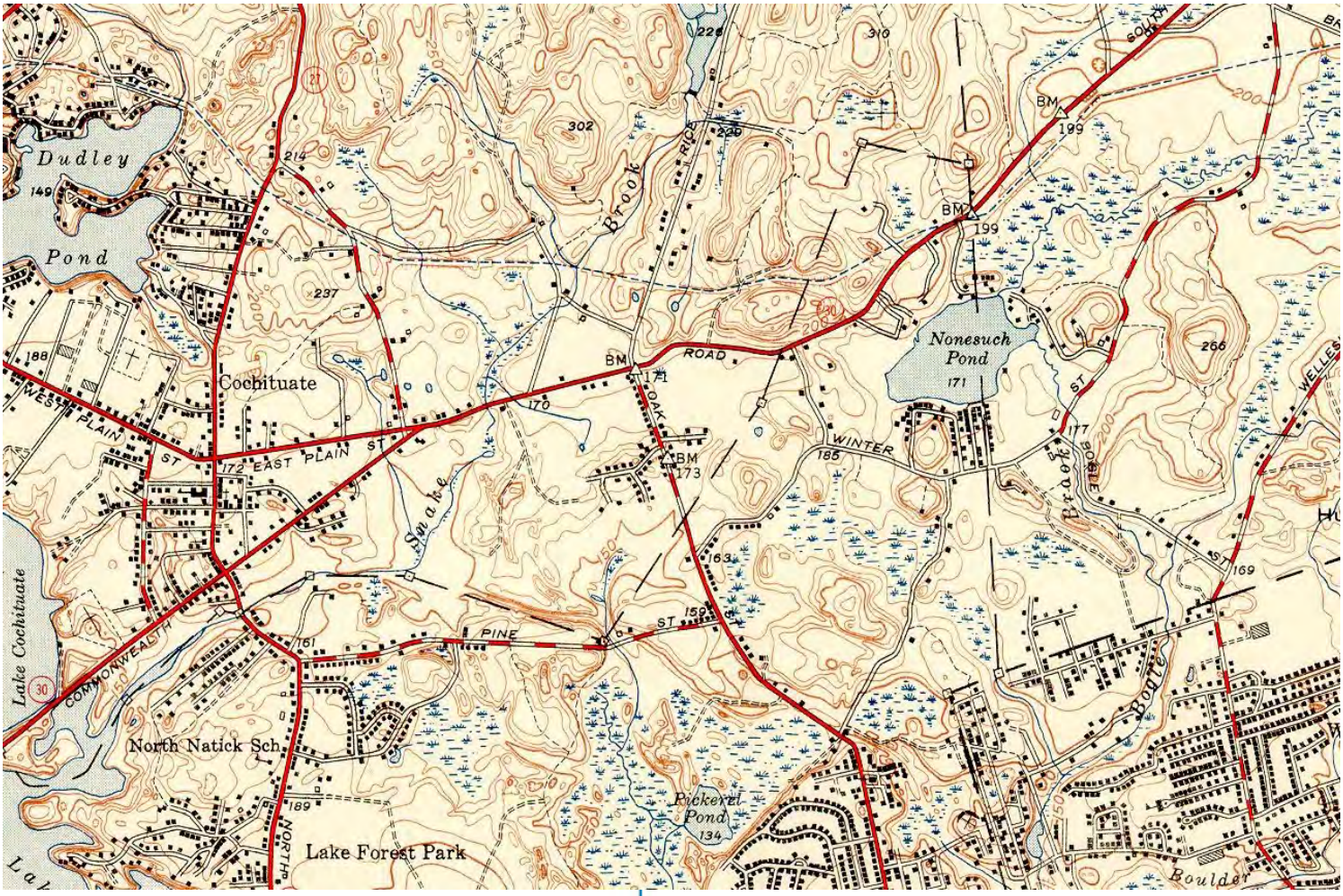

Tighe&Bond

Dudley Area Land Study

Submitted to

Town of Wayland, Massachusetts

July 2013

Section 1
Executive Summary

On November 22, 2010, the Dudley Area Advisory Committee (DAAC) was established by the Board of Selectmen as a temporary advisory committee to assist the Board with studying the use of Town-owned land located on Doran Road, Pond Drive, Cross Street, and Curtis Road. This property constitutes approximately 7.4 acres, and is as described in Article 7 of the November 16, 2010 Special Town Meeting Warrant and shown on the plan entitled "Plan of Land in Wayland, Massachusetts Prepared for the Doran Road~Dudley Pond Comprehensive Feasibility Study" dated September 30, 2010, prepared by the Town of Wayland, Town Surveyors Office.

The Dudley Area Land Study focuses on how best to address several areas of concern in the Dudley Pond watershed including: wastewater management, stormwater management, public open space and recreation, affordable housing and the use of town-owned property. The Dudley Pond community has a history of resourcefully developing and implementing solutions to address pond issues. The Tighe & Bond / Gates, Leighton & Associates project team worked closely with the DAAC and Town staff to provide technical expertise in the areas of development constraints, potential solutions to wastewater and stormwater concerns, and low impact development concepts for potential use on the Town-owned property. The consultant team provided the technical information for use by the DAAC in developing land use recommendations for the Town-owned 7.4 acres.

The process included: review of available site information, review of Town records, field investigations, public meetings, and two charrettes. The DAAC also held numerous meetings to discuss the potential uses of the Town-owned property. This process identified specific issues and areas of concern; highlighted the various community goals; identified key factors that make the Dudley Pond Area unique; and resulted in three conceptual plans for review and consideration by the DAAC. The three conceptual plans included different scenarios including combinations of open space, passive recreation, stormwater management, wastewater management, affordable housing, parking and access to public amenities.

Section 2
Introduction

Dudley Pond is both an indispensible community resource and a vulnerable aquatic ecosystem. The vulnerability of this resource is best demonstrated by MassDEP's listing of Dudley Pond as an impaired water, requiring a Total Maximum Daily Load (TMDL) for organic enrichment (low dissolved oxygen), turbidity and exotic plant species. These water quality issues all have a clear link to septic systems and stormwater runoff from local development.

The Dudley Area community has a history of joining together to develop and implement solutions to protect this resource: from removing old shacks discharging sewage directly to the pond, to more recent upgrades to septic systems and milfoil harvesting activities.

In this spirit of collaboration to address Town concerns, the Town embarked on a process to determine the best use of municipal property in the Dudley Area, while simultaneously attempting to address water quality problems in the Pond. The Town of Wayland owns approximately 7.4 acres of land in the vicinity of Doran Road, Pond Drive, Curtiss Road and Cross Street (see Figure 2-1). The Dudley Area Land Study incorporates a holistic view of water quality issues within the Dudley Pond watershed, community needs and community sentiments in order to assess potential uses of the Town-owned land.

Developing a plan for the use of this land requires careful consideration of several competing needs, including:

- Improving the water quality of Dudley Pond, through improvements to wastewater and stormwater infrastructure
- Providing open space and recreational opportunities, including public access to Dudley Pond
- Addressing Town-wide needs, such as meeting the Town's affordable housing goals

This report summarizes the technical data gathered with respect to the Town-owned land, the results of the charrettes and public meetings, and the development of different land use options that respect and complement the unique character of the Dudley Pond community for consideration by the DAAC in developing their ultimate recommendations to the Board of Selectmen.

2.1 Dudley Area Advisory Committee

On November 22, 2010, the Board of Selectmen established the Dudley Area Advisory Committee to assist the Board with studying the disposition of and make recommendations on the use of approximately 7.4 acres of Town-owned land located on Doran Road, Pond Drive, Cross Street, and Curtiss Road.

The committee is comprised of nine members appointed by the following committees and organizations with an interest in the disposition of the Town land and the Dudley Pond area:

- Dudley Pond Association
- Conservation Commission
- Surface Water Quality Committee
- Recreation Commission
- Wayland Neighbors for Responsible Land Use (WN4RLU)
- Planning Board
- Housing Partnership
- Housing Authority
- Chair, appointed by the Board of Selectmen

The DAAC was tasked with the following:

> *Oversee expenditure of funds appropriated by Town Meeting for the purpose of studying the feasibility of disposition and use of the Town-owned parcels for open space preservation, passive recreation use, septic treatment for any new structures on the land or for adjacent properties, pond management, and construction of affordable housing.*
>
> *Review findings from feasibility studies to determine extent of the five potential disposition and uses of the Town-owned parcels.*
>
> *Make a recommendation to the Board of Selectmen on the best use or combination of uses of the municipal land, and in what proportion, said recommendation to take into account impacts on Dudley Pond and the surrounding watershed, public access to the pond, public health considerations, and community preferences for disposition or use of the property.*
>
> *Evaluate wastewater management alternatives that may include:*
>
> a. *New Centralized Wastewater Treatment and Disposal near Dudley Pond or the project area.*
>
> b. *New Centralized Wastewater Treatment and Disposal Off Site which could include Wayland DPW garage, the Wayland Middle School site or other town-owned areas.*
>
> c. *Localized collection and satellite wastewater treatment and groundwater disposal facilities within the project area.*
>
> d. *Individual On-Site Treatment and Disposal with continued reliance on individual on-site wastewater treatment and disposal systems.*
>
> e. *MWRA Connection and transmission main to convey wastewater to the nearest practical MWRA connection, likely in Natick.*
>
> *In completing its evaluation and in making its recommendations, the advisory committee shall consider the use of properties in the general area and the resulting impacts on Dudley Pond and the municipal parcels, the capacity of the municipal land to address issues in the general area,*

and identify conditions and costs that influence the range of options considered, as well as the recommended plan.

(Source: Dudley Area Advisory Committee website: www.wayland.ma.us/Pages/WaylandMA_BComm/Dudley/index)

2.2 Project Scope

In order to develop technical information, explore options, and advise the DAAC, the Design Team of Tighe & Bond and Gates, Leighton & Associates were engaged by the Town. The Design Team reviewed relevant reports and studies, compiled available mapping, compiled zoning information, performed test pit and percolation tests, identified environmental resources, located and observed drainage structures, obtained and evaluated available septic system information, identified potential costs for wastewater and stormwater improvements and assessed requirements to tie into the MWRA sewer system.

The Design Team also reviewed the land abutting the project area to gain an in-depth understanding of transition zones, gateways, and connections to understand how the Town-owned land coordinates with the surrounding areas.

The Design Team identified opportunities and constraints based on information from the stakeholders, a review of existing information, supplemental field data and public input through the charrette process. Two (2) charrettes were held with the DAAC and the general public to obtain input on land use, stormwater and wastewater issues within the study area.

The information compiled through the assessment and public process was used to develop alternative concepts for the land use disposition of the Town-owned parcels. Land use options included open space, passive recreation, affordable housing, stormwater management and wastewater treatment and disposal. The concepts developed incorporated input from the public through the charrette process and from the DAAC committee members. The DAAC worked to develop a final concept and land use program that took into consideration the various town goals as well as the public input, in conjunction with the design criteria provided by Tighe & Bond and Gates, Leighton & Associates.

2.3 Acknowledgements

Tighe & Bond and Gates, Leighton & Associates would like to acknowledge all in the Town of Wayland who helped guide this process and provided data and information during the project including:

The Dudley Area Advisory Committee:

- Patricia Reinhardt, Chair, designee of the Board of Selectmen
- Russ Ashton, Member, designee of the Housing Authority
- Rachel Bratt, Member, designee of the Housing Partnership
- Steve Garone, Member, designee of the Dudley Pond Association
- Bob Goldsmith, Member, designee of the Conservation Commission

- Kent Greenawalt, Member, designee of the Planning Board
- Mike Lowery, Member, designee of the Surface Water Quality Committee
- Alan Palevsky, Member, designee of the Wayland Neighbors 4 Responsible Land Use
- Brud Wright, Member, designee of the Recreation Commission

Sarkis Sarkisian, Town Planner

Alf Berry, Town Surveyor

Brendan Decker, GIS Coordinator

Frederic E. Turkington Jr., Town Administrator

Steven Calichman, R.S., C.H.O., Director of Public Health

Sheila Cuttell, Planning Department Administrative Assistant

2.4 Public Participation

The DAAC held regular meetings, which were open to the public, to discuss the project, to obtain input from the various board and committees represented on the DAAC, and to hear feedback from the public. In addition, two charrettes were held to seek public input into the appropriate uses of the Town owned parcels. These charettes were held on June 27, 2011 and September 27, 2011. The June 27, 2011 charrette focused on obtaining input on the potential land use or mix of land uses for the Town-owned property. The September 27, 2011 charrette focused on technical information related to use of the Town-owned property for wastewater and stormwater water quality. The charrettes are described in more detail in Section 5. Copies of these presentations are included in Appendix A.

FIGURE 2-1
ORTHOPHOTOGRAPH

LEGEND

- Assessors Parcels
- Study Area Parcels

LOCUS MAP

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W E
S

0 250 500
Feet

NOTES

Based on MassGIS Color Orthophotography (April 2008)
Orthophoto Sheet ID # 21028975 & 21178975

Dudley Pond
Wayland, Massachusetts

March 2013

Tighe&Bond

G:\GIS\MA\WaylandMA\1753\avproj\Figure1.mxd

W-1753

Section 3
Background Information

The DAAC was established to advise the Board of Selectmen on the recommended use or mix of uses of 7.4 acres of Town-owned land adjacent to Dudley Pond. The DAAC is tasked with the assessment of a range of land uses including open space, recreation, wastewater and stormwater treatment, and affordable housing with water quality protection and enhancement. The following information provides background regarding the Town-owned property and the larger Dudley Pond area.

3.1 Water Resources

The Town has been actively addressing environmental issues at Dudley Pond since the Wayland Surface Water Commission was established in 1980. Dudley Pond comprises 84 acres, and is a designated "Great Pond." Massachusetts regulations define a Great Pond as any pond or lake that contained more than 10 acres in its natural state. The Commonwealth of Massachusetts protects the public benefits of Great Ponds under Chapter 91 of the Massachusetts General Laws and corresponding regulations at 310 CMR 9.00. The pond is shallow, with depths throughout the majority of the pond of 8 to 10 feet. The deepest point is 26 feet deep.

More than a century ago, in the mid-1880s, Dudley Pond served as a back-up water supply to Boston via an underground pipe connecting to Lake Cochituate. This pipe was blocked in the 1920s when the water quality of the Pond made it no longer desirable as a drinking water source. Historically the pond also experienced heavy recreational use, including fishing, boating and water skiing. Today Dudley Pond is still used for fishing, swimming and boating; however boating is limited to human-powered boats, sailboats, or motored boats with electric motors of 10 horsepower or less.

The Dudley Pond watershed is approximately 368 acres now characterized by relatively dense residential development. The Pond is fed by a wetland at its southeast corner, and outlets through Dudley Brook at the northeast corner of the Pond.

3.2 Land Use

The first major development in the Dudley Pond area was Mansion Inn, constructed in circa 1883. Shortly thereafter, in the early 1900s, the Dudley Pond area experienced a development boom resulting in a summer cottage community. In the 1930s, during the Great Depression, many of the seasonal homes became year-round residences. Many of the houses originally constructed for summer-only use had inadequate septic systems for year round use. This scale and type of development impacted the water quality of the pond and by the 1950s there was an effort to better control land use and to consolidate parcels, thereby providing additional land for upgrading septic systems. As mentioned above, today the Dudley Area generally consists of relatively high density residential development. The Dudley Chateau is a restaurant/bar located on the eastern shore of Dudley Pond. The development around the pond is primarily served by paved roads, and two gravel roads: Doran Road and Pond Drive.

The Town-owned Property consists of 32 contiguous parcels that are under the jurisdiction of different municipal interests as shown on Figure 3-1. The land is

undeveloped and is crossed by Pond Drive. A breakdown of the parcels is provided below and is also depicted on Figure 3-1.

Table 3-1
Existing Property Classifications

	Number of Parcels	Parcel Acreage	% Total Acreage
DPW - Highway	1	0.94	13%
Municipal/Tax Title	15	2.77	37%
Recreation	16	3.71	50%
Total	**32**	**7.42**	**100%**

Town of Wayland Assessor Database and Town Surveyor's Office.

3.3 Zoning

The Study Area is entirely within Wayland Zone R20, which is residential zoning of 20,000 sf minimum lot size. There are 32 parcels of land whose jurisdictions and sizes are shown in Table 3-1.

The Town-owned Property includes no designated scenic roads, no designated trails, no flood plain overlay areas or areas of Federal floodplain, no Federal or State properties, no town conservation areas, no conservation protected properties, no properties with conservation restrictions, and no Sudbury Valley Trust properties.

The property is entirely within an aquifer protection district and entirely within water resource protection district Zone II (see Figure 3-2). All the non-developed properties in the study area are marked as "Conservation Open Space" on the Town of Wayland Zoning Map. Further discussion of environmentally designated areas within the Property can be found in Section 3.5.

3.4 Geology, Topography and Soils

The topography in the general area of the Town-owned land gently slopes from an elevation of approximately 197 feet at Route 27 downward to Dudley Pond at an approximate elevation of 157 feet. The Town-owned land includes a low point of elevation 157 feet immediately north of Pond Road, midway between Route 27 and Dudley Pond.

The surficial geology in the Dudley Pond watershed is comprised primarily of coarse sand and gravel with a short groundwater travel time to the Pond. According to the Natural Resource Conservation Service (NRCS) Soil Survey of Middlesex County, the soils are Merrimac-Urban land complex, 0 to 8 percent slopes. These soils are somewhat excessively drained soils generally associated with terrace and plain landforms. The parent material is friable loamy eolian deposits over loose sandy glaciofluvial deposits derived from granite and gneiss.

The Town-owned property has minor topographical variations. Certain areas appear to have been previously mined for gravel borrow.

A soil map of Dudley Pond watershed is provided in Figure 3-3.

3.5 Natural Resources and Environmentally Sensitive Areas

Tighe & Bond performed a desktop analysis of natural resources and environmentally sensitive areas at and in the vicinity of the Town-owned Property. In addition, the Town-owned Property was surveyed by a wetland scientist to identify the location of wetland resources areas subject to regulation by federal, state and local regulations. The results of this analysis are discussed below.

3.5.1 Rare Species and Wildlife Habitat

The Massachusetts Division of Fisheries and Wildlife (DFW) delineates Priority Habitats of Rare Species and Estimated Habitats of Rare Wildlife in Massachusetts through the Natural Heritage and Endangered Species Program (NHESP). The Massachusetts NHESP Atlas, 13th Edition, effective October 1, 2008, and data layer maintained by Massachusetts Geographic Information System (MassGIS), were consulted for this study. According to these resources, the Town-owned Property is not located within mapped Priority Habitat for Rare Species or Estimated Habitat for Rare Wildlife.

3.5.2 Vernal Pools

Seasonally flooded depressions provide important habitat for invertebrates and amphibians, including some species that are entirely dependent on this habitat type for completion of their life cycles. The NHESP certifies vernal pools in the Commonwealth. Vernal pools are natural depressions that temporarily hold water. Vernal pools occasionally dry out, preventing fish from establishing a permanent population and thereby providing a fish-predator free breeding habitat for many amphibians and invertebrates. There are no certified vernal pools in the Town-owned Property, however, the isolated wetland identified in the southwest corner of the Town-owned Property to the north of Doran Road, is a potential vernal pool as described below. In order to confirm if this location is a vernal pool, additional out-of-scope field work is required in the spring season to determine the time period that the pool holds water and the biota that uses the pool.

3.5.3 Wetland Resources

An evaluation of inland wetland resource areas was conducted on July 21, 2011 by Tighe & Bond. A Tighe & Bond wetland scientist identified wetland resource areas regulated under the Massachusetts Wetland Protection Act and Chapter 194 of the Code of the Town of Wayland - Wetlands and Water Resources Protection Bylaw on the Town-owned property to identify potential limitations to use of the property.

An isolated wetland area that is a potential vernal pool was identified at the southeast corner of the Town-owned property, immediately north of Doran Road (see Figure 3-4). To be conservative, it was assumed that this area is jurisdictional under Chapter 194. The Wayland Conservation Commission regulates any alteration with 100 feet of the limits of the wetland, and requires a 30 foot no-disturbance zone from the limits of the resource area. These buffer zones also apply to the Bank of Dudley Pond.

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Map Number 25017C0528E (revised: June 4, 2010) was reviewed to determine the extent of lands subject to flooding. According to this source, the Town-owned land is not located within the 100-year flood zone.

3.5.4 Zone II Wellhead Protection Area

The Town-owned Property lies within the Zone II wellhead protection area to a municipal drinking water supply (see Figure 3-2). A Zone II is the primary recharge area for an aquifer. Zone IIs are defined by hydrogeologic studies and represent the surface area that contributes water to a well.

Zone IIs are designated nitrogen sensitive areas under the Title 5 regulations. Title 5 limits septic system discharges to 440 gpd/acre in nitrogen sensitive areas to achieve nitrogen concentrations in the groundwater that do not exceed the drinking water standard of 10 mg/L. Increases in the allowable discharge per acre may be allowed by using enhanced treatment systems (I/A systems) to reduce nitrogen loading.

Groundwater discharge regulations for larger (greater than 10,000 gpd sanitary wastewater discharges) also provide for increased protection of Zone IIs. Groundwater discharge permits are based on water quality limits, as opposed to technology standards. Permit limits for most facilities are 30 mg/L biochemical oxygen demand (BOD), 30 mg/L total suspended solids (TSS) and 10 mg/L total nitrogen. Where dictated by receiving water quality requirements, MassDEP may impose more stringent permit requirements. Table 3-2 below summarizes the technology and water quality based effluent limitations in a Zone II.

TABLE 3-2
Groundwater Discharge Effluent Quality Standards

Discharge Parameter	Zone II	Zone II and within the Two-Year Groundwater Travel Time to the Source
Total Suspended Solids	10 mg/L	5 mg/L
Turbidity	5 NTU	2 NTU
Total Organic Carbon	3 mg/L	1 mg/L
Biological Oxygen Demand	Primary treatment and filtration	10 mg/L
Total Nitrogen and Nitrate Nitrogen	Primary treatment and filtration	5 mg/L
Fecal Coliform	200 organisms/100 mL	Median of ND/100 ml over running 7-day Not to exceed 14/100 ml Prove process can inactivate and/or remove five logs of F-specific bacteriophage of MS 2 or poliovirus

Note: A privately-owned wastewater treatment facility located within a Zone II or IWPA shall not treat industrial wastewater.

Of these parameters, the total organic carbon (TOC) will be the hardest and costliest to meet. Treating TOC to 3 mg/L requires advanced treatment using granular activated carbon adsorption, reverse osmosis or advanced oxidation, which are all costly additions to a secondary treatment process.

3.6 Background Reports

The Design Team reviewed pertinent reports and studies provided by the Town. The reports provided to Tighe & Bond by the Planning Office for review are listed below and summarized in the following sections.

- Housing Production Plan August 2010
- Comprehensive Plan January 4, 2005
- Master Plan 2004
- Master Plan Review Committee Report 2010, 2011
- Wayland's Growth Management Goals (1998)
- Gale Report on Town of Wayland School Athletic Field Master Plan
- Surface Water Quality reports on Dudley Pond

3.6.1 Housing Production Plan August 2010 and Updated Housing Inventory

In 2003, the Board of Selectmen identified the development of affordable housing as a top priority for the Town and tasked the Town with the preparation of a housing plan based on the housing component of the Town's Master Plan. This was completed in January 2005. The August 2010 Housing Production Plan updated the 2005 Comprehensive Housing Plan with current information on demographics, housing characteristics and trends, as well as housing goals and strategies that reflect progress over the past few years and new State housing regulations. The 2010 plan also identified a lack of affordable housing for the elderly, persons with special needs, young families who grew up in Wayland and wish to move back, and Town Employees (75% of who reside outside of Wayland). Based on trends in census data, the plan concludes that the demand for large single-family homes will decrease while the need for smaller starter homes and apartments will grow.

