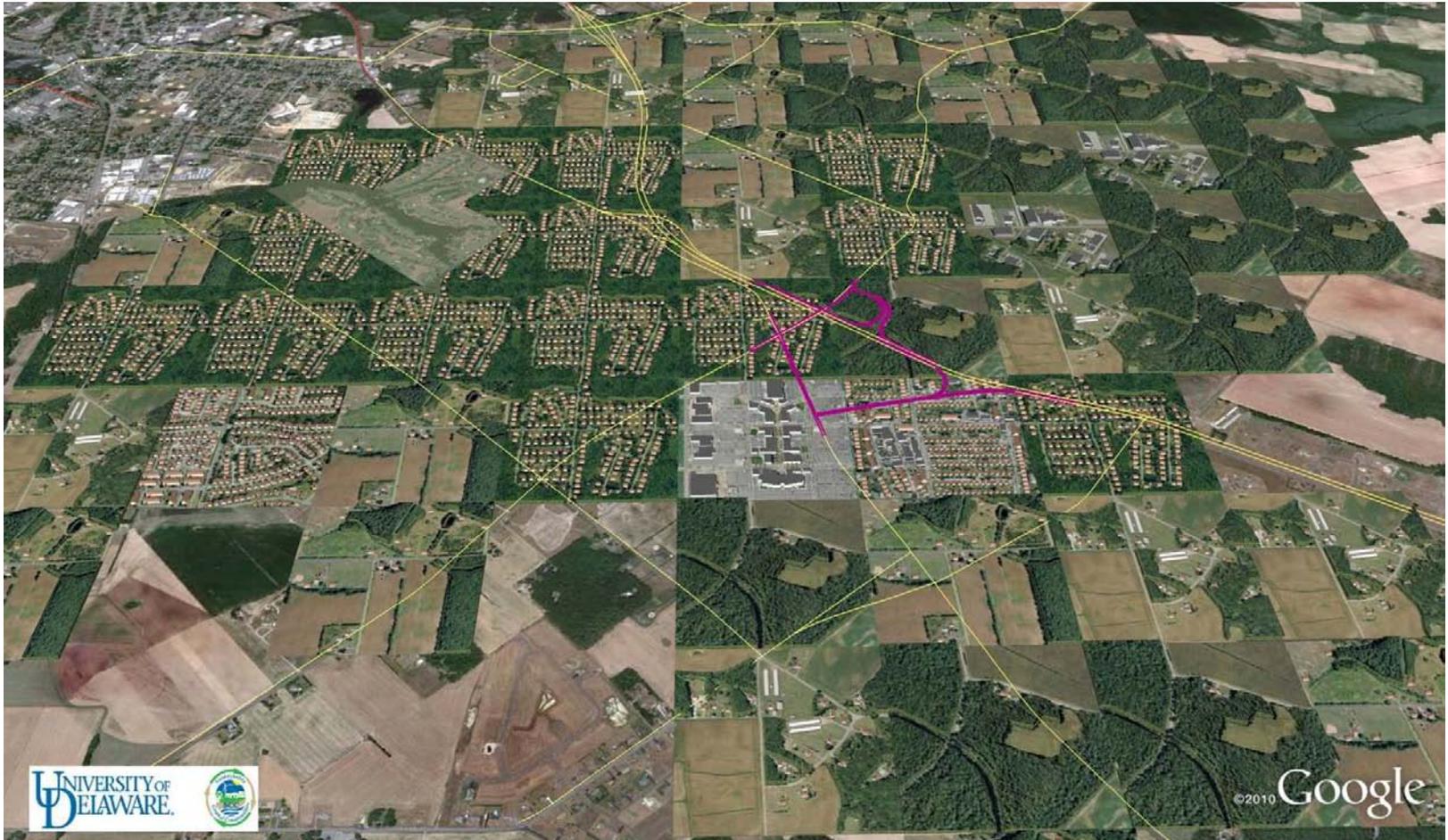


Year 2030

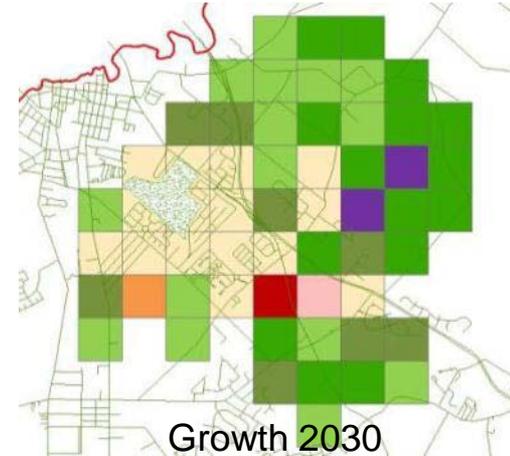
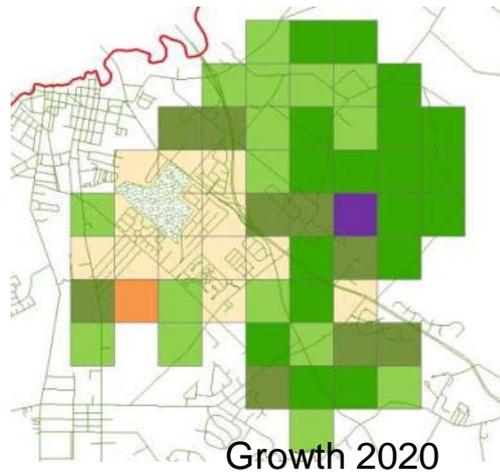
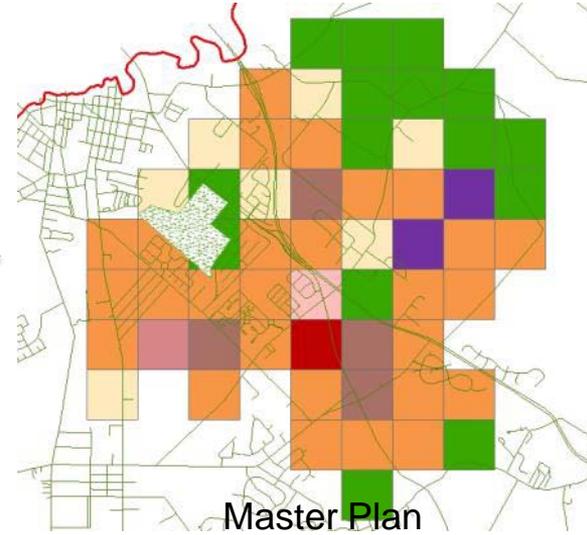
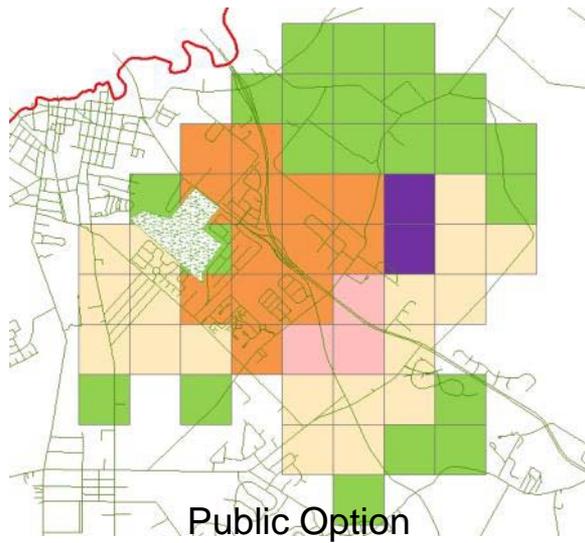


Dwelling Units	3,000
Residents	8,000
Nonresidential Floor Area	1,185,000
Employees	2,300

Year 2030 Density Visualization

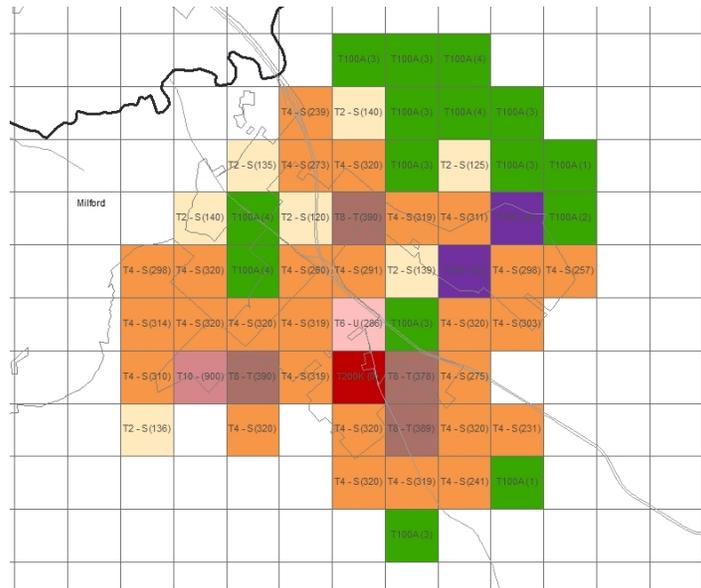


Public Preferred Option → Master Plan



Milford Southeast Neighborhood Master Plan

July 25, 2011



Adopted and Certified as an Amendment to the
City of Milford Comprehensive Plan
July 25, 2011

Prepared by

The City of Milford, Delaware

In conjunction with

The State of Delaware

With assistance from the

University of Delaware

Sustainable Coastal Communities Initiative

Acknowledgements

The Milford Southeast Neighborhood Master Plan was developed as a partnership between the City of Milford and the State of Delaware and its Agencies. The University of Delaware's Sustainable Coastal Communities Initiative provided invaluable support during the public participation workshops and through the use of their UD-SCC Model for land use modeling throughout the project.

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Chapter 1

Overview of the Master Plan

Milford's Comprehensive Plans

The City of Milford has a long history of comprehensive planning. In the early 1990s the City developed a comprehensive plan that included land use, growth, and annexation recommendations for an area that surrounded the existing city. Despite a rather large growth area, annexations were slow during this time. In 2003 Milford updated that plan with a new comprehensive plan designed to comply with the State's new planning statutes. That plan was eventually reviewed and certified by the State of Delaware in accordance with the new requirements in the Delaware Code.

During the mid-2000s, the national economy experienced what was then thought of as a "housing boom." Milford was not immune to this economic force and experienced a rapid increase in annexation and subdivision requests during this time period. The development community aggressively sought to take advantage of new market opportunities, eventually subdividing over 8,000 lots in the city alone. Some of these lots were in projects that were not recorded or otherwise did not move forward, so the current estimate is that approximately 4,500 lots were created in Milford during this period. Several of the annexations requested required amendments to Milford's plan. Milford amended its plan in 2004, 2005 and 2006 to address new annexation opportunities, among other changes to its plan document.

Annexation in the Southeast Neighborhood

Prior to 2005, the land to the east of State Route 1 (SR 1) Southeast of Milford was farmland interspersed with a few large-lot subdivisions and various rural homes on large lots. In 2005 a developer proposed a major subdivision consisting of approximately 780 single-family homes in this area. The developer's intention was to develop this subdivision under existing Sussex County regulations. This property was not adjacent to the City of Milford but was very close to property that was already within the City limits. The City became concerned that if this subdivision were to be constructed, it would be the *de facto* provider of services (fire, police, library, parks, and eventually even sewer and water) without the benefit of a tax base to support those services.

Milford engaged in discussions with the developer, other adjacent property owners, and the Office of State Planning Coordination to explore the annexation of this area. The City was neutral on whether or not this area should be developed. However, if the area was to be

developed the City's position was that they would rather have it in the municipal jurisdiction in order to provide necessary public services and infrastructure in a cost-effective manner. The State and its agencies were concerned about "urban sprawl" in this area compromising active, productive farmland, some of which had been permanently protected using State tax dollars. There are also many environmentally sensitive resources in this area associated with Cedar Creek and its tributaries. And finally, the location east of SR1 was difficult and dangerous to access due to an at-grade cross over and heavy traffic, especially during the summer months.

After much discussion, a consensus was reached. The State supported a comprehensive plan amendment that would allow for annexation and development of this area. The caveat was that the development must occur in accordance with a Master Plan to be developed collaboratively by the city and the state. This Master Plan would address detailed strategies to protect farmland and open space, provide needed transportation and utility infrastructure, and prevent further development activities to the east of this area. This document is the Master Plan that was envisioned during these discussions.

Milford's comprehensive plan was amended in 2006 to include this area as an annexation area, subject to the Master Plan. Annexations of some of these parcels began shortly thereafter.

The Memorandum of Agreement

The process of developing this Master Plan began in earnest with the signing of a Memorandum of Agreement (MOA) by the City and the State in March 2008. The MOA set out the general parameters that formed the consensus of all parties for working together on development in this area. These parameters included a commitment to work collaboratively, include other stakeholders, address utility and road infrastructure in a comprehensive manner, protect the agricultural economy through farmland preservation and limits on further utility expansions, protect natural resources, and ensure an appropriate mix of land uses in the developed area.

The original signatories of the MOA included the city, the Office of State Planning Coordination, the Delaware Department of Transportation (DelDOT) and the Delaware Department of Agriculture (DDA). As the development of this document has progressed, the Delaware Department of Natural Resources and Environmental Control (DNREC), the Delaware State Housing Authority (DSHA), and the State Historic Preservation Office (SHPO) have all contributed materials and have become partners in this endeavor.

The project area covered by the MOA was originally limited to areas east of SR1. In 2008 the City engaged in a complete re-write of its comprehensive plan which culminated in an entirely

new document that was adopted in early 2009. The new plan separated the city into several “neighborhoods” for planning purposes. The area covered by the MOA was located in the Southeast Neighborhood, which also included lands west of SR1, including a number of existing and developing subdivisions. By mutual consent, all parties agreed that it made sense to adopt the entire Southeast Neighborhood as the project boundary for this Master Plan. The City’s new 2009 comprehensive plan included other planning concepts that have been integrated into the Master Plan, including an urban-growth boundary and a greenbelt with open space and farmland within and adjacent to the eastern edge of the project area.

What is a Master Plan?

Definition of a Master Plan

A land use plan focused on one or more sites within an area that identifies access and general improvements, and is intended to guide growth and development over a number of years or in phases.

From the Planners Dictionary, American Planning Association

While the City’s comprehensive plan forms the foundation for the Master Plan, the Master Plan differs from a local government’s comprehensive plan in a number of ways:

- A more detailed plan for land use, including build-out calculations
- Detailed planning for the provision of infrastructure and services, including timing, phasing, and funding
- Partnerships and collaborative planning between and among various levels of government
- A more predictable plan that addresses items necessary for implementation
- Commitments, agreements and timeframes for implementation coordinated among the various partners in the planning process.

The Master Plan Process

The development of the Master Plan has proceeded from 2008 until today. The City and the Office of State Planning Coordination have been the co-chairs of this planning effort. The process was kicked off with a series of three public meetings to consider ideas and public opinions about the future of this area. The University of Delaware’s Sustainable Coastal

Communities Initiative provided support for these workshops and has continued to work with the city to assist with land use modeling and phasing of development.

After gathering public input, Milford's City Planner developed a consensus land use plan that reflected a composite of the public's input. That land use plan has continued to be revised based on input from the other stakeholder agencies and the City's plans for utilities in the area. All of the stakeholder agencies have worked with the co-chairs to develop chapters for this Master Plan. The stakeholders have included the city itself, DDA, DNREC, and DelDOT. In addition, DSHA and SHPO have provided valuable input.

The Result: Predictable, Shovel-Ready Development Along with Proactive Preservation

This process has resulted in the achievement of two complementary goals for this Master Plan Area.

Ready for Economic Development

The detail of this Master Plan has addressed many of the infrastructure issues that would have been managed in an ad-hoc manner through conventional development practices. As such, in the areas that are identified for future development, developers will know in advance how utilities will be provided and what their other contributions and requirements would be. Notably, the City and State have designed the following "package" of infrastructure improvements for the area:

- DelDOT will be constructing a new grade-separated intersection at SR1 and SR30. Construction is currently scheduled for 2012 and 2013, with completion due in late 2013. This improvement will allow safe, efficient movement of traffic between the east and west sides of the Master Plan Area and enable the development of the area east of SR 1. See Chapter 8 for more details.
- The City will be constructing a new water system in the Master Plan Area that will include a water tower and distribution lines. Depending on the acquisition of easements and other siting factors, this infrastructure may extend east of SR 1. Funding is in place to construct this system in the immediate-term future. See Chapter 9 for more details.
- The City has commissioned its engineering consultant to design the sewer transmission system for the Master Plan Area. The basics of the design are described further in Chapter 9. The City's commitment extends to actually completing the engineering necessary to have the system installed and permitted so that it is ready to be constructed as soon as there is a user ready to build a new project and tie in to it. The City will work with interested developers to identify financing options that will enable development to occur in accordance with the Master Plan.

The impact of these infrastructure commitments is that virtually any parcel within the Master Plan Area will be ready for development and occupancy. Areas to the west of SR 1 could be constructed at any time, pending completion of the water system. Areas to the east of SR 1 could be ready for occupancy in late 2013, which is when the road access is projected to be completed by DelDOT.

Poised for Preservation

The Master Plan is not only about preparing land for development. Much of the detailed work that has gone into preparing this Master Plan has been done to assure that any new development is completed in a way that does not negatively impact the natural environment or the viability of the agricultural lands located in the Master Plan Area.

- The Delaware Department of Agriculture has developed an innovative Transfer of Development Rights (TDR) program that provides land owners incentives and options to preserve the lands that are identified as Open Space Agriculture in this plan. This program is but one of many options land owners have to remain in farming and protect their land. The Land Use Plan clearly identifies where land is to be protected and where development is to be promoted so that issues of fragmentation and encroachment are minimized. See Chapter 4 for more details.
- DNREC has identified significant natural resources in the Master Plan Area and promoted design guidelines to protect these areas. Most of the critical resources are located along the tributaries of Cedar Creek and include wooded areas, rare species, excellent wildlife habitat, wetlands, and sensitive watercourses. The Master Plan directs dense development away from these areas. When parcels that contain sensitive resources are subject to future development, DNREC has offered design guidelines that will enable development that does not degrade or encroach on these important natural features. See Chapter 5 for more details.

Chapter 2

Public Workshop Sessions

To kick off the Master Plan process, the City held three public workshops at the Carlyle Fire Hall in September and October of 2009. The goal was to engage citizens and property owners in the Master Plan area in a discussion about the future of the neighborhood. Over 1,000 invitations were mailed to those who lived or owned property in this area. Only a portion of this land is currently in the city limits, so both city and county residents were included in this mailing. The meetings were also widely advertised through newspapers and on the city's website.

The University of Delaware's Sustainable Coastal Communities Initiative was engaged to help structure and run the workshops to maximize public participation and ensure that productive input was received. UD devised the three workshops as a series: the expectation was for residents to attend all three in sequence as each built upon the last. More than 70 individuals attended the first workshop, and of those more than 30 remained with the process for all three.

The UD project team used CommunityViz® (an ArcGIS software extension from Placeways, LLC) geographic information system software to develop the "University of Delaware SCC Land Use Model (UD-SCC Model)." This model was developed for use throughout Sussex County and was immediately useful for this process because the entire Southeast Neighborhood is in Sussex County. The model uses 100-acre tiles in a grid across Sussex County to illustrate potential development patterns. A palette of colors ("crayons") represents 13 typical land use types (4 rural, 6 suburban/urban mixed, and 3 non-residential), each with its associated residential and non-residential densities, population, employment, tax, water and wastewater usage, and traffic-generation characteristics. To help people visualize the land uses, the team used computer graphics programs including CommunityViz® Scenario 3D and Google Earth to create three-dimensional models for each of the 13 land use types.

At Meeting One, citizens reviewed current plans for the neighborhood, learned about constraints to development, and identified their values. They viewed and deliberated about three potential long-range growth scenarios based on 3D representations of land use types and their associated demographics.

At Meeting Two, citizens used a table exercise to plan the Southeast Neighborhood, using colored tile "crayons" placed on an aerial map. The attendees produced seven plans that were

merged into three scenarios: “Current Trends,” “New Community,” and “Suburban.” Build-outs of each scenario were analyzed in numeric terms, mapped, and visualized in 3D, and had their associated demographic impacts estimated.

At Meeting Three, citizens viewed the results of the analyses and discussed the benefits, challenges, and cost implications of each. They used keypads to vote on preferred scenarios. A resulting Composite Scenario was developed by Milford’s City Planner and has become the basis for this Master Plan for the neighborhood.

The project modeled an expanded public process combining scenario development and deliberation, analysis, and decision-making. According to UD project leaders, citizens were astounded to be able to significantly influence the resulting plan. The County Plan had envisioned approximately 18,000 dwelling units for the area, and the City Plan showed approximately 15,000 dwelling units. The agreed-upon Composite Scenario (labeled Preferred – Alt) results in only 8,500 dwelling units, incorporates open space, consolidates commercial areas, and retains areas of farmland. Map 2.1 shows the Preferred-Alt Scenario developed at the workshops.

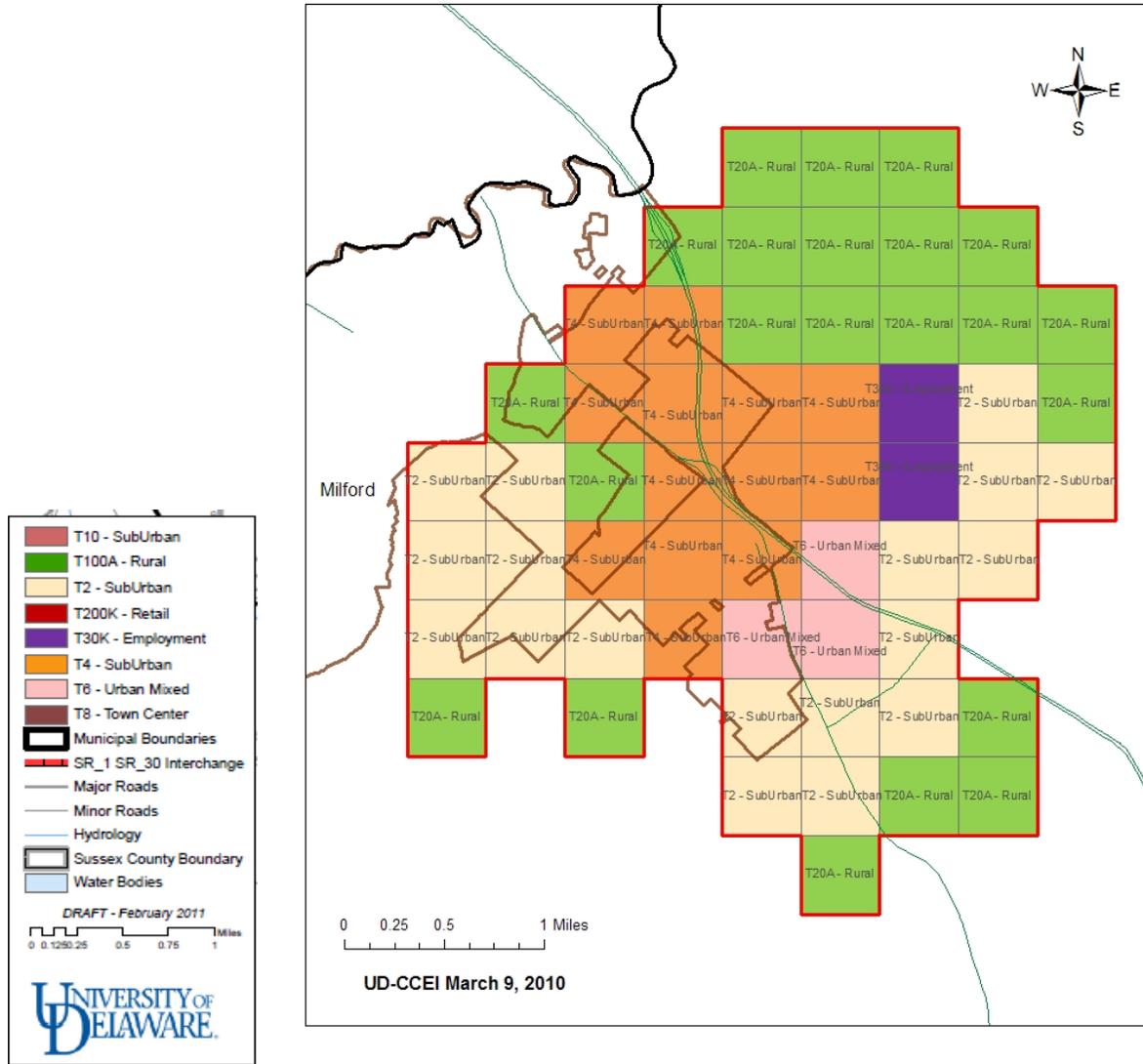
UD has continued to assist the partners as they have developed detailed plan elements. UD-SCC Model has been very helpful to estimate build-out potential for the area and phasing for infrastructure improvements. The final version of the land use plan (known as Preferred – Revised) contains the potential for approximately 11,700 dwelling units and corresponding increases in commercial space and jobs. The increases over the Preferred-Alt scenario are due to a more accurate accounting of existing units and approved and recorded subdivisions, as well as a reflection that the base density in the city is approximately 3 du/acre corresponding to the least dense zoning district available. The Preferred-Revised Scenario is more fully described in the Land Use Plan, Chapter 3.

Portions of this chapter have been adapted from a CommunityViz® case study titled “Community Planning with Digital Crayons and Real-Time 3D” written by Carol Bason and Bill McGowan of the University of Delaware Sustainable Coastal Communities Initiative. This document has been used with permission. The software vendor, Placeways LLC, has this case study on their website. To view the full case study, please visit:

<http://placeways.com/communityviz/gallery/casestudies.php>

Map 2.1. The Preferred – Alt Scenario

SE Neighborhood - Milford
 "Preferred" Scenario Map by Land Use



Chapter 3

Land Use Plan

The standard way of thinking about land use for the Southeast Neighborhood was that it would continue as it had in the past, in a rather haphazard way, commonly referred to as “urban sprawl.” As a result of public input at the workshop series and through many meetings and with input from state agencies including the Office of State Planning Coordination, DeIDOT, DNREC, and DDA, as well as the University of Delaware, and the City of Milford, a new planning concept has emerged. As proposed, this new “planning model” protects and preserves valuable farm land from development through a program called Transfer of Development Rights, conserving approximately over 500 acres of agricultural lands for future generations. This plan shields the environment through recommendations from DNREC concerning encroachment of the flood plain, storm water management in designated water-recharge areas, and the protection of aquifer areas. With the cooperation of DeIDOT, a Transportation Element has been developed for the Southeast Neighborhood Planning Area that identified and analyzed the transportation improvements that will be required to accommodate the expected changes in land use and increases in traffic volumes for this area. The City of Milford’s part in this program was the preparation of a master plan for the construction of water and sewer utilities to serve this neighborhood in a cost-efficient manner, ensuring that development would be served adequately and that this new development would pay its fair share through a variety of options. The second contribution from the City was the preparation of a Land-Use Plan for this area, which would reflect the actual development presently occurring in this neighborhood and guide future development in accordance with this Master Plan.

Public Input: The “Preferred – Alt” Plan

The public input received at the three public meetings described in Chapter 2 formed the basis for this Land-Use Plan. The final result of these three meetings was the development, by the public, of three (3) Future Land-Use Map Scenarios. The first was labeled “Current Trends” because it reflected a business-as-usual approach to development. The second was called “New Community” because it consolidated growth, particularly non-residential uses, around the grade separated intersection that was to be built at SR30 and SR1. The third was labeled “Suburban.” This scenario drastically reduced density and removed most commercial or employment uses. At the last civic meeting the participants voted on the three Scenarios. After the vote was tallied, there was no clear-cut preference for the most representative Future Land Use Map. Milford’s City Planner took the three scenarios and consolidated them into the “best choice” Future Land Use Map. This version of the map was titled Preferred – Alt (see Map 2.1).

All of the partners agreed that this map reflected the goals of the public during the public workshops, while also reflecting existing conditions, approved subdivisions, and known infrastructure improvements occurring in the neighborhood. Density and commercial development were reduced from the current comprehensive plan, development was concentrated around the interchange, and open space and agricultural lands were protected around the periphery of the planning area.

Refining the Public's Vision: The "Preferred – Revised" Plan

The City and the partner agencies worked over the next year and a half to refine the Preferred – Alt Land Use Plan into the plan that has become the Future Land Use Plan for this Master Plan. The important components of the revision process are described below.

Moving from 100-Acre Grids to Parcels

The UD-SCC model was designed using 100-acre grids as a unit of measure. This makes it easy for planners and members of the public to visualize various land use and neighborhood types. It is easy to move the grids around to create various land use scenarios, even in public meeting settings such as those held at the fire hall. The relative simplicity of this model allows the software to "recalculate" the impact of new land use scenarios quickly, even when using a standard laptop computer.

