



CHAPTER VII: ENVIRONMENT

A. OVERVIEW

New Haven is located at the confluence of the Mill and Quinnipiac Rivers as they drain into a long and protected harbor at Long Island Sound. The shoreline and tidal wetland areas gradually give way to uplands accented by dramatic trap rock ridge formations at **East Rock** and West Rock.

The environmental health of New Haven is addressed relative to air quality, water quality, and landscape conditions. The recommendations that follow are anchored first in ecological sustainability with ancillary benefits to the region's quality of life and to policies, as well as, regional planning initiatives.

Air Quality

According to CT DEEP, air quality in Connecticut has improved in recent years. The 2010 annual report on air quality for the New England region published by DEEP states that concentrations for most of the other criteria pollutants (nitrogen dioxide [NO₂], carbon monoxide [CO], and **particulate matter [PM]**) measured at monitoring sites throughout New England either declined or remained at historically low levels. A variety of DEEP



View of Mill River and East Rock

Particulate matter and ground level ozone have been linked to numerous health effects, primarily associated with the aggravation of asthma. With asthma rates of nearly 25 percent among school-age children and susceptible elderly populations living in areas of compromised air quality, the issue is one that must be addressed at the local level.

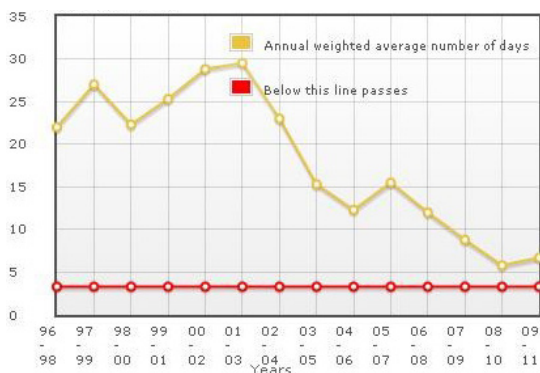


Non-attainment areas are areas that have poorer air quality than National Ambient Air Quality standards.

and EPA regulations have assisted in improving air quality. Of note, unleaded gasoline and vehicle emissions standards have contributed significantly to the change.

Among the key air pollutants, the state as a whole remains in **non-attainment status** for ozone. **Ozone pollution** is usually caused from gases that come out of tailpipes, smokestacks, and many other sources. Children and teens; adults 65 years of age and older; people with existing lung diseases, chronic pulmonary, and cardiovascular diseases; and people who work or exercise outdoors are generally affected by ozone pollution causing respiratory and breathing problems.

New Haven also is **non-attainment for particulate matter**. Particulates, both PM 10 and PM 2.5, encompass a number of airborne substances that originate from mobile and stationary locations. These may aggravate respiratory function and affect children with asthma.

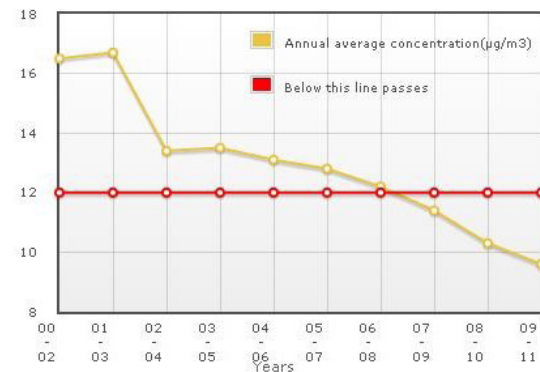


Source: American Lung Association, 2013
Ozone pollution in New Haven County, 2000-2011

Energy Efficiency

In addition to monitoring the key air pollutants, the City of New Haven has also been monitoring **greenhouse gas (GHG) emissions**, which contribute to global warming, and hazardous air toxics, which pose a variety of environmental health issues. The 2001 air toxics inventory found that the New Haven community emitted 16.4 tons of GHGs per capita, similar to other medium-sized cities, but well ahead of state and national averages. By 2009, these emissions per capita reduced to 12.2 tons, nearly a 25 percent decrease since 2001. An analysis of emissions by sector indicates that the majority of these emissions were from commercial and residential sector properties in New Haven in 2009, whereas the majority of GHG emissions in Connecticut were from the transportation sector when monitored in 2007 (2009 data unavailable) as shown in the Databook. The GHG emissions for the industrial sector increased by nearly 5 percent from 1999 to 2009, whereas they decreased considerably for all other sectors.

The GHG emissions from businesses and homes primarily come from fossil fuels burned for heat, the use of certain products that contain greenhouse gases, and the handling of waste. For the transportation sector, they primarily come from burning fossil fuel for automotive uses such as petrol and diesel. For the industrial sector, they primarily come from certain types of chemical reactions necessary to produce goods from raw materials.



Source: American Lung Association, 2013
Particle Pollution in New Haven County, 2000-2011

Many scientists across the globe believe that these greenhouse gas emissions are responsible for causing extremities in climate conditions that were observed in recent years, such as increased severity of cyclones, decreased rainfall, increased incidence of drought, sea level rise, and a general increase in extreme temperatures.

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Deregulation of the electric industry presents an environmental and economic challenge to the city and its residents. From an environmental perspective, the reliance on traditional power sources contributes to climate change and continues to compromise air quality. Viable domestic and renewable sources are necessary to offset potential shortages and rising costs associated with a competitive marketplace and the nation's increasing dependence on imported oil.

The City and the community have taken several steps to improve energy efficiency, largely based on demand-side management, fixture retrofits, and peak saving programs. The City of New Haven's energy management program, which includes all of the aforementioned elements, has realized over \$13 million in cost savings.

The energy consumed in New Haven consists of: electricity, transportation fuels, and fuels used for heating and hot water such as natural gas and heating oil. In all three categories, patterns of energy use in the city changed in the past ten years.

Electricity use in the city totaled 1000 gigawatt-hours (Gwh) in 2010, which is about 4 percent more than was consumed in 1999. Municipal operations represented approximately 5 percent of this total. There has been a decrease of approximately 14 percent in GHG emissions and energy use in the transportation sector.

The amount of energy consumed in the form of natural gas and liquid fuels (primarily heating oil, heavy fuel oil, and liquid petroleum gas) increased by roughly 3 percent from 1999 to 2009. However, during this time, the fuel mix shifted significantly from dirtier liquid fuels—which dropped by almost half—to cleaner burning natural gas. As a result, emissions from burning these fuels dropped significantly despite the overall slight rise in consumption.

Several accomplishments were made over the past decade in ensuring a sustainable environment within the city, some of which are listed below:

- ❖ **5 new fuel cell installations** that make the New Haven a leader in renewable energy adoption in the state.
- ❖ New Haven was the first municipality in Connecticut to sign up for the statewide "20 percent by 2010" campaign on sustainable energy—a commitment to generate 20 percent of energy from renewable sources.



The state's largest photovoltaic array panel (3,920 panels) with a 140.8 kW system was installed on the IKEA store at Sargent Drive in 2012.



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Phoenix Press on James Street installed a 100 kW wind turbine to provide a third of its electricity needs in 2010.

- ❖ The city was the first in Northeast to purchase B50 bio-diesel for its municipal fleet in 2007.
- ❖ New Haven is the leader in the CTCleanEnergyOptions program, which allows residents to sign up for clean electricity through their local utility.
- ❖ New Haven is host to **Connecticut's first and largest commercial wind turbine**, which was installed at Phoenix Press, a family run business, to offset a third of electric needs for the printing plant.
- ❖ In 2005 the City of New Haven became the fourth city in the United States, and the only one on the East Coast, to pass an ordinance allowing free metered parking for hybrid and alternative fuel vehicle cars.
- ❖ The City created its own High Performance School Energy Standards for its 1995-launched City-wide School Construction Program, which maximizes energy efficiency and community involvement. After the development of Leadership in Energy and Environmental Design (LEED) and the expanded use of ENERGY STAR, the City incorporated both standards into its existing framework.
- ❖ Environmental boasts a 196 panel, 72.4 kilowatt (kW) solar array agreement with PSEG regarding the 140 megawatt (mW) expansion of their existing New Haven Station Plant. Modifications to the existing plant and targeted air quality projects will ensure a net air quality benefit for New Haven's residents.



360 State street mixed-use building is the first building in the city to obtain LEED platinum status with a 400 kW fuel cell on site to produce clean, renewable power and a rooftop garden.

Moving forward, the city will require a continued commitment to sustainable environmental policy and a systematic approach to energy efficiency and development of renewable energy resources to further improve air quality and ensure a high quality environment.

Water Quality

New Haven lies at the nexus of several bodies of water. To the west flows the West River, to the east, the Mill River and the Quinnipiac River. All three empty into New Haven Harbor, and eventually Long Island Sound. While much of the historic wetlands have been filled along the harbor and Mill River, extensive wetlands cover much of the Quinnipiac and remain an important part of the local environment. These waterways are not only valuable and potential resources for human use, but they are home to thousands of species of fish, birds, mammals, and invertebrates.

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As stewards of these resources, it is our responsibility to manage them responsibly, to improve them, and to maintain them for generations to come.

