

Woonasquatucket River & Promenade District

Recommendations for Management

Part of the Metro Bay SAMP Plan



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INTRODUCTION

Stakeholders have identified a need for a collaborative visioning process for the revitalization of the Promenade Street District of the Woonasquatucket River. Currently, the river is considered to be glutted with invasive species and trash, its bikeways and sidewalks are unpleasant at best, and access to the river is limited both visually and physically. Busy streets border it to the north and south, and define the area's primary function as vehicular access to the Providence Place Mall.

Meanwhile, development is quickly filling in along the banks with new condos and commercial and retail uses moving into old industrial buildings. With this influx of new people to the area, there is a unique opportunity to reclaim the river as a focal point for the district.

The vision described in this plan foresees a corridor that will offer a continuous greenway that allows for public access, recreation, and habitat for wildlife. It will be a source of neighborhood pride, bringing the community together around a green jewel in the heart of vibrant urban corridor.

This plan has been drafted at the request of numerous stakeholders (see below) and presents a unified vision that may be implemented by state and municipal authorities, as well as nonprofits and private developers. This document synthesizes much of the work that has been done in the area by various groups and provides guidance for redeveloping and revitalizing the river, its banks, and the immediate lands surrounding it. Rhode Island Sea

Grant/University of Rhode Island Coastal Resources Center (RISG/CRC), together with the Rhode Island Coastal Resources Management Council (CRMC), provided research and facilitated drafting the plan through interviews, site visits, and workshops that brought various stakeholders together to inform the vision presented here.

This management plan serves as a visioning and guidance document and is a sub-element of CRMC's Metro Bay Special Area Management Plan (SAMP). The SAMP includes an Urban Coastal Greenway Policy (UCG) whose goal is to create a continuous greenway with public access along northern Narragansett Bay's urban shoreline. The UCG divides that shoreline into zones where different buffer regulations apply. This Woonasquatucket River management plan serves as guidance for implementing the UCG policy specifically within the coastal area between the Providence Place Mall and Atwells Avenue, an area that is part of the SAMP-delineated Inner Harbor and Rivers Zone. This plan outlines activities and suggests changes for that area.

More information about the UCG is online at <http://www.crmc.ri.gov/>, and more information on the Metro Bay SAMP may be found at <http://seagrants.gso.uri.edu/metrosamp>.

These recommendations cover special concerns within this defined area, including public access, the maintenance of existing sites, vegetation management (including

invasive species), habitat maintenance and restoration, and sedimentation. Any physical construction improvements made to the area should also take into account projected sea-level rise. The recommendations contained herein do not preclude other improvements that interested parties may wish to implement. They represent portions from existing plans for the area (see bibliography for plans consulted), meetings with major stakeholders, and the results of stakeholder workshop held on February 9, 2007. A subsequent workshop on October 9 further refined these ideas and developed consensus around the top priority recommendations for each of the sections.

CRMC will take the lead on the following top priorities identified by stakeholders:

Vegetation Assessment and Action Plan

In 2008, CRMC will seek funding and cooperative partnerships to undertake a fine-grained GIS analysis that identifies invasive and native vegetation, as well as density of vegetation throughout the project area. Through this analysis, priority restoration areas will be identified. Based on the vegetative assessment, CRMC will begin work to secure state, municipal, and other funding to begin restoring and maintaining vegetation in project area. The subsequent work will remove exotic species, create habitat connections, and restore native species.

Address Immediate Safety/ Management Concerns

By winter 2008, CRMC will respond to requests for immediate management

measures by landowners and other stakeholders to address vehicular and pedestrian traffic and sightline issues and other safety concerns linked to vegetation. Visual access points will be identified and agreed upon by stakeholders, and will serve as a framework for vegetation management along the riparian corridor. Site visits by CRMC and interested parties will be organized and permits will be efficiently processed by CRMC to allow for the agreed upon management measures to be implemented immediately.

Create New and Improve Existing Public Access Points

Through the use of the UCG, CRMC will acquire new public access points and improve on existing points. Public access includes trails, new pedestrian bridges, canoe/kayak launches, and benches. A pilot project at the American Locomotives Works (ALCO) site will serve as a model for providing new and improved access, as well as demonstrating the intended outcome of the UCG. This management plan will serve as a guide to CRMC and others in identifying future public access as well as improving existing sites.

Create New Catch Basins

Beginning in 2009, CRMC will work with the city of Providence to identify areas suitable for new catch basins. This work may include acquiring land and creating infrastructure to keep sediment basins maintained, and establishing an appropriate maintenance schedule, which will be communicated to the public. To be completed by 2010.

Background

Before the 19th century, the Woonasquatucket River, named by the Native Americans as “the place where the salt water ends,” flowed through forests and farmlands before it emptied into Narragansett Bay. The southern portion of this 19-mile river is tidal, and the tidal influence still reaches to what is now Atwells Avenue. Narrow and with a rapid flow of water, the river was an ideal location for mills during the Industrial Revolution. During the 19th century, textile mills could be found lining its banks. Mill ponds and dams were built further upstream to allow for control of water flow during drier seasons. By the end of the 1800s, giants of the Industrial Revolution like Brown and Sharp, Nicholson Files, and Riverside Mills all had situated along the Woonasquatucket. At one time, discharges from the mills flowed freely into the river, coloring its waters with textile dyes. Heavy metals and other toxins from these discharges still remain along the river bottom.

As manufacturing waned in the Northeast, these old brick factory and mill buildings were left vacant or underutilized. In 1997, Senator John H. Chaffee nominated the river as an American Heritage River. President Bill Clinton acknowledged the Woonasquatucket’s historic importance, naming it one of 10 American Heritage rivers, a designation designed, *“to help communities alongside them revitalize their waterfronts and clean up pollution in the rivers, proving once again that we can grow the economy as we protect the environment.”*

Today, developers have begun to seize on the opportunities presented by these grand

old structures with their high ceilings and sweeping views of the city. Though cleaning up these brownfield sites and maintaining their historic significance is a challenge, a number of projects have already been completed. At the western end of the project area, Eagle Square features a number of shops, condos, and a supermarket housed in revitalized brick buildings, as well as new ones designed to match them. Monahasset Mills has also been restored for living space and a nonprofit industrial arts cooperative. The Steelyard offers space for artist studios and classes in blacksmithing, ceramics, and other arts. On the north side of the river, the American Locomotive Works complex redevelopment project is well underway with creating condos, commercial, and retail space. Closer to the Providence Place Mall, the Foundry and the 903 developments have also been completed and feature condominiums, office space, a gym, and other amenities. Remaining vacant or underutilized parcels along this corridor are expected to be redeveloped.

The Department of Environmental Management DEM recently developed a water quality restoration plan, or more specifically, a Total Maximum Daily Load (TMDL), that addresses pathogen and dissolved metals impairments in the Woonasquatucket River. This significant body of work received U.S. Environmental Protection Agency (EPA) approval and has been posted on the DEM website at: <http://www.dem.ri.gov/programs/benviron/water/quality/rest/pdfs/woofinal.pdf>.

The TMDL analysis determined that the largest and most persistent pollution sources to the lower portions of the river,

including the Promenade Street district, include stormwater runoff and dry and wet weather Combined Sewer Overflow (CSO) discharges. Other significant sources of pollution include illegal dumping, unmanaged litter and trash, and pet waste and nuisance wildlife. The TMDL describes pollution reduction responsibilities assigned to cooperating agencies and other responsible parties. Requirements specific to the Promenade Street district may be found in Appendix C. This plan, therefore, does not specifically address water-quality restoration, though many of the recommendations will result in improvements to water quality.

This document identifies many existing conditions and issues in the area. At the end of each section, suggestions for next steps and actions are identified. These recommendations may be carried out by a number of entities alone or in partnership as funding becomes available. These entities include, but are not limited to: CRMC, the City of Providence, the R.I. Department of Transportation (DOT), the Woonasquatucket River Watershed Council, DEM, property owners and developers, the Paul Cuffee School, Narragansett Bay Commission (NBC), and others.

Other Studies and Projects

Urban Coastal Greenway Policy (2006)

The Urban Coastal Greenway Policy (UCG) helps Rhode Island government work with private and community interests to ensure that economic vitality and environmental enhancement are elements of a vibrant Metro Bay waterfront. The UCG is a detailed buffer policy and alternative to the

pre-existing statewide buffer policy. With RISG/CRC as facilitators, and with a cadre of technical experts and public participants, CRMC drafted the new UCG to customize coastal vegetative buffer regulations for the urban landscape of the Metro Bay region (Cranston, East Providence, Pawtucket, and Providence). The policy is intended to balance development of the Metro Bay shoreline with environmental protection, restoration, and public access through a more flexible and streamlined regulatory structure. Parcels were analyzed for conservation, restoration, recreation, and scenic values, and the shoreline was divided into zones, where buffer requirements vary and reflect the unique characteristics of each urban area. The UCG also provides compensation options for development applicants; thus a developer, depending on site location, may choose to reduce a property's buffer width by providing new public access, increasing the amount of vegetation on the site, or creating new public amenities. The Promenade District falls within the Inner Harbors and Rivers Zone of the UCG. Specifics on the UCG and this particular zone may be found at <http://www.crmc.ri.gov/>.

Woonasquatucket River Greenway Project Land Use and Zoning Implementation Plan (2004)

This plan, created by DEM, was designed to integrate existing neighborhood plans in a single proposal that addresses brownfields, vacant lots, and attempts to reconnect neighborhoods to the river. A task force consisting of the city of Providence, DEM's Sustainable Watersheds Office, Smith Hill Development Corporation, Olneyville Housing Corporation, city council members, and other stakeholders was established, and the Woonasquatucket

River Watershed Council facilitated a number of workshops to gather stakeholder input. A set of recommendations was developed that aimed to improve the quality of the river and the surrounding area. Key recommendations concern land-use density, dimensional requirements, parking regulations and availability, brownfield property development, public access, and maintenance of the river.

Providence 2020 (2006)

This document describes Providence's vision for the future of the city. It identifies the Promenade areas as a place for innovation and a potential center for economic development with retail, cafes, and small businesses. It also calls for improvements to the civic places in the area, better access, and more efficient traffic flows. It identifies a number of potential implementation projects, including improvements to the riverfront edge, streetscapes, bridges, and parks; a transit spine; changes to the internal street network; and the creation of a business incubator or incentive packages for the district.