While this model is perfect for working with the public to visualize various land use scenarios, it is not accurate enough to plan for new infrastructure such as sewer, water, and roads. DeIDOT, a partner in this project, offered its staff expertise to provide detailed mapping of the Master Plan Area using its geographic information system (GIS) software. Very early on in the process, the project team worked with DeIDOT GIS and planning staff to develop a version of the preferred scenario at the parcel level. This map has continued to be refined and is now known as the Land Use Map, Map 1.

Accurately Reflecting Existing Units and Approved Subdivisions

The Master Plan Area currently contains many existing houses, subdivisions, and approved subdivisions. Moving to a parcel-based map allowed the project team to accurately count those units. Although the area is quite large and has a lot of land left to develop, the team quickly realized that many of the parcels already had approved and recorded subdivisions located on them. Some of those subdivisions had already started to be constructed, although construction had slowed by this time due to economic conditions. The decision was made to assume that these subdivisions would eventually be built as they are currently designed. This

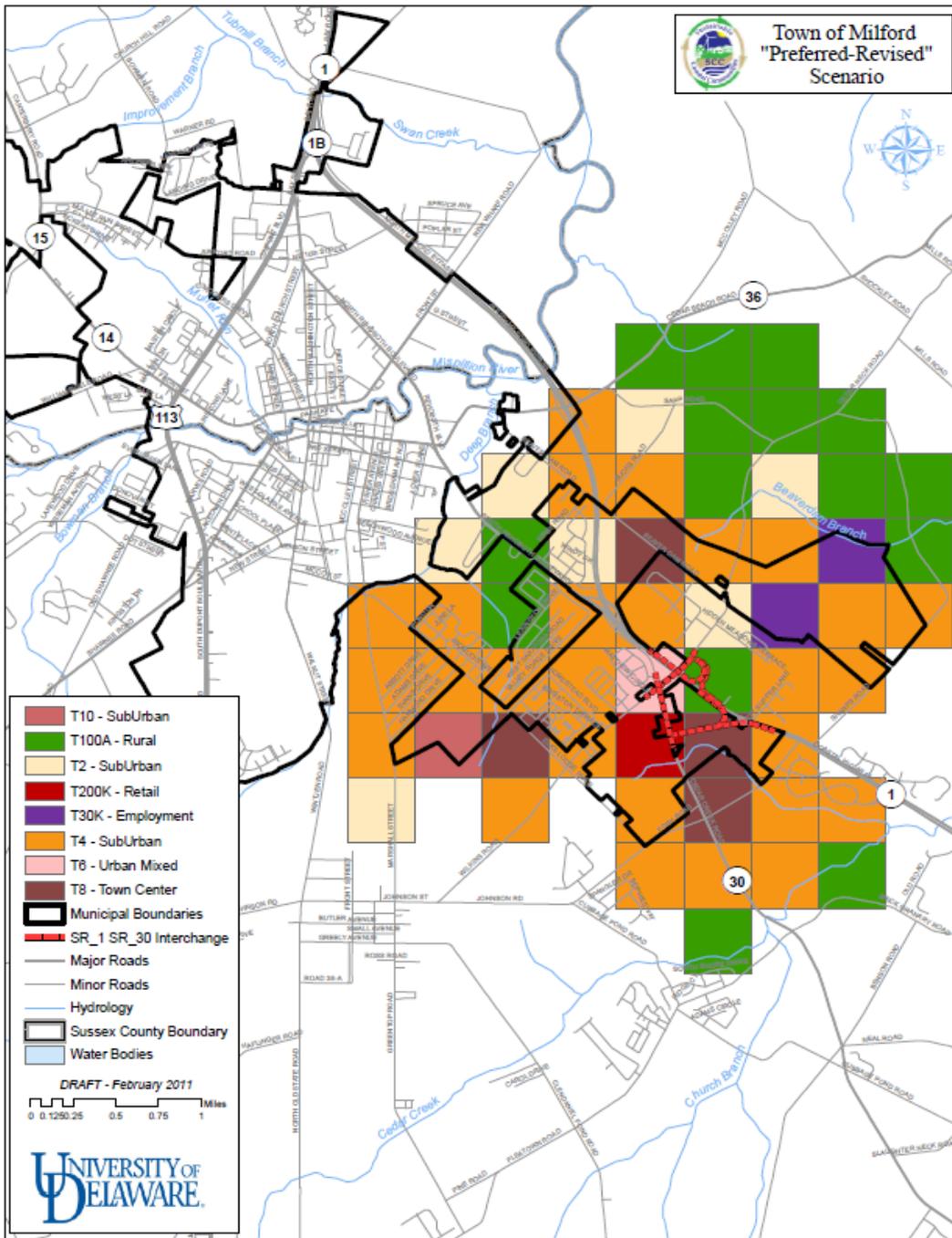
left a smaller subset of parcels that would be the focus of new residential, commercial, and employment land uses. This information is reflected on the Future Land Use Map (Map 1), and eventually was fed back in to the UD-SCC Model to become the Preferred – Revised Scenario (Map 3.1).

Coordinate Land Use Plan with Agricultural Preservation

As a partner in this project, the Delaware Department of Agriculture (DDA) worked to develop a strategy to preserve the agricultural lands along the eastern portion of the Master Plan Area. A number of large farms have already been preserved in this area, and they developed a program to encourage land owners of nearby farms to preserve their land as well. This program is called Transfer of Development Rights (TDRs) and is fully described in Chapter 4.

DDA evaluated the lands within the Master Plan Area in detail and determined which farms had the characteristics and suitability to remain productive. These were identified for future preservation and have been shown as Open Space Agriculture on Map 1. Should the land owners choose to preserve their land using the TDR program, they would be compensated for their “development rights,” and those rights would be transferred to another area. Those areas would be called “receiving areas,” where higher densities would be permitted only by redeeming rights purchased from landowners willing to sell them and protect their land. The land use plan identified three receiving areas where up to eight units per acre would be permitted. These areas are shown as hatch marks on Map 1.

Map 3.1. The Preferred – Revised Scenario



The Land Use and Transportation Connection

As DelDOT was developing its transportation plan for the Master Plan Area (see Chapter 8), it identified the concept of transit loops that would link residential, employment, and commercial uses in the developing area with the existing downtown. Transit service is not viable at the low densities that are present in the area today. In order for transit to be efficient and cost effective, there must be “nodes” or locations of activity where people or jobs are clustered together, so that they might take advantage of bus service or other transit.

The Master Plan initially provided two important nodes of activity. The first is a commercial center or district that is planned west of SR 1 in the vicinity of the planned grade-separated intersection at SR1 and SR30. The other is the proposed employment center located to the east of the same interchange. Both areas will provide a concentration of jobs and services that make them ideal locations for future bus stops. The TDR receiving areas conceived by DDA would also be ideal locations because they would allow for higher-density residential uses, up to 8 du/acre. The project team carefully planned the location of the TDR receiving areas so that they would be along the bus routes, providing bus stop locations to ensure the future viability of transit service for the Master Plan Area.

Base Density in Milford

The Preferred – Alt land use scenario developed as a composite of the public input received at the workshops identified a large portion of the land area to be for single family housing at a density of 2 du/acre. This is consistent with the density permitted by-right under Sussex County’s regulations with access to sewer and water. The City’s position is that any lands that will receive sewer and water must annex into the City limits. Milford’s zoning ordinance allows for a minimum base density of approximately 3 du/acre through their R-1 Zoning District. The City finds that sewer and water utilities are not cost effective with densities of less than this. This information was loaded back into the Community Viz model as a part of the Preferred – Revised scenario.

Milford Southeast Neighborhood Master Plan - Land Use Plan

The final map that will guide future land use in the Master Plan Area is the Land Use Plan, included as Map 1. The land uses identified on this are described as follows:

Residential – Low Density. The majority of the residential land uses in the Master Plan Area are low density, which includes many existing homes and subdivisions, some of which are unbuilt. It

is assumed that undeveloped lands would be built as mostly single-family homes at a density of about 3 units per acre if annexed into Milford.

Residential – High Density. This land use category is reserved for two approved subdivisions that are planned for up to 12 units per acre. One of these subdivisions, Hearthstone I, has been under construction for many years. The other is currently unbuilt.

Open Space Agriculture. The eastern portion of the Master Plan Area is identified for open space and agriculture. This will protect the viability of the agricultural industry in this area, protect the environment, and create a “greenbelt” to prevent future development from encroaching to the east toward Slaughter Beach and the sensitive coastal environment near the Delaware Bay. This land use category is also used for the golf course at Shawnee Country Club, as the assumption was made that this land would stay as open space of some type.

Employment Center. This land use category is identified with a large employer to bring jobs and economic development to the Master Plan Area. The current concept is for a medical campus and / or educational institution that would provide many jobs and services for the region.

Commercial. This land use category is used to identify a future commercial use or district in the vicinity of the proposed interchange at SR 1 and SR 30. It is expected and encouraged that this commercial district may include some mixed uses, such as residential condos or apartments over stores, to provide a vibrant community center that will serve the entire Master Plan Area with needed services and recreation.

TDR Receiving Areas. In these areas the City will allow residential development of up to 3 du/acre “by-right.” In addition to this, developers will be given the opportunity to purchase TDR credits through the program described in Chapter 4 and build at a density of up to 8 du/acre. The areas are hatch-marked to indicate that the boundaries are subject to change based on design review at the time of development. The only criterion is that all of the higher-density units must be within ¼ mile of a current or future transit stop. Mixed uses, such as small scale commercial to serve the residents, may be considered at the time of development.

DeIDOT-Owned Property. Lands in this category are owned by DeIDOT to allow for the construction of the grade-separated intersection at SR 1 and SR 30.

Table 3.1 shows a comparison of the land use categories used on Map 1 with the land use categories used by the UD-SCC Model. This table will allow the reader to compare the

Preferred-Revised Scenario (Map 3.1) to Map 1. Keep in mind that the Preferred-Revised Scenario shown as Map 3.1 is the result of UD’s modeling work. Map 3.1 was completed using 100 acre grids, not parcels, so it is not possible to directly compare the two maps. Although Map 3.1 was important in developing the land use concept for the Southeast Neighborhood, please be aware that Map 1 is the final map which guides future land use in the Southeast Neighborhood governed by this plan.

Table 3.1 Land Use Categories in Map 1 Compared to Land Use Categories in Map 3.1

Land Use Category on Map 1, Land Use	Land Use Category in Preferred Revised Scenario, Map 3.1
Residential – Low Density	T2 Suburban; T4 Suburban
Residential – High Density	T10 Suburban
Open Space Agriculture	T100 Rural
Employment Center	T30 Employment
Commercial	T6 Urban Mixed; T8 Town Center; T200 Retail
TDR Receiving	T8 Town Center
DeIDOT-Owned Property	T100 Rural

Sources: Map 1 created by City of Milford with assistance from the Office of State Planning Coordination and DeIDOT. Map 3.1 created by the City of Milford with assistance from the Office of State Planning Coordination and the University of Delaware Sustainable Coastal Communities Initiative. Map 3.1 developed using the UD-SCC Model.

By the Numbers: Build-Out Timing and Phasing

The land use details included in Map 1 were loaded back into the UD-SCC Model in order to generate build-out calculations for the area. This allowed the project team to compare the Land Use Plan with the Preferred – Alt scenario developed as a composite from the workshops. It also allowed comparisons to the current Milford Comprehensive Plan. See Table 3.2 for a summary of the differences and Appendix 1 for a more detailed review of the model output.

Build-Out: How Much Could be Built Some Day?

Planners use the term “build-out” to describe how much development could be achieved in a given plan or planning area. This is a very effective and necessary exercise for this Master Plan, as it has allowed the project team to properly design and size infrastructure improvements such as roads, water, and sewer.

The current Milford Comprehensive Plan would allow for up to 15,000 new dwelling units and approximately 39,700 new residents. The Preferred – Alt scenario yielded approximately 7,600 new homes and 19,500 residents. The Land Use Plan, reflected by the Preferred – Revised scenario on Table 3.1, has room for about 11,800 homes and 30,700 residents. This is less than

the current comprehensive plan but more than the Preferred – Alt scenario. The increases are due to Milford’s base density for low-density development and the higher accuracy in accounting for existing homes as well as approved subdivisions.

In terms of jobs and non-residential space, the relationship is similar. The current comprehensive plan would allow for a massive amount of commercial space, almost 8 million square feet and 10,200 jobs. In the workshops, the public drastically reduced this amount of commercial to just less than 1 million square feet and about 2,500 jobs. Perhaps more importantly, the commercial activities and employment land uses were clustered around the new grade separated intersection to allow for safe road access. Other positive effects of this choice were that these areas can be served by transit and have the potential to serve as a commercial district for the new community. The project team revised the amount of building square footage up to about 3 million and 4,800 jobs to account for developer’s plans for these areas, but it did not increase the overall amount of land devoted to commercial and employment uses. In fact, the team realized that some of the commercial lands identified in the current comprehensive plan were not able to be safely accessed from the roadways and were thus changed to low-density residential future land use.

Timing and Phasing: How Long Will This Take?

While the “build-out” exercise is important for planners and engineers, the question that most people want to know the answer to is, “When will all of this development be built?” The answer to this question is very important to planners as well because it is necessary to develop timing and phasing plans to ensure that infrastructure is in place when it is needed by new residents and businesses. It is not a cost effective use of tax dollars to build infrastructure before it is needed, either. So timing is critical.

The project team developed some realistic assumptions about the pace and timing of development based on regional and statewide data about population growth and data specific to Milford in the form of building and development permits. Many people can remember the frantic pace of building and land-development activity just a few short years ago in the mid-2000s. We all know now that this was what economists call a “bubble” and was an unusual and short term phenomenon that does not reflect what might happen in the future over a longer period of time. Actual growth and development rates will be much more modest and sustainable based on economic realities, not market “bubbles.”

The team selected a growth rate of approximately 2% per year for Milford, including the Master Plan Area. This averages out to about 40 new houses and 80 new residents per year, which is similar to the historic average experienced in Milford. Using the UD-SCC Model, two future scenarios were developed to reflect what is expected in future years. In 2020 it is expected that an additional 491 houses and 1,251 residents would be in the Master Plan Area. This scenario also assumes that a small amount of new commercial is constructed, only 160,000 square feet employing 462 people. The second scenario assumes the same rate for residential growth, with an additional 525 houses and 1,330 people. However, by 2030 the team assumed that some of the larger commercial and employment uses would be constructed and operational (perhaps a new shopping center, or even a medical campus at the Innovation Park site). As such, more than 1 million non-residential square feet of building space and over 1,100 new employees would be expected by 2030.

Table 3.2. Summary of Alternative Plan Scenarios from Community Viz

	Existing Land Use	Preferred Alt (at buildout)	Preferred Revised (at buildout)	Growth 2020	Growth 2030	Milford Comp Plan as adopted (at buildout)
Dwelling Units	1,943	7,626	11,769	2,434	2,959	15,083
Number of Residents	4,709	19,459	30,739	5,960	7,290	39,659
Commercial Floor Area	0	995,000	2,985,000	160,000	1,185,000	7,970,000
Employees	262	2,519	4,875	724	1,854	10,275
Date Created	Oct. 2009	Oct. 2009	Dec. 2010	Apr. 2011	Apr 2011	Jan. 2009

Sources: University of Delaware Sustainable Coastal Communities Initiative. Growth 2020 and 2030 scenarios developed by City of Milford, Office of State Planning Coordination, and UD based on Delaware Population Consortium growth rates and City of Milford building permit information.



Milford South East Neighborhood Master Plan

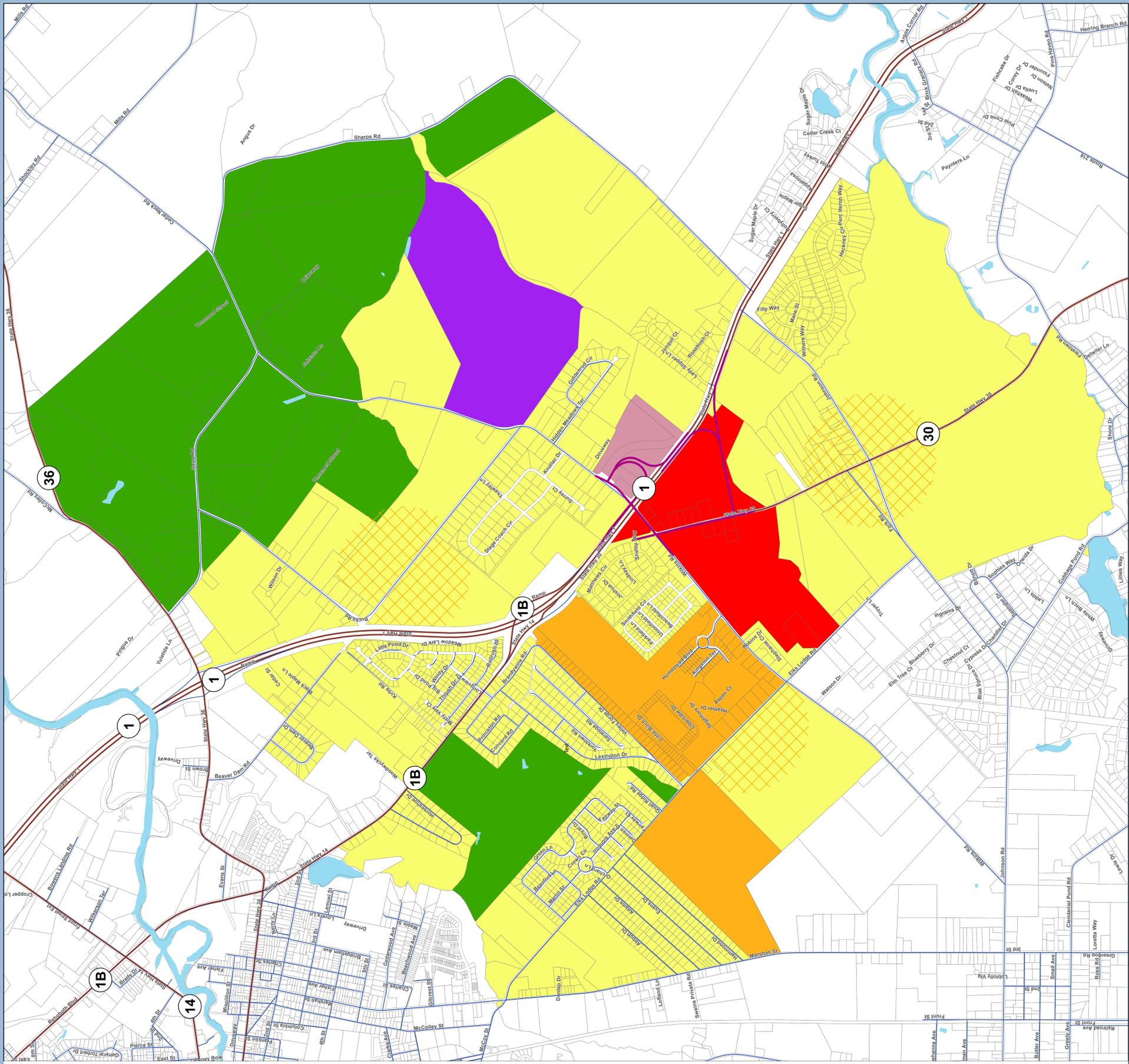
Map #1 Land Use

Legend

- Residential - Low Density
- Residential - High Density
- Open Space Agricultural
- Employment Center
- Commercial
- TDR Receiving Areas
- DelDOT Owned Property



0 0.25 0.5 1 Miles



Chapter 4

Agricultural Preservation

The Delaware Department of Agriculture (DDA) supports and endorses the City of Milford Southeast Neighborhood Master Plan. The Department is especially encouraged to see the large area of farmland to southeast designated as continued agricultural use. The state has already made a significant investment of taxpayer's money to permanently preserve a number of farms in this area through the Delaware Agricultural Lands Preservation Foundation (DALPF). In addition, the Department has performed a Land Evaluation/Site Assessment (LESA) analysis of the parcels designated as Open Space-Agricultural in the plan. The LESA model was developed by the United State Department of Agriculture (USDA) to evaluate a parcel of land's suitability to remain in agriculture for the foreseeable future. The analysis showed all of the parcels are well-suited, and best used, for agricultural in the future. The DDA will continue to work with land owners in this area to preserve their farms permanently, and build on the investment the state has already made.

Simply preserving farmland is not enough to encourage and support farming in the state. State government and municipalities must make the occupation of farming a viable and rewarding living for the farmer and their family. The Department offers some suggestions below that are mutually beneficial to both the city and the surrounding farms. In addition, the Department has outlined a plan for a transfer of development rights (TDR) program whereby the city and DALPF can partner to permanently preserve the farmland identified in the master plan.

In addition to providing a living to farmers, farmland provides a number of intangible benefits to the cities and people who live around them. In the case of Milford, preserving the farmland to the southeast will create a predictable city limit, with no threat that the land can be developed into residential developments through Sussex County. This would ensure that city's services and infrastructure will not be stressed and overextended without additional tax base to support it.

The farmland will also provide a visual amenity of open green space to city residents along the southeast boundary of the city. There are also environmental benefits such as cleansing precipitation before it recharges the underlying aquifers that feed the city's well fields. The surrounding farm businesses will also be a source of income for the city's businesses, when farm families shop in city. Nearby farms also present the possibility of providing fresh local fruits and vegetables to city residents via roadside produce stands or "u-picks."

Milford Southeast Neighborhood Master Plan Transfer of Development Rights Program

The Delaware Agricultural Lands Preservation Foundation (DALPF) will partner with the City to develop a Transfer of Development Rights (TDR) program. The Department suggests a program whereby the city selects which farms it wants to permanently preserve, and which properties within the city would be allowed to use the TDR credits to build additional dwelling units.

Although the city would have discretion in choosing which farms to preserve, the Department recommends the farms be enrolled in the DALPF program first in order to be eligible. The DALPF is a voluntary program whereby the landowner initially agrees not to develop the land for 10 years. During that 10-year period, the landowner is eligible to sell his/her development rights to the state and receive money in exchange for permanently preserving the property in agriculture. In this area, the landowner will also have the option to sell Transfer of Development Rights through the program that will be described in this chapter. Landowners will have at least two options for preservation from which to choose.

The DALPF is a well-established program for preserving farmland. It has been in operation for nearly 20 years and has permanently preserved over 100,000 acres in Delaware. This 100,000 acres represents nearly 20% of the state's available farmland and approximately 8% of the state's total land area.

By partnering with DALPF, the City will avoid the initial financial expenditures required to preserve a parcel of land. These expenditures include paying to survey the property, paying the legal costs of a real estate settlement, and other associated administrative costs. DALPF would bear those costs. In addition, the City would avoid the future obligation of monitoring the preserved farms to make sure they remain in compliance with the preservation agreement (easement). DALPF would assume that responsibility and would add any properties preserved by Milford to the hundreds of permanently preserved farms it already monitors. In addition, should any future litigation be required to uphold the preservation easement, the City would not have to incur any legal costs.

How a Transfer of Development Rights (TDR) Program Works:

In order for a TDR program to work, a viable market has to be created through a number of steps, including ordinances.

The first step in the process is for the City of Milford to identify “sending areas” and “receiving areas.” TDR sending areas are defined as the areas, and properties, from which TDR credits will come. The goal is to permanently preserve these areas as farmland and open space through deed restriction/easement. In return for agreeing to permanently preserve a farm, the landowner would be compensated monetarily. The number of dwelling units (DUs) that could have been built on the property would then be “sent,” or “transferred,” to a previously designated receiving area where the City is prepared for development at higher densities. In addition to sending areas, the City would also have to identify “receiving areas” within its municipal boundary. These areas would have to have the available infrastructure to accept higher density. The City would also need strong ordinances in place that would only allow additional density if the developer participated in the city’s TDR program. In addition, the ordinance must make the addition of more DUs (higher density) through the TDR program “by right.”

Milford’s TDR Program

Selecting the Sending Areas

In order to identify suitable sending areas, DDA performed a GIS analysis of properties just outside, or straddling, the city’s future projected growth boundary to the southeast. In order to determine which farm parcels would be most suitable for preservation, the department applied the same qualifying criteria used by the state’s Agricultural Lands Preservation Program. The analysis identified 11 farm parcels encompassing 720 acres. These properties are shown in Table 4.1 and on the Agriculture Map, Map 2. This area is ideal because a number of farms have already been permanently preserved by the Delaware Agricultural Lands Preservation Program. In addition, there are several other farms in the area that are currently enrolled in the DALPF program, waiting to be permanently preserved. The farms in the sending area are currently zoned for two (2) units to the acre under the Sussex County zoning code. Therefore, approximately 1,452 dwelling units could be transferred into the City of Milford and used on properties designated as receiving areas. The proposed sending areas are shown as “Open Space Agriculture” (green color on legend) on the land use map (Map 1).

Selecting the Receiving Areas

Finding eligible farms willing to sell their development rights is only one side of the equation. The City must also identify areas prepared to accept additional dwelling units above the maximum number allowed by the underlying zoning. The additional DUs would only be allowed if the developer participated in the city’s TDR program. Receiving areas have been identified based on a number of enabling factors, including sewer and water availability, road and traffic

considerations, availability of public transportation, existing density in the area, proximity to public services, environmental considerations, and other factors.

After considering and weighing all the factors previously discussed, DDA supports the city using the three (3) areas defined by the hatch-marked areas on the Land Use Map (Map 1). These areas are centered on future public transportation locations, or nodes. These areas are in proximity to future employment centers and commercial services and are not located on environmentally sensitive lands as identified by DNREC. See Table 4.2 for more details.

Some the land in the receiving areas is already within Milford's municipal boundaries. In order for the other lands to participate as receiving areas through this program, they will have to be annexed into the City of Milford. Upon annexation, these lands will be zoned at the base density, currently known as R-1 under Milford's existing zoning ordinance. This ordinance currently allows development at up to approximately 3 du/acre. Property owners/developers would be allowed to develop at that density under the current regulations. However, if the property owner/developer choose to participate in the TDR program, the land could be developed at up to 8 du/acre if there is a transfer of units from the sending area. This transfer would be "by-right," meaning that there is no special approval needed to complete the transfer as long as the parameters and requirements of the program are met. The developer's plan would still have to go through the standard subdivision review process through the Planning Commission and City Council, to ensure it meets city code requirements. The area encompassed by the hatch-marked areas equals approximately 280 acres. Therefore, multiplying that area by five (5) additional units per acre would allow up to 1,400 units to be transferred, potentially preserving 720 acres of farmland in the receiving area.

Table 4.1. TDR Sending Area Analysis

Parcel Number	LESA Score	Acres	Zoning Yield ¹
330-12.00-10.00	185.08	60	120
330-08.00-47.00	220.19	14.7	28
330-12.00-08.00	222.51	117.4	235
330-08.00-28.00	172.61	46.2	92
330-08.00-24.00	189.26	41.29	101
330-12.00-01.03 ²	210.7	118.18	236
330-12.00-01.02 ²	Part of 330-12.00		
330-12.00-01.02 ² (Unit 21805)	Part of 330-12.00		
330-12.00-01.00	181.54	66.8	132
330-08.00-19.00	192.19	85.5	170
330-08.00-19.02	192.19	16.3	32
330-08.00-20.00	232.5	105.6	210
330-07.00-75.00	184.27	48.4	96
Totals		720.37	1,452

Source: Delaware Department of Agriculture

¹ Zoning Yield reflects 2 dwelling units per acre, which is currently allowed in the Sussex County AR-1 Zoning District

² Shaded parcels are currently enrolled in an existing Agricultural District.

Table 4.2. TDR Receiving Area Analysis

Milford TDR Receiving Areas: Located within ¼ Mile of Public Transportation Nodes				
Node	Acres	Base Zoning at 3 DU / Acre	TDR Zoning at 8 DU / Acre	Additional DUs through TDR Use
1	58	174	696	522
2	118	354	1,416	1,062
3	104	312	1,248	936
Totals	280	840	2,240	1,400

Source: Delaware Department of Agriculture, City of Milford, and Office of State Planning Coordination

Purchasing Development Rights Using a TDR Bank Concept

Some traditional TDR programs require the developer to find a suitable farm to preserve and a landowner willing to sell his/her development rights. The developer would have to negotiate a price with the owner and handle all of the legal and administrative requirements to permanently preserve a parcel of land from future development. This process typically requires a lot of time and money from the developer. This is generally not in the developer's best interest if they are trying to take advantage of prevailing real estate market conditions favoring building at higher densities.