Water Quality in Long Island Sound

The city has a long history of heavy industry and commercial traffic, and the waterways have been subjected to pollution. Much of this has settled at the bottom of rivers and the harbor, and over the years, the water quality of the rivers and the Sound has improved drastically. Between 1988 and 2008, chemical discharges into the Sound's watershed have decreased from 35.1 million pounds to 3 million pounds per year, a drop of 91.5 percent. Despite this improvement, the Sound is considered an "impaired body of water" under the Clean Water Act. The main water quality issues in the Sound are high bacterial levels, high nitrogen levels, and low oxygen levels (also known as hypoxia). Many lifeforms cannot tolerate hypoxic conditions, and hypoxic waters therefore become depleted of the fish and shellfish that are vital to a healthy ecosystem. At certain times of year, especially in August, as many as 190 square miles of the Sound can become hypoxic.

All of these problems are caused by the release of wastewater into the Sound (discussed in detail in the following section). High bacterial levels result from stormwater runoff and combined sewer overflows (CSOs). Wastewater, even when properly treated, can have high levels of nitrogen. Though not toxic itself, the nitrogen in wastewater causes ecological changes in the Sound that results in hypoxia. In order to manage these problems, the States of Connecticut and New York have formed the Long Island Sound Study, a research and management body that drafted a 15-year management plan to improve water quality in the Sound. The City of New Haven participates in this plan by working to reduce CSOs and nitrogen emissions into the Sound.

Drinking Water Quality

New Haven's water needs are met by three main fresh water sources. More than 80 percent of tap water comes from lakes to the north, with the rest sourced from the Quinnipiac and Mill River aquifers in Cheshire and Hamden, and the Housatonic River aquifer in Derby and Seymour. New Haven has good drinking water quality. New Haven's water has low quantities of Safe Drinking Water Act-designated pollutants in most cases, and meets the standard safe levels of contaminants in drinking water. Watersheds are maintained by the South Central Connecticut



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Regional Water Authority (RWA) through direct ownership and conservation easements, which encompass over 26,000 acres throughout the New Haven area.

The majority of New Haven residents receive their tap water from RWA. The Regional Water Authority provides water to multiple municipalities in the Greater New Haven area, serving a total population of approximately 430,000, of which 124,000 are in New Haven. The per capita water usage adjusted to population count indicated that in 1987, per-capita water usage in Greater New Haven totaled 58,927 gallons whereas, in 2008, that figure was 42,805 gallons—a 27 percent decrease. Overall the trend shows that water use has had a significant—and statistically relevant—drop over the previous years. A number of factors underlie this downward trend in water use, the most important of which likely include a shift away from heavy industry and manufacturing in the New Haven area, economic trends, and the introduction of more efficient technologies in homes.

Sewage and Stormwater

One of the most important issues for any city is the issue of wastewater, including sewage and stormwater. In New Haven, these two forms of wastewater are closely connected, and a major reason for our rivers and harbor areas failing to meet water quality standards. The dedicated stormwater system in New Haven is owned and operated by the City. During a rain or storm event, water running over man-made structures such as streets, gutters, and buildings picks up oils, fuel, and other chemicals that, untreated, have a negative impact on waterways. According to the EPA, stormwater runoff is responsible for approximately 70 percent of all water pollution in lakes, rivers, and creeks. Effective stormwater management requires working with the natural environment and **reducing impervious built cover**. The City needs to consider **more effective non-point source pollution prevention and mitigation programs**, including exploring options to shift stormwater costs to a more fair allotment based on impervious cover ownership and use throughout the city.

New Haven’s centralized wastewater system is owned and operated by the Greater New Haven Water Pollution Control Authority. Created as a regional wastewater authority in 2005, GNHWPCA provides wastewater services to New Haven, Hamden, East Haven, and Woodbridge. Sewage in all four municipalities is pumped through 30 pump stations to the East Shore Water



View of rooftop garden installed on mixed-use building at 360 State Street

Several communities across the country are adopting a major policy shift in protecting the quality of the natural environment and ensuring sustainability by encouraging natural infiltration measures as opposed to promoting standard hard engineering conventional methods for managing stormwater runoff.

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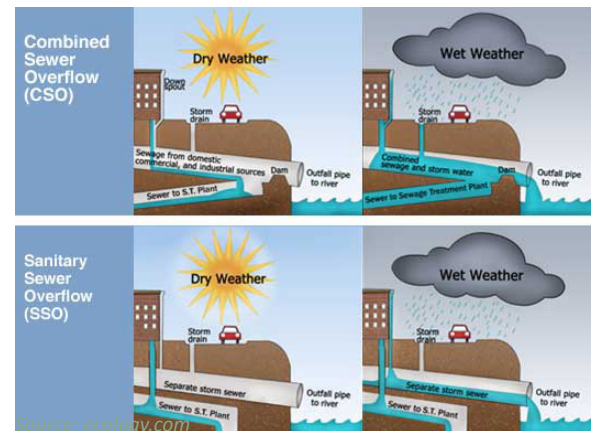


Pollution Abatement Facility (ESWPAF) in New Haven where it is treated and discharged into New Haven Harbor. Unlike other municipalities served by the GNHWPCA, New Haven has a combined sewer collection system in certain sections of the city. Combined sewers collect both sewage and stormwater runoff within the same piping network. During heavy rain events, this system is used to its full capacity and wastewater sometimes overflows into our local rivers and harbor. When this condition occurs it is called a **combined sewer overflow (CSO)** event. CSOs are permitted and regulated by DEEP under the National Pollution Discharge Elimination System permit program.

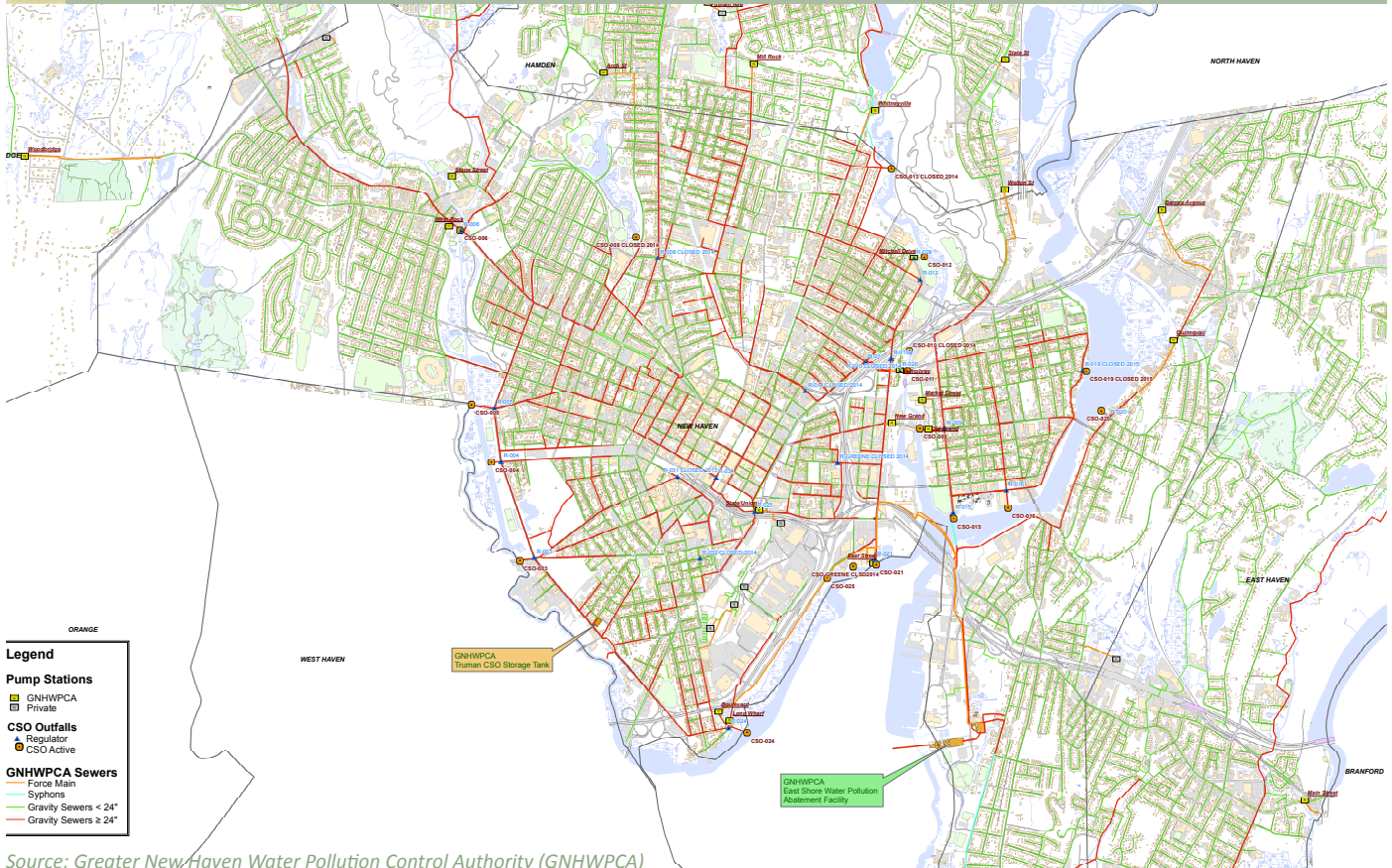
The GNHWPCA's ESWPAF has a permitted design capacity of 40 million gallons per day (mgd) and processes approximately 26.5 mgd on an average dry weather day (i.e. no rainfall) with roughly 18.0 mgd from City of New Haven sewer users. Therefore, under dry weather conditions the ESWPAF currently operates at approximately 66 percent capacity.