The plan highlights that as of August 2010, Wayland had 216 affordable units (including 52 units that have not yet been built) that meet the state's requirements for inclusion in the Subsidized Housing Inventory, helping Wayland strive towards meeting the state's 10% affordability goal. To address this need, the plan included key housing strategies in the following categories: Community Outreach and Education, New Production Initiatives, Regulatory Strategies, and Housing Preservation Strategies.

Based on the 2010 census, the Wayland Town Planner's data indicates that 5.3% of the year-round housing stock is considered affordable by the State. This includes many units that have been approved but not yet developed. The State's tally does not reflect these anticipated units and puts Wayland's affordable housing percentage at 3.2%.

3.6.2 Comprehensive Housing Plan January 4, 2005

The 2005 Comprehensive Housing Plan developed a production plan with the goal of meeting the Commonwealth's affordable housing goal of 10% of Wayland's housing stock. As of 2003, the Commonwealth of Massachusetts had certified Wayland's affordable housing stock at 3.3% of the overall housing inventory. According to the Plan, Wayland needed to create 344 affordable housing units in order to be fully certified by the Commonwealth. The town's affordable housing stock in 2003 was 150 units.

The 2005 Housing Plan notes the efforts of the Wayland Housing Authority, the Planning Board, and the Board of Selectmen in encouraging the development of affordable

housing. The Board of Selectmen identified affordable housing development as a top priority for the Town and made the Wayland Housing Partnership the primary governmental body responsible for affordable housing.

The objectives identified in Wayland's housing plan are to:

1. Meet local housing needs along the full range of incomes to promote diversity and stability of individuals and families.

2. Leverage public and private resources to the greatest extent possible.

3. Ensure the creation of new housing that is compatible with the existing community and helps promote open space.

4. Make steady progress toward the State standard for affordable housing of 10%.

5. Produce affordable housing that equals ¾ of 1% of the Town's housing stock in order to remain housing certified under MGL Chapter 40B 760 CMR 31.07(1 i), which is 35 units per year based on the 2002 US Census for housing units in the Town of Wayland.

Recommendations from the Comprehensive Housing Plan include zoning changes to encourage housing diversity, such as allowing multi-family units, providing density incentives in exchange for affordable housing units or contributions to the Town's affordable housing fund, allowing housing on upper floors in the Business A and Business B districts and revising the accessory apartment bylaw.

3.6.3 Wayland Town Master Plan – August 2004

The Wayland Town Master Plan was developed based on input from residents and an eleven-member Master Plan Advisory Task force representing various Town boards and other interested parties in the community. The plan contains an inventory and analysis of existing conditions, sets general goals and contains implementation strategies for achieving these goals.

The housing section of the Master Plan provides an overview of Wayland's existing housing stock (noting it is one of the most expensive in the Boston region and is very homogenous- consisting mainly of large single-family homes), current and potential future housing needs, housing affordability, and current housing strategies and initiatives in Wayland. The plan notes there is a need to diversify the town's housing stock in order to offer housing choices to groups such as Town employees, senior citizens who are looking to "downsize", and young adults who grew up in Wayland and would like to return. To accomplish this, the Master Plan proposes several zoning changes. The plan proposes to expand the Town's existing Conservation Cluster Development Bylaw to offer different development options (such as 1, 2, 3, and 4-family homes) for vacant parcels in Residential zones. The plan notes a portion of the units would need to be reserved for senior citizens and a portion would need to have a deed-restriction guaranteeing affordability. The plan also recommends the implementation of an Inclusionary Zoning Bylaw to encourage the provision of affordable housing. The bylaw would offer incentives to build at a higher density in exchange for providing affordable housing or making a contribution to the Town's affordable housing fund. The Master Plan also evaluated the potential for new housing in infill settings throughout the town, specifically in town centers and existing neighborhoods. For town centers, the

plan recommends a bylaw that would allow housing on the upper floors of buildings within the Business A and Business B Districts to expand local housing choices and help enliven town centers. For existing neighborhoods, the plan recommends modifying the town's existing accessory apartment zoning bylaw to require any accessory dwelling units to remain affordable and to also allow them by right. The plan also notes that additional town initiatives are necessary to address ADA Compliant Housing. Steps necessary to create additional affordable housing are summarized in an Implementation Plan table.

The Natural Resources section of the Master Plan identifies both storm water management and septic system management as critical to the protection of water resources. The plan recommends adopting an erosion control policy and the adoption of a local Storm Water Management Bylaw that requires developers to follow MassDEP's Storm Water Management Policy for all projects. The Master Plan also recommends that the zoning definition of "lot coverage" be revised to include all impervious surfaces (such as roads, driveways, parking areas, and other impervious areas), not just the building footprint. This would help decrease the amount impervious surfaces and the resulting non-point source pollution from stormwater runoff. The plan also encourages the use of environmentally sensitive structural and nonstructural stormwater management systems, such as bioretention cells (rain gardens) and vegetated swales, and contains information on where they may be appropriate for use in Wayland.

The Septic System Management section of the plan notes that Dudley Pond is a critical area as many of the lots are too small for effective on-site disposal. As a result, some of the systems are not functioning properly and have contributed to the pollution, eutrophication, and invasive aquatic vegetation problem in Dudley Pond. The Plan recommends that the Board of Health develop and distribute education materials on proper operation and maintenance of septic systems and suggests the Town subsidize a program to encourage regular septic tank pump-out. For the area surrounding Dudley Pond, the plan recommends two different options: a septic system management program and a municipal system. The plan recommends that a program be established that requires septage haulers to conduct a brief inspection of the system at the time of pump-out. If problems were identified the homeowner would be required to either perform a Title 5 inspection within one year or declare their system failed; thus saving them the cost of the inspection. At this point the Board of Health would work with the homeowner to develop a solution to the problem that was not unduly expensive to the homeowner. The other option would be for the Town to build and administer a municipal system. The study notes that previous investigation has shown promising results for a shared leach field and if enough property owners connect to the system the per property costs could be acceptable. The health of Dudley Pond could be improved by diverting effluent from septic systems away from the Pond.

3.6.4 Master Plan Review Committee Report 2010/2011

The 2004 Master Plan called for an evaluation of the implementation status after five years. As such, progress regarding implementation of each section of the 2004 Master Plan was evaluated and compiled into the Master Plan Review – 2010/2011 Report. Relevant sections of the 2010/2011 Report are summarized below.

The housing section of the review notes that Wayland has taken steps towards addressing its housing needs (such as adopting an inclusionary zoning bylaw and building an affordable development); however, it also recognizes that these gains are modest compared to the overall trends towards more expensive, less diverse housing.

The 2010 report also notes that the town voted to accept the Community Preservation Act (which provides funding for housing in addition to historic preservation and open space) and became a member of the WestMetro H.O.M.E. Consortium, which will also provide a small amount of funding. The Master Plan Advisory Committee created a list of action items to be addressed over the next few years by a volunteer Implementation Committee. These goals include setting "green housing" goals for developers, focus on the best use of town owned land vs. affordable housing as a primary goal (develop a set of criteria for how/where affordable housing will be developed in town), revise the accessory apartments bylaw to encourage senior housing, and encourage more cluster housing.

The Natural Resources section of the review recognizes that a stormwater bylaw (incorporating erosion control measures) was adopted by town meeting in 2008 and recommends that rules and regulations be established in addition to the bylaw. Regarding septic management efforts, it notes the 1983 IEP Report on Dudley Pond recommended that the town parcels in the Doran Road area be dedicated to municipal/community leaching fields. The evaluation notes the town delivered brochures on Septic Management Practices to sensitive areas. The town has implemented timely review of septic design plans; however, inspections occur only when the system is sold or approved. No action has been taken on the goal of implementing a more aggressive approach for Dudley Pond such as a septic management program or municipal system. The evaluation continues to list the protection of lakes, ponds, and riverfront as an important action.

3.6.5 Wayland's Growth Management Vision and Goals (1998)

In developing a growth management strategy, the Town developed a vision and goals for growth management within Wayland. The following Community Vision was developed through this process:

People want Wayland to remain basically the same only better as time goes on. They like the "semi-rural character," which means a primarily residential character with ample open spaces, top quality education, a sense of identity, a strong volunteer tradition, effective and responsive government, economic diversity of residents, and a vibrant business community serving local needs.

In order to achieve the general goal of preserving Wayland's semi-rural character, the following goals were developed:

Preserve Community Resources, including:

- Preserve and protect the Town's water supply
- Preserve, protect and maintain natural areas in order to mitigate flooding problems, provide wildlife habitat and corridors, promote environmental education, provide opportunities for passive outdoor recreation, and maintain scenic vistas and a sense of openness
- Preserve, conserve, restore and maintain cultural and historic assets that connect us with our cherished and distinctive history

- Design and utilize environmentally sound and energy-efficient products in new construction and in major renovations in order to enhance environmental quality and improve public health

- Promote Wayland's financial well-being by balancing the demand for services, infrastructure and affordability by residents in a broad range of financial circumstances

Preserve and Enhance Municipal Services, including:

- Build and maintain a sound public infrastructure, including roads, public buildings, the water supply system, waste-disposal operations, public transportation, recreational facilities, and other needed facilities

- Provide bike paths or lanes, sidewalks, pedestrian crossings, and other infrastructure that will promote walking and bicycling and other active recreation, thereby enhancing public health and safety and making it more enjoyable and efficient to live in, work in, or visit Wayland

Manage Development, including:

- Foster a village-like center in Cochituate in order to maintain or improve the quality of life for local residents and to support future development that conforms to the existing character of the neighborhood

- Promote a variety of housing options to encourage economic and social diversity

3.6.6 Gale Report on Town of Wayland School Athletic Field Master Plan – July 15, 2010

In the summer of 2010, Gale Associates, Inc. assessed existing outdoor field facilities for the Town of Wayland. The study found that the existing facilities were in poor condition due to overuse (no spring, summer, or fall rest period) and that the Town is lacking sufficient athletic field space to accommodate the existing amount of Youth and Adults sports programs that are active in the town. Gale Associates estimated that the Town is lacking two multi-purpose athletic fields, five 60-foot diamonds, and two ninety-foot diamonds. Gale Associates also analyzed each athletic field for its potential for redevelopment as well as two town owned sites: the undeveloped Greenways Property and the minimally developed Loker Recreation Area on Route 30, and issued a Master Plan for Wayland's municipal, outdoor athletic field redevelopment. The Master Plan aims to improve the fields through reconstruction, reduction in the use of selected fields, and the provision of a rest period on all fields over a period of three years. Phase I consists of the development of the Loker Recreation Area and can be phased to complete the two southern-most fields and phase the north fields afterwards. Phase II includes the reconstruction and renovation of Alpine Field to include a new synthetic turf area that will accommodate a 90-foot diamond and multi-purpose rectangular field. Phase II also includes the renovation of the six natural turf fields at the Claypit facility to include irrigation and drainage improvements. This renovation would enable the Claypit facility to maintain the fields adequately to sustain the current use. Phase III consists of the renovation of the seventh field at the Claypit facility to synthetic turf field to provide additional use capabilities and a dedicated soccer complex for the Town. All of these renovations will result in upgraded facilities that could potentially generate additional revenue streams for the town. The report also includes a recommended maintenance

regimen as the implementation of the master plan is only effective if the completed work is properly maintained.

3.6.7 Surface Water Quality reports on Dudley Pond

In 1981 the Town of Wayland contracted IEP, Inc. to perform a Diagnostic/Feasibility Study of Dudley Pond, which was finalized in 1983. The goal of the study was to identify the cause of pollutant/nutrient input to the pond and evaluate and recommend watershed and in-lake management strategies for reducing pollutant/nutrient inputs. The study found that groundwater travels from the southeast to the northwest of the pond, noting that the elevation of the groundwater divide in the northwest/downgradient portion of the watershed is not known and that additional information on groundwater levels is needed. The study notes that due to the high density of residential development surrounding the pond, non-point source nutrient contributions have a significant impact on the waterbody, specifically nutrient loading caused by stormwater runoff and leaching of subsurface sewage disposal systems. The greatest nutrient loading sources to Dudley Pond are septic systems (accounting for 32% of the phosphorus load) and stormwater runoff (58% of the phosphorus load). This excess phosphorus caused a "eutrophic" state in Dudley Pond, meaning that the excess phosphorus promoted the growth of plant and algae growth. The increase in aquatic vegetation and algae has interfered with recreational usage of the pond, impeding fishing, swimming, and boating. The study found that the soil types located close to the Pond have a low capacity to attenuate nitrogen and that the septic systems located close to the water eventually deplete the available attenuation capacity and leach into the pond. The study notes that as shoreline septic systems continue to age, more of them will contribute to phosphorus loading. At the time of the study the average age of the septic systems was 22 years and an estimated 51% of them consisted of cesspools (the majority of them on undersized lots).

However, as both of these sources of phosphorus (septic systems and stormwater runoff) are considered controllable, the study also assessed various measures to limit them. The study made the following recommendations:

- add Dudley Pond to the Town's Watershed Protection District
- create a Lakefront District that encompasses all land within 300 feet of the Pond
- encourage the use of infiltrating catch basins and redesign existing stormwater systems to accommodate infiltration techniques
- improve street cleaning and catch basin cleaning
- consider the town contracting with septage pumping/hauling companies to inspect individual's systems at the time of pumping
- require the individual homeowners to submit proof their system has been inspected on a regular basis
- create a sewer system (regional, local, or sublocal/district) (environmental and financial hurdles for implementation of this recommendation were noted)
- consider possibility of a communal septic system, ideally servicing homes within 200-300 feet of the shoreline. Two areas were highlighted for siting a communal

septic system: an area bounded by Lakeview Road and Curtiss Road that could accommodate the disposal of sewage up to 50 homes, and the Schoenfield land that could serve between 30 and 40 homes. Sewage from individual homes would flow to existing septic tanks, then be piped to a collection system and pumped to the disposal area. The report notes this would require additional detailed study and private costs such as installation of septic tanks at properties currently served by cesspools.

Lastly, the report evaluated a number of options to address the overgrowth of aquatic vegetation, including herbicide/algaecide treatment, mechanical harvesting, dredging, nutrient precipitation/inactivation, and aeration/live bacteria, hypolimnetic withdrawal, biological controls/substitution and drawdown. The study further recommended a combined phosphorus precipitation/inactivation treatment for Dudley Pond, but only after implementation of the stormwater management alternatives, to further reduce sediment derived phosphorus and improve water quality clarity.

FIGURE 3-1
EXISTING PROPERTY CLASSIFICATIONS

LEGEND

- Town Property
- Park & Recreation Property
- Highway Department Property
- Beaumont Property (Existing Septic)
- Road
- 10' Elevation Contours
- Assessors Parcels

LOCUS MAP

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NOTES

Based on MassGIS Color Orthophotography 30cm (April 2009)

Dudley Pond
Wayland, Massachusetts

March 2013

Tighe&Bond

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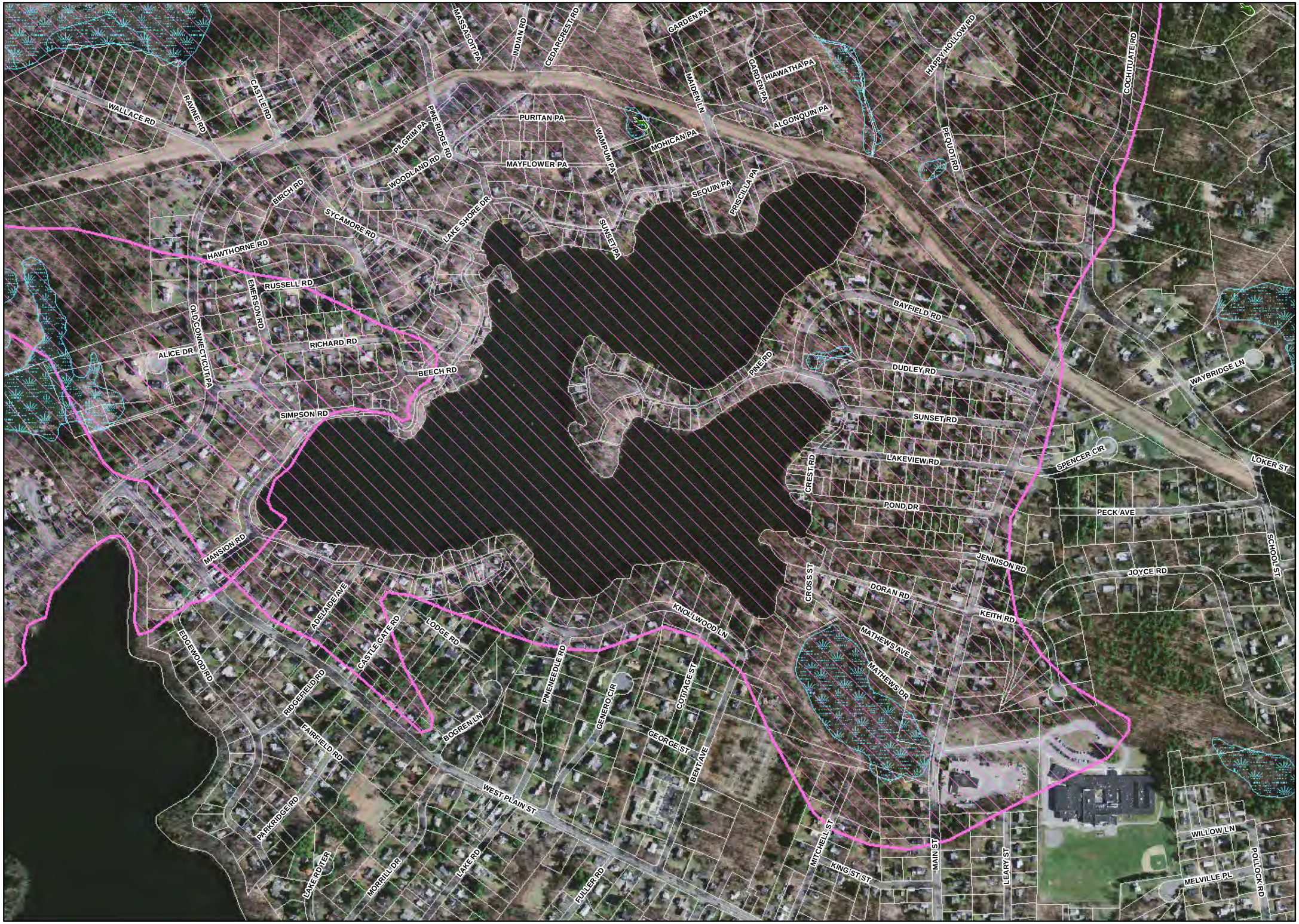
W-1753

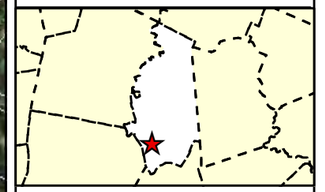
FIGURE 3-2
PRIORITY RESOURCES



LEGEND

- NHESP Certified Vernal Pools
- Public Surface Water Supply Protection Area (Zone A)
- Area of Critical Environmental Concern (ACEC)
- DEP Wetlands
- DEP Approved Wellhead Protection Area (Zone II)
- DEP Interim Wellhead Protection Area (IWPA)
- Assessors Parcels

LOCUS MAP



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Based on MassGIS Color Orthophotography (April 2008)
Orthophoto Sheet ID # 21028975 & 21178975

Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts
Executive Office of Environmental Affairs.
Data valid as of February 2011.

Dudley Pond
Wayland, Massachusetts

March 2013

Tighe&Bond

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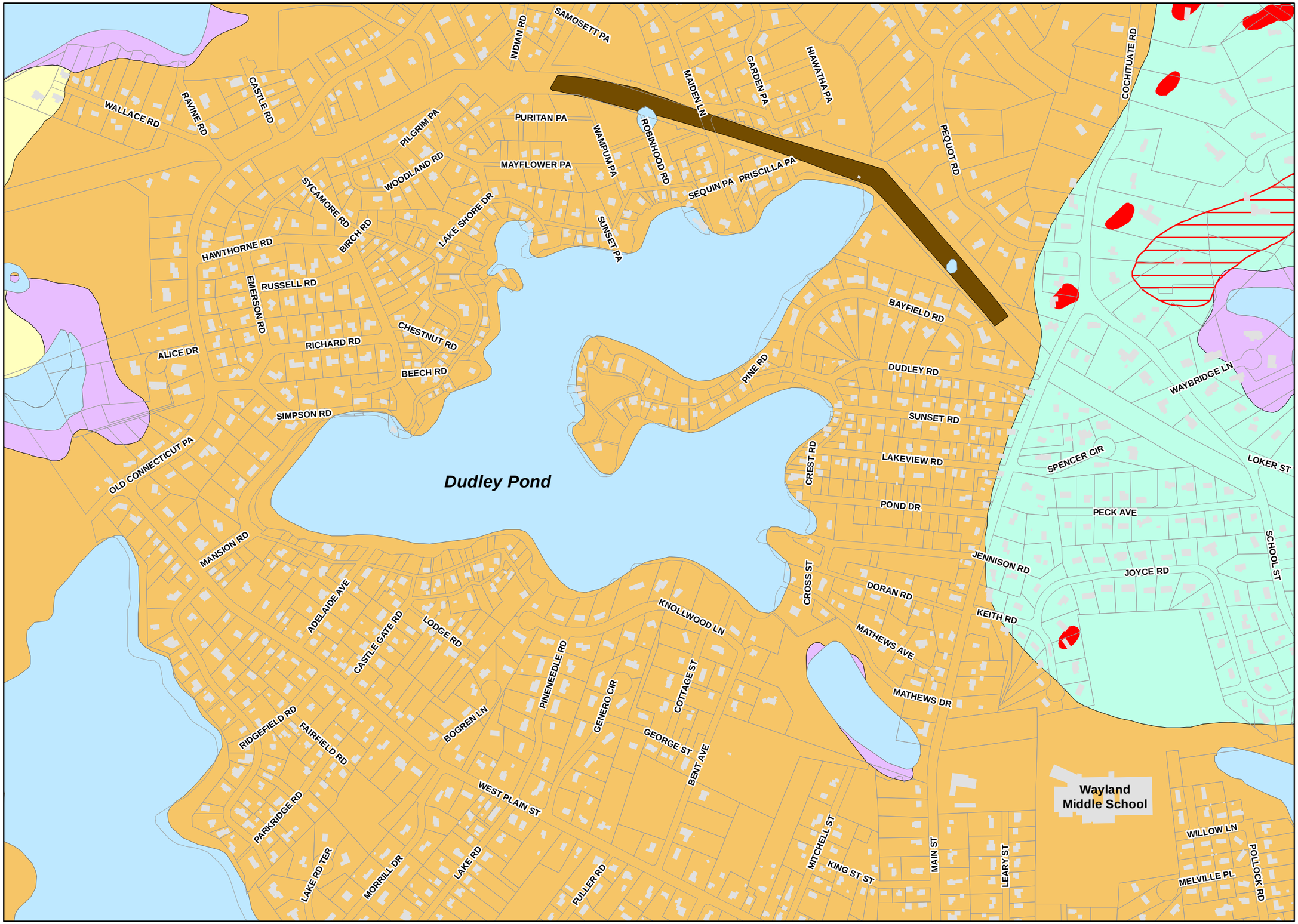
W-1753

FIGURE 3-3
SURFICIAL GEOLOGY



LEGEND

- Assessors Parcels
- Water

Shallow Bedrock
- areas of abundant outcrop and shallow bedrock

Postglacial Deposits
- artificial fill

Postglacial Deposits
- beach and dune deposits
- floodplain alluvium
- salt-marsh deposits
- swamp deposits

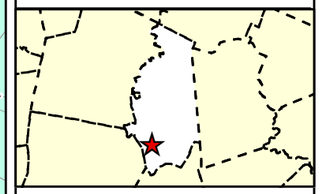
Early Postglacial Deposits
- Inland Dune
- Marine Regressive

Glacial Stratified Deposits
- Coarse
- Glaciolacustrine Fine
- Glaciomarine Fine

Till Bedrock
- thick till
- end moraine deposits

Till Bedrock
- bedrock outcrop
- thin till

LOCUS MAP



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NOTES

Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs.
Data valid as of February 2011.

