ASH CREEK ESTUARY

Master Plan 2023

Ash Creek Conservation Association, Inc.

Ash Creek Estuary Master Plan

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ONE NATURE

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Note: This document has been prepared for review by the Board of Directors at the Ash Creek Conservation Association and immediate stakeholders. It is not intended for wider distribution.

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INTRODUCTION

Ash Creek is one of Connecticut's few remaining ecologically significant urban tidal estuaries. Most urban tidal estuaries have been destroyed by development or are in such poor condition that they cannot provide habitat for migrating birds, wading birds, seed oysters, hard shell clams, finfish, or opportunities for valuable vegetation like saltmarsh cordgrass to grow. Over the course of four hundred years of continued industrialization and development in the watershed, this ecologically significant ecosystem has persisted, most recently under the watchful eye of the Ash Creek Conservation Association (ACCA). Despite its historic resilience, the Estuary is now on the verge of ecological collapse due to a variety of factors. Unless urgent action is taken soon this valuable resource will be lost.

In 2012, ACCA published the "Ash Creek Ecological Master Plan," its first master plan for the Estuary with a defined list of recommended projects and actions.[1] Many of the plan's recommendations have been implemented since originally published, others have remained out-of-reach. The Master Plan was intended to establish a trajectory towards a comprehensive strategy for the restoration, use, and management of the Estuary as well as a road map for further action.

Since the completion of the original 2012 Master Plan, the Ash Creek Conservation Association published the Ecohistory Report of Ash Creek Estuary, the 2014 Restoration Plans for St. Mary's-by-the-Sea, and the 2021 Ecological Analysis of the Barrier Spit. In 2013, the Rooster River Watershed Plan was published. Throughout the Watershed Plan, the authors referred to information stated in the Master Plan and endorsed water-quality and habitat related recommendations proposed in the Ash Creek Master Plan. Ash Creek Conservation Association has seen many improvements within the Estuary. There has been an increase in environmental education programming, coordination of dredging between Fairfield and Bridgeport (as of 2021), restoration of the coastal forest at St. Mary's-by-the-Sea (2019-2022), and most recently, beach grass plantings at St. Mary's-by-the-Sea (2022).

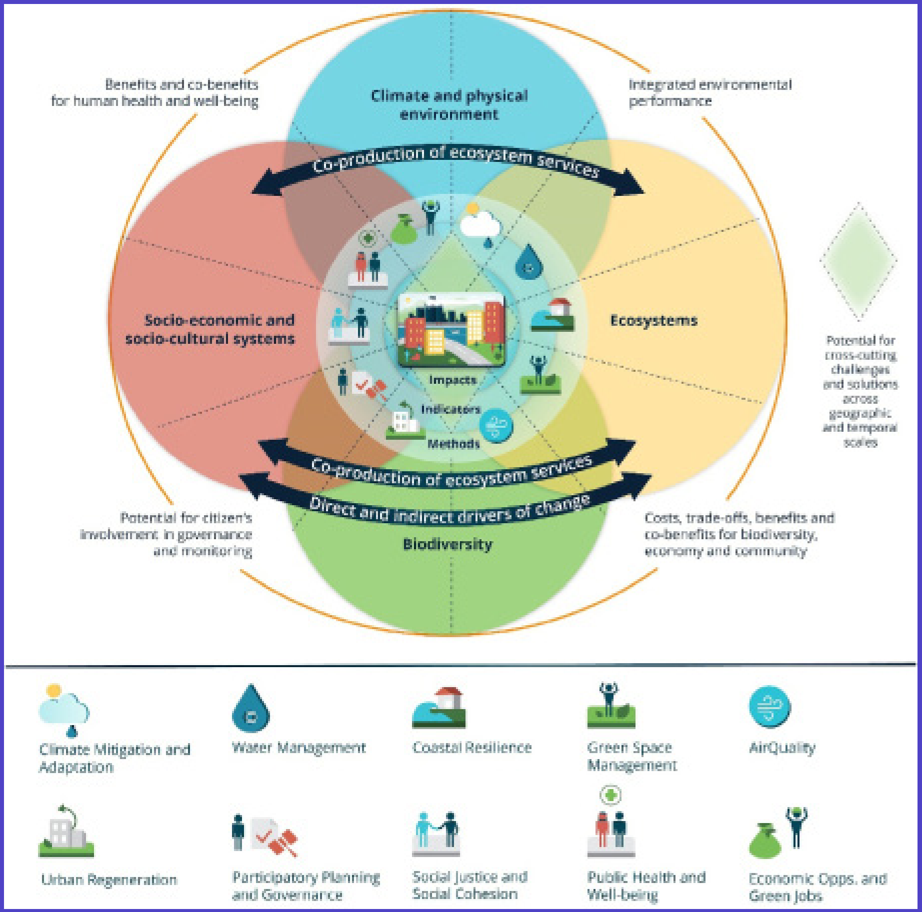
Environmental education has also expanded. Currently, several local schools and the Norwalk Maritime Aquarium use the Estuary for environmental education. In Fairfield, the non-profit Mill River Wetland Committee has developed the River-Lab Program to provide classroom materials and activities for students, extensive training for study-trip guides, and professional development for teachers. The program uses outdoor activities to help students from Osborne Hill and Fairfield Middle School discover the principles of river basin systems and their interrelationships with other important systems and human beings. In Bridgeport, the Black Rock School, St. Ann's School, the Bridgeport Regional Aquaculture Science and Technology Education Center (BRASTEC), and others also use the Estuary for environmental education.

Despite these many positive outcomes, the rate of systemic ecological deterioration in the Estuary has increased significantly in the past decade. CIRCA recommends that planning should anticipate a 1.75 foot sea level rise above the tidal datum by 2050.[2] With today's most conservative 2019 CIRCA estimates, total wetland loss of the Estuary is predicted by 2100[3]. In addition to wetland loss, erosion, habitat fragmentation, further development, and jurisdictional uncertainty, left unchecked, are likely to lead to the complete ecological collapse of the resource.

The socio-economic consequences of ecological collapse in the estuary are many. The Estuary has been, and remains, an important feature in the community. It is an important educational resource for children, especially in disadvantaged areas of Bridgeport. It is a scenic area, a place where urbanites can come to walk, fish, enjoy non-mechanized boating, and breathe in the relaxing breezes of Long Island Sound. The Estuary also provides flood control for abutting low elevation flatlands, its barrier spit slows erosion that threatens utilities and housing, its wetlands and mudflats filter pollution from upstream sources in the greater Rooster River Watershed, and its plant, soil, and animal life sequesters a huge amount of carbon. The Estuary also provides an aesthetic identity to the surrounding neighborhoods and serves as important open space. These culturally important services improve the quality of life in the local community and in turn enhance local property values.

Ecologically, the estuary is a refuge of biodiversity. In a relatively small area, it contains upper and lower spartina marsh, dune plant communities, coastal forest, mudflat, stream corridors, and an oyster reef. All of these habitats would be seriously damaged, some even eliminated, by the ecological collapse of the system. The tidal estuary serves as a wildlife sanctuary for nesting birds, shellfish, and finfish. It is also a breeding ground for horseshoe crabs. The Estuary's location along the Atlantic Flyway makes it a

CO-BENEFITS OF NATURE-BASED SOLUTIONS IN URBAN AREAS



"A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas;" Environmental Science & Policy, Volume 77, 2017; Christopher M. Raymond, Niki Frantzeskaki, Nadja Kabisch, Pam Berry, Margaretha Breil, Mihai Razvan Nita, Davide Geneletti, Carlo Calfapietra.

prime stopover and feeding location for migratory shorebirds along the Connecticut shoreline. The presence of these species within cities offers residents and visitors a unique experience while providing the ecological community a foothold for future regeneration of ecosystem services.

Estuaries such as this are important hotspots for carbon capture. Coastal wetlands have been found to store and sequester carbon at a rate ten times greater than mature tropical forests.[4] The Ash Creek tidal estuary contains significant wetland habitat and the loss or degradation of these wetlands can impact carbon storage abilities. With carbon dioxide concentrations increasing in the atmosphere, it is more important than ever to preserve and restore our coastal ecological systems. Bridgeport, with exceptionally high asthma rates among its population, is a high carbon emitting municipality currently and historically.

Importantly, the geography and conditions in the Ash Creek Estuary makes it an excellent location to focus investment for restoration and coastal resiliency. It has a narrow mouth that could be quickly stabilized through beach replenishment and revegetation, large linear runs of publicly-owned riparian buffers that could be converted to living shorelines, wetlands that could be raised with readily available dredged material, and several hydraulic blockages along small tidal creeks which will be replaced in the coming decades. When compared to larger, more open tidal systems along the Long Island Sound coastline, relatively small investments can therefore have major positive impact.

While a wide array of viable ecological management projects with excellent cost-benefit ratios exist that would mitigate against ecological collapse, perhaps the most significant obstruction to their implementation is the political complexity that exists within this urban watershed. Natural ecosystems are already well documented to be complicated. Urban ecosystems, such as the estuary, add an element of anthropocentric conditions that make environmental resources even more difficult to manage. The Ash Creek Estuary is bisected between two municipalities, each with its own management plan and management history. Perhaps the most important recommendation in this report is for the formation of a collaborative entity capable of co-managing the Estuary.

The Estuary is bisected by the Fairfield-Bridgeport municipal boundary. This political division creates challenges, complications, and opportunities regarding local planning and management of the creek. Until recently, contemporary planning efforts have been primarily tailored to the natural resources physically located within one municipality or the other. Although Bridgeport and Fairfield have addressed Ash Creek in one form or another in their open space planning (e.g. the City of Bridgeport Open Space Master Plan, the Town of Fairfield Multiple Use Management Plan for Coastal Open Space), these planning documents tend to be specific to their municipal boundaries and rarely do they consider the Estuary as a unified whole.

More recent planning efforts have attempted to move beyond the municipal boundaries. Notable efforts include the educational and advisory activities of the Ash Creek Conservation Association, and the 2013 Rooster River watershed planning effort. Ash Creek, although part of the greater Rooster River watershed, is located downstream of the Rooster River, connecting the Rooster River to Long Island Sound. Unlike the Rooster River, Ash Creek is a different type of habitat that requires its own management plan. This comprehensive restoration plan for Ash Creek therefore will serve as a contribution and a complement to the Rooster River planning effort.

The practical implications of Ash Creek being shared by two municipalities have long been recognized. The Ash Creek Conservation Association was formed as a unifying organization to protect and preserve the Estuary. As such, the Association is ideally situated, and uniquely qualified, to be a bridge between the two municipalities and therefore play a central role in developing and coordinating planning efforts for the Estuary.

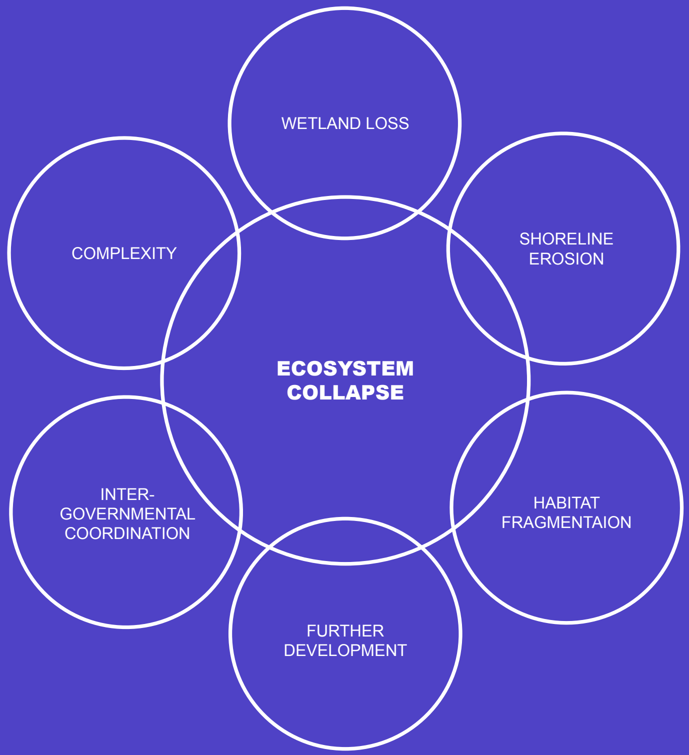
In consideration of the urgent need for action in the Estuary, ACCA has published this revised Ecological Master Plan to guide the next decade's efforts to mitigate against ecological collapse in the Estuary. Funding for this updated and revised master plan has been provided by Long Island Sound Stewardship Fund at the Long Island Community Foundation and the Community Environmental Benefits Fund managed by the Environmental Task Force.

AVERTING ECOLOGICAL COLLAPSE

Despite the current trajectory of the Estuary, there are solutions available that can avert ecological collapse, thereby preserving the Estuary's ecological, economic, and social importance to the local community. This report identifies the most pressing problems in the Estuary: Wetland Loss, Shoreline Erosion, Habitat Fragmentation, Development, Complexity, and Intergovernmental Coordination.

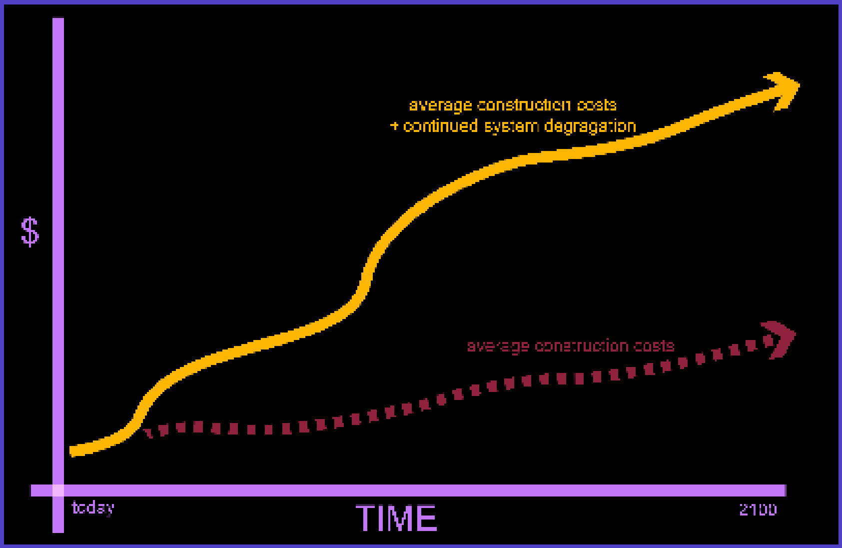
ECOSYSTEM COLLAPSE

Ecosystem collapse occurs when the fundamental habitat identity of a landscape degrades to a point that it must reform itself through successional processes. Because ecosystems are interrelated systems, collapse can happen quickly after a tipping point has been reached.



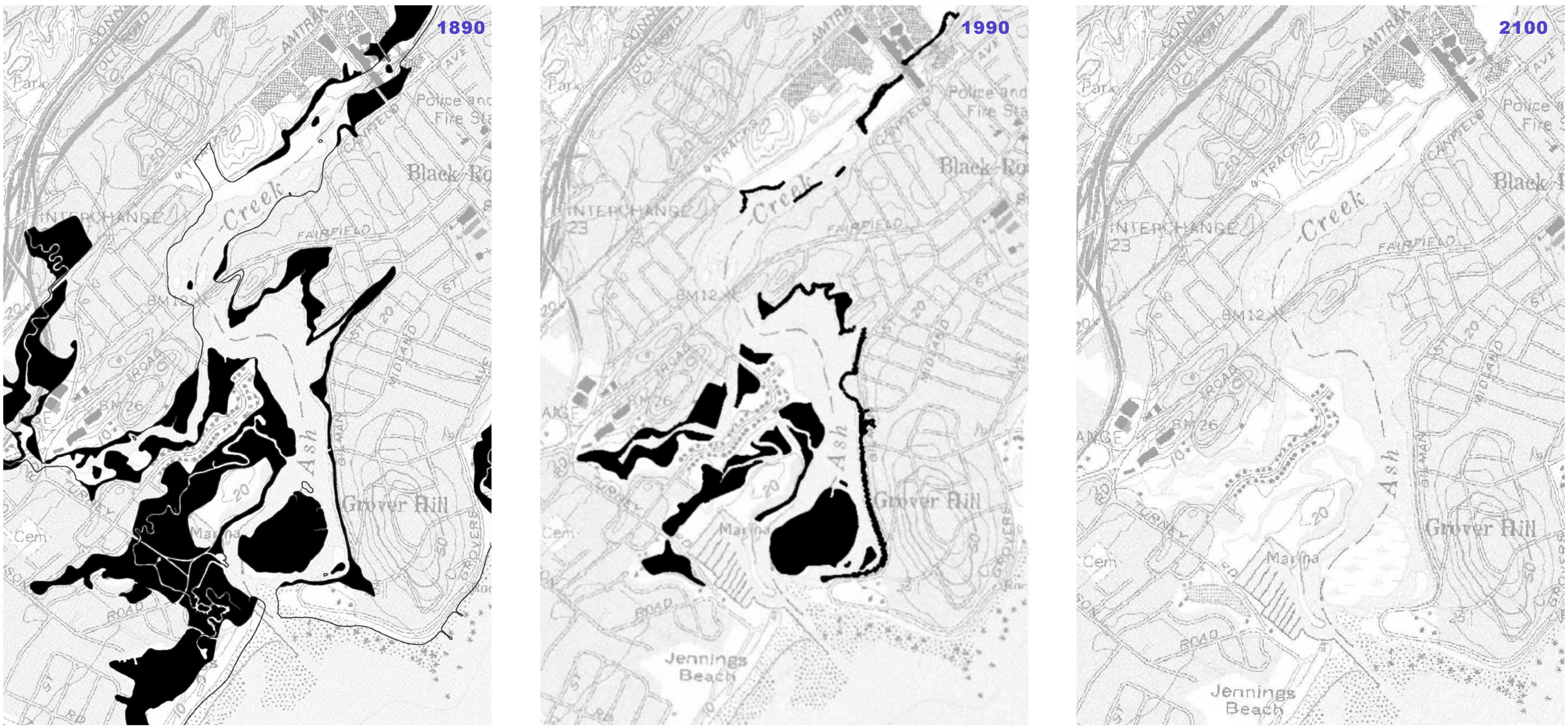
COST ESCALATION OVER TIME

The cost of ecological restoration often escalates unpredictably and more than other types of construction types. The loss of key habitat components, such as the sediments under eroding wetlands, make the project harder to build. For this reason, near-term action is important in a rapidly deteriorating system like the Ash Creek Estuary. Moreover, demand for public funding is likely to become more competitive as similar coastal systems begin to fail along our coastlines.