The ESWPAF has the ability to provide both primary and secondary treatment beyond the design capacity up to 60 mgd of sewage on a wet weather day (i.e. day with rain) and can provide primary treatment and disinfection for flows up to 115 mgd. All flows exceeding the maximum capacity of the ESWPAF and the wastewater collection system overflow at some or all of the **13 permitted CSO outfalls throughout the City of New Haven** (see map on following page). Currently, CSO events occur between 30 and 35 times in any given year depending on the duration and intensity of rain events. Hydraulic models predict that the ESWPAF currently treats approximately 89 percent of the combined sewer flow while approximately 11 percent of the flow overflows at the CSO outfalls during a two-year rainfall event (2.05 inches of rain in 6 hours).

Further plans to eliminate CSOs during the two-year rainfall event lie within the implementation of the CSO Long Term Control Plan (LTCP). Prior to regionalization, the City of New Haven began implementing the CSO LTCP in order to improve the water quality of the West River, Mill River, Quinnipiac River, New Haven Harbor, and ultimately Long Island Sound. The GNHWPCA has continued with implementation of the CSO LTCP. CSO volumes have been reduced by 66 percent on an annual basis since 1997 through implementation of projects included in the CSO LTCP.



Sanitary sewers prevent untreated sewage from overflowing into rivers and the harbor during heavy rainfall.



Source: Greater New Haven Water Pollution Control Authority (GNHWPCA)

There are currently 13 CSOs outfalls in New Haven. An additional five have been closed since 2014.



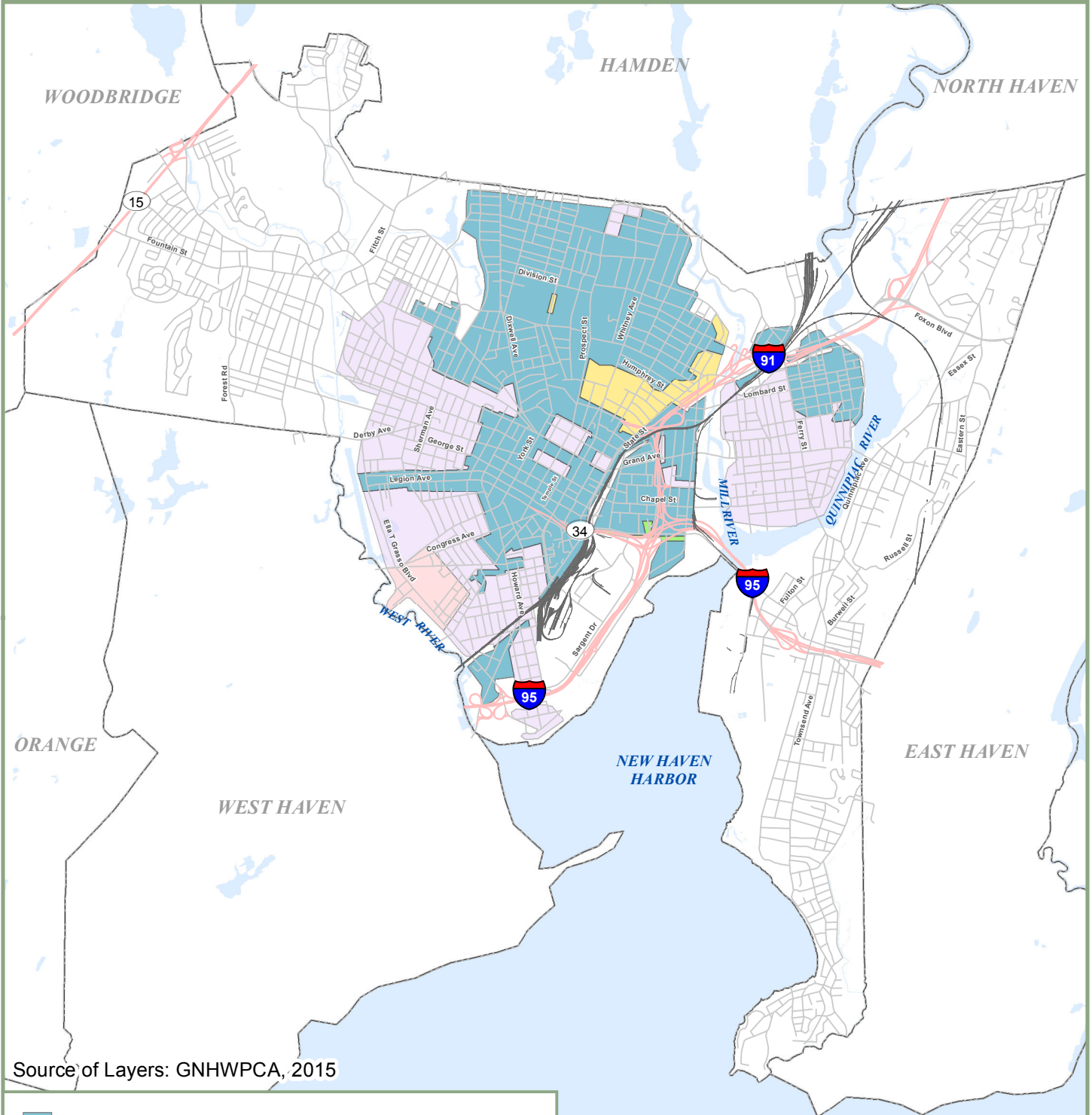
View of recently installed bioswale at Edgewood School. With the help of federal grant money, the City plans on installing nearly 200 bioswales all across the city, within the next two to three years, to manage stormwater runoff effectively.

The benefits, when implementation of the CSO LTCP is complete, will include eliminating 100 percent of CSOs for the average annual rainfall (including the two-year design storm), reducing basement backups and street flooding, and protecting critical shoreline areas. In addition to these measures, the GNHWPCA is currently conducting a study to explore the feasibility of implementing **green infrastructure** projects to assist in the goal.

Parks and Open Space

New Haven has a total of 121 parcels of open space which comprise just over 2,000 acres. Of these, there are 33 major areas for recreational use totaling 1,860 acres.

NEW HAVEN VISION 2025 STATUS OF SEWER SEPARATION MAP



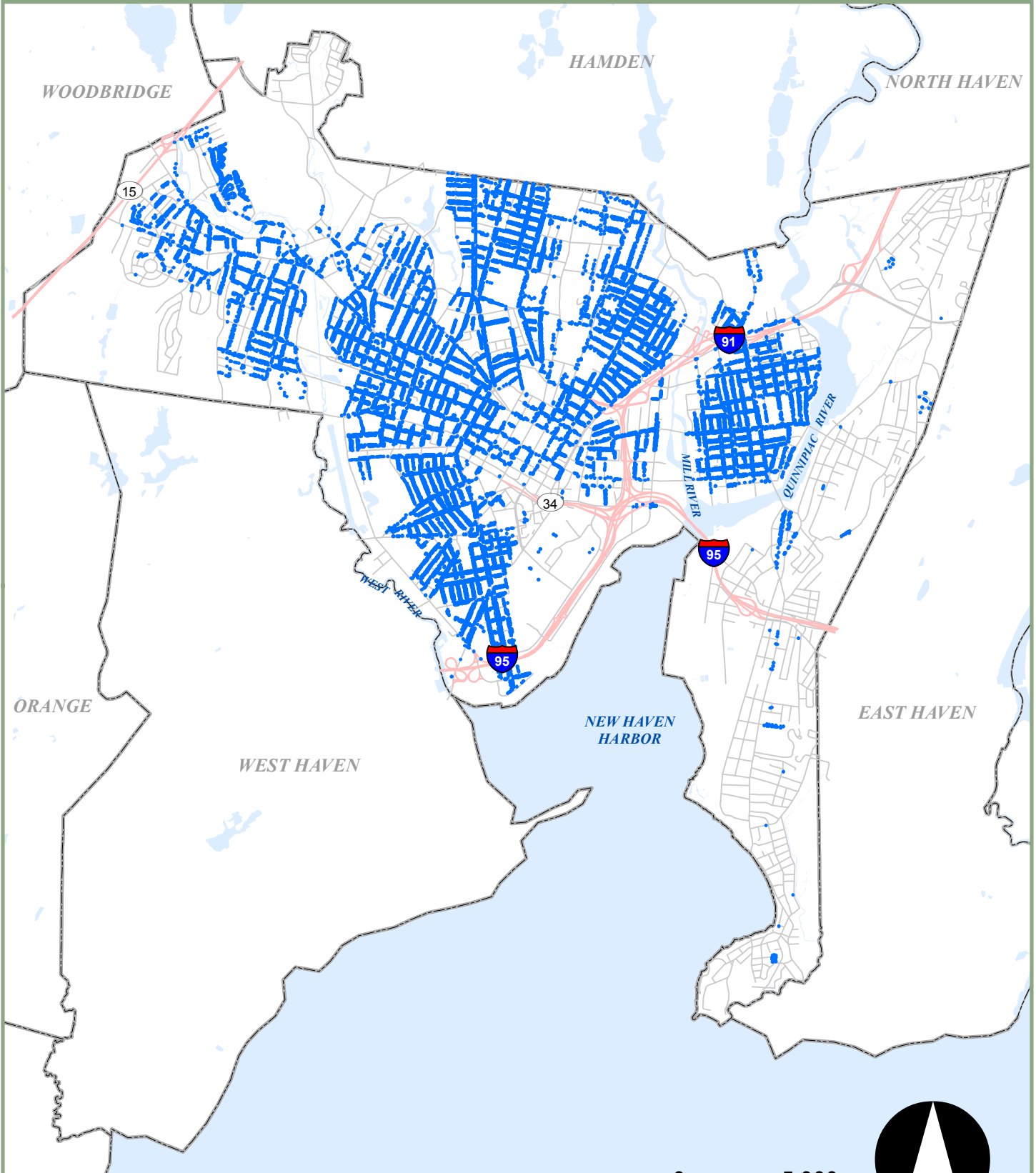
Source of Layers: GNHWPCA, 2015

- Completed
- Under Construction
- Under Design
- Combined
- Originally Separated
- Combined Area Served by Truman CSO Storage Tank