Dudley Pond
Wayland, Massachusetts

March 2013

Tighe&Bond

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W-1753

Legend

- 100' Buffer Zone
- 30' No Disturbance Zone
- Isolated Seasonal Wetland (approximate)
- Study Areas
- Assessors Parcels

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Based on MassGIS Color Orthophotography 30cm (April 2009)

FIGURE 3-4
WETLANDS SITE PLAN

Dudley Pond
Wayland, Massachusetts

Tighe&Bond

March 2013

Path: V:\Projects\W\W1753\wetlands_siteplan.mxd J:\W\W1753 Wayland Dudley Area Land Study\GIS Pdfs

Section 4
Needs Analysis

The Design Team assessed the Dudley Pond watershed area for water quality needs, with a focus on wastewater and stormwater needs. The general study area was defined by the following limits (see Figure 4-1):

- Route 27/Main Street to the east
- The Hultman Aqueduct to the north
- Old Connecticut Path to the west
- West Plain Street to the south

This area consists of approximately 650 lots, of which approximately 420 are developed. The area was subdivided into 6 study areas to help assess the water quality conditions (see Figure 4-2). The study areas are generally defined as follows:

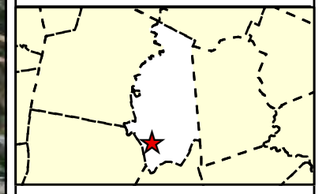
- Study Area 1: Bounded by Dudley Pond to the south, the Hultman Aqueduct to the east and north, and Sycamore Road to the west
- Study Area 2: Bounded by Dudley Pond to the east, Old Connecticut Path and West Plain Street to the west, and Mansion Road to the south.
- Study Area 3: Bounded by Dudley Pond to the north, Mansion Road to the west, West Plain Street to the south, and Bogren Lane to the west.
- Study Area 4: Bounded by Dudley Pond to the north, Bogren Lane to the west, West Plain Street to the south, and the Dudley Pond Recreation Area to the east.
- Study Area 5: Bounded by Dudley Pond to the west, the Dudley Pond Recreation Area to the south, Route 27/Main Street to the east and Doran Road to the north.
- Study Area 6: Bounded by Dudley Pond to the west, Doran Road to the south, Route 27/Main Street to the east and the Hultman Aqueduct to the north.

FIGURE 4-1
STUDY AREA

LEGEND

- Parcels within Study Area
- Study Area
- Study Area Parcels

LOCUS MAP



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Based on MassGIS Color Orthophotography (April 2008)
Orthophoto Sheet ID # 21028975 & 21178975

Dudley Pond
Wayland, Massachusetts

March 2013

Tighe&Bond

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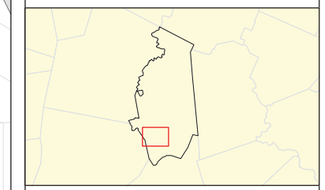
W-1753

FIGURE 4-2
WATER QUALITY NEEDS ANALYSIS STUDY AREA

LEGEND

Study Areas

LOCUS MAP



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NOTES

Buildings data courtesy of the Town of Wayland.

Dudley Pond
Wayland, Massachusetts

March 2013

Tighe&Bond

Study Area 1
Study Area 2
Study Area 3
Study Area 4
Study Area 5
Study Area 6

INDIAN RD
WALLACE RD
RAINE RD
CASTLE RD
PURITAN PA
PILGRIM PA
PINE RIDGE RD
ORONO PA
WOODLAND RD
MAYFLOWER PA
WAMPUM PA
MINNEHAHA PA
ROBINHOOD RD
MOHICAN PA
MAIDEN LN
PARK LN
GARDEN PA
HIAWATHA PA
ALGONQUIN PA
PEQUOT RD
COCHITUATE RD
PRISCILLA PA
SEQUIN PA
CROWN PA
SUNSET PA
MOHA PA
LAKE SHORE DR
BIRCH RD
SYCAMORE RD
HEMLOCK RD
RUSSELL RD
EMERSON RD
HAWTHORNE RD
CHESTNUT RD
BEECH RD
RICHARD RD
ALICE DR
SIMPSON RD
OLD CONNECTICUT PA
DAMASON RD
BAYFIELD RD
SCHOOL ST
PINE RD
CREST RD
DUDLEY RD
SUNSET RD
LAKEVIEW RD
SPENCER CIR
POND DR
PECK AVE
CURTIS ST
JENNISON RD
JOYCE RD
DORAN RD
MATHEWS DR
MATHEWS AVE
KEITH RD
MAIN ST
KNOLLWOOD LN
PINEWEDGE RD
COTTAGE ST
GEORGE ST
BENT AVE
BOGREN LN
LODGE RD
CASTLE GATE RD
ADELAIDE AVE
EDGEWOOD RD
RIDGEFIELD RD
FAIRFIELD RD
PARKRIDGE RD
MORRELL DR
WEST PLAIN ST
GERBINO CIR
LAKE RD
MITCHELL ST
LEARY ST

4.1 Water Quality

In 1983, IEP determined the annual nutrient loading for both nitrogen and phosphorus to Dudley Pond based on pollutant source. As part of the current study, the nutrient loading calculations were updated based on the current land uses. A comparison of the 1983 and the updated 2011 nutrient loading calculations are provided in Tables 4-1 and 4-2 below.

TABLE 4-1
Dudley Pond Annual Phosphorus Loading

Source	1983 IEP Study Annual Loading (Kg/yr)	% Total	2011 Update Annual Loading (Kg/yr)	% Total
Stormwater Runoff	83.3	57.5	89.9	40.7
Precipitation (on pond)	9.9	6.8	9.8	4.4
Septic Systems	46.6	32.2	116.1	52.6
Regional Groundwater	5.1	3.5	5.1	2.3
Total	**144.9**	**100**	**220.8**	**100.0**

TABLE 4-2
Dudley Pond Annual Nitrogen Loading

Source	1983 IEP Study Annual Loading (Kg/yr)	% Total	2011 Update Annual Loading (Kg/yr)	% Total
Stormwater Runoff	784.33	47	527.1	36.3
Precipitation (on pond)	0.00	29	485.1	33.4
Septic Systems	258.05	15.4	296.6	20.4
Regional Groundwater	0	8.6	142.8	9.8
Total	**1042.38**	**100**	**1451.5**	**100.0**

One measure of pond and lake water quality is its trophic state, which is a classification based on nutrients and plant growth. Oligotrophic waterbodies low nutrients and low plant growth, while eutrophic waterbodies have high nutrients and high plant growth. Mesotrophic waterbodies have an intermediate level of nutrients and plant growth, greater than oligotrophic waterbodies, but less than eutrophic waterbodies.

Comparing Dudley Pond with other regional ponds with similar physical characteristics (such as size, residence time, depth) including both eutrophic waterbodies (Lover's Lake and Stillwater Pond) and oligotrophic waterbodies (Perkins Pond and Rust Pond), a nutrient budget for both nitrogen and phosphorus was estimated. The estimated nutrient loading for an oligotrophic/mesotrophic trophic level at Dudley Pond is provided in Table 4-3

TABLE 4-3
Dudley Pond Nutrient Loading

Nutrient	Nutrient Budget	% of Current Nutrient Loading
Total Phosphorus	36.7 kg/yr	602%
Total Nitrogen	616.4 kg/yr	235%

Based on the estimated nutrient budget, a significant reduction in current nutrient loading is required to improve the water quality of Dudley Pond.

4.2 Wastewater

The lots in the Dudley Pond area were evaluated based on several criteria to determine the adequacy of conventional on-site wastewater disposal systems to address wastewater needs including:

- Existing on-site wastewater disposal problems
- Lot size
- Depth to groundwater
- Proximity to water resource areas (Dudley Pond)

The State Environmental Code (310 CMR 15.00), "Title 5: Standard Requirements for the Siting, Construction, Inspection, Upgrade and Expansion of On-Site Sewage Treatment and Disposal Systems and for the Transport and Disposal of Septage", regulates wastewater treatment and disposal systems up to design flows of 10,000 gpd. These regulations were significantly overhauled in 1995. Local Boards of Health are responsible for overseeing compliance with Title 5 in their communities. MassDEP approval is required for Innovative/Alternative (I/A) systems, shared or cluster systems, and systems requiring variances beyond modification of setback requirements.

Title 5 specifies system design requirements based on soil types and groundwater depths. The code also includes minimum siting offsets from resources, such as wetlands, watercourses and wells.

The Board of Health is also responsible for administering inspections of existing systems and regulating repairs to these systems. Inspections are required when a property changes ownership, existing facilities are expanded or when the use of a facility served by a septic system changes. Repairs are intended to maximize compliance with current regulations. When a system cannot be upgraded to current standards, the standard of "maximum feasible upgrade" as determined by the Board of Health is used and may include allowable variances or conversion to an I/A treatment method.

Title 5 identifies Zone IIs, Interim Wellhead Protection Areas, nitrogen-sensitive embayments, and other areas designated by MassDEP as nitrogen sensitive areas. Title 5 limits discharges to 440 gpd/acre in nitrogen sensitive areas to achieve nitrogen concentrations in the groundwater that do not exceed the drinking water standard of 10 mg/L. Increases in the allowable discharge per acre may be permitable by using enhanced treatment systems (I/A systems) to reduce nitrogen loading.

The Wayland Board of Health maintains records regarding on-site septic systems within the Town. These records include septic system inspections, Title 5 failures and repairs, applications for new construction, soil and perc test evaluations, and septic system pumping information.

As part of this evaluation, available Board of Health septic system records for properties within the study area were reviewed and summarized by Wayland Planning Department staff. Data collected from the Wayland Board of Health includes the date of system construction and dates of latest septic tank pump-outs.

Of the approximate 650 lots within the study area, approximately 420 are developed lots. Septic system information on approximately 330 of these lots (78% of developed lots) was available at the Wayland Board of Health. Information from this record review was compiled into an electronic database and was used to estimate the extent of existing on-site wastewater disposal problems within each study area.

Table 4-4 summarizes the evaluation criteria and associated categories that were used for the wastewater management needs analysis.

TABLE 4-4
Wastewater Management Needs Analysis Evaluation Criteria

High Concern	
Septic System:	Pumpouts: 4 or more times per year
Septic System:	Constructed pre-Title 5 (1978) without upgrade
Lot Size:	Developed Lots ≤ 5,000 sf
Medium Concern	
Septic System:	Pumpouts: 2-3 times per year
Septic System:	Constructed between 1978 and 1995 without upgrade
Lot Size:	Developed lots ≥5,000 sq. ft. and <1/4 acre
Water Resources:	Located within 100 feet of Dudley Pond

A summary of the percentage of lots of high and medium concern per study area is provided in Table 4-5 (See Figure 4-2 for location of Study Areas).

TABLE 4-5
Percentage of Lots with Septic Concerns

	High Concern	High Concern (%)	Medium Concern	Medium Concern (%)	Total Number of Parcels
Study Area 1	9	8%	47	40%	118
Study Area 2	20	14%	27	19%	141
Study Area 3	12	12%	48	47%	102
Study Area 4	17	24%	29	40%	72
Study Area 5	19	51%	27	73%	37
Study Area 6	20	11%	37	21%	180

Septic System Age
The septic system criterion that was most ubiquitous was system age, systems that predated the 1995 Title 5 regulations. Approximately 46% of septic systems within the Study Area were constructed prior to 1995. These older systems have a high likelihood for failure and the potential for significant environmental impacts throughout the watershed. Local sources suggest that some homeowners have held off property transfers and system inspections to avoid identification of substandard systems that would need to be updated.

Lot Size
Lot size can impede the siting of a complying septic system. According to MassDEP's criteria for State Revolving Fund (SRF) project funding described in the Project Evaluation Form guidelines, lots less than 5,000 square feet (sf) are considered to be too small for a complying system and are considered failures. In nitrogen-sensitive areas, Title 5 regulations require a maximum design flow of 440 gallons per day per acre, equivalent to one four-bedroom home per acre. The smaller the lot, the more likely the effluent will impact the groundwater quality, especially when lots are less than one acre.

Of the Municipal Lots in the study area, 62.5% are less than 5,000 sf, and 75% are less than a quarter acre. Of the Parks and Recreation Lots, about 43% are less than 5,000 sf, and about 86% are less than a quarter acre. Of the so-called "Beaumont Lots," none are less than 5,000 sf but both are less than one quarter acre.

Water Resources
Septic system proximity to water resources has the potential to impact both human health and the environment. Septic system effluent can contaminate water resources with bacteria, nutrients, and other pollutants. The majority of lots within the study area are located within the Zone II groundwater protection area of municipal public water supply wells. Systems located within Zone IIs are required to comply with the Title 5 requirements for nitrogen-sensitive areas.

Furthermore, the Wayland DPW Lot upon which Rocky Point sits is located within 100 feet of Dudley Pond, which is classified on the 2010 Massachusetts Integrated List of Waters as an impaired waters "requiring a TMDL" for organic enrichment/low dissolved oxygen, turbidity and exotic species. Required setbacks from water and wetland resources for systems per Title 5 vary from 25 to 400 feet, depending on the resource. The Wetlands Protection Act and Chapter 194 of the Code of the Town of Wayland - Wetlands and Water Resources Protection Bylaw regulate construction within 100 feet of water resources including wetlands and surface waters.

4.3 Stormwater

Stormwater runoff is water from rain or melting snow that "runs off" the land instead of seeping into the ground. Stormwater runoff picks up pollutants on its way into stormwater systems (catchbasins, stormdrains) or directly to water resources, including wetlands, streams, or ponds. Pollutants can include debris (leaves, litter, sand), nutrients from plant material and fertilizers, oils and grease from roadways and driveways, and animal waste.

Stormwater runoff flows overland and may enter a collection system, which may or may not offer any treatment, or flow directly into a water resource. Options to address pollution in stormwater runoff include non-structural and structural solutions.

Non-structural solutions focus on controlling pollution at its source. These options include:

- Education – Educating the public in how their actions can impact the quality of water resources can have a significant impact on the water quality of stormwater runoff. Some educational topics include the proper use of fertilizer, including minimizing high-phosphorus content status, and limiting use of fertilizer before rainfall events. Xeriscape and best management practices such as rain gardens or pervious pavers are low cost improvements that residents can incorporate on their properties that both minimize runoff and provide some water quality treatment.

- Regulation – The state of Minnesota has led the nation in addressing phosphorus in cleaning products and fertilizers. The Minnesota Phosphorus Lawn Fertilizer Law includes the following provisions:

    - A soil test or plant tissue test shows a need for phosphorus
    - A new lawn is being established by seeding or laying sod
    - Phosphorus fertilizer is being applied on a golf course by trained staff
    - Phosphorus fertilizer is being applied on farms growing sod for sale
    - When these situations do not exist, state law requires phosphorus-free lawn fertilizer is to be used

While the Minnesota Phosphorus Lawn Fertilizer Law has been successfully implemented on the state-wide level, these regulations would be difficult to regulate in a small geographic area. The Massachusetts legislature recently enacted a law (August 2012, effective January 1, 2014) to restrict phosphorus in fertilizers on a state-wide level and allows for further regulation by municipalities. Massachusetts already has state laws banning phosphorus in household cleansers, effective in July 2010.

Structural best management practices (BMPs) are physical structures that are installed to remove pollutants. The correct type of structural BMP needs to be chosen and sized correctly for the watershed and desired pollutant removal level. Structural BMPs also need to be maintained regularly to function as designed.

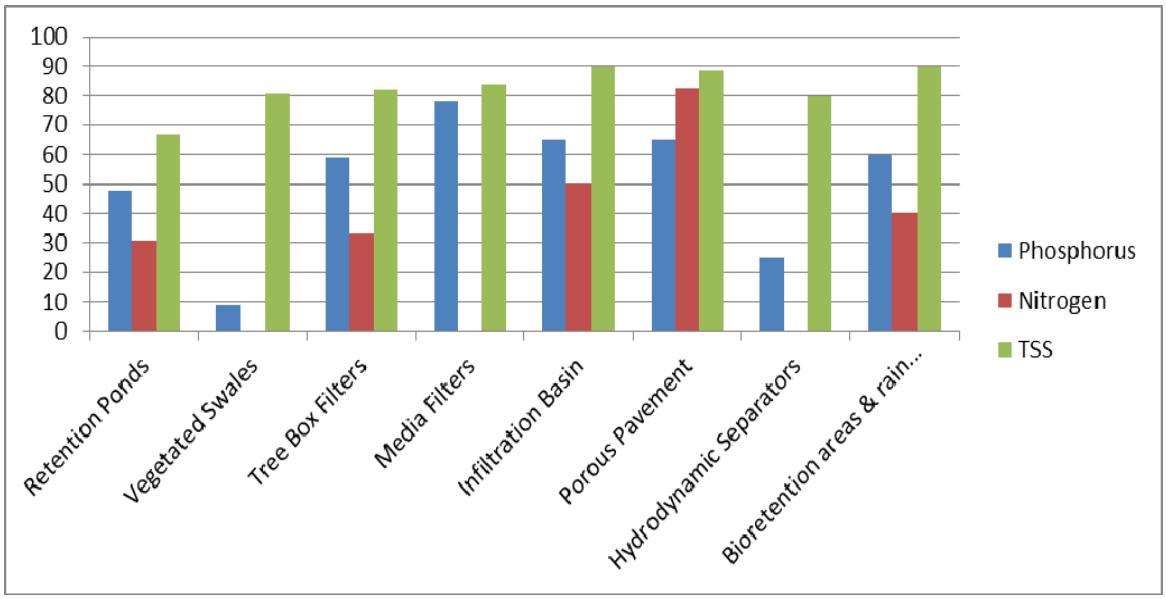
There are many structural stormwater BMPs, including:

- Retention Ponds
- Vegetated swales
- Tree Box Filters
- Adsorptive Media
- Infiltration Basins
- Porous pavement

- Hydrodynamic separators
- Bioretention areas/rain gardens

Each BMP has a different rate of pollutant removal for the design storm event. The chart in Figure 4-3 provides the percentage removal rates for total suspended solids (TSS), nitrogen and phosphorus, for a variety of structural BMPs.

FIGURE 4-3
Pollutant Removal Percentages for Stormwater BMPs



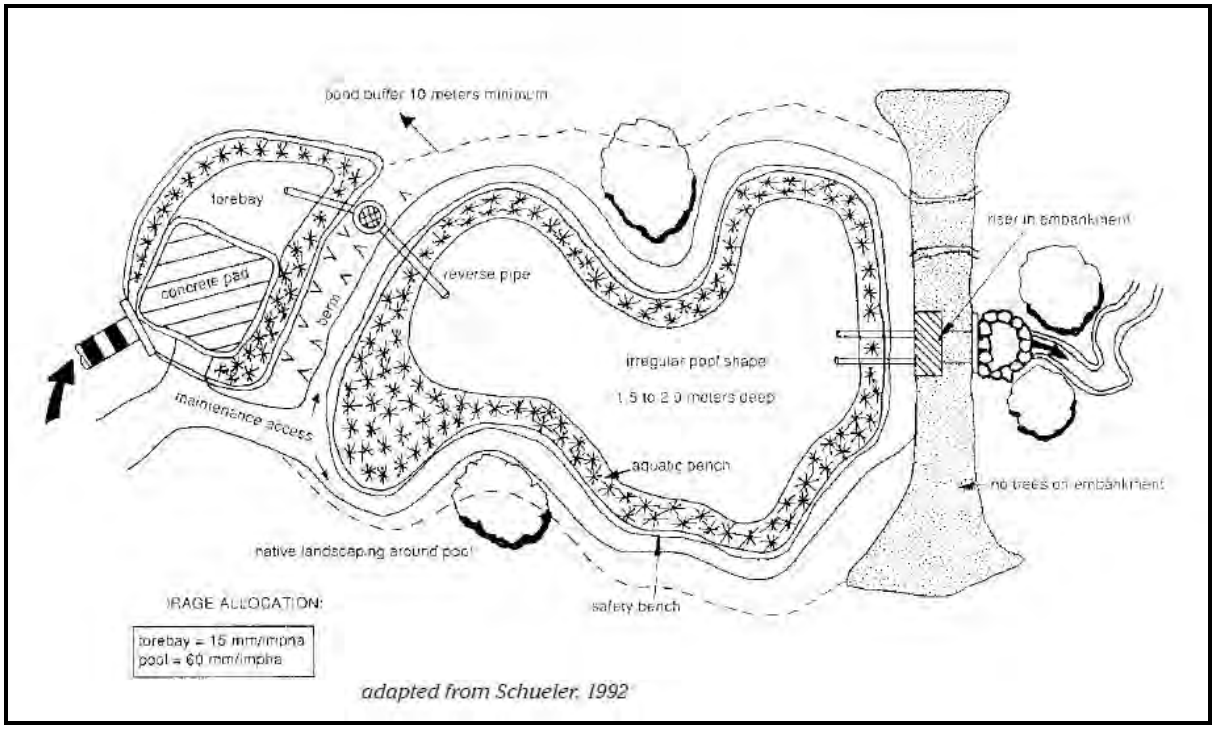
Certain stormwater BMPs, such as retention ponds, vegetated swales, infiltration basins and bioretention areas can require large land areas. Smaller footprint BMPs, such as hydrodynamic separators and media filters require frequent maintenance to remove accumulated sediments or install new media. Following is a description of various structural BMPs and advantages and disadvantages to their use.

Retention Ponds/Wet Basins
Retention ponds/wet basins are designed to retain a permanent pool of runoff. The pool allows sediments to settle and removes soluble pollutants. Large storage volumes are required for both the permanent pool and for peak flows.

Maintenance involves annual inspection, biannual mowing, annual inspection of the sediment forebay and remove sediments. Accumulated sediment within the basin should be removed at least every 10 years.

Concerns with retention ponds/wet basins are associated with the permanent standing water which can be a drowning hazard, and provide habitat for mosquitoes that harbor disease. In hot weather, retention ponds can increase the temperature of runoff.