WETLAND LOSS

Spartina marsh can only exist in a relatively narrow section of the tidal column, within 1' of high tide. As sea levels have shifted over the eons, tidal marshes have migrated into inland areas. But with heavy development throughout the Estuary, the wetlands have nowhere to go as sea levels rapidly rise in the coming decades. Today's wetlands are degrading due to the changing climate, rising sea level, and altered sediment regimes.[5] The wetlands in the Ash Creek estuary are at risk of being lost forever if serious action is not taken. From the 1890s to 1990s, a significant decrease in wetland acreage can be seen. In the 1880s, about 100 acres of wetland existed within the study boundary.[6] In the 1990s, just under 50 acres are present.[7] This indicates that within a hundred years, over half the wetlands within the Ash Creek estuary were lost. Based on sea level predictions, and GIS analysis, Great Marsh Island and the wetlands surrounding Turney Creek and Riverside Creek will completely disappear by 2090.



These comparative images are maps of the Estuary's tidal wetlands (shown in black). Preservation, restoration, and creation of new wetlands will all be needed in the next fifty years to avoid ecological collapse.

The loss of the wetlands in the Estuary has the potential to impact wildlife and humans. Ash Creek's wetlands contain unique flora and fauna that rely on this ecosystem, and it is important that serious action is taken now to protect this unique ecosystem

With the loss of the estuary wetlands, there will be a significant impact on the wildlife and biodiversity of the area. The estuary contains tidal wetlands which are an important ecosystem along the Connecticut shoreline. Tidal wetlands provide refuge and habitat for numerous shorebird species and are a suitable nursery for many species.

The tidal wetlands contain three areas – mudlflats, low marsh and high marsh. Each area contains unique plant and wildlife species and provide their own essential roles to the ecosystem.

Mudflats are submerged during high tide and during low tide, are exposed. This area is teeming with biodiversity, containing species such as saltmarsh snails, saltmarsh isopods, and saltmarsh amphipods.[8] Some fish such as the common mummichog use the marsh for breeding grounds during spring high tides.[9] The marsh offers a source of protection for the eggs and young fish against predators. Blue crab and green crab can also be found in the intertidal zone of a tidal wetland.

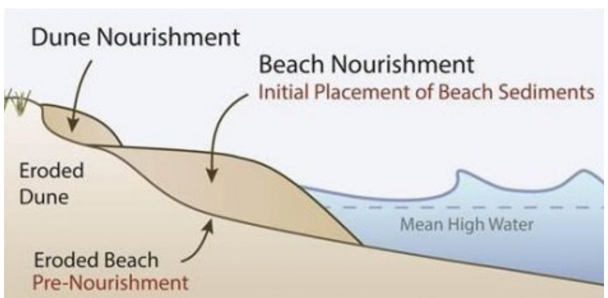
Low marsh areas are primarily dominated by smooth cordgrass, Spartina alterniflora.[10] Between the low marsh and mudflat boundary, ribbed mussels and fiddler crabs are found. Ribbed mussels are important for water filtration and shore stabilization. Research has shown that there is a mutualism between mussels and cordgrass.[11, 12]

High marsh is not continually flooded, but will get flooded by some spring high tides. Saltmeadow cordgrass, Spartina patens, grows in this area. In the upper limits of the high marsh, switchgrass and the common reed are typically present.

Sea level rise threatens the wildlife and biodiversity of these wetlands. The relative sea level trend is 3.14 millimeters/year, which is equivalent to a change of 1.03 feet in 100 years.[13] Based on this statistic, in the past ten years since the publication of the original master plan, the sea level at Ash Creek Estuary has risen 30mm which is equivalent to 1.2 inches. With the rising sea level, Connecticut shorelines are at risk for increased erosion, flooding, and coastal inundation.[14] The increased risk of erosion and flooding puts beaches and salt marshes at risk, which is of special concern to the Ash Creek estuary. Global sea level is rising at an accelerating rate.[15] Sea level rise rates along the east coast, including Connecticut, are higher than the global average due to the sinking of the coastline.[16] This puts an urgent nature to the response needed in the Ash Creek estuary to combat sea level rise.

During sea level rise, salt marshes move inland due to increasing soil salinity, encroaching on suburban areas, agricultural fields, and low-lying forests. As a result, upland vegetation is replaced by salt-tolerant marsh plants.[17] Ash Creek estuary and its marshes are situated in a highly urban environment. This raises the concern of marsh loss due to rising sea levels. Higher sea levels also means that storm surges are affecting coastal properties even further inland. Tidal wetlands also are an important source of shoreline protection and water quality improvement, and their loss due to rising sea level will lead to more flooding inland.

SOLUTIONS



Living Shorelines. Living shorelines are built structures consisting of natural materials such as rock, sand, vegetation, and other organic materials designed to break wave action and create wetland shelves. They are implemented for shore stabilization and are a preferable alternative to structures of man-made materials such as concrete because they will not prevent plant and wildlife colonization. Living shorelines allow the continuation of natural processes and can be a solution to wetland loss due to the protection they offer. They tend to cost less than hard shorelines. Living shorelines should be installed to allow for marsh migration by converting a limited amount of mudflat to Spartina intertidal zones.

Wetland Accretion. Sediment input into wetlands is important, made even more necessary with rising sea levels according to CIRCA estimates. The natural rate of vertical accretion will not be able to keep up with the rate at which sea level is rising. The Estuary has a sustainable and abundant supply of sediments suitable for wetland accretion because of regular dredging in the navigation channel that connects the Marina to the Sound. This material should be used for the barrier spit's restoration in addition to enhancements to Great Marsh Island and the fringe tidal marsh.

Barrier Spit Reinforcement. The reduction in size of the barrier spit in the Ash Creek estuary negatively impacts Great Marsh Island. Barrier spits absorb wave action and can be a vital source of protection for inland habitats. Reinforcing the barrier spit would protect Great Marsh Island from erosive wave action. Reinforcement of the barrier spit should include additional soil stabilizing plants and the addition of sand to raise the overall elevation of the landform significantly (thereby also expanding the width). The Estuary has a sustainable and abundant supply of sediments suitable for wetland accretion because of regular dredging in the navigation channel that connects the Marina to the Sound. This material should be shared with wetland accretion projects. In 2022, a large re-vegetative planting was installed across the barrier spit as a short-term stabilization solution. The installed plants, once established in 2023, should be buried by several feet of sand to increase the total height of the landform. The ideal topography for the landform was established in 2014 with funding from the State of Connecticut Department of Justice related to an upstream natural resource damage event.[18]

Land Use Changes. Where possible, low areas where marsh migration can be successful should be identified as potential sacrificial areas. Suitable areas, by definition, are also areas likely to flood during storm surges and are most susceptible to sea level rise inundation. Given how highly developed the Estuary uplands are, vertical changes will be critical.

SHORELINE EROSION

The Estuary's ecological integrity is suffering from several instances of erosion.

Most significantly impacted is the barrier spit. Sand naturally moves parallel to the shoreline. This natural process is known as littoral drift. Littoral drift is not predictable in Long Island Sound as its primary influence is through storm and wave action, whose direction varies depending on wind and wave direction. In the past century, the process of littoral drift has been severely impacted along the entire eastern United States because of shoreline armoring and marine dredging, depriving naturals areas of needed sediment. Nearshore sediments are also regularly mined for beach sand to support public beaches. In the estuary, Jennings Beach is dependent on offshore sand mining.

In this estuary, significant evidence of erosion of the barrier spit can be seen by analyzing historical aerial photography of the area. The erosion is so extreme that it is predicted the barrier spit will erode to below sea-level elevations in the next two decades, or in less time if a major hurricane accelerates the process.

As the result of wetland loss, land along the edges of the Great Marsh Island and the Gilman Street walkway has also suffered erosion. The loss of wetland allows increased wave and current-driven erosion, which undermines slopes and root mats.

Recreational use can also lead to loss of vegetation which in turn increases susceptibility to erosion. Recreation use includes increased boat traffic and/or docks in shallow waters, shellfish harvesting, foot traffic over sensitive dune and wetland plant root systems, and unleashed dogs. These can all accelerate or cause shoreline erosion. A popular recreational activity, digging in the mudflats for worms and clams, disturbs the sediment which in turn contributes to shoreline erosion.

Tidal wetlands are also known to sequester pollutants. Centuries of heavy metals and other pollutants are likely buried under some of the Estuary's soil. Any unmonitored disruption of these soils, such as shellfish consumption or construction of dock piles, could cause mobilization of potentially hazardous materials.

SOLUTIONS

Plant Stabilization. The addition of vegetation in areas vulnerable to erosion would be beneficial to the Estuary and would help against erosive wave action. Plant roots hold sediment in place. As water passes through these areas, surrounding vegetation will not only absorb the water but will also prevent the sediment from being washed away. Plantings should occur on slopes along St. Mary's barrier spit and throughout the tidal estuary.

Sand Replenishment. Sand replenishment, also known as beach nourishment, is a process of replacing beach sand lost through erosion or drift. This is usually done by sourcing sand from other sources and pumping or barging it onto the shore. Sand replenishment is a way to mitigate the effects of erosion by widening the shoreline. This has benefits for both wildlife and recreation. Widening the shoreline will also serve as further inland protection against waves and storms. Sand replenishment is a process that will need to be repeated periodically.

Dredging Coordination. The town of Fairfield currently dredges the marina channel in Ash Creek Estuary and places the dredged material at the nearby Jennings beach. Coordination between organizations to place a thin layer of high-quality dredge material on the barrier spit, Great Marsh Island, and other areas in the Estuary would provide a local source of sediment to the Estuary.

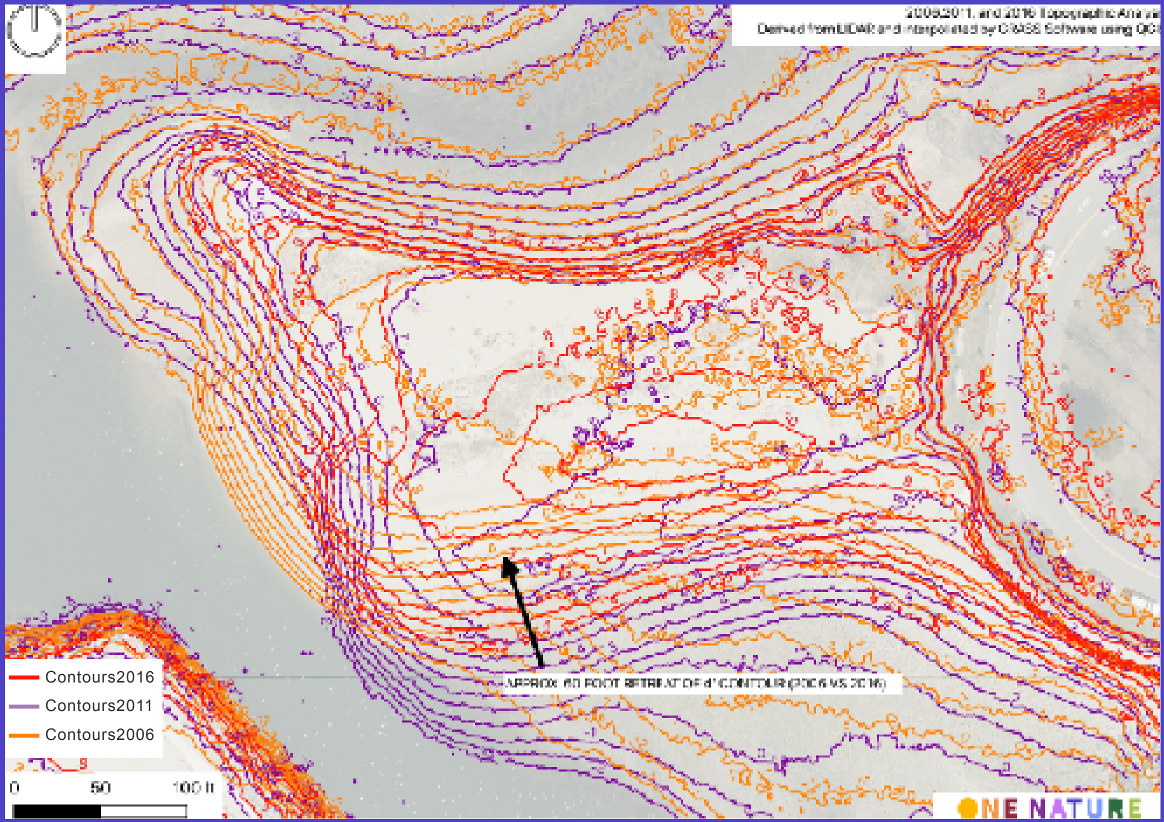
Dock Removal and Moratorium. The construction of docks can damage plant communities that stabilize the Estuary's shoreline. Once built, increased recreational activity and shading make the problem more pronounced.

No new docks should be allowed in the Estuary. Incentives should be offered to remove existing docks.

Invasive Species Management. In some cases, invasive species exacerbate erosion. An example is the impact vines have on shoreline trees and shrubs, weighing them down and uprooting their root balls to expose loose soil. In other cases, invasive species protect against erosion. For example, Phragmites marsh has been shown to significantly reduce wave impacts. Invasive species management in the Estuary should therefore be targeted to best reduce shoreline erosion.

SHORELINE EROSION OF THE BARRIER SPIT AND GREAT MARSH ISLAND

In 2021, ACCA commissioned an analysis of shoreline change for the Barrier Spit and Great Marsh Island. Using historic LIDAR, topographic surveys, and aerial imagery, the report demonstrated rapid beach and wetland loss in both areas. The report suggested at the current rate of erosion the Barrier Spit could be completely below the high tide line by 2036.



SHORELINE EROSION AT SOUTH BENSON MARINA

South Benson Marina is a relatively new addition to the Estuary. It was created in the post-WWII population boom of the 1950's along-side rapid residential development in Fairfield County. In recent times, the navigable channel required for the Marina has been deepened to allow for larger and deeper drafting boats. Because in sandy coastal environments deeper channels require wider slopes, the Barrier Spit appears to suffer even more rapid decline in recent years.

1934

1951

1970

HABITAT FRAGMENTATION

The Estuary does not end at high tide line: marine forest, salt meadows, and hilltops are an integral part of estuarine ecological function. All that falls within the drainage basin of the Estuary contributes to or impacts the function of the Estuary. The upland habitats and wildlife are therefore an important facet of the Ash Creek estuary and are threatened by habitat fragmentation.

Habitat fragmentation is the process by which a contiguous patch of habitat is divided, or fragmented, into smaller patches. This occurs through natural process or more commonly through human intervention. Fragmentation is a side effect of urbanization and can lead to a loss of biodiversity and ecosystem services of a given area. The Ash Creek estuary sits in a unique location, surrounded by a highly urbanized environment. Habitat fragmentation is a concern within the Estuary and within the surrounding areas as it continues to be developed.

As patches of undeveloped habitat decrease in size and increase in distance from each other, local wildlife is threatened. Pollinators and birds rely on the plants found along the streets and in residential landscapes as well as plants within the estuary. Habitat fragmentation can threaten urban wildlife and bring in invasive species.

Breaking up the landscape decreases connectivity, meaning wildlife cannot travel as easily between patches for food and shelter. This leads to population isolation.

As habitat patches decrease in size, the ratio of “edge” habitat to interior habitat increases. Edge habitats have higher instances of disturbance which is ideal habitat for invasive species to colonize.

As the acreage of natural areas decreases in an urban setting such as Bridgeport and Fairfield, temperatures can increase, known as the “heat island effect.” The heat island effect occurs in urban environments where vegetation is severely limited. Structures such as buildings, roads, and sidewalks absorb more of the sun’s energy compared to natural areas containing trees and water. Heat is emitted and causes the temperature in these areas to be much higher than the surroundings.[19] The impacts of these heat islands can cause increases in electricity usage, impairment in water quality, and can compromise human health.[20] The urban heat island effect has also been found to affect phenology in early environments which can have effects on local wildlife species.[21]

Residential development contributes to habitat fragmentation through less desirable landcover, flooding, and water quality impacts.

There is an abundance of impermeable surfaces (roads, roofs, driveways, parking lots, etc.) within the area that drains into the Estuary. When rainfall events occur, the water moves quickly to the Estuary, bringing with it pollutant loads and temperature spikes. The majority of permeable landscape is dominated by lawn and non-native ornamental species of plants. As a result, wildlife habitat suffers.

Impermeable surfaces also contribute to localized flooding during extreme storm events. With nowhere to go, water collects and overwhelms collection systems.

Engineered restrictions of freshwater and tidal streams in the Estuary are also a cause for concern. Road culverts, flood control structures, and buried streams all create habitat blockages, tend to increase localized flooding, and negatively impact water quality in the Estuary. For example, Turney Creek is buried as it travels under the Old Post Road. Stream daylighting allows for an increased area for water to pass through, which can prevent flooding. Stream daylighting also has benefits for wildlife and can increase connectivity for aquatic organisms.[22] While complete culvert removal may not be feasible, improvements to the design could be implemented.[23]

This comparative aerial analysis of the Black Rock neighborhood shows the extent of fragmentation that has occurred in the past 90 years.

SOLUTIONS

Native Plants. Public outreach and incentives should be done to increase the presence of native plants in the upland landscapes around the Estuary. Edge habitats, a result of habitat fragmentation, are prone to including invasive species due to their ability to colonize a disturbed site. Connecting these fragments with native plants would reduce the edge habitat and increase connectivity. Native plants support more wildlife than nonnative plants and are adapted to this area. Therefore they are more likely to persist. They will also provide food and host sources for local wildlife. There are a very large number of native plants suitable to the Estuary's uplands, many of which can be utilized ornamentally to meet resident's needs.

Opportunities for native plant establishment in upland and riparian areas include: residential landscapes, parks and roadsides, institutional landscapes, commercial use properties, and vacant lands.

Stormwater Management. Promote stormwater capture technologies including bioswales, vegetative buffer strips, rain barrel use, vacant lot conversions, and permeable paving throughout the drainage area. Buried streams should be daylit (dug up and planted so they flow freely in the sunshine). Culverts should be eliminated or widened where possible. Flood control structures should be closely examined to ascertain their impacts to water quality and plant communities. North of Old Post Road, Turney Creek runs underground through a culvert.