Woonasquatucket Greenspace Protection Strategy (2004)

This plan, funded by the U.S. Forest Service, evaluates three resource types as they occur in the Woonasquatucket Watershed: natural resources (wetlands, aquifers, and wildlife habitat), cultural resources (historic sites, scenic vistas, and rural landscapes), and recreational resources (hiking trails, bike touring, and water trails). It identifies and maps priorities for each of the resources for use by state agencies, towns, and nonprofits in making decisions about open space and resource management. Key recommendations include updating com-

prehensive plans, separating areas that should be preserved outright from those that should see continued growth, and revising zoning to reflect the goals of the plan.

Woonasquatucket River Restoration Initiative (2002-present)

NBC, with support from CRMC, the city of Providence, DOT, the Rhode Island Resource Recovery Corporation, the Woonasquatucket River Watershed Council, and other sponsors, hosts a number of events, including an annual Earth Day cleanup. NBC's goal is to remove debris from the river, offer educational programs, utilize floatable booms and screens to filter water at CSOs, and generally improve the quality of the river.

Wetland Restoration Plan for the Woonasquatucket River Watershed, Rhode Island (2002)

This study, conducted by URI's Department of Natural Resources Science (Francis C. Golet, Dennis H.A. Myshrall, Nicholas A. Miller, and Michael P. Bradley) for DEM and EPA. It is watershed-wide and identifies 77 potential sites for wetland restoration. None of these sites is in the Promenade district. However, restoration of sites that are upriver of the district would clearly have beneficial results downstream.

The Woonasquatucket River Greenway Corridor Master Plan (1997)

Conducted by the Providence Plan, in coordination with the Providence's department of planning and development and other stakeholders, this master plan covers 4.4 miles of the Woonasquatucket River

from Manton Pond in Johnston to Waterplace Park in Providence. It lays the foundation for a continuous greenway that links the 10 neighborhoods within the corridor and aims to improve the environmental quality of the river, increase recreational opportunities, stimulate economic redevelopment, and reestablish the Woonasquatucket River as a symbol for renewed neighborhood identity and civic pride. The plan describes the design of the proposed trail, gateways, and “action sites” along the way. For the section from the Eagle Square Bridge to Waterplace Park, this plan does not call for any new land acquisitions or easements for the creation of the greenway. It does suggest the widening of pedestrian bridges around Bath Street, the creation of a café and additional state offices, and the conversion of some existing mill buildings for mixed uses.

Woonasquatucket River Riparian Buffer Restoration Project (2001)

Prepared for DEM and the Woonasquatucket River Watershed Council by Kleinshmidt Associates, this report consists of a comprehensive inventory of potential restoration sites. These sites represent opportunities for improving water quality, habitat, and other ecological and social values. It found that 19 percent of the river corridor remains natural riparian forestland. A subsequent restoration demonstration project was carried out at Riverside Mills in Providence. None of the candidate sites was in the lower portion of the Woonasquatucket along Promenade Street, though clearly restoration of upriver sites would have a positive impact on the environmental quality of the lower river

HABITAT

Priority Action Items

- By winter 2008, CRMC will respond to requests for immediate management measures by landowners and other stakeholders to address vehicular and pedestrian traffic, sightline issues, and other safety concerns linked to vegetation. Visual access points identified in this management plan will serve as one of the priorities for vegetation management along the riparian corridor. Site visits by CRMC and interested parties will be organized and permits will be efficiently processed by CRMC to allow for the agreed-upon management measures to be implemented immediately.
- In 2008, CRMC will seek funding and cooperative partnerships to undertake a fine-grained GIS analysis that identifies invasive and native vegetation, as well as density of vegetation throughout the project area. Through this analysis, priority restoration areas will be identified. Based on the vegetative assessment, CRMC will begin work to secure state, municipal, and other funding to begin restoring and maintaining vegetation in project area. The subsequent work will remove exotic species, create habitat connections, and restore native species.
- CRMC will require that all future development plans include a maintenance plan that follows the Design, Installation, and Management Standards in *Appendix A*. The guidelines establish standards for maximum plant heights and setbacks around public access and recreation areas, public utilities, and traffic and pedestrian viewsheds and sight triangles at intersections. They describe how to remove and control overgrown invasive vegetation and restore native plantings around public access and recreation areas, and within traffic and pedestrian sight triangles. Vegetation management for viewsheds identified in this plan will be required so that views are available at regular intervals along both sides of the river.



Photo credit: Pam Rubinoff
Swans on the Woonasquatucket River

Existing Conditions

Although the Woonasquatucket River courses through a highly urbanized environment, it has significant value as habitat for resident and migratory species. It is tightly channelized and contained as it passes through the western Metro Bay SAMP area. This habitat supports a reasonably diverse and native riparian plant community along its banks: species such as gray birches (*Betula populifolia*), box elder (*Acer negundo*), silver maples (*Acer saccharinum*), cottonwoods (*Populus deltoides*), and elms (*Ulmus* sp.). Exotic and invasive species occur as well: Autumn olive (*Eleagnus umbellata*) and tree-of-heaven (*Ailanthus altissima*) may be found, and there is an understory of Japanese knotweed (*Polygonum cuspidatum*) in some areas. These invasive species, generally introduced into the area from a foreign country, can choke out native species and reduce an area's wildlife habitat value. This dense cover of vegetation provides habitat for a variety of resident and migrating fish, including alewife (*Alosa aestivalis*) and blueback herring (*Alosa pseudoharengis*), and neotropical migrant birds such as common yellowthroat, kingbird, and black-crowned night herons. The river continues to support fish. Species recorded by DEM just west of Valley Street include: sunfish (*Lepomis* sp.), golden shiner (*Notemigonus chrysoleucas*), tessellated darters (*Etheostoma olmstedii*), white suckers (*Catostomus commersoni*), alewife (*Alosa aestivalis*), and large numbers of American eels (*Anguilla rostrata*).

Though it has significant habitat value, in some places the dense understory growth encroaches on public sidewalks, impeding pedestrian and visual access to the river, and obstructing sightlines for motorists,

pedestrians and cyclists. Overgrowth onto public right of ways of roadside vegetation behind the metal guardrail is a recurring problem despite the city's periodic trimming and maintenance efforts. An exception is the area adjacent to Eagle Square, where the existing riparian vegetation has been removed and replaced with a highly managed landscape that is mainly lawn. This area has little habitat value (but is attractive to Canada geese) and is highly susceptible to erosion. In places where the riverbank has been reinforced with hardened structures such as concrete and stone floodwalls, there is visible damage where vegetation has grown through spaces between stones or cracks in the concrete, which undermines the structural integrity of these features.

Over the years, the river has been heavily impacted by industry and development. The most evident physical modification to the river within the SAMP area is the elimination of natural banks and the addition of retaining walls. In many stretches there are drops of more than a meter from the top of the bulkhead to the water's edge. Where revetments occur, they constrain riparian habitats to narrow strips and reduce public access to the river. These walls may also restrict and alter groundwater recharge by reducing overbank flow and natural floodplains. Silt and sand are introduced to the riverbed from storm drains, and runoff and sediments collect in the slower sections of the stream filling the pools. Chemical contaminants have also been introduced through runoff, percolation through soils, and directly by industrial sources. In the 1990s, the EPA found high levels of dioxins in fish taken from the Woonasquatucket, and subsequently they have found polychlorinated biphenyls (PCBs), volatile organic compounds

(VOCs), semi-VOCs, and heavy metals in soil, sediment, wetlands, and the water. In 1996, the EPA collected baseline data on dioxin levels in sunfish and American eels taken from the Woonasquatucket (Beliveau et al, 2003).

The Centredale Manor Restoration Project, a Superfund process, is ongoing with assistance from NRCS. Polluted soils are being removed or capped, banks are being restored, and fishways are being constructed in this region upstream of the SAMP area. Conversations with EPA personnel (Population Ecology Branch, US EPA Atlantic Ecology Division, Narragansett, R.I.) indicate that the EPA has continuing interest in Woonasquatucket programs and may have funding to assist with them. Soil contaminant level, water quality evaluation, and contaminant levels in fish taken from the river will provide reliable indices with which to monitor recovery of the river environment.

The DEM Division of Fish and Wildlife, in conjunction with the EPA Urban Development Initiative and Rhode Island Greenway Project, developed a database of fish species occurrence in the Woonasquatucket Watershed between 1993-2002, and are currently preparing to publish their results (DEM, in prep). Upstream portions of the Woonasquatucket have a diverse fish species assemblage which would tend to disperse to restored habitats downstream. The fish faunal assemblage provides another reliable index to recovery of the Woonasquatucket within the SAMP area. Additionally, baseline data on toxin level in tree swallow eggs and nestlings has been collected by EPA and USGS as part of the Centredale Manor Restoration Project.



*Photo credit: Austin Becker
Woonasquatucket River looking toward
Providence Place Mall*

Vision

This section of the Woonasquatucket River features a diverse wildlife community, beautiful views, a safe area for the public, and is regularly maintained by a partnership between the city of Providence, local property owners, and volunteer efforts. Water quality is improved, natural banking restored, and Pleasant Valley Stream daylighted. Restored and enhanced wetland and upland habitat areas offer natural environments for wildlife, as well as improved air quality, reduced urban heat effect, filtered and cooled stormwater runoff, and improved neighborhood aesthetics. These changes increase the integrity and quality of the habitat corridor, promoting greater diversity and numbers of wildlife species, including migratory birds. Improvements in water quality and development of fish ladders will help anadromous fish (e.g. the blueback herring, *Alosa pseudoharengis*) populations recover to historical levels of abundance. Areas designated for public access and view corridors are more intensively managed through invasive plant removal and natural landscaping with native species. Where the riverbank has been structurally reinforced,

innovative techniques such as green walls and terraced rain gardens are in place providing structural support and enhance the existing vegetated habitat.

Issues

Interrupted habitat corridors limit the amount of wildlife diversity

Interruption of habitat corridors has resulted from tributary burial, retaining walls, and the absence of connected riparian habitats. Vertebrate species (birds, mammals, reptiles, amphibians, and fish) may be disinclined to venture across areas where there is no appropriate habitat. Most species avoid areas without natural vegetation because they are more vulnerable to predation, food species may not be present, or they may be unable to find the habitat on the other side of the break. For these reasons, disjunctive strips of riparian habitat may not attract or support the diversity of wildlife that a larger continuous habitat would. Revetments designed to retain and channelize the river vertically isolate riparian habitats, allow development to encroach on banks and to prevent wildlife access, and reduce groundwater recharge.