FIGURE 4-4
Example of Retention Pond/Wet Basin

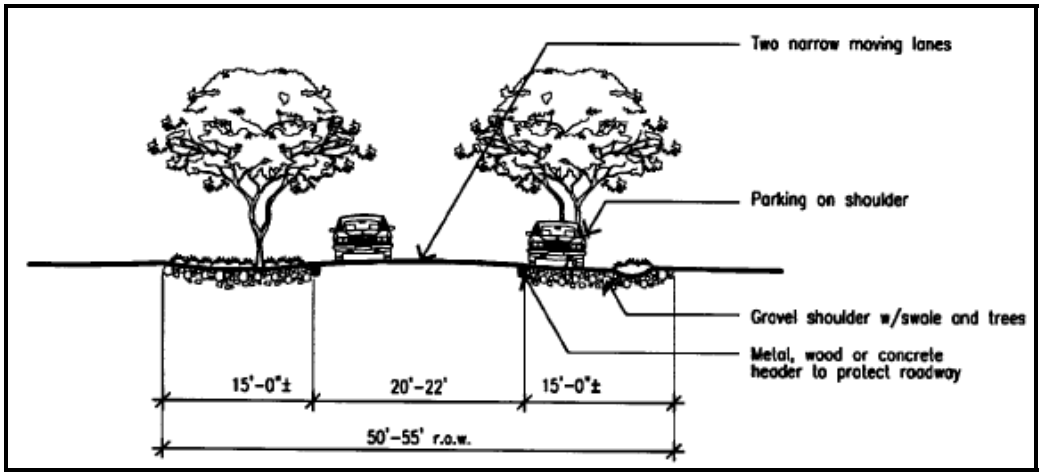


Source: MassDEP Stormwater Management Handbook. February 2008.

Vegetated Swales/Bioswales

Bioswales include depressed vegetated areas, buffer strips, or bioretention facilities. This BMP minimizes stormwater runoff by providing infiltration and improves stormwater runoff quality through infiltration through the soil media and uptake by the roots of the vegetation. Bioretention areas can vary in size, but generally have sideslopes of 3:1; therefore, a small bioretention area would be a minimum of 10 feet wide to allow for 6 feet of side slopes and 4 feet of flat bioretention area. Bioretention areas are designed to allow ponded water six to eight inches deep. An overflow outlet structure is usually incorporated into the design to prevent flooding. Perforated underdrains connected to the storm drain system, or a drop inlet catch basin can be used for the overflow structure. Filter fabric or coarse gravel can be used at the bottom of the bioretention cell to function as a filter. The cell is usually filled with a soil mix of sandy loam or loamy sand. The top soil should be covered with two to three inches of mulch.

FIGURE 4-5
Example of a Vegetated Swale



Source: Start at the Source, Design Guidance Manual for Stormwater Quality Protection, 1999 Edition, Bay Area Stormwater Management Agencies Association

The soil media in bioswales can be clogged with fines, which impairs the infiltration and water quality benefits. Ponding within the bioswales may result in flooding of adjacent sidewalks or streets. Bioswales need adequate pretreatment to minimize sedimentation and clogging of the soil media. Also, depending on the underlying soils, infiltration may be limited; therefore a drainage system is still required. In addition, tree belt modifications would be required.

Bioswale construction costs approximately $18 per square foot.

Maintenance involves monthly inspection and trash removal, regular mowing, and annual fertilization, mulching, and pruning of dead vegetation. The surface of the bioswale will require periodic scraping and removal of fines. The vegetation required maintenance, including mowing, pruning and occasional replacement.

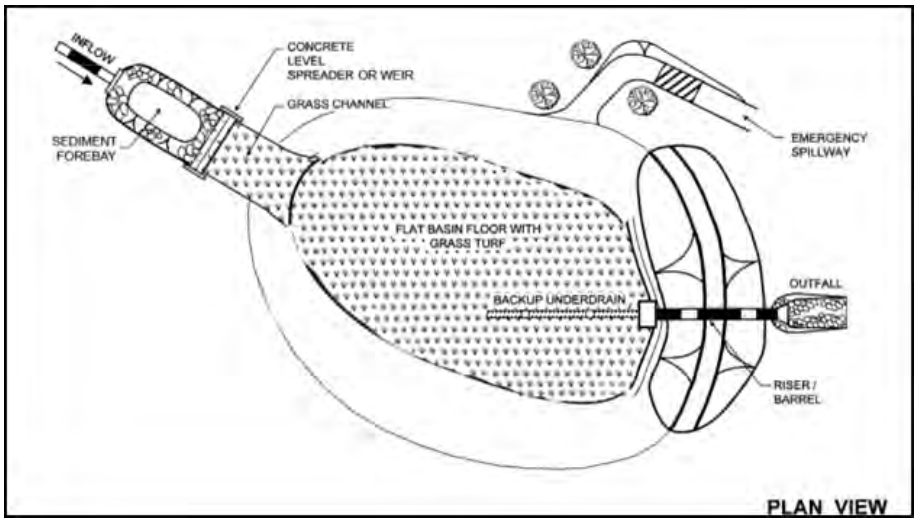
Infiltration Basins

Infiltration basins provide stormwater storage, groundwater recharge and water quality improvements through infiltration. Appropriate siting is important in order for the infiltration basin to function properly. The systems should be separated an adequate distance from groundwater, and be sited in an area with well-drained soils to allow for adequate infiltration. Pre-treatment is required to remove sediments, which can clog the infiltration system. These systems are not suitable for sites with a potential high pollutant load, as groundwater contamination is a concern.

Infiltration basins range in cost based on the size of the system and conditions of the site.

Maintenance involves biannual inspection of inlets and removal of debris as needed. Accumulated sediment and debris from pretreatment structures should be removed annually.

FIGURE 4-6
Example of an Infiltration Basin



Source: MassDEP Stormwater Management Handbook. February 2008.

Rain Gardens

Rain gardens are landscaped depressions that receive runoff from a relatively small drainage area. Runoff is directed to rain gardens, where the stormwater ponds and filters through the soil media and roots. Rain gardens either drain directly to the ground or tie into existing storm drain systems through an underdrain. Rain gardens provide stormwater storage and water quality improvements through infiltration and biological uptake. Rain gardens should include an appropriate soil mix that contains the right balance of fines and organic matter to sustain vegetation and slow down infiltration rates, but not clog the system. Rain garden vegetation must be able to withstand periodic inundation. Rain gardens are preferably sited in soils that allow for infiltration. If they are sited in poor-draining soils, underdrains connected into an adjacent storm drain system will be needed.

FIGURE 4-7
Typical Rain Garden

Source: MassDEP Massachusetts Stormwater Handbook, February 2008.

Rain gardens provide stormwater runoff, groundwater recharge and water quality benefits for small drainage areas. Rain gardens can also provide aesthetic and wildlife habitat benefits.

Rain gardens need adequate pretreatment to minimize sedimentation and clogging of the soil media. Rain gardens also require regular maintenance.

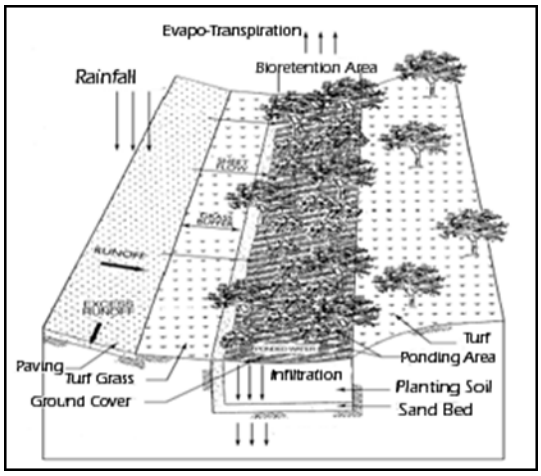
Rain gardens costs vary by size, type, density and age of selected plants, but a typical cost is about $14 per square foot.

Maintenance involves monthly inspection and trash removal, regular mowing/weeding, and annual fertilization, mulching, and pruning of vegetation. In addition, replacement of dead vegetation may be periodically needed.

Bioretention Areas

Bioretention areas minimize stormwater runoff by providing infiltration and improve stormwater runoff quality through infiltration through the soil media and uptake by the roots of the vegetation. Bioretention areas can vary in size, but generally have sideslopes of 3:1; therefore, a small bioretention area would be a minimum of 10 feet wide to allow for 6 feet of side slopes and 4 feet of flat bioretention area. Bioretention areas are designed to allow ponded water six to eight inches deep. An overflow outlet structure is usually incorporated into the design to prevent flooding. Perforated underdrains connected to the storm drain system, or a drop inlet catch basin can be used for the overflow structure. Filter fabric or coarse gravel can be used at the bottom of the bioretention cell to function as a filter. The cell is usually filled with a soil mix of sandy loam or loamy sand. The top soil should be covered with two to three inches of mulch.

FIGURE 4-8
Diagram of a Bioretention Area



Source: EPA Stormwater Technology Fact Sheet for Bioretention Area

The soil media in bioretention areas can be clogged with fines, which impairs the infiltration and water quality benefits. Ponding within the bioretention areas may result in flooding of adjacent properties or streets. Bioretention areas need adequate pretreatment to minimize sedimentation and clogging of the soil media.

Maintenance involves monthly inspection and trash removal, regular mowing, and annual fertilization, mulching, and pruning of dead vegetation. Replacement of all media and vegetation is required as needed.

Bioretention area construction cost is approximately $5 to $8 per square foot.

Sorbtive Filter
Media filters can be installed within catchbasins or water quality inlets/hydrodynamic separators to remove target pollutants. An adsorptive media has been developed to remove dissolved phosphorus from stormwater. Canisters of granular adsorptive filtration media can be installed in water quality inlet structures. This BMP needs consistent operation and maintenance to function as designed. When the absorptive media is bound by phosphorus, the media needs to be replaced.

Furthermore infiltration basins can be further improved with amended media. The University of Minnesota has seen success using a soil amended with iron filings to remove phosphorus.

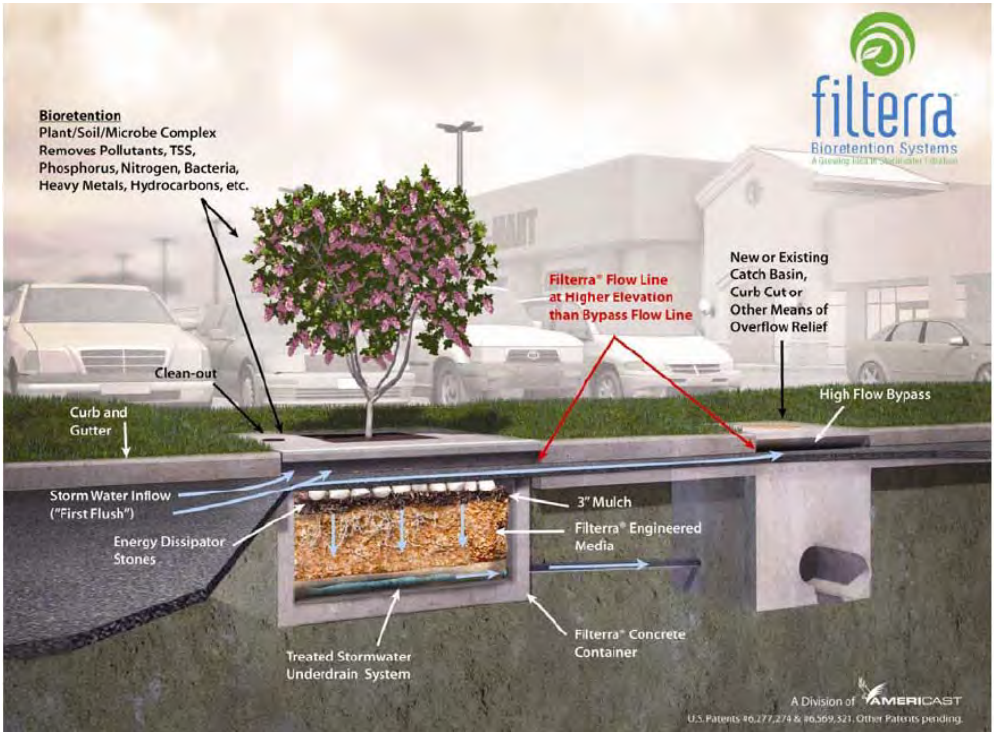
The costs for installing an absorptive media filters can be expensive. The media canisters will require replacement at regular intervals as media is bound by phosphorus.

FIGURE 4-9
Sorbitive Filter

Tree Box Filters

Tree Box Filters are mini-bioretention units that can be incorporated into streetscapes. Tree Box Filters include an underground concrete structure that holds a soil matrix, a compost layer, an underdrain system and a tree or shrub. Stormwater runoff is directed to the Tree Box Filter directly from the pavement, and filters through the soil, mulch and root system. The soil and roots uptake pollutants and the runoff irrigates the vegetation. A connection to the street storm drain system is required to handle overflow from Tree Box Filters.

FIGURE 4-10
Typical Filterra Tree Box Filter Design



Source: http://www.filterra.com/pdf/FilterraSchematic.pdf

Tree Box Filters have a small footprint that can be incorporated into an existing tree belt. A curb cut can be installed to direct stormwater directly from a roadway or parking area directly to a Tree Box Filter. Tree Box Filters provide some stormwater storage, and improve water quality through uptake of pollutants in the vegetation.

Tree Box Filters are only appropriate for small drainage areas and require overflow connections to a storm drain system; therefore, they do not offer a significant reduction in runoff quantities. Tree box filters cost approximately $15,000 installed.

Maintenance involves annual inspection, removal of accumulated debris, and replacement of the mulch layer. Vegetation may require pruning or eventual replacement.

Permeable/Porous Pavement

Existing, impermeable pavement in parking areas or other low-traffic areas can sometimes be replaced with alternative, permeable materials such as porous asphalt, pervious concrete, modular concrete paving blocks, modular concrete or plastic lattice, or grass pavers. Site-specific factors including traffic volumes, soil permeability, maintenance, sediment loads, and land use must be carefully considered for the successful application of permeable paving materials. Porous asphalt or pervious bituminous concrete are pavement products that are mixed with a very low content of fine sand to create 10%-25% void space in comparison to the 2%-3% of conventional asphalt.

Incorporation of permeable pavement minimizes large areas of impervious surfaces, thereby decreasing stormwater runoff volumes. Porous pavement allows for infiltration of stormwater, groundwater recharge and a reduction in stormwater volume. There is a reduced need for sodium chloride for de-icing.

FIGURE 4-11
Water Pouring Through Permeable Pavement

Source: http://www.perviouspavement.org/index.html

A major disadvantage to porous pavement is that it is susceptible to clogging. Proper care and maintenance is imperative to maintain the pervious nature. Due to the porosity of the material, petroleum releases should be addressed immediately. The pores allow migration of the petroleum product to greater depths with significant break-down of the asphalt binder if these releases are not addressed correctly. De-icing options are limited for porous pavement as sand can clog the porous material and reduce the infiltration capacity. Porous pavement is less durable than typical asphalt.

According to the University of New Hampshire Stormwater Center 2009 Biannual Report, typical installation costs for porous pavement converted to 2011 costs is approximately $3.10/sf compared with approximate cost of $2.50/sf for standard asphalt. However, this does not include sub-base material. Additional sand/gravel filter course may increase porous pavement costs.

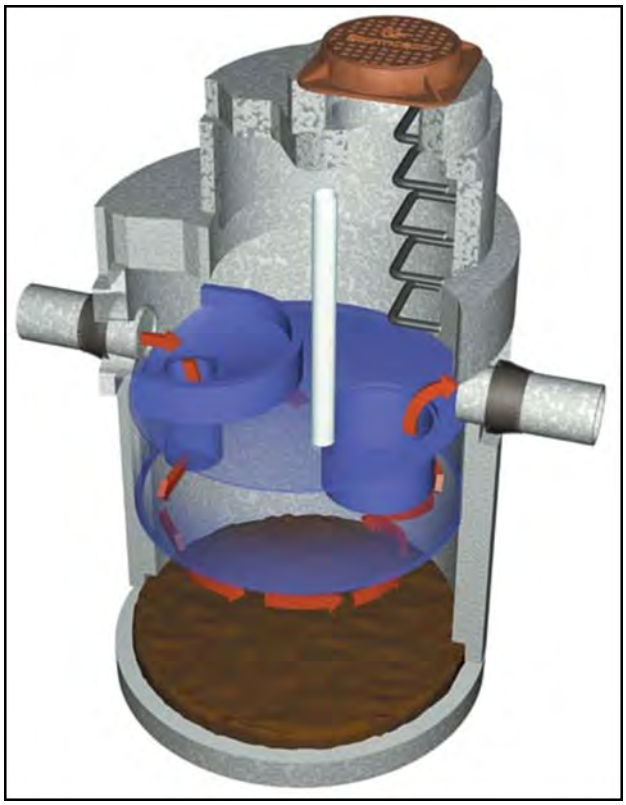
Porous pavement needs to be treated differently than typical asphalt. Porous pavement should not be resealed or repaved with non-porous materials. On a monthly basis, the paved area should be cleaned of debris and sediments. The surface should be vacuum swept typically 3 to 4 times a year to remove sediments and fines from clogging the pores.

Hydrodynamic Separators

Several proprietary separators are available that remove sediments and other pollutants from stormwater runoff through a settling or separation unit. Hydrodynamic separators use gravity and centrifugal forces to separate floatables and coarser sediments. These separators are installed underground, so they can generally be fitted into any site.

Hydrodynamic separators require frequent maintenance. Maintenance includes annual inspections and removal of accumulated litter and sediments per the manufacturers recommendation. Materials removed from hydrodynamic separators need to be disposed of in accordance with local, state and federal requirements. Chemical analysis may be necessary to determine disposal methods.

FIGURE 4-12
Hydrodynamic Separator Cross-Section



Source: MASTEP - http://www.mastep.net/database/sections_display.cfm?RecID=527&vID=43

Costs for a hydrodynamic separator depend on the site conditions and the size of the installation, but a ballpark cost for installation of a hydrodynamic separator is $30,000.

Stormwater Opportunity Areas

The Wayland DPW maintains a stormwater drainage system within the roadways surrounding Dudley Pond. Within the study area, this system includes shallow-sump catch basins, leaching catch basins, storm drains, and outfalls. There are approximately 12 outfalls that discharge untreated stormwater directly to Dudley Pond (see Figure 4-13):

- 6 outfalls along the Pond's western shoreline
- 3 outfalls along the Pond's northern shoreline
- 4 outfalls along the Pond's eastern shoreline
- 1 outfall along the Pond's southern shoreline

The majority of drainage from Route 27 is collected in a stormdrain system that discharges to the wetlands located at the southeast corner of the pond. It is expected that the wetland vegetation filters pollutants in the stormwater.

Structural stormwater BMPs can be installed close to targeted development or along the existing storm drain system. End of pipe controls are more expensive than source controls, however, in existing developments, end of pipe controls may be more effective to incorporate.

The Town-owned property does not currently contribute much stormwater runoff directly to the Pond. The main stormwater concerns related to the Town-owned property are the result of flows channelizing within Pond Drive and Doran Road. Pond Drive slopes down from Route 27 to a point approximately midway between Route 27 and the Pond. Flows in this location are generally channelized to a low point to the north of Pond Drive and towards the development located on Lakeview Road. This low point also accepts flows from the development to the north, east and west of Lakeview Road. Construction of a bioretention/infiltration basin closer to Pond Drive could accept flows from the Pond Drive area and minimize a portion of the stormwater influences on the flooding of basements.

Doran Road generally slopes down from Route 27 to the Pond. There are locations where channelized flow in storm events results in erosion of the gravel roadway. Opportunities exist to redirect flows from Doran Road to the Town-owned property to minimize erosion from stormwater flows.

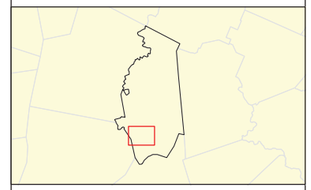
Flows from the developed areas close to the pond cannot easily be directed to the Town-owned parcels. A complex collection and pumping system would be required to divert flows from these areas to the Town-owned parcels. However, flows from Route 27 could be picked up and diverted to the parcels by connecting a pipe to the existing roadway drainage system at the intersection with Doran Road. The pipe could be extended to a midpoint on Doran Road and directed under private property to the Town-owned land for treatment into bioretention areas, potentially amended with iron filings.

FIGURE 4-13
EXISTING STORMWATER INFRASTRUCTURE

LEGEND

- Discharge Directly to Pond
- Leaching Manhole
- Outfall
- Inlets
- Manhole
- Catchment Areas
- Contributing Area
- DPW Drain Lines Discharge to Pond
- Drain Lines
- Streams

LOCUS MAP



0 200 400
Feet

NOTES

Based on MassGIS Color Orthophotography (April 2009)

Dudley Pond
Wayland, Massachusetts

March 2013

Tighe&Bond

Document Path: \\GIS3\Data\GIS\MA\WaylandMA\avproj\DudleyPondCatchment_Ortho.mxd

Section 5
Town-Owned Parcel

Any development on the Town-owned property needs to complement the existing community character. Land use planning for the Town-owned property also needs to take into consideration: natural resources, open space, recreation areas, housing needs and circulation to guide the development of the appropriate use and provide solutions that will be a benefit to both the Dudley Pond area and the community at large.

The Design Team reviewed existing conditions, including analysis of natural resources, such as wetlands, soils types, and drainage patterns. We reviewed historic and current land uses and zoning and subdivision requirements in the neighborhood to understand existing design patterns. This information was used to develop an existing conditions plan, incorporating existing site conditions, environmental constraints, unique features, planning and zoning criteria and infrastructure needs. Using this base plan as a starting point, the design team sought input from the neighborhood and public-at-large in two charrettes to achieve consensus on the right blend of uses and density at the property.

The two (2) charrettes, both held with the DAAC and the general public, obtained input on land use, storm water, and wastewater issues within the study area. The June 27, 2011 charrette focused on obtaining input on the potential land use or mix of land uses for the Town-owned property. The September 27, 2011 charrette focused on technical information related to use of the Town-owned property for wastewater and stormwater water quality. The charrette process allowed the Design Team to identify opportunities and constraints based not only on a review of existing information and supplemental field data, but also on information from the stakeholders and public input. The results of the charrettes are described below.

Using the stakeholder input and an understanding of the environmental resources and zoning requirements, conceptual designs were developed and reviewed by the DAAC. The conceptual plans include preliminary building layouts, recreational amenities, parking, vehicular and pedestrian circulation, water resources, wastewater management options, and stormwater management options. These conceptual designs were further considered by the DAAC, and a final Discussion Plan was developed.