Urban Forestry. Urban forests, the collective tree community on streets, in parks, in backyards,

URBAN FORESTRY

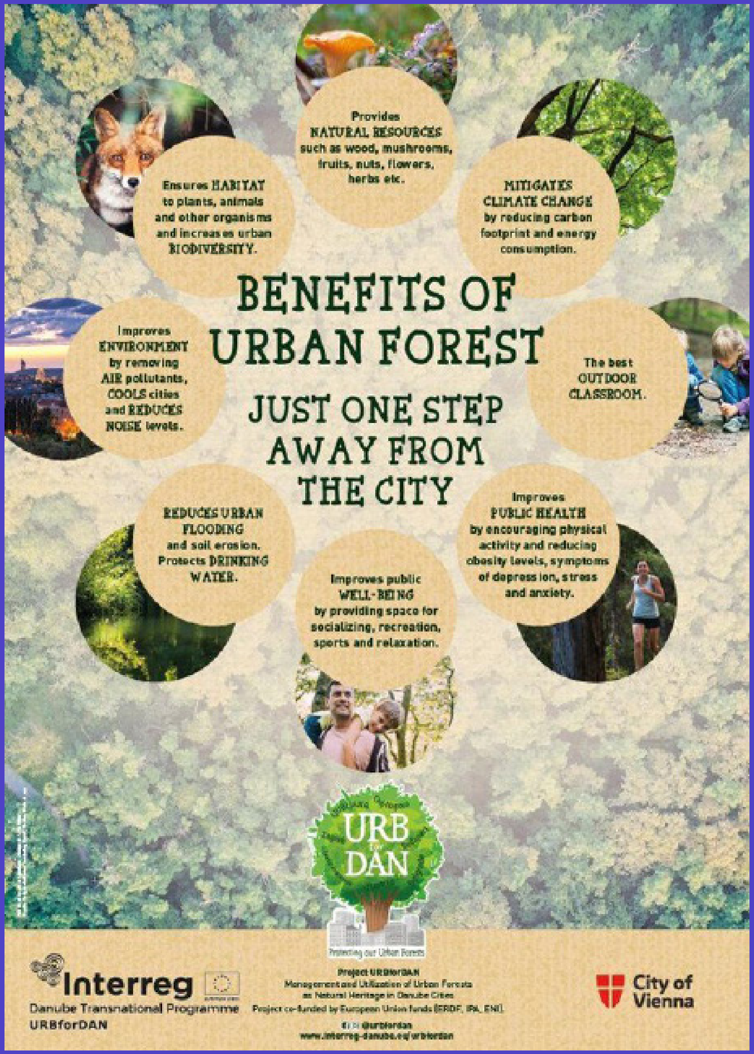
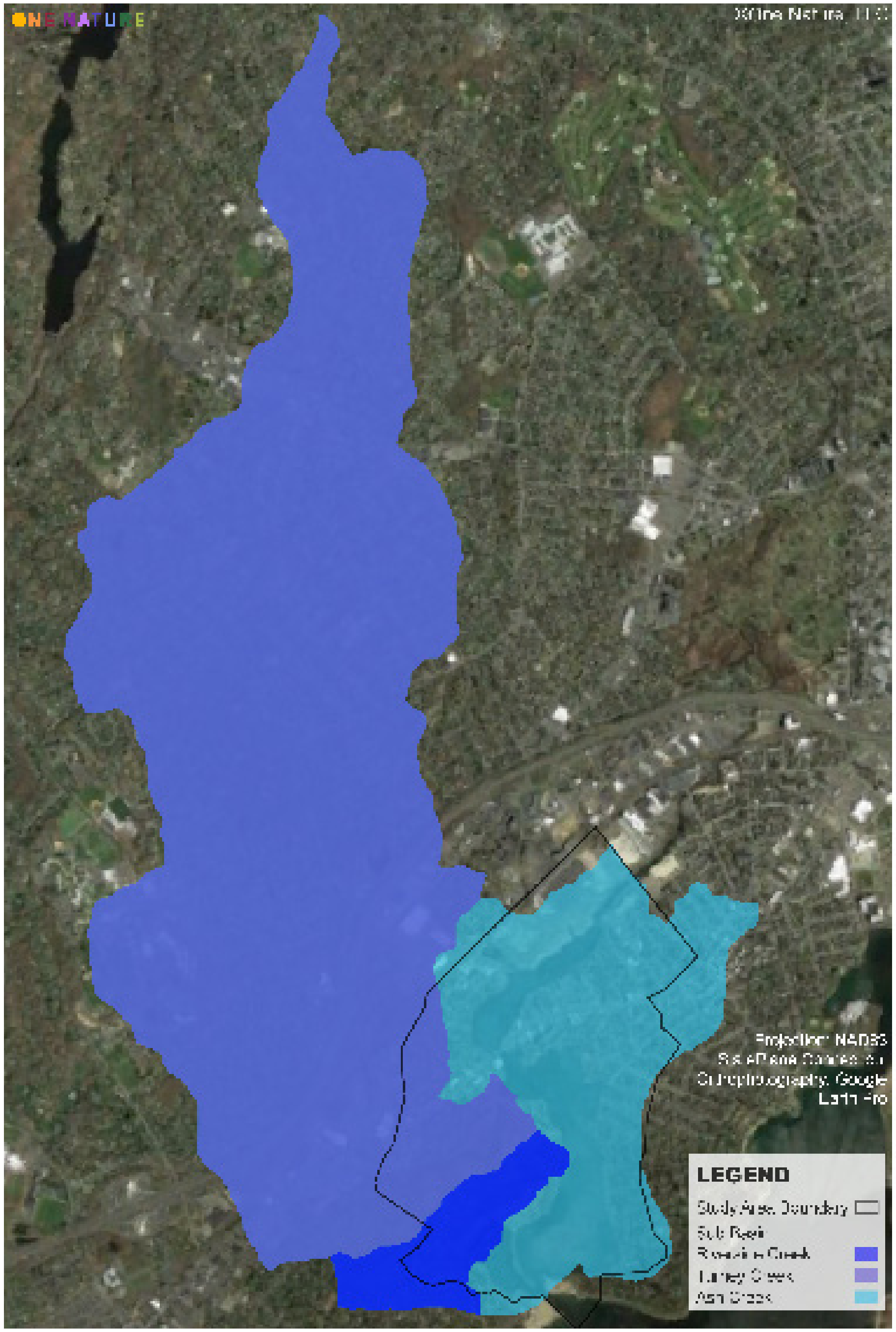


Image credit: City of Vienna



and other areas, are critical in providing food and shelter to migrating and resident wildlife. There should be a priority on developing and protecting the urban forests surrounding the Estuary. Trees in urban environments not only provide benefits to wildlife but to humans too. They keep cities cooler, manage stormwater, and sequester carbon.[24] Efforts such as the restoration of the Preserve at Saint Mary's have been underway since 2019. Similar projects should be developed. In addition, a tree survey of the estuary's uplands should be kept that includes both Bridgeport and Fairfield street trees. A comprehensive urban forestry plan should be established and implemented throughout the watershed. Local nurseries that provide native plant installation services should be identified and made known to the community for private property plantings.

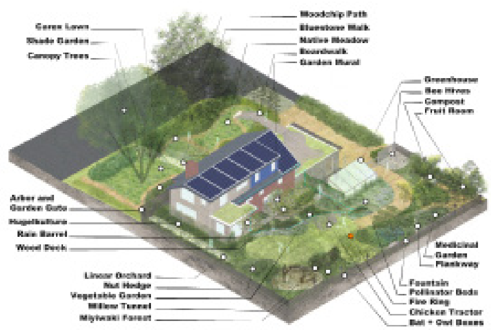
This watershed map includes all storm water drainage basins below the Brewster Street Bridge. Note the size of the Turney Creek watershed, most of which travels through buried pipes.

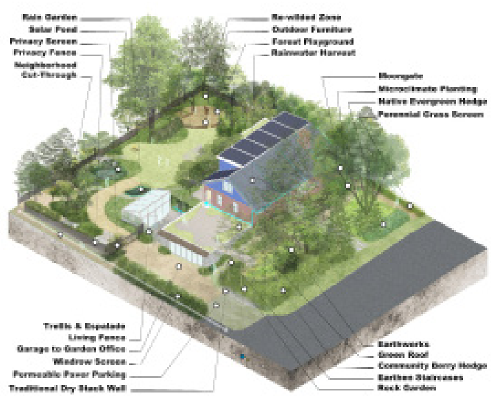
SUBURBAN AND URBAN SPRAWL

Suburban and urban sprawl have come at great cost to their surrounding ecosystems. From toxic fertilizers and pesticides to the addition of ecologically insignificant plant species, the upland and riparian habitat around the Estuary is greatly impaired.

Changing the landscapes around homes, schools, and other important parts of a community can be difficult because it often requires aesthetic paradigm shifts and alternate types of landscaping equipment.

The two images on the right illustrate how much potential exists in low-density and suburban areas to make major ecological improvements. While most landowners do not have the resources to build a landscape as intensive as this one, most can incorporate at least a few of the technologies shown here.





STREAM DAYLIGHTING

"Stream Daylighting" is the practice of uncovering buried watercourses for ecological restoration purposes. Many small perennial and intermittent streams that once flowed in the Estuary have been buried by sewer systems. This centuries old practice has resulted in "pinch points" for rainwater during floods while dramatically reducing habitat connectivity. Where possible, streams should be "daylighted."

The Saw Mill River in Yonkers, NY was once covered by concrete deck but has been "daylit" and restored with native plants and boulders.

Saw Mill River, Yonkers, NY

DEVELOPMENT - PAST AND FUTURE

Development pressures continue throughout the Ash Creek estuary in many forms. Dock construction has been a topic of concern in the Estuary. Construction and use of these docks can cause major disturbance to the mudflats, surrounding vegetation, and wildlife through habitat alterations, erosion, and increased boating activity.

Many species rely on the Estuary and would be affected by further development. The Estuary is located along the Atlantic Flyway and provides food and shelter for migrating birds including ducks, sandpipers, and plovers.[25] Species of fish and shellfish live in the Estuary. Oysters are a significant species in the Estuary and have a long running history.

Oyster reefs are a crucial part of the coastal ecosystem and provide many ecosystem services. The reefs create habitat for species such as mussels and barnacles. They filter and clean the water and can provide a degree of protection against storms, tides, and erosion.[26]

Given the industrial legacy of the Estuary, there is likely a tremendous amount of hazardous materials in current and future floodzones. The mobility of these materials should be understood and accounted for in all future land-planning decisions.


Harbor--Ash Creek
sh Creek Beckons Its Past Glories
BRIDGEPORT SUNDAY POST, MARCH 18, 1951
LONG ISLAND SOUND
Ash Creek as it might become. "Great Marsh" connected to mainland by causeway, raised above high-tide level forming buildable land. Harbor dredged to provide a safe, much-needed yacht basin.
Basin for Yachts

Upland Habitat and Flooding. Ash Creek is part of the Rooster River Watershed, a 15 mile primarily urban watershed running through the towns of Bridgeport, Fairfield, and Trumbull. It can be categorized into six subwatersheds: Rooster River, Horse Tavern Brook, Long Hill, Londons Brook, Ash Creek, and Turney Creek. Ash Creek and Turney Creek are both within the study area boundary, with Ash Creek being the tidal portion of the Rooster River, flowing into Long Island Sound. The Rooster River watershed, like many coastal urban watersheds in Connecticut, has a long history of flooding as a result of historical development of the watershed.[28]

Runoff from urban watersheds can carry potentially hazardous materials such as prescription drugs, fecal matter, heavy metal, and other toxins. These contaminants travel downstream until they are flushed into the Estuary. Urban stormwater runoff is a significant cause of water quality impairment in the Rooster River Watershed and Ash Creek.[29]

In the Technical Memorandum #1, it was found that total phosphorus (TP), total nitrogen (TN), total suspended solids (TSS), and total fecal coliform (FC) are major nonpoint source pollutants of concern within the Rooster River Watershed . Nonpoint source runoff accounts for approximately 95% of the TN load, 79% of the TP load, 38% of the TSS load, and 42% of the FC load for the entire watershed.[30] This has implications for the Ash Creek estuary as the sub-basins drain into the Estuary.

Oyster Aquaculture. The Ash Creek estuary had been used for seed oyster harvesting in the past, but pollutants from the city's combined sewer overflows have negatively impacted this water body. In addition, oyster populations have faced a serious decline due to the MSX virus. There have been efforts made to increase oyster populations in the Estuary due to its ideal location for oyster growth and its previous history.

The Fairfield Shellfish Commission has been implementing a small-scale restoration of the oyster reef at the Ash Creek Estuary for the past 5 years. They also in the past year became the pilot site for the state shellfish restoration movement. Through the work of volunteers, the reef has been built up by adding shells collected in the community and spat-on-shell.

While oysters are not harvested for consumption from the Ash Creek estuary, the Fairfield Shellfish Commission has a spat in shell program in which oyster spat is planted in the reef and after a season, these oysters are transplanted to other beds in the area.[27]

Development and construction in the Estuary can negatively impact these reefs. Tidal estuaries are well-known for their recreational uses. Dock construction in the Estuary can disrupt aquatic species that use the Estuary as their habitat. Connecticut DEEP has guidelines on construction of docks in tidal estuaries. The addition of new docks near the reef would increase boat traffic and could cause degradation of the reef. If larger boats are using the docks, this may call for dredging which could also impact the oyster reef. Right now, the oyster reef is in an ideal location due to the low/limited boat traffic.

The Fairfield, CT, Shellfish Commission holds an annual free Clam Clinic in the spring. Here, the public is participating in the 2015 clinic; photo credit: Shellfish Commission.

SOLUTIONS

Education and Outreach. Perform community outreach to improve citizen understanding and stewardship of the Estuary. This might include, for example, installation of signage and educational kiosks, information placed on the ACCA website, public presentations, and environmental education work.

Land Use Improvements. Encourage land-use practices that protect, maintain, and enhance the sand dunes on the St. Mary's barrier.

The barrier spit plays an important role in the function of the creek, notably by providing a unique ecology and biodiversity to the area, and by protecting the creek from erosive wave action during storm events. The sand dunes are a vital component to the landscape of the spit and should be protected along with the natural processes that create them. Excessive human disturbances should be minimized, and land-use practices which allow the continued trapping of sand and which promote vegetational stability should be encouraged.

Bird watching in the estuary is a great way to connect people with the area. Shown here a group observes fall migratory birds. Photo by Gail Robinson.

Estuary-Beneficial Development. Future development that supports the Estuary requires a whole-system approach to building that uses engineering and ecological principles to create measurable benefits to the ecological, cultural, and social integrity of the Estuary. This approach integrates development projects with the surrounding environment in a way that has a net-positive impact and has the ability to co-evolve with the surrounding environment. Development projects in and around Ash Creek Estuary should be designed in a way that harmonizes with the wildlife and ecology of this unique area, are located outside of sea-level rise and hurricane flood zones, support multi-modal transportation methods, and do not require fossil fuels to function.

COMPLEXITY

The Ash Creek Estuary is an ecologically and geographically complex system that is difficult to understand. Estuaries are complicated ecological systems where freshwater and saltwater ecosystems merge and result in huge levels of productivity. Urban estuaries, as opposed to less developed ecosystems, are inherently more complex to manage due to the social and economic impacts. These complexities can quickly become obstructions to managing the resource and implementing improvements in the public realm. For example, the dredge material from the navigable channel has been historically used to replenish Jennings Beach, depriving the barrier spit of its natural source of sediment to the detriment of the barrier spit

SOLUTIONS

Environmental Outreach and Education. The work already being done to educate people about the Estuary should continue and be expanded. In addition to scientific education, educational events related to the arts and humanities should be continued and expanded.

Technical Guidance. From ecological restoration to economic cost-benefit analysis, expert guidance must be a guiding, apolitical presence in all management discussions. A collaborative Adaptive Management Team should be established.

Wayfinding and Signage. A consistent graphic identity throughout the entire Estuary's uplands should define and inform all projects in the public realm. Benches, light fixtures, railings, and other furnishing should match. "This drain leads to the Ash Creek Estuary" language should be installed on all catch basins. A map of the entire estuary that locates features should be available at informational kiosks and online using best current digital technologies (such as QR codes and Virtual Reality apps).


Barrier Spit, 2010


Barrier Spit, 2022

INTERGOVERNMENTAL COORDINATION

Ash Creek estuary is split between the towns of Fairfield and Bridgeport. The municipal boundary line runs directly through the barrier spit St. Mary's-by-the-Sea and through the approximate center of the Post Road Bridge. The Estuary, however, is an interconnected habitat system that ignores political boundaries. In consideration of the threat of near-term ecological collapse of the system, existing coordination obstacles are likely to become worse.

Collaborative Adaptive Management is a results-based practice to guide decisions making in complex environments. The CAM process recognizes that even the best made plans fail in a variety of ways when applied to specific situations so therefore focuses on feedback cycles.

SOLUTIONS

Create Joint Estuary Management Authority. Joint management of the Estuary by Fairfield and Bridgeport and a non-profit organization (such as the ACCA). This area needs clear coordination between the two cities and to establish unifying goals and local ordinances.

Increase State and Federal Involvement. CIRCA/UConn and CT DEEP are doing extensive research into climate change and other important topics relevant to the Ash Creek Estuary. Involving these organizations could help bridge the gap between the two town jurisdictions and direct funding. Other organizations such as MetroCOG, NOAA, and the US Army Corps of Engineers should be included where possible to provide expertise and financial assistance.

Expand Not-for-profit and Higher Education Partnerships. Continued coordination with University of Connecticut's CIRCA, Save the Sound, BRASTEC, Aspetuck Land Trust, Southwest Conservation District, and other organizations.

Coordinated Project Development. Fundraising for projects within the Estuary should be blind to municipal boundaries whenever possible. What is best for the whole estuary should be the priority. In 2013, the Rooster River Watershed Plan was published, which included coordination with multiple municipalities. This is a successful example of how multiple groups can collaborate over a common goal.

QUALITATIVE ASSESSMENT METHODS

The tidal estuary and its adjacent environs were visited multiple times between 2012 and 2022.