Exotic species reduce habitat value along the riparian corridor

Exotic vegetation and poorly developed biotic communities have reduced habitat value along the riparian corridor. Exotic species of vegetation (such as autumn olive and Japanese knotweed) tend to have no natural means of population control, and often out-compete valuable native species,

growing into large monocultures. In general, native herbivores are not adapted to eat species with which they have not co-evolved. Native plant communities tend to be diverse because they are controlled by native species of herbivores; therefore, no one plant species can get too numerous. Greater plant species diversity means greater food plant diversity. Native plant communities also tend to support wildlife for longer periods each year than exotic plant communities, because ripening times for fruit or seeds are staggered, not simultaneous.

Sedimentation reduces aquatic habitat

River morphology has been altered by diversions and blockages, which have reduced the river's cross-sectional area in many places and increased sedimentation by slowing flows. This has resulted in less available aquatic habitat and made the remaining aquatic habitat more sensitive to temperature change and pollutants. Unconsolidated substrates can cover or bury aquatic vegetation, and are not appropriate



*Photo credit: Caitlin Chaffee
Pleasant Valley Stream*

habitat for many native species of fish and invertebrates.

Water quality is impaired due to past and present uses

Chemical pollutants from soil, water, drains, and tributaries have impaired water quality.

Unmanaged vegetation reduces both aesthetic and viewshed quality

The existing vegetation is overgrown, littered with debris, and does not provide adequate views of the river. Though a highly-groomed vegetation plan is not always the best answer, areas that are left in a more natural state must still be managed in a way that does not block all views of the river and provides some access for the public and for maintenance purposes.

Public safety is compromised due to unmanaged vegetation.

The dense understory vegetation does not allow for safe access to river and blocks sightlines for pedestrians and cyclists. Dense vegetation also allows for hiding places, in which illegal or illicit activities can take place just out of sight, a common problem in areas that are not visually accessible. In a highly urbanized environment such as this, public safety is a critical component in vegetation management and should be a primary consideration in the development of a management plan.

Committed Implementation Actions

CRMC is committed to managing the Woonasquatucket River to preserve and enhance the area's wildlife habitat value while allowing appropriate, safe public access to the river, and improving views



*Photo credit: Austin Becker
Eagle Square with possible future kayak access*

from pedestrian, residential, and commercial areas, and for boaters and kayakers on the river itself. This may be achieved by preserving and restoring areas of denser native vegetation and designating them as habitat areas, while more intensively managing the vegetation at public access points and within viewsheds and critical sightlines. The result should be an aesthetically pleasing natural design that serves the needs of the public while retaining riparian wildlife habitat. A multifaceted restoration effort will increase wildlife access to and use of riparian habitats, along with the diversity and number of aquatic plant and animal species.

CRMC will consider the following additional actions and coordinate with other entities to implement them if funding becomes available:

- Expand monitoring efforts to include systematic and opportunistic collection of bird and mammal occurrence data. Records should be maintained noting dates of use, resident or transient use, and nesting activity. For birds, point

counts may be made in spring and fall at two stations along the river within the Metro Bay SAMP boundary to assess the progress of the recovery effort.

- Develop a draft monitoring report that includes vegetative recovery, water quality, diversity, abundance, toxicity data, and species lists and usage.
 - Support a strong and diverse stewardship program for the Woonasquatucket River to ensure that all activities meet the needs of citizens and wildlife.
 - Daylight Pleasant Valley Stream, currently beneath Rathbone Street; restore banks to natural slopes and create riparian habitat. Banks of the stream should be reconstructed with shallow grades to provide access and should be revegetated with native riparian plant communities. Purchase lands along the Woonasquatucket and Pleasant Valley Stream (Rathbone Street), and wherever possible restore riparian habitat. This will form a habitat corridor between forested wetland at Davis Park and the Woonasquatucket. It will also improve views of the area and allow for increased groundwater recharge. Pocket wetlands or a park could be constructed along this daylighted corridor along Rathbone and Hemlock streets.
 - Wherever possible, restore natural banking to permit increased groundwater recharge. Remove
- revetments on Woonasquatucket and widen banks and riparian zones wherever possible.
 - Use selected stones from disassembled bulkheads to create complex habitats for small mammals in upper bank areas with native plant communities. As fish numbers and restored natural bank habitat improve, residents should begin to see mink and other mammals using the area.
 - Increase river flow to naturally reduce silt and sand deposition. If coupled with removal of existing sources of contamination, these efforts should encourage fish repopulation and support piscivorous species of mammals and birds to the river bank. Remove road sand deposits; create sediment traps and ensure that they are maintained (see Sedimentation section).
 - Create interpretive signage to educate the public about the Woonasquatucket and plans for restoration. Interpretive signage might allay concerns about the array of wildlife that might be seen in a particular habitat. Muskrat, for example, have a natural history and place in the ecology of the marsh that, when explained, might lead to its greater acceptance by urbanites. Signage could explain why overhanging branches, logs in the river, and other riverine habitat features are left in place in certain areas.
 - Enhance debris clean-up efforts that involve various stakeholders to

bolster community stewardship of the river. Residents, property owners, school children, and officials should all be engaged in these efforts at least twice a year.

- Create an “Adopt-A-Spot” type of program that allows businesses, non-profit organizations, property owners, residents, or other groups to choose a section of the river to maintain and enhance in accordance with the guidelines in this plan. Participation could involve activities from litter and debris clean up to invasive plant removal and native plant installation, to the installation of public amenities such as benches and educational signage.

- Work with DOT to introduce traffic-calming features and increase pedestrian and vegetated riparian areas. Kinsley Avenue is a major artery to the Providence Place Mall, the Foundry, etc. and, as currently designed (a two-lane road), is an impediment to bank improvement and widening east of Dean Street.



PUBLIC ACCESS



Photo credit: Pam Rubinoff
Kayak launch site

Existing Conditions

The current state of the river is uninviting to the public. A metal barrier and heavy vegetation along most of the perimeter obstructs views of and access to the river. Despite community efforts, litter is a recurrent problem. Pedestrians and cyclists face danger from a lack of visibility due to overgrown vegetation and from the high volume and speed of traffic along roadways adjacent to the river. Additionally, poor lighting, limited signage, and a lack of benches at strategic locations hinder recreational use of the river. Although there is a bike path that runs from the Providence Place Mall to Atwells Avenue, it is seldom used and dangerous for bikers due to cars traveling at excessive speeds along the roadway. Fencing along the road provides for safety, but prevents pedestrians and cyclists from accessing the river shoreline. The City Department of Public Works does periodically maintain the grass strips on the street side of the railing and grass whip vegetation that pokes through the railing. One trash can adopted by the Steel Yard has been placed at an overlook area near Sims Street, though this is the only one along the entire corridor. NBC, Paul Cuffee School, CRMC, Woonasquatucket River Watershed Council, and the city of Providence cosponsor a cleanup effort annually to collect and dispose of trash and debris. NBC also began a River Restoration Initiative, which included a floatables control program, an assessment of overgrowth, cleanup efforts, and education programs.

Priority Action Item

- Through the use of the UCG, CRMC will acquire new public access points and improve on existing points. Public access includes trails, new pedestrian bridges, canoe/kayak launches, and benches. A pilot project at the ALCO site will serve as a model for providing new and improved access, as well as demonstrating the intended outcome of the UCG. This management plan will serve as a guide to CRMC and others in identifying future public access as well as improvement of existing sites.

Phase one of the Fred Lippitt Woonasquatucket River Greenway, completed by DOT, consists of bike lanes along the road and signage. A bicycle/pedestrian path will eventually link recreational areas, green spaces, destination sites, and the neighborhoods of Manton, Hartford, Valley, Olneyville, Smith Hill to Waterplace Park in downtown Providence. DOT placed benches along the river by in 1989 (some are now broken and/or tagged with graffiti) and the EPA and the Woonasquatucket River Watershed Council posted signs along the river telling the public not to eat the fish and to keep the river clean (some of those signs need to be replaced). The watershed council has installed signs and artwork and runs canoe trips, and is collaborating with sculptor Will Machin on creating 19 nesting houses for American kestrels, screech owls, and tree swallows. Banners indicating river assets and highlighting the bike path adorn the lamp posts along Kinsley and Promenade.

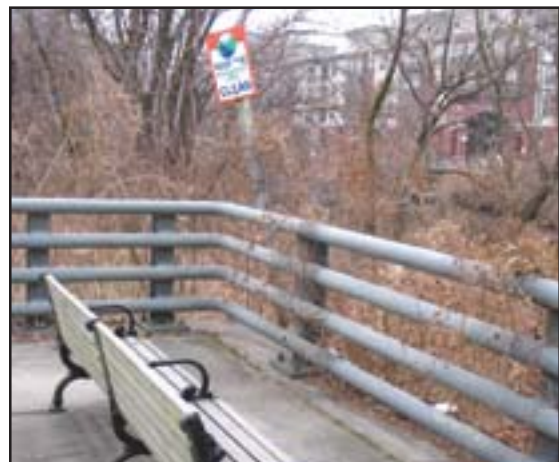
Public access points exist at the following locations:

- Eagle Square.
- Pedestrian bridge east of Bath Street with benches and overlooks.
- New bike path at Eagle Square.
- Striping between mall and Dean Street.
- Striping between Dean Street and Eagle Square.
- Kayak launch with parking underway at American Locomotive Company (Alco.)
- New bike path underway at Alco.
- Large, barren pedestrian platform across from the Providence Journal. The Woonasquatucket River Watershed Council is installing a

sculpture and signage that will remind people of the name of the river and the fact that fish actually live in it.

Vision

The Woonasquatucket River is a focal point for the Promenade District, with areas available for wildlife and nature viewing, kayak and canoe access, and public art that complements the landscape. Bikers and walkers are given priority over vehicular traffic and there are ample areas to sit and enjoy the outdoors. The area is well-used by a community that feels a sense of pride in its river. The area is clear of trash and debris and regularly maintained as such by a core team of volunteers and paid municipal and private workers. Trash barrels are found at regular intervals along the riverbanks and regularly emptied.



*Photo credit: Austin Becker
Existing benches on river overlook*

Issues

Minimal public access points reduce use of the river

Enhanced physical public access is needed in this corridor. The area is relatively inaccessible to those wishing to canoe, kayak, bike, bird, walk, or just generally enjoy the river area.

Public infrastructure reduces access to river

Existing traffic circulation and guardrails create an unwelcome environment for pedestrians and cyclists. Inadequate public parking exists for future access points. Design and lighting are important considerations, so as not to create new areas for illegal activities to take place.

Solid waste inundates the river

Trash and debris have been a constant problem along this section of the Woonasquatucket, but there is only one trash barrel along this section of the river. Tires, shopping carts, small appliances, and other debris are pulled from the river every year. As the river is at the base of a valley, trash picked up by the wind naturally settles out on or next to the river. Some of the trash is likely tossed out of passing vehicles.