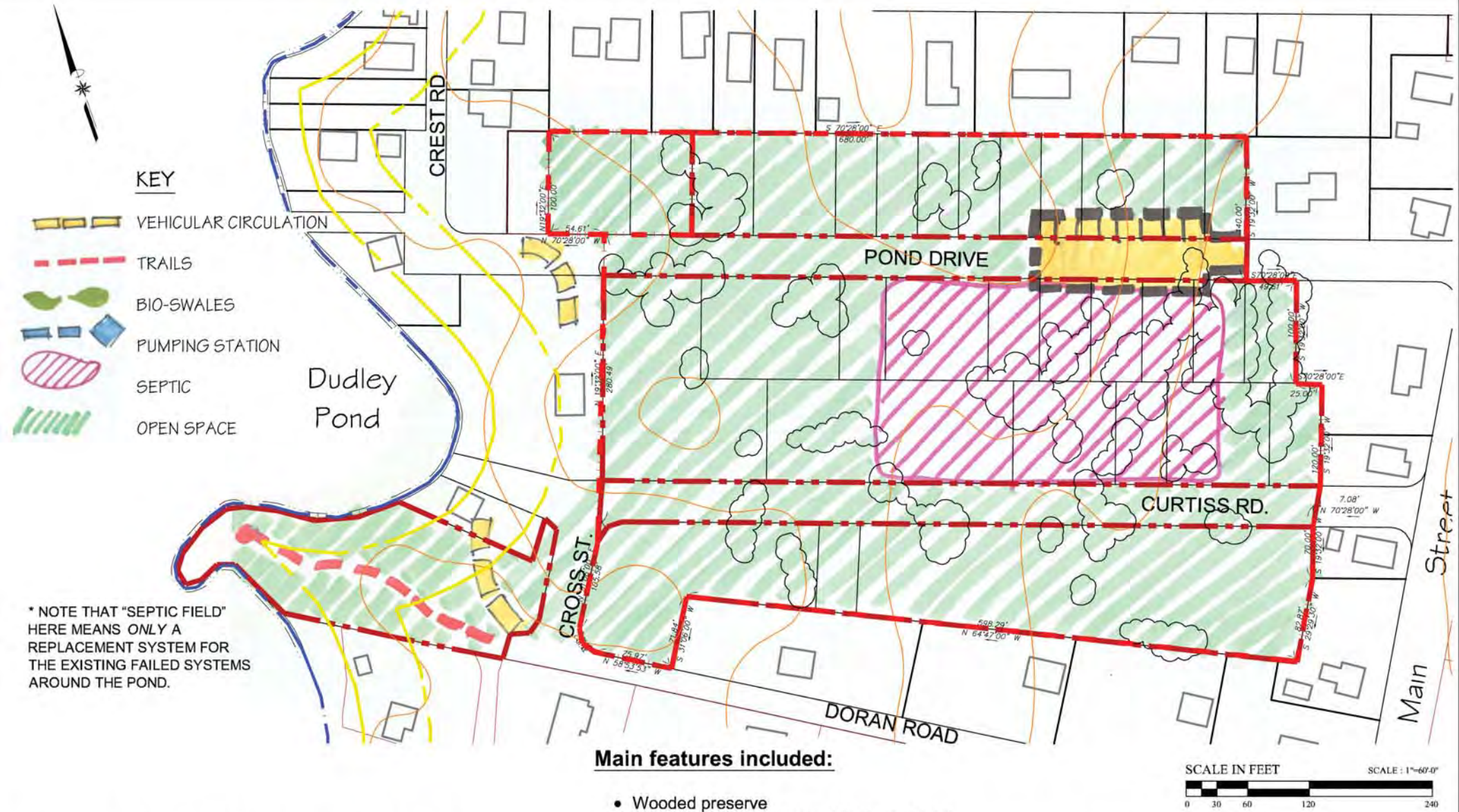
5.1 Charrette 1

The June 27, 2011 charrette focused on obtaining input on the potential land use or mix of land uses for the Town-owned property. Attendees were directed to consider the following uses: wastewater management, stormwater management, public open space and recreation, and affordable housing. Each group discussed the potential uses and developed a sketch summarizing the group's preferred uses. Common themes for the work groups included:

- Passive recreation uses
- Creation of access points
- Possible septic fields
- Improvement of access at Rocky Point for canoeing/kayaking
- No housing

- Preservation of existing natural features

The plans developed from each of the six workgroups are provided as Figures 5-1 through 5-6 on the following pages. These plans depict the common themes noted above. Providing affordable housing units on a portion of the Town-owned property was discussed in each of the groups. A small minority of participants strongly supported some level of affordable housing on the eastern portion of the site. However, the majority of participants present at the meeting did not want to promote housing on this property, as reflected in the following plans.



Main features included:

- Wooded preserve
- Minimum trail improvement to Rocky Point
- Possible septic field* but major vegetated buffer surrounding it
- Possible closure of Pond Drive (if allowed by safety officials)
- Small vehicular access and parking area from Route 27 with LID (low impact development) features.

Main focus was to preserve the town parcel as a wooded conservation area with minimal trails. This group did, however, strongly support the concept of using a portion of the land as a possible septic field* that could in any way improve the water quality in Dudley Pond.

FIGURE 5-1

Charrette 1: GROUP #1

Main features included:

- Wooded preserve
- Possible septic field in southeast corner of site (if it were feasible)
- No trail improvements

Group Two was a strong advocate for a wooded preserve. Trail improvements would be minimal, but some discussion focused on how the property could solve the storm water run-off from Doran Road, especially at the bottom near the pond. Consideration was also given to a septic field* if it did not overwhelm the 7.5 acre parcel.

FIGURE 5-2

Charrette 1: GROUP #2

Main features included:

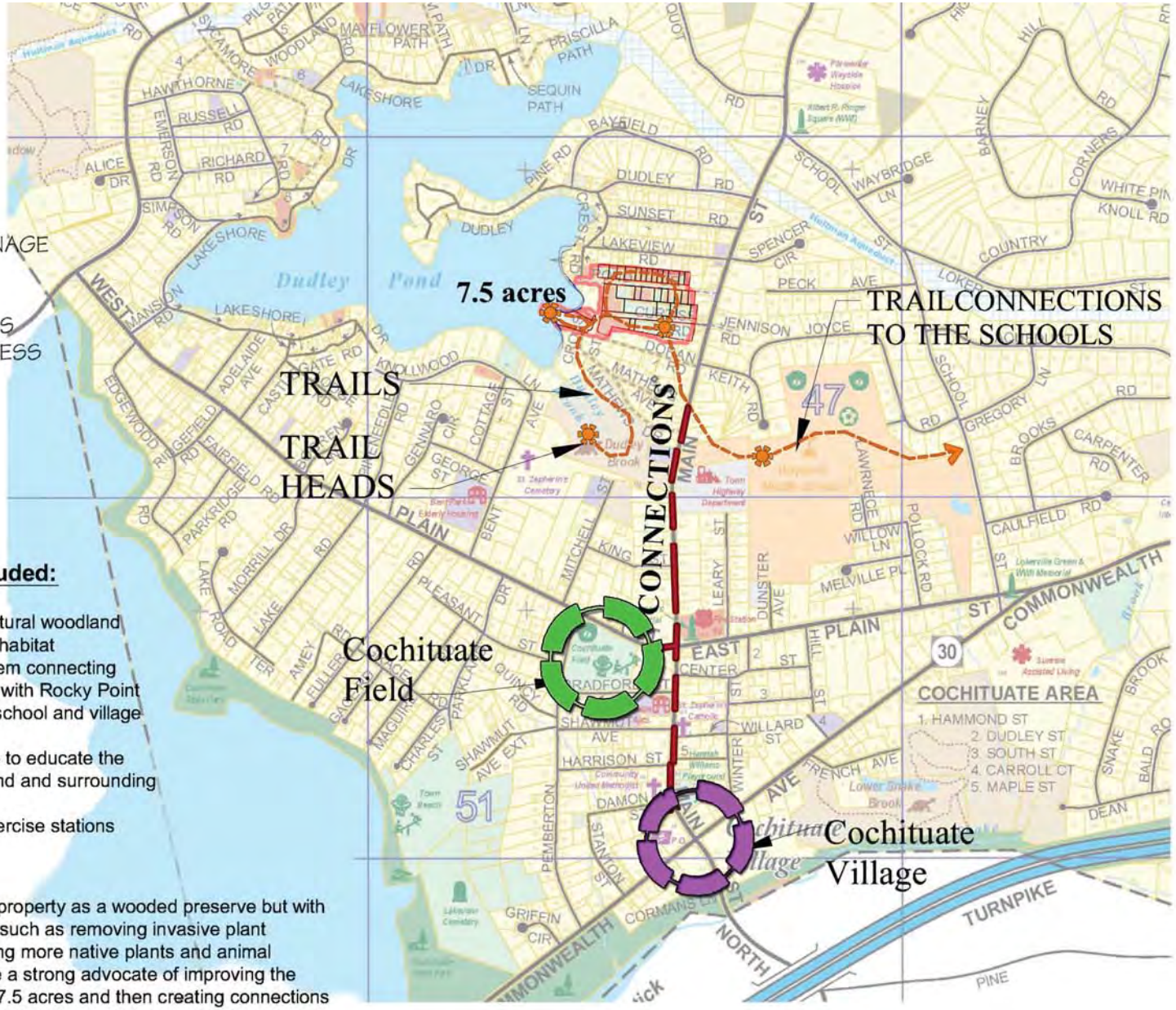
- Wooded preserve
- Possible septic field* (if feasible) in center of property with access to Route 27
- No trail improvements

Maintaining a woodland preserve was a priority of Group 3 with the option of locating a septic field* if it were feasible. The concept of removing Pond Drive was also discussed, if allowed by safety officials so that the gravel roadway could be converted to additional vegetation and/or be used to control storm water from Route 27

FIGURE 5-3

Charrette 1: GROUP #3

- INTERPRETIVE SIGNAGE KIOSKS
- PICNIC TABLES
- CONNECTING TRAILS
- HANDICAPPED ACCESS
- TRAIL EXERCISE STATIONS



Main features included:

- Enhancement of natural woodland through supporting habitat
- Expanded trail system connecting neighboring homes with Rocky Point and beyond to the school and village center to the south
- Interpretive signage to educate the public about the pond and surrounding environments
- Fitness trail with exercise stations

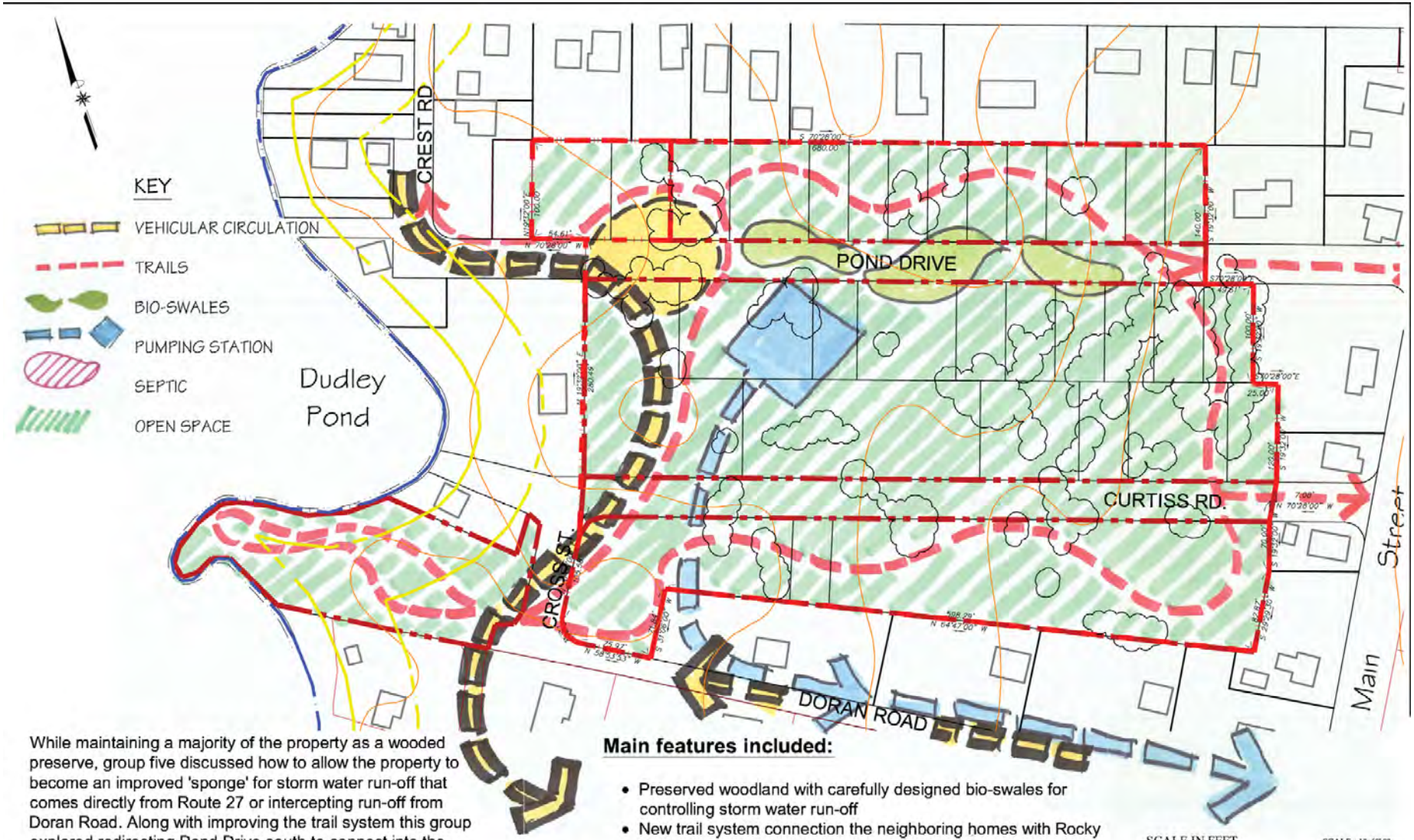
Group 4 supported the property as a wooded preserve but with natural enhancements, such as removing invasive plant material and encouraging more native plants and animal habitat. They also were a strong advocate of improving the trails, both through the 7.5 acres and then creating connections with existing and proposed trails to other parts of town. A main loop trail within the site would feature interpretive signage and connect the adjacent neighborhoods with an improved trail (and handicap parking) that would access Rocky Point. A canoe launch was also discussed for Rocky Point.

FIGURE 5-4

Charrette 1: GROUP #4

Dudley Area Land Use Study

The Town of Wayland, Massachusetts



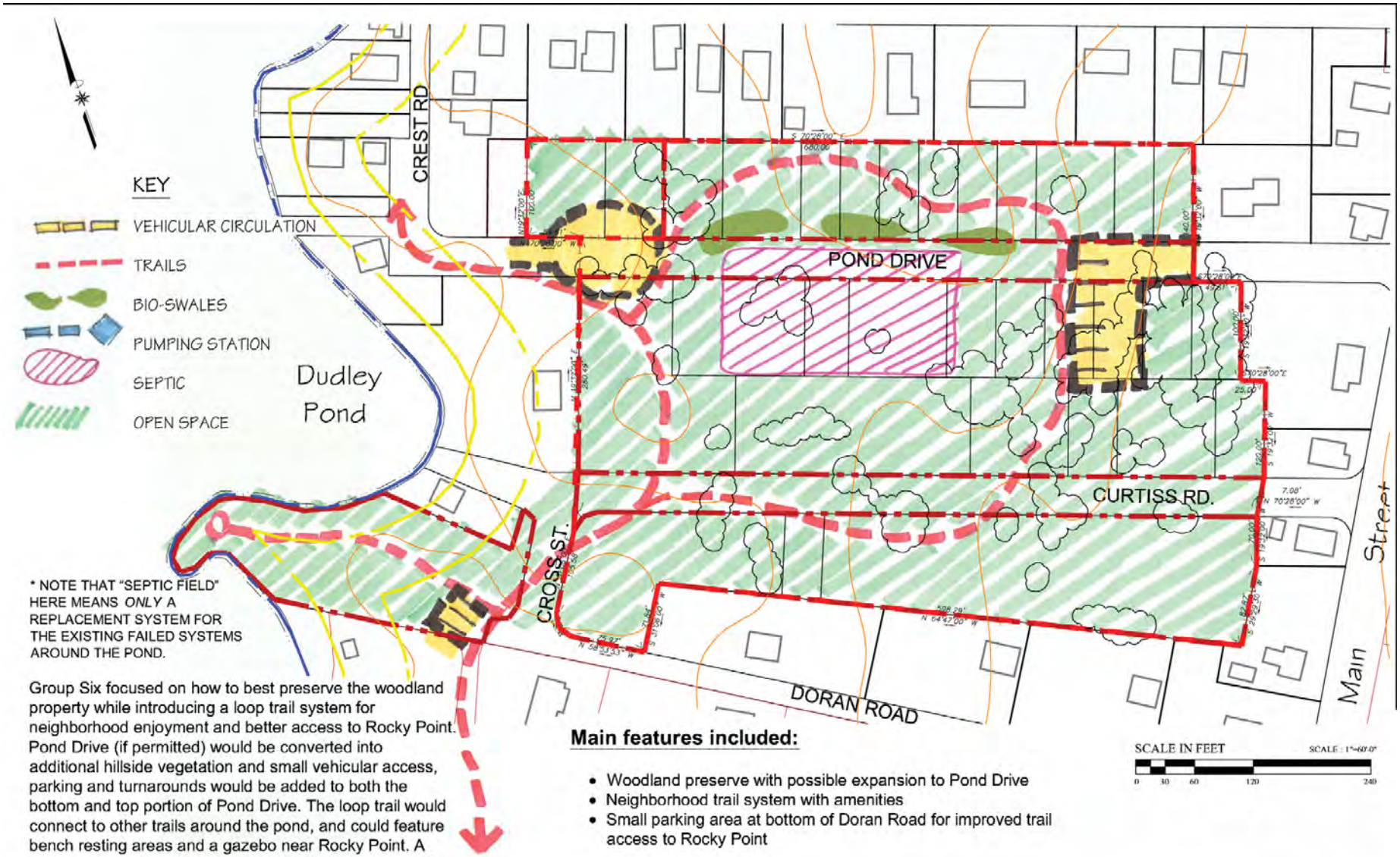
While maintaining a majority of the property as a wooded preserve, group five discussed how to allow the property to become an improved 'sponge' for storm water run-off that comes directly from Route 27 or intercepting run-off from Doran Road. Along with improving the trail system this group explored redirecting Pond Drive south to connect into the bottom of Doran Road. If feasible, a small central area was set aside for a future pump station with the concept that the pipe installation along Doran Road would result in an improved roadway/drainage infrastructure.

Main features included:

- Preserved woodland with carefully designed bio-swales for controlling storm water run-off
- New trail system connection the neighboring homes with Rocky Point
- Redirecting Pond Drive to Doran Road and creating one way traffic down Doran and out Mathews Drive
- Pumping station (if feasible)

FIGURE 5-5

Charrette 1: GROUP #5



* NOTE THAT "SEPTIC FIELD" HERE MEANS *ONLY* A REPLACEMENT SYSTEM FOR THE EXISTING FAILED SYSTEMS AROUND THE POND.

Group Six focused on how to best preserve the woodland property while introducing a loop trail system for neighborhood enjoyment and better access to Rocky Point. Pond Drive (if permitted) would be converted into additional hillside vegetation and small vehicular access, parking and turnarounds would be added to both the bottom and top portion of Pond Drive. The loop trail would connect to other trails around the pond, and could feature bench resting areas and a gazebo near Rocky Point. A system of exercise stations, possible location for a small community septic field*, and the use of bioswales for storm water were also discussed.

Main features included:

- Woodland preserve with possible expansion to Pond Drive
- Neighborhood trail system with amenities
- Small parking area at bottom of Doran Road for improved trail access to Rocky Point

FIGURE 5-6

Charrette 1: GROUP #6

Dudley Area Land Use Study

The Town of Wayland, Massachusetts

Tighe&Bond, Inc.
Consulting Engineers
Environmental Specialists

GLA
Gates, Leighton & Associates, Inc.
Landscape Architecture

5.2 Charrette 2

The September 27, 2011 charrette focused on technical information related to use of the Town-owned property for wastewater and stormwater water quality.

5.2.1 Wastewater

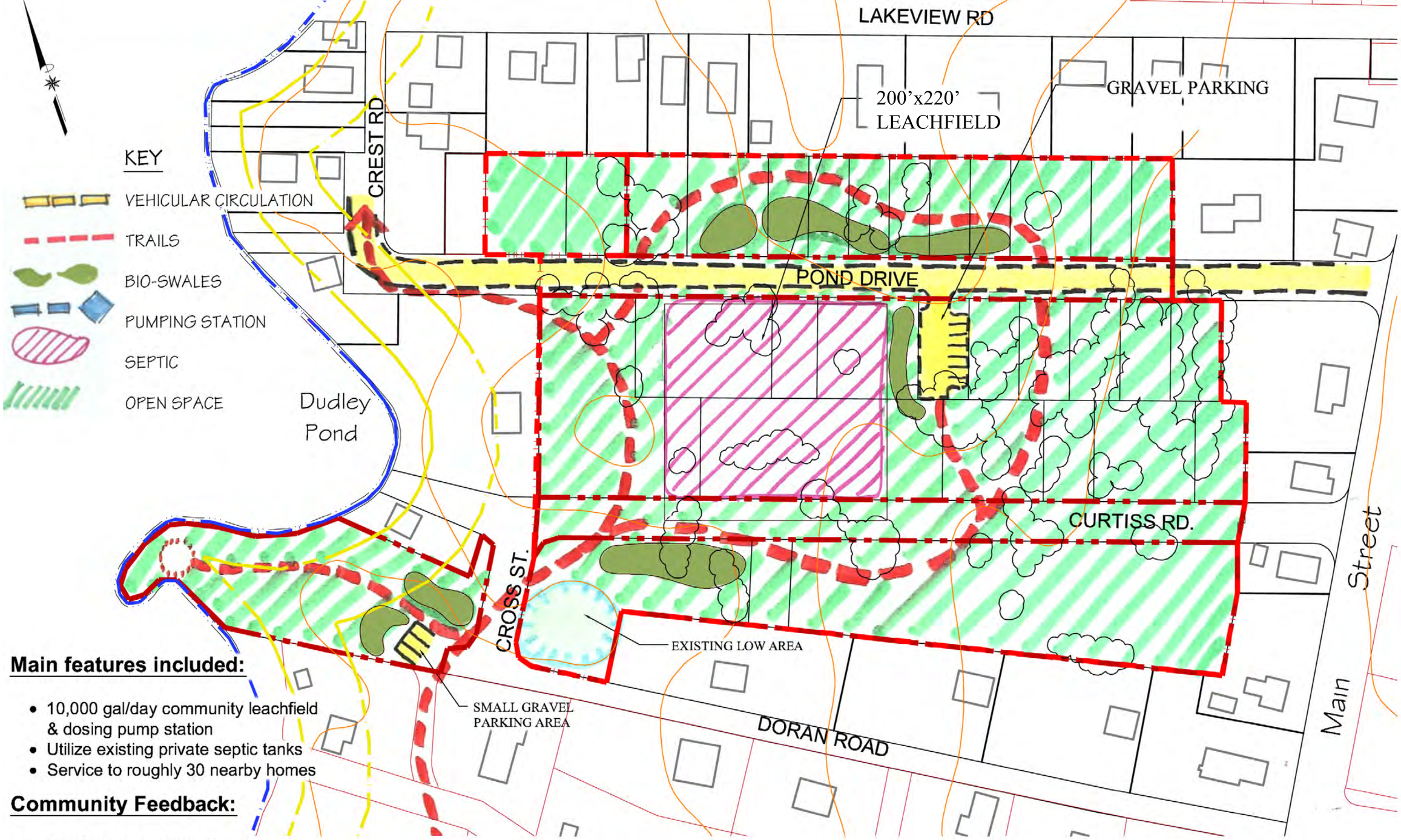
Options for wastewater treatment included constructing a collection system and community septic system that would be able to address wastewater for up to 30, 3-bedroom houses or installing a collection system and either treating wastewater on-site or pumping the wastewater to the MWRA system, with a connection in either Natick or Framingham.

Community Septic System Option

This wastewater option would include a community septic system on the Town-owned land which could address wastewater flows of less than 10,000 gpd. This system could accommodate up to 30, 3-bedroom houses. Costs for the community septic system would range from $1 million to $1.5 million and would include a collection system utilizing low pressure sewers. The cost will vary with the extent of the sewer collection system. A concept of this option is provided as Figure 5-7.