0 5,000
Feet



NEW HAVEN VISION 2025 EXISTING AND PROPOSED SEWER CONNECTIONS



● Active sewer connections

Source of Layers: GNHWPCA, 2015

0 5,000
Feet



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The city has four important public squares. The first is the **New Haven Green**, the central public space of the original nine square layout of 1638. It is the oldest public square in the country and plays host to a number of summer festivals. Another important public square is **Wooster Square**. This beautiful urban square comes alive each spring when the dozens of cherry trees lining the perimeter burst into full bloom providing a visual cascade of white and pink flowers and filling the air with a sweet fragrance. The next is historic **Trowbridge Square**. This square was laid out as part of the egalitarian social vision of local ministers in the early 19th century. Trowbridge Square area was designed to be a smaller copy of the original nine squares layout with the square itself centering the development. Today this historic site and neighborhood is undergoing a renaissance after years of decline. The last significant public square is **Chatham Square**, a formal neighborhood square anchoring the northeast part of Fair Haven.

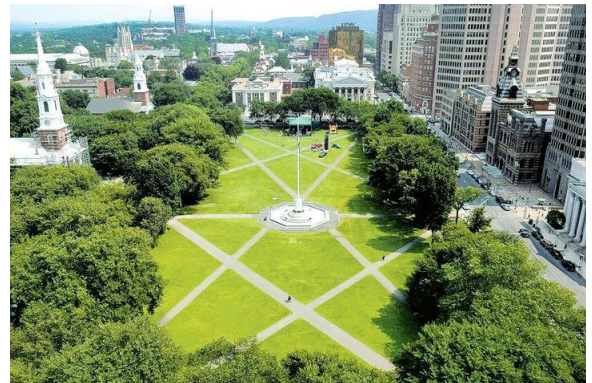
The largest recreational parks in the city are major geological features. The largest of these two trap rock promontories is East Rock Park, comprising 442 acres. This City-owned park features many hiking/walking trails and picnic areas, and the view from the top of the park overlooks the city and harbor. The other trap rock promontory is the State-owned and historically significant West Rock Park with 355 acres of quiet woodland and hiking/biking trails. It was here in West Rock Park that the famous “regicides” of early New Haven hid out in caves to avoid capture by the forces of England’s King Charles II after the restoration of the monarchy in the middle 17th century.

Among the significant recreation-oriented parks are Edgewood Park, West River Memorial Park, Lighthouse Park (including a boat launch), East Shore Park, Fort Hale Park, and Long Wharf Park. These facilities, along with a variety of additional smaller sites provide a broad mixture of passive and active recreation.

In 2009, the City of New Haven partnered with URI and announced a five-year commitment of planting 10,000 trees in the city, i.e., up to 2,000 each year. To date, the city planted an average of 600 trees between 2009 and 2014 and is set to reach its target of planting 10,000 trees by 2016.

Solid Waste

New Haven’s waste is composed of residuals from containers and packaging (31 percent); food scraps (13 percent); yard trimmings



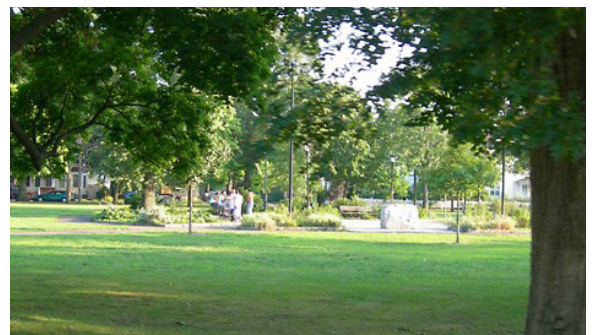
New Haven Green



Wooster Square



Trowbridge Square



Chatham Square



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(13 percent); durable goods (18 percent); and non-durable goods such as paper, rubber, and textiles (24 percent). These figures show that while increasing the recycling rate of paper and plastic packaging is a worthwhile goal, much progress can also be made by encouraging repair and reuse of durable goods such as appliances, and by purchasing products with reduced packaging.

The City provides waste and recycling receptacles to most residences for curbside collection as a public service, and to many commercial entities on a fee-paying basis. Waste is collected weekly and bulk collections are scheduled periodically. All municipal solid waste (MSW), construction and demolition (C&D) debris, and recycled materials leave New Haven via the City's transfer station. About 90 percent of the City's MSW is burned along with natural gas to generate electricity. The remaining 10 percent of MSW is not incinerated and is sent to a landfill along with the incinerator ash.

There is virtually no landfill space left in the state. For this reason, resource recovery is vital, as it both reduces the landfill burden and saves money. In New Haven, recycling is collected and sent to a single stream sorting facility where recyclables are grouped according to material type and sold as feedstock for industrial processes. Whereas MSW is costly to dispose of, recycling saves the City money and provides income from the sale of recycled material. For every ton of recyclable material diverted from the waste stream, the City saves \$105. Sending the remaining waste to **landfills and incinerators has significant impacts** on the environment and public health.

For these reasons, both financial and environmental, the City should work to increase the recycling rate and reduce the amount of waste sent to incinerators and landfills. This will require a two-part strategy: first, through better waste management, including recycling and composting and second, through the reduction of the amount of waste that is generated in the first place. Source reduction is the fastest, easiest, and most cost-effective means of minimizing the environmental impact of waste. The City currently has in place residential a recycling program for up to six units, which includes curbside pick up or drop off at recycling center, and commercial and multi-family recycling programs for businesses and residences with more than six units.

Landfills produce a toxic liquid called leachate, as well gaseous pollutants such as methane, carbon dioxide, and other volatile compounds. Incinerators, though they save scarce landfill space and generate electricity, are sources of sulfur dioxide, nitrogen oxides, chloride, hydrogen fluoride, carbon monoxide and dioxide, dioxins, furans, metals, dust, and volatile organic compounds.

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Coastal Areas

As a shoreline community, New Haven is home to many coastal resources. Tidal wetlands and salt marshes are among the City's most significant environmental assets and integral components of coastal ecology. Tidal wetlands provide nutrients and habitats for shellfish and coastal organisms, and are popular nesting and feeding spots for shorebirds. Much of New Haven's tidal areas were filled in over the last century. In non-filled areas, tide gates have dried much of the remaining salt marsh. Natural tidal areas are still found at Vietnam Veterans Memorial Long Wharf Park ("Long Wharf Park") and along the North Haven town line to the east side.

The lower Mill River and Quinnipiac River areas are the center of the City's aquaculture industry. New Haven Harbor is home to high quality and quantity oyster beds and is a central contributor to Connecticut's premier status in the industry. The \$62 million Connecticut oyster industry represents 94 percent of all production in the Northeast. Dockside facilities are located on the rivers. The eight distinct coastal land areas based on geographic setting are: West River, City Point, **Long Wharf**, Canal and Belle Dock, Fair Haven, Quinnipiac Meadows, Port District, and East Shore.

Coastal area planning plays an important role in the city's land use development. Historic and more contemporary land use patterns are shaped in relationship to the city's waterfront and riverfront locations. Current conditions within the coastal zone suggest a number of opportunities to affect positive change. These opportunities directly relate to immediate concerns, including real estate development pressures, environmental issues, the presence of deteriorating waterfront property, and planned transportation improvements. The City Plan Commission's **Harbor Plan** (2002) adopted in 2002 emphasizes a balance of economic development, environmental sustainability, and cultural enrichment along the waterfront. Considering the changes that occurred in Long Wharf area over the past decade, an updated plan is needed with the intent to develop a framework for the redevelopment of this area into a more mixed-use, more dense, commercial and coastal district.

The Coastal Management District comprises approximately 3,700 acres and 5,300 parcels of land. Over 40 percent of all land in the district is exempt property, including large areas of protected open space and park land, as well as institutional and government



View of Long Wharf pier which is home to the historic Schooners Amistad and Quinpiack.



The City's Harbor Plan, which dates from 2002, is in need of an update in order to address present day conditions.