Committed Implementation Actions

CRMC is committed to improving both physical and visual public access along this stretch of the Woonasquatucket River. Visibility for the public should be balanced with creating sufficient tree and shrub canopy for wildlife habitat. Parking for the

public to access the river should be created. Traffic calming measures should be implemented when appropriate. Sidewalks should be broadened, and buffers and bikeways should be widened. New pedestrian and traffic bridges should be created, and present bridges should be improved with art, landscaping, or interpretive signage. CRMC will use the contents of this management plan, specifically *Map B: Proposed Changes in SAMP Area*, which identifies proposed additional access points, as guidance to achieve this goal.

CRMC agrees to implement the following action in coordination with major partners including the city of Providence, EPA, NRCS, DEM, and the Woonasquatucket River Watershed Council:

Through the use of the UCG, CRMC will acquire new public access points and improve on existing points. Public access includes trails, new pedestrian bridges, canoe/kayak launches, and benches. A



*Photo credit: Caitlin Chaffee
Existing bike lane*

pilot project at the ALCO site will serve as a model for providing new and improved access, as well as demonstrating the intended outcome of the UCG Policy. This management plan will serve as a guide to CRMC and others in identifying future public access as well as improvement of existing sites.

CRMC will consider the following additional actions and coordinate with other entities to implement them if funding becomes available:

- Place trash barrels at regular intervals.
- Place signage along the roadways discouraging litter.
- Increase street sweeping along both sides of the river.
- Increase community clean-ups involving various groups to four times/year.
- Parking – Although there is plenty of parking in the area, it is necessary to identify specific spots where the public may park vehicles and access the river area. This may be achieved through striping or signage. New parking areas should implement LID techniques to address stormwater runoff (see *Map B: Proposed Changes in SAMP Area* for proposed new public parking spaces).
- Require all undeveloped riverfront properties to grant a dedicated easement for public access.
- Maintain and enhance existing public access.
- Where possible, replace railings with less intrusive barriers that allow for increased visibility of the river. These barriers could also allow for canoe/kayak access where feasible.
- Consider restricting heavy truck traffic to Harris Avenue.
- Increase public awareness of the value of the river to promote stewardship. Awareness may be increased through signage that depicts the history of the area and/or the current conditions. Community events such as art installations block parties, cleanups, and street fairs will bring people down to the river to enjoy a natural environment within this urbanized area.
- Trim low-lying branches to retain shade while improving safe passage and visibility. This requires an ongoing maintenance plan that



*Photo credit: Austin Becker
Existing guard rails and unsightly solid waste along the riverside*



Photo credit: Caitlin Chaffee
Metal guard rail

doesn't require permits/approval each year.

- Canoe/kayak portages could be created or improved at one or more of the following sites (*see Map B: Proposed Changes in SAMP Area*):
 - Eagle Square with parking provided in the adjacent lot.
 - At 349 Kinsley Street (across from CAPCO), there are two possible kayak launch sites, one to the west of the bridge and one to the east. Both sites offer an easier grade to get down to the water and a flatter area for kayaks and canoes to launch.
 - A kayak/canoe launch is possible at the foot of Holden Street on the 903 side of the river. This site also offers an easier grade to get down to the water and a flatter area for kayaks and canoes to launch. Parking could be provided across
- the street with a pedestrian crossing and/or traffic light.
- Sims/Kinsley Avenues – the Woonasquatucket River Watershed Council owns canoes and kayaks that are kept at The Steel Yard. A launch at this location would facilitate public paddling trips.
- New paths down to the water could be created at any or all of the following three locations, which, due to their shallower grade, are most suitable for public access. Placement and infrastructure should take into account projected sea-level rise:
 - To the east Acorn Street bridge on the south bank of the river.
 - To the west of the Acorn Street bridge on the south bank of the river .
 - To the east of Holden Street on the south side of the river.
 - Traffic calming devices would be required at any new canoe/kayak portages where crossings are dangerous. Parking spaces would also be needed to integrate with new access points. Dedicated parking spaces may be designated within existing lots at Eagle Square and other properties.

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- Consider an adaptable traffic scheme whereby lanes could be opened to traffic during peak flow times (during winter holidays for example) and blocked off for pedestrian/bicycle access at other times.
 - Improvements could be made to bridges:
 - Pedestrian bridge east of Barron Street could be improved with art, landscaping, and interpretive signage. This bridge could be opened up for vehicular traffic to create better traffic flow and more options for vehicles to turn around without having to drive the entire length of the Promenade. Alternatively, this bridge could be used for public access parking and a new public access site, as it is constructed to carry vehicles and could be converted relatively inexpensively.
 - New pedestrian and traffic bridges are needed along the river. Bridges could be constructed to allow for canoe/kayak passage underneath them. One possible location for a new bridge is at Leland Street; another could be at the 903/Holden Street (see *Map B: Proposed Changes in SAMP Area*).
 - Curblines could be moved out to create a dedicated bike path instead of a bike lane.
 - Consider installing more traffic lights.
 - A gateway structure could be constructed at Dean Street and Kinsley Avenue and/or Atwells Avenue and Kinsley to help create a sense of place on the river.
 - Develop interpretative and historical signs that promote protection of waterways and enhanced understanding of American and Rhode Island heritage. Form a committee to decide what signs would be appropriate for which locations.
 - Designate space for education and public events. For example, platform access points near new kayak launch sites could be used for student hands-on education opportunities (water sampling, hydrology lessons, habitat lectures, etc.). Create platform access points between Dean and Acorn streets (north side of river) and/or at end of Holden Street, with a possible additional river crossing there. Platform access will allow for student groups to have access to the river for educational programming purposes. Placement and infrastructure should take into account projected sea-level rise (see *Map B: Proposed Changes in SAMP Area*).

- Widen areas between walkways and roads and/or alter traffic patterns to slow or reroute traffic adjacent to heavily used public access points. Specifically, widen the sidewalk along river on Promenade Street from the Providence Place Mall to Bath Street, and widen the bikeway on Promenade Street and Kinsley Avenue. Curve the road to slow down vehicles and create interest along the streetscape.

- All above improvements should be open and well-lit so as not to provide areas for criminal activity *see Map B: Proposed Changes in SAMP Area.*



SEDIMENTATION

Priority Action Items

- Beginning in 2009, CRMC will begin work with the city of Providence to identify areas suitable for new catch basins. This may include acquiring land and creating infrastructure to keep the sediment basin maintained, then the establishment of an appropriate maintenance schedule, which will be communicated to the public. To be completed by 2010.
- CRMC will require that all future development plans incorporate low impact development techniques to minimize runoff and insure 100 percent on-site treatment of stormwater. This will mostly be implemented through the UCG.

Existing Conditions

Sediments from street-sanding operations, stormwater runoff, poor catch basin maintenance practices, and upriver sources are flowing into the river and making small craft (canoe and kayak) navigation difficult due to shoaling and shallower depths. In addition, the basin at Waterplace Park acts as a settling pond and is rapidly filling in. This impacts the WaterFire program by making small motorcraft navigation difficult, especially during low tides. Flood waters following large rainfall events push this sediment downstream and eventually into the Narragansett Bay estuary. There are also a number of overflow outfall pipes

that discharge polluted water and sediments into the river.

Vision

The river is navigable by small craft except on the lowest of tides. River water is clean and provides fish passage through to the upper portions beyond the project area. In the summer, the river offers areas where the public can paddle, fish, and enjoy the water's edge. A regular maintenance schedule will ensure that new sediment basins are cleaned regularly.

Issues

Sedimentation is impeding navigation by recreational craft and affecting navigation downstream of the project area at Waterplace Park.

Polluted water and sediments are affecting water quality and habitat.

Committed Implementation Actions

CRMC is committed to managing the river so that it is navigable by small craft most of the time and that this portion is clean and provides fish passage through to the upper portions beyond the project area. CRMC agrees to implement the following actions in coordination with major partners

including the city of Providence, EPA, NRCS, DEM, and the Woonasquatucket River Watershed Council.

In addition to the priority action above, CRMC will consider the following additional actions and coordinate with other entities to implement them if funding becomes available. Many of the sedimentation issues identified here are addressed in greater detail in DEM's TMDL report (see Appendix C.)

- Create program to re-open ponds in Greenville/Smithfield to increase flow during low flow times.
- Identify and protect from encroachments a settling basin just upstream of the Providence Place Mall or near Dean Street that can be easily dredged from the land on an as-needed basis. Develop staging area for dredging to maintain settling basin on frequent basis.
- Begin regular public posting of catch-basin maintenance schedule online or in other public arenas.
- Create dredge plan and fund to provide for ongoing coordinated dredge maintenance schedule.
- Create sediment basin(s) upstream of project area to catch sediment before it filters downstream.
- Inventory stormwater discharges and identify which sediment catch basins and sumps require more frequent cleaning and maintenance.



*Photo credit: Austin Becker
Sand sedimentation from street sanding operations.*

CONCLUSION

This plan is meant to guide improvements to the Promenade District of the Woonasquatucket River. Since its days as a driver of the Industrial Revolution, the river has become neglected and overgrown. But, the area is full of promise. Nestled between the ever-popular Waterplace Park and the up and coming Olneyville neighborhood, this river area can serve as a gateway to the downcity area and as a new place for recreation, habitat, and enjoyment of the outdoors. As the center of the neighborhood, the river can generate community pride and a sense of stewardship among residents and visitors alike. Much work has already been completed for the area, but much is still left to do in order to achieve the shared vision laid out in this plan.

At the request of the stakeholders, CRMC, together with RISG/CRC, has assembled this plan to lay out a course of action. Responsible parties are identified, as well as a timeline for completion. Although some of the recommendations in this plan will be implemented by CRMC through permitting, many must be adopted by other responsible parties. This plan is meant to serve as a guidance document, and can only be effective with the ongoing collaborative spirit already established by the stakeholders.



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APPENDIX A. VEGETATION DESIGN, INSTALLATION, AND MANAGEMENT STANDARDS

LANDSCAPE DESIGN

General Considerations

Intensive landscape management will be allowed only in those areas of the Woonasquatucket Promenade district riparian corridor that are designated as 1) viewshed areas, 2) public access areas and their associated setbacks or 3) public recreation areas and their associated setbacks. Only minimal management will be allowed in designated wildlife habitat areas.