Decentralized Wastewater Treatment Alternative

This treatment option would include a small wastewater treatment facility on the Town-owned land and disposal either on an adjacent parcel or off-site. Costs for the decentralized wastewater treatment facility would range from $1.5 million to $5.5 million and would include the collection system consisting of low pressure sewers, the wastewater treatment facility, and a force main to an off-site discharge site. The cost will vary with the flow and discharge permit limits. A concept of this option is provided as Figure 5-8.



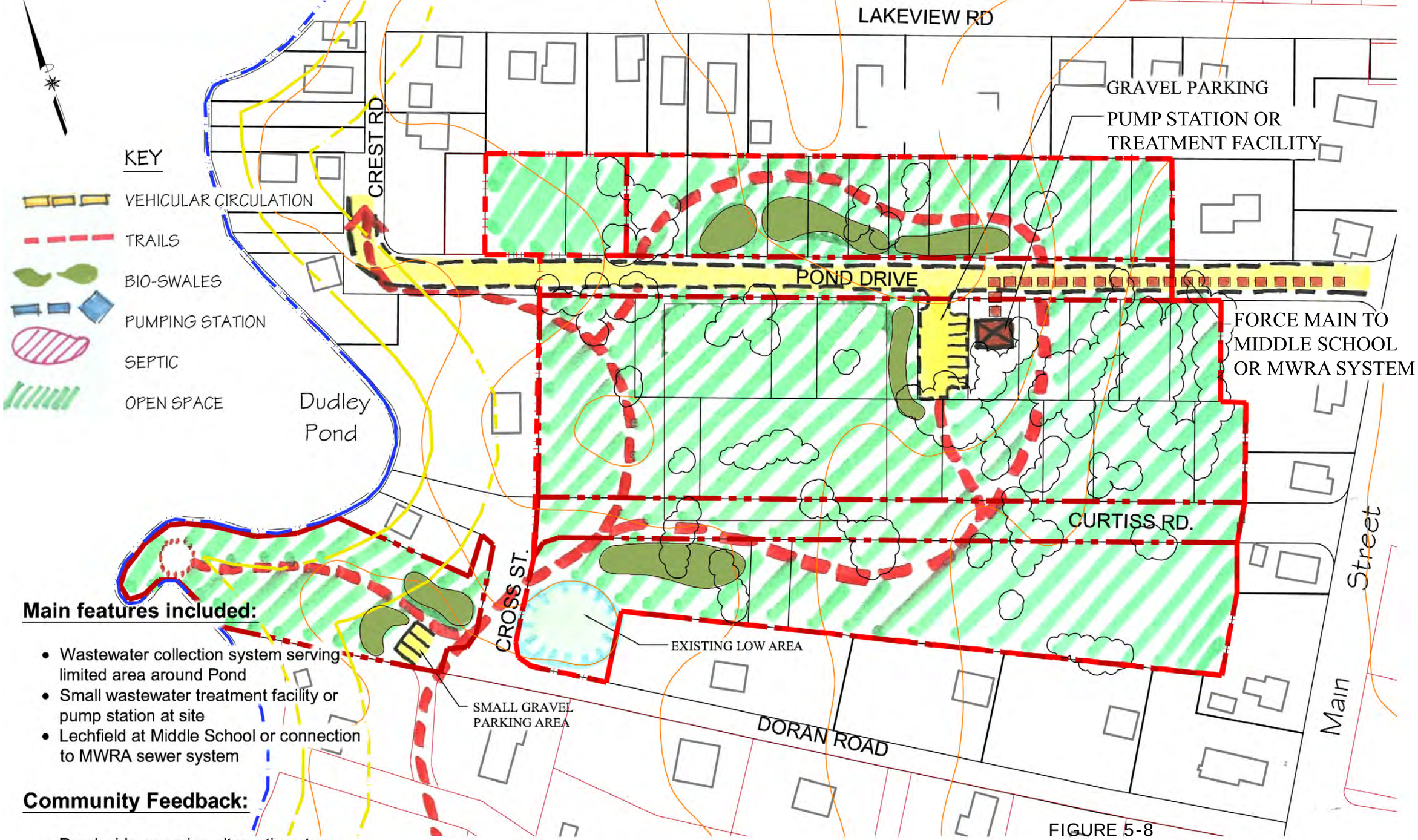
Main features included:

- 10,000 gal/day community leachfield & dosing pump station
- Utilize existing private septic tanks
- Service to roughly 30 nearby homes

Community Feedback:

- Provide septic alternative to failed systems
- Services only homes in immediate vicinity of site

FIGURE 5-7
Community Septic Option



Main features included:

- Wastewater collection system serving limited area around Pond
- Small wastewater treatment facility or pump station at site
- Lechfield at Middle School or connection to MWRA sewer system

Community Feedback:

- Pond wide sewering alternatives too expensive
- Cost outweighed water quality benefits to local residents

FIGURE 5-8

Pump Station Treatment Facility Option

Massachusetts Water Resources Authority Alternative

The MWRA option would include installation of a collection system consisting of low pressure sewers, a pump station at the Town-owner land, and a one-mile force main to a Natick pump station.

As Wayland is not currently an MWRA community, connecting to the system will require a rigorous permitting and review process, including:

- Massachusetts Environmental Policy Act
- Interbasin Transfer Act
- Massachusetts Department of Environmental Protection
- Sewer Extension or Connection Permit
- Legislation approval
- MWRA Advisory Board approval
- Governor's Approval
- Majority vote at Town Meeting of Wayland to connect

The transporting community must have no objection to provision of sewer service.

Connection Costs & Arrangements

As the Town of Wayland is located outside of the MWRA sewer service area, a sewer connection into the system would need to be made through a transporting community (specifically, Natick or Framingham). The transporting community may require additional fees through institutional agreements that address maintenance, auditing procedures (for wastewater volumes), management, and any other as needed issues. These costs are not included in the fee estimates below.

Flow Assumptions

For the purposes of approximating interconnection fees, we have assumed a daily flow of 50,000 gallons per day (gpd). This flow is equivalent to 150 three bedroom homes or 250 two bedroom homes. The fee estimates below also do not address any fees that may be incurred during application preparation, such as the costs to create and implement a plan that would satisfy the MWRA infiltration/inflow removal requirements (4 to 1 gallon reduction). It should also be noted that MWRA Policy #OP.11 (Admission of New Community to MWRA Sewer System and Other Requests for Sewer Service to Locations Outside MWRA Service Area) states that entrance fees and annual user charges shall not be waived. The costs associated with connecting a community to the MWRA sewer system fall into 3 categories: Entrance Fees, an Annual User Charge and Connection Costs & Arrangements, as outlined below.

Entrance Fee
The Entrance Fee is charged by the MWRA to cover the new user's fair share of the costs of the sewer system that is in place at the time the new user connects. The entrance fee recovers the new user's proportional share of the sewer system's asset base that has already been paid for by the existing users of the system. The basic formula for calculating the entrance fee is:

$$\text{Entrance Fee} = \frac{\text{New user's flow}}{\text{Total System flow (including new flow, 3 year average)}} \times \text{Sewer System Net Asset Value}$$

MWRA staff has estimated the Entrance Fee as $4 per gallon. Assuming a flow of 50,000 gallons per day (gpd), the Entrance Fee is approximately $200,000.

Annual User Charge
The Annual User Charge is calculated differently depending on whether a community or user(s) other than a community are connecting into the MWRA system. Conversations with Ms. Pam Heidell (Manager - MWRA Policy and Planning) indicated that the proposed connection of a new community into the MWRA sewer system is unprecedented. Given this, MWRA is uncertain whether to calculate the Annual User Fee as if a community was connecting or an individual given the precedent setting nature of this determination.

Community being Admitted into the MWRA System
If the interconnection is treated as a direct customer being admitted into the MWRA system, Wayland would be obligated to pay the estimated retail surcharge for sewer services, as established by the MWRA Board of Directors pursuant to Section 10 of the Enabling Act and the sewer rate methodology approved by the Board. Assuming a flow of 50,000 gallons per day; Pam Heidell has estimated this amount to be approximately $9,050 a month.

User Other than a Community being Admitted into the System
If the interconnection is treated as a user other than a community being admitted into the MWRA system, the new user will be billed through the transporting community at its local rate or MWRA could decide to charge an Annual Use Charge directly to the user.

A user that is billed through the transporting community at its local rate is considered a customer of the transporting community and does not need to pay an additional retail charge to the MWRA. Assuming a flow of 50,000 gpd, the quarterly bill for tying into Natick would be $73,746 or $120,600 every quarter for Framingham. This is based on Framingham's rate of $20.00 a unit (748 gallons) for those users with a sewer account located outside of the Town and Natick's rate of $12.23 a unit (748 gallons). However; the MWRA would increase the transporting community's sewer assessment by approximately $70,000 to pay for the increased flow that Wayland would be adding. The transporting community could require Wayland to pay for some or all of the increased assessment as part of the sewer interconnect agreement.

If the MWRA decides to charge an Annual Use Charge directly to the customer, this is calculated as follows:

$$\text{Annual Use Charge} = \text{(User's metered volume) X (unit cost derived from the wholesale portion of a modified retail bill in place in the } 90^{th} \text{ percentile community)}$$

The unit cost ensures that the proportional share of flow costs which are part of each community's wholesale payment are reflected in the wholesale portion of a retail bill. The units' costs calculation is updated annually following adoption of MWRA fiscal year community charges. Pam Heidell has indicated the cost to Wayland would be approximately $70,000 to $100,000, depending on the agreements between the MWRA, Wayland, and the Transporting community. It is also worth noting that if MWRA directly charges a user that is connected to the system of a transporting community, the transporting community may also charge the user for providing its sewer services to the user.

Summary of fees to connect into the MWRA system

- **Entrance Fee**
  - $200,000 Covers new user's fair share of the costs of the sewer system
- **Annual User Charge**
  - Community being admitted into system: $6,033 per million gallons or approx. $9,050/month ($108,600/year)
  - Individual being admitted into system
    - » Billed through transporting community at local rate:
      - Natick: ~$300,000/year*
      - Framingham: ~$500,000/year*
    - » MWRA directly charges user based on unit cost: $70,000 to $100,000 depending on the agreements between MWRA, Wayland, Transporting Community
- **Infrastructure Upgrades**
  - Pump Station & Force Main to Natick: $2.88M
  - 4:1 I/I Removal

5.2.2 Stormwater Management

Stormwater management alternatives included discussion of the use of the Town-owned property. There is limited potential to use the Town-owned property to address existing stormwater-related impacts to Dudley Pond. The existing stormwater flows in the Study Area are depicted on Figure 5-9.

Stormwater flow causes erosion in discrete areas of Pond Drive and Doran Road and is contributing to localized flooding on Lakeview Road. Options for stormwater controls to minimize these stormwater concerns include the use of bioswales as depicted on Figure 5-10.

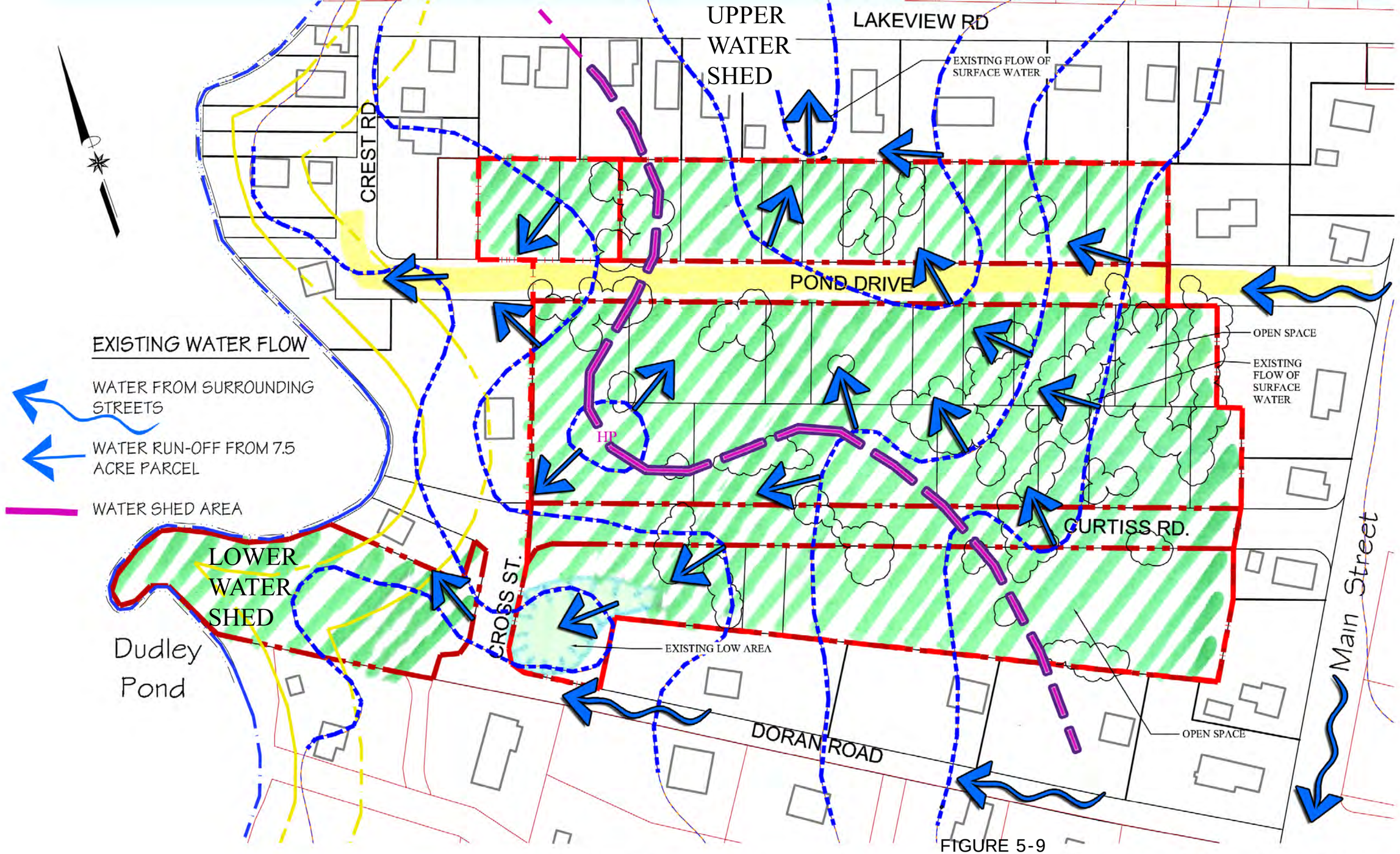


FIGURE 5-9

Storm Water Management

Existing Water Flow

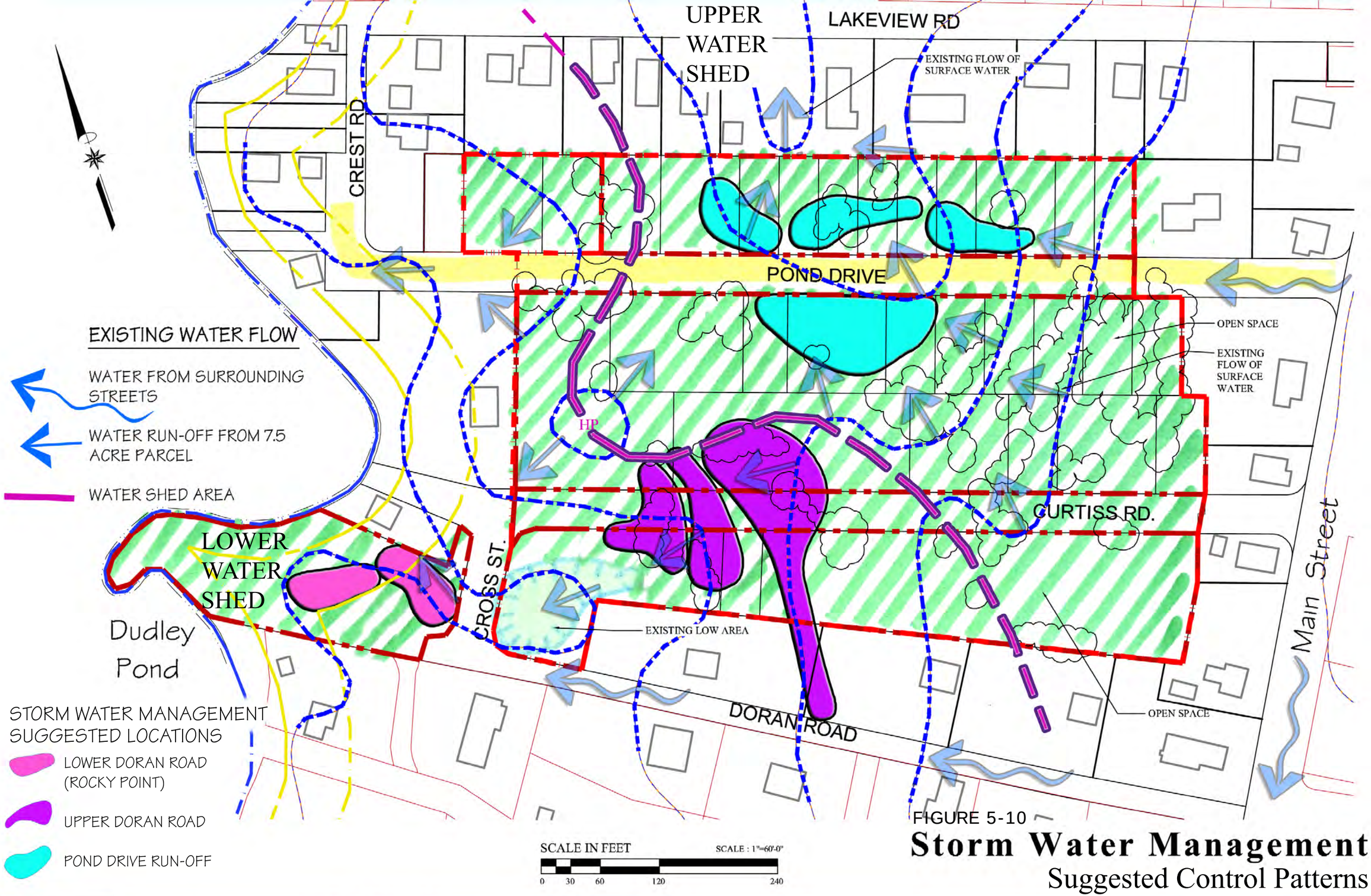


FIGURE 5-10

Storm Water Management

Suggested Control Patterns

Additional stormwater management discussion included the potential to focus stormwater efforts to existing outfalls of untreated stormwater to Dudley Pond. Focusing on existing outfalls can address water quality issues at existing discharge points around the pond. Existing outfalls were identified in Figure 4-13.

Options for stormwater management BMPs that could be implemented should a housing option be implemented were also discussed. These were included in the Preliminary Discussion Plan 2 provided below.

5.3 Conceptual Plan Alternatives

The Design Team was asked to consolidate the consensus items reached during the process of this Land Use Study into one or more graphic plans portraying conceptual, yet realistic, uses of the Town-owned Property. Consensus on landscape uses and storm water management clearly pointed in one direction, and a conceptual plan portraying these was developed for DAAC and Town use (Plan A, Figure 5-11). The possibility for location of a moderate housing cluster (containing four units) within this landscape and storm water design was also explored through another conceptual plan (Plan B, Figure 5-12). A third concept plan (Plan C, Figure 5-13) with a reduced number of affordable housing units was also developed for consideration. The DAAC did not unanimously agree on Plan A, B or C. All three plans include the following:

- Improved public access to Dudley Pond by better signage and parking
- Bio swales/rain gardens at localized areas to improve the water quality of the pond
- Handicapped access to the Pond
- Trails and a canoe/kayak launch for the community to enjoy
- Rocky Point protected as conservation land by transferring ownership to the Conservation Commission
- Land reserved for a community septic system.

Each plan is described below.

5.3.1 Preliminary Discussion Plan A

As depicted on Figure 5-11, Preliminary Discussion Plan A maintains the use of the Town-owned Property primarily for open space and passive recreation. An area is proposed to be set aside for use as a community septic system. Preliminary Discussion Plan A incorporates the following elements:

- Primary use as open space and passive recreation
- Land set aside for a community septic system
- Passive recreation trail system
- Bioswales for localized stormwater management
- Parking for recreational users along Pond Drive
- Canoe/kayak launch at Rocky Point
- Scenic overlooks at Rocky Point
- Parking for recreational users at the end of Doran Road

KEY

- TRAILS
- PARKING
- BIOSWALES / RAIN GARDENS
- CONSERVATION LAND
- SEPTIC TREATMENT
- HOUSING
- NEW ROAD
- BOAT LAUNCH
- OVERLOOK
- TAX TITLE/MUNICIPAL LOTS
- PARK & RECREATION LOTS

CREST RD

EXISTING SEPTIC

POND DRIVE

SEPTIC

SEPTIC

Dudley Pond

CURTISS RD.

CROSS ST

FLAGGED WETLAND

CONSERVATION LAND

PARKING (2 CARS)

DORAN ROAD

Main Street

OPEN SPACE: 293,546SF / 6.73 ACRES
NEW SEPTIC AREA: 23,804SF / .54 ACRES

December 15, 2011

FIGURE 5-11
Plan A

Tighe&Bond, Inc.
Consulting Engineers
Environmental Specialists

GLA
Carr, Leighton & Associates, Inc.
Landscape Architecture

SCALE IN FEET

Dudley Area Land Use Study
The Town of Wayland, Massachusetts

5.3.2 Preliminary Discussion Plan B

As depicted on Figure 5-12, Preliminary Discussion Plan B adds four units of affordable housing accessed off Pond Drive to Preliminary Discussion Plan A. The major elements identified in Discussion Plan A remain in Discussion Plan B. Preliminary Discussion Plan B incorporates the following elements:

- Primary use as open space and passive recreation
- Land set aside for a community septic system
- Four affordable housing units off Pond Drive
- Passive recreation trail system
- Bioswales for localized stormwater management
- Parking for recreational users along Pond Drive
- Canoe/kayak launch at Rocky Point
- Scenic overlooks at Rocky Point
- Parking for recreational users at the end of Doran Road

KEY

- TRAILS
- PARKING
- BIOSWALES / RAIN GARDENS
- CONSERVATION LAND
- SEPTIC TREATMENT
- HOUSING
- NEW ROAD
- BOAT LAUNCH
- OVERLOOK
- TAX TITLE/MUNICIPAL LOTS
- PARK & RECREATION LOTS

CREST RD

EXISTING SEPTIC

POND DRIVE

SEPTIC

SEPTIC

Dudley Pond

CURTISS RD.