DDA will assist the city in the creation and administration of a TDR bank in lieu of the aforementioned process. In a TDR bank concept, the City would begin with either seed money or TDR credits from lands already preserved. Developers would purchase TDR units to allow them to build at higher density from the bank. An administrative fee may also be assessed to account for legal and other costs that may be necessary to complete the transfer. The City (aka “the bank”) would aggregate all the funds it collects from developers who purchase these rights and use that money to purchase the development rights on properties enrolled in the DALPF program and located in the city’s designated sending area. These units would then be available to be re-sold to future developers. The City would choose which farms it wanted to purchase based on predetermined criteria they establish.

In addition to the funds the City would have, the City would also be eligible for state-matching funds from DALPF, as well as any federal matching funds from United States Department of Agriculture (USDA) Farm and Ranch Lands Protection Program (FRPP). As allowed by law, these matching funds would be awarded to the city based on availability. If the City were able to capture state and federal matching funds, it could significantly leverage funds with additional money and preserve additional farm land.

Setting the Cost of TDR Credits or Units

DALPF recommends that the value/cost of a unit of development rights for transfer be based on the most recent real estate appraisals done on properties near the designated sending areas. If there are insufficient real estate appraisals to determine a value, DALPF could undertake a sample appraisal process to establish a fair value. The value could be established for a given calendar year, or on any other schedule the City deems appropriate. Pricing could be done by land classification if the rights were variable in the city’s system, again based on recent appraisal information. As another option, the City could set values based on the presumed value of the rights, with a deduction for the developer’s profit. Studies have shown that a developer needs to realize a 35 percent profit margin when buying TDR credits in order to have an incentive to buy them.

Summary of Benefits of this Program

- The TDR bank allows developers to purchase rights at pre-set prices. No need to locate willing land owners and negotiate prices.
- Farmers and landowners can sell directly to the TDR bank at pre-set prices, determined through fair appraisal methods. No need to negotiate with developers.

- TDRs can be sold and purchased in appropriate increments based on needs and market conditions at the time. No need to match a farmer/landowner with a developer who needs exactly the number of TDRs they wish to sell.
- Additional density would be allowed “by right,” and the developer will not have to go through a separate public approval process to use the credits.
- As a part of this program, the use of TDRs will entitle the builder/developer to all of the benefits of expedited review and processing that accrue to those who adhere to the recommendations and requirements in the Master Plan area.
- The City and the State will also dedicate a permanent plaque or marker in the development, and the farmland that was preserved, that memorializes and recognizes the developer’s contribution.

Additional Recommendations for Implementation of Agricultural Preservation:

1) DDA recommends that the City require any property developed adjacent to land designated as Open Space Agriculture to include a forested buffer between the property and adjacent farmland. This is already required by Sussex County. As a courtesy to Sussex County, DDA’s Forest Service reviews the effectiveness of the buffer and makes a recommendation to the county on whether or not to accept the buffer as is, or require modifications. The Department would offer the same service to the city.

2) In addition to a forested-buffer requirement, DDA also asks that the City work with developers on where they “mass” their houses or buildings. Whenever practical the Department requests that the City require developers to cluster their approved building lots and place as much of the residual community open space near adjacent farm parcels. This would further help eliminate or mitigate any conflict that may arise from dissimilar land uses.

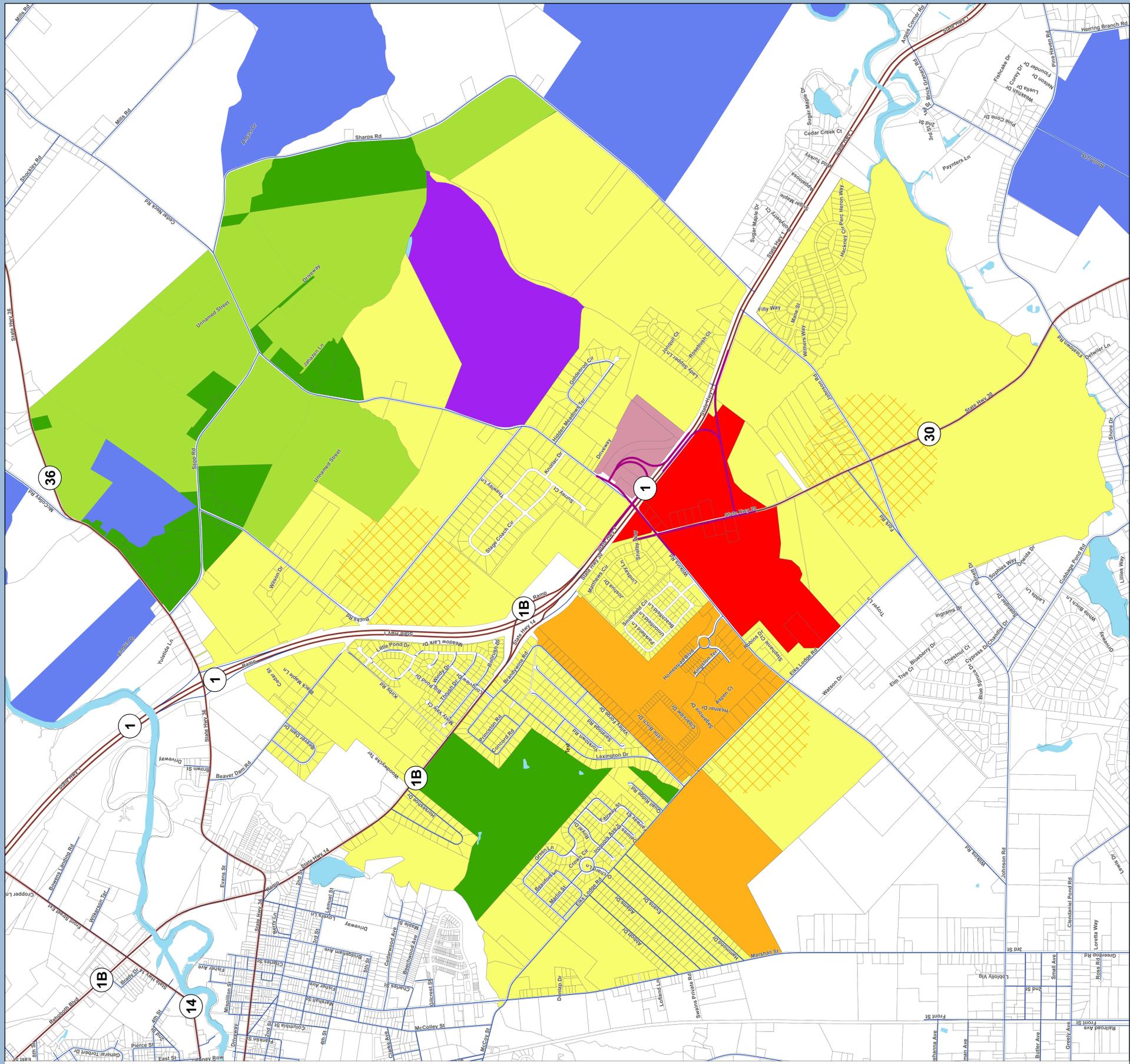
3) DDA asks that the city review its zoning ordinances for compatibility with future agricultural business or agriculture related uses. It is important to provide provisions and flexibility in the zoning code to accommodate future agriculture related activities.

4) DDA would note that all properties enrolled in the state’s farmland preservation program are afforded the protections listed in Appendix 3. In addition, Sussex County adopted a “mirror” ordinance to provide these protections to all farms located in Sussex County. These protections should be considered during the city’s planning process in an attempt to place more compatible land uses next to properties engaged in agriculture. In addition, there is a restriction on the location of water wells in DNREC’s regulations that should be considered.



Milford South East Neighborhood Master Plan

Map #2 Land Use & Agriculture



Legend

- Residential - Low Density
- Residential - High Density
- Open Space Agricultural
- Employment Center
- Commercial
- TDR Receiving Areas
- DeIDOT Owned Property
- Agricultural Easement
- TDR Sending Areas

Map created by DeIDOT Division of Planning



Chapter 5

Environmental Protection

The Delaware Department and Natural Resources and Environmental Control (DNREC) has evaluated Milford's Southeast Neighborhood in order to develop a proactive environmental protection strategy to be a part of this plan. This plan will allow the development of the master plan area to proceed while protecting key resources and creating more livable and connected communities in that area. DNREC utilized GIS resources and a collaborative planning process involving several programs within the Department to identify three opportunity areas for preservation and environmental protection. The first area is the medical/commercial area east of SR1 (Area 1). The second is the mixed-use shopping area at the intersection of SR30 and Johnson Road (Area 2). The third area is the southernmost boundary of the Southeast Neighborhood along Swiggetts Pond and Cedar Creek (Area 3).

Environmental Overview of the Master Plan Area

Delaware's natural life-support system (often referred to as green infrastructure) is a network of natural areas, parks, conservation areas, and working lands all with conservation value. Many of these areas are carefully planned and managed by federal, state, or local governments, not-for-profit organizations and individual landowners. These components support native species, maintain natural ecological processes, sustain air and water resources and agricultural enterprises, and contribute to the health and quality of life for Delaware's communities and people.

DNREC has embraced as its core policy for natural-resource protection, the following eight Ecological Guidelines:

- 1) Maintain large areas of contiguous habitat and avoid fragmenting these areas.
- 2) Maintain meaningful wildlife corridors and potential non-consumptive bicycle and pedestrian connections between habitat areas and adjacent land uses.
- 3) Protect rare landscape elements, sensitive areas, and associated species.
- 4) Allow natural patterns of disturbance to continue to maintain diversity and resilience of habitat types.
- 5) Minimize direct and indirect human disturbances and the introduction and spread of non-native species and favor native plants and animals.
- 6) Minimize human introduction of nutrients, chemicals, and pollutants.

- 7) Avoid land uses that deplete natural resources over a broad area and allocating such land uses to areas of minimal natural resource impacts.
- 8) Compensate for adverse effects of development on natural processes.

Excellent Recharge Areas

There are several excellent recharge areas within the Southeast Neighborhood, notably in the vicinity of the employment center proposed east of SR 1 (Area One). The protection of excellent-recharge areas offers multiple long-term environmental benefits. These benefits include water quantity, water quality, and the preservation of stream/wetland ecological functions. An estimated one-third of Milford's total drinking water supply is withdrawn from a shallow unconfined aquifer known as the Columbia aquifer. The Columbia aquifer's major source of water recharge is from those areas delineated as areas of excellent recharge. Therefore, using this area of excellent recharge to site building structures and/or water-infiltration structures may reduce the quality and quantity of water available to existing and future residents from wells that obtain drinking water from this aquifer. Moreover, the impact to water quality and quantity is likely to extend to those residents who live far beyond the proposed project site, as the Columbia aquifer is a major drinking water source for a significant portion of the population who reside in Kent and Sussex counties. The upshot to development in the area of excellent water recharge is to pass those water-quality and water-quantity impacts in the form of increased water utility rates to existing and future residents as the waters of the Columbia aquifer are depleted and/or contaminated.

Regional Stormwater Management

Originally DNREC had urged the City to consider regional approaches to stormwater management for new development in the planning area. A GIS review of the terrain and natural features indicated that a regional stormwater-management approach is not practical at this time. In order to obtain sufficient drainage area for a regional system to work, existing subdivisions would need to be retrofitted and stormwater from DeIDOT roads and road improvements would have to be included. Neither is likely to happen in the short term, or on a regional scale in this area. This is due to both the topography as well as the fact that there are numerous existing developments that are not likely to re-develop in the foreseeable future.

However, there is an opportunity for greater communication and coordination between DNREC and DeIDOT with regard to stormwater management and road improvements. This coordination will be ongoing throughout the development of this master-plan area.

Opportunities to share facilities and streamline the review process will be continually evaluated and implemented as individual properties within the master plan area develop and re-develop.

A stormwater utility is a legal and financial structure to allow stormwater facilities to be constructed, managed, and maintained in common by a local government or other entity that functions as a public utility. A stormwater utility would be modeled after a sewer or water utility, only the infrastructure would be stormwater ponds, pipes, outfalls, ditches, drainage ways and the like. Stormwater-management facilities rarely impact only one property, which is what makes the utility approach a logical tool for managing drainage. This master-plan area is well suited to such a utility, although there are many ways to structure such an entity. Both the City and DNREC agree to explore this option in more detail as this area develops in accordance with this master plan.

Cedar Creek Natural Area.

Sections of the wooded areas of the Milford Southeast Master Plan Area are part of the Cedar Creek Natural Area (see Map 5.1). Natural Areas contain lands of statewide significance identified by the Natural Areas Advisory Council as the highest quality and most important natural lands remaining in Delaware. The Milford Southeast Area Master Plan acknowledges and provides protection for the Cedar Creek Natural Area.

Natural Area protection recommendations are listed below. These protections are included as Design Guidelines in Chapter 10:

1. Prohibit/limit the removal of trees within the Natural Area.
2. Provide buffers to the Natural Area. Prohibit additional development within 300 ft. of the existing Natural Area.
3. Prohibit storm water structures in the Natural Area.
4. Require green technologies to manage stormwater in the master-plan area, and particularly in the vicinity of the Natural Area. These best management practices use the natural processes of vegetation to filter stormwater, take up harmful pollutants, and improve groundwater recharge without expensive infrastructure.

Cedar Creek Nature Preserve

Cedar Creek Nature Preserve is adjacent to the south end of the Southeast Planning Area (see Map 5.1). A number of rare species can be found in association with this habitat type. To protect the rest of this contiguous forest area, it should be preserved as a Nature Preserve. A Nature Preserve is a special designation that provides additional protection for this important natural-resource area. Such a designation would be achieved with the assistance of the State Office of Nature Preserves within DNREC. Should these areas be annexed as envisioned by the Master Plan, Milford will work with private landowners and the State Office of Nature Preserves to promote the dedication of the Natural Area as a Nature Preserve.

Wildlife Habitat

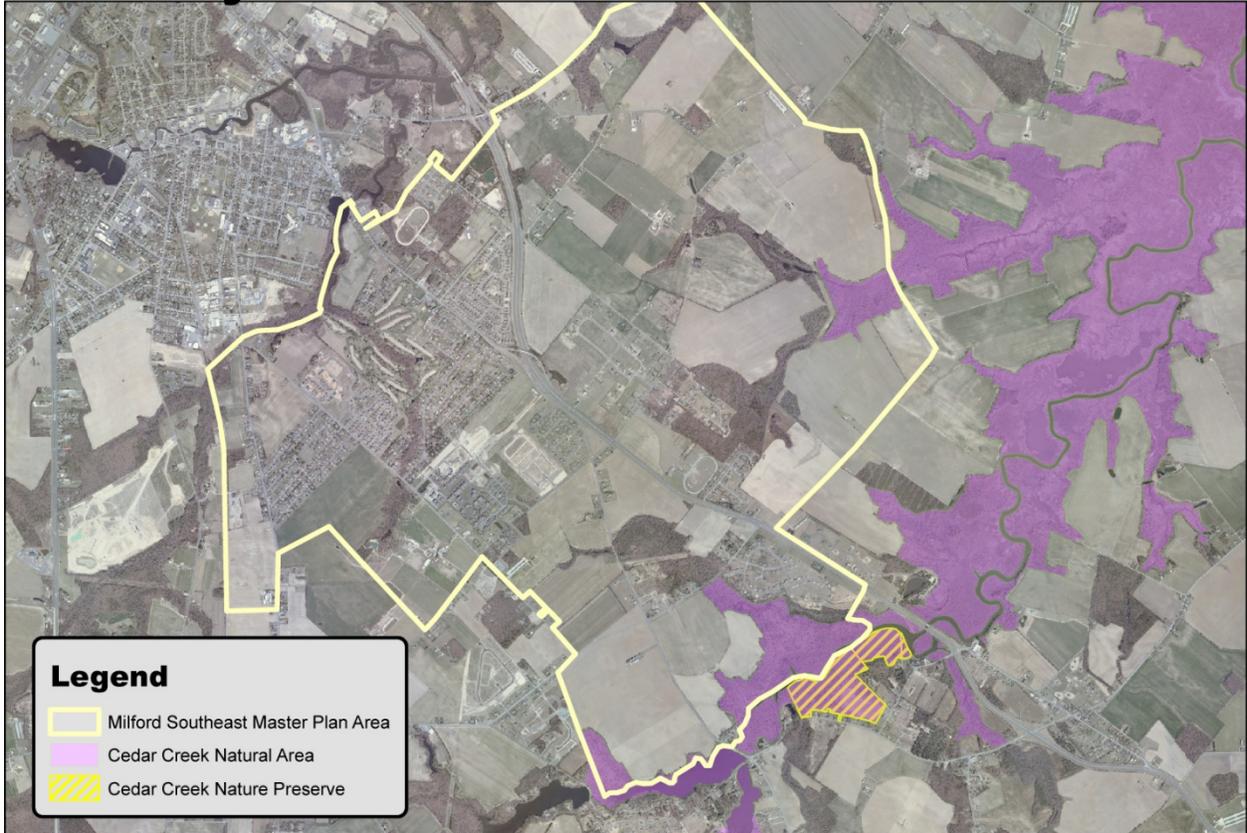
There are several significant natural features in the Southeast Master Plan Area, including the aforementioned Cedar Creek Natural Area and Cedar Creek Nature Preserve, which provide habitat for a wide variety of plant and animal species. Key Wildlife Habitats (KWH), a designation found within the Delaware Wildlife Action Plan (DEWAP) are rare, have special significance in Delaware, are particularly sensitive to disturbance, and/or have a high diversity of rare plants. Large blocks of unfragmented forests and wetlands are also considered to be KWH because of their importance to area-sensitive species, particularly vertebrates.

Priority areas include riparian buffers, contiguous forest blocks, and forested corridors. In order to retain the ecological function of the forests within the Southeast Master Plan Area, fragmentation of existing forest blocks would need to be minimized. Preserving larger, connected areas of forest as open space will provide wildlife with needed food, water, shelter, and places to raise young.

A 300-foot minimum upland buffer is recommended in all areas that support State-rare Atlantic White Cedar Wetlands (AWCW), specifically in Area One and Area Three. Swamp pink, a federally threatened plant, occurs within the AWCW and is very sensitive to changes in hydrology, especially increases in pH and sediment. To protect water quality for other wetlands, water courses, and water bodies, and to provide wildlife habitat for wetland dependent species, upland buffers of at least 100 feet are recommended within the planning area.

Map 5.1. Cedar Creek Natural Area and Nature Preserve

Cedar Creek Nature Preserve City of Milford SE Area Master Plan



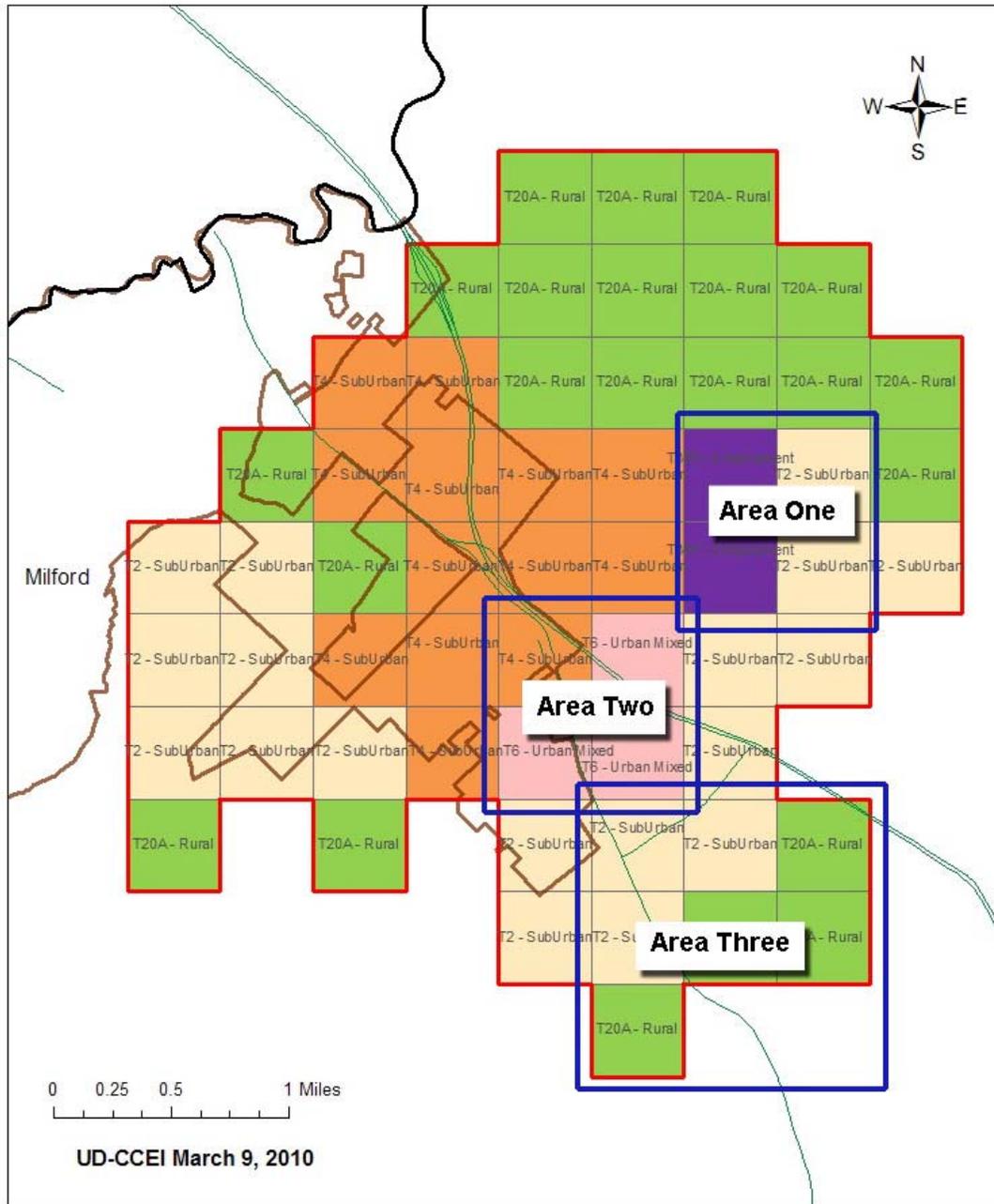
Parks and Recreation

The City of Milford has been awarded a grant through the Delaware Land and Water Conservation Trust Fund (DTF) to develop a Pedestrian/Multi-Modal Master Plan. The purpose of this plan will be to identify new routes within the City of Milford that need to be designated for bicycle facilities and multi-modal paths as well as gaps in the existing connectivity system and links to other modes of transportation. The plan will expand the existing transportation system and will support economic activity and growth by integrating land use and transportation planning through coordinated bike and multi-modal routes. The recommendations and findings of this plan will be implemented in the Master Plan area in coordination with Chapter 8, Transportation.

The 2008 - 2011 Statewide Comprehensive Outdoor Recreation Plan (SCORP) provides guidance for investments in needed outdoor recreation facilities. Citizens surveyed in Milford and eastern Sussex County list the following as high priorities for recreation: walking/jogging paths, bicycle paths, public swimming pools, playgrounds, open space/passive recreation, picnic areas, hiking trails, and fishing areas. In the Master Plan area, these outdoor recreation priorities will be implemented through the development of complete streets and a multi-modal transportation network as described in Chapter 8, Transportation. They will also be addressed through the design of new communities in accordance with Chapter 10, Design Guidelines, and the other ordinances found within the City of Milford Subdivision Ordinance.

Map 5.2. Specific Conservation Areas in the Master Plan

SE Neighborhood - Milford "Preferred" Scenario Map by Land Use



Specific Conservation Areas

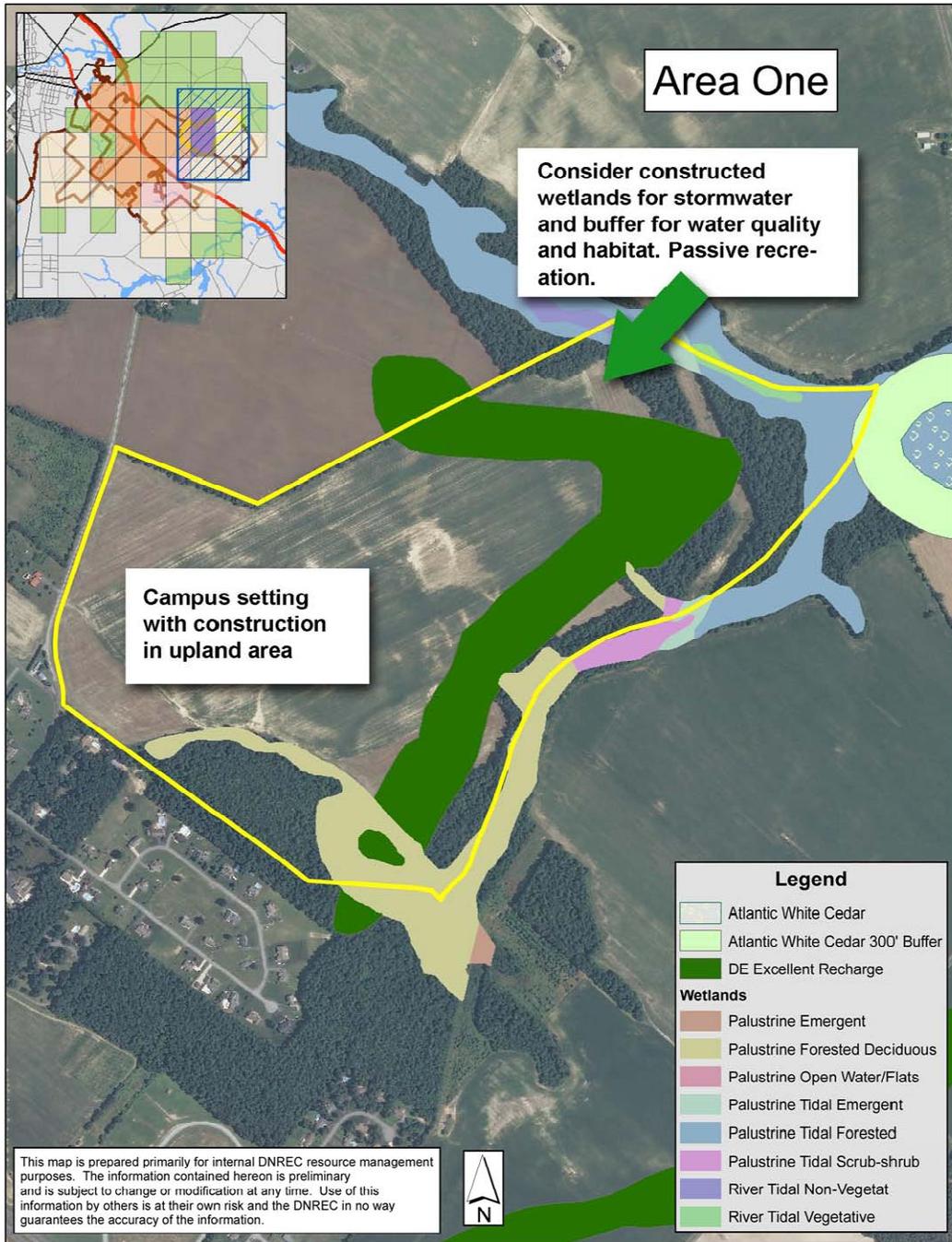
Area One - Employment Center

Area One consists of the lands proposed for an employment center in the master plan. The current proposal for the development of this area contains a commercial and medical campus. This area contains a large excellent-recharge area (see Map 5.3, Area One) and forested tidal wetlands on its easternmost edge.

The current developers have said they intend for this complex to be developed as a campus, with the likelihood of multiple stories and even structured parking. Such an approach is necessary to limit impervious cover and protect these key resources. Intense development should be clustered on the upland portion of the parcel, and the eastern portion would be used for passive recreation and open space.

The Downer and Ingleside soils in Area One are the preferred location for stormwater infiltration. The excellent-recharge areas should be protected so that they may function for the maximum benefit possible to limit the generation of stormwater runoff. When these areas are to be utilized for any stormwater runoff-management practices, the pretreatment of stormwater may be necessary prior to infiltration. Another possibility is to construct wetlands between the excellent-recharge area and the forested tidal wetlands to manage stormwater and strengthen the buffer between the tidal areas and the developed portion of the property. This is one area that could benefit from a stormwater utility approach. Revenues from a stormwater utility could be used to purchase easements and/or construct and maintain those wetlands as stormwater facilities by the city or other management entity identified in the design of the utility.