The purpose behind these investigations were multifold:

- To refine the draft habitat map;
- To perform a qualitative assessment of the study area; and,
- To begin to identify strategies and opportunities that will lead to habitat and water quality improvements for future Rooster River Watershed planning and educational efforts.

For the purposes of this plan, the study area was divided into five geographic units for assessment. The units were labeled A-E.

The geographic units simplify the tidal estuary geography for observation and understanding. They also provide a unifying framework for identifying future management needs and prescriptions.

The geographic assessment units were formulated based on shared topography, hydrology, and cultural history. This combination of environmental and cultural criteria was chosen to reflect the current geography of the Estuary system, which in turn is a result of a long series of natural events, natural processes, human management and watershed manipulation, and post-colonial settlement patterns.

Each geographic unit was visited, and qualitative observations were noted regarding notable environmental features and landforms present, overall condition, appearance and condition of aquatic and wetland habitat, general function and values, potential threats and stresses, general vegetative structure, presence of invasive vegetation, buffer condition, ecological and landscape level connections to the upland and greater watershed, overall general uniqueness, and other management issues.

GIS Methodology. Geographic Information System (GIS) software was used to generate the maps in this report. Orthophotography and Lidar DEM images were downloaded from Connecticut Environmental Conditions Online (CT ECO) with the most recent files from 2019 and 2016 respectively. From the Lidar DEM, contours were generated. These contours were used to map sea level rise (SLR).

Referring to NOAA's Tides and Currents page, mean high water/tide (MHT) elevation was determined to be 3.15 feet in NAVD88. This value was rounded down to 3 feet for the purpose of mapping. Using this value, a polygon was created with the assumption that the high tide reaches the Estuary and its connecting waterbodies, including Turney Creek and Riverside Creek. These areas are tidally influenced. From this value and polygon, all subsequent SLR and storm surge polygons were based.

Sea Level Rise projections obtained from the University of Connecticut CIRCA's Sea Level Rise Report (updated 2019) by James O'Donnell.[31] These projections were used rather than NOAA's sea level rise projections because of regional variation in sea level/sea level rise. The Long Island Sound has higher rates of Sea Level Rise compared to the national average. The projections used were 2ft (low), 4 ft (intermediate), and 7ft (extreme) by year 2100. Polygons were created adding these values to the current sea level.

Hurricane Sandy's Storm Surge was reported to be 9 feet above the average high tide by NOAA. This was much higher than previous recorded hurricane storm surge data for the Bridgeport-Fairfield coast in the past century. Because it was the most recent severe hurricane to impact the surrounding area of the Ash Creek Estuary, this value was chosen to model future storm surge and storm tide heights. Using this value, storm surge polygons were created for each of the three SLR scenarios: low, intermediate, and extreme by adding 9 feet to the SLR projection polygons.

STUDY AREA A: UPPER CREEK

A.1 DESCRIPTION

This geographic assessment unit includes the portion of Ash Creek that flows from Brewster Street to Fairfield Avenue. The geographic unit is approximately 184 acres in size, of which the creek at high tide occupies approximately 22.5 acres within the geographic unit's interior.

Three environmental and cultural landscapes define this area.

- The Ash Creek tidal waterway
- The east bank – Bridgeport side
- The west bank – Fairfield side

The tidal waterway flows 3500 linear feet from the Brewster Street bridge to the Fairfield Avenue bridge. The width of the waterway ranges from approximately 65 feet near the Brewster Street bridge to 560 feet upstream of the Fairfield Avenue bridge. A UI/CL&P power line crosses over the waterway south of Warsaw Street, Bridgeport and under the waterway at the Fairfield Avenue bridge. Within the waterway is the inner channel, mudflats, low marsh, high marsh, and an overhanging woody riparian buffer along certain portions of the bank of the waterway.

The defining characteristic of the tidal waterway is the mudflats. As the creek widens out, water velocity decreases, and sediments suspended in the current deposit, forming the mudflats.

The east bank is highly urbanized, and consists of medium density residential and commercial land uses, all within the Black Rock community of Bridgeport. The land has a gentle slope and was formerly farmland before urbanization. The edge of the developed portions of this area abruptly slopes down to the waterway. Most of this area is underlain by relatively thin deposits of poorly sorted, rocky, glacial till.

The west bank is located within Fairfield and is predominately hilly with a small lowland area in its most western region. The flatter portions of this area are underlain by deep sandy glacial outwash deposits, while the hilly portions are underlain by relatively thin deposits of poorly sorted, rocky, glacial till.

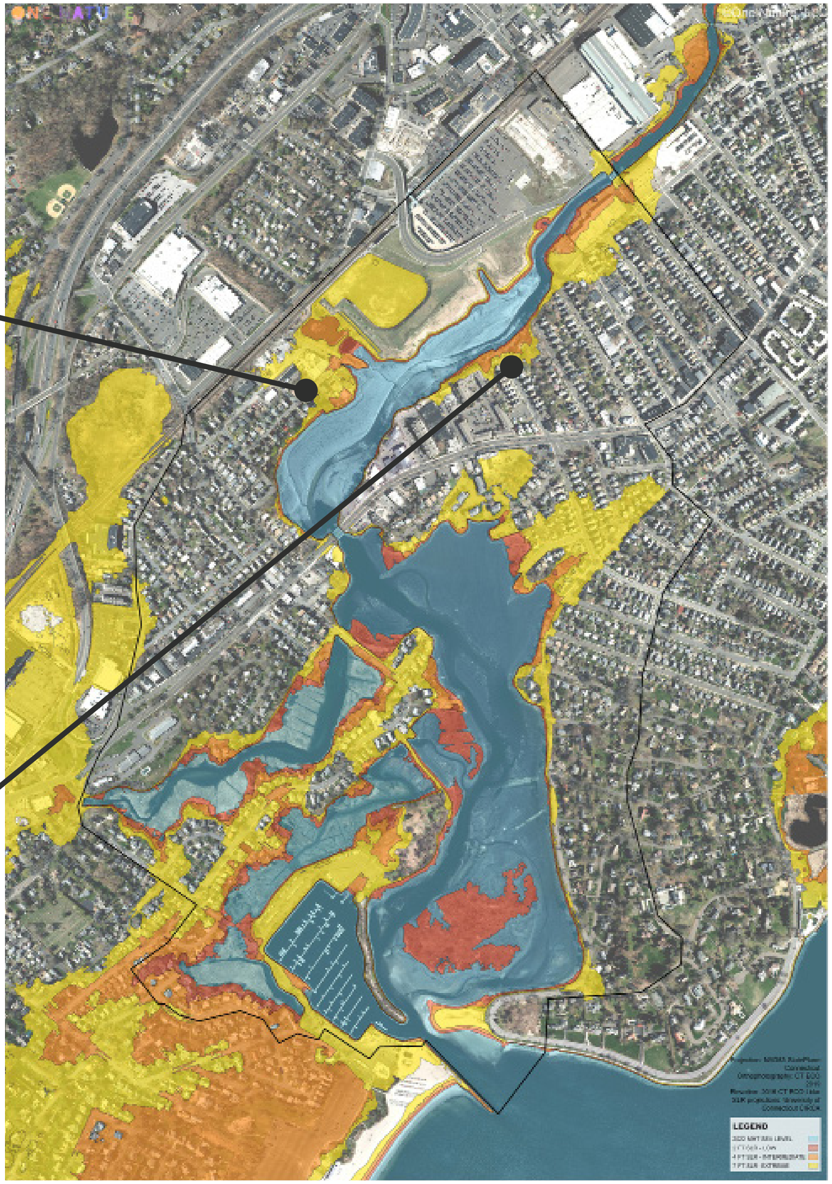
Roughly half of the west bank area (43 acres) is dominated by the Metro Center train station complex and its adjacent open areas, which have been re-sculpted into a reclamation meadow, with a created wetland near its western boundary. The Metro Center site was formerly a foundry used to manufacture large machine tools.

The site has been heavily remediated for the new Metro Center. According to the remediation site plan designers, the 50 years of industrial activity had resulted in the placement of over 250,000 cubic yards of casting sand (a byproduct of foundry operations) and a number of releases of volatile organic compounds and oils containing polychlorinated biphenyls. Remediation for the Metro Center involved partially reusing contaminated casting sand and soils in some of the areas. Other contaminated soils were isolated by burying them under engineered controls underneath the parking lot and in other areas. Truckloads of PCBs were removed from the site as well.

The remaining (non-Metro Center) land within the west bank is covered by medium density residential development. Most of the terrain adjacent to the creek slopes moderately to steeply down to the water.

1934

2019



- 2 ft Sea Level Rise - Low
- 4 ft Sea Level Rise - Intermediate
- 6 ft Sea Level Rise - Extreme

STUDY AREA A: UPPER CREEK

A.2 HISTORIC INTERPRETATION

This area of the Estuary immediately abuts the railroad line, which created a major impediment to tidal flow and likely altered the plant and animal communities of the Estuary significantly. The New Haven Railroad Company constructed a railroad through Connecticut establishing a station in Fairfield. Land near Ash Creek was developed to provide services by the railroad. Changes to the landscape increased mobility, but also blocked drainage of streams and rivers to the Sound creating a negative impact on the health of the community. The railroad embankment cutting off many of the streams with insufficient or filled up culverts, and in many instances no outlet provided. The industrial legacy of this area has likely made it the most polluted of the five study areas in this report.

A.3 QUALITATIVE ASSESSMENT OF EXISTING CONDITIONS AND ECOLOGICAL FUNCTIONS

Habitat. Overall, the inner aquatic habitat of the creek appears to be in relatively good condition. There are expansive intertidal mud flats located near the southern portion of the waterway that provide good habitat for invertebrate organisms.

Tidal marsh conditions are poor, however. A thin strip of Spartina alterniflora is commonly found around the perimeter of the study area, but it is constrained by robust growth of Phragmites australis. Spartina patens, and other high marsh native species, are noticeably absent. A restoration of the northeast shore of the Estuary currently provides little intertidal marsh habitat. Riparian habitat along the shoreline varies between stands of Phragmites and salt tolerant shrubs and trees.

One of the more important environmental values of the upper creek is that it serves as the transition zone between the tidally influenced saline tidal lower creek, and the freshwater non-tidally influenced Rooster River which flows down from above.

Although the actual tidal limit is in most likelihood a bit farther upstream, in the vicinity of the I-95 crossing, the area below the Brewster Street Bridge is ecologically noteworthy since it provides the first opportunity for the channel to significantly widen out. This allows the freshwater inputs from above to dilute quickly during the larger storm events.

The widening of the river also allows sediments to deposit, forming the creek's characteristic and environmentally valuable mudflats.

Despite being partially dominated by invasive species, the Metro Center's planted meadows provide important pollinator habitat.

Mudflats typically have an abundant population of bivalve organisms such as oysters, clams, and mussels, which are known to filter and sequester pollutants out of the Estuary system.

The widening of the channel also has a positive impact on water quality. Fine particles carried by swifter upstream currents settle out in the channel prior to reaching the Lower Creek and the Sound.

A large drainage outflow at the Brewster Street Bridge, and several smaller outlets likely negatively contribute to water quality.

A large stormwater outfall releases rainwater into a constructed wetland system on the west bank.

Toxic impacts of urban fill (which is frequently contaminated) and the adjacent industrially-impacted landscapes may negatively impact the Estuary, along with the also likely transport of various contaminants from locations farther upstream.

Hydrologic, Biogeochemical, and Ecological Functions of the Tidal Ecosystem. The tidal area is performing and providing many valuable ecological functions that a healthy wetland and tidal ecosystem would be expected to provide. These include floodwater alteration, fish and shellfish habitat, sediment/toxicant/pathogen retention of pollutants, nutrient removal/retention/transformation, carbon fixation to reduce global warming, shoreline stabilization, wildlife habitat, (limited) recreational opportunities, and visual quality/aesthetics.

Carbon Storage. The large swaths of mudflat provide significant levels of carbon storage, preventing carbon dioxide emissions, buffering the impact of global warming. Saltwater wetlands and mudflats are known to sequester as much as 2000 tons of carbon per acre per year. The exact quantity of carbon fixed in this study area is unknown, but it can be assumed to be important. It should be noted that intertidal mudflats when inundated with water also release methane, nitrous oxide, nitric oxide, and nitrogen gases, which are also known as greenhouse gases. The net balance between carbon fixation and the release of these other greenhouse gases is unknown, but usually salt marshes release less greenhouse gases than their inland wetland complements due to alternation of the tides.

Aesthetic. The area provides a positive visual aesthetic for commuters using the new Metro-Center, for the adjacent park users, for the adjacent neighbors and other local residents. The area serves as the gateway to the Estuary, especially on the Brewster Street Bridge. Street ends on both sides of the Upper Creek have relatively poor views of the water but do provide some aesthetic value. A pavement and boardwalk path system on the northeast side of the creek provides dramatic views of the natural resource from its higher elevations.

Recreation. The area is a particularly good site for bird watching. The tidal waterway itself provides limited level recreational opportunities, as the area is attractive to small watercraft such as kayaks and canoes. Difficulty of passage under Fairfield Avenue at high and upper mid tides restricts boating access into the area from below.

Biodiversity. The created wetland area located in the southwest corner of the Metro Center site consists of three stepped pools which enhance the biodiversity of the area by introducing additional habitat types – freshwater, brackish, and saline aquatic habitats. As of 2022, in the created wetland, small patches of Spartina are present at the high tide line. Stands of cattails and Phragmites border the body of water, with small sumac trees present throughout the surrounding land area. The boardwalk and created inland and brackish wetlands appear to be completed. The upland buffer to this area appears to be well vegetated with a mix of native and nonnative species.

Of note was a demonstrative lack of tidal wetland vegetation colonizing the 2800 foot length of the newly created bank to the creek below the Metro Center. The banks appear to be of a grade sufficient to support high and low marsh species, and the substrate has been stabilized with coir netting and stakes. According to the set of restoration plans reviewed at the Town of Fairfield, there appears to be no intent by the project managers to actively vegetate the lower tidal interface of the bank with the creek with Spartina plugs, or any other type of tidal wetland vegetation. As a result, it is assumed that this area is supposed to re-vegetate through local seed sources. In the case of the Upper Creek, mid to high level flow velocities through the area may preclude the ability of such a natural seedbed to become established.

A.4 POTENTIAL THREATS

Phragmites Seed and Rhizome Source. Upstream of the Brewster Street bridge, the watercourse is less saline and more constricted. Farther upstream, the waterway flows though the Phragmites dominated marsh next to the Mt. Grove Cemetery. Seed and rhizomes from this marsh are likely transported downstream by the current and deposited on the tidal fringes of the channel.

Water Quality. According to the 2022 305b CT DEEP Water Quality Assessment, the tidal creek does not meet water quality goals for three designated uses: Marine and Aquatic Life, Recreation, and Commercial Shellfish. It should be noted that the Creek does meet designated uses for Fish Consumption. The stream segment evaluated by the CT DEEP includes both the Upper Creek and the Lower Creek.

The cause of the impairment to Commercial Shellfish use is fecal coliform, from residential development, stormwater, combined sewers, non-point pollution, waterfowl, and boating discharges. The cause of the impairment to Marine and Aquatic Life use is gold and silver, from contaminated sediments and industrial discharge. The cause of the impairment to recreation use is Enterococcus, from residential development, industrial discharges, stormwater, combined sewers, non-point pollution, waterfowl, and boating discharges.

Water quality in the creek is also classified by the State of Connecticut as “SB”, a less desirable classification than “SA”.

Combined Sewer Overflows (CSOs). Combined Sewer Outflows (CSOs) are designed to transport both wastewater and stormwater. At the time of their initial construction, they were an innovative and economical design. Advancements in infrastructure have been made in recent years and CSOs are now less frequently used and there are efforts to eliminate current CSOs in Connecticut. CSOs present environmental and health concerns because during heavy rains, untreated water is discharged into nearby waterbodies. When Ash Creek Conservation Association was founded, there were five CSOs in Ash Creek. Today, there are two located on Dewey and State Street Extension, and Mt. Grove Cemetery and Dewey Street. These are likely to be shut off by 2027.

Stormwater Outflows. There is a major stormwater outfall located under the Brewster Street bridge. It is unclear if these outflows are retrofitted with modernized structural stormwater treatment controls or not.

A second stormwater outfall on the west bank releases at the head of the newly constructed freshwater wetland.

Stormwater runoff in this study area likely carries a variety of potentially harmful substances such as sediment, litter, dog waste, and oil.

The volume of water relative to drainage areas is very high due to the relatively low permeable surface area.

A substantial amount of surface runoff occurs at the street ends.

Impervious Cover of Watershed. Overall, there is a high degree of impermeable cover within the bordering residential and commercial districts. Most of the runoff flows untreated into the waterway through old stormwater outlets, or sheet flows directly from parking lots and roads down the bank with little to no vegetative buffering.

Jurisdictional Overlap. Ash Creek separates Bridgeport and Fairfield in this study area. Management of the creek will need to involve both municipalities.

Low Amounts of High Marsh. There is relatively little native high marsh vegetation left in this area. Much of this is due to Phragmites colonization, human disturbances, and a general lack of available topographic habitat which in turn may be due to former manipulations of the banks of the waterway.

Condition of Upland Buffers. The condition of the upland buffer is generally poor on both sides of the creek, with a general lack of structured native tree canopy, and a lack of area suitable for establishing a thicker overstory. On the west bank, the riparian and upland tree canopy was apparently eradicated during reclamation of the site, and a meadow installed.

The meadow enhances several ecological functions and values such as 1) beautifying the view towards the creek from the Metro-Center side; 2) promoting soil stabilization, and; 3) providing potential habitat for grassland species.

However, the conversion from forest to meadow also 1) diminishes thermal buffering for the creek,

2) decreases the wildlife habitat for forest species, and; 3) diminishes the quality of the view from the neighborhoods on the east bank towards the Metro Center.

Proposed Bridge Crossing. At the time of the publication of the original master plan, the future of the pedestrian bridge was not yet known. In 2014, the Ash Creek Feasibility Study was published, and plans have now launched for the Ash Creek Pedestrian Bridge Project. This project will provide additional recreational access into the Estuary and create another linkage from the community to the Estuary. It should be noted that the current electric line crossing involves a small free standing island for the footings of one of the towers. This island has developed habitat value over time due to its vegetative cover of shrubs and trees. Any future placement of support structures for a proposed bridge within the channel could likewise represent an opportunity for aquatic or island habitat creation.