Over the past decade, coastal and inland flooding events have increased in Connecticut causing property damage all over the state, including New Haven, and disrupting quality of life for many residents. Three flash floods, two major summer storms (Hurricane Irene in 2011 and Hurricane Sandy in 2012), and 16 major winter storms were recorded in Connecticut between 2003 and 2010.

facilities. Just under 700 acres (19 percent) of all district land is used for residential purposes. There are over 5,600 residential units, not including apartments and condominiums, within the district. Commercial and industrial uses, including the Port of New Haven, comprise the balance of coastal area lands. All development activities within the Coastal Management District are currently regulated through the City’s Coastal Area Management (CAM) District regulations.

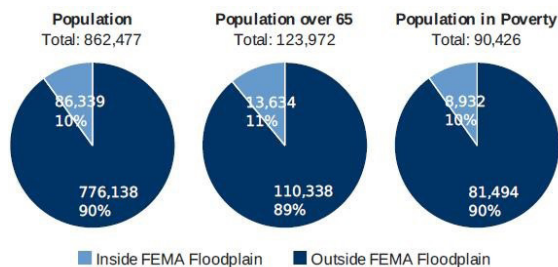
Flood Mitigation

New Haven lies in the zone of westerly prevailing winds and often experiences cyclonic disturbances that have crossed the country from the west or southwest. It is also exposed to coastal storms, some of tropical origin, that move up the Atlantic coast with heavy rainfall. In late summer and autumn these storms may attain hurricane intensity. Most **inland flooding** in New Haven is caused by storms with heavy rainfall.

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of floodplain management. This flood has a 1 percent chance of being equaled or exceeded each year and is expected to be exceeded once on the average during any 100-year period. Similarly, a 500-year flood has a 0.2 percent chance of occurring in a given year. The 500-year floodplain is shown to indicate areas of moderate flood hazard.

FEMA has information to demonstrate areas within the City of New Haven that are **vulnerable to flooding** such as recently updated (2013) Flood Insurance Rate Maps (FIRM) and a Flood Insurance Study (FIS). In some areas of the city, flooding occurs from heavy rains with a much higher frequency than those mapped by FEMA. These frequent flooding events occur in areas of the city with insufficient drainage, where conditions may cause localized flash floods, and where tidal influences may exacerbate drainage problems. According to Connecticut’s Natural Hazard Mitigation Plan (2010), a moderate **Category 2 hurricane** was expected to strike Connecticut once every ten years, whereas a **Category 3 or 4 hurricane** is expected before the year 2040. These frequencies are based partly on the historic record.

According to the FIRMs updated in 2013, approximately 2,564 acres of land in New Haven are located within the **high risk flood zones** with at least a 1 percent chance of flooding (A, AE, AO and



Source: NOAA, 2013 (Based on US Census 2010 Estimates)

A Snapshot of Flooding Risk in New Haven County



Hurricane Irene’s Impact on Edgewood Park



Shoreline Erosion at Long Wharf Park due to Hurricane Irene.

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VE flood zones). The total includes actual river and stream ways, as well as parts of the East Shore/Tweed Airport area that are located in East Haven. The map on the following page illustrates special flood zones in and around Union Station, Boulevard/Kimberly and the Port District. New buildings or uses within these zones are subject to the revised regulations provided within the Flood Damage Prevention District, Section 56 of the New Haven Zoning Ordinance. The Flood Damage Prevention District allows the same uses as that of the underlying zone with additional design/development restrictions to minimize damage in the event of flooding.

Climate Change and Sea Level Rise

New Haven's climate is characterized by moderate but distinct seasons. The average mean temperature is approximately 52 degrees, with summer temperatures in the mid-70s (daily average) and winter temperatures in the mid-30s Fahrenheit. Extreme conditions raise summer temperatures to near 100 degrees and winter temperatures to below zero. Mean snowfall is approximately 52 inches per year and average annual precipitation is 52.3 inches. The continued increase in precipitation only heightens the need for hazard mitigation planning, as the occurrence of floods and other hazards may change in accordance with the greater precipitation.

The Intergovernmental Panel on Climate Change (IPCC) concludes that there has been a global mean rise in sea level between 10 and 25 cm (approximately 4 to 10 inches) over the last 100 years (Neumann et. al., 2000). Relative **sea level rise in Connecticut** in the same time period is estimated as between 1.5 and 3.0 millimeters per year. In Connecticut, the current rates of sea level rise are 2.54 millimeters (0.10 inches) per year in Bridgeport and 2.03 millimeters (0.08 inches) per year in New London. These trends exceed the global mean trend of sea level rise of around 1.52 ± 0.51 millimeters (0.06 ± 0.02 inches) per year (Environmental Defense, 2004). Including the effects of regional subsidence, sea level is likely to rise two feet along most of the Atlantic coast in the next 100 years (US DOT, 2002). The Nature Conservancy, a global conservation organization, has also developed future scenarios for flooding in New Haven due to sea level rise that are included within the Databook. (See Appendix).

The areas susceptible to sea level rise in New Haven are the areas surrounding New Haven Harbor, the tidal areas of the Quinnipiac and Mill Rivers, and the lower reaches of the West River. In general,



Flooding at IKEA located on Sargent Drive, along Long Wharf Coast, due to Hurricane Sandy in 2012.



Sea Level Rise Due to Hurricane Irene Impact at Morris Cove in 2011



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Floodgates installed at Dean Street in Morris Cove neighborhood.

areas below an elevation of four to five feet are vulnerable to rising sea level. Transportation infrastructure at risk includes the railroad station and track yards, Tweed-New Haven Airport and parts of Interstate 95. Port facilities on the water's edge, docks, jetties, and other facilities are deliberately set at an optimal elevation relative to the water level, and therefore a rise in sea level leaves them at a suboptimal elevation. The most vulnerable areas are those where topography is relatively flat, such as the Morris Cove neighborhood, areas adjacent to the harbor, and properties along the Quinnipiac River estuary that are accessed from Middletown Avenue. The City currently has in place **structures that prevent shoreline erosion**, such as bulkheads and seawalls. The existing riprap at Criscuolo and Quinnipiac Parks protect the shoreline up to the level of the current high tide.

The City's flood prevention ordinance is useful in implementing flood proofing measures within new developments/and rehabilitation activities proposed in existing developments. In addition to this, coastal resiliency measures must be undertaken along the coast to prevent loss of lives or property due to sea level rise. Funding is needed to assist private property owners in mitigating the impacts of sea level rise.



B. PLANNING CONSIDERATIONS

- ❖ The harbor area is enriched with a number of assets, including an extensive park system, a working port district, and ecologically significant tidal marshes.
- ❖ These assets are compromised by adverse environmental impacts including air and water pollution and inappropriate use of coastal area land, as well as the spatial constraints largely derived from railroad and highway rights-of-way.
- ❖ The City will require a continued commitment to sustainable environmental policy and a systematic approach to energy efficiency and development of renewable energy resources to further improve air quality and ensure a high quality environment.
- ❖ To mitigate the range of adverse impacts associated with the highway, the City must be proactive with regard to environmental protection, contextual design, construction operations, and land preservation.
- ❖ The City's approach should be based on a commitment to quality of life issues, balancing economic development, environmental protection and cultural enrichment.
- ❖ Moreover, the approach must account for the coastal area as a unique resource in need of a critical mass of sustainable activities.
- ❖ This critical mass includes not only the traditional pattern of commercial development, but also a commitment to mixed-use environments and public access.
- ❖ Given the land constraints along the waterfront, redevelopment and long-term spatial planning strategies must be employed to achieve a critical mass.
- ❖ Due to the recurring coastal events experienced over the past decade and the rising sea levels, coastal resiliency measures must be undertaken along the coast to prevent loss of lives or property due to sea level rise.
- ❖ In order to ensure a sustainable and high-quality environment, source reduction methods should be adopted for waste management and stormwater management.
- ❖ A major policy shift is needed in stormwater management i.e., from promoting hard engineering solutions to promotion of natural infiltration measures.



C. GUIDING PRINCIPLES FOR RECOMMENDATIONS

- ❖ Improve air quality and surface water quality.
- ❖ Continue to protect drinking water quality.
- ❖ Protect and preserve environmentally sensitive areas.
- ❖ Encourage the creation of safe open space opportunities and community gardens.
- ❖ Encourage increased positive use of city’s parks to enhance public health.
- ❖ Protect floodplains from inappropriate development so as to prevent the loss of life or property due to flooding.
- ❖ Implement measures to correct existing flooding issues in the city.
- ❖ Mitigate the impacts of sea level rise.
- ❖ Promote awareness and education regarding coastal flooding issues.
- ❖ Provide sustainable food options for all neighborhoods.
- ❖ Encourage energy conservation and greenhouse gas reduction.

D. RECOMMENDATIONS

Natural Systems

- ❖ Continue to monitor environmental indicators on air and water quality for the city and establish a set of baseline indicators for further improving these indicators over the next decade; update these indicators periodically and assess progress made.
- ❖ Promote conservation of natural habitat and archaeological sites through development standards that encourage sound land use practices. To that end, publish the **city’s endangered species** location map (prepared by CT DEEP) and map of archaeological resources on City web page and raise awareness on protecting these habitats/resources.
- ❖ Work with private property owners of environmentally significant sites contributing to the natural heritage to propose conservation easements to preserve such sites.