Map 5.3. Area One

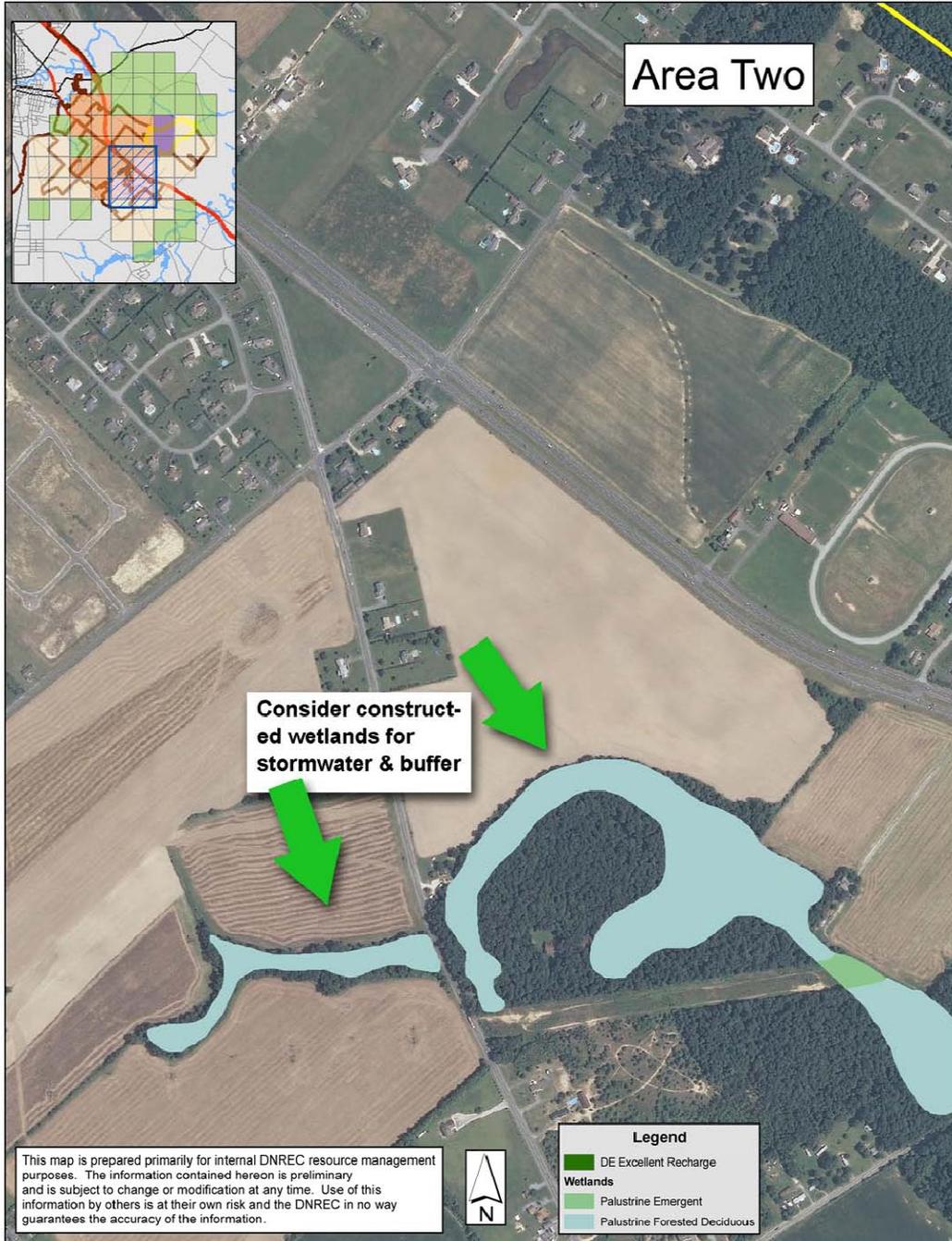


Area Two- Commercial/Mixed-Use Area

A large mixed-use residential and retail development is planned for Area Two (see Map 5.4, Area Two). Our chief area of concern here is protecting the forested wetlands that are mapped in the southern end of this area, on both sides of SR 30. Because of the falling elevations from the north end of this area toward the mapped wetlands, optimal stormwater management would be constructed wetlands or other green-technology best management practices in the area immediately north of the forested wetlands, on either side of SR 30. They would help buffer the wooded wetlands from development.

The wooded section in this area also supports Key Wildlife Habitat. Generous riparian buffers (300 feet or greater) are important to protect water quality and preserve forested areas surrounding the tributaries of Cedar Creek to enable these rare species to thrive.

Map 5.4. Area Two



Area Three – Southern Master Plan Area

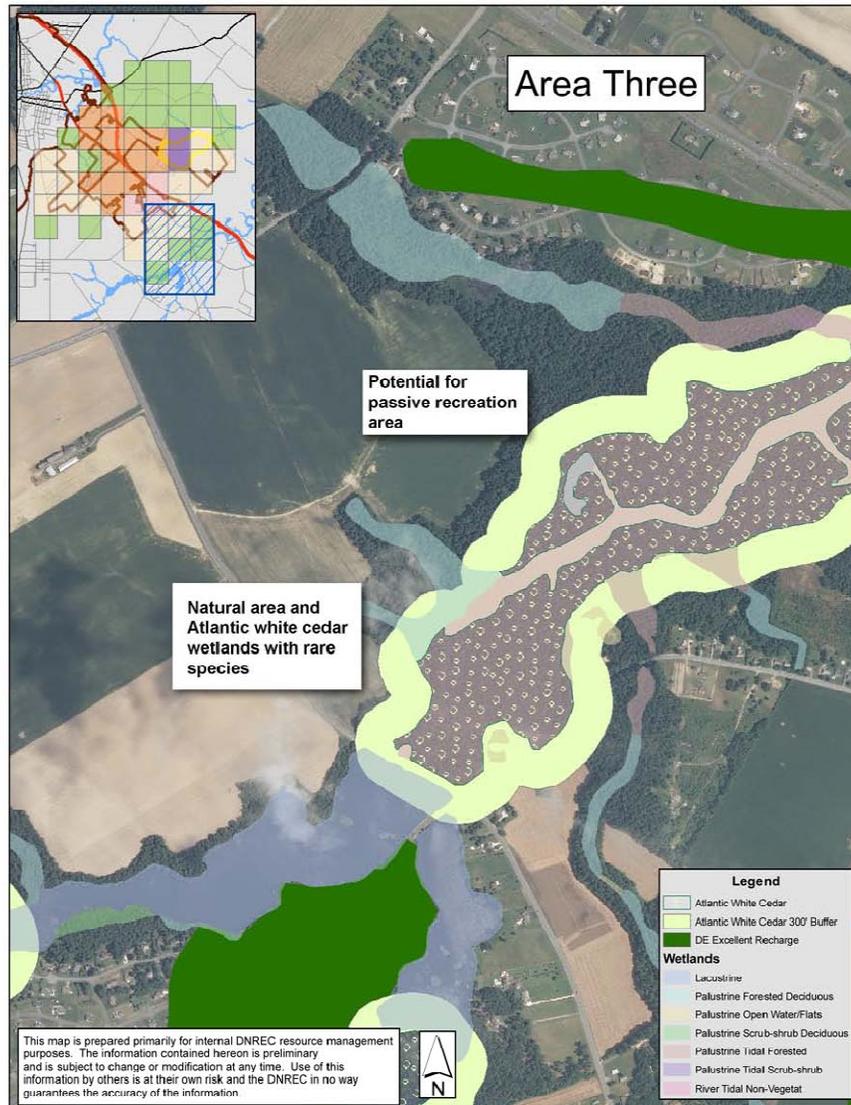
Area Three (see Map 5.5, Area Three) contains Atlantic White Cedar Wetlands, which are considered very rare within the state and support rare species. This vegetative community grows under unique conditions and is sensitive to changes in water quality, especially pH. Adequate upland buffers are extremely important to the persistence of these wetlands and the species it supports.

Rare plant, insect, mussel, fish, and birds occur within the forest and wetland areas associated with the Cedar Creek drainage, as well as impoundments such as Swiggetts Pond and Cabbage Pond. Known occurrences of the federally threatened plant swamp pink (*Hellonias bullata*) have been documented within wetlands associated with Beaverdam Branch and Cedar Creek.

In most cases, a 300 foot minimum upland buffer is recommended primarily due to the presence of or potential for swamp pink. The buffer would also be instrumental in achieving the Total Maximum Daily Load (TMDL) pollution limits for this portion of the Mispillion watershed.

It is believed that the recommended buffer also provides an opportunity for Milford to work with landowners, DNREC, and other partners to establish a passive-recreation resource that could include a kayak launch and allow for birding and hiking on unpaved trails in and around the Cedar Creek Natural Area.

Map 5.5. Area Three



Chapter 6

Housing

The Delaware State Housing Authority (DSHA) supports the inclusion of affordable housing in the Master Plan area. The Master Plan area includes all of the elements of a complete community, including employment, transit, commercial services, and opportunities for the construction of a variety of housing types, especially in Transfer of Development Rights (TDR) receiving areas. Consider these factors:

- Moderate-income working families benefit the most from having access to transit, employment, retail, and services. They are also the most likely to use transit. Typically, well-designed developments on transit and nearby community amenities become desirable places to live. As a result, if left unchecked, prices quickly rise beyond the reach of the families that would most benefit.
- Even though there is a surplus of housing on the market, most of the surplus are large homes for move-up buyers. As a result, there is a significant mismatch between product available and housing demand. To better meet demand, these master-planned areas should provide various types of housing in more compact configurations to create more housing choices, which often means more affordable options.

How DSHA can contribute to the current master planning efforts

Low Income Housing Tax Credit Program

DSHA administers the Low Income Housing Tax Credit program, which provides direct federal income tax credit to qualified owners and investors to build, acquire, or rehabilitate rental housing units. DSHA has just revised its Qualified Allocation Plan (QAP), which is the selection criteria to be used to determine housing priorities, to ensure developments facilitated through the LIHTC program are well integrated into communities.

Up to fifteen (15) points can now be awarded to developments that demonstrate overall quality of location, access to services and transit, community design and compatibility, connectivity to surrounding communities (via Complete Streets), and protection of environmental resources. DSHA is exploring other incentives to include in the QAP to prioritize affordable housing in areas that are considered “strategically important” by the state. Master Plan areas such as this

one in Milford may be considered as we work with the Office of State Planning Coordination to define “strategically important” and integrate those areas into our criteria.

Affordable Housing Resource Center

DSHA has developed an online Affordable Housing Resource Center that communities can access to learn about various strategies that can be used to encourage affordable housing. In addition, DSHA has a range of homeownership, rental, and rehabilitation programs, as well as relationships with nonprofits, that are familiar with DSHA’s programs that we can bring into these master planning efforts.

Design Assistance

DSHA finds value in Form-Based Codes (FBCs) in that they emphasize the physical character of development and de-emphasize the regulation of land use. FBCs provide greater predictability about the look and feel of development and offer developers a clearer understanding of what the community seeks. More importantly, they emphasize site design and building form over density and land uses and, therefore, encourage a mix of uses and housing types. As this master plan area develops, DSHA would be willing to work with the City of Milford, the Office of State Planning Coordination and others to develop a FBC or something similar to ensure good design in the master plan area.

Future Grant Opportunities

The Partnership for Sustainable Communities is a national effort to coordinate the activities of the Department of Housing and Urban Development (HUD), the Department of Transportation (DOT), and the Environmental Protection Agency (EPA) to help communities become economically strong and environmentally sustainable. Through the Partnership and guided by six Livability Principles, the three agencies are coordinating investments and aligning policies to support communities that want to give Americans more housing choices, make transportation systems more efficient and reliable, reinforce existing investments, and support vibrant and healthy neighborhoods that attract businesses. Last year, this Partnership provided several grant opportunities that supported activities similar to those being considered in the Milford and Georgetown master plan areas.

While we realize that the federal government is going through severe budget cuts and that these initiatives may suffer as a result, DSHA would be interested in participating on a working group to do some of the pre-planning work that would be needed if another grant opportunity is available, either from the Sustainable Communities effort or some other effort, that the master planning efforts would be competitive.

Chapter 7

Historic and Cultural Preservation

The Division of Historical and Cultural Affairs/State Historic Preservation Office (DHCA/ SHPO) is the state agency responsible for promoting and protecting Delaware’s historic identity through its leadership in museums, collections, historic preservation, and stewardship of historic properties. The DE SHPO Research Center manages information collected statewide about historic buildings and structures, archaeological sites, and cultural landscapes. SHPO provides project developers, interested parties, and agencies with information on historic buildings and sites that may be affected by their projects and makes recommendations on how to avoid or reduce any adverse effects.

In general, SHPO performs the following services:

- Reviews federally funded, permitted, or licensed undertakings/projects and advises the sponsors of the effects on cultural resources that include historic properties and sites
- Reviews and comments on land use and development proposals under the state Preliminary Land Use Service
- Leads efforts in securing and accepting nominations of significant properties and sites to the National Register of Historic Places in conjunction with the Delaware State Review Board for Historic Preservation
- Encourages and assists local governments in securing Certified Local Government designation for potential awarding of federal grants for historic-preservation activities
- Administers federal and state historic preservation tax incentive programs for the rehabilitation of properties listed in the National Register of Historic Places
- Monitors and enforces the terms of maintenance and public benefit covenants and easements under the stewardship of the Division of Historical and Cultural Affairs
- Provides guidance upon the discovery of historical unmarked human remains and for the identification, treatment, and disposition of non-Native-American historical unmarked human burials and/or skeletal remains

- Conducts, or supports others in conducting, statewide cultural-resource surveys of historic properties
- Maintains a central research repository of historical and cultural-resource information related to historic properties and sites in Delaware
- Provides technical assistance to the public regarding historic-preservation topics
- Provides and participates in educational programs about Delaware history, archaeology, and historic architecture
- Drafts every five years and maintains a commitment to Delaware's State Historic Preservation Plan
- Disseminates historic-preservation information via the latest information technology

DHCA is responsible for overseeing the requirements of three major preservation laws in Delaware: the National Historic Preservation Act of 1966 (as amended), the State Antiquities Act of 1933 (last amended 2005), and the Unmarked Human Remains Act of 1987. All of these laws are applicable to future preservation and development activities in the Milford Master Plan Area.

National Historic Preservation Act

The National Historic Preservation Act established a federal-state partnership approach to the identification, study, and preservation of historic properties, creating the National Register of Historic Places as the standard for determining if a property is worthy of preservation. Section 106 of the Act mandates a review process for all federally funded, permitted, or licensed projects that may impact properties listed or eligible for listing, in the National Register. The main purpose of the Section 106-review process is to minimize potential harm to historic properties and sites. A federal agency whose project (undertaking) may harm a historic property must consider alternative plans for its project. If it is believed that such a project would not have an adverse effect, the federal agency is required to document this finding. If an adverse effect is expected, the agency is required to work with SHPO to ensure that all interested parties are given an opportunity to review the proposed work and provide comments. SHPO staff members assist planners, developers, research consultants, agencies,

and interested parties in planning for projects while maintaining compliance with applicable laws and regulations and protecting important resources from adverse effects. This federal review often requires that an agency or its client conduct architectural and/or archaeological surveys and mitigations prior to any construction. Much of the information and reports in the Research Center has been generated by these reviews.

Delaware State Antiquities Act

The State Antiquities Act requires that archaeological excavations on state-owned or controlled lands must be done under a permit from the Director of DHCA. Recent amendments also give the Director authority to close or restrict access to state lands, including sections of public beaches and shorelines, if needed, to protect an archaeological resource from damage.

Delaware Unmarked Human Remains Act

SHPO administers provisions under Delaware's Unmarked Human Burials and Human Skeletal Remains law, 7 Delaware Code, Chapter 54. The law is generally triggered when, in the course of construction or archaeological activities, human remains are discovered. The law assigns certain duties to the Division of Historical and Cultural Affairs to investigate, attempt to identify, protect, and ensure the proper treatment of historical unmarked human remains that do not fall under the jurisdiction of the State Medical Examiner.

SHPO staff carries out procedures under this law relating to public notification, assisting in the development of treatment and disposition plans, and, where indicated, conducting the dignified reburial of disturbed remains.

Discovery of Forgotten Burials and Cemeteries

On occasion, historical human remains (that is, remains that were interred a long time ago) are accidentally discovered in Delaware. These discoveries are often made during construction and other earth-moving activities. In such cases, state law protects the historical remains from further damage, first by requiring that the actions that uncovered the remains stop immediately, and then that the Division of Historical and Cultural Affairs and the state Medical Examiner's Office be notified.

Within 24 hours of notification, a SHPO archaeologist will visit the discovery site to determine if the remains are human and to ascertain the approximate time period in which the remains were interred. Any time that remains are determined to be of human origin, the Division of Historical and Cultural Affairs is required to notify the state Medical Examiner's Office of the

discovery. The Medical Examiner's Office then determines whether or not the case is under its jurisdiction.

The preferred approach for managing historical human remains that have been discovered is to leave them *in situ*—that is, to keep them where they have been found—until a treatment and disposition plan can be developed. In the event that historical remains need to be removed for safekeeping, they will be transported to SHPO's curation facility. SHPO holds any recovered remains for appropriate study and storage until they can be respectfully re-interred. Generally, the project, developer, or agency that inadvertently disturbed the remains pays for historical research and an archaeological survey of the area to determine the extent of possible other burials or remains that could be damaged by the project, and the approximate date and origin of the remains. (Because this process is costly in both money and time, SHPO often advises developers to hire an archaeological consultant prior to any construction and have the project area investigated for the presence of a small family cemetery or Native American site with burials.)

If the remains are determined to be from a historical period cemetery or burial, SHPO advertises for next-of-kin, based on the date of the burials and the ownership history of the property. If the remains are determined to be Native American, a committee defined by law convenes to develop a treatment and disposition plan.

In both cases, SHPO writes the plan for the treatment and ultimate disposition of the remains in consultation with the next-of-kin (if any come forward), or the committee, the land owner, and the project developer, or other representative. Once agreement is reached, the plan is put into action.

The preferred option for reburial is always in the original location. If this is possible, a preservation covenant recorded with the deed is usually placed on the area to prevent any disturbance of the remains in the future. If removal and re-interment in another location is the decision, any associated archaeological, acreage, reburial, and marking costs are borne by the project, developer, or agency requiring the removal. Next-of-kin have the option of claiming their kin and paying for re-interment in a cemetery and plot of their choice.

What if one uncovers or sees remains that may be human?

First, the finder should leave them in place if at all possible. If he/she thinks the remains are recent in origin, perhaps due to accident or criminal action, he/she should notify the police (911) immediately. If not, call SHPO at 302-736-7400.

Historic Properties Research and Assistance

DHCA staff members are available to assist agencies and developers with questions about any of these processes and with information on historic properties. The SHPO Research Center is open Monday through Friday, 8:30 a.m. to 4:00 p.m., except for state holidays; an appointment is recommended to use the Center. DHCA also has an on-line web portal, the Cultural and Historical Resource Information System (CHRIS). While the public has some access, full access to archaeological site location information and other features requires a password. Information on this system and an application form for a password can be found at <http://history.delaware.gov/preservation/research/gis.shtml>.

Historical and Cultural Resources in the Milford Master Plan Area

This area falls within Cedar Creek Hundred. Native Americans began populating this area thousands of years ago. European settlement began in Cedar Creek as early as the 1670s. Milford was an early crossing point, and the area around it quickly became farmland.

The first historic-architecture survey of Cedar Creek Hundred was in 1983. The located buildings and structures included 19th- and 20th-century farms with dwellings, barns, and other outbuildings; a school; and bridges. These have not been evaluated for their importance to Delaware's history at this point, but these probably would contribute to our understanding of farming, settlement, education, and transportation in this area.

More recently, DelDOT hired consultants to perform further historic-architecture survey of this area in preparation for the U.S. Route 113 project. This survey added a number of early- to mid-20th-century dwellings and commercial buildings to DHCA's inventory. Much of this area, however, is now outside of the narrowed project area under consideration, and these properties will not be evaluated further. They, too, probably contribute to our understanding of changes in settlement in this area during the 20th century.

The area has not been comprehensively surveyed for archaeological sites. Two small projects have been done, with reports on file at DHCA. There are several areas of high probability for the location of prehistoric, colonial, and 19th-century sites. Such sites have the potential to contain significant information to our understanding of prehistoric and historic settlement and ways of life in Delaware.

Because many family farms included family cemeteries, this area also has a high potential for containing unmarked human burials. Two cemeteries are recorded in the area. Unmarked human remains are protected in state law (see 7 Del. Code Ch. 57).

A table describing known historic properties and sites and some aerial pictures showing their locations is included as Appendix 4.



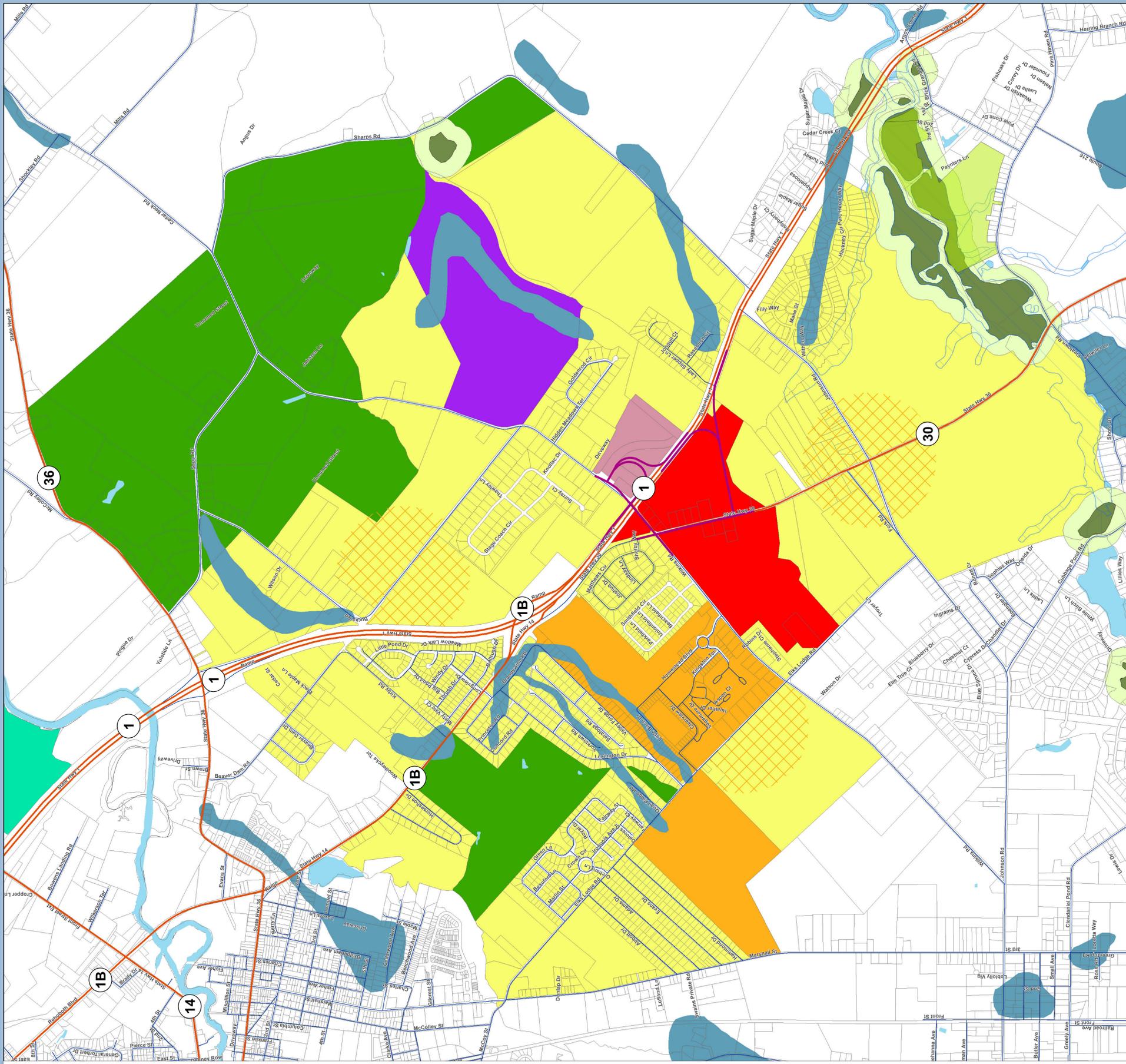
Milford South East Neighborhood Master Plan

Map #3 Land Use & Environment

Legend

- Residential - Low Density
- Residential - High Density
- Open Space Agricultural
- Employment Center
- Commercial
- TDR Receiving Areas
- DeIDOT Owned Property
- Wetlands
- Excellent Recharge Area
- Atlantic White Cedar
- Atlantic White Cedar 300' Buffer
- Nature Preserve
- Natural Areas

Map created by DelDOT Division of Planning



Chapter 8

Transportation Plan

This chapter documents transportation recommendations developed by the Delaware Department of Transportation (DelDOT) Division of Planning that are required to support the implementation of the Milford Southeast Neighborhood Master Plan (the Master Plan). The Master Plan was developed by the city (with assistance from the Office of State Planning Coordination, State agencies including DelDOT, and the University of Delaware) to provide the community with a plan that will be used to oversee the orderly development of southeast Milford, including those areas identified in the City's Comprehensive Plan Urban Growth Boundary.

The Master Plan also seeks to ensure that new residential and commercial growth within the study area encompasses the goals and objectives of good planning practice, including:

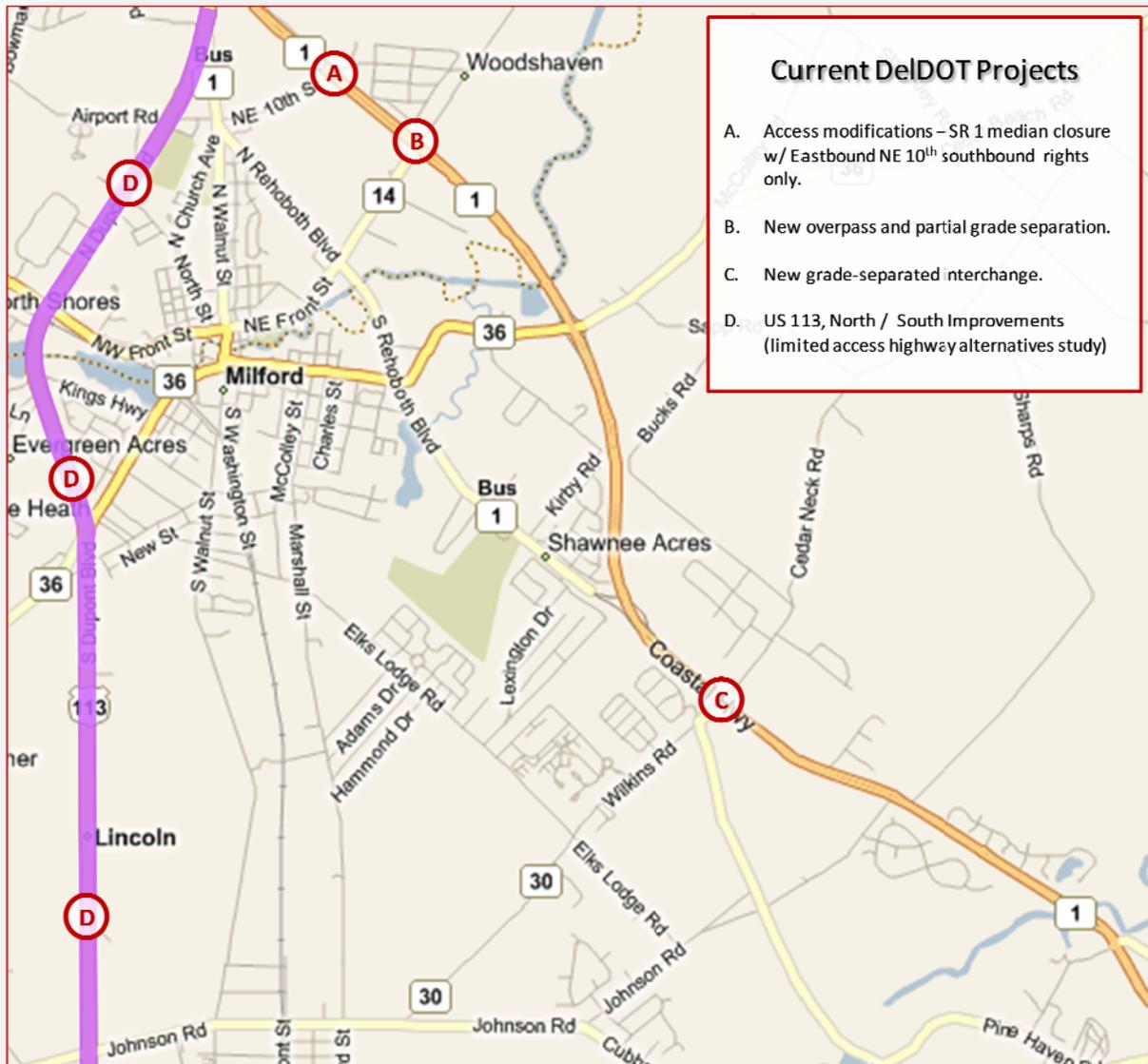
- More efficient land use
- Farmland preservation
- Greater variety in housing types and affordability
- More bicycle and pedestrian facilities and connections
- Transit Opportunities
- Natural Resource Preservation

Current DelDOT Projects

DelDOT currently has several capital projects (see Map 8.1) within or near the study area that are either in the planning, design, or construction stages. The DelDOT Capital Transportation Program (FY 2010-2015) contains the following major projects:

- (a) SR 1 / NE 10th Street – access modifications
- (b) SR 1 / NE Front Street – new overpass and partial grade separation
- (c) SR 1 / SR 10 – new grade-separated intersection
- (d) U.S. 113 – limited access highway study

Map 8.1. Current DelDOT Projects



Master Plan – Transportation Element

The primary role of DeIDOT in the development and implementation of the Master Plan is to identify and analyze transportation improvements that will be required to accommodate projected traffic volume associated with the Plan's land use designations and demographic projections. Many of the transportation project recommendations found in this report will be implemented in conjunction with private and/or public land use development as it occurs. This document provides a framework by which those future projects will be identified and implemented and includes the following goals and objectives:

- Establish the Master Plan study area as a DeIDOT Transportation Investment District (TID).
- Increase the mode share of non-vehicle trips by supporting and proposing transportation projects that enhance the expansion of pedestrian, bicycle, and transit facilities within the study area.
- Formally partner with the development community and the public to ensure that transportation improvements are constructed and sequenced in a proper order that supports the quality of life goals and objectives of the Master Plan.
- Ensure that traffic studies associated with DeIDOT projects or new development are coordinated in a manner that improves efficiency and reduces costs.
- Support smart growth concepts and design in all future proposed land use development and implement the DeIDOT Complete Streets program when designing and constructing any transportation projects deemed necessary to support the Master Plan.