Sea Level Rise. The following areas are likely to be most impacted by sea level rise in this study area:

- The intersection of Kenwood and Kenard
- Canfield Avenue
- Davidson Street End
- The MetroNorth Railroad line is likely to be systemically impacted along it's length. It is unknown how ridership and services will be impacted.

Concept Plans, 2014 Ash Creek Bridge Feasibility Study

A.5 POTENTIAL ECOSYSTEM IMPROVEMENTS

Aesthetic

1. Enhance native vegetation throughout the study area;
2. Supplemental tree plantings at Train Station restoration site;
3. Improve vistas across the study area through planting, placement of benches, and pathway alignment;
4. Improve and create street end access and gathering spaces;
5. Reclaim upland lots with non-water dependent uses for ecological restoration purposes, especially in areas threatened by sea level rise;
6. Ensure pedestrian footbridge becomes an aesthetic asset to the community and is built to withstand future sea level projections;
7. Promote stormwater capture technologies including bioswales, vegetative buffer strips, rain barrel use, and permeable paving throughout the drainage area;
8. Alter street ends to create views of water; and
9. Create custom signage and educational kiosks to be used throughout the Ash Creek estuary that establish a local feeling respectful of cultural and ecological conditions.

Biodiversity

1. Encourage the creation of high marsh plants besides Phragmites;
2. Educate local property owners about the value and importance of native plant species;
3. Supplemental spot planting and seeding to encourage specific native species wherever possible; and
4. Develop forest management plan for forested edges.

Carbon Fixation

1. Generally encourage the restoration of native plant materials; and
2. Monitor all design and construction activities to reduce use of heavy equipment or building materials with high carbon footprints.

Habitat

1. Create living shorelines for shore stabilization and additional habitat;
2. Explore land use changes to create habitat in areas susceptible to sea level change;
3. Create green spaces at street ends;
4. Perform feasibility study to examine options to daylight the creek north of the Old Post Road;
5. Use pedestrian footbridge as an opportunity to create and improve habitat;
6. Reclaim land from adjacent low lying areas currently used for non-water dependent purposes; and
7. Convert public and private lawn spaces to native vegetation.

Recreation

1. Define public access points and encourage ADA accessibility;
2. Develop bikeway and pedestrian routes with location of new pedestrian bridge;
3. Install educational signage and kiosks in high traffic areas; and
4. Install blinds for bird watchers.

Water Quality

1. Develop and implement a green infrastructure plan that specifically addresses street end runoff, residential properties, and permeable pavement conversion;
2. Map and monitor all outfalls;
3. Perform regular testing to quantify upstream pollutant contribution; and
4. Coordinate with any upstream Rooster River watershed planning efforts to identify specific water quality improvement projects.

STUDY AREA B: LOWER CREEK

B.1 DESCRIPTION

This geographic assessment unit includes the portion of Ash Creek that flows from Fairfield Avenue to its tidal outlet to the Sound at the St Mary's barrier spit. The geographic unit is approximately 190 acres in size, of which the creek at high tide occupies approximately 59 acres (excluding the 13.5 acre and 0.3 acre islands) within its interior.

The environmental and cultural landscapes that define this area include:

1. The Ash Creek tidal waterway
2. The two marshy islands
3. The artificial peninsula
4. The east bank residential community (Bridgeport side)
5. The west bank open space and residential community (Fairfield side)

The tidal waterway gently meanders 4850 linear feet from the Fairfield Avenue Bridge to its outlet to the Sound at the St. Mary's barrier spit. The direct linear distance is only 3500 feet. The width of the waterway varies from 100 feet at the Fairfield Avenue bridge to 450 feet opposite Midland Street in Bridgeport, to approximately 1500 feet wide in the lowest portion from Gilman Street, Bridgeport to the peninsula opposite South Benson Marina.

Within the waterway is the inner channel, mudflats, low marsh, high marsh, and a thin overhanging woody riparian buffer. Remnants of an old road dating back to the period of 1750-1802 that linked what is now the Pennfield Mills - Ash Creek Open Space, Fairfield, to Balmforth Road, Bridgeport are still visible at low tide.

There are multiple ways for public access into the tidal waterway. Public access is possible almost anywhere from the eastern shore (Black Rock side) along Gilman Street or through the St. Mary's barrier spit. Access from western shore (Fairfield side) is possible through the South Benson Marina, through the Penfield Mills-Ash Creek Conservation Area, and through the Riverside Drive-Ash Creek Conservation Area.

The two marshy islands are located at the bottom portion of the waterway, near the tidal inlet/outlet. The larger island, known as either Great Island Marsh or Great Salt Marsh Island, is approximately 13.5 acres at high tide. Half of the island is in Fairfield and half of the island is in Bridgeport. The island was acquired for open space in 2004 by the Town of Fairfield (Fairfield side) and Aspetuck Land Trust (Bridgeport side).

The smaller island, 0.3 acres at high tide, is located directly to the east of Great Island Marsh, off the Bridgeport shore.

Both islands have high and low marsh comprised almost completely of native species. Great Island Marsh is noteworthy for its Osprey nests.

The artificial peninsula is located at the bottom of the Lower Creek on the Fairfield side of the waterway, west of the large island. It was built on dredge spoils from the adjacent marina basin, and its major design function is to shelter the marina. The peninsula is about 950 feet long and 100 feet wide. The top is flat with a trail leading to waterfront access at its tip and at its base. Frequent users of this trail include dog walkers and people wanting to fish. The top of the landform is predominately shaded by a woody canopy of Locust trees. The sides of the landform are hardened with rip rap.

The east bank residential community (Bridgeport side) is moderately to highly urbanized, and consists mainly of medium density residential land use, all within the Black Rock community of Bridgeport. There is a minor level of commercial land use in the northern portion of the area off Fairfield Avenue, and a pocket of higher density residential land use.

Topographically, most of the area occupies the western side of a north/south trending drumlin known locally as Grovers Hill. Drumlins are long, glacially scoured hills underlain by thick till deposits. Grovers Hill is approximately 70 feet above sea level and the highest point in the entire study area.

Gilman Street separates the residentially developed areas from the natural area of the tidal creek along most of its length. The separation of urban and natural is punctuated by a steep slope located west of the roadway right of way. There is very little natural upland area left between the roadway and the creek.

The west bank open space and residential community (Fairfield side) side is different in character from the east bank side of the tidal creek because of the higher level of undeveloped open space adjacent to the creek.

North of the peninsula is the Pennfield Mills - Ash Creek Open Space Area which is managed by the Town of Fairfield. The area was named after the tide-powered grist mill(s) constructed nearby by Peter Pennfield in 1735. More recently the site of a gravel mine and construction and dredge spoils dump, the area was acquired by the town in 1968. The upland areas were re-graded in 1985 to create a wildflower meadow, a fruit orchard, a woodlot, and a playground.

Today a semi-naturalized upland meadow exists there with a thin forest edge overhanging the creek. To the north and west of this open space, there are expansive areas of high and low marsh, as well as the tidal inlet to Riverside Creek located to the west.

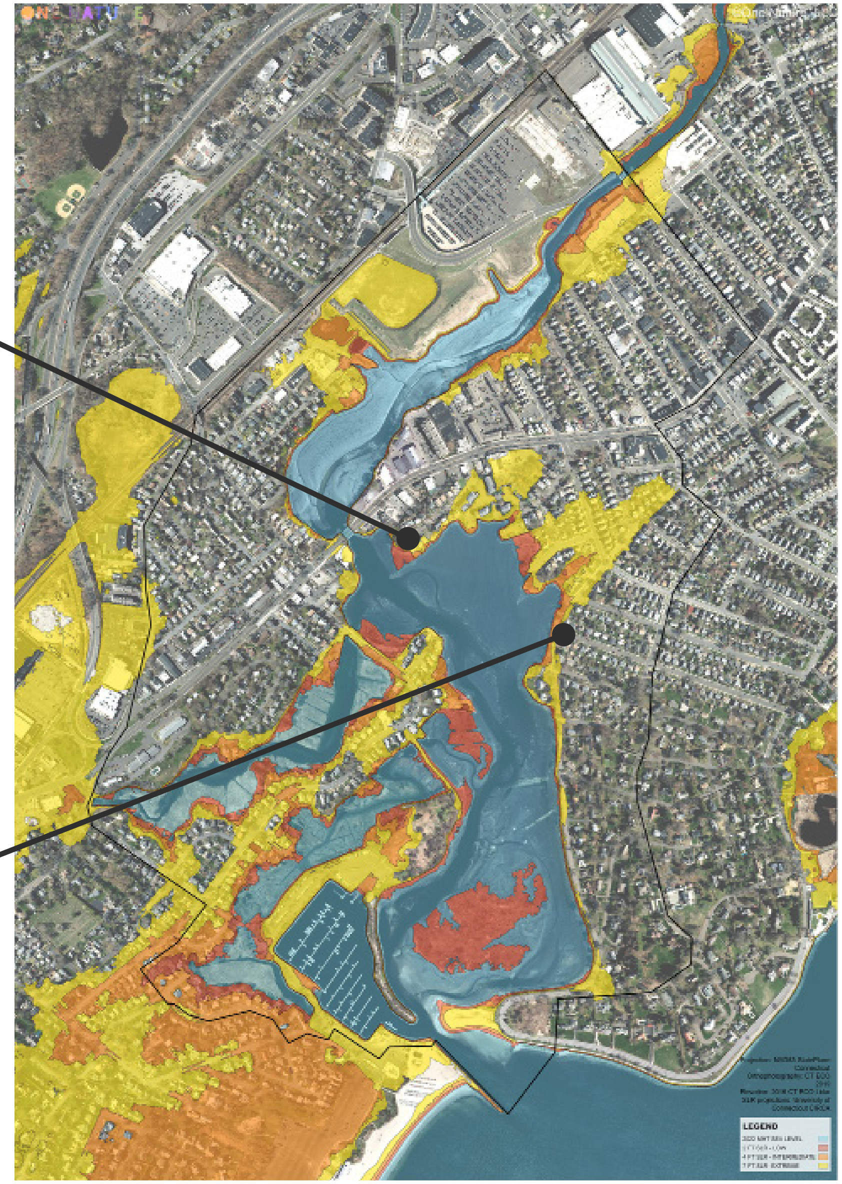
Another open space area is the Riverside Drive-Ash Creek Wetland Conservation Area, also owned and managed by the Town of Fairfield. The open space consists of 2.85 acres of mainly tidal wetlands south of the Turney Creek tidegates, and a 0.2 acre shoreline floodplain parcel just north of the tidegates. The parcels were acquired by the Town of Fairfield in 1978. The area is accessible from Riverside Drive, and provides opportunities for fishing, bird and other wildlife watching, shellfishing, and access to Lower Ash Creek.

The relative natural openness of this region is punctuated by pockets of residential development along Riverside Drive, Fairfield, most of it dating back to 1917.

1934

2019

2 ft Sea Level Rise - Low
4 ft Sea Level Rise - Intermediate
6 ft Sea Level Rise - Extreme



B.2 HISTORIC INTERPRETATION

This section of Ash Creek retains much of its original characteristics. The Great Marsh Island appears on early colonial maps, as does the alignment of the channel. Based on historic photos, this area was once an oystering and has always been noted for its remarkable aesthetic beauty. The Estuary was the peaceful back side to the busy wharfs of Black Rock Harbor, which was noted for its shipbuilding. A fort was once erected on Grover's Hill to protect against British Troops in the Revolutionary War. Various environmental advocates and advocacy groups worked throughout the 20th Century to preserve the naturalistic character of the place.

B.3 QUALITATIVE ASSESSMENT OF EXISTING CONDITIONS AND ECOLOGICAL FUNCTIONS

Hydrologic, Biogeochemical, and Ecological Functions of the Tidal Ecosystem. The tidal area is performing and providing many valuable ecological functions that a healthy wetland and tidal ecosystem would be expected to provide. These include floodwater alteration, fish and shellfish habitat, sediment/toxicant/pathogen retention of pollutants, nutrient removal/retention/transformation, carbon fixation to reduce global warming, shoreline stabilization, wildlife habitat, recreational opportunities, and visual quality/aesthetics.

Habitat and Biodiversity. The lower creek area has a significant and notably large level and variation of habitat types, including open water, mudflats, oyster reef, low marsh, high marsh, riparian areas, maritime forest, and upland meadow. These varying habitats attract a variety of wildlife and aquatic life.

Great Marsh Island is noteworthy for its Osprey habitat, as well as its intertidal and aquatic life. It is also the only section of the Estuary that was not subjected to mosquito ditching.

The bottom of the creek is good quality habitat for shellfish. It provides the substrate for recreational shellfishing, especially oystering.

The open space areas on both the Bridgeport and Fairfield sides are especially noteworthy, as they serve to protect and enhance the ability of the tidal ecosystem to perform its functions and values. Furthermore, the maritime forest within these areas serves as an important refuge for birds during the migration season.

Recreation. Recreational opportunities abound within the lower creek region. These include enjoying the views, walking, bird watching, wildlife appreciation, fishing, shellfishing, and boating.

There are currently four private residential docks for motorized watercraft in the creek with one more in construction. Minimal level of dock proliferation encourages quieter and less intrusive boating uses such as canoeing and kayaking, which in turn promotes valuable quiet moments for visitors. It also minimizes the negative impacts of motorized boating such as motor oil pollution, erosion and turbidity due to prop dredging and wake effects which lead to the smothering of seed oysters and other bottom dwelling and aquatic organisms, and the disturbance of nesting patterns of shorebirds.

Aesthetic. The area is especially valuable to humans due to its aesthetics. The wide visible expanse of intertidal zone is especially stunning considering its location within a dense urban region. The minimal level of dock proliferation encourages quieter and less intrusive boating uses such as canoeing and kayaking, which in turn promotes valuable quiet moments for visitors.

Overall, the area significantly contributes to the property values of the adjacent neighborhood. The creek provides scenic value, recreational opportunities without the need of a car for school children, creative opportunities for artists and photographers, bird watchers, nature lovers, quiet and contemplative experiences, and a natural buffer to screen the edge of the neighborhood from increased urban development.

The area is also of scenic value to visitors on the way to the St. Mary's-by-the-Sea rocky shorefront, and anyone else passively driving through.

Flood Protection. The open space parcels serve as natural buffers to attenuate both the stormwater quantity and stormwater quality before it enters the creek. The creek serves as the major avenue for stormwater conveyance to quickly remove stormwater runoff from the adjacent neighborhoods.

B.4 POTENTIAL THREATS

CT DEEP Water Quality Assessment. According to the 2022 305b CT DEEP Water Quality Assessment, the tidal creek does not meet water quality goals for three designated uses: Marine and Aquatic Life, Recreation, and Commercial Shellfish. It should be noted that the Creek does meet designated uses for Fish Consumption. The stream segment evaluated by the CT DEEP includes both the Upper Creek and the Lower Creek.

The cause of the impairment to Commercial Shellfish use is fecal coliform, from residential development, stormwater, combined sewers, non-point pollution, waterfowl, and boating discharges. The cause of the impairment to Marine and Aquatic Life use is gold and silver, from contaminated sediments and industrial discharge. The cause of the impairment to Recreation use is Enterococcus, from residential development, industrial discharges, stormwater, combined sewers, non-point pollution, waterfowl, and boating discharges.

Water quality in the creek is also classified by the State of Connecticut as “SB”, a less desirable classification than “SA”.

Extent of Phragmites. The growth of Phragmites is limited in the Lower Creek area. There are some sporadic but notable stands at the end of Riverside Drive, Fairfield near the tidal gates where natural flow has been altered. There are also isolated stands surrounding a few of the stormwater outfalls along Gilman Street, Bridgeport. These stands off Gilman Street are of the most concern, as they have the potential to spread along the length of the remaining high marsh areas. In most likelihood, their presence is in part due to the freshwater runoff from the stormwater system.

Gilman Street Stormwater Outfalls. Drainage from Gilman Street and the adjacent neighborhood is collected from a basin system from along the road into series of small PVC pipes which outlet directly into the tidal creek. Most of the outlets are located on a steep slope and lack a bottom structure to dissipate flow velocities. The erosive potential and quality of the flows through these outlets is a concern.

Tidal Gates Tide gates do not obstruct flow within this section, but they do reduce ecological connectivity of the Lower Creek with Turney and Riverside Creeks. Plans for new tide gates are currently underway in the Estuary.

Buffer Condition on East Side. In many areas the buffer to the tidal creek on the east side is in poor condition due to inadequate widths. The available area is constrained by the road. Furthermore, the soils on the slope below the road are compacted in many areas, leading to reduced permeability and hydraulic conductivity. This discourages the establishment of vegetation, and discourages pollutant attenuation, leading to water quality impacts to the creek.

Rip-rapped peninsula. The habitat around the bottom of much of the man-made peninsula sheltering the marina is hardened, limiting the potential of any future bioengineered habitat enhancements in this area. However, it is also noted that hardened habitats can serve as opportunities for the attachment of invertebrates.

Waterfront Access from the Peninsula. There was some minor erosion due to concentrated overuse at the base and tip of the peninsula at the point of waterfront access. This access point has removed most vegetation from the immediate area and leaves the landform susceptible to erosion, especially during large storm events.

Sea level rise may be a long-term threat to the tidal wetlands as there is limited habitat area left for any future wetland to naturally create along the fringe of any future sea level rise.

The Lower Creek is the l**owest point in the watershed**, and therefore subject cumulative impacts from above. These include urbanization effects, hydrological alterations, ecological habitat modifications, and generation of non-point and point pollution from greater watershed which includes the upper portions of the tidal creek and the Rooster River.

Heavy dog use of the barrier spit and adjacent high marsh leads to the fecal pollution of the waterway and the Sound.

Heavy minimally managed recreational use of the tidal marsh adjacent to the barrier spit leads to loss of plant life and accelerated erosion of the landform.

Increased use of the tidal creek by motorized watercraft will lead to adverse impacts to the ecosystem such as motor oil pollution, erosion, sedimentation, and increased turbidity due to prop dredging and wake effects which lead to the smothering of seed oysters and other bottom dwelling and aquatic organisms, and the disturbance of nesting patterns of shorebirds.