To maximize habitat value and maintain a “natural” aesthetic in all areas, informal, dense groupings of approved plants should be used in lieu of isolated specimen plantings. Plantings should include an appropriate mix of trees, shrubs, and groundcovers and a diversity of species similar to that of existing native vegetation in the Woonasquatucket riparian corridor. Monotypic stands (large areas covered by a single species) are to be avoided. Plants should be sited appropriately according to the requirements (sunlight, soil moisture, etc.) of each species. Existing native trees should be preserved in all areas along the Woonasquatucket.

Landscape Plan Requirements

Applicants wishing to alter riparian vegetation within the Woonasquatucket Promenade district riparian corridor must submit a landscape design plan that is created by a licensed landscape architect (for areas

greater than 1000 square feet) and includes the following:

- Photograph(s) of existing conditions.
- Property lines.
- Location, Latin and common names, and caliper of existing native trees and other native vegetation.
- Location and Latin and common names of vegetation to be removed
- Latin and common names and caliper or container size of plants to be installed, their planned locations, and spacing
- Easements and public utilities
- Existing and proposed curbs, gutters, sidewalks, or pavement edges.
- Proposed public amenities (parking areas, walks, etc.).
- Proposed stormwater management practices.
- Hardscaping and any other proposed landscape features
- Cross-sections of landscape features
- Delineation of public access, viewshed and habitat restoration areas.
- Delineation of existing and planned turf areas
- Vegetation maintenance plan.

Plant Selection

In order to minimize fertilization and irrigation requirements and improve wildlife habitat value, only native species or

approved non-native, non-invasive species should be planted within the Woonasquatucket riparian corridor. Only native species should be planted in designated habitat areas. Minimize maintenance requirements through the proper selection and siting of plant material. Determine planting locations for each species according to its requirements (e.g. full sun, shade, soil type).

Vegetation planted within the floodplain of the river should consist of riverbank species that will help to mitigate erosion and that are capable of withstanding the shear force of storm flows. Appropriate erosion control measures (e.g. use of coconut fiber mats) should be applied where necessary during establishment of riverbank vegetation.

Lawn areas should be kept to a minimum throughout the Woonasquatucket riparian corridor. Lawns will not be permitted within designated habitat areas. Where lawns are planted, low-maintenance fescue seed mixes should be used.

Habitat

The following guidelines should be observed within designated habitat areas:

- Existing native trees and shrubs should be preserved to the greatest extent possible.
- The leaf litter layer should be preserved to enhance habitat value and inhibit invasive species growth.
- Invasive species removal within designated habitat areas will be approved on a case-by-case basis, and must be accompanied by a revegetation plan.

- Selective pruning and removal of dead native plant material should only be done where necessary to protect public safety (e.g. where vegetation poses a threat to existing utilities).
- Clear cutting of vegetation is not permitted in habitat areas.
- Only native species (as identified on URI/CRMC Coastal Plant List) should be used for restorative plantings.
- Hybrids and cultivars of native species should be avoided to maintain genetic diversity within the plant community. Use of specific cultivars will be approved on a limited basis.
- Restorative plantings should mimic the existing native plant communities along the Woonasquatucket riparian corridor in species diversity and vegetation type.
- Maximum spacing between planted shrubs and groundcovers within habitat areas should be equal to the plant's estimated diameter at maturity to ensure an acceptable minimum density of vegetation.
- Living herbaceous groundcovers should be planted or shredded bark mulch applied beneath new plantings of trees and shrubs to discourage the growth of invasive plant species.

Public Safety and Access

To promote public safety and facilitate pedestrian and visual access to the river, the following vegetation height restrictions and setbacks should be observed*:

- Vegetation within designated view corridors should be kept to a maximum height of 3 feet. Trees may be placed within view corridors if they are able to be limbed or otherwise maintained to preserve the view of the river
- Vegetation within sight distance triangles at the intersection of the public right-of-way or at the intersection of any ingress or egress driveway and the public right-of-way should be kept to a maximum height of 2 feet. Sight distance triangles should be calculated according to the American Association of State Highway and Transportation Officials (AASHTO) guidelines (<http://www.fhwa.dot.gov/programadmin/y2k.gb.htm>).
- A setback of 4 feet should be maintained from the edges of all public access areas within which vegetation should be maintained at a maximum height of 2 feet.
- Vegetation should be maintained at appropriate heights such that it does not visually screen public access areas. Public access areas and pathways should be easily viewed from adjacent streets and properties.
- Planted trees and shrubs should be offset so as not to interfere with overhead utilities and signals.

* In public access, setback, and viewshed areas, shorter dwarf cultivars of approved species may be used to facilitate maintenance of the vegetation at specified heights.

Landscape Installation

The following installation guidelines should be observed:

- Planting should be done according to nursery specifications.
- Materials to be planted should meet the American Nursery and Landscape Association's Standards for Nursery Stock.
- At time of planting, canopy trees should be at least 1.5 to 2" caliper size (min. 20 gal container size). Shrubs should have a minimum container size of 5 gallons.
- Planting should occur in late fall or early spring. Avoid planting during summer months.
- The use of soil amendments such as compost prior to planting is encouraged to reduce the need for additional fertilizers during plant establishment.

Landscape Maintenance

Maintenance plans should be submitted along with landscape plans, and should include a detailed list of vegetation maintenance activities. Activities addressed within the maintenance plan should include:

- Pruning and removal of dead material.
- Leaf removal (not permitted in habitat areas).
- Weeding and removal of invasive species.
- Mulching.
- Irrigation.
- Fertilization.
- Pest management.

For each activity, the maintenance plan should identify the party responsible for

that activity, as well as a detailed schedule of when the activity will occur.

Suggested Practices:

Pruning and weeding

- Whenever possible, use mechanical methods of vegetation removal (e.g., mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.
- Avoid loosening the soil when conducting mechanical or manual weed control; this could lead to erosion. Use mulch or other erosion-control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Invasives control

- See CRMC certification for invasives control. <http://www.crmc.ri.gov/index.html#coastlandscapes>

Waste management

- Leaves, sticks, or other collected vegetation should be disposed of as leaf and yard waste at the Central Landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Reduce the use of high-nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming. Use soil mixtures that reduce fertilization.
- Avoid landscape wastes in and around storm drain inlets by using bagging equipment or by manually picking up the material.

Irrigation

- Keep landscape irrigation needs to a minimum through proper plant selection.
- Irrigation of plant materials will only be permitted during the establishment of new plant material.
- Whenever possible, utilize water collected in stormwater management practices such as rain barrels and cisterns for landscape irrigation.
- Where irrigation is necessary during plant establishment, use practices that promote water conservation, such as soaker hoses and moisture sensors.

Fertilizers and pesticides

- The use of fertilizers will only be permitted for the establishment of new plant material.
- Soil tests should be performed to determine whether fertilizer is needed for the establishment of new plant material.
- The use of fertilizer is not recommended for newly planted trees. Soil amendments such as compost should be used in lieu of fertilizers.
- Do not use fertilizers or pesticides if rain is expected within the following 24 hours. Apply fertilizers

and pesticides only when wind speeds are low (less than 5 miles per hour).

- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Incorporate fertilizers into the soil where possible, rather than broadcasting onto the surface.
- After application, sweep excess fertilizer from pavement and sidewalk back onto lawn or vegetated areas. Never rinse fertilizer off of these surfaces with a hose or sweep excess fertilizer into a curb, gutter, or storm drain.
- Periodically test soils to determine fertilizer needs.
- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques (see the Northeastern IPM Center's website at www.northeastipm.org for references).
- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Do not mix or prepare pesticides for application near storm drains or within 50 feet of the river's edge.
- Prepare the minimum amount of pesticide needed for the job, and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consider-

ation of alternative application techniques.

- Triple-rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

*Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.



APPENDIX B. STORMWATER MANAGEMENT USING LOW IMPACT DEVELOPMENT (LID)

Stormwater runoff from urbanized areas can be a significant source of pollutants to surface water bodies. In addition, the high percentage of impervious surfaces (roofs, roads, parking lots) in these areas prevents water from infiltrating into the ground and replenishing groundwater supplies. This increases the volume of stormwater runoff that is generated during rainfall events.

The Metro Bay UCG requires applicants within the Metro Bay SAMP area to use LID to the greatest extent possible to manage stormwater runoff. LID refers to a suite of stormwater management techniques that aim to mimic the natural hydrology of a site. LID uses small-scale distributed practices that retain, filter, infiltrate, or collect stormwater on site for reuse, instead of directing it to a sewer system and discharging it into surface water bodies. LID reduces stormwater volumes and enhances groundwater recharge, protecting water quality and groundwater supplies. Because many LID techniques have vegetation incorporated into their design, they offer aesthetically pleasing stormwater management methods that can enhance property values by doubling as landscape amenities. LID techniques can also be used as educational tools to raise awareness about stormwater and its environmental effects. LID techniques include rain gardens, vegetated swales, dry wells, cisterns for rainwater collection, pervious paving surfaces, and green roofs.

The Promenade district can be a showcase for LID innovations. New and renovated

buildings can feature a wide variety of LID techniques that result in new habitats, visually interesting architectural and landscape design features, and zero untreated discharge into the Woonasquatucket River.

Recommendations

The UCG requires 100 percent onsite stormwater management through innovative LID practices. All new permit applications must be signed by a reviewer who has been LID certified by CRMC. Property owners not required to submit applications to CRMC are encouraged to enhance their properties using these types of techniques in order to reduce the pressure on the sewer system in the area.

Innovative LID Applications for the Woonasquatucket River Area:

- Vegetated “green walls” can be used as retention walls that provide for new habitat and greenspace.
- New and old buildings can be fitted with “green roofs” that provide habitat, improve air quality, and filter and use rainwater.
- Terraced rain gardens or tiered systems can collect water in a series of basins that filter runoff before it finally enters the river.
- Vegetated swales can be installed as drainage channels that help to slow surface runoff and convey it to other storm water management practices.

Additional Information

The Urban Coastal Greenways Design Manual provides detailed guidance for selecting, designing, and implementing LID practices. This document can be found online at <http://www.crmc.ri.gov/regulations/programs/UCG10oct06.pdf>.

APPENDIX C. WOONASQUATUCKET RIVER FECAL COLIFORM BACTERIA AND DISSOLVED METALS TOTAL MAXIMUM DAILY LOADS

April 2007. From RI Department of Environmental Management

MS4-SPECIFIC REQUIREMENTS

City of Providence

The city of Providence submitted a Draft Phase II Stormwater Management Program Plan (SWMPP) in March 2004. TMDL recommendations for the city focus on the control of stormwater from the large amounts of impervious area draining to the river. The EPA Pipe Reconnaissance Survey identified approximately 236 pipes along the Woonasquatucket within the city limits of Providence. The SWMPP requires the city to compile a map of existing storm sewer overflows based on existing municipal mapping and GIS projects. The city should utilize the existing information compiled by EPA and coordinate with the NBC and DOT to confirm EPA study outfalls and identify and map any remaining outfalls.