Similar to other Master Plan agreements within the state, DeIDOT will work with the city, development community, and the public to forge an agreement that encompasses the following responsibilities:

1. DeIDOT – Conduct traffic analysis for the purposes of identifying needed roadway improvements, rights-of-way, and funding requirements by the public and private sectors.
2. City – Plan and identify and funding mechanisms for needed electrical, water, and sewer service.

3. Development Community – contribute equitable funding to roadway projects, donate rights-of-way where necessary, and work with the city and DeIDOT to maximize the most efficient vehicle, transit, bicycle, and pedestrian connections and services.

Master Plan Preferred Land Use Scenario

The Master Plan preferred land use scenario was developed by the city with assistance from the Office of State Planning Coordination and the University of Delaware. Community VIZ software was utilized at several public workshops to gather input from the public regarding what type of land uses they desired for the study area. Land use preferences derived from the public workshops were at the grid level and did not follow any natural or man-made boundaries. A final land use map produced at the tax parcel level that also included three transfer-of-development right (TDR) receiving areas was created and adopted by the technical working group in October, 2010 (see Map 1 and Map 4).

Outputs from the UD-SCC Model included daily residential and commercial vehicle trips for each grid within the study area. The Preferred Land Use Scenario is considered a build-out plan.

Projected demographic changes (Table 8.1) associated with the scenario, as compared to existing land use, are as follows:

- * +5,581 dwelling units (+272%)
- * +14,503 population (+292%)
- * +2,268 employment (+903%)
- * +76,260 daily residential vehicle trips (+272%)
- * +24,875 daily commercial vehicle trips (n/a)

Editor’s Note: DeIDOT model runs are based upon the first UD SCC Model future land use scenario, labeled “Preferred Alt” in Table 8.1 below. The City of Milford and the University of Delaware continued to refine this scenario from October 2009 through December 2010. The resulting final scenario, labeled “Preferred Revised,” reflects a more accurate count of existing dwelling units, approved and recorded subdivisions, and a based density of approximately 3 du/acre in Milford’s R-1 zoning district, the least dense available. This resulted in +9,826 dwelling units and corresponding increases in population and employment as well. At time of publication we consider these model runs adequate to address growth for the foreseeable future. Growth projections indicate that only +1,016 dwelling units are expected through 2030 (see Chapter 3). Additional model runs can be considered in the future if the pace and timing of growth changes.

Table 8.1. Summary of Alternative Plan Scenarios from UD-SCC Model

	Existing Land Use	Preferred Alt (at buildout)	Preferred Revised (at buildout)	Growth 2020	Growth 2040	Milford Comp Plan as adopted (at buildout)
Dwelling Units	1,943	7,626	11,769	2,434	2,959	15,083
Number of Residents	4,709	19,459	30,739	5,960	7,290	39,659
Commercial Floor Area	0	995,000	2,985,000	160,000	1,185,000	7,970,000
Employees	262	2,519	4,875	724	1,854	10,275
Date Created	Oct. 2009	Oct. 2009	Dec. 2010	Apr. 2011	Apr 2011	Jan. 2009

Source: University of Delaware's Sustainable Coastal Communities Initiative, UD-SCC Model

Methodology

DelDOT utilized the following methodology for incorporating and analyzing the daily vehicle trip outputs from Community VIZ into the DelDOT Travel Demand Model (CUBE 5):

1. Create new traffic analysis zones (TAZs) in CUBE 5 model to match UD-SCC Model grids.
2. Create additional road network detail in CUBE 5 model to match the study area.
3. Import UD-SCC Model daily trip data into CUBE 5 model.
4. Run CUBE 5 model.
5. Analyze outputs (Level of Service and Volume/Capacity ratio) from model to compare existing conditions with Preferred Scenario.
6. Create and analyze additional road network improvements as necessary.
7. Develop recommendations.

Recommendations

Project recommendations contained in this chapter are broken into the following categories and are reflective of both quantitative results from the travel demand model and qualitative goals aimed at improving transportation choices for residents and employees within the study area:

- Bicycle facilities
- Pedestrian facilities
- Transit facilities
- Park-and-ride facilities
- Intersection upgrades or modification

- Road upgrades
- Smart growth
- Policy

The project and policy recommendations contained in this report are also reflective of the DeIDOT Complete Streets policy, which was adopted in 2009. This policy mandates that any new transportation projects in the state right-of-way (road reconstruction and/or widening) take into consideration all transportation modes and accommodate accordingly. This includes public transit users, bicyclists, pedestrians and motorists.

Please note that a summary listing of this report's transportation recommendations can be found in Table 8.2 at the end of this chapter.

Bicycle Facilities

Currently, there are no DeIDOT designated bicycle routes within the study area. While bicycle use is allowed by law on all of the study area roads (with the exception of SR 1) many of these roads do not include shoulders, which enhance rider safety (see Map 8.2). Approximately 28% of the study area roadways have hard surface shoulders with a width of three feet or greater. Similarly, there are few sidewalks or other pedestrian facilities within the study area.

Recommendations:

On-road bicycle facilities should be included as part of any new roadway construction, entrance plans, widening and rehabilitation of existing roadway facilities. Implement specific bicycle recommendations as per Table 8.2.

Pedestrian Facilities

Currently, there are limited pedestrian facilities within the study area (see Map 8.2). The City of Milford does now require, however, the construction of sidewalk facilities for new residential streets within its municipal boundaries.

DeIDOT is in the process of implementing the Delaware Statewide Pedestrian Action Plan, which includes the following elements:

- (1) Inventory of pedestrian facilities
- (2) Transition Plan identifying all gaps and facilities not in compliance with the Americans with Disabilities Act (ADA).
- (3) Complete Streets policy and implementation plan

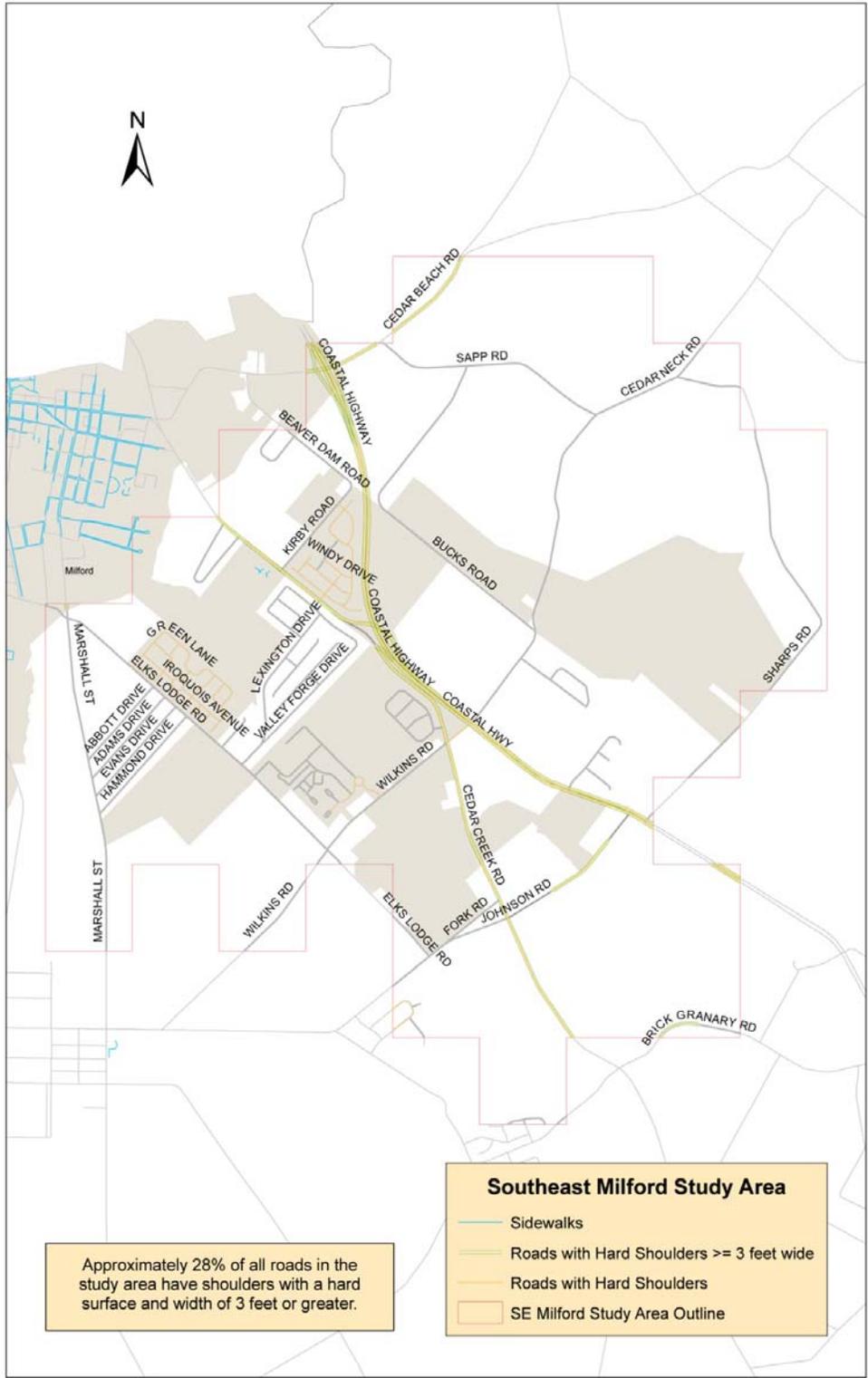
(4) Development of a transition plan

The Pedestrian Action Plan will identify gaps in the system and opportunities for enhanced pedestrian facilities for the City of Milford. It will also highlight access issues to transit locations and include recommendations for improvements.

Recommendations:

Evaluate the need for bicycle and pedestrian facilities and transit stops as part of any new roadway construction, entrance plans, widening and rehabilitation of existing roadway facilities in accordance with the Complete Streets Policy, the Statewide Bicycle Plan, and the Statewide Pedestrian Action Plan. Implement specific recommendations as per Table 8.2.

Map 8.2. Existing Pedestrian and Roadway Shoulder Facilities



Transit Facilities

Between 2,500 and 4,900 new employees are projected to be added to the City of Milford's Southeast Neighborhood under the adopted Master Plan. Many of these new employees are expected to work at a new major employment center east of SR 1 along Cedar Neck Rd. This employment center, currently known as "Innovation Park" presents DelDOT with a unique opportunity to establish a new transit loop that would service the employment center while also making a connection to currently established residential neighborhoods and businesses west of SR 1.

Recommendations:

Establish a new DART transit loop to connect existing and new development on the east and west sides of SR 1. The transit loop would consist of the following three phases and locations:

Phase I – Establish a new transit route adjacent to existing and developing residential and employment areas west of SR 1 utilizing the following road network:

- Business Route 1
- Wilkens Rd.
- SE Front St.
- State Route 36
- Marshall St.
- Elks Lodge Rd.

Phase II – Establish a new transit route east of SR 1 for the purpose of providing access between the eastern and western side of Milford and to service the proposed "Innovation Park" employment center utilizing the following road network:

- Cedar Neck Rd.
- Bucks Rd.
- Sapp Rd.
- State Route 36

Phase III – Establish a new transit route west of SR 1 in the southern portion of study area for the purpose of servicing proposed new residential and employment areas utilizing the following road network:

- Elks Lodge Rd.
- Johnson Rd.
- State Route 30

Intersection Upgrades or Modifications

A projected increase of nearly 100,000 new daily residential and commercial vehicle trips in the study area will require upgrades or modifications to several existing intersections within the study area.

The proposed adoption by the City of Milford to require traffic-impact studies for new residential and employment developments within the study area will serve to provide DeIDOT with additional analysis needed to determine the various geometric improvements required for each intersection to function in an efficient manner. It is anticipated that additional intersections will need to be improved as development of the study area progresses in the future.

Preliminary traffic-capacity analysis has identified the following intersections that would require improvements under the land use projections of the Master Plan:

- State Route 30 and Johnson Rd.
- Elks Lodge Rd and Wilkens Rd.
- Cedar Neck Rd and Bucks Rd.

The following intersections or road segments have been identified for either removal or access modifications:

- SR 30 (Cedar Creek Rd) and Fork Rd. – the removal of Fork Rd. has inherent safety benefits that would result from the shifting of vehicles from Fork Rd. to the Johnson Rd. / SR 30 intersection.

The existing intersection approaches (Fork Rd at Johnson Rd/SR 30) are under-utilized and not necessary for area traffic-flow needs.

Map 8.3: Fork Rd and SR 30



- SR 1 and Sharps Rd / Johnson Rd

DelDOT is aware of and actively involved in identifying and proposing solutions for potentially unsafe median crossings onto SR 1. The SR 1 / Sharps Rd. – Johnson Rd. intersections are two closely spaced (425 ft.) facilities that gain access to SR 1 via a median crossing. Due to the close proximity of the intersections it is recommended that DelDOT investigate possible re-configuration alternatives that could enhance the safety of the intersection.

Roadway Upgrades

Much of the study area road network east of SR 1 and south of Wilkins Rd. on the west side of SR 1 has served primarily rural and/or agricultural land uses in the past. A majority of these roads do not include any shoulders. In fact, only 28% of the entire study area roadways contain hard surface shoulders with a width of three feet or greater. As the study area continues to accommodate new and projected future residents and employers much of the transportation network will require upgrades including shoulders, intersection improvements, capacity increases, and possible new connections.

Recommendations:

Improve the following roadway facilities to meet a minimum standard of two 11-ft. travel lanes and 5-ft. shoulders:

- (1) Kirby Rd. (from RD 14 to Cedar Beach Rd.)
- (2) Bucks Rd. – (from Sapp Rd to Cedar Neck Rd.)
- (3) Sapp Rd. (from Bucks Rd. to Cedar Beach Rd.)
- (4) Cedar Neck Rd. (from Sapp Rd. to SR 1)
- (5) Sharps Rd. (from 1 mile north of SR 1 to SR 1)
- (6) Business Route 1 (from Wilkins Rd. to SE Front St)
- (7) Cedar Beach Rd./SR 36 (from Sapp Rd. to Business Route 1)
- (8) Wilkens Rd.
- (9) Elks Lodge Rd. south of Wilkins Rd.

The preceding road-segment improvements also overlap proposed new transit routes, which will, in turn, support pedestrian and bicycle accessibility to future bus stop locations.

Smart Growth

DelDOT seeks to further support the land use designations contained in the Milford Master Plan by implementing projects and policies that encourage the construction of smart growth-based residential and commercial spaces.

Smart growth is a set of principles and guidelines that attempts to create a nexus between land use and transportation in which zoning, subdivision regulations, architectural standards, and transportation design act as mutually supporting entities, leading to greater efficiencies in vehicle and person movements and an enhanced sense of quality of life.

DelDOT supports the creation and adoption of a unified development ordinance by the City of Milford as a means for maximizing DelDOT's transportation investments in the study area.

Map 8.4. Bucks Rd Area - Conceptual New Residential Development



Map 8.5. Bucks Rd Area - Conceptual New Residential Development



Policy

The successful adoption and implementation of several policy initiatives are necessary for the Transportation Element to function as a successful component of the overall Master Plan for southeast Milford.

Recommendations:

- Work with the City to assist in the creation of a Transportation Investment District (TID) for the purpose of allowing the City to enter into agreements with the private sector community for the development and implementation of cost-sharing mechanisms to fund transportation improvements identified in this report.
- Adoption of provision requiring traffic studies by the City of Milford to be undertaken when proposed residential or commercial development exceeds particular dwelling unit and/or commercial square footage thresholds.
- Adoption of development ordinances by the City of Milford for the purpose of providing land development standards that support transportation improvement projects.

Table 8.2. Transportation Recommendations

Improvement	Area or Location	Type	Goal
Bicycle	Statewide connector, regional, and statewide bike routes within Study Area	Install bike facilities as part of roadway improvements as per the Delaware Bicycle Facility Master Plan.	Improve multi-modal options for residents.
Pedestrian	Existing DART bus stop locations	Provide safe pedestrian access to stops.	Improve multi-modal options for residents.
	Existing bus stops in the study area	Install improvements at bus stops (bus stop signs, bus pad, benches, lighting, shelters).	Improve multi-modal options for residents.
Transit	<u>New Local Circulator Routes</u> Phase I (see Map 4) Phase II Phase III	Increase frequency of bus service to provide access to downtown and new residential development / employment centers east of SR 1.	Improve multi-modal options for residents .
Park and Rides	To be identified		Reduce congestion
Intersection Upgrades	(1) Elks Lodge Rd. / Wilkins Rd. (2) SR 30 / Johnson Rd. (3) Bucks Rd. / Cedar Neck Rd. (4) SE Front St. / Marshall St.	Add turn lanes and/or signalization to be determined by existing and projected traffic-count data and studies.	Improve safety and reduce delay.

Intersection Modifications	(1) SR 1 / Johnson Rd. (2) SR 1 / Sharps Rd.	Revise movements to rights-in and rights-out only. Remove SR 1 median crossover. Add NB SR 1 acceleration lane.	Improve safety.
Road Upgrades	(1) Kirby Rd. (from SR 14 to Cedar Beach Rd.) (2) Bucks Rd. – (from Sapp Rd. to Cedar Neck Rd.) (3) Sapp Rd. (from Bucks Rd. to Cedar Beach Rd.) (4) Cedar Neck Rd. (from Sapp Rd. to SR 1) (5) Sharps Rd. (from 1 mile north of SR 1 to SR 1) (6) Business Route 1 (from Wilkins Rd. to SE Front St.) (7) Cedar Beach Rd./SR 36 (from Sapp Rd. Business Route 1) (8) Wilkins Rd. (9) Elks Lodge Rd. south of Wilkins Rd.	Improve to a minimum of two 11 ft. travel lanes and 5 ft. shoulders	Improve safety, reduce delay, enhance multi-modes of travel.
Smart Growth	Master Plan Study Area	Assist city with integration of smart growth transportation designs and principles.	Enhance quality of life.

Table 8.2 – Transportation Recommendations (cont.)

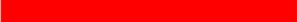
Policy	Master Plan study area	Transportation Investment District (TID)	(1) Coordination of land use and transportation projects as per DeIDOT Complete Streets Policy (2) Private / Public partnership to identify and share costs associated with required capital transportation projects within study area
Policy	Master Plan study area	Development Ordinances	Efficient use of land use and transportation design standards
Policy	Assist City of Milford with drafting a traffic impact study requirement.	City code	Collection of existing and projected traffic data



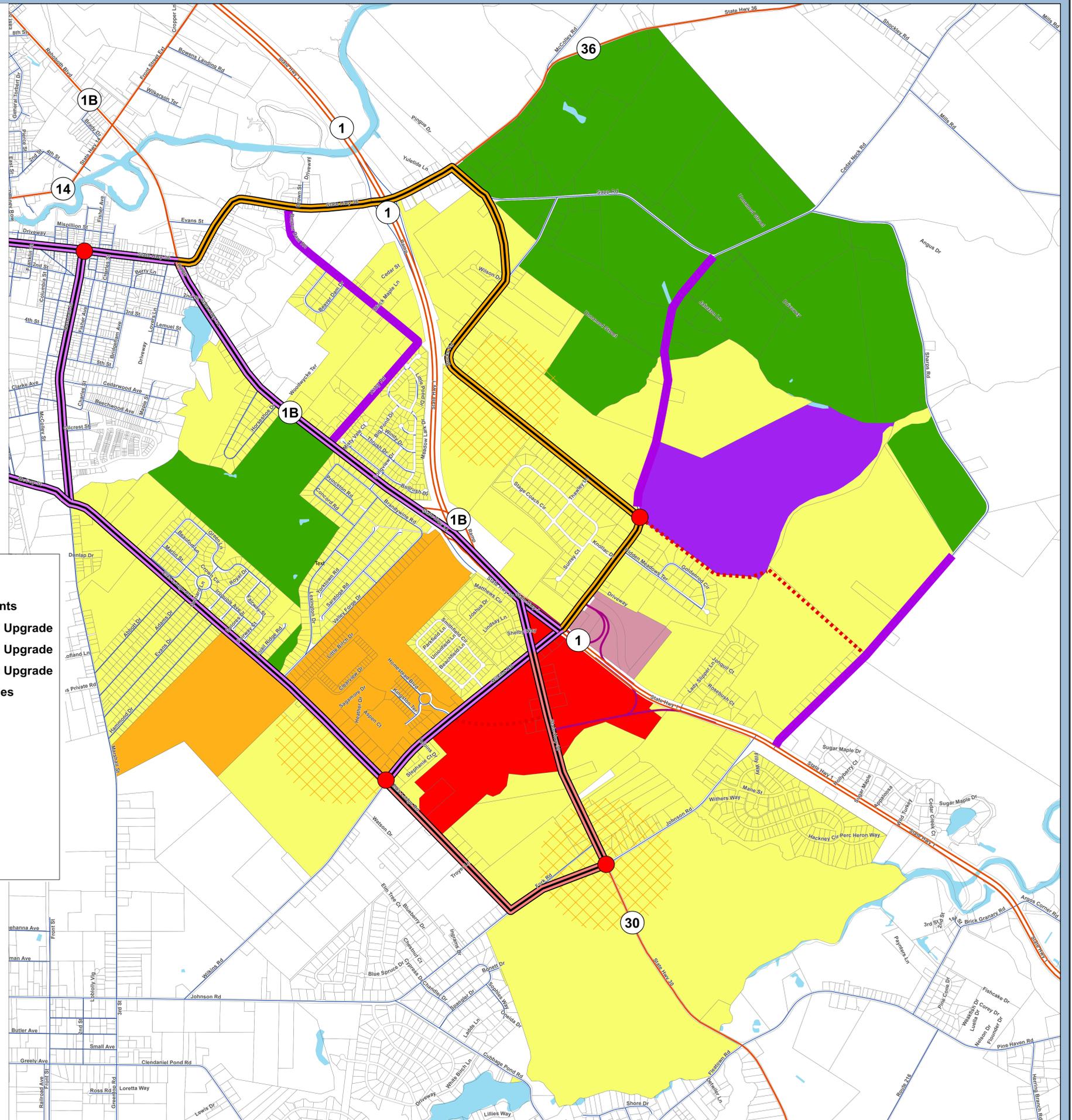
Milford South East Neighborhood Master Plan

Map #4 Transportation Recommendations

Legend

-  Proposed Intersection Improvements
-  Phase 1 - Transit Circulator / Road Upgrade
-  Phase 2 - Transit Circulator / Road Upgrade
-  Phase 3 - Transit Circulator / Road Upgrade
-  Proposed Additional Road Upgrades
-  Proposed New Connector Roads*
-  Residential - Low Density
-  Residential - High Density
-  Open Space Agricultural
-  Employment Center
-  Commercial
-  TDR Receiving Areas
-  DeIDOT Owned Property

Map created by DeIDOT Division of Planning
*Conceptual alignment subject to change



Chapter 9

Water and Sewer Infrastructure

One responsibility of the City of Milford for the Southeast Neighborhood is the planning, financing, and construction of public utilities for this area. These public utilities include water, sewer and electricity.

The City of Milford has engaged the engineering firm of Davis, Bowen, & Friedel (DB&F) to prepare the water and sewer extensions east of SR 1. After reviewing proposed and existing development, DB&F has prepared cost estimates and schematic drawings showing the proposed location of these public utilities (see Map 5).

Public Water System Improvements

The water extensions include a new elevated storage facility, water treatment facility and a new proposed well either east of SR 1 or west of SR 1, depending on the availability of land and locating a sufficient water source. Additional water facilities include extension of a 12 inch water line from an existing connection near Meadows at Shawnee running southward near the three major properties east of SR 1 (Dugan Property, Isaac Property, and the Mills Property) then westward along Johnson Road until it meets Cedar Creek Road. At this intersection the water line is reduced to a 10 inch water line then continues in a westerly direction until it meets Elks Lodge Road. At Elks Lodge Road it continues in a northerly direction until it connects with an existing water line near the Orchard Hills development. This proposed extension of the water utility into the Southeast Neighborhood includes additional wells and will loop with the existing City of Milford water system to provide improved water supply and storage and fire fighting capabilities.

The estimated cost of these improvements according to DB&F is approximately \$5.25 million. Presently the City of Milford has funding in place through the U.S. Department of Agriculture for the construction of these water facilities.

Public Sewer System Improvements

Regarding the proposed sewer extensions for the Southeast Neighborhood, again DB&F has provided cost estimates and schematic drawings showing the proposed location of these public utilities. The sewer extensions include the construction of a proposed 12 inch force main from an existing 18 inch force main near the Meadows of Shawnee along Rehoboth Blvd. running eastward then southward along the Dugan property, which would serve the area east of SR 1.

Additional construction in this area would include the erection of a pump station on the Isaacs property.

Proposed sewer extension for the area west of SR1 include the construction of a 12 inch force main near the Meadows at Shawnee on Rehoboth Blvd., continuing southward along Rehoboth Blvd. then along the right-of-way of SR 1 near the Matlinds Estate housing development, then southward along Cedar Creek Road. This proposed sewer extension would serve all the proposed development west of SR 1 and south of existing development within the corporate limits of the City of Milford (see Map 6).

Costs estimates prepared by DB&F for this sewer extension amount to \$9 million.