Sea Level Rise. The following areas are likely to be most impacted by sea level rise in this study area:

- Northern Gilman Street
- Great Marsh Island
- Ash Creek Open Space
- Livingston Street

Jurisdictional Overlap. Great Marsh Island is bisected by the boundary between Fairfield and Bridgeport and is managed by the Town of Fairfield (Fairfield side) and the Aspetuck Land Trust (Bridgeport side). This poses a threat to the island because management of the island requires joint management by the two organizations, which adds a level of complexity.

The presence of this municipal boundary triggers certain regulatory requirements that are often overlooked. All development activities that may impact the island may be subject to dual regulation by BOTH the Town of Fairfield and the City of Bridgeport, and possibly the CT Department of Energy and Environmental Protection (CTDEEP).

According to the CT General Statutes, even activities that appear to be constrained to one side of the municipal boundary are likely still subject to regulation by the other municipality IF the activity is within 500 feet of the municipal boundary, or IF the activity impacts the environmental resources of the other municipality.

B.5 POTENTIAL ECOSYSTEM IMPROVEMENTS

Aesthetic

1. Enhance native vegetation throughout the study area;
2. Improve vistas across the study area through planting, placement of benches, and pathway alignment;
3. Create new community overlook area on Bridgeport side at the terminus of the promenade;
4. Work with adjacent property owners to integrate native plants into their landscape design choices;
5. Work with local stakeholders post-Sandy reconstruction efforts to integrate native plants into redevelopment plans;
6. Promote stormwater capture technologies including bioswales, vegetative buffer strips, rain barrel use, and permeable paving throughout the drainage area;
7. Create custom signage and educational kiosks to be used throughout the Ash Creek estuary that establish a local feeling respectful of cultural and ecological conditions; and
8. Improve signage at Fairfield Avenue Bridge.

Biodiversity

1. Identify newest stands of Phragmites for removal;
2. Encourage the creation of high marsh plants;
3. Educate local property owners about the value and importance of native plant species;
4. Supplemental spot planting and seeding to encourage specific native species wherever possible; and
5. Develop forest management plan for forested edges.

Carbon Fixation

1. Generally encourage the restoration of native plant materials; and
2. Monitor all design and construction activities to reduce use of heavy equipment or building materials with high carbon footprints.

Habitat

1. Create living shorelines for shore stabilization and additional habitat;
2. Add sediment to wetlands for vertical accretion;

3. Discourage Phragmites colonization;
4. Reclaim land from adjacent low lying land currently used for non-water dependent purposes;
5. Convert mown lawn on Bridgeport side walkway to native shrubs and grasses to discourage Geese;
6. Encourage soft edge retrofits for hardened shorelines;
7. Convert public and private lawn spaces to native vegetation; and
8. Create a more robust native plant community along the Bridgeport side. Phase out all non-native plantings;

Recreation

1. Link bikeway and pedestrian routes with other sections of the Estuary and Jennings Beach; and
2. Install educational signage and kiosks in high traffic areas;

Water Quality

1. Develop and implement a green infrastructure plan that specifically addresses street end runoff, residential properties, and permeable pavement conversion;
2. Rethink road drainage on Bridgeport side to reduce flooding and runoff contamination;
3. Identify runoff pollution sources such as fertilizer, pesticide, and other potentially harmful substances; and
4. Post signage to prevent digging in the mudflats backed up by local ordinances.

STUDY AREA C: TIDAL INLET

C.1 DESCRIPTION

This unit includes the inlet of Ash Creek, where the waters of the Sound flow into Ash Creek and where the flow from Ash Creek outlets into the Sound.

The geographic unit is approximately 10.8 acres in size, of which the water at high tide occupies about 7 acres.

The environmental and cultural features that define this area include:

- The tidal inlet/outlet channel;
- The St. Mary's barrier spit;
- St. Mary's-by-the-Sea rocky shorefront;
- Forested Open Space; and,
- The tidal creek.

The tidal inlet/outlet channel is the narrow passageway between the barrier spit and the Fairfield mainland. The channel area is bounded by the barrier spit on its east side. The channel is bounded on the west side by rip rap lined coastline including a jetty at the terminus of Jennings Beach and an artificial peninsula that was created by dredging activities related to the construction of Benson Marina. The channel is approximately 220 feet in width between the barrier spit and the far shore. The channel is relatively deep due to regular dredging and therefore has a strong tidal current. Dredging activities in the central channel appear to be limited north of the navigable entry to Benson Marina.

The St. Mary's barrier spit is a type of coastal barrier landform known as a barrier spit. Barrier spits are coastal barriers that are attached to the mainland at only one end and extend into open water. (Barrier spits can become barrier islands if they detach completely from the mainland, and conversely, a barrier spit can attach on both sides to the mainland and be called a bay barrier). This Barrier Spit is documented in its current location since at least the 17th Century in early colonial maps. It persisted, more or less, in stable form until the creation of a new marina and jetty immediately to the west of the inlet. The barrier spit occupies approximately 2.5 acres at high tide.

The barrier spit faces both inland towards the tidal creek and outward towards the Sound.

The Sound facing portion of the barrier spit is a fore (sand) dune environment. Vegetation is primarily characterized by low growing herbaceous plants, shrubs, and a few trees. These plants are rooted in deposits of unconsolidated loamy and course sand. The shape of taller species is impacted by the predominant onshore winds. Between the dune vegetation and the Sound is an intertidal zone of vegetated beach..

The tidal creek facing portion of the barrier spit is a back (sand) dune environment. Vegetation is primarily characterized by low growing herbs, shrubs, and grasses, rooted on a deposit of unconsolidated loamy and coarse sand.

The St. Mary's-by-the-Sea rocky shorefront consists of approximately 660 feet of predominantly rocky intertidal shorefront. The far most western portion of this area is sandy. Above the slope to the shorefront there is a promenade with a walking path, and a grassy strip with park benches. Grovers Avenue runs parallel to the promenade with parallel parking spaces on the Sound side of the street. The promenade is part of the City of Bridgeport St. Mary's-by-the-Sea Park. Benches, streetlights, and occasional trash receptacles can be found up and down the promenade.

The Forested Open Space is located at the bottom of Black Rock, Bridgeport, east of the Gilman Street bend. It is approximately 1.75 acres in size, and is mainly forested with a small lawn area in front. The locals refer to the area as the "bird sanctuary" although it's officially known on several maps as Capozzi Park.Vegetation within the forested portion of the open space consists of a thick woody overstory and a dense understory which is dominated by nonnative species. From 2019-2022, significant progress toward restoring this forested area have been made. With the help of volunteers and local landscaping businesses, the ACCA has removed the dense, invasive understory and planted dozens of native trees, shrubs, and grasses.

The tidal creek runs along the north side of the barrier spit. It contains mudflat, low marsh, and high marsh plant communities. The walkway along Grover's Avenue rises above the eastern side of the tidal creek. The creek is discussed in greater detail in section A: Lower Creek.

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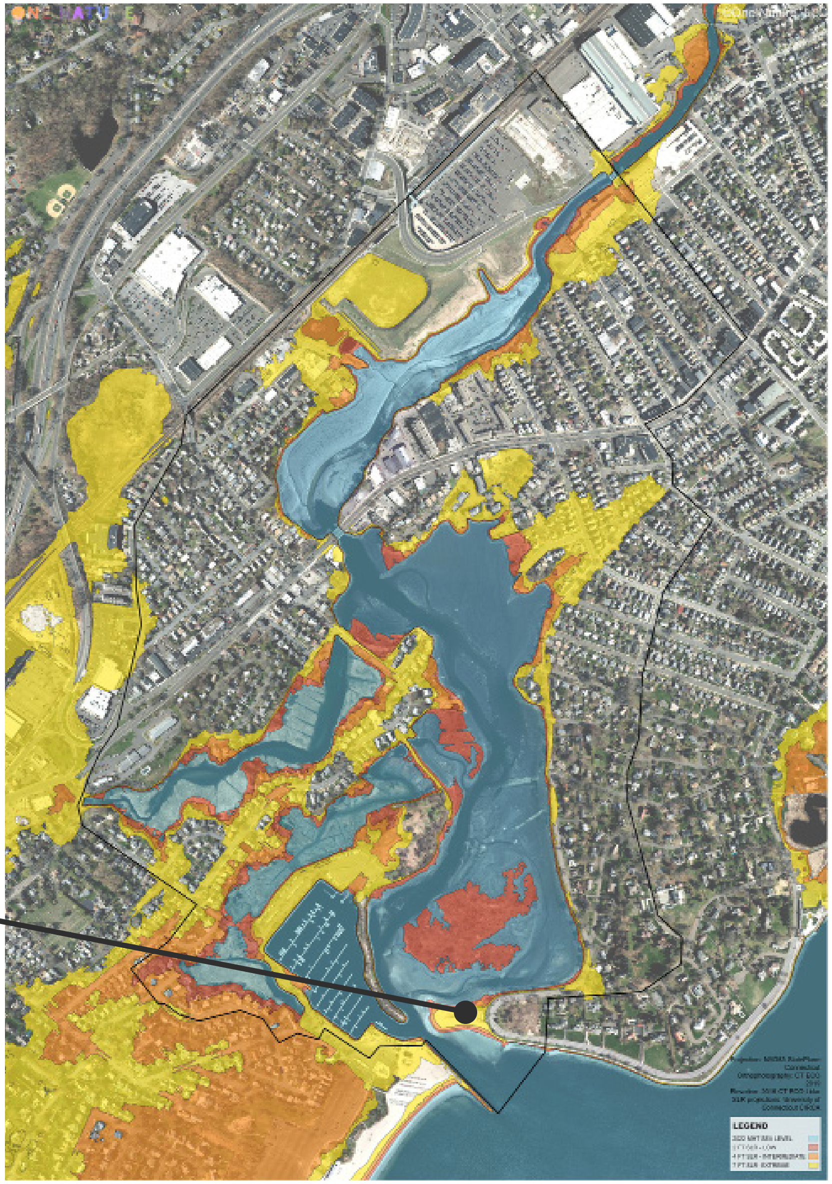

2 ft Sea Level Rise - Low
4 ft Sea Level Rise - Intermediate
6 ft Sea Level Rise - Extreme

C.2 HISTORIC INTERPRETATION

Densely packed glacial deposits formed what is known today as Black Rock during the Pleistocene. The hilly Black Rock landform provides a hardened shoreline which partly creates the conditions for the formation of a barrier spit and barrier beach (Jennings Beach) to the west.

This area appears to have been a tidal inlet at least since the late 17th Century. The barrier spit and barrier beach complex, split by the Ash Creek inlet, formerly abutted a large intertidal marshland to the north (described in Section X Lower Creek) which drained into Ash Creek. Though heavily modified in the past few centuries, the barrier spit appears to have retained its basic morphological character. In contrast, the barrier beach (Jennings Beach) has been heavily modified.

The channel and peninsula (Fairfield side of the study area) was created as part of the creation of Benson Marina when the former tidal marshland was dredged to make navigable harbor. Some of the dredge spoils were then used to create the peninsula and to fill in surrounding tidal wetlands. This entire area, consisting of the western edge of the study area, is now lined with medium sized rip rap.

Approximately at the same time, large rip rap was used to create the jetty along the edge of Jennings Beach. The purpose of the jetty is to capture littoral drift (i.e. to keep the beach sand) from moving away from Jennings Beach).

The edge of the barrier spit has aggraded and degraded over the years according to the influence of human activities on vegetation and by the channel maintenance. The channel was most recently dredged in 2019. A review of 2020 and 2021 aerial photography suggests the damage from this most recent dredging has been more detrimental to the Barrier Spit than in the past. It is unknown if beach nourishment activities have taken place on Jennings Beach, or how frequently the channel is dredged. Deep waters created by dredging activities make this location a popular fishing area.

Historic dredging activities and the development of Benson's Marina have had a disturbance impact on the great marsh island. Channel deepening has caused stronger currents with erosive ripple effects on the adjacent landforms. Dredging activities appear to have also required mobilization of heavy equipment on the barrier spit, which has resulted in damaged habitat.

C.3 QUALITATIVE ASSESSMENT OF EXISTING CONDITIONS AND ECOLOGICAL FUNCTIONS

Aesthetic. The barrier spit offers a unique contrast to the interior sections of the Estuary and the eastern rip rap shore. The estuary showcases many visually distinctive habitats which creates a diverse visitor experience. Moreover, the physical forms found in intertidal sandy beaches and dune environments (such as sand waves, the dune geometry, and the angles of repose) are typically considered aesthetically pleasing design elements. The point of the Barrier spit is a particularly beautiful place where visitors may gaze deep into clear water, out towards the horizon line above the sound, or inward to the Great Marsh. The undeveloped nature of the Barrier spit provides an aesthetic complement to the comparatively more developed Fairfield and Bridgeport shorelines.

Biodiversity. This study area is relatively small compared to the overall size of the Estuary but contains species found nowhere else in the system. In this small section there are unique habitats such as foredune, backdune, and maritime forest which attract a diversity of vertebrate and invertebrate species. This study area contains a small community of the state-listed threatened species Sporobolus cryptandrus, known as sand dropseed.

Flood and Storm Protection. This barrier spit absorbs wave action and protects interior marshland, and plays an important role in absorbing storm surges. If the spit were to be reduced in width or elevation, it could cause negative impacts especially on the Great Marsh Island. The spit also protects the St. Mary's walkway and Gilman Street from erosive wave action that could cause undercutting. The marine forest in the Capozzi Park buffers coastal winds from interior sections of the lower creek, especially the eastern shoreline. It also creates a sheltered environment for recreational walkers, bikers, and dog walkers.

Habitat. Foredune and Backdune environments in the barrier spit are important habitat types for a variety of sand loving plant and animal species. American beachgrass, in particular, is not found elsewhere in the Estuary. Capozzi Park provides an important refuge for migratory and resident species of birds and insects, especially during storm events.

Recreation. The barrier spit provides important waterfront access for multiple user types including fishermen, bird watchers, sunbathers, and beachcombers. Recreational use of the rest of the public landscapes is also significant. Walkers, bikers, dog walkers, and fisherpeople all utilize the barrier spit's public space. The seaward views, parking availability and the promenade make this an attractive resource for recreation.

Water Quality. By decreasing wave action within the lower creek, the barrier spit calms the waterway which enables more productive sediment deposition and nutrient fixation. This preserves and enhances the water quality of the lower creek.

C.4 POTENTIAL THREATS

Erosion and Deposition of the Barrier Spit. The underlying barrier spit deposits are subject to erosion during severe storms. The erosion has been accelerated in recent years due to human related activities. In a relatively short time period, 2006 to 2016, our analysis has shown an exceptionally rapid retreat and loss of sand at the Barrier Spit – approximately 60 linear feet in some areas. At this rate of beach loss, we have computed that the Barrier Spit will be gone by 2036. The disappearance may even occur sooner as its protective vegetative cover declines. The loss of vegetation makes the Barrier Spit more susceptible to erosion and significantly diminishes the resiliency of the landform. Recent large storm events (such as Tropical Storms Irene, Lee, and Sandy) have all negatively impacted the width of the landform.

Although large storm events can negatively affect and degrade the landform, on the whole this is a short-term impact. The long-term stability and therefore the health of the landform depends mainly on the replenishment by sand carried by the offshore currents moving westerly along the edge of the coast.

If this normal process of littoral drift is interrupted over time due to diversions from groins, jetties, or other hardened structures, there will be no current to transport and deposit the sand. Additionally, if there is a shortage of sand due to excessive shorefront development, then there will be a shortage of sand to replenish the spit sand and the landform would be expected to degrade over time. Both factors may be of concern to the future of this landform.

The spit is especially sensitive to the level of human use. Humans can impact the stability of the landform by accelerating erosion. This impact is more pronounced when a high level of human alteration coincides with a large storm event.

The barrier spit plays an important role in the function of the creek, notably by providing a unique ecology and biodiversity to the area, and by protecting the inner creek from erosive wave action during storm events, and therefore mitigating flooding to the inner creek and to inland structures. Without the sheltering from the barrier spit, the Great Salt Marsh Island would erode away. The barrier spit also serves as sand storage areas that supply sand to eroded beaches during storms, and serves to buffer windblown sand and salt spray from the inner shores.

The sand dunes located in the middle of the spit are an important component of the barrier spit, and are absolutely vital to the protective function of the spit. By being at a higher elevation than the rest of the barrier spit, they absorb the impact of storm surges and high waves. The dunes are created and maintained by wind blown sand that becomes trapped by the vegetation. Over time, the sand accretes into dunes. Any activity such as trampling or unnecessary development which disturbs the natural vegetation will also ultimately harm the sand dunes, since the natural vegetation is required to create and maintain the sand dunes. Furthermore, care should be taken in any future restoration project to ensure that the higher elevation of the dune zone is maintained so that the barrier spit can fully perform all of its protective functions to the Estuary.

The promenade walkway along the exposed coast shows signs of erosion damage which will eventually lead to the collapse in undermined sections.

Jurisdictional Overlap. According to Town of Fairfield documents such as their Multiple Use Management Plan for Coastal Open Space, the USGS topographic quadrangle, and several newspaper articles dating back to 1954, the Fairfield/Bridgeport municipal boundary line possibly runs directly through the barrier spit, or through an accreting edge. This makes dual municipal management of the spit a complex and often neglected matter. Because of the uncertainty of the location of the municipal boundary, often site plans for the barrier spit neglect to indicate the municipal boundary in relation to the landform.

The presence of this municipal boundary triggers certain regulatory requirements that are often overlooked. All development activities that may impact the barrier spit may be subject to dual regulation by BOTH the Town of Fairfield and the City of Bridgeport, and possibly the CT Department of Energy and Environmental Protection (CTDEEP).

According to the CT General Statutes, even activities that appear to be constrained to one side of the municipal boundary are likely still subject to regulation by the other municipality IF the activity is within 500 feet of the municipal boundary, or IF the activity impacts the environmental resources of the other municipality.

Alien and Invasive Species. There is a high level of invasive species growing in the shrub and herbaceous understory of the “bird sanctuary” (Capozzi Park). Non-native species have been observed in the barrier spit area. Alien and invasive species pose a threat to certain types of native plants and animals, such as the native dune grass, Ammophila breviligulata, American Beachgrass. As of 2022, the invasive species that made up the dense understory of Capozzi Park have been removed in an herbicide-fee approach with coordination and management by the ACCA.

Sea Level Change. Predicted rises in sea level would negatively impact the integrity of the barrier spit. Under higher sea conditions, waves would more easily overtop and wrap the existing landform, causing increased erosion of the spit and lower creek habitats.