Upon approval of this TMDL, the city of Providence will have 180 days to amend its SWMPP consistent with Part IV.D of the General Permit and more specifically, Section 7.3B and 7.3D of this TMDL. The city of Providence will be required to identify all outfalls, including channelized flows, to the Woonasquatucket as part of their Stormwater Phase II Requirements.

The city should coordinate with DOT to complete the identification, mapping, and determination of ownership and interconnections for all stormwater outfalls dis-

charging directly to the river. Best management practices (BMP) priority areas must include those outfalls and any other stormwater conveyances located in Dyerville, Olneyville, and Smith Hill. Many streets within this area exhibit a significant slope towards the river and allow rapid concentration and transport of stormwater to the river. Priority must be given to those outfalls that are greater than 24 feet in diameter. All BMP evaluations must investigate the feasibility of distributing infiltration throughout the drainage area of priority outfalls.

As part of its Good Housekeeping/Pollution Prevention requirements (Section 7.3a), the city must investigate the feasibility of street sweeping certain areas within the watershed more than the required once-annual schedule. Additional street sweeping would be beneficial within the Olneyville area. Street sweeping must also occur more regularly in those areas within the immediate topographic boundary of the river (i.e., focusing on those streets and roads that drain directly towards the river). In addition, the city must make efficient removal of debris and litter on streets a priority and tailor street sweeping activities accordingly. The city should coordinate with NBC and examine the feasibility of increased street sweeping activities within the CSO catchments. This would have the added benefit of reducing litter and debris that enter and often block regulators and diversion structures causing dry weather overflows.

As stated in the SWMPP and in order to prevent water quality impairments from stormwater runoff, the city must focus their efforts on the following, particularly in the Smith Hill and Olneyville neighborhoods:

- Focus commercial and industrial educational programs on companies located in the floodplain. These programs must include discussions of proper waste management and good housekeeping practices. The city should continue to work with and support the efforts of watershed organizations such as the Woonasquatucket River Watershed Council.
- Focus on an aggressive city-wide educational program to change current behaviors to protect and preserve water quality in the Woonasquatucket. Topics that must be included are pet and solid waste management proper lawn care and good housekeeping practices, and discouraging litter and debris.
- There are areas located along Kinsley Avenue and Promenade Street where significant amounts of industrial, commercial, and high-density residential areas exist. Focusing on the illicit discharges in this area may dramatically reduce the amount of pathogens discharged to the Woonasquatucket River.
- Consider other litter management strategies such as increasing the number of trash cans in common areas, using youth volunteers to pick up trash, increasing the number of dog waste receptacles, and initiating targeted inspections by city officials to insure dumpsters are covered and regularly emptied.

APPENDIX D. POTENTIAL FUNDING SOURCES FOR WOONASQUATUCKET PROJECTS

(DEM)

May/June—Riparian Restoration Grants

Funding for these grants is provided by the Narragansett Bay and Watershed Restoration Bond to restore and protect the water quality, and enhance the economic viability and environmental sustainability of Narragansett Bay and the state's watersheds. Eligible parties include state, local, and regional government and nonprofit agencies and private individuals with appropriate administrative capacity. The grants, provided on a matching basis, will give financial assistance for projects for the re-establishment of native species or other improvement projects that restore riparian habitat to a natural condition for the purpose of water quality improvement/protection.

Nov. to Jan.—Recreation Acquisition & Development Grants (individual awards = \$40,000 to \$300,000)

Eligibility: applicant must be a Rhode Island municipality. The property must be kept available solely for public outdoor recreation on a permanent basis. Once the funds have been granted, the structures, land, and facilities may never be used for non-outdoor recreational purposes.

May(?)—Historic and Passive Park Restoration Grants (\$8,000,000 for FY06),

June—Greenways Land Acquisition and Bikeway Development Grants

(\$15,000,000 total divided between land acquisition and bikeway and greenway development projects).

Feb. / March?—319 Grants (\$4,000,000 for FY07).

Clean Water Act Section 319(h) funds are provided only to designated state and tribal agencies to implement their approved nonpoint source management programs. State and tribal nonpoint source programs include a variety of components, including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and regulatory programs. Each year, EPA awards Section 319(h) funds to states in accordance with a state-by-state allocation formula that EPA has developed in consultation with the states. In accordance with guidance issued by EPA under Section 319 of the Clean Water Act, Section 319(h) funding decisions are made by the states. States submit their proposed funding plans to EPA. If a state's funding plan is consistent with grant eligibility requirements and procedures, EPA then awards the funds to the state. (RI Coordinator: Betsy Dake)

(OTHER—STATE)

Coastal Habitat Restoration Trust Fund (CRMC)

- \$250k annual.
- Eligible Organizations: City/town; State; NGO; Non-profit.
- Match Requirements: None, however match provided included as evaluation criterion.
- Contact: Caitlin Chaffee, CRMC

Ongoing - R.I. State Revolving Fund

- Funding through the R.I. Clean Water Finance Agency (CWFA) and DEM.

- Contact - Anthony Simeone – (401) 453-4430 (CWFA) or Jay Manning (401) 222-4700 x7254 (DEM).
- Eligible organizations: Local government entities.
- Fundable activities: Restoration projects with direct benefit to water quality.
- Matching requirements: Unknown.

*Tax Incremental Financing District (TIF)
(according to Fred Vincent, 903 Properties)*

This form of public financing was used for public improvements for the Providence Place Mall and also for the Corliss Landing waterfront project. Given the huge projected tax increases to result from the Farmer's Market redevelopment, the American Locomotive development, expansion of the Foundry complex and the full tax levy in 2013 from the 903 Residences, it would not be difficult to craft a TIF that would generate sufficient annual tax income (above current tax income) from these developments to fund a local revenue bond for river improvements.

(OTHER—FEDERAL)

February - Five Star Restoration Challenge Grants

- Funding through the National Fish and Wildlife Foundation and EPA.
- Contact - John Pai (EPA) – (202) 260-8076 or Tom Kelsch – (202) 857-5662.
- Eligible organizations: Public and private project sponsors.
- Fundable activities: Community-based restoration initiatives in watersheds.
- Matching requirements: None.

March 15 to November 1 - Wildlife Habitat Incentives Program (WHIP).

- Funding through the NRCS
- Contact - Joseph Bachand – (401) 822-8818.
- Eligible organizations: Private landowners, state agencies, and non-governmental organizations.
- Fundable activities: Ecosystem restoration.
- Matching requirements: Up to 75 percent cost share.

May - Community-Based Restoration Program

- Funding through the National Marine Fisheries Service.
- Contact - Robin Bruckner or Chris Doley – (301) 713-0174.
- Eligible organizations: Public and private project sponsors.
- Fundable activities: Small-scale locally driven habitat restoration projects.
- Matching requirements: 1:1 cash and in-kind.

June 1/October 15 - National Fish and Wildlife Foundation Grants

- Funding through the National Fish and Wildlife Foundation.
- Contact - Karen Hester – (401) 222-2023.
- Eligible organizations: States, federal agencies, non profits, universities and local governments.
- Fundable activities: On the ground restoration and conservation work.
- Matching requirements: Varies.

September - Wildlife Conservation and Appreciation Grant

- Funding through the U.S. Fish and Wildlife Service and EPA.
- Contact – (703) 358-1852.

- Eligible organizations: State fish and wildlife agencies (*Private organizations and individuals must work with their state agency).
- Fundable activities: Restoration of habitat as part of broader conservation plan.
- Matching requirements: N/A.

(Ongoing) U.S. Army Corps of Engineers

Partner with local sponsors (state agencies) to provide technical assistance and funding for large-scale projects involving environmental remediation and restoration, natural resource management, stream bank and shoreline protection, and navigation maintenance and improvement.

(OTHER—NGO)

December—Embrace-A-Stream program, Trout Unlimited

Embrace-A-Stream (EAS) is a matching grant program administered by the National Office of Trout Unlimited (TU) that awards funds to TU chapters and councils for coldwater fisheries conservation. Since its inception in 1975, EAS has funded 884 individual projects for a total of more than \$3.5 million in direct cash grants. Local TU chapters and councils have contributed an additional \$6.5 million in cash and in-kind services to EAS funded projects for a total investment of more than \$10 million.

Partners include the National Oceanic and Atmospheric Administration, Costa del Mar Sunglasses, and the Fish America Foundation. In 2007, the average grant award was \$5,800. Projects were located in 18 states and were consistent with TU's national conservation priorities concerning water quality, instream flows, Pacific and Atlantic salmon restoration, and native and wild trout conservation.

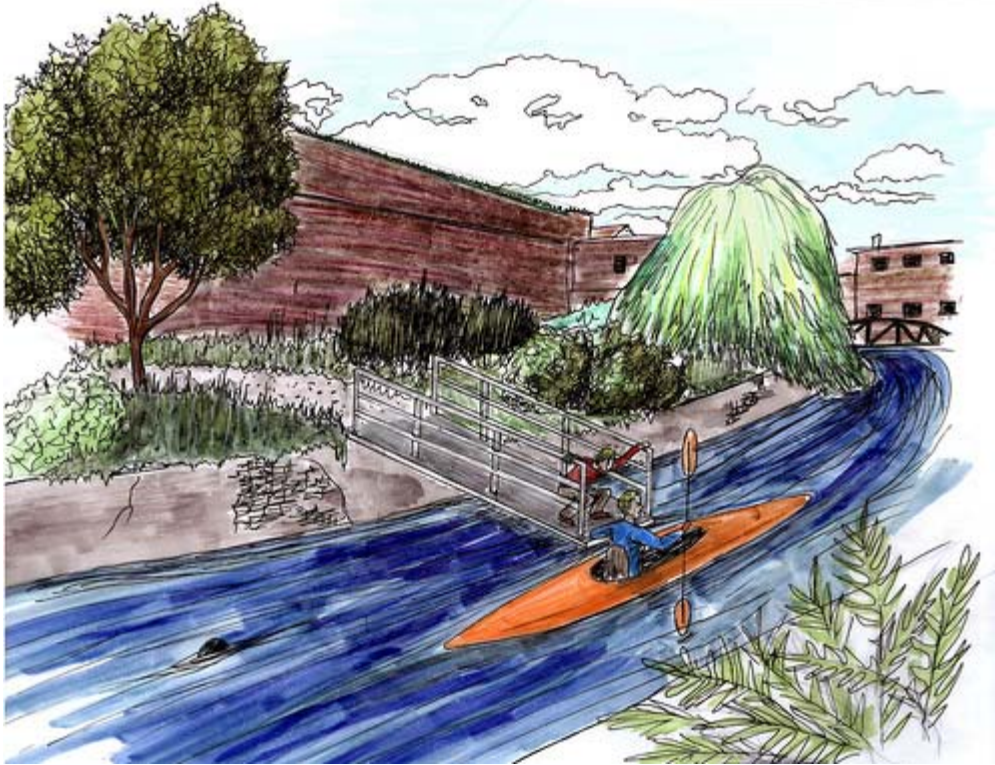
APPENDIX E. UNIVERSITY OF RHODE ISLAND LANDSCAPE ARCHITECTURE STUDIO

The renderings below were done in Spring 2007 by URI Landscape Architecture students in Professor Richard Sheridan's senior design studio. This class studied low impact development and best management practices for the Woonasquatucket River area of Providence, Rhode Island. The selected illustrations highlight increased public access, recreation, green space for local residents, and new methodologies for storm water retention and filtration while providing for wildlife habitat in an urban setting.