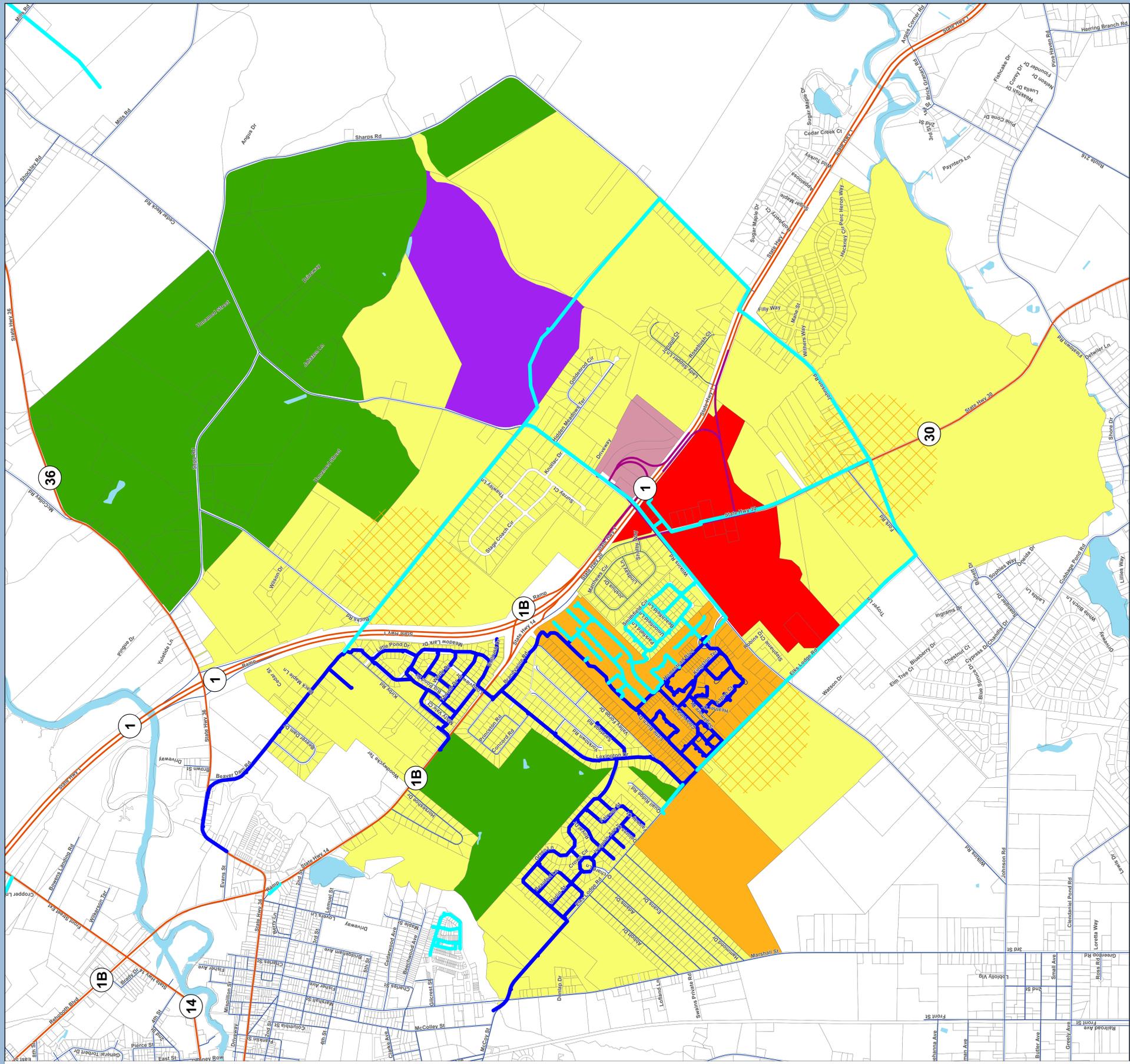
Electric Utility

The City's electric utility currently serves a majority of the area included in the Southeast Neighborhood planning area. Areas currently not included in the City's service territory will be added once they are annexed in to the City limits.



Milford South East Neighborhood Master Plan

Map #5 Land Use & Water



Legend

- Residential - Low Density
- Residential - High Density
- Open Space Agricultural
- Employment Center
- Commercial
- TDR Receiving Areas
- DeIDOT Owned Property
- Existing Water System
- Proposed Water System Extension

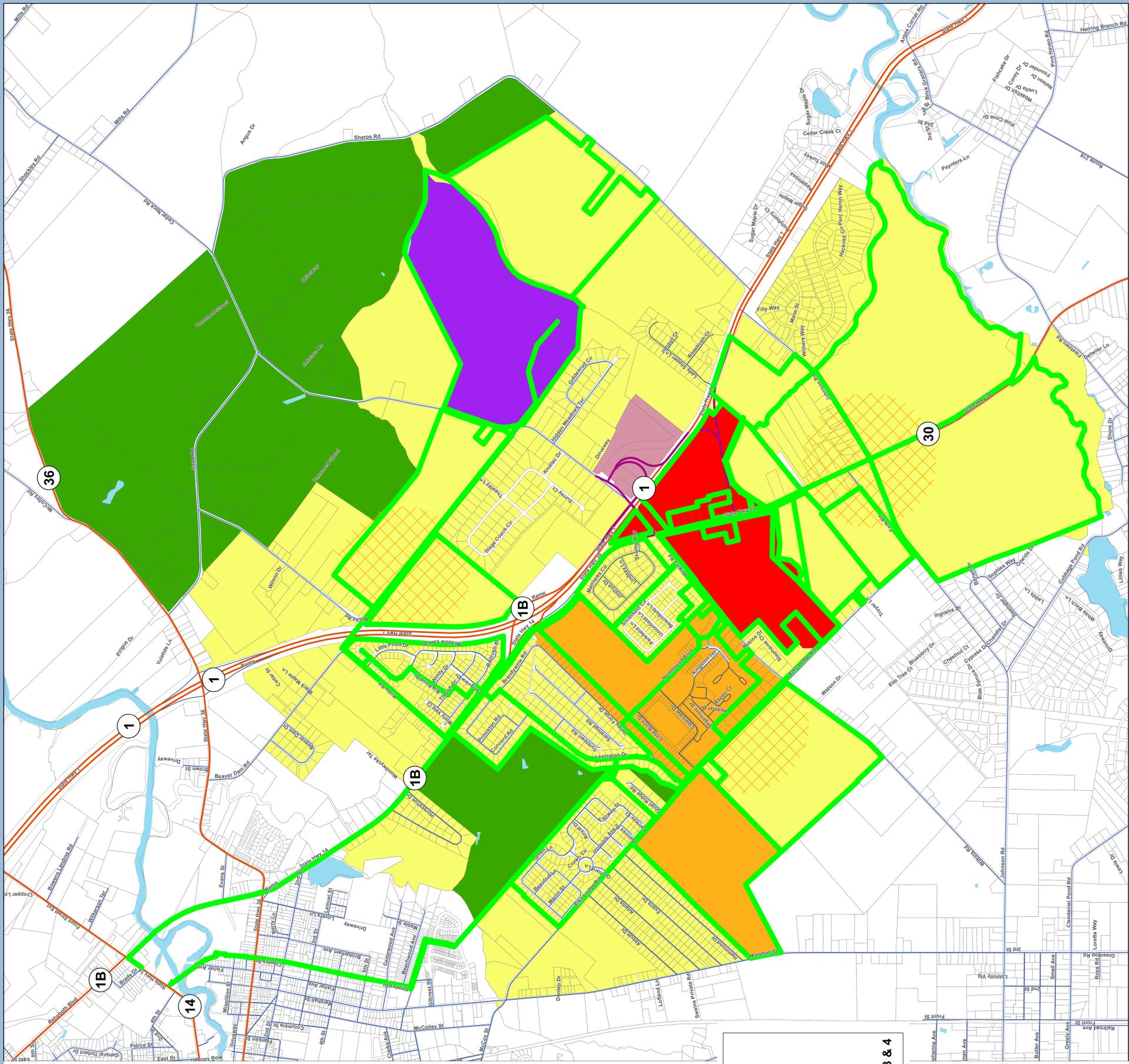
Map created by DeIDOT Division of Planning





Milford South East Neighborhood Master Plan

Map #6 Land Use & Sewer



Legend

- Residential - Low Density
- Residential - High Density
- Open Space Agricultural
- Employment Center
- Commercial
- TDR Receiving Areas
- DeIDOT Owned Property
- Proposed SE Sewer Extension Phases 3 & 4

Map created by DeIDOT Division of Planning



0 0.25 0.5 1 Miles

Chapter 10

Design Guidelines

1. DDA recommends that the city require any property developed adjacent to land designated as Open Space Agriculture to include a forested buffer between the property and adjacent farmland. This is already required by Sussex County. As a courtesy to Sussex County, the DDA Forest Service reviews the effectiveness of the buffer and makes a recommendation to the County on whether or not to accept the buffer as is, or require modifications. DDA would offer the same service to the City.
2. In addition to a forested buffer requirement, the DDA also asks that the City work with developers on where they “mass” their houses or buildings. Whenever practical, the Department requests that the City require developers to cluster their approved building lots and place as much of the residual community open space near adjacent farm parcels. This would further help eliminate or mitigate any conflict that may arise from dissimilar land uses.
3. When considering site plan and subdivision design, the placement of active and passive open space is important. Passive open space should be located to give a priority to protecting existing natural resources on the site. Active open space (for recreational use) is better placed in a more centralized location in order to be more accessible to future residents of the subdivision.
4. As each new project is proposed, the City, DNREC, DelDOT, and the developer should discuss opportunities to develop shared stormwater management facilities that integrate best practices for maximum flood protection and water quality protection and enhancement.
5. Utilize green technologies to manage stormwater. Green technology stormwater management is a best practice that uses the natural processes of vegetation to filter stormwater, and take up harmful pollutants, and improve groundwater recharge without expensive infrastructure.

6. Minimize the removal of trees within the Cedar Creek Natural Area to the greatest extent possible with the goal of preserving all existing trees and all contiguous forested blocks (see map 5.1).
7. Provide buffers to the Cedar Creek Natural Area and the Cedar Creek Nature Preserve. DNREC recommends prohibiting additional development within 300 ft. of the existing Natural Area (see map 5.1).
8. Do not place stormwater structures, including stormwater outfalls, in the Cedar Creek Natural Area (see map 5.1).
9. Incorporate sidewalks, bike lanes, and multi-modal paths in the Master Plan Area in accordance with Chapter 8 and the Milford Pedestrian/Multi-Modal Master Plan.
10. Specific Conservation Areas, Area One (see Chapter 5 and Map 5.3, Area One)
 - a. Avoid building and/or stormwater infiltration in the area of excellent recharge
 - b. Limit intense development to the upland portion of the parcel; the eastern portion should be used for passive recreation and open space.
 - c. The Downer and Ingleside soils in Area One should be the preferred location for stormwater infiltration.
11. Specific Conservation Areas, Area Two (see Chapter 5 and Map 5.4, Area Two)
 - a. Protect the forested wetlands that are mapped in the southern end of Area Two, on both sides of SR 30. Because of the falling elevation from the north end of this area toward the mapped wetlands, we advise that optimal stormwater management would be constructed wetlands or other green-technology best management practices in the area immediately north of the forested wetlands, on either side of SR 30.
 - b. The wooded section in this area also supports Key Wildlife Habitat. Generous riparian buffers (300 feet or greater) are recommended to protect water quality, and preserve forested areas surrounding the tributaries of Cedar Creek to enable rare species to thrive.
12. Specific Conservation Areas, Area Three (see Chapter 5 and Map 5.5, Area Three)
 - a. Provide at least a 300 ft upland buffer because of the presence of or potential for swamp pink. The buffer would also be instrumental in protecting the Atlantic

White Cedar wetlands as well as achieving the Total Maximum Daily Load (TMDL) pollution limits for this portion of the Mispillion watershed.

Chapter 11

Implementation

Commitments:

The City of Milford

1. The City will develop and adopt an ordinance to enable to use of transfer-of-development rights (TDRs) credits in receiving zones. This ordinance will enable developers build at up to eight (8) units per acre by-right through the purchase of TDR credits from farms in the sending areas.
2. A stormwater utility is a legal and financial structure to allow stormwater management facilities to be constructed, managed, and maintained in common by a local government or other entity. This master plan area is well suited to such a utility, although there are many ways to structure such an entity. Both the City and DNREC agree to explore this option in more detail as this area develops in accordance with this master plan.
3. The City will construct a public water system as described in Chapter 9 to serve the Master Plan Area. This is a funded project.
4. The City will design and permit a sewer system to serve the Master Plan Area as described in Chapter 9. Private developers will be responsible for funding and constructing this system. The City will discuss various financing and construction options with any developer.

Delaware Department of Agriculture

1. The Delaware Department of Agriculture (DDA) and the Delaware Agricultural Lands Preservation Foundation (DALPF) will partner with the City to establish a Transfer of Development Rights program as described in the Agricultural Preservation chapter of this document (Chapter 4).
2. By partnering with DALPF, the City will avoid the initial financial expenditures required to preserve a parcel of land. These expenditures include paying to survey the property, paying the legal costs of a real estate settlement, and other associated administrative costs. DALPF would bear those costs.
3. The City would avoid the future obligation of monitoring the preserved farms to make sure they remain in compliance with the preservation agreement (easement). DALPF would assume that responsibility and add any properties preserved by Milford to the hundreds of permanently preserved farms it already monitors. In addition, should any

future litigation be required to uphold the preservation easement, the City would not have to incur any legal costs.

4. DDA will assist the City in the creation and administration of a TDR bank as described in the Agricultural Preservation chapter of this document (Chapter 4). This includes assistance with appraisals to set the fair market value of TDR units.
5. In addition to any funds the City would have for agricultural preservation and the TDR bank, they would also be eligible for state matching funds from DALPF, as well as any federal matching funds from United States Department of Agriculture (USDA) Farm and Ranch Lands Protection Program (FRPP). As allowed by law, these matching funds would be awarded to the city based on availability. If the City were able to capture state and federal matching funds, it could significantly leverage its funds with additional money and preserve additional farmland.

Delaware Department of Natural Resources and Environmental Control (DNREC)

1. There is an opportunity for greater communication and coordination between DNREC and DelDOT with regard to stormwater management and road improvements. This coordination will be ongoing throughout the development of this master plan area. Opportunities to share facilities and streamline the review process will be continually evaluated and implemented as individual properties within the master plan area develop and re-develop. Streamlined review and approval processes will only be available in return for implementing “best practice” designs.
2. DNREC will work with the city to explore and implement the concept of a stormwater utility in the master plan area as development occurs.

Delaware State Housing Authority (DSHA)

If requested, the DSHA stands ready to assist in the development of affordable housing opportunities in the Master Plan Area in the following ways:

1. Work with the Office of State Planning Coordination to further refine its criteria for tax credits, which may give more weight to Master Plan areas such as this one in the future.
2. Continue to provide developers information and resources through its Affordable Housing Resource Center and other sources.
3. Work with the City and the Office of State Planning Coordination on the development of ordinances, such as Form Based Codes, to ensure quality design in the Master Plan Area.
4. Participate with the City on future grant applications to facilitate development in the Master Plan Area.

Delaware Department of Transportation (DelDOT)

1. DelDOT will fund and construct the grade separated interchange at SR 1 and SR 30 as per the current Capital Transportation Plan (CTP). The current timeline involves construction in 2012 and 2013, with completion in late 2013. Please note that the CTP is subject to amendment annually.
2. Work with the City of Milford to adopt this master plan area as a Transportation Improvement District (TID) to enable equitable and timely funding for roadway improvements within the area in accordance with the recommendations in this Master Plan.
3. DelDOT will work with the City to ensure that the road improvements identified in this report are implemented by the public and/or private sector in a phased manner that is paced with the timing of development activities.

Requirements:

Division of Historical and Cultural Resources: Delaware State Historic Preservation Office

1. Any project that involves federal funds or permits must comply with Section 106 of the National Historic Preservation Act.
2. The State Antiquities Act requires that archaeological excavations on state-owned or controlled lands must be done under a permit from the Director of DHCA.
3. Any unmarked human remains that are disturbed during construction must be respectfully handled in conformance with the Delaware Unmarked Human Remains Act.

Recommendations:

Recommendations for Implementation of Agricultural Preservation:

1. DDA recommends that the city require any property developed adjacent to land designated Open Space Agriculture to include a forested buffer between the property and adjacent farmland. This is already required by Sussex County. As a courtesy to Sussex County, the DDA Forest Service reviews the effectiveness of the buffer and makes a recommendation to the County on whether or not to accept the buffer as is, or require modifications. The Department would offer the same service to the City.
2. In addition to a forested-buffer requirement, the Department also asks that the City work with developers on where they “mass” their houses or buildings. Whenever

practical, DDA requests that the City require developers to cluster their approved building lots, and place as much of the residual community open space near adjacent farm parcels. This would further help eliminate or mitigate any conflict that may arise from dissimilar land uses.

3. DDA asks that the city review its zoning ordinances for compatibility with future agricultural business or agriculture related uses. It is important to provide provisions and flexibility in the zoning code to accommodate future agriculture related activities.
4. DDA would note that all properties enrolled in the state's farmland preservation program are afforded the protections listed in Appendix 3. In addition, Sussex County adopted a "mirror" ordinance to provide these protections to all farms located in Sussex County. These protections should be considered during the city's planning process in an attempt to place more compatible land uses next to properties engaged in agriculture. In addition, DNREC's regulations include a restriction on the location of water wells that should be considered.

Recommendations for Protection of the Cedar Creek Natural Area

1. Sections of the wooded areas of the Milford Southeast Neighborhood Master Plan Area are part of the Cedar Creek Natural Area (see Map 5.1). All developments near or adjacent to this Natural Area are recommended to follow the design guidelines regarding protection of the Natural Area, found in Chapter 5.
2. Cedar Creek Nature Preserve is adjacent to the south end of the Southeast Planning Area (see Map 5.1). A number of rare species can be found in association with this habitat type. To protect the rest of this contiguous forest area, it should be designated as a Nature Preserve, a special designation that provides additional protection for an important natural resource area. Such a designation would be achieved with the assistance of DNREC's State Office of Nature Preserves. Should these areas be annexed as envisioned by the Master Plan, Milford will work with private landowners and the State Office of Nature Preserves to promote the dedication of the Natural Area as a Nature Preserve.

Recommendations for the Protection of Specific Conservation Areas

1. When designing development projects within Specific Conservation Areas One, Two and Three (see Chapter 5 and Maps 5.3, 5.4 and 5.5), the land developers and the City will collaborate to ensure that the specific design guidelines related to these important conservation areas are incorporated into the site designs. The design guidelines are specifically listed in Chapter 10.

Transportation Recommendations

1. Upgrade primary circulation and transit routes (see Chapter 8, and Map 4) to 11 ft. lanes and 5 ft. shoulders.
2. Along these same routes, construct bicycle and pedestrian improvements to ensure interconnectivity, multi-modal connections, and “complete streets.”
3. In order to accommodate increased traffic from new development activities, upgrade the intersections identified in Chapter 8 and shown on Map 4.
4. Encourage the use of TDR to enable higher density developments (up to 8 du/acre) at the designated TDR receiving areas. These areas are planned around bus stops to enable the transit improvements envisioned to operate smoothly.

Signatures:

The undersigned agree to honor the above stated commitments, agreements, requirements and recommendations as they relate to the development and preservation of land within the Milford Southeast Neighborhood Master Plan area. This document, including text and maps, shall guide land development, agricultural preservation, environmental protection, and infrastructure investments in the Southeast Neighborhood Master Plan Area described herein. This document shall be in full force and effect until such time as all parties reconvene and mutually consent to amend this document and the commitments, agreements, requirements, and recommendations.

Mayor, City of Milford

Director, Office of State Planning Coordination

Secretary, Delaware Department of Agriculture

Secretary, Delaware Department of Natural Resources and Environmental Control

Secretary, Delaware Department of Transportation

Appendices

Appendix 1. Southeast Neighborhood Master Plan Land Use Scenarios Comparison

Appendix 2. TDR Sending and Receiving Area Analysis

Appendix 3. Proposed Agricultural Use Protections

Appendix 4. Historic and Cultural Resources in or Near the Master Plan Area

Appendix 1. Southeast Neighborhood Master Plan Land Use Scenarios Comparison

South Milford Master Plan
SE Neighborhood Land Use Scenarios - Demographic Comparative Analysis
April 2011

Master Plan Build-Out Scenarios						
Build-Out Results	Existing Land Use	SE Neighborhood Preferred (ALT) Scenario ¹ October, 2009	SE Neighborhood Master Plan Preferred (Revised) Scenario ² December, 2010	Growth 2020 ³ April, 2011	Growth 2030 ⁴ April, 2011	Milford Comp Plan (SE Neighborhood) July, 2008
Build-Out Numeric Dwelling Units	1,943	7,626	11,769	2,434	2,959	15,083
Build-Out Numeric Buildings	1,943	6,815	10,103	2,438	2,693	7,570
Build-Out Numeric Floor Area	0	995,000	2,995,000	160,000	1,385,000	7,970,000
RESIDENTIAL						
Dwelling Units	1,943	7,626	11,769	2,434	2,959	15,083
Residents	4,709	19,459	30,739	5,960	7,290	39,659
Children	1,360	3,865	4,692	1,608	1,884	4,414
Residential Taxes	184,295	756,930	1,153,035	234,535	287,905	1,384,985
Residential VTD	19,430	76,262	114,596	24,340	29,590	134,488
Residential Waste Water	582,900	2,287,800	3,530,700	730,200	887,700	4,524,900
Residential Water Use	582,900	2,287,800	3,530,700	730,200	887,700	4,524,900
NONRESIDENTIAL						
Commercial FloorArea (SQFT)	0	995,000	2,995,000	160,000	1,385,000	7,970,000
Employees ⁵	262	2,519	4,875	724	1,854	10,275
Commercial Taxes	0	49,539	137,065	7,966	65,371	320,632
Commercial VTD	0	24,875	70,692	4,000	30,692	178,000
Commercial Waste Water	0	32,875	70,158	8,000	30,158	186,000
Commercial Water Use	0	41,098	87,698	10,000	37,698	232,500

¹ Existing Land Use Scenario employees are calculated as home-based employees, therefore no associated nonresidential space.

² SE_Neighborhood "Preferred (ALT)" Scenario - composite of scenarios developed at Public Workshop, October, 2009

³ SE_Neighborhood "Preferred (Revised)" Scenario - Public Option composite revised December 2010 by City of Milford Planning after reviewing State Agency Input & PLUS project constraints

⁴ Growth 2020 and Growth 2030 Scenarios assume a growth rate of 2% per year

Source: UD-SCC Community Land Use Model

Analysis performed by the University of Delaware, Sustainable Coastal Communities (SCC) Program, 2011



5/3/2011

SE_Neighborhood_Indicators_22APR11_UD

Page 1 of 1

Appendix 2. TDR Sending and Receiving Area Analysis

TDR Sending Area Analysis for Select Parcels East of Milford

Parcel Number	Owner Name	LESA Score	Acres	Zoning Yield ¹	Build Yield ²	Septic Yield ³
330-12.00-10.00	Ruth Williams	185.08	60	120	78	78
330-08.00-47.00	Richard Fay Shockley	220.19	14.7	28	19	19
330-12.00-08.00	GW Shockley & Sons, Inc.	222.51	117.4	235	153	59
330-08.00-28.00	Alan and Arenath Mills	172.61	46.2	92	60	60
330-08.00-24.00	Beverly & Louis C'Day	189.26	41.29	101	66	66
330-12.00-01.03	Howard & Katherine Webb ⁴	210.7	118.18	236	153	59
330-12.00-01.02	Howard & Katherine Webb ⁴	Part of 330-12.00				
330-12.00-01.02 (Unit 21805)	Howard & Katherine Webb ⁴	Part of 330-12.00				
330-12.00-01.00	BKW Farm Limited	181.54	66.8	132	86	86
330-08.00-19.00	Alan & Arenath Mills	192.19	85.5	170	111	59
330-08.00-19.02	Alan & Arenath Mills	192.19	16.3	32	21	21
330-08.00-20.00	Warnock Farms, LLC	232.5	105.5	210	137	59
330-07.00-75.00	GW Shockley & Sons, Inc.	184.27	48.4	96	63	63
Totals		720.37	720.37	1,452	947	789

- ¹ Sussex County AR-1 zoning provides for 2 units to the acre
- ² In practice, the average subdivision yields 1.3 units per acre
- ³ Del Code Title 7, Chapter 60 limits the number of individual on-site septic systems to 99; a community wastewater system is required to achieve the max. dwelling units allowed by zoning.
- ⁴ Existing Agricultural District

**Milford TDR Receiving Areas
Located within 1/4 Mile of Public Transportation Nodes**

Node	Acres	Base Zoning 3 DUs/acre	TDR Zoning 8 DUs/acre	Additional DUs through TDR use
1	58	174	696	522
2	118	354	1416	1062
3	104	312	1248	936
Total	280	840	2240	1,400

Appendix 3. Proposed Agricultural Use Protections

The following is sample language that the Delaware Department of Agriculture recommends the City of Milford integrate into their review of any subdivision located adjacent to an Agricultural Preservation District:

The proposed development is near two properties currently enrolled in the State's Agricultural Lands Preservation Program (Example: N & M Burton Farm Agricultural District, (Parcel Numbers # 2.34-16.00-11.00 and 2.34-16.00-17.00). Therefore, the activities conducted on these preserved properties will be protected by the agricultural use protections outlined in Title 3, Del. C., Chapter 9. These protections effect adjoining developing properties. The 300 foot notification requirement affects all new deeds in a subdivision located in whole or part within 300 feet of an Agricultural District. Please take note of these restrictions as follows:

§ 910. Agricultural use protections.

(a) Normal agricultural uses and activities conducted in a lawful manner are preferred and priority uses and activities in Agricultural Preservation Districts. In order to establish and maintain a preference and priority for such normal agricultural uses and activities and avert and negate complaints arising from normal noise, dust, manure and other odors, the use of agricultural chemicals and nighttime farm operations, land use adjacent to Agricultural Preservation Districts shall be subject to the following restrictions:

(1) For any new subdivision development located in whole or in part within 300 feet of the boundary of an Agricultural Preservation District, the owner of the development shall provide in the deed restrictions and any leases or agreements of sale for any residential lot or dwelling unit the following notice:

This property is located in the vicinity of an established Agricultural Preservation District in which normal agricultural uses and activities have been afforded the highest priority use status. It can be anticipated that such agricultural uses and activities may now or in the future involve noise, dust, manure and other odors, the use of agricultural chemicals and nighttime farm operations. The use and enjoyment of this property is

expressly conditioned on acceptance of any annoyance or inconvenience which may result from such normal agricultural uses and activities."

(2) For any new subdivision development located in whole or in part within 50 feet of the boundary of an Agricultural Preservation District, no improvement requiring an occupancy approval shall be constructed within 50 feet of the boundary of the Agricultural Preservation District.

(b) Normal agricultural uses and activities conducted in accordance with good husbandry and best management practices in Agricultural Preservation Districts shall be deemed protected actions and not subject to any claim or complaint of nuisance, including any such claims under any existing or future county or municipal code or ordinance. In the event a formal complaint alleging nuisance related to normal agricultural uses and activities is filed against an owner of lands located in an Agricultural Preservation District, such owner, upon prevailing in any such action, shall be entitled to recover reasonably incurred costs and expenses related to the defense of any such action, including reasonable attorney's fees (68 Del. Laws, c. 118, § 2.). In addition, if any wells are to be installed, Section 4.01(A)(2) of the Delaware Regulations Governing the Construction and Use of Wells will apply. This regulation states:

(2) For any parcel, lot, or subdivision created or recorded within fifty (50) feet of, or within the boundaries of, an Agricultural Lands Preservation District (as defined in Title 3, Del. C., Chapter 9); all wells constructed on such parcels shall be located a minimum of fifty (50) feet from any boundary of the Agricultural Lands Preservation District. This requirement does not apply to parcels recorded prior to the implementation date of these Regulations. However, it is recommended that all wells be placed the maximum distance possible from lands which are or have been used for the production of crops which have been subjected to the application of land applied federally regulated chemicals.