The following areas are likely to be most impacted by sea level rise in this study area:

- St. Mary’s-by-the-Sea barrier spit
- South portion of Gilman Street

Recreational Use and Development. Heavy dog use of the barrier spit and adjacent high marsh leads to the fecal pollution of the waterway and the Sound. Heavy and minimally managed recreational use of the barrier spit leads to loss of plant life, and also leads to accelerated erosion of the landform. Intensive use of the sole portable port-o-john located at Capozzi Park has led to a visually offensive and potentially unsanitary condition of the amenity.

Any activity such as trampling and unnecessary impact, which disturbs the natural vegetation of the sand pit, will also ultimately harm the sand dunes, since the mat of native grasses required to create and maintain the sand dunes is easily damaged by human foot traffic.

Motorized Boats. Increased use of the channel by motorized watercraft will lead to adverse impacts to the marsh and aquatic ecosystem such as motor oil pollution, erosion, sedimentation, and increased turbidity due to prop dredging and wake effects. This to the smothering of seed oysters and other bottom dwelling and aquatic organisms, and the disturbance of nesting patterns of shorebirds.

Storm Events. Major storm events, such as hurricanes and Nor’easters, have the potential to cause major changes to coastal morphology and upland habitat. These events, though unpredictable, may intensify in the future as a result of climate change.

C.5 POTENTIAL ECOSYSTEM IMPROVEMENTS

Saint Mary's by-the-Sea should be reconstructed and restored. This will create significant recreational, economic, and environmental benefits to the region. The proposed plan for the barrier spit features a restored salt marsh, dune fencing around a raised dune with plantings for coastal meadow and beach grass, an improved woodland aside the coastal meadow, and a planted buffer next to the restored marsh. Long-term landscape stewardship should be aided by ongoing dredging activities for the adjacent South Benson Marina in Fairfield, CT. These dredging activities currently take sand from Ash Creek and place it on Jennings Beach—it would be better used and cheaper to place it at Saint Mary's to build and maintain the dune's elevation. Overall, the existing high point of the spit would be lifted approximately four feet.

The restoration project would create a tremendous aesthetic improvement to the community. Native grasses adapted to salt spray, storms, and coastal dynamics would lushly cover and help to rebuild the dune; visitors would have the opportunity to walk the high tide line around the barrier spit year round. Improvements to adjacent woodland, a new picnic area, and better linkages to the St. Mary's walkway would further enhance the beauty and use of the space.

Aesthetic

1. Enhance native vegetation throughout the study area;
2. Improve vistas across the lower creek and the sound through planting, placement of benches, and pathway alignment;
3. Install aesthetically pleasing dune fencing along topographic contours;
4. Improve gathering spaces through use of permeable pavers, fill placement, and historically appropriate site furnishing; and
5. Create custom signage and educational kiosks to be used throughout the Ash Creek estuary to establish a local feeling respectful of cultural and ecological conditions.

Biodiversity

1. Protect large sections of the barrier spit from dogs and foot;
2. Supplemental spot planting to encourage specific species; and
3. Develop forest management plan for Capozzi Park. Thin trees and control invasive species to create greater plant diversity.

Carbon Fixation

1. Generally encourage the restoration of native plant materials;
2. Monitor all design and construction activities to reduce use of heavy equipment or building materials with high carbon footprints;
3. Manage the Bird Sanctuary to promote more standing and ground sequestered biomass. Expand the forest farther west; and
4. Convert all lawn spaces to native coastal vegetation.

Habitat

1. Promote living shorelines for stabilization and habitat;
2. Add sediment to wetlands for vertical accretion;
3. Restore tidal salt marsh and riparian zones on the northeast side of the barrier spit;
4. Bring back coastal mud and shrub habitat on the southwest edge of the Bird Sanctuary; and
5. Convert mown lawn on promenade walkway to native shrubs and grasses.

Recreation

1. Better define access points to the barrier spit to avoid trampling native plants;
2. Install bike racks;
3. Construct new pathways through the Bird Sanctuary to counter the dominance of the road on visitor experience and to provide access to additional environmental education;
4. Temporary toilets should be removed, added, better maintained, or replaced with permanent bathrooms; and
5. Design and install a defined bikeway and sidewalk system to create a safer and more accessible experience.

Water Quality

1. Use green infrastructure techniques to address street drainage;

2. Provide bags and signage to control dog waste. The drainage for the road can be improved using green infrastructure technologies; and

3. Restore native plant communities and discourage off-trail disturbance.

STUDY AREA D: TURNEY CREEK

D.1 DESCRIPTION

Turney Creek is a tidal tributary to Ash Creek. The tributary is entirely located in Fairfield. At its highest point, it openly flows from near the intersection of Turney Road and Old Post Road to its tidal outlet/inlet, which is located just to the east of Riverside Drive and south of the Post Road. The tributary connects to the main Ash Creek in the northwest corner of the Lower Creek region.

North of the Old Post Road, Turney Creek is a buried waterway.

The greater Turney Creek geographic unit encompasses about 59 acres, of which the open water habitat occupies approximately 6.5 acres. The length of the channel, including its meanders, is about 3000 feet from its inlet/outlet to its saline/freshwater boundary.

The environmental and cultural landscapes that define this area include:

- The Turney Creek tidal waterway
- The Southern bank residential area
- The Northern bank residential area

The Turney Creek tidal waterway consists of the channel and its flanking low and high marsh areas.

Tidal flow enters Turney Creek from the main Ash Creek through a combination of old and relatively new tidal gates. These gates narrow the flow under the Riverside Drive bridge. Once flow passes through the constricted tidal gateway area, it spreads out over wide expanses of marsh for most of the remaining length of the creek. Once the waterway reaches the region in the rear of the Circle Diner (441 Post Road), the wide marshy areas disappear, and the channel becomes constrained between high sloping banks for the next 100 feet until it reaches the Old Post Road bridge.

The saline-freshwater boundary is located not far to the west of the Old Post Road Bridge - approximately 75 feet west of the traffic triangle which joins the Old Post Road and Post Road, below the parking lot to Fairfield Wines and Spirits (957 Post Rd).

Above the saline/freshwater boundary area, the creek is no longer subject to tides. The watercourse drains freshwater from the watershed located above the Old Post and Post Roads, extending as high up as the Fairfield Woods neighborhood in eastern Fairfield between Routes 58 and 59.

Within the marsh and waterway are two properties owned and managed by the Town of Fairfield – the Cambridge Street Wetland Conservation Area, and the Woods Wetland Conservation Area.

The Cambridge Street Wetland Conservation Area consists of 0.5 acres of tidal wetlands along the creek, north of Cambridge Street. It was acquired in 1988 by the Town of Fairfield as a result of delinquent taxes. The property is inaccessible through its uplands, but it can be canoed or kayaked through at high tide. It is managed by the Town of Fairfield to conserve its natural resources and to protect the ecological functions of the greater estuary, with a lesser emphasis on its use for passive recreation.

The Woods Wetland Conservation Area consists of 3.0 acres of tidal wetlands along the creek, off of Shoreham Village Drive. It was acquired as a donation from James Woods in 1988. Upland access is through a small grassy strip, and it can be canoed or kayaked through at high tide. Similar to the Cambridge Street Wetlands, it is managed by the Town of Fairfield more to conserve its natural resources and to protect the ecological functions of the greater estuary, with a lesser emphasis on its use for passive recreation.

The Southern bank residential area consists of the medium density residential neighborhoods along Cambridge Streets and along the north side of Riverside Drive. The area is predominately lowland, underlain by deep, sandy, well drained, glacial outwash lake deposits.

The Northern bank residential area consists of the medium density residential neighborhoods of Shoreham Village and Shoreham Terrace / Riverside Drive, with a pocket of commercial/industrial development located along the Old Post and Post Roads. Much of the residential area is located on relatively gentle hills underlain by thin glacial till deposits. The hills trend to the northeast. The commercial-industrial pocket is located in a lowland area consisting of deep, sandy, well drained, glacial outwash lake deposits.

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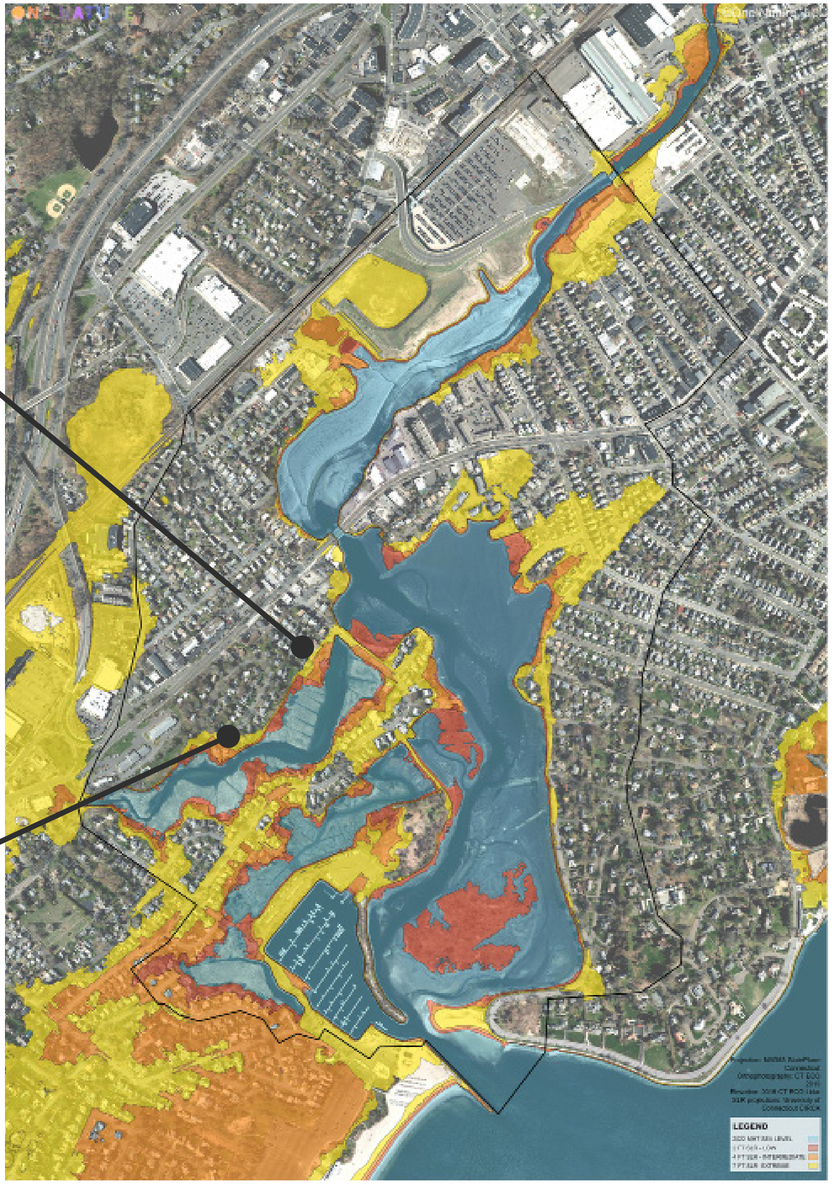

- 2 ft Sea Level Rise - Low
- 4 ft Sea Level Rise - Intermediate
- 6 ft Sea Level Rise - Extreme

D.2 HISTORIC INTERPRETATION

Named after an early Fairfield family, Turney Creek was once part of a large tidal wetland system that was severely disrupted by the railroad, and later by Fairfield's expansion. With its headwaters several miles north of Fairfield, the creek today travels underground for much of its length before daylighting at the Old Post Road. The tidal creek has also suffered from the installation of a tidal gate that was installed to reduce flood risks.

D.3 QUALITATIVE ASSESSMENT OF EXISTING CONDITIONS AND ECOLOGICAL FUNCTIONS

Hydrologic, Biogeochemical, and Ecological Functions of the Tidal Ecosystem. The tidal creek and its associated wetland areas are performing and providing many valuable ecological functions. These include floodwater alteration, fish and shellfish habitat, sediment/toxicant/pathogen retention of pollutants, nutrient removal/retention/transformation, carbon fixation to reduce global warming, shoreline stabilization, wildlife habitat, and visual quality/aesthetics.

Flood Protection. The creek and adjacent wetlands provide important flood protection to the surrounding neighborhood through its capacity to absorb flooding during and after storm events. Its ability to provide that protection is a function of its channel capacity, and the integrity of its vegetation. The tide gates provide an additional level of flood protection from storm surges but appear not to be high enough to protect from the most severe conditions.

Saline/Freshwater Exchange. Of historical note is the impact to the creek by the system of tidal gates and culverts which constrain and obstruct free flow into the creek at its inlet/outlet. These gates and culverts, though improved over time, likely impact salinity levels to an unknown degree, resulting in the encroachment of Phragmites. The tall clumps of Phragmites displace high marsh vegetation, and restrict views into the interior of the marsh, impacting the aesthetics.

Turney Creek also buffers the Lower Ash Creek from the impact of freshwater from upper reaches of the watershed. The quality of freshwater outflow is also likely relatively poor due to low dissolved oxygen levels, increased water temperature, and the resultant anaerobic process.

Mosquito Ditching. The marsh was ditched in the 1870s, in 1911, and a few times more recently during the last midcentury, in an attempt to limit mosquito breeding. The ditching is still observable. The ditches divert flow away from the marshy substrate during high tides. Despite the historical ditching, the marsh substrate still appears to be physically stable.

Habitat and Biodiversity. Turney Creek still has relatively wide expanses of marsh, which enhances its habitat values. It has been suggested in the past that the area may be suitable for the recruitment and establishment of oysterbeds, however, its commercial value would be limited by the impossibility of access by any type of large watercraft.

The adjacent riparian forest (on public and private property) also provides valuable habitat.

Recreation. The lower sections of Turney Creek are accessible for canoeing and kayaking, though of limited utility due to limited length. The area is suitable for bird watching and nature appreciation. Public upland access to the tidal system is possible, but limited, through the Woods Wetland Conservation Area.

Aesthetic. The wide expanses of marsh, viewable from the backyards of the private residents and several businesses, bring exceptional aesthetic value to the community. However, in some places views are blocked due to very tall stands of Phragimtes (10+ feet in some cases).

D.4 POTENTIAL THREATS

Tidal Gates. As previously noted, flow is constricted through the inlet/outlet due to the tidal gates. Originally the tidal gates were installed as part of a flood protection project, and greatly restricted tidal exchange. This led to noticeable impairments to the creek, and in 1979 and 1994 the Town of Fairfield Conservation Department replaced some of these gates with two new, improved 48 inch culverts with self regulating tide gates. Three older 8 foot diameter culverts with conventional tide gates were left in place. Previous assessments have noted that the newer tidal gates have improved the water quality. However, the presence of Phragmites in the vicinity of the gates suggests that flow might still be constricted to some degree. Restricted flow impacts salinity levels which in turn may encourage the recruitment and establishment of Phragmites, an invasive and alien plant.

Wetland – Upland Buffer Condition. Many of the residences along the south side of Shoreham Village Drive and the north side of Riverside Drive maintain rear lawns all the way down to the tidal wetlands or waterway channel. Ideally, there should be more natural buffer width in these yards in order to attenuate lawn pollutants such as fertilizers and pesticides.

Upstream Watershed Influences. Turney Creek not only conveys tidal flow from the main portions of Ash Creek, but also freshwater flow from the watercourse network that drains the rest of the watershed above the creek. That watershed extends far out from the local neighborhoods adjoining the tidal creek, extending deep into the eastern portion of Fairfield, all the way up to the Fairfield Woods neighborhood located between Routes 58 and 59. As a consequence, Turney Creek, which is a relatively small creek in relation to its watershed area, is fairly sensitive to storm events that may occur as far away as 3 miles upstream from its freshwater-saline boundary. The creek is also sensitive to nonpoint and point source pollutants from farther up in that watershed as well.

CT DEEP Water Quality Assessment. The 2022 305b CT DEEP Water Quality Assessment does not specify whether this creek was sampled, however, it would be expected that its water quality status would be similar to the main Ash Creek as well due to similarities in geography, suffering from impairments to Aquatic Life, Recreation, and Commercial Shellfish due to fecal coliform and other bacteria, metals, and other types of contaminated sediments.

Water quality in the creek is also classified by the State of Connecticut as “SB”, a less desirable classification than “SA”.

Sea level rise may be a long term threat to the tidal wetlands as there is limited habitat area left for any future wetland to naturally create along the fringe of any future sea level rise. As sea levels rise, wetland habitat may be pinched between residential properties and the rising average tide level, resulting in less and less habitat over time.

The following areas are likely to be most impacted by sea level rise in this study area:

- Riverside Drive
- Southern Shoreham Village Drive
- Bottom of Shoreham Terrace
- Cambridge Street

D.5 POTENTIAL ECOSYSTEM IMPROVEMENTS

Aesthetic

1. Enhance native vegetation throughout the study area;
2. Improve vistas across the study area through planting, placement of benches, and pathway alignment;
3. Work with adjacent property owners to integrate native plants into their landscape design choices;
4. Improve and create street end access and gathering spaces;
5. Examine potential for removing fill form adjacent land to increase tidal marsh habitat, perhaps in coordination with flood mitigation efforts;
6. Work with Fairfield post-Sandy reconstruction efforts to integrate native plants into redevelopment plans;
7. Promote stormwater capture technologies including bioswales, vegetative buffer strips, rain barrel use, and permeable paving throughout the drainage area;
8. Integrate restoration with Hurricane Sandy recovery efforts;
9. Alter street ends to create views of water; and
10. Create custom signage and educational kiosks to be used throughout the Ash Creek estuary that establish a local feeling respectful of cultural and ecological conditions.

Biodiversity

1. Encourage the creation of high marsh plants;
2. Educate local property owners about the value and importance of native plant species;
3. Supplemental spot planting and seeding to encourage specific native species wherever possible; and
4. Develop forest management plan for forested edges.

Carbon Fixation

1. Improve tidal gates to allow more tidal flushing, thereby reducing methane and nitrous oxide releases (both greenhouse gases);
2. Create more wetlands;
3. Generally encourage the restoration of native plant materials; and
4. Monitor all design and construction activities to reduce use of heavy equipment or building materials with high carbon footprints.