Peregrine Falcon, one of the endangered species, found on East Rock cliff.

Environment



- ❖ Continue to enhance public health and quality of life by allocating adequate resources for a litter-free urban environment that is free of trash, litter, graffiti, and other blight inducing elements.
- ❖ Facilitate the linkage of all existing and proposed trail networks within the city (*Plan for Greenways & Cycling Systems*, 2004) and increase public access to city's waterfront. To that end, the Commission recommends assessment of opportunities along waterfront to promote ecotourism and selective acquisition of parcels along waterfront for **promoting access to waterways** and thus capitalizing on the city's wealth of natural resources.
- ❖ Continue to seek funding to remediate contaminated sites (aka brownfields). To that end, explore the feasibility of promoting urban farms, community gardens, and other recreational uses as interim uses for such sites.



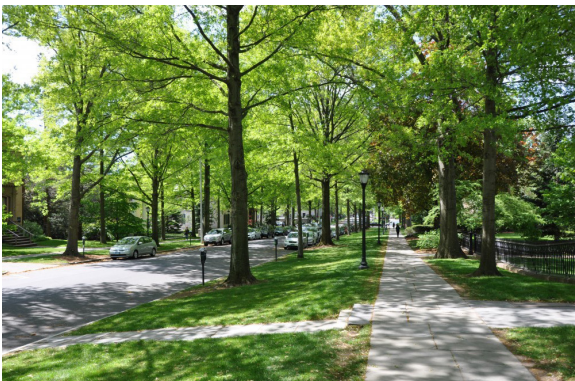
A conceptual view of a trail along Long Wharf Park which would help enhance residents access to the waterfront.

Air Quality

- ❖ Partner with the public and private sector companies to ensure at least 30 percent reduction rate in VMT for the city over the next decade. To that end, build the missing infrastructure for enhancing existing bike/pedestrian network and facilitate enhanced use of transit through the implementation of effective land use, housing, transportation, and economic development strategies (as discussed in previous chapters). Promote residential densities and land use patterns that facilitate increased transit use and further reduce local VMT movements.
- ❖ Continue to pursue broad reductions in pollutants, ozone, particulate matter, and other air toxic emissions from point, area, and mobile sources, according to priorities identified by the Connecticut Air Toxics Inventory (updated in 2005). To that end, continue to encourage the use of diesel-powered on- and off-road vehicles to reduce automobile emissions, expand car-sharing programs, and encourage private owners to locate publicly available bicycle sharing facilities throughout the city.
- ❖ Partner with local employers to encourage transportation demand management strategies such as telecommuting, carpooling, van pooling, Transit Check, etc.



Environment



Hillhouse Avenue, example of a green street



Rain barrels could be used to reduce runoff from stormwater by collecting and storing rainwater from rooftops and using it later to water plants and yards.

- ❖ Continue to promote complete streets policy within the city. The Commission recommends an update to the *Complete Streets Design Manual* (prepared in 2010) to include urban street design standards that help implement “green streets.”
- ❖ Encourage the implementation of **source reduction methods** to reduce stormwater runoff. Explore the feasibility of sharing and re-using industrial waste within the city’s light industrial areas to reduce the amount of waste generated. Identify and seek new sources of funding to educate residents about various source reduction methods and assist them in implementing these methods.
- ❖ Continue to utilize renewable power sources for all City-owned buildings and educate private property owners regarding the benefits of using renewable power sources to the natural environment. Encourage the use of green technology, green building standards, and careful site planning within all types of existing and new developments in the city. To that end, identify and secure new sources of funding to implement a far reaching energy program within the city.
- ❖ Encourage full access between freight railroads and the Port District, in particular by extending rail service along Waterfront Street and to the North Yard to reduce some of the existing commercial vehicular traffic.
- ❖ Support and promote commercial and non-profit urban agriculture as one important method of mitigating the urban heat island effect.
- ❖ Designate a portion of development sites to be used for natural landscaping to improve public health and reduce energy costs associated with artificial cooling.
- ❖ Continue to retain existing trees, to the extent possible, and aim at further increasing the tree canopy to improve aesthetics and public health, as well as mitigate adverse effects of air pollution.

Water Quality

- ❖ Promote aggressive implementation of sewer separation throughout the city by GNHWPCA, as proposed within the CSO LTCP (1999).
- ❖ Continue to seek improvements to upstream wastewater treatment facilities and support statewide regulation of non-point sources of pollution.

Environment



- ❖ Continue to regularly update the *City of New Haven Natural Hazard Mitigation Plan* (last updated in 2011), consistent with the Disaster Mitigation Act of 2000.
- ❖ Continue to ensure that all coastal planning efforts are consistent with the City of New Haven's Coastal Area Management District regulations.
- ❖ Update and adopt New Haven's Harbor Management Plan to more accurately reflect current conditions, issues, and opportunities for the development of New Haven Harbor and to guide inland water activities and public access on Long Island Sound.
- ❖ Promote natural infiltration measures for sedimentation and erosion control and effective stormwater management and thus reduce urban heat island effect. To that end, continue to implement the City's green regulations through the City's site plan review process.
- ❖ Raise awareness among city residents regarding waste reduction and recycling strategies to eliminate pollutants from entering the city's stormwater management system.
- ❖ Continue to maintain and improve the city's drainage system to protect water quality and prevent any adverse environmental impacts.
- ❖ Advocate for a **cleaner and well-maintained Long Island Sound** and support periodic dredging of New Haven Harbor. To that end, advocate for a dredged materials management plan for EPA Region 1 (which includes Connecticut) with a goal of mitigating adverse impacts associated with dumping the dredged material in Long Island Sound.

Flood Protection

- ❖ Continue to update and adopt the *City of New Haven Natural Hazard Mitigation Plan* (last updated in 2011) to identify locations prone to frequent flooding within the city and seek funding opportunities to implement strategies to correct existing coastal, as well as inland flooding issues within the city.
- ❖ Continue to enforce the city's floodplain ordinances to limit development in Special Flood Hazard Areas (SFHAs) of the city, as identified by FEMA. To that end, publish the updated flood maps for the city (last updated in 2013) online that show locations of all SFHAs within the city and base flood elevations (BFEs) on all parcels.



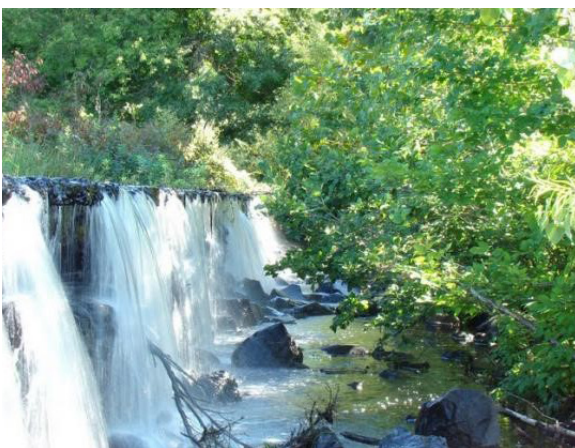
The marsh located by the Quinnipiac River (an inlet of Long Island Sound) consists of unique wetland habitat and endangered species. National Audubon Society had designated this marsh as an Important Bird Area due to the presence of large number of migratory birds. The combined sewer outflow system in the city continues to be a major problem to this estuary.



Environment



View of properties at risk at Pardee seawall in Morris Cove neighborhood.



The Pond Lily dam located in New Haven Land Trust's Pond Lily Nature Preserve, at the intersection of Whalley Avenue and Amity Road, will be removed by the end of this year through a federal grant received in 2013 to preserve endangered fish species and promote their free passage along the West River and to eliminate likely hazards due to dam failure during major storm events.