Section 1. Chapter 99, Code of Sussex Section 99-6 may also apply to this subdivision. The applicant should verify the applicability of this provision with Sussex County. This Section of the Code states:

G. Agricultural Use Protections.

(1) Normal agricultural uses and activities conducted in a lawful manner are preferred. In order to establish and maintain a preference and priority for such normal agricultural uses and activities and avert and negate complaints arising from normal noise, dust, manure and other odors, the use of agricultural

chemicals and nighttime farm operations, land uses adjacent to land used primarily for agricultural purposes shall be subject to the following restrictions:

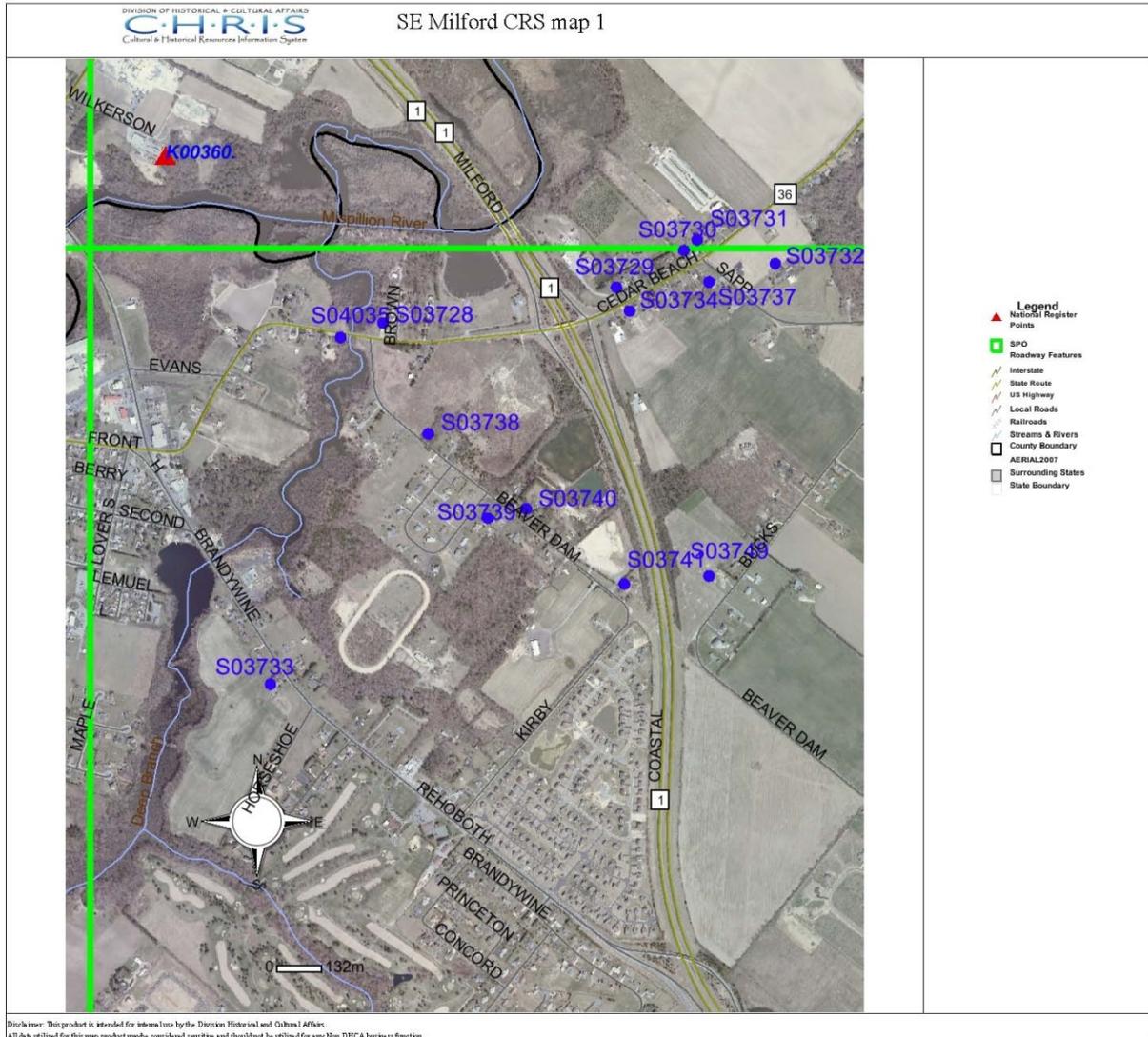
(a) For any new subdivision development located in whole or in part within three hundred (300) feet of the boundary of land used primarily for agricultural purposes, the owner of the development shall provide in the deed restrictions and any leases or agreements of sale for any residential lot or dwelling unit the following notice:

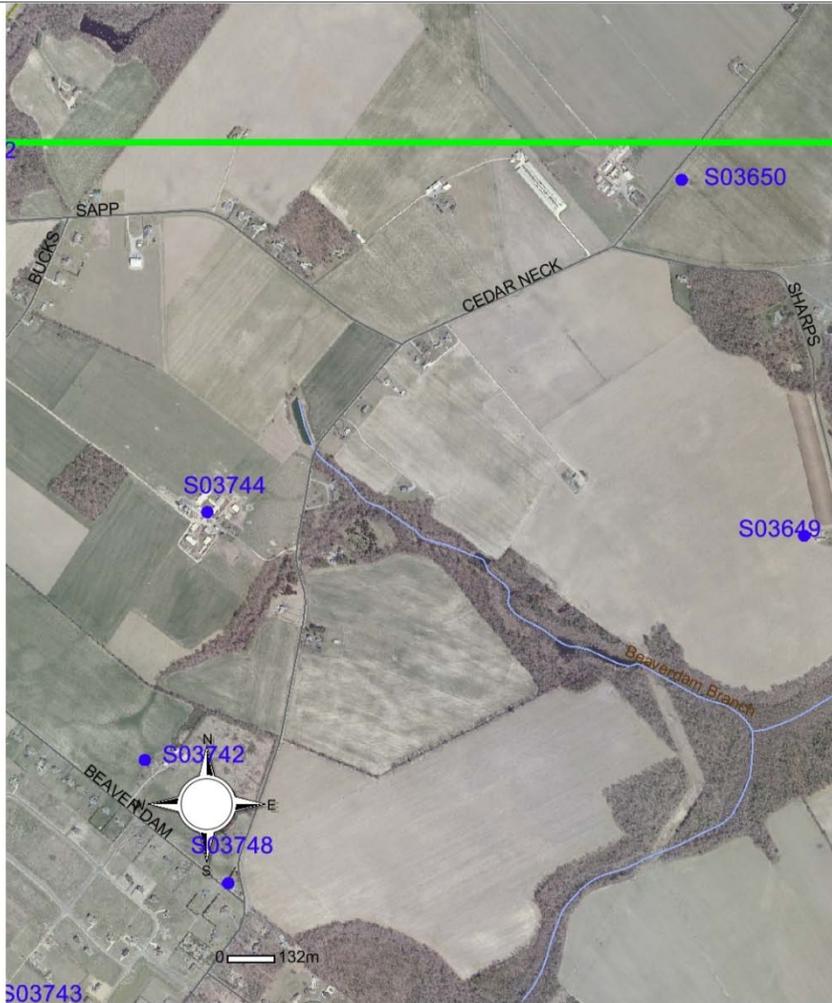
“This property is located in the vicinity of land used primarily for agricultural purposes on which normal agricultural uses and activities have been afforded the highest priority use status. It can be anticipated that such agricultural uses and activities may now or in the future involve noise, dust, manure and other odors, the use of agricultural chemicals and nighttime farm operations. The use and enjoyment of this property is expressly conditioned on acceptance of any annoyance or inconvenience which may result from such normal agricultural uses and activities.”

(b) For any new subdivision development located in whole or in part within fifty (50) feet of the boundary of land used primarily for agricultural purposes no improvement requiring and occupancy approval for a residential type use shall be constructed within fifty (50) feet of the boundary of land used primarily for agricultural purposes.

Appendix 4.

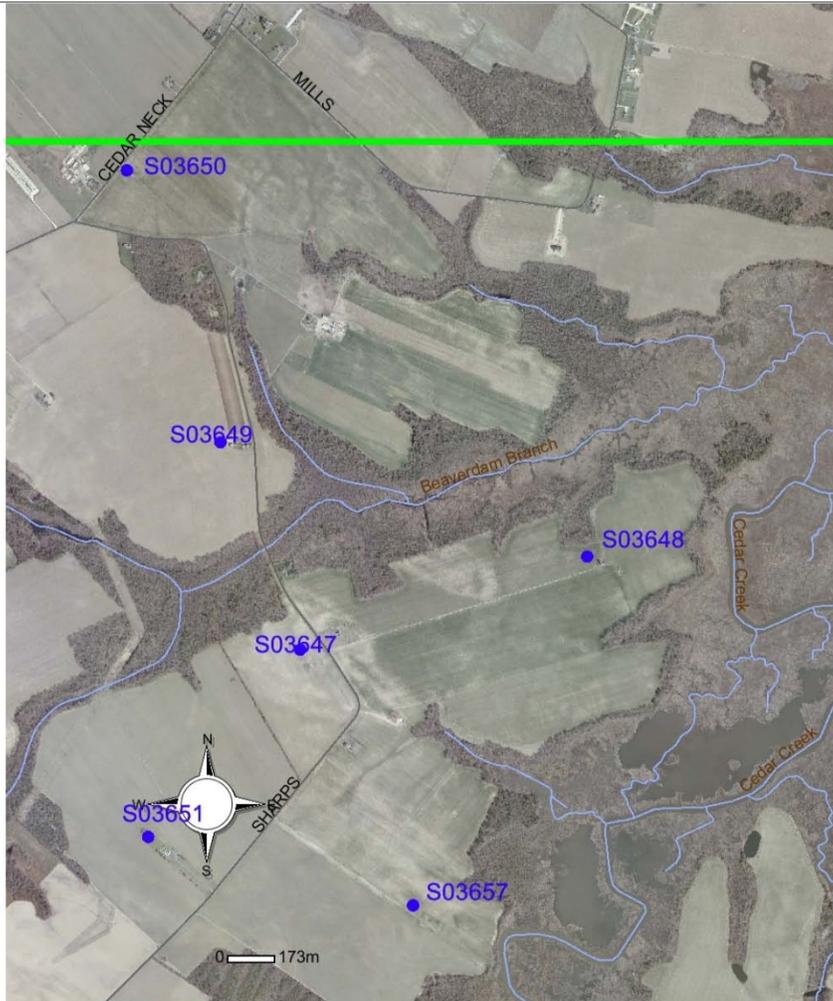
Historical and Cultural Resources in or Near the Master Plan Area





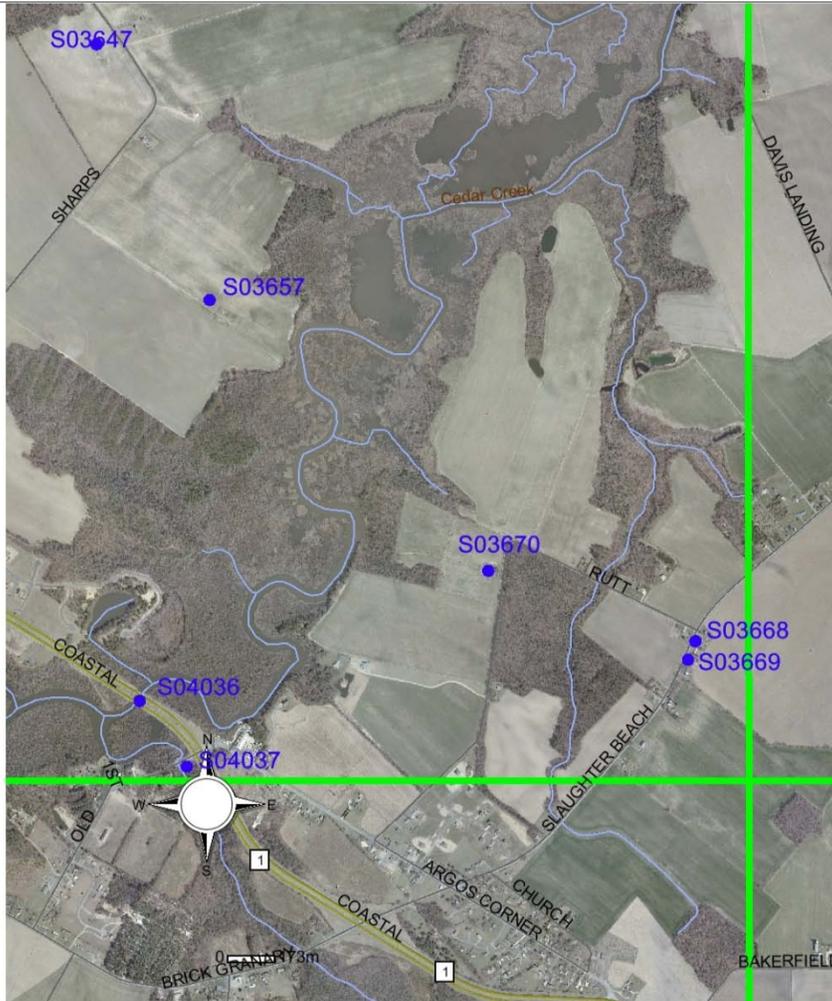
- Legend**
- ▲ National Register Points
 - SPO
 - Roadway Features
 - Interstate
 - State Route
 - US Highway
 - Local Roads
 - Railroads
 - Streams & Rivers
 - County Boundary
 - AERIAL2007
 - Surrounding States
 - State Boundary

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 All data utilized for this map product may be considered sensitive and should not be utilized for any Non-DHCA business function.



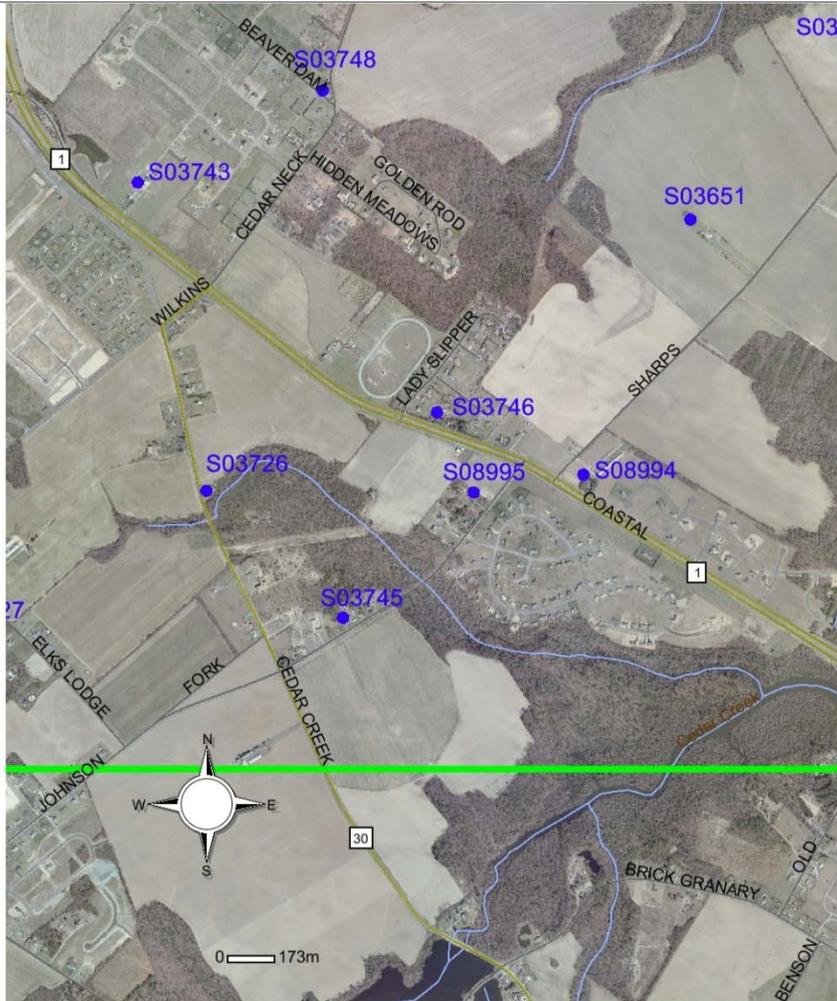
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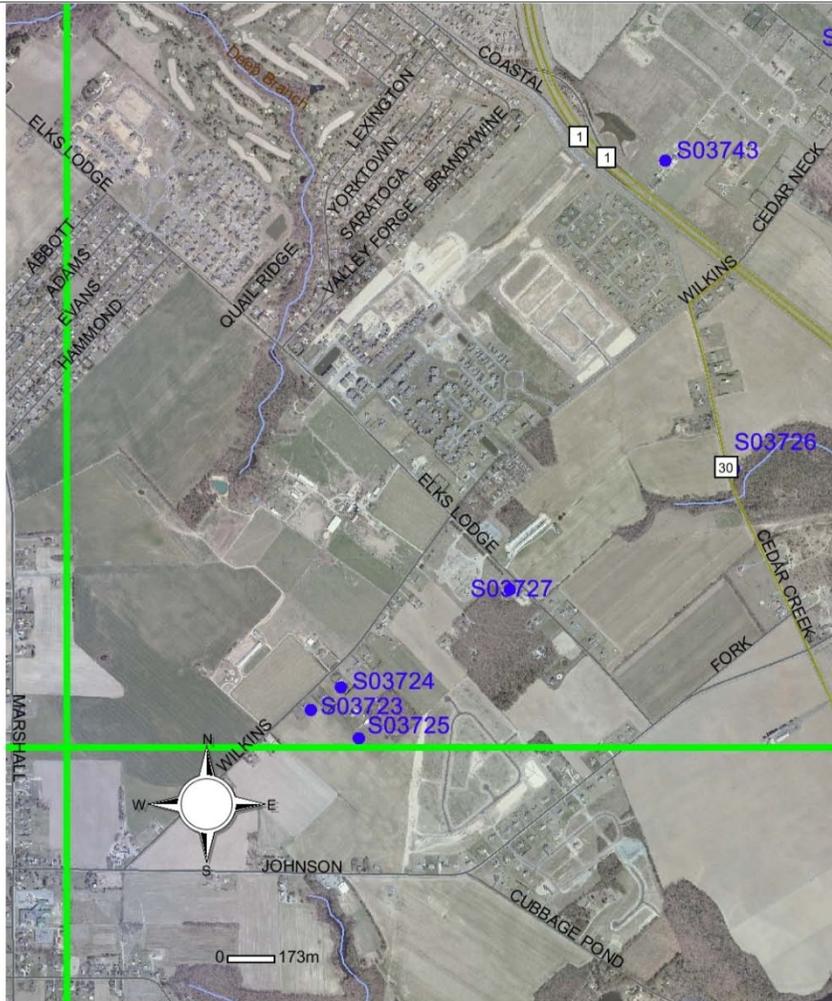
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- ▲ National Register Points
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- Legend**
- ▲ National Register Points
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 - Roadway Features
 - Interstate
 - State Route
 - US Highway
 - Local Road
 - Railroad
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- Legend**
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State Historic Preservation Office Map Key			
Map Number	Item	Type	Location
CRS Map 3, 4	S03647	dwelling	Sharps Rd
CRS Map 3	S03648	agricultural complex	Sharps Rd
CRS Map 2, 3	S03649	dwelling	Sharps Rd
CRS Map 2, 3	S03650	dwelling	Cedar Neck Rd
CRS Map 3, 5	S03651	agricultural complex	Sharps Rd
CRS Map 3, 4	S03657	agricultural complex	Sharps Rd
CRS Map 4	S03668	dwelling	Slaughter Beach Rd
CRS Map 4	S03669	dwelling	Slaughter Beach Rd
CRS Map 4	S03670	dwelling	Rutt Rd
CRS Map 6	S03723	agricultural complex	Wilkins Rd
CRS Map 6	S03724	agricultural complex	Wilkins Rd
CRS Map 6	S03725	dwelling	Wilkins Rd
CRS Map 5, 6	S03726	dwelling	Cedar Creek Rd
CRS Map 6	S03727	dwelling	Elks Lodge Rd
CRS Map 1	S03728	dwelling	Cedar Beach Rd
CRS Map 1	S03729	dwelling	Cedar Beach Rd
CRS Map 1	S03730	dwelling complex	Cedar Beach Rd
CRS Map 1	S03731	agricultural complex	Cedar Beach Rd
CRS Map 1	S03732	dwelling complex	Sapp Rd
CRS Map 1	S03733	agricultural complex	Rehoboth Blvd
CRS Map 1	S03734	dwelling	Cedar Beach Rd
CRS Map 1	S03737	dwelling	Sapp Rd
CRS Map 1	S03738	dwelling	Beaver Dam Rd
CRS Map 1	S03739	dwelling	Beaver Dam Rd
CRS Map 1	S03740	agricultural complex	Beaver Dam Rd
CRS Map 1	S03741	agricultural complex	Beaver Dam Rd
CRS Map 2	S03742	agricultural complex	Beaver Dam Rd
CRS Map 2, 6	S03743	agricultural complex	Coastal Hwy
CRS Map 2	S03744	agricultural complex	Cedar Neck Rd
CRS Map 5	S03745	dwelling	Johnson Rd
CRS Map 5	S03746	dwelling	Coastal Hwy
CRS Map 2, 5	S03748	school	Cedar Neck Rd
CRS Map 1	S04035	State Bridge No. 927	Cedar Beach Rd
CRS Map 4	S04036	State Bridge No. 933A	Coastal Hwy
CRS Map 4	S04037	State Bridge No. 934	Brick Granary Rd
CRS Map 5	S08994	Promise Land Farm	Coastal Hwy
CRS Map 5	S08995	dwelling	Coastal Hwy

*Ordinance No. 2011-15
Amending and Adopting by Ordinance
The 2008 City of Milford Comprehensive Plan by Including the SE Master Plan*

WHEREAS, Title 22, Section 702 of the Delaware Code, the Livable Delaware program of the Governor of the State of Delaware and House Bill 255 amending Title 9, Title 22 and Title 29 of the Delaware Code authorize Delaware municipalities to carefully prepare and adopt Comprehensive Land Use Plans to guide and regulate future growth and community development, and

WHEREAS, Delaware's Office of State Planning Coordination provides guidance to municipalities in order to effectuate the goal of having well-drawn and executed Comprehensive Plans for all Delaware counties and municipalities, including the provision that Comprehensive Plans be approved and certified by the Governor of Delaware upon their completion, and further requires that certified Comprehensive Plans be revised on a five-year cycle, and

WHEREAS, the City of Milford's Comprehensive Plan was last adopted in 2009, and requires revisions to account for physical changes and potential growth in the Southeast Planning Area which have occurred in both the built and natural environments of the community; and

WHEREAS, the City of Milford Planning Commission has prepared and approved, in consultation with the public, interested parties, and government agencies, a Southeast Master Plan for the City of Milford, which articulates an overall vision for the Southeast Planning neighborhood's future, including policies and action project recommendations for achieving that vision and has conducted a duly advertised public hearing for public review and comment on June 16, 2011 and, at its meeting on June 21, 2011 did recommend approval and adoption of the Amended 2008 City of Milford Comprehensive Plan to include the Southeast Master Plan by Milford City Council.

WHEREAS, the Amended 2008 City of Milford Comprehensive Plan will be the foundation for planning and development in the Southeast Planning Area;

WHEREAS, the Mayor and City Council held a duly advertised public hearing on the Southeast Milford Master Plan on July 11, 2011, at which time the Amended 2008 City of Milford Comprehensive Plan was reviewed with the public.

NOW, THEREFORE, THE CITY OF MILFORD HEREBY ORDAINS that the Amended 2008 City of Milford Comprehensive Plan is hereby adopted and made effective as the Comprehensive Plan for Milford on this ___ day of July 2011.

Dates:

Planning Commission Review and Recommendation: June 21, 2011

Introduction to City Council: June 27, 2011

City Council Review and Adoption: July __, 2011



July 8, 2011

Mr. Mark Mallamo, P.E.
Public Works Facility
P.O. Box 159
180 Vickers Drive
Milford, DE 19963

**Re: City of Milford, SSES Phase III – 1
Construction Phase Services**

Dear Mark:

As requested, URS Corporation d/b/a URS Corporation Americas is pleased to offer the following proposal for Construction Phase Services to the City of Milford on the above referenced project. As indicated in our April 12, 2010 contract to complete the SSES in the high priority areas, the construction related services were not included because the extent of the work was not known at that time. At this time, the work has been bid, and award of three separate contracts by City Council is anticipated on July 11, 2011. This proposal will serve as an amendment to our original contract and will cover the Construction Phase Services as described in more detail below.

A. SCOPE OF WORK

The City opened bids for three separate projects on July 1, 2011 for sewer rehabilitation work identified as part of the City's ongoing effort to identify and correct inflow and infiltration into the gravity collection system. URS has reviewed the bids and made recommendations for award of the contracts. The work area generally encompasses North Walnut Street between 2nd Avenue and 6th Avenue, and the Fisher Avenue Pump Station drainage basin, as presented to City Council and more accurately reflected in the bidding documents. The rehabilitation work proposed will involve: one contract for open cut excavation to remove and replace leaking manhole frames and covers and sewer pipe, the sealing of leaking joints in manholes and the heavy cleaning and televising of pipe segments within the sewer that contain heavy solids; one contract for the trenchless rehabilitation of pipe by the installation of cured-in-place main line pipe liners; and one contract for the trenchless rehabilitation of pipe by the installation of cured-in-place lateral pipe liners and the installation of clean outs.

Based on the above Scope of Work, URS Corporation will provide the following services.

B. SERVICES TO BE PROVIDED

1. Provide Engineering support. URS will provide a senior construction manager to oversee the daily activities of the onsite field staff, as well as engineering support for the review of submittals provided by the Contractors, review pay requests submitted by Contractors, day-to-day engineering support of the field activities, assistance with contract closeout, and general coordination between the Contractors, URS and the City of Milford. In addition, the senior construction manager and / or engineer will:
 - Prepare the contract documents to expedite the start of construction.
 - Work with the Contractors to coordinate the work so that it proceeds in an orderly fashion to the maximum extent possible.

- Make visits to the site at intervals appropriate to the various stages of construction to observe the progress and quality of the executed work by Contractors
 - Review the CCTV lateral inspection videos and select up to 65 laterals for the installation of cleanouts.
 - Oversee the work of the Resident Project Representatives.
 - Prepare Preconstruction and Progress Meeting Agenda's. Conduct the meetings, prepare and distribute meeting minutes.
 - Review and sign monthly applications for payment from the contractor.
 - Review proposed Change Order proposals from the contractor.
2. Provide Resident Project Representative (RPR) Services. URS will provide one full time RPR and one part time RPR to assist the City of Milford with construction observation of the projects described above. The full time RPR will generally observe the open cut work, which is anticipated to take 36 weeks to reach final completion. The part time RPR will generally observe the CIPP main line and lateral lining work which is anticipated to require 20 weeks observation over the course of the two contracts. All inspectors will be PACP / MACP and / or CIPP inspector certified by NASSCO. In addition to observation of construction activities, the URS RPR's will perform the following:
- Prepare "Daily Reports of Construction". Reports will be distributed to the City of Milford weekly.
 - Verify quantities and units of work installed on a daily basis. Quantities will be included in the "Daily Report of Construction".
 - Record "As Built" data while on site. Review final "As Built" Record Documents submitted by Contractor at project completion.
 - Attend periodic project meetings with the City of Milford, the design team and the Contractors.
 - Review Applications for Payment and provide recommendations to the City of Milford.
 - Review and make recommendations on "Work Change Directives".
 - Serve as project liaison between the City of Milford and the engineering design team to respond to the contractors' questions and coordinate written responses to all parties.
 - Provide ongoing coordination with permitting and regulatory agencies as needed.
3. As discussed previously, URS will make every effort to utilize qualified City staff to assist URS in observing construction during the course of the projects. It is assumed that City staff will coordinate closely with URS and provide the same level of reporting and observation as URS staff.
4. URS will review schedules, proposed material submittals and samples to assure compliance with the approved plans and specifications. Such reviews and approvals or other action shall not extend to means, methods, techniques, sequences or procedures of construction, or to safety precautions and programs incidental thereto.
5. Conduct inspections to determine if the work is substantially complete. Prepare a "Punch List" of work to be completed. Conduct a final inspection with the Design Engineer and the City of Milford to determine if the work has been completed per the requirements of the approved plans and specifications.

C. SERVICES NOT INCLUDED

URS can provide additional services as requested. The following services have not been included in this Construction Phase Services Proposal:

1. Design.
2. Survey and layout for construction operations.
3. Third Party Testing required by the approved plans and specifications (i.e., soils density testing, concrete testing, etc.).
4. Any Services not specified in Section B above.

D. PROJECT MANAGEMENT

The Principal-in-Charge for this project will be Brian Bolender, P.E. The Project Manager will be Ed Strauss, P.E. and he will be assisted by Jerry Katzmire as the Senior Construction Manager.

E. FEE

We shall provide our services on a time and material basis and fees will be billed monthly based on the amount of work completed during that period. The proposed budget is based on the project being completed within the project time listed in the contracts. The project time is 270 calendar days for the open cut project, 150 days for the CIP main line liner project and 240 days for the CIP lateral liner project. For both liner projects, our proposal is based on requiring 20 weeks of RPR oversight. We suggest you budget approximately \$225,000 for the services described above. We will not exceed this amount without written authorization.

We are very interested in continuing to serve you on this project and hope this proposal meets your needs. If you wish for us to proceed with these services, please sign the attached Time and Materials Work Authorization and return one copy to confirm your authorization. If you have any questions or desire additional information regarding our services, please contact us.

Very truly yours,

URS Corporation



Ed Strauss, P.E.
Project Manager



Brian Bolender, P.E.
Vice President

cc: Gerald N. Katzmire

TIME AND MATERIALS WORK AUTHORIZATION NO. 4

In accordance with the Agreement for Consulting and Professional Services between the City of Milford, Delaware ("Client"), and URS Corporation d/b/a URS Corporation Americas, a Nevada corporation, dated April 12, 2010, this Work Authorization describes the Services, Schedule, and Payment Conditions for Services to be provided by URS Corporation d/b/a URS Corporation Americas ("Consultant") on the Project known as:

**SSES PHASE III-1
CONSTRUCTION PHASE SERVICES**

Client Authorized

Representative: Mark Mallamo, P.E.
Address: 180 Vickers Drive
Milford, Delaware 19963
Telephone No.: 302.422.6616

URS Authorized

Representative: Brian N. Bolender, P.E.
Address: Iron Hill Corporate Center, 4051 Ogletown Road, Suite 300
Newark, Delaware 19713
Telephone No.: 302.781.5900

SERVICES. The Services shall be described in our proposal letter dated July 8, 2011 attached to this Work Authorization.