CROSS ST

FLAGGED WETLAND

CONSERVATION LAND

PARKING (2 CARS)

DORAN ROAD

Main Street

OPEN SPACE:	278,554SF / 6.39 ACRES
DEVELOPED AREA:	14,992SF / .34 ACRES
NEW SEPTIC AREA:	23,804SF / .54 ACRES

FIGURE 5-12

Plan B

December 15, 2011

Tighe&Bond, Inc.
Consulting Engineers
Environmental Specialists

GLA
Carol, Leighton & Associates, Inc.
Landscape Architecture

SCALE IN FEET

Dudley Area Land Use Study
The Town of Wayland, Massachusetts

5.3.3 Preliminary Discussion Plan C

In addition to the plans above, a one house plan and a two house plan were presented to the DAAC for discussion. Preliminary Discussion Plan C depicted on Figure 5-13 shows the one unit of affordable housing option accessed off Pond Drive. The other major elements identified in Preliminary Discussion Plans A and B remain in Preliminary Discussion Plan C. Preliminary Discussion Plan C incorporates the following elements:

- Primary use as open space and passive recreation
- Land set aside for a community septic system
- Up to two affordable housing units off Pond Drive
- Passive recreation trail system
- Bioswales for localized stormwater management
- Parking for recreational users along Pond Drive
- Canoe/kayak launch at Rocky Point
- Scenic overlooks at Rocky Point
- Parking for recreational users at the end of Doran Road

FIGURE 5-13

Plan C

October 30, 2012

Tighe&Bond, Inc.
Consulting Engineers
Environmental Specialists

GLA
Gates, Leighton & Associates, Inc.
Landscape Architecture

SCALE IN FEET
0 30 60 120 240

Dudley Area Land Use Study
The Town of Wayland, Massachusetts

Section 6
Other Recommendations

Based on the project scope and the input received from the DAAC and the public, the Design Team developed the following recommendations to address the following major goals: to provide open space and passive recreational opportunities; to improve access and parking to the open space and passive recreation trails, especially in the vicinity of Rocky Point; to provide for a community septic system to address failing systems in proximity to the Town-owned land; to incorporate stormwater management features to address localized concerns; and to consider the potential for providing affordable housing units. The following recommended elements could be introduced in a coordinated and phased approach to meet the needs and desires of the community.

6.1 Trail System with Signage

Existing trails can be rerouted and connected to form a pleasant pedestrian woodland trail system. The recommendation is for unpaved trails surfaced with woodchips, pine needles, or forest duff. Selected trail sections should be made accessible; the Town Recreation Department should be consulted. Opportunities to include educational, interpretive signage highlighting natural and historic features should be explored, as should directional signage. Opportunities to connect to other trail systems in town exist and could be explored.

6.2 Parking Areas

Small, permeably paved parking areas to accommodate visitors and maintenance workers should be strategically located near the proposed septic area off Pond Drive and near the Rocky Point Trailhead.

6.3 Bioswale and Rain Garden Stormwater Treatment

The recommended method for handling storm water runoff in this area is several systems of bioswales and rain gardens. The swales and gardens are biomorphic in form, planted with native vegetation, and will integrate seamlessly with the landscape. The clustered systems have been located on the plan where they are most needed to catch and infiltrate storm water before it enters the pond and/or the northerly properties. The bioswales and rain gardens are also near trail routes in order to provide an educational opportunity for visitors. Storm water treatment to the south of the property includes collecting runoff from Doran Road, piping it to the property, and then treating it through a series of bioswales.

6.4 Septic System Area

A central area has been located for a shared septic system, should this option be chosen by the community. This would include construction of a soil absorption system to accommodate less than 10,000 gpd. This upland area would look like a meadow. It is largely hidden from surrounding residential and recreational uses, and from the pond itself.

6.5 Road Upgrades

It is recommended that Pond Drive be regraded and paved within the Town-owned Property in order to maintain accessibility to Crest Road and for maintenance of the proposed shared septic system. If possible, porous asphalt is the recommended material to allow stormwater infiltration. Although not within the study area, also repaving Doran Road with porous material would minimize stormwater running from the road into the study area.

6.6 Canoe/Kayak Launch and Overlooks on Rocky Point

Small shoreline areas on Rocky Point that are already used as overlooks and a canoe/kayak launch are currently becoming eroded and tree roots are exposed. They should be reinforced and protected in keeping with the natural surrounding scenery and to protect and enhance the experience of the pond for users such as children and those with disabilities.

6.7 Compatibility with Housing Option

All of the aforementioned landscape enhancements will work with a small housing cluster, should the Town decide to place one on this property. The recommended siting for housing is shown on Preliminary Discussion Plans B and C on Figures 5-12 and 5-13. Stormwater management for a housing development could be designed such that post development runoff was equal or better than pre development runoff in terms of quality and quantity. Wastewater management could also be designed such that wastewater discharges did not increase nutrient loads to the pond. In order to achieve nutrient removal from wastewater, a secondary treatment system would be required to treat wastewater produced from housing on the Town-owned property as well as from a number of adjacent properties. The latter would be needed to offset the nutrient increase in the watershed from the new housing development.

Section 7
Summary

The Town-owned Property next to Dudley Pond lends itself to several concurrent uses that could successfully coexist and add to Wayland's recreational, historic, educational and social assets. Of great importance is continuing to support the land's natural features, including its natural hydrology and its habitat value, to maintain the land's value and add to the town's legacy of natural beauty and environmental health.

To that end, this study was conducted to obtain public input on wastewater management, stormwater management, public open space, recreation, and affordable housing uses as well as to conduct a technical assessment of potential solutions to water quality concerns. This report summarizes the public input obtained through the charrette process, the technical information regarding the impacts of wastewater and stormwater on Dudley Pond, and potential improvements that could be incorporated into the Town-owned property. As discussed in previous sections, construction of a community septic system has a greater potential to improve Dudley Pond water quality than provision of stormwater management BMPs in this location. Localized stormwater BMPs are recommended to address stormwater-related erosion along Pond Drive and Doran Road. As discussed in Section 6, a small housing development could be designed with appropriate stormwater and wastewater management systems to minimize impacts to Dudley Pond.

This study culminated in the development of the three Preliminary Discussion Plans presented in Section 5. The three conceptual plans included different scenarios including combinations of open space, passive recreation, stormwater management, wastewater management, affordable housing, parking and access to public amenities. These plans provide land use options for consideration by the DAAC in developing their final recommendations to the Board of Selectmen and Town Meeting.

Permitting and funding sources for development on the Town-owned property is highly dependent on the ultimate plan chosen by the DAAC. Permitting is likely to include approval by the Wayland Conservation Commission under the Wetlands Protection Act and Chapter 194 of the Code of the Town of Wayland - Wetlands and Water Resources Protection Bylaw for work in the buffer zone to Dudley Pond and an isolated wetland off of Doran Road.

As the property is within the Town's Aquifer Protection District, any activity that will disturb 20,000 sf of greater or will increase impervious surfaces by 500 sf or more, requires a permit from the Conservation Commission under Chapter 193 of the Code of the Town of Wayland – Stormwater and Land Disturbance. Projects that impact one acre of more of land are required to gain coverage under the US EPA's Construction General Permit.

A rough cost estimate was developed for Preliminary Discussion Plan 1 of approximately $460,000. Potential funding options include:

- MassDEP Section 604 b (Stormwater-planning)

- MassDEP Section 319 grant (Stormwater-implementation)
- Community Preservation Act (CPA) funding (affordable housing/open space/recreation)
- Stabilization Fund (all aspects – would need to be placed on Capital Improvement Plan)

J:\W\W1753 Wayland Dudley Area Land Study\REPORT\FinalReport07162013.docx

Tighe&Bond

APPENDIX A

Dudley Area Advisory Committee

On November 22, 2010, the Board of Selectmen voted to establish a temporary advisory committee to be known as the Dudley Area Advisory Committee to assist the Board with studying the disposition of and make recommendations on the use of Town-owned land located on Doran Road, Pond Drive, Cross Street, and Curtis Road as described in Article 7 of the November 16, 2010 Special Town Meeting Warrant and shown on the plan entitled "Plan of Land in Wayland, Massachusetts Prepared for the Doran Road~Dudley Pond Comprehensive Feasibility Study" dated September 30, 2010, prepared by the Town of Wayland, Town Surveyors Office.

The committee will be established and appointed provided funding is approved at the Special Town Meeting of November 2010 to retain consultants to provide information to be used in making recommendations for the property. Terms shall expire on November 30, 2011 unless extended by vote of the Board of Selectmen.

<u>The following tasks are delegated to the committee:</u>

- Oversee expenditure of funds appropriated by Town Meeting for the purpose of studying the feasibility of disposition and use of the Town-owned parcels for;
  1. ***open space preservation***
  2. ***passive recreation use***
  3. ***septic treatment for any new structures on the land or for adjacent properties***
  4. ***pond management, and construction of affordable housing***

- Review findings from feasibility studies to determine extent of the five potential disposition and uses of the Town-owned parcels listed above.

- Make a recommendation to the Board of Selectmen on the best use or combination of uses of the municipal land, and in what proportion, said recommendation to take into account impacts on Dudley Pond and the surrounding watershed, public access to the pond, public health considerations, and community preferences for disposition or use of the property.

Evaluate wastewater management alternatives that may include:

a. New Centralized Wastewater Treatment and Disposal near Dudley Pond or the project area.
b. New Centralized Wastewater Treatment and Disposal Off Site which could include Wayland DPW garage, the Wayland Middle School site or other town-owned areas.
c. Localized collection and satellite wastewater treatment and groundwater disposal facilities within the project area.
d. Individual On-Site Treatment and Disposal with continued reliance on individual on-site wastewater treatment and disposal systems.
e. MWRA Connection and transmission main to convey wastewater to the nearest practical MWRA connection, likely in Natick.

In completing its evaluation and in making its recommendations, the advisory committee shall consider the use of properties in the general area and the resulting impacts on Dudley Pond and the municipal parcels, the capacity of the municipal land to address issues in the general area, and identify conditions and costs that influence the range of options considered, as well as the recommended plan.

<u>DUDLEY AREA ADVISORY COMMITTEE MEMBERS</u>

Russ Ashton	Member	Housing Authority
Rachel Bratt	Member	Housing Partnership
Steve Garone	Member	Dudley Pond Association
Bob Goldsmith	Member	Conservation Commission
Mike Lowery	Member	Surface Water Qualtiy Committee
Alan Palevsky	Member	Wayland Neighbors 4 Responsible Land Use
Brud Wright	Member	Recreation Commission
Kent Greenawalt	Member	Planning Board
Patricia Reinhardt	Chair	Board of Selectmen
Sarkis Sarkisian		Wayland Town Planner
Tighe & Bond, Inc		Consulting Engineers, Environmental Specialists
Gates, Leighton & Associates, Inc.		Landscape Architects, Planners

Vicinity Map

LEGEND

LOCUS MAP

0 200 400 Feet

1 " = 400 ′

NOTES

Data Source: MassGIS, EOEA

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Environmental Specialists

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Landscape Architecture

Dudley Area Land Use Study

The Town of Wayland, Massachusetts

June ~ 2011

What is Planning

Planning is the application of foresight to action.

Planning is a profession designed to develop and improve our Town. The goals is to create attractive, safe, healthful, and efficient environments for all people both in the present and in the future. Planners are not solitary designers, rather they plan within a collaborative process.

The Charrette Process

A charrette is a highly interactive design process in which project stakeholders learn about project constraints and opportunities while developing a vision of the project. Within a scheduled time frame, a full range of site utilization issues and design alternatives are discussed to achieve an optimum development program. The charrette also yields a cohesive implementation agenda, as well as goals and objectives responsive to the needs of all stakeholders.

Past project charrette sessions

A charrette offers five distinct advantages as a planning tool:

1. It is an interactive, participatory event in which all stakeholders have an opportunity to think and act creatively about a specific project.

2. All participants focus on the project's history, constraints and opportunities at the same time.

3. The charrette provides a timely and cost effective forum for debate, clearly defines relevant design and development issues, structures alternative solutions, and concludes with a graphic presentation of project designs.

4. At its conclusion, stakeholders understand their role and the role of other stakeholders in the project's implementation.

5. The charrette's public presentation, graphic images, design standards, and implementation strategies provide substantial documentation for project approval, implementation and marketing.

Site Drainage

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Environmental Specialists

GLA
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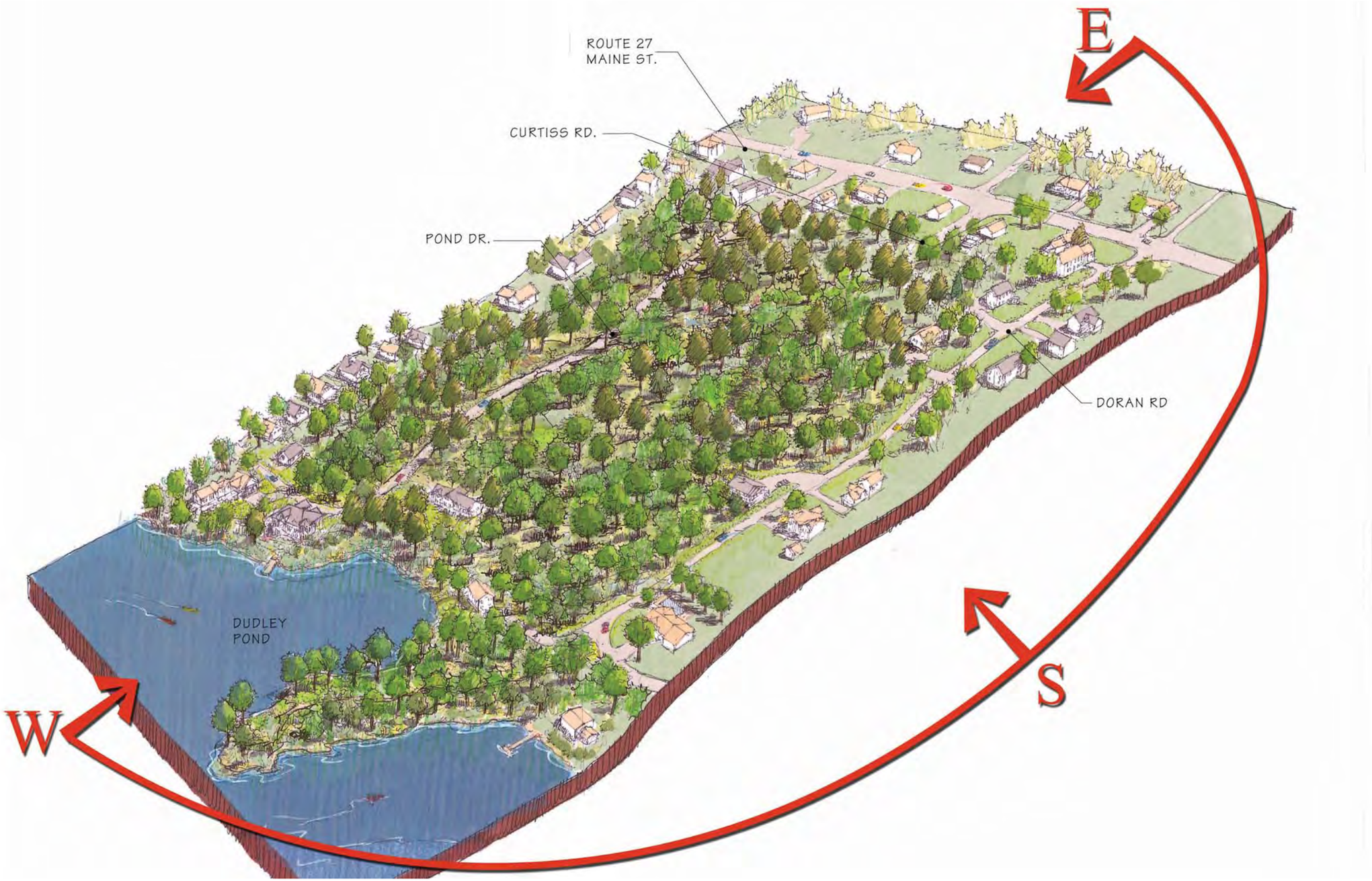
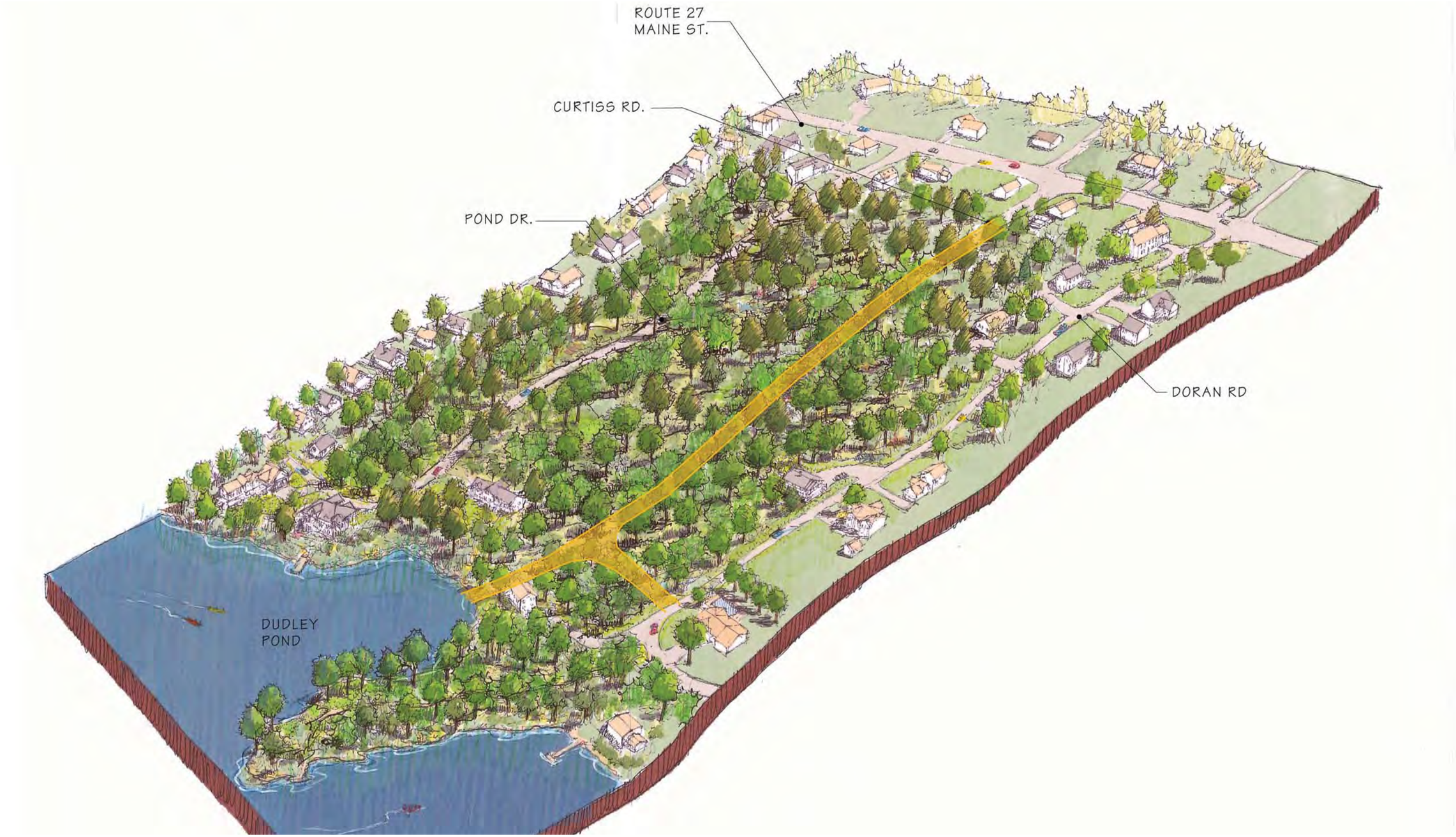
Landscape Architecture

Site Orientation



Easement Road



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Environmental Specialists

GLA
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Landscape Architecture

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The Town of Wayland, Massachusetts
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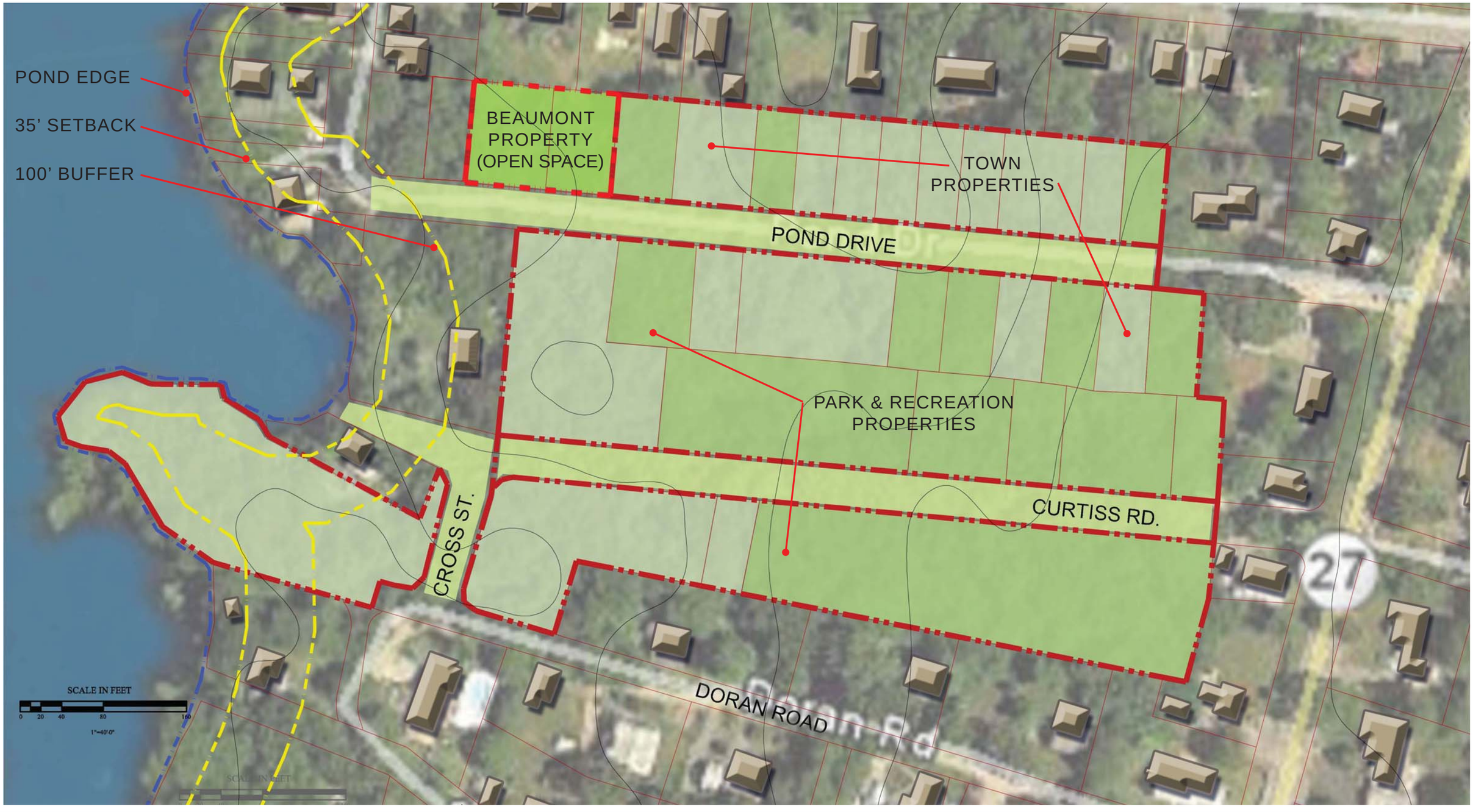
Town Property Analysis