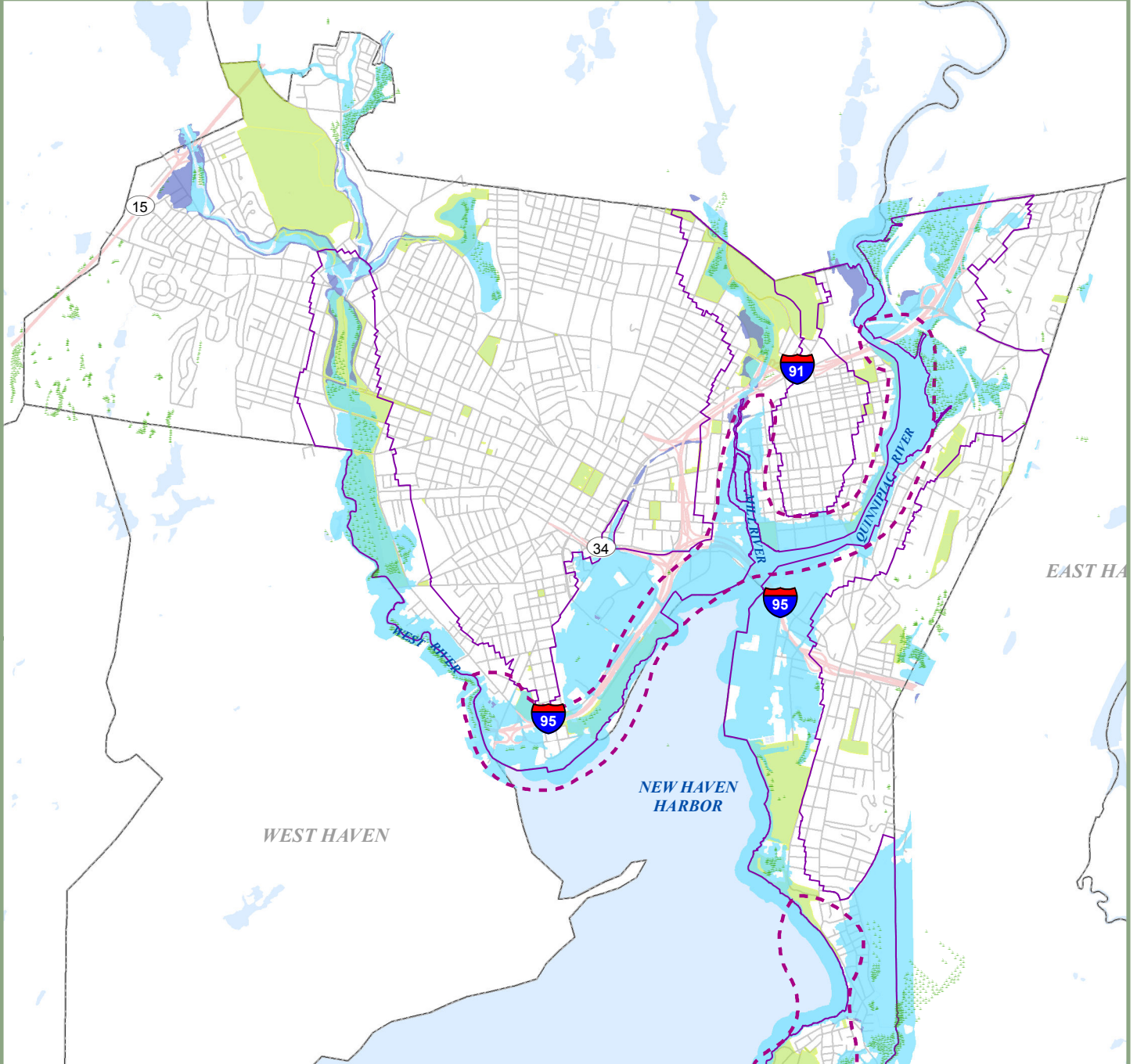
- ❖ Implement flood proofing and coastal resiliency measures along the coast to prevent loss of life or property and **mitigate adverse impacts of sea level rise**. To that end, identify and seek (pre-disaster mitigation) funding opportunities to assist property owners in elevating any non-conforming, existing properties in coastal areas above BFEs; to implement coastal resiliency measures; and to ensure compliance with the floodplain ordinances of the city.
- ❖ Implement shoreline stabilization measures as recommended within the *New Haven Coastal Program* (2006) and increase plant and natural buffer along the coast. The Commission further recommends implementation of context sensitive coastal resiliency measures for the coast, incorporating structural measures where necessary, and pursuing zoning amendments based on the future land use map of the city (as discussed in Land Use chapter).
- ❖ Continue to enforce the city's Coastal Area Management District regulations for all new constructions and major renovations proposed within the coastal zone boundary.
- ❖ Continue to implement bioswales (such as the recently installed Edgewood Avenue bioswale) to promote natural infiltration of water, reduce flooding, and increase ground water recharge. To that end, identify specific locations within all neighborhoods of the city where bioswales could be implemented to allow maximum rainwater capture.

Habitat Protection

- ❖ Continue to protect the city's endangered species by **regulating development activities** at locations where such species are found. To that end, publish a list of all endangered species found in the city according to state DEEP's most recent inventory and the endangered species map prepared by DEEP on City web page.
- ❖ Support natural buffers around conservation areas to minimize adverse impacts from development activities and regularly maintain these buffers through periodic clean ups.
- ❖ Continue to promote conservation easements as a tool to local or regional land trusts to protect, conserve, and maintain existing plant and natural habitat.

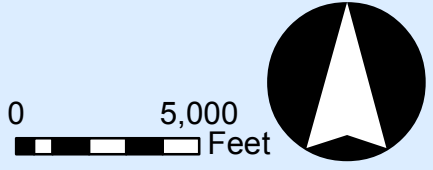
NEW HAVEN VISION 2025

CURRENT & PROPOSED ENVIRONMENTAL SYSTEMS



-  Existing Wetlands
-  Existing Parks and Open Space
-  Existing Coastal Area Management Boundary
-  Existing 100 Year Flood Area
-  Existing 500 Year Flood Area
-  Proposed Areas for Coastal Resiliency Infrastructure

0 5,000 Feet



A scale bar showing 0 to 5,000 feet and a north arrow pointing upwards.



Environment

- ❖ Raise awareness among residents through brochures, email lists, and online materials regarding the importance of preserving plant and natural habitat areas to maintain a balanced ecosystem.

Parks and Open Space

Greenways

- ❖ Update and officially adopt the City's *Plan for Greenways & Cycling Systems*, originally prepared in 2004, to more closely reflect the current vision for a continuous and inter-connected network of trails within the city.
- ❖ Partner with non-profit organizations such as the New Haven Land Trust to acquire adequate vacant lands and easements to link the proposed network of trails within the city and to buffer some of the existing industrial/commercial land by the waterfront.

Open Spaces

- ❖ Develop an open space conservation plan for the city, which can be not only used to preserve historically significant open lands but also serve as a guide in providing accessible, quality outdoor recreation to all residents of the city.
- ❖ Demonstrate the value of urban spaces through the **revitalization of public plazas** in and around the central city.

Parks and Recreation

- ❖ Pursue specific value-added improvements to the City's park system in a manner consistent with Parks Master Plan (prepared in 2001). To that end, update this plan and promote official adoption to better coordinate proposed park improvements with the City's Capital Improvements Program.
- ❖ Continue to **enhance the image of all City parks** to make them accessible, inviting, exciting, and well maintained. This can be accomplished through landscape improvements, turf renovations, and new signage and site furniture. The Commission further recommends repair of deteriorated infrastructure such as bulkheads; parking lots; roadways; irrigation systems; tennis, basketball, and bocce courts; splash pads; and other support amenities.



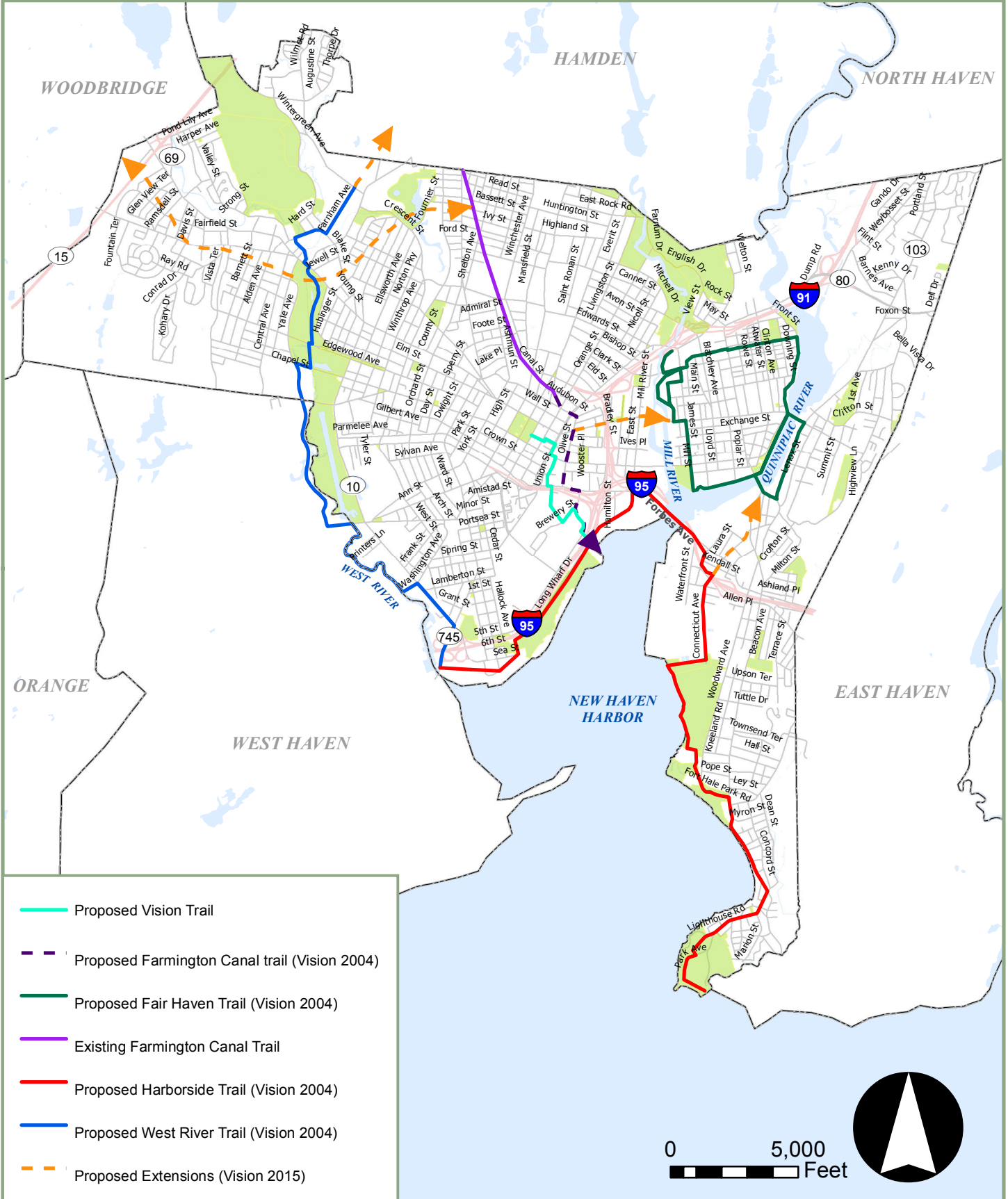
Plazas such as the Pitkin plaza located in Downtown New Haven (pictured above) help promote opportunities for community interaction, create identity, and increase a community's value.