SCHEDULE. The Estimated Schedule shall be set forth in our proposal letter dated July 8, 2011 attached to this Work Authorization. Because of the uncertainties inherent in the Services, Schedules are estimated and are subject to revision unless otherwise specifically described herein.

PAYMENT. URS charges shall be on a "time and materials" basis and shall be in accordance with the Consultant's Schedule of Fees and Charges in effect at the time the Services are performed. Payment provisions and the Consultant's current Schedule of Fees and Charges are attached to this Work Authorization as Exhibit A.

TERMS AND CONDITIONS. The terms and conditions of the Agreement referenced above shall apply to this Work Authorization, except as expressly modified herein.

ACCEPTANCE of the terms of this Work Authorization is acknowledged by the following signatures of the Authorized Representatives.

CLIENT

Signature

Typed Name/Title

Date of Signature

CONSULTANT

Brian N. Bolender

Signature
Brian N. Bolender, Vice President

Typed Name/Title

7/8/11

Date of Signature

**URS CORPORATION
DELAWARE OFFICES
BILLING RATES FY11**

CHARGES

Our current billing rates shall be as follows:

<u>Classification</u>	<u>Hourly Rate</u>
Senior Principal Professional	\$160.00 - 215.00
Principal Professional	\$130.00 - 185.00
Project Professional / Construction Manager	\$105.00 - 145.00
Senior Professional	\$ 80.00 - 115.00
Staff Professional / Project Field Technician	\$ 50.00 - 100.00
Staff Designer	\$ 50.00 - 100.00
Staff Field Technicians	\$ 40.00 - 85.00
Administrative Staff	\$ 40.00 - 90.00
Survey Crew (2 person)	\$140.00 - 175.00
Survey Crew (3 person)	\$175.00 - 240.00
Contracted Services and Equipment Rentals	1.1 times our cost

These rates include our general overhead, profit and nominal expenses. Communication, transportation, and any special equipment required or requested for the project will be billed as a direct expense unless otherwise noted. Transportation costs will be billed by computed mileage using the most current IRS approved rate. These billing rates are updated annually. Individual billing rates are determined using our direct salary costs and set multipliers for field and office staff. Charges for contract personnel under our supervision and using our facilities will be billed according to the hourly rate corresponding to their classification.

Chapter 57-Planning Commission

§57-1. Establishment.

There is hereby established, pursuant to 22 Del. C. § 701 et seq., the Milford Planning Commission.

§57-2. Membership; term of office.

The Commission shall consist of nine members to be appointed by the Council. The term of each member so appointed and confirmed shall be for three years, except that of the members first appointed, three shall be appointed to a term of three years, three shall be appointed to a term of two years and three shall be appointed to a term of one year.

§57-3. Removal; vacancies

Any member of the Planning Commission may be removed for cause, after a public hearing, by the Mayor with the approval of the City Council. A vacancy occurring otherwise than by expiration of term shall be filled for the unexpired term in the same manner as an original appointment.

CITY OF MILFORD

PLANNING COMMISSION MEMBERS

Charles M. Rini, Chairman

Appointed: 07/07

Term Expiration: 08/31/11

Kim S. Hoey-Stevenson, Vice Chair

Appointed: 10/05

Term Expiration: 08/31/11

James F. Burk, Secretary

Appointed: 11/08

Term Expiration: 08/31/12

Vacant

Karen K. McColley

Appointed: 02/08

Term Expiration: 08/31/13

Marvin C. Sharp

Appointed: 09/08

Term Expiration: 08/31/12

Archie J. Campbell

Appointed: 10/09

Term Expiration: 08/31/13

George R. Pilla

Appointed: 10/09

Term Expiration: 08/31/11

William J. Lane

Appointed: 08/10

Term Expiration: 08/31/12

Gary Norris, AICP

City Planner

Christine Crouch

Recording Secretary/Department Administrative Assistant

All correspondence is to be mailed to:

*Planning Commission
c/o Planning Department
201 S Walnut Street
Milford, DE 19963*

BURKE EQUIPMENT COMPANY

54 ANDREWS LAKE RD, FELTON DE 1994



PROPOSAL

Sales Rep: **BOB COOKE**
 OFFICE PHONE: 302-697-3200
 Cell Phone: (302) 632-1763
 Fax: (302) 284-0225
 bcooke@burkeequipment.com
 www.burkeequipment.com

Date: July 19, 2011
 Bill To: CITY OF MILFORD DEPT OF
 PARKS AND REC.
 Address: 207 FRANKLIN ST
 MILFORD, DE. 19963
 GARY EMORY -DIR.
 County:
 Office/Home Phone: 302 422 1104
 Mobile Phone:
 Email:

Customer Purch. Order _____

Serial #	Make	Model	Description	Amount
	KUBOTA	ZD331LP-72	31 hp DIESEL COMMERCIAL Z TURN W/72 PRO DK	\$13,422.60
	KUBOTA	ZD331LP-72	31 hp DIESEL COMMERCIAL Z TURN W/72 PRO DK	\$13,422.60
	KUBOTA	ZD3116A	WORK LIGHT KIT (ROPS MOUNTED) QUANTITY 2	\$337.00
	KUBOTA	ZD3110A	FRONT MOUNT SNOW BLADE -QUANTITY 2	\$1,587.00
PRICING IS IN ACCORDANCE WITH DELAWARE STATE BIDDING QUOTES				
ALL PRICES ARE INCLUDING FREIGHT, INSTALLATION AND PRE DELIVERY INSPECTION				
ALL UNITS WILL COME WITH COMPLETE OPERATORS MANUALS AND BE FILLED WITH FUEL				

TRADE SERIAL NUMBER	MAKE	MODEL	DESCRIPTION	ALLOWANCES
TOTAL TRADE ALLOWANCES:				

Outstanding Loan Balance: _____
 Outstanding Loan Balance Payable To: _____

CONSIGNMENT OR TRADE	
I AGREE THERE IS NO LIEN ON ANY TRADE OR CONSIGNMENT EQUIPMENT	
INITIAL HERE >	
IF THERE IS A LIEN LIST THE LIEN HOLDER BELOW	
WHAT INSURANCE COMPANY INSURES THIS EQUIPMENT?	
WHAT IS THE PAYOFF?	

Invoice Subtotal:	\$28,769.20
Less Trade Allowance, Plus Outstanding Loan Balance:	\$0.00
Subtotal:	\$28,769.20
Tax:	\$0.00
Tag and Title Fees:	\$0.00
Less Deposit Received:	
Total Amount Due:	\$28,769.20

CUSTOMER SIGNATURE:	DATE:	
WHAT TYPE OF BURKE ADVERTISING/MARKETING HAVE YOU SEEN?		
BURKE WEBSITE	YELLOW PAGES	DIRECT MAIL
MANF. WEBSITE	TRADE SHOW	STORE LOCATION/ SIGN
NEWSPAPER	BILLBOARD	RADIO/ TV
BURKE TRUCK	EBAY	AM EXPRESS PROMO

PUBLIC NOTICE

NOTICE IS HEREBY GIVEN the following ordinance is currently under review by Milford City Council:

ORDINANCE 2011-20

PROVIDES FOR THE READJUSTMENT OF WARD BOUNDARIES IN THE CITY OF MILFORD
PURSUANT TO ARTICLE II, SECTION 2.07 OF THE CITY OF MILFORD CHARTER

WHEREAS, the City of Milford, Delaware desires to ensure that its voting districts, to be known as Wards, are apportioned in compliance with the United States Constitution, Voting Rights Act and other applicable laws;
WHEREAS, the adoption of this Ordinance will ensure such conformance;
WHEREAS, members of Milford City Council comprise the Districting Commission;
WHEREAS, Section 2.07(c) requires the Districting Commission to file a report, containing a recommended plan for adjustment of the district boundaries, with the City Clerk no later than the first day of January of the second year following the decennial Census;
WHEREAS, said report must comply with specifications outlined in Subsections 2.07(c)(1) and 2.07(c)(2);
WHEREAS, Section 2.07(c)(1) requires the Census data be used to ensure that council districts are formed of compact, contiguous territory and the population does not differentiate by more than ten percent in the smallest district created;
WHEREAS, the Districting Commission has officially revised the district boundaries by ordinance on several occasions, most recently on September 27, 2010, and in accordance with applicable laws;
WHEREAS, it was anticipated that the 2010 Decennial Census of Population conducted on April 1, 2010 would show a need to rebalance district populations;
WHEREAS, the 2010 Federal Decennial Census has been officially published and the data for the State of Delaware, including the City of Milford, released on the 2nd day of March 2011;
WHEREAS, based on the 2010 Census data, the population data was considered and the council districts reviewed and altered;
WHEREAS, City Staff, City Consultants and the Districting Commission have worked diligently to study legal guidelines to ensure that all required steps will be completed before the next City election scheduled for April 28, 2012; and
WHEREAS, the health, safety, and welfare of the citizens of Milford, Delaware will be positively impacted by the adoption of this Ordinance.

THEREFORE, the City of Milford hereby ordains:

Section 1.

The boundaries of the City Council Districts, designated as Wards 1, 2, 3 and 4, shall be described as follows:

The First Ward shall consist of all the territory within the City limits as follows: Beginning at a point in the center of the intersection of Southeast Second Street and Franklin Street; thence along the centerline of Southeast Second Street in an easterly direction to the point of intersection with Columbia Street; thence by the centerline of Columbia Street in a southerly direction to the point of intersection with Southeast Third Street; thence by the centerline of Southeast Third Street in an easterly directions to the point of intersection with Lovers Lane; thence by the centerline of Lovers Lane in a southerly direction to the point of intersection with Lemuel Street; thence by a straight line coincident with the centerline of Lemuel Street in an easterly direction to the point of intersection with Marshall Pond and the corporate limits of the City; thence along the corporate limits, Marshall Pond, and Deep branch in a southerly direction to a point on the lands of Shawnee Country Club; thence along the corporate limits of the City in a northeasterly direction to the point of intersection of the corporate limits of the City and U.S. Route 1; thence continuing with the corporate limits in a southeasterly direction to the intersection of the corporate limits and Sharps Road; thence with the corporate limits and along the Northern Right-of-Way of Sharps Road in a southwesterly direction 2,650 feet; thence leaving Sharps Road and continuing with the corporate limits in a northwesterly direction to the eastern Right-of-Way of U.S. Route 1; thence along the corporate limits in a southeasterly direction to a point on the centerline of U.S. Route 1 being 190 feet north of Johnson Road; thence along the corporate limits in a southwesterly direction to a point at the intersection of

Johnson Road and Elks Lodge Road; thence along the corporate limits in a northwesterly direction to a point on the western most point of Shawnee County Club; thence along the corporate limits in a westerly direction to a point on the centerline of Right-of-Way of the railroad tracks; thence by the centerline of the railroad tracks in a northerly direction to the point of intersection with South Washington Street; thence by the centerline of South Washington Street in a northerly direction to the point of intersection with Buzzard Alley; thence by the centerline of Buzzard Alley in an easterly direction to the point of intersection with Ballpark Lane; thence by the centerline of Ballpark Lane in a northerly direction to the point of intersection with Southeast Third Street; thence by the centerline of Southeast Third Street in an easterly direction to the point of intersection with Franklin Street; thence by the centerline of Franklin Street in a northerly direction to the point and place of beginning.

The Second Ward shall consist of all territory within the City limits as follows: Beginning at a point in the intersection of North Walnut Street and Northwest Front Street; thence along the centerline of North Walnut Street and continuing with South Walnut Street in a southerly direction to the point of intersection with Southeast Front Street; thence along the centerline of Southeast Front Street in an easterly direction to the point of intersection with Franklin Street; thence along the centerline of Franklin Street in a southerly direction to the point of intersection with Southeast Third Street; thence along the centerline of Southeast Third Street in a westerly direction to the point of intersection with Ballpark Lane; thence along the centerline of Ballpark Lane in a southerly direction to the point of intersection with Buzzard Alley; thence along the centerline of Buzzard Alley in a westerly direction to the point of intersection with South Washington Street; thence along the centerline of South Washington Street in a southerly direction to the point of intersection on the centerline of Right-of-Way of the railroad tracks; thence by the centerline of the railroad tracts in a southerly direction to the point of intersection with the corporate limits of the City; thence leaving the railroad tracks and along the corporate limits in a southwesterly direction to the point of intersection with Route 113; thence along the corporate limits in a generally northerly direction to the point of intersection with East Lane; thence along the centerline of East Lane in an easterly direction to the point of intersection with the western Right-of-Way of Route 113; thence along the western Right-of-Way of Route 113 in a northerly direction to the point of intersection with Northwest Front Street; thence along the centerline of Northwest Front Street in an easterly direction to the point and place of beginning.

The Third Ward shall consist of all territory within the City limits as follows: Beginning at a point in the center of the intersection of Northwest Front Street and North Street; thence along the centerline of North Street in a northwesterly direction to the point of intersection with Church Street; thence along the centerline of Church Street in a northeasterly direction to the point intersection with Rehoboth Boulevard; thence along the centerline of Rehoboth Boulevard in a northerly direction to the point of intersection with Route 113; thence along the centerline of Route 113 and U.S. Route 1 in a northerly direction to the point of intersection with Millwood Drive and the corporate limits of the City; thence along the corporate limits in a northerly direction to the northern most point of the City; thence along the corporate limits in a generally southeasterly direction to a point on the corporate limits being 350' south of the intersection of State Route 36; thence along the corporate limits in a generally westerly direction to a point formed by the extension of the centerline of Lemuel Street to the corporate limits; thence leaving the corporate limits and following the centerline of Lemuel Street in a westerly direction to the point of intersection with Lovers Lane; thence along the centerline of Lovers Lane in a northerly direction to the point of intersection with Southeast Third Street; thence along the centerline of Southeast Third Street in a westerly direction to the point of intersection with Columbia Street; thence along the centerline of Columbia Street in a northerly direction to the point of intersection with Southeast Second Street; thence along the centerline of Southeast Second Street in a westerly direction to the point of intersection with Franklin Street; thence along the centerline of Franklin Street in a northerly direction to the point of intersection with Southeast Front Street; thence along the centerline of Southeast Front Street in a westerly direction to the point of intersection with South Walnut Street; thence along the centerline of South Walnut Street and continuing with North Walnut Street in a northerly direction to the point of intersection with Northeast Front Street; thence along the centerline of Northeast Front Street in a westerly direction to the point and place of beginning.

The Fourth Ward shall consist of all territory within the City limits as follows: Beginning at a point in the center of the intersection of Northwest Front Street and North Street; thence along the centerline of North Street in a northwesterly direction to the point of intersection with Church Street; thence along the centerline of Church Street in a northeasterly direction to the point intersection with Rehoboth Boulevard; thence along the centerline

of Rehoboth Boulevard in a northerly direction to the point of intersection with Route 113; thence along the centerline of Route 113 and U.S. Route 1 in a northerly direction to the point of intersection with Millwood Drive and the corporate limits of the City; thence along the corporate limit of the City in a generally westerly direction to the point of intersection with Church Hill Road; thence continuing along the corporate limits in a generally southerly direction to the point of intersection with Williamsville Road; thence continuing along the corporate limits in a generally easterly direction to the point of intersection with East Lane; thence along the centerline of East Lane in an easterly direction to the point of intersection with the western Right-of-Way of route 113; thence along the western Right-of-Way of Route 113 to the point of intersection with Northwest Front Street; thence along the centerline of Northwest Front Street in an easterly direction to the point and place of beginning.

Section 2.

The boundaries of all four (4) wards shall at all times be shown on a map to be retained in the Office of the City Clerk and designated as the "Official Ward Map, Milford, Delaware" and signed by the Mayor, attested by the City Clerk and bearing the seal of the City.

Section 3.

Territory annexed into the City shall become a part of the ward it abuts as assigned in the resolution finalizing the annexation of said territory.

Section 4.

This Ordinance has been properly advertised and copies of the Ordinance and related materials will be made available to the public on July 20, 2011.

Section 5.

All ordinances and parts of ordinances in conflict herewith are hereby expressly repealed.

Section 6.

The new Council districts and boundaries, as of the date of enactment, shall supersede previous Council districts and boundaries for the purposes of the next regular City election, including nominations. The new districts and boundaries shall supersede previous districts and boundaries for all other purposes as of the date on which all Councilpersons elected at the regular City election take office. Legal descriptions, contained herein, and official map shall be filed in the Office of the City Clerk.

Section 7.

Official Maps (see attached).

#1 Current Wards

#2 Proposed Wards

Section 8. Dates.

Ordinance & Map Publication Dates:

Milford Chronicle 07/20/11

The Beacon 07/21/11

Date of Introduction 07/25/11

Adoption Date of Adoption 08/22/11

Effective Date 09/01/12

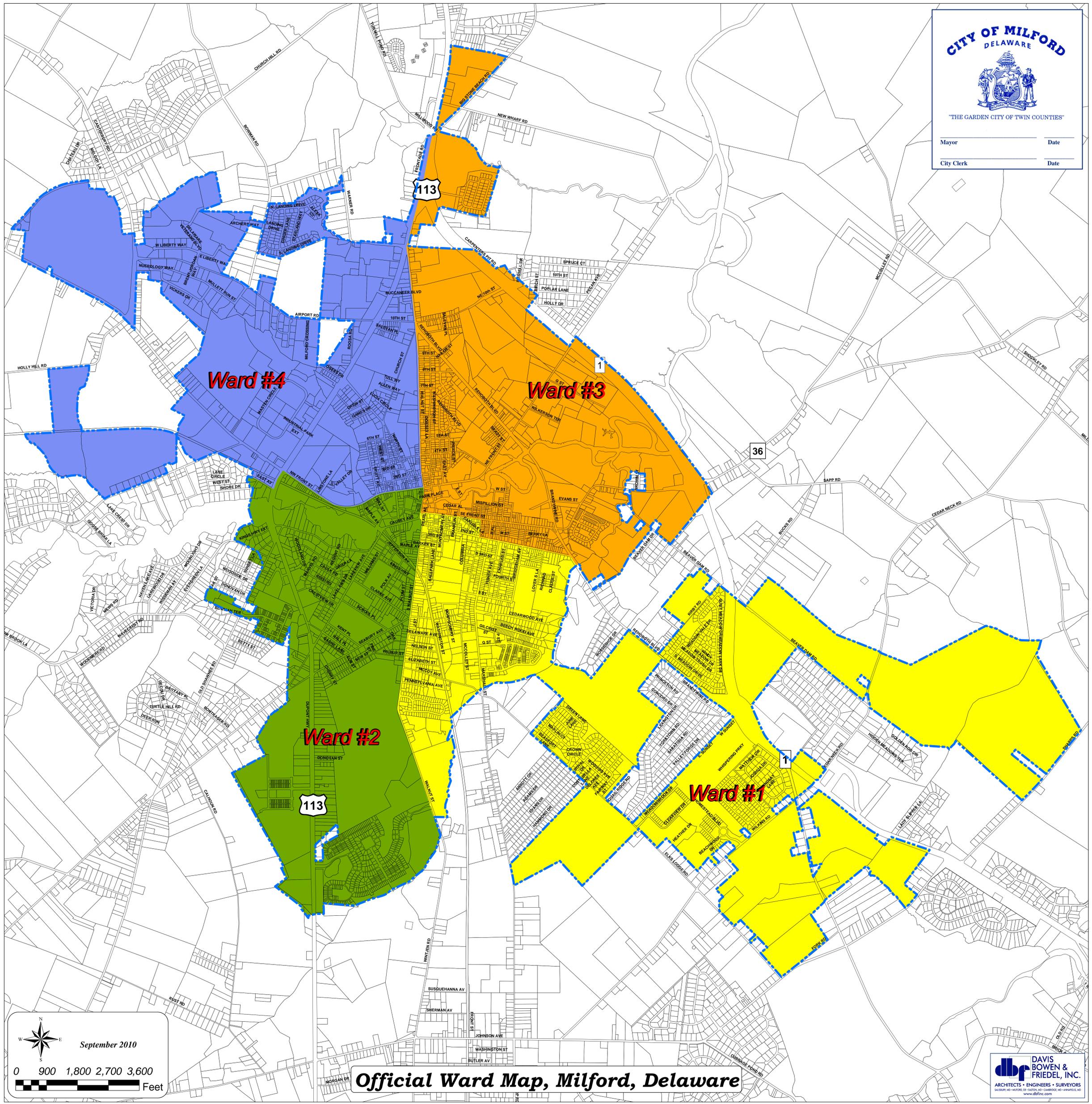
A complete copy of the City of Milford Charter is available for review at the City Clerk's Office at Milford City Hall, 201 South Walnut Street, Milford, Delaware or on the website cityofmilford.com

By: Terri K. Hudson, CMC
City Clerk

Attachments (2)



Mayor _____ Date _____
City Clerk _____ Date _____



Ward #4

Ward #3

Ward #2

Ward #1

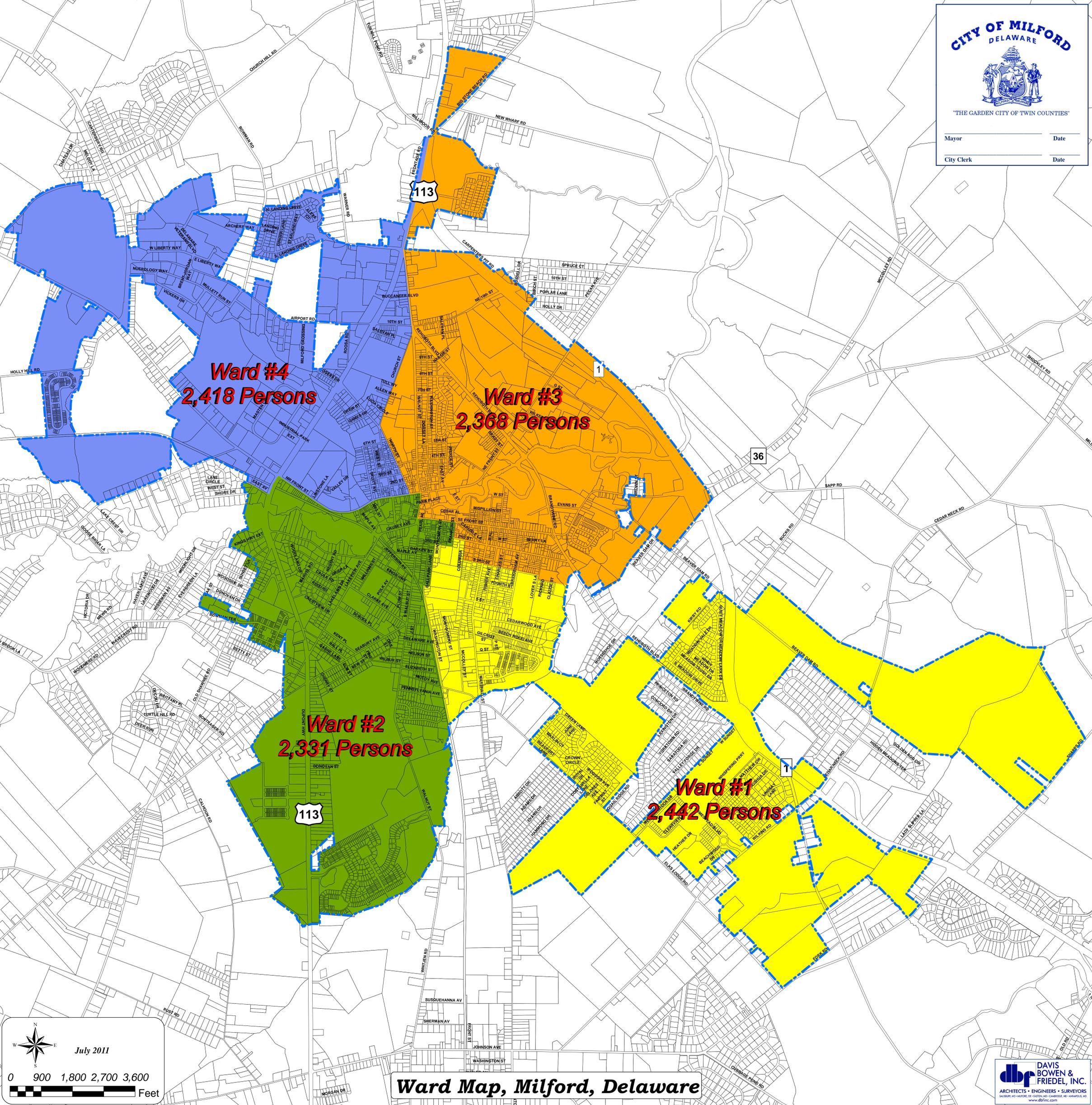
September 2010

0 900 1,800 2,700 3,600 Feet

Official Ward Map, Milford, Delaware



Mayor _____ Date _____
City Clerk _____ Date _____

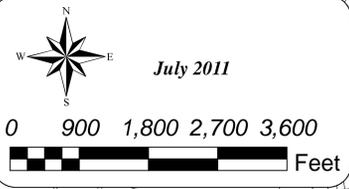


Ward #4
2,418 Persons

Ward #3
2,368 Persons

Ward #2
2,331 Persons

Ward #1
2,442 Persons



Ward Map, Milford, Delaware



12 Goose Lane
Tolland, Connecticut 06084

P: 800.273.8605
F: 860.872.9526

www.tyler.com

July 18, 2011

Mr. David W. Baird, City Manager
City of Milford
201 S. Walnut Street
Milford, DE 19963

Dear Mr. Baird:

Tyler | CLT is pleased to provide information related to assisting you in maintaining your assessments by providing the following services. I have broken out our response into two categories: anticipated annual costs, and costs on years five & ten of your cycle. The fees presented are in today's dollars and assume modest growth in parcel counts. Should the City be interested in this concept we will refine the scope and fee into a mixed price of fixed prices for the predictable part of the scope and per parcel prices for the variable parts.

Our plan includes the annual duties listed below being performed at a per diem rate of \$685.00. This approach will allow for the amount of permits, subdivisions, and annexations to dictate the level of our efforts and billings. We have reviewed the permit summary information provided by the City, and believe 40 days of effort would meet your current needs, plus the extra work described below. That is a total estimated annual fee of \$27,400.00. Our annual scope of work would include:

- Perform inspections, measure improvements, photograph improvements, and change data as required
- Value all new improvements
- Field visit to verify sales and data on sales
- Data entry
- Annual sales & economic review make adjustments as needed to stay within IAAO standards.**
- Appeal hearing support
- Insure 10% of the City's properties are visited each year of a ten year cycle. We anticipate the majority of the 10% each year consisting of the new construction (permits) and sales verification. This annual field work would prevent the City from ever needing a municipal wide data collection effort again.

****The City will be responsible for mailing out an income & expense request forms to all income producing properties. This information will remain confidential and is important to maintain accurate commercial values.**



12 Goose Lane
Tolland, Connecticut 06084

P: 800.273.8605
F: 860.872.9526

www.tylertech.com

The second part of our plan would happen in years five and ten of the City's ten year cycle. The scope of this work would be very similar to the contract the City recently signed with Tyler. Updates on years five and ten would include:

- Data Mailers
 - Analysis & table adjustments
 - Full field review of values
 - Valuation letters to taxpayers
-
- Informal meetings with taxpayers

The biggest difference is there would be no need for "door to door" data collection because of the City's ongoing 10% per year approach. Our estimated cost of the fifth year and tenth year projects would be approximately \$20/parcel, plus the annual permits/sales/10% fees.

I am hopeful this information is helpful to you as you conduct your analysis. I would be happy to answer any questions you may have as they arise. Feel free to call (610.246.6539) or e-mail me (paul.miller@tylertech.com) at anytime.

Yours truly,

A handwritten signature in black ink, appearing to read "Paul C. Miller".

Paul C. Miller, CPE, CTA
Project Manager/Sales Executive

Proposed FY 11-12 Budget Amendment

Tax Billing and Assessments

	<u>Budget</u>	<u>Revised Budget</u>	<u>Net</u>
Salaries & Wages	\$ 54,995	\$ -	\$ (54,995)
Contract Services	1,200	30,000	\$ 28,800
Auditing Service	1,000	1,000	-
CAMA Software	5,600	5,600	-
Training	1,000	-	\$ (1,000)
Materials & Supplies	500	-	\$ (500)
General Expense	500	-	\$ (500)
Postage	1,600	1,600	-
Employee Benefits	19,160	-	\$ (19,160)
City Hall Allocation	3,865	3,865	-
Subtotal	89,420	42,065	\$ (47,355)
Reassessment Cost (annualized over 10 yrs)	26,120	26,120	-
Total Budget (Annual)	115,540	68,185	\$ (47,355)
Total Budget (10 yrs)	\$ 1,155,400	\$ 681,850	\$ (473,550)

Notes: \$0.01 Tax Rate generates \$65,000. A savings of \$47,355 is equal to saving \$0.0073