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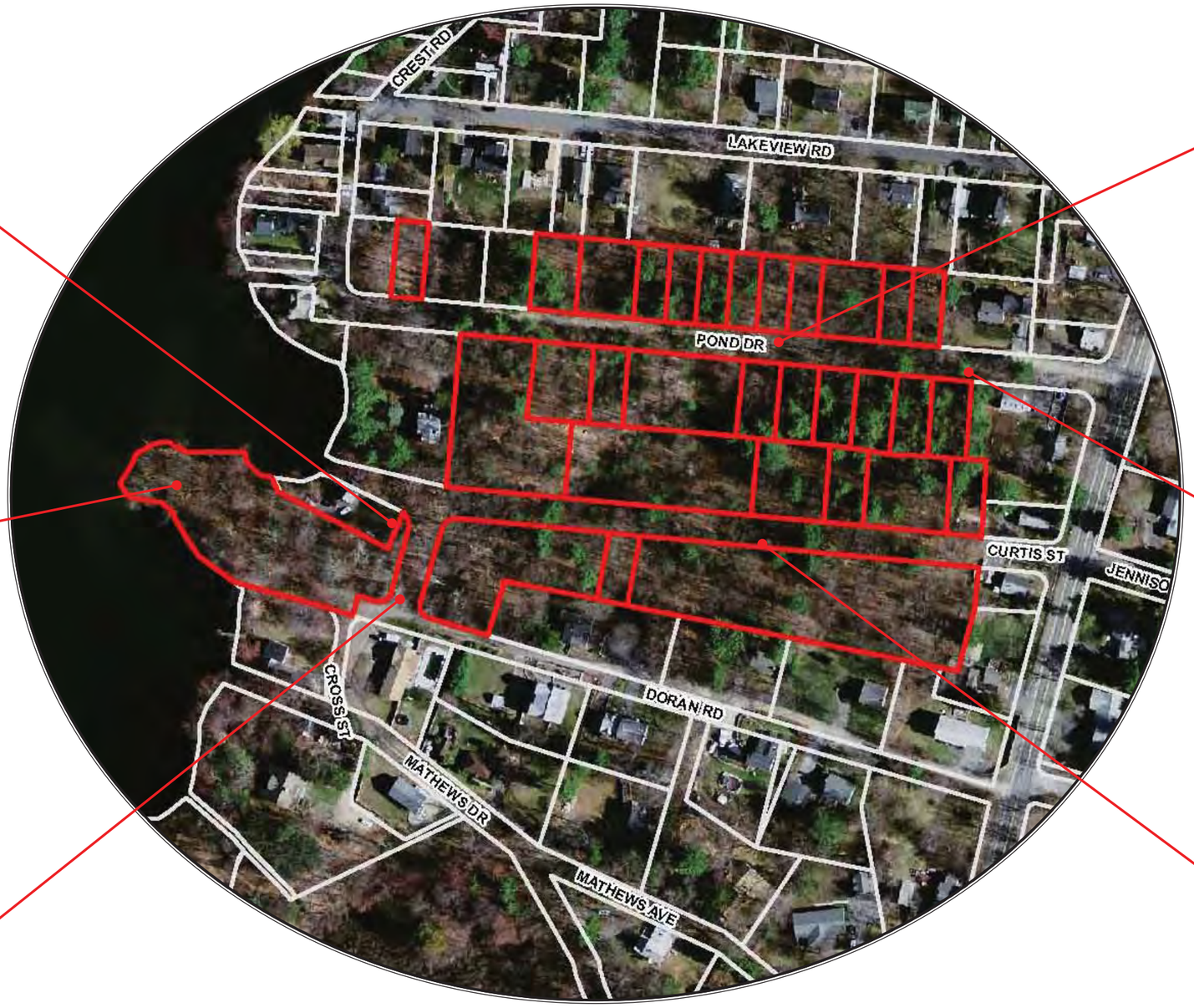
Dudley Area Land Use Study

The Town of Wayland, Massachusetts

June ~ 2011

Existing Site Observations



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Environmental Specialists

GLA
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Landscape Architecture

Dudley Area Land Use Study
The Town of Wayland, Massachusetts
June ~ 2011

View From Above

Charrette 2 – Water Quality

Dudley Area Land Use Study

September 27, 2011

Tighe&Bond

GLA

Recent DAAC Efforts

- **All DAAC Meeting Minutes & Presentations Posted To:**
  - http://www.wayland.ma.us/Pages/WaylandMA_BComm/Dudley/index
- **Tonight's Presentation**
  - **Water Quality Overview**
  - **Wastewater Treatment Alternatives**
  - **Stormwater Treatment Alternatives**

Tighe&Bond

DAAC Charge From Selectmen

- Complementary and compatible uses and orientation of site amenities
- Analysis of wastewater and pond management opportunities and impacts
- Options that improve and emphasize the project area and surrounding neighborhoods character while balancing the concept that project area is a town asset
- Balance general cost with design elements

Tighe&Bond

DAAC Membership

- Rush Ashton-Housing Authority
- Rachel Bratt-Housing Partnership
- Steve Garone-Dudley Pond Association
- Bob Goldsmith-Conservation Commission
- Mike Lowery-Surface Water Quality Committee
- Alan Palevsky Wayland Neighbors 4 Responsible Land Use
- Brud Wright-Recreation Committee
- Kent Greenawalt-Planning Board

Tighe&Bond

Presentation Overview

- Committee Status Update 6:30 to 6:45 (Ms. Reinhart, Chair)
- Wastewater Presentation 6:45 to 7:15 (Mr. Catlow, Tighe & Bond)
- Wastewater Related Public Comment 7:15 to 7:30
- Stormwater Presentation 7:30 to 8:00 (Ms. Adamski, Tighe & Bond)
- Stormwater Related Public Comment 8:00 to 8:15
- Approval of Prior Minutes/Other Business 8:15 to 8:30
- Adjourn

Tighe&Bond

GLA

Dudley Pond History Of Water Quality Issues

Photo Credits: Mike Lowery & Jackson Madnick

- **Historic Problems**
  - Eurasian Milfoil
  - $20 - $80K Annual Mitigation Cost
  - e Coli Contamination
  - Use Limitations
- **Known Sources**
  - Surface Runoff
  - Septic Systems
- **303d Listing**
  - Organic Enrichment
  - Turbidity
  - TMDL Required

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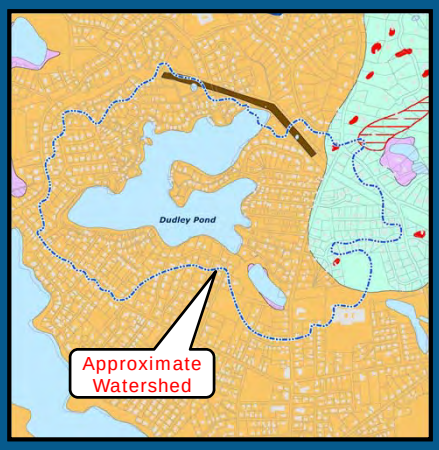
Dudley Pond Hydrogeologic Setting

- **84 Acre Pond**
- **368 Acre Catchment**
- **Pond Depth**
  - Majority 8 – 10 FT
  - Deepest Point 26 FT
- **Soils Are Coarse Sand & Gravel**
  - Short Groundwater Travel Time to Pond



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Dudley Pond Phosphorous Budget

- **Primary Source of Noxious Weed Problem In Pond**
- **Majority of Phosphorous from Two Sources**
  - Stormwater Runoff (58%)
  - Septic Systems (32%)
- **Effective Mitigation Must Focus On Largest Sources**

Phosphorous Budget

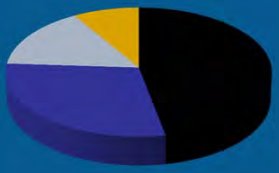
- Stormwater Runoff
- Precipitation On Pond
- Septic Systems
- Regional Groundwater

Tighe&Bond GLA

Dudley Pond Nitrogen Budget

- **Majority of Nitrogen from Two Sources**
  - Stormwater Runoff (47%)
  - Septic Systems (15%)
- **Effective Mitigation Must Focus On Largest Sources**

Nitrogen Budget



- Stormwater Runoff
- Precipication On Pond
- Septic Systems
- Regional Groundwater

Tighe&Bond GLA

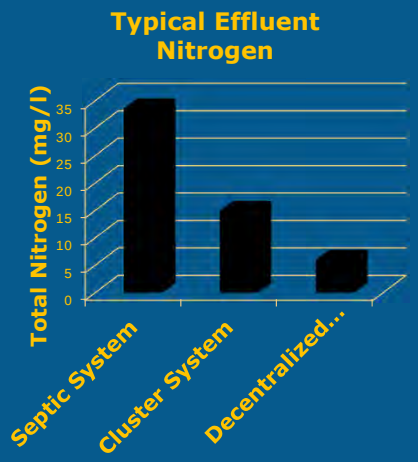
Wastewater Mitigation Alternatives

- **Septic Upgrade Viable Throughout Area**
  - Limited Effectiveness
- **WWTF Only Viable Outside Zone II**
- **Test Pits Completed**
  - Favorable Soils at 7.5 ac Site
  - Favorable Soils at Middle School Site
- **MWRA Connection Via Natick**

Tighe&Bond GLA

Wastewater Mitigation Activities

- **Septic Systems**
  - Repairs Reduce Nitrogen Discharges
  - Repairs Reduce e Coli Problems
  - Septic Systems Provide Minimal Phosphorous Removal
- **Decentralized WWTF**
  - Significant Nitrogen & Phosphorous Removal
  - Not Appropriate for All Locations



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Septic System Characteristics

Wastewater Characteristics for Typical Residential Title 5 Systems[1]

Parameter	Units	Influent Concentration	Septic Tank Effluent Concentration
Biochemical Oxygen Demand	mg/L	210-530	140-200
Total Suspended Solids	mg/L	237-600	50-90
Fecal Coliform	MPN/ 100 ml	10^6 -10^{10}	10^3 -10^6
Total Nitrogen	mg/L	35-80	25-60
Total Phosphorus	mg/L	10-27	10-30

[1]Tchobanoglous, George and Franklin L. Burton. Wastewater Engineering Treatment, Disposal and Reuse. Third Edition. McGraw-Hill, New York, NY. 1991.
[2]EarthTech. Comprehensive Wastewater Management Plan and Environmental Impact Report Phase I Needs Analysis and Screening of Alternatives for the Town of Holliston, MA. December 1998.
[3]The assimilative capacity for phosphorus in the subsurface may be finite. Therefore, long-term SAS effluent concentrations may not be significantly less than influent concentrations.

Tighe&Bond GLA

Septic Needs Analysis

High Concern

- Developed lots <5,000 sf
- Septic system constructed prior to 1978
- Over 4 Pump Outs Per Year

Medium Concern

- Developed lots >5,000 sf and <1/4 acre
- Septic system constructed between 1978 and 1995
- Lots within 100 feet of Dudley Pond
- 2-3 Pump Outs Per Year

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Relative Need for Wastewater Mitigation

HIGHEST NEED

Area 6

Area 1

Area 3

Area 2

Area 5

Area 4

LOWEST NEED

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Wastewater Treatment System

System Components:

- **Limited Collection System**
  - Low Pressure Sewers
- **Treatment**
  - Small WWTF On 7.5 ac Site
  - Off-site Treatment
- **Preliminary Costs**

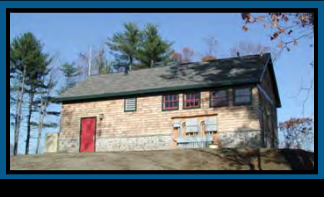
Study Area	1	2	3	4	5	6
System Cost	$1.7M	$2.3M	$1.1M	$1.2M	$1.0	$2.4

Tighe&Bond

Decentralized Wastewater Treatment Facility

System Components:

- **Collection System**
- **WWTF at 7.5 Ac Site**
- **Effluent Force Main to Middle School Discharge Site**
- **Cost: $1 to $5.5M**
  - Varies With Flow & Discharge Permit Limits



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Massachusetts Water Resources Authority Alternative

Design Concept:

- **Low Pressure Sewers Around Pond**
- **Pump Station at 7.5 Ac Site**
- **1 Mile Force Main to Natick Pump Station**

Tighe&Bond

Massachusetts Water Resources Authority (MWRA) Alternative

- **Sewer Interconnection Process**
  - Proceed through the following regulatory review processes:
    - » Massachusetts Environmental Policy Act
    - » Interbasin Transfer Act
    - » Massachusetts Department of Environmental Protection
    - » Sewer Extension or Connection Permit
  - Propose Legislation
  - Obtain Final Approvals from:
    - » MWRA Advisory Board
    - » General Court
    - » Governor
    - » Majority vote at Town Meeting of Wayland to connect
    - » Transporting community must have no objection to provision of sewer service

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MWRA Interconnection Fees

- **Assumed 50,000 gpd flow (150-3 bedroom homes or 250-2 bedroom homes)**
- **Entrance Fee**
  - $200,000 Covers new user's fair share of the costs of the sewer system
- **Annual User Charge**
  - Community being admitted into system: $6,033 per million gallons → approx. $9,050/month ($108,600/year)
  - Individual being admitted into system
    - » Billed through transporting community at local rate:
      - Natick: $294,987/year*
      - Framingham: $482,400/year*
    - » MWRA directly charges user based on unit cost: $70,000 to $100,000 depending on the agreements between MWRA, Wayland, Transporting Community
- **Infrastructure Upgrades**
  - Pump Station & Force Main to Natick: $2.88M
  - 4:1 I/I Removal

* This does not include any part of the approx. $70,000 assessment increase that the transporting community may have Wayland offset

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Public Comment Related To Wastewater

Things to Consider…

- **Extent of Sewering**
- **Growth Impacts of Sewering**
- **Water Quality Impacts of Sewering**
- **Construction Related Disturbances**
- **Project Costs**
- **Economies of Scale**
- **Impact to Home Values**

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Stormwater Contributions

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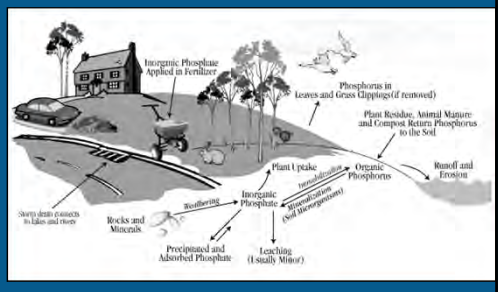
Stormwater Issues

- **Nutrient of concern: Phosphorus**
  - Bounded to particles/sediment
  - Dissolved
- **Main Source in Stormwater**
  - Fertilizers / Lawn Areas
  - Overland Flow
  - Stormwater System
- **Options**
  - Non-Structural
  - Structural



Source: Minnesota Department of Agriculture

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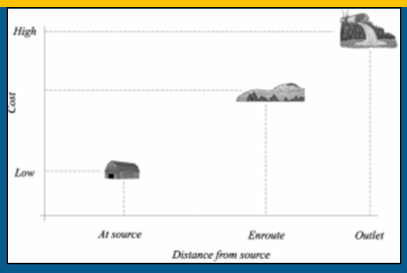
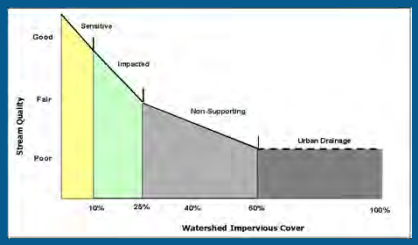
Non-structural BMPs: Control the Source

- **Phosphorus total and dissolved in SW**
  - Lawns
  - Streets
- **More cost effective**
- **More effective control measures**
- **Can be implemented watershed-wide**





Source: The Impervious Cover Model, www.stormwatercenter.net

Non-structural Stormwater BMPs

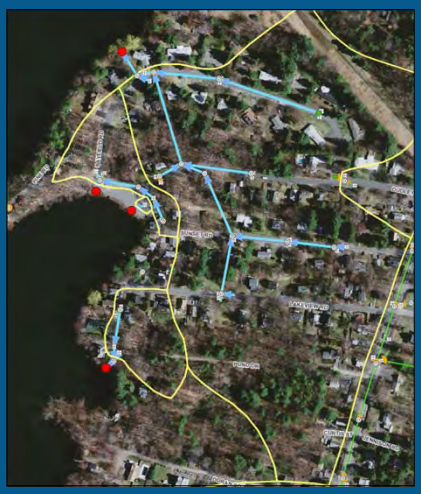
- **Education**
  - Proper use of Fertilizers
  - Xeriscape
  - Rain gardens/pervious pavers
- **Regulation**

Minnesota Phosphorus Lawn Fertilizer Law

- **A soil test or plant tissue test shows a need for phosphorus.**
- **A new lawn is being established by seeding or laying sod.**
- **Phosphorus fertilizer is being applied on a golf course by trained staff.**
- **Phosphorus fertilizer is being applied on farms growing sod for sale.**
- **When these situations do not exist, state law requires phosphorus-free lawn fertilizer is to be used.**

Structural Stormwater BMPs

- Retention Ponds
- Vegetated swales
- Tree Box Filters
- Adsorptive Media
- Infiltration Basins
- Porous pavement
- Hydrodynamic separators
- Bioretention areas/rain gardens



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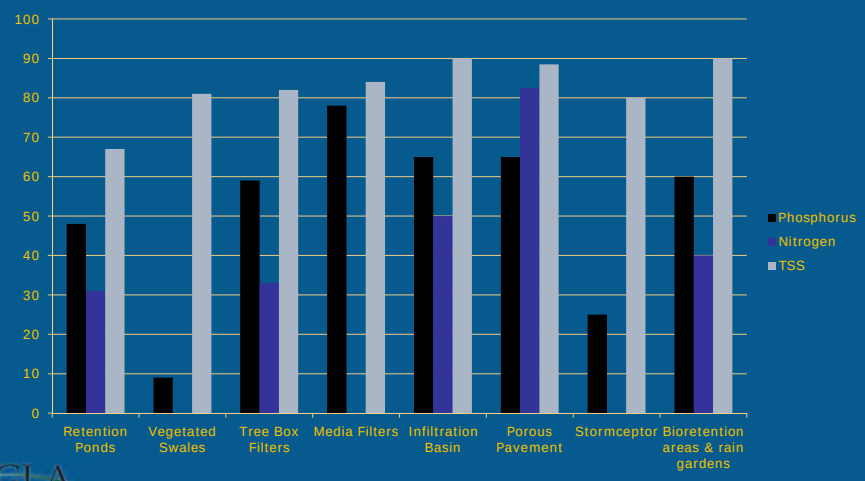
TSS & Nutrient Removal Rates (%)



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Dissolved Phosphorus

- **Up to 50% of phosphorus in stormwater**
- **Removal Options:**
  - Filter Media
  - Biological Uptake
  - Amended media (such as Iron Filings, University of Minnesota Research)

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Rain Gardens

Source: www.lowimpactdevelopment.org/raingarden_design/downloads/RaingardenHow2HomeownerUWExtension.pdf

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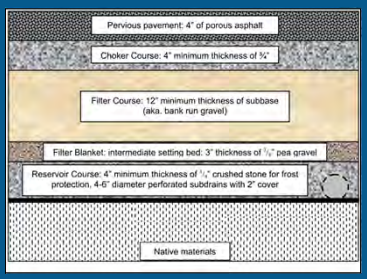
Porous Pavement

- Pavement with air voids to allow water to pass through into a stone reservoir
- Reservoir holds runoff before allowing it to infiltrate into the soil
- Requires routine maintenance/sweeping
- $3.10/sf + for additional subgrade material



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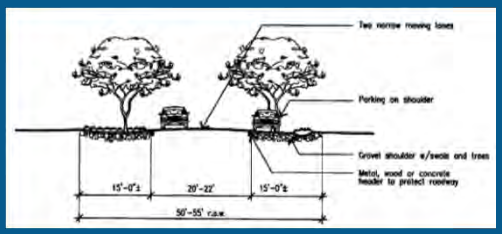
Grassed/Vegetated Swale

- Often used as a conveyance system
- Broad shallow channel with dense vegetation covering slopes
- $5,000 - $10,000 Installed


Grassed swales can be used along roadsides and parking lots to collect and treat stormwater runoff



Source: *Start at the Source*, Design Guidance Manual for Stormwater Quality Protection, 1999 Edition, Bay Area Stormwater Management Agencies Association

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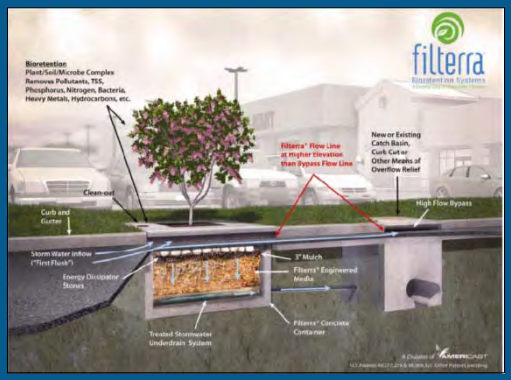
Tree Box Filter

- Treats small drainage area
- Limited treatment potential
- Requires overflow
- Small footprint
- $15,000 installed



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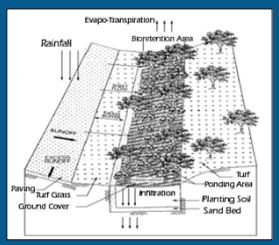
Bioretention Areas

- Uses soils & plants to remove pollutants
- Shallow, landscaped depressions
- Gradually infiltrates through soil, media traps particulate matter
- $25,000



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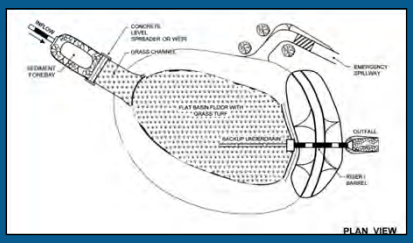
Infiltration Basins

- Permeable soils
- Pre-treatment is critical
- Runoff filters through soil of basin floor
- Option for media amendment such as iron filings to enhance P uptake
- Large area of land downgradient of source
- $125,000



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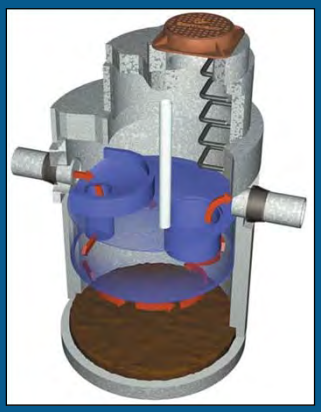
Hydrodynamic Separator

- Several Proprietary Options
- Removes finer sediment, oil, and floating and sinking debris
- 2 chambers – traps oils and suspended solids
- Settle to bottom of chamber by gravity & centrifugal force
- $30,000



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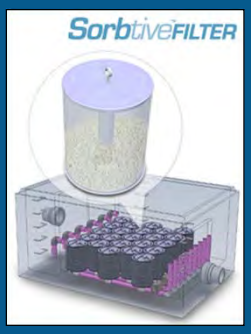
Sorbtive Filter

- Adsorbs dissolved P to media to remove from stormwater
- Granular adsorptive filtration media
- Needs Consistent O&M to Function
- $150,000
- Amended media (such as Iron Filings, University of Minnesota Research)



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Stormwater Opportunity Areas

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Stormwater Opportunity Options

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Stormwater Improvement Potential

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Stormwater Opportunity Options

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Limitations to Siting Stormwater Improvements

Bioretention

- Need large land area
- Downgradient of source
- Need separation to groundwater

Filter media

- Easier to site
- Can be subsurface
- Expense to install and maintain

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Public Comment Related To Stormwater

Things to Consider…

- BMP Effectiveness
- Water Quality Impacts of Improvement
- Construction Related Disturbances
- Project Costs

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