Greenspace. (Pleasant Valley Park)

Rendering by: Lara Skillins



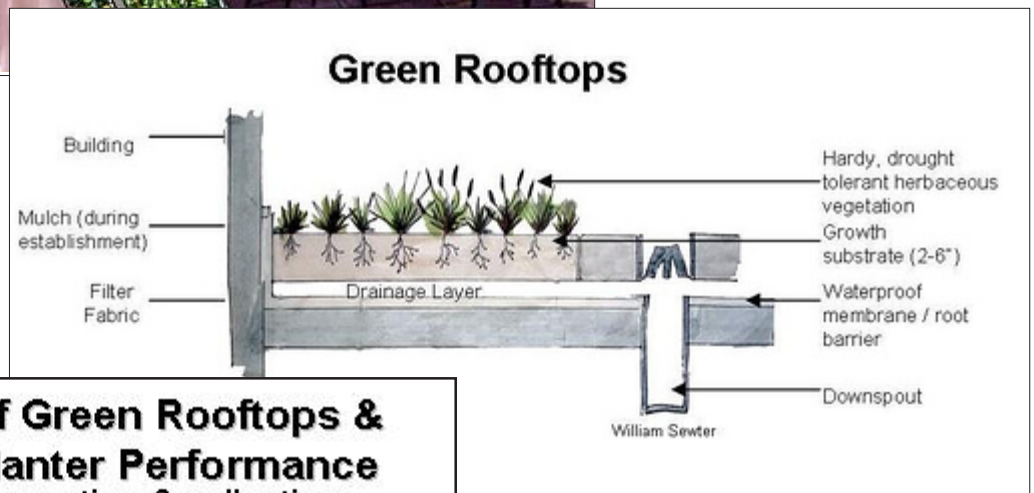
Eagle Square with urban wetlands implemented as well as a boat ramp. *Rendering by: Rayna Coletta*



The Green Bridge showing solar panels, informational signage, and vegetated channels with pipes. *Rendering by: Rayna Coletta*

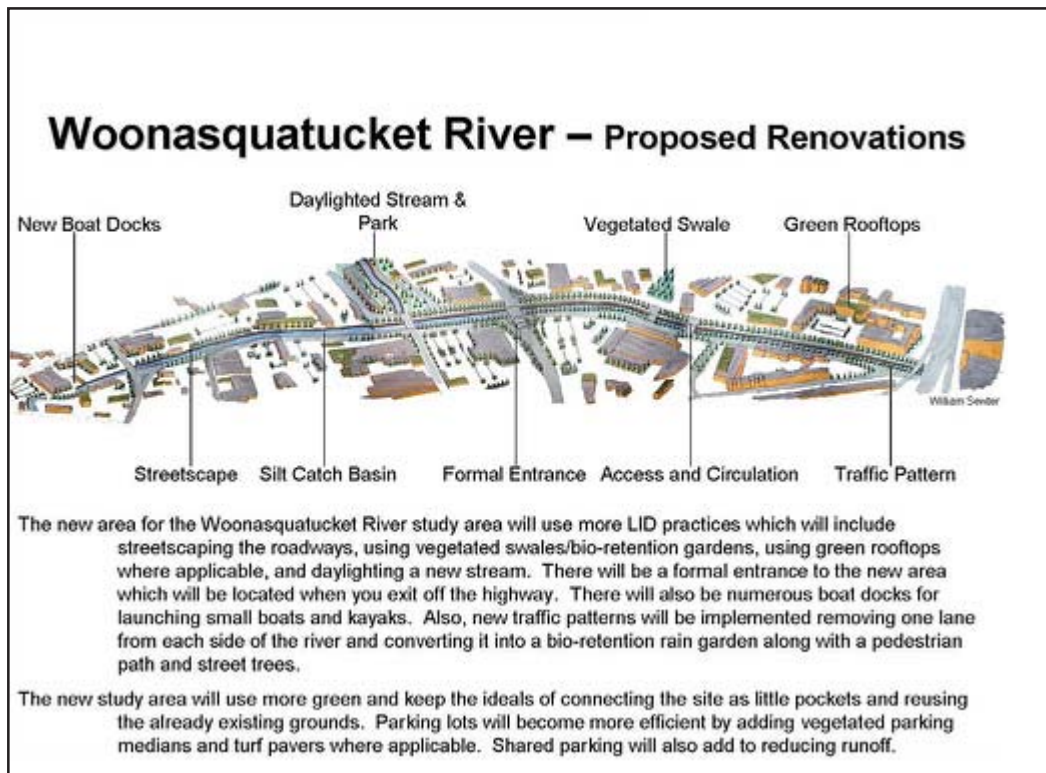


An intensive green roof on the foundry. Views of the river.
 Rendering by: Rayna Coletta



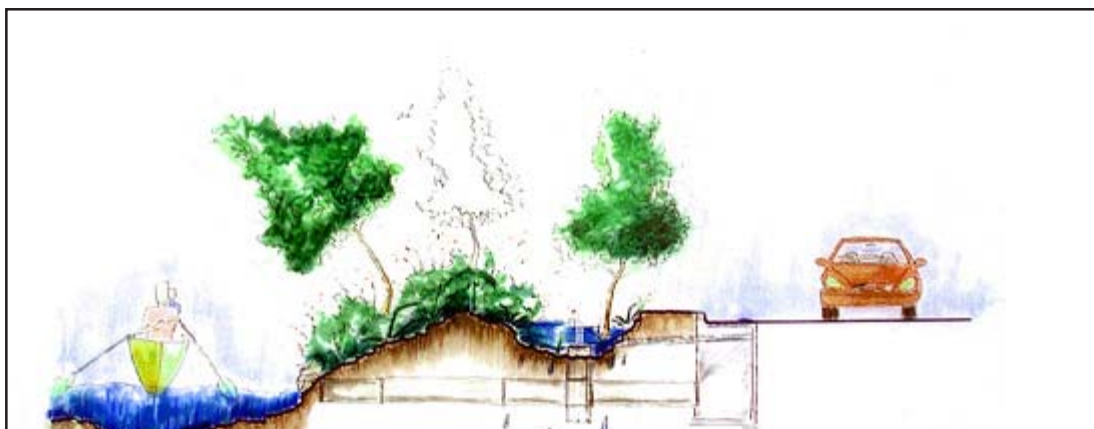
- ### Advantages of Green Rooftops & Stormwater Planter Performance
- Stormwater runoff absorption & collection
 - Reduced flooding of & damage to urban streets
 - Reduced combined sewer overflows (CSOs)
 - Climate Moderation
 - Air purification
 - Recreational amenity
 - Improved aesthetics
 - Extended roof life
 - Vegetative uptake of stormwater pollutants
 - Pretreatment for suspended solids
 - Aesthetically pleasing
 - Reduction of peak discharge rate

Green Rooftops.
 Rendering by William Sewter



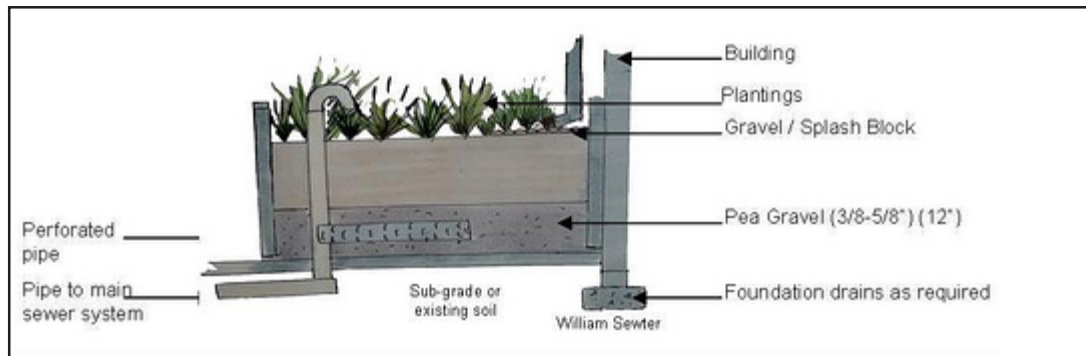
Woonasquatucket River - Proposed Renovations