Habitat

1. Create living shorelines for shore stabilization and additional habitat;
2. Discourage Phragmites colonization;
3. Create green spaces at the end of street ends;
4. Reclaim land from adjacent low lying land currently used for non-water dependent purposes;
5. Convert mown lawn on promenade walkway to native shrubs and grasses; and
6. Increase intertidal marsh areas through reclaiming vacant properties; and
7. Convert public and private lawn spaces to native vegetation.

Recreation

1. Define public access points;
2. Link bikeway and pedestrian routes with other sections of the Estuary and Jennings Beach;
3. Install educational signage and kiosks in high traffic areas;
4. Improve ADA access to waterfront views; and
5. Install blinds for bird watchers.

Water Quality

1. Develop and implement a green infrastructure plan that specifically addresses street ends runoff, residential properties, and permeable pavement conversion;
2. Study the function and design of all tide gates and culverts; and
3. Identify runoff pollution sources such as fertilizer, pesticide, and other potentially harmful substances.

STUDY AREA E: RIVERSIDE CREEK

E.1 DESCRIPTION

Riverside Creek is located entirely within the Town of Fairfield. Although a tidal waterway, it is hydrologically connected to Ash Creek at both ends, and therefore more of an estuary than a tidal tributary. Both connections to Ash Creek are regulated by tidal gates.

The area described for this assessment is approximately 58 acres in size. This includes 12 acres of open water within the South Benson Marina, and about 4 acres of open water in the active channel within its marsh during high tide.

The environmental and cultural landscapes that define this area include:

- The "Northern" waterway segment (located north of Turney Road)
- The "Southern" waterway segment (located south Turney Road)
- The west bank (of the northern segment) lowland residential area
- The north and south bank (of the southern segment) residential area
- The marina
- The artificial peninsula

The northern waterway segment begins at its connection to Lower Ash Creek underneath the earthen flood control dike located off Riverside Drive. The segment flows southerly between Riverside Drive and the Penfield Mills -Ash Creek Open space and parking area to the marina until it reaches the culvert underneath the Turney Road near the entrance to the marina. The length of this segment of waterway as it threads it way through its meanders is about 2600 feet.

The earthen flood control dike at inlet/outlet was constructed in 1957 after a series of coastal storms and hurricane for the purpose of protecting the adjoining neighborhoods from flooding. When the dike was originally constructed, a conventional tide gate was installed to allow freshwater to drain from the wetland. This tidegate prevented tidal exchange. This led to detrimental effects on the local ecology. It was replaced in 1975 by a self regulating tidegate which allowed salt water flow back into the creek, improving the local ecology.

Within the northern waterway segment is a channel, high marsh, low marsh and forested riparian land. The tidal channel is very narrow (5-10') and provides limited mudflat habitat.

South of the Riverside Drive bend is the Riverside Drive-Ash Creek Wetland Conservation Area, consisting of 2.85 acres of mainly tidal wetlands south of the Turney Creek tidegates, and a 0.2 acre shoreline floodplain parcel just north of the tidegates. The parcels were acquired by the Town of Fairfield in 1978. The area is accessible from Riverside Drive, and provides opportunities for bird and other wildlife watching, shellfishing, and access to Lower Ash Creek.

The southern waterway segment is the portion of the creek that flows southerly from the culvert underneath Turney Road (across from the "headwaters" of the northern waterway segment) near the entrance to the Marina. From the culvert, the creek flows southerly approximately 200 feet where it joins the tidal wetland complex in the rear of the residences located along Milton Street and Oyster Road. The creek then flows easterly until it ultimately connects back into the marina basin through a 48 inch culvert and conventional tidal gate located underneath the marina access drive.

The Town of Fairfield owns and manages the 3.1 acres of wetlands and adjacent uplands in the rear of Milton Street and Oyster Road, west of the marina basin. This area is designated as the Milton Street – Oyster Road Wetland Conservation Area, and was acquired in stages from 1939 to 1968. Dredge material from the marina was placed in this area in the 1960s and 70s. The wetland is degraded due to the lack of tidal exchange, and mainly functions as stormwater detention for the adjacent area.

Within the southern waterway segment is a channel and low marsh dominated by Phragmites.

The west bank lowland residential area includes the medium density residential neighborhood located on the southern side of

Riverside Drive and the neighborhood located both sides of Concord Street. These residences are located on the west bank to the northern segment of the waterway. These neighborhoods occupy a lowland area, and are built over deep, sandy, well drained, glacial outwash lake deposits.

The north and south bank residential area includes the medium density residential neighborhoods located on the north and south banks of the southern segment of the creek. These areas include Milton Street, the end of Clinton Street, and the north side of Oyster Road. These neighborhoods occupy a lowland area similar to the west bank lowland residential area, and are built over deep, sandy, well drained, glacial outwash lake deposits. These areas were once tidal wetland.

The marina includes the 12 acres of the open water basin, the parking lot to the Town of Fairfield Pennfield Mills - Ash Creek Open Space and marina, and the paved access drive alongside the boating slips. The South Benson Marina is owned by the Town of Fairfield.

The basin was dredged out of marshland in 1964, and expanded again in 1970 and 1981, along with the parking areas. The spoils were placed in various places; along what is now the peninsula, within the area which now constitutes the meadow in the Pennfield Mills -Ash Creek Open Space area, and in the existing parking areas. The basin was previously tidal wetland.

The artificial peninsula is located between the marina and the bottom of the Lower Creek. It appears to be built of dredge spoils from the adjacent marina, and its major design function is to shelter the marina. The peninsula is about 950 feet long and 100 feet wide. The top is flat with a trail leading to waterfront access at its tip and at its base. Frequent users of this trail include dog walkers and people wanting to fish. The top of the landform is predominately shaded by a woody canopy of Locust trees. The sides of the landform are hardened with rip rap.


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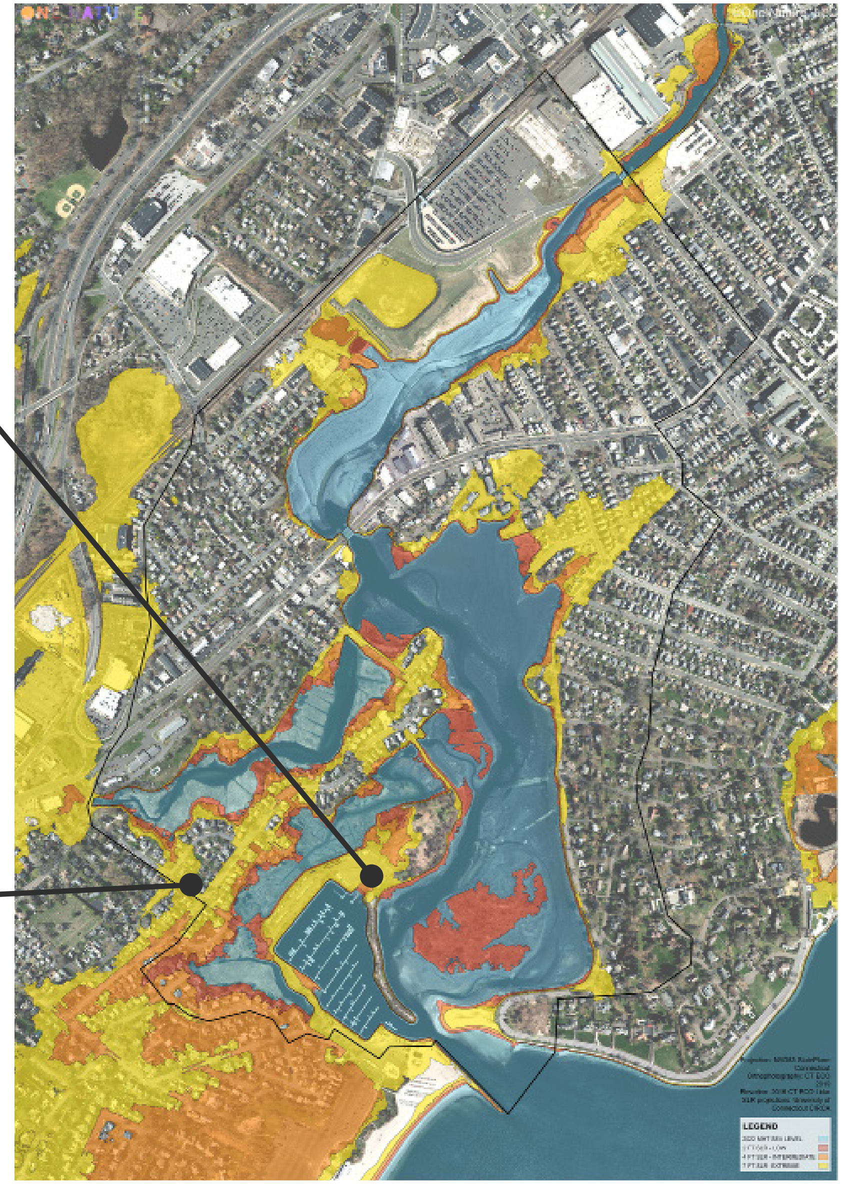


- 2 ft Sea Level Rise - Low
- 4 ft Sea Level Rise - Intermediate
- 6 ft Sea Level Rise - Extreme

E.2 HISTORIC INTERPRETATION

Historical maps indicate that this southern segment was originally not connected to the northern segment. It was its own tidal creek flowing east/west. The current watershed to the creek extends 1200 feet from its most western remaining extent, to near the intersection of South Benson and Old Post Roads. Very likely the historical creek extended up into the top of this area. Overtime, the western extension of the creek was filled, and the neighborhoods constructed on top of it. The eastern portion of the creek was somewhat preserved, and was reengineered to be connected to the northern segment in the area located above Turney Road, near the entrance to the marina.

Since the southern segment is connected to the northern segment, and both segments connect to Ash Creek (The lower creek area and the marina basin respectively), it is theoretically possible for the creek to accommodate tidal flow into its interior segments from either inlet side. However, it appears that in most likelihood this does not occur. Continuous bidirectional tidal flow is reduced due to the conventional tidal gates that connect the creek to the marina basin. It appears that these constraints probably keep more of the flow from the southern segment from flowing north than vice versa.

E.3 QUALITATIVE ASSESSMENT OF EXISTING CONDITIONS AND ECOLOGICAL FUNCTIONS

Habitat and Biodiversity. Riverside Creek contains significant amounts of low and high tidal marsh. High marsh is dominated by Phragmites while the low marsh is dominated by Spartina alterniflora. A thin strip of mudflat exists along the narrow tidal creek.

Despite the self-regulating tidal gates which allow tidal exchange, there are still a few stands of Phragmites near the northern segment's inlet, and a few stands within the waterway of the northern segment's itself. There are also dense stands of Phragmites within the southern segment, especially in the Milton Street – Oyster Road Wetland Conservation Area. The tall clumps of Phragmites displace high marsh vegetation, and restrict views into the interior of the marsh, impacting the aesthetics.

Hydrologic, Biogeochemical, and Ecological Functions of the Tidal Ecosystem. The tidal creek and its associated wetland areas are performing and providing many valuable ecological functions. These include floodwater alteration, fish and shellfish habitat, sediment/toxicant/pathogen retention of pollutants, nutrient removal/ retention/ transformation, carbon fixation to reduce global warming, shoreline stabilization, wildlife habitat, and visual quality/ aesthetics.

Saline/Fresh Water Exchange. Of historical note is the impact to Riverside Creek by the artificially created system of tidal gates and culverts for floodwater control and to accommodate flow underneath the roadways. These constrain and obstruct free flow into the creek at its inlet, at its connection to the marina basin, and through the culvert underneath Turney Road. These gates and culverts likely impact salinity levels.

Flood Protection. Overall, the creek provides important flood protection to the surrounding neighborhood through its capacity to absorb flooding from rainfall during and after storm events. Its ability to provide that protection is a function of its channel capacity, and the integrity of its vegetation. It does not provide any significant storage capacity during tidal flood events.

The culvert underneath Turney Road, near the marina entrance, appears to be undersized, causing surface flooding along the entrance way road after storm events, and constricting tidal exchange during normal tidal cycles.

The channel is quite deeply entrenched near its outlet to the marina basin, probably due to obstructions in the outlet to the marina basin during storm events.

The Milton Street – Oyster Road Wetland Conservation Area serves as a natural stormwater detention basin for the adjacent community.

However, sometimes it has been responsible for flooding to the adjacent neighborhood during storm events when the culvert to the marina basin has been blocked on the seaward side due to debris during high tide.

Recreation. Recreation in the creek is limited to the northern segment due to constrictions is limited to shallow watercraft such as kayaks and canoes. Public access is only through the steep slope adjacent to the meadow in the Pennfield Mills-Ash Creek Conservation Area, or from the parking area to the open space and marina, or from the flood control dyke. There is public signage to the south of the bend in Riverside Drive.

Aesthetics. The northern segment of Riverside Creek, as viewed from the backyards of the residences along Riverside Drive and from the parking lot of the marina and town owned open space, is aesthetically pleasing and therefore brings value to the neighborhood and surrounding areas. Tall stands of Phragmites limit viewsheds.

Mosquito Ditching. Mosquito ditching of the marsh areas during the last two centuries has also permanently impacted the marsh. The ditching is still observable. The ditches divert flow away from the marshy substrate during high tides. Despite the historical ditching, the marsh substrate still appears to be physically stable.

E. 4 POTENTIAL THREATS

Tidal Gates and Culverts. As previously noted, flow is constricted through the inlets of both sides of the creek due to the tidal gates and culverts. Restricted flow may impact salinity levels which in turn may encourage the recruitment and establishment of Phragmites, an invasive vegetation.

Wetland – Upland Buffer Condition. Many of the residences along the banks of the creek maintain rear lawns all the way down to the tidal wetlands or waterway channel. Ideally, there should be more natural buffer width in these yards in order to attenuate lawn pollutants such as fertilizers and pesticides.

Fire. Dense stands of Phragmites are a fire hazard in areas such as the Milton Street – Oyster Road Wetland Conservation Area. There have been reports of fires in the past in the northern segment downstream from the flood control dyke before the improved self regulating tide gate was installed. The improved tide gate has increased salinity levels, decreasing the extent of Phragmites in that area.

Impervious Surfaces. The parking lot for the marina and open space area is impervious. Drainage off of this surface is predominately sheet flow, with little or no attempt to mitigate the impact of nonpoint pollutants from the impervious surfaces into the creek. Rooftops on houses also significantly reduce permeable land.

Marina Boat Basin. Usage of the boat basin is high, with the frequent motorboat traffic and the use of the moorings. It is likely that that the motorized watercraft generate petroleum byproducts which become a source of local contamination to the marina basin and Ash Creek. It is likely that the watercraft serve as vectors for the transport of invasive plant species. It is likely that wake effects and prop dredging from the boats cause erosion of the basin sides and floor.

CT DEEP Water Quality Assessment. The 2022 305b CT DEEP Water Quality Assessment does not specify whether this creek was sampled, however, it would be expected that its water quality status would be similar to the main Ash Creek as well due to similarities in geography, suffering from impairments to Aquatic Life, Recreation, and Commercial Shellfish due to fecal coliform and other bacteria, metals, and other types of contaminated sediments.

Water quality in the creek is also classified by the State of Connecticut as “SB”, a less desirable classification than “SA”.

Sea level rise may be a long term threat to the tidal wetlands as there is limited habitat area left for any future wetland to naturally create along the fringe of any future sea level rise.

The following areas are likely to be most impacted by sea level rise in this study area:

- Oyster Road
- Milton Street
- Turney Road

E.5 POTENTIAL ECOSYSTEM IMPROVEMENTS

Aesthetic

1. Enhance native vegetation throughout the study area;
2. Improve entryway to public open space at the Marina;
3. The bench at the end of the peninsula faces the backside of the sign and should be re-oriented. In general, vistas should be improved across the study area through planting, placement of benches, and pathway alignment;
4. Work with adjacent property owners to integrate native plants into their landscape design choices;
5. Improve and create street end access and gathering spaces;
6. Examine potential for removing fill form adjacent land to increase tidal marsh habitat, perhaps in coordination with flood mitigation efforts;
7. Work with Fairfield post-Sandy reconstruction efforts to integrate native plants into redevelopment plans;
8. Promote stormwater capture technologies including bioswales, vegetative buffer strips, rain barrel use, and permeable paving throughout the drainage area;
9. Integrate restoration with Hurricane Sandy recovery efforts;
10. Add native vegetation to parking islands near the public open space at the peninsula;
11. Alter street ends to create views of water; and
12. Create custom signage and educational kiosks to be used throughout the Ash Creek estuary that establish a local feeling respectful of cultural and ecological conditions.

Biodiversity

1. Encourage the creation of high marsh plants;
2. Educate local property owners about the value and importance of native plant species;
3. Increase salinity in tidal creeks to allow;
4. Supplemental spot planting and seeding to encourage specific native species wherever possible; and
5. Develop forest management plan for forested edges.

Carbon Fixation

1. Improve tidal gates to allow more tidal flushing, thereby reducing methane and nitrous oxide releases (both greenhouse gases);
2. Create more wetlands;
3. Generally encourage the restoration of native plant materials; and
4. Monitor all design and construction activities to reduce use of heavy equipment or building materials with high carbon footprints.

Habitat

1. Create living shorelines for shore stabilization and additional habitat;
2. Discourage Phragmites colonization;
3. Create green spaces at the end of street ends;
4. Reclaim land from adjacent low lying land currently used for non-water dependent purposes;
5. Convert mown lawn on promenade walkway to native shrubs and grasses;
6. Increase intertidal marsh areas through reclaiming vacant properties; and
7. Convert public and private lawn spaces to native vegetation.

Recreation

1. Define public access points;
2. Link bikeway and pedestrian routes with other sections of the Estuary and Jennings Beach;
3. Install educational signage and kiosks in high traffic areas; and
4. Improve ADA access to waterfront views.

Water Quality

1. Develop and implement a green infrastructure plan that specifically addresses street ends runoff, residential properties, and permeable pavement conversion;
2. Study the function and design of all tide gates and culverts; and
3. Identify runoff pollution sources such as fertilizer, pesticide, and other potentially harmful substances.

RECOMMENDED NEXT STEPS

HABITAT IMPROVEMENTS

1. **Investigate wetland mitigation opportunities.** Municipal review boards that review development proposals often require mitigation to offset impacts to the natural resources. Because Ash Creek is situated within a dense urban area where development impacts are common, the Estuary could play a key role in satisfying any future mitigation projects in coordination with the