Like most other neighborhood parks in the city, Galvin Park located in the Hill neighborhood has been renovated in 2007 with state of the art playground equipment and new splash pads as can be seen in the picture above.

NEW HAVEN VISION 2025

EXISTING & PROPOSED GREENWAYS & TRAILS





Environment



Safe pedestrian access should be promoted at all city parks to further increase their use. For instance, the West River Memorial Park is currently separated from the West River neighborhood by Route 10 /Ella Grasso Boulevard, which is a four-lane state highway with high vehicle speeds that have caused several pedestrian crashes in the past.



New Haven is famously known as “Elm City” since the nation’s first public tree planting program started in the city with the planting of elm and buttonwood trees on New Haven Green in the 18th century. In 2009, the City of New Haven partnered with Yale’s Urban Resources Initiative and revived this program by pledging to plant 10,000 public trees in five years (aka Tree Haven 10K pledge).

- ❖ Seek to expand opportunities to **promote safe access** to the existing parks and enhance programming in underserved neighborhoods by capitalizing on site and resource opportunities when available.
- ❖ Although not part of the City’s park system, the Commission encourages increased maintenance and capital improvements (to support a larger user base) at West Rock Ridge State Park.
- ❖ Conduct a comprehensive recreational needs assessment to set priorities for funding improvements in City parks.
- ❖ Encourage better management of City’s irrigation systems by identifying plant species that consume less water and planting them accordingly.
- ❖ Encourage and support formation of “friends for parks” that promote stewardship of parks.

Trees and Landscaping

- ❖ Continue to foster partnership between the City and URI to establish a goal for enhancing the tree canopy in New Haven for the next decade similar to the **Tree Haven 10K** pledge for the city for the 2010-2014 period. To that end, the Commission recommends that the tree canopy should be enhanced in those parcels or blocks where there is minimal or no tree canopy with relatively large amount of impervious surface.
- ❖ Update the City’s *Complete Streets Design Manual* to include urban street design standards and promote the design of “green streets”.
- ❖ Encourage private retailers and businesses to increase trees on their properties by offering incentives such as free planting materials and landscaping assistance. To that end, emphasize the value of urban forestry and tree programs to the city’s quality of life through intensive community education and implementation programs.
- ❖ Continue to maintain existing city trees and encourage preservation of on-site (healthy) trees, to the extent possible, for all development/utility projects. Encourage replacement of trees that could not be preserved due to unhealthy condition. The Commission further recommends that efforts should be made to monitor, maintain, and enhance the city’s elm trees.

Environment



- ❖ Allocate adequate resources for the Parks Department to inventory trees, assess the health of the trees, and document and update the City's tree inventory.
- ❖ Continue to promote the City's Adopt a Tree program, through which residents can partner with the City to care for and improve the appearance of a tree.

Community Maintained Green Spaces and Gardens

- ❖ Continue to support **community garden programs** by planning short- and long-term locations with defined leases, encouraging new locations for **farmers markets**, and providing resources when feasible. The Commission further emphasizes that these spaces should foster community building across generational and other social lines, provide opportunities for locally-grown produce, and enhance civic pride. Such type of commercial and non-profit urban agriculture is also useful in mitigating the urban heat island effect.
- ❖ Update the city's green map, which shows all community-maintained gardens and green spaces within the city and make it publicly available to raise awareness of available options to access healthy food within the city, especially in inner city neighborhoods.
- ❖ Support the remediation of soils for urban farms and community gardens to allow safe and healthy food to be grown. Studies indicate that New Haven has the highest number of cases for childhood lead poisoning in Connecticut and soil lead levels above the residential standard of 400 parts per million (ppm) are widespread in neighborhoods throughout New Haven. The Commission therefore recommends that the City raise measures for the remediation of lead in soils such as keeping the soil where children play covered and encouraging only the growth of fruits and fruiting vegetables on such soils.

New Haven has nearly 50 community gardens that are managed by New Haven Land Trust. These gardens enable community building efforts, improve neighborhood aesthetics, promote neighborhood health, and provide healthy food choices to the residents nearby.



Among New Haven's many community gardens are, from top to bottom, Winchester Garden in Dixwell neighborhood, Davenport Children's Garden in the Hill neighborhood, and Chapel Seed in West River neighborhood..



City Seed manages farmers markets that sell fresh local produce in Fair Haven, the Hill, Wooster Square, Downtown, and Edgewood neighborhoods and a mobile market through partnership with Common Ground High School and Urban Farm.



Build...

E. SUMMARY OF RECOMMENDATIONS

- ❖ ...an integrated and continuous trail network within the city by completing Phase IV of Farmington Canal Trail and updating the vision of *Plan for Greenways & Cycling Systems* (2004).
- ❖ ...an integrated and continuous trail network within the city by identifying and seeking funding to start work on the proposed West River Greenway Trail, identify partners for initiating the process of designating proposed Harborside and Fair Haven Trails as official greenways, and subsequently build these trails.
- ❖ ...the missing infrastructure for enhancing the existing bicycle/pedestrian network within the city and facilitate enhanced use of transit through the implementation of sustainable land use, housing, transportation, and economic development strategies, as discussed in previous chapters, to improve air quality.
- ❖ ...natural infiltration measures such as bioswales and other green infrastructure and source control measures in all city neighborhoods for sedimentation and erosion control and effective stormwater management, thus reducing urban heat island effect and allowing maximum rainwater capture.
- ❖ ...natural buffers around conservation areas to minimize adverse impacts from development activities and regularly maintain these buffers through periodic clean ups.
- ❖ ...value-added improvements to the city's park system to enhance its usage and promote safe access to parks, especially in underserved neighborhoods, by capitalizing on site and resource opportunities.



Connect...

- ❖ ...residents to city parks by encouraging “friends of parks” groups to promote stewardship and also increase revenues.
- ❖ ...all of the existing city parks and open spaces with safe pedestrian and bicycle access routes.
- ❖ ...residents to the city’s waterfront by promoting ecotourism opportunities through selective acquisition of parcels along the waterfront.
- ❖ ...residents to effective waste reduction and recycling strategies to eliminate pollutants from entering the city’s stormwater management system and to soil lead testing measures through advanced outreach campaign.
- ❖ ...residents to year round indoor/recreational opportunities through effective programming and staffing at the new Q-House (currently in design stage) serving central neighborhoods of the city and by exploring the feasibility of re-using Coogan Pavilion and Salperto Rink as all-weather indoor community-based recreational centers serving western and eastern neighborhoods of the city, respectively.

Preserve...

- ❖ ...the quality of the natural environment by ensuring at least a 30 percent reduction VMT in the city over the next decade by implementing effective land use, housing, transportation, and economic development strategies, as discussed in previous chapters.
- ❖ ...archaeological sites and natural habitat through development standards that encourage sound land use practices and by making the city’s endangered species location map and map of archaeological resources publicly available to raise awareness among residents on the locations of these sites.
- ❖ ...on-site healthy trees, to the extent possible, for all development/utility projects, and where such trees cannot not be preserved due to poor health, encourage replacement of those trees.



Adapt...

- ❖ ...to sea level rise and other coastal/inland flooding events by implementing flood proofing, coastal resiliency, and shoreline stabilization measures along the coast.
- ❖ ...to sea level rise and other coastal/inland flooding events by continuing to strictly enforce the City's floodplain ordinances to limit developments in SFHAs and by updating and adopting the *City of New Haven Natural Hazard Mitigation Plan* (last updated in 2011 and expiring in 2016) and Climate Action Plan (prepared in 2001), in addition to identifying and seeking funding opportunities to correct coastal, as well as inland, flooding issues within the city.

Grow...

- ❖ ...the image of all city parks to make them accessible, inviting, exciting, and well maintained through landscape improvements, turf renovations, new signage and site furniture. Repair deteriorated infrastructure such as bulkheads; parking lots; roadways; irrigation systems; tennis, basketball, and bocce courts; splash pads; and other support amenities.
- ❖ ...opportunities for promoting commercial, non-profit agriculture through amendments to the local land use regulations that help mitigate the urban heat island effect, as well as promote community cohesion.
- ❖ ...existing tree canopy in New Haven for next decade similar to the Tree Haven 10K pledge for the city for the 2010-2014 period by identifying parcels or blocks with minimal or no tree canopy and relatively large amount of impervious surface and planting street trees in such areas.