Rendering by: William Sewter



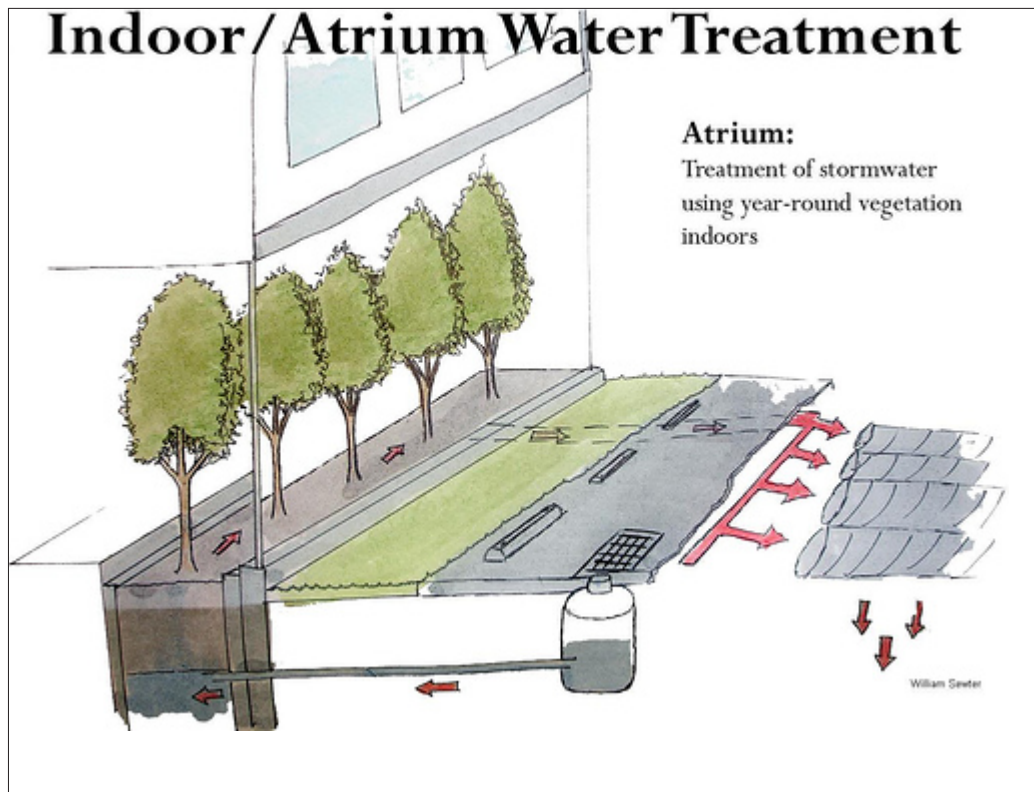
Roadway Cross Section- Catch basin/Wetland Alternative

Rendering by: Michael D'angelo



Storm Planters

Rendering by: William Sewter



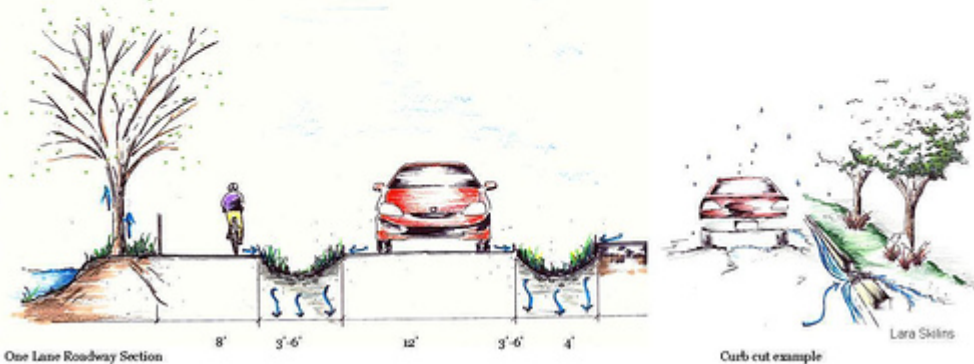
Indoor/Atrium Water Treatment

Rendering by: William Sewter

Streetscape. (swales)

Vegetative Swales

Vegetative and grassy bio swales remove high amount of phosphorus, nitrogen, zinc and lead from the water. The dry swale will be at least two feet deep with 3:1 side slope and will not exceed more than 600 feet in length to ensure that all runoff is properly treated. Soil in the dry swale will have an infiltration rate of 0.27 to 0.5 inches per hour and contains high amount of organic matter. All water will generally drain within 24 hours. Proper maintenance is critical to ensure the most successful swale. Curb cut will be placed every three hundred feet along the dry swale, enabling runoff to directly enter the swale and receive treatment.



Streetscape

Rendering by: Lara Skilins

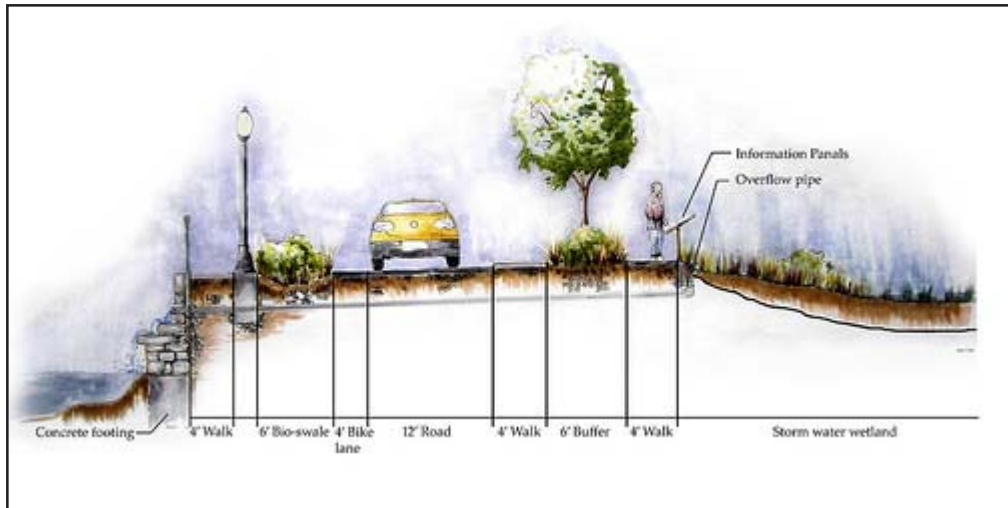
Green space. (floating garden etc.)

The walkways through the floating garden will be made of ipe wood because of its strong, dense and durable qualities. The wood is naturally rot, decay, and insect resistant in addition to being mold proof without the use of toxic chemicals. All ipe wood is harvested in sustainable forests and has an incredibly long lifespan in comparison to other woods. The wood also has a high no slip resistance. The railings will be made of ipe wood and stainless steel handrails to mimic the waves of an ocean.

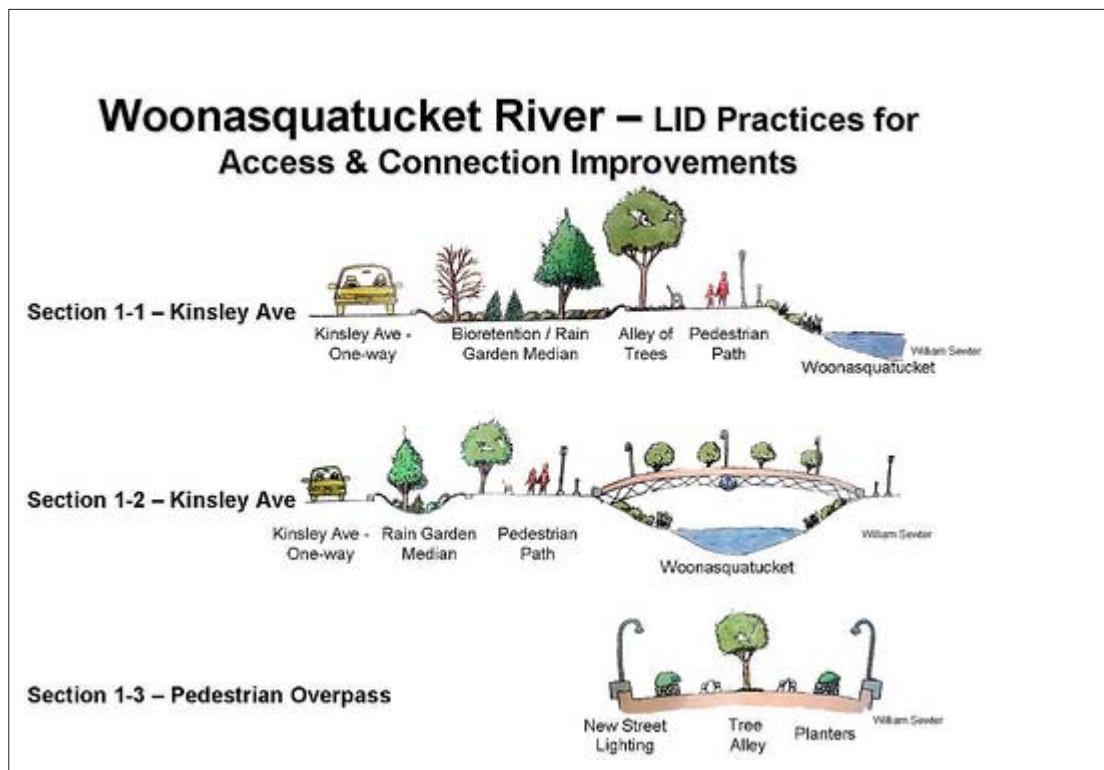


Greenspace

Rendering by: Lara Skilins




Roadway Cross Section - Catch Basin/Wetland Alternative
 Rendering by: William Sewter



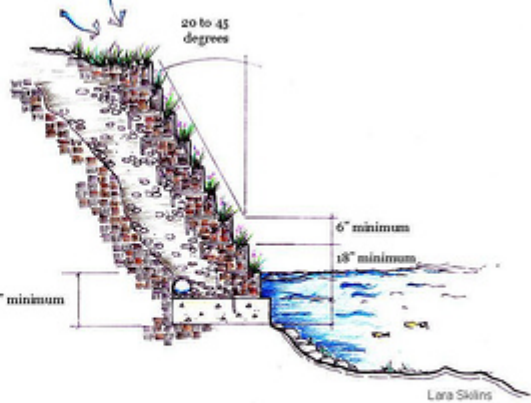
Access & Connections
 Rendering by: William Sewter

Riverbank. (green walls)



Existing conditions show degradation of walls along the riverbank.

Sample green walls along a riverbank.



20 to 45 degrees

6" minimum

18" minimum

12" minimum


Lara Skilins

Green walls

As existing walls along the riverbank deteriorate green walls will replace old structures. Storm water from the site and rooftops will run into the green wall systems before it enters the river. The various layers ensure ultimate filtration of the runoff as it flows through the plant material planted in a structural soil mix. Primary vegetation in the wall will be native grasses; it is essential that these plants be tolerant of coastal zone conditions.

Riverbank (green walls)
Rendering by: Lara Skilins

Green space. (clearwater park)



Clearwater Park

The park serves as a hub for surrounding facilities that has a pathway system top link adjacent facilities. Centrally located, is a rain water retention system that collects runoff from the site.

Parking for the adjacent facilities has been moved underground. Energy costs for underground structures run 40 to 70% less than above-ground structures. Dewatering will be introduced on the site to ensure structural integrity of the garage and to preserve the groundwater located on the site. Dewatering pipes groundwater off site and will treat groundwater before entering the river.

Although underground structures do not allow grass or other vegetation to absorb nutrients, minerals or pollutants from storm water runoff, the retention system above the garage will compensate.

Lara Skilins

Greenspace (Clearwater Park)
Rendering by: Lara Skilins



Eagle Square with possible future kayak access
Rendering by: Michael D'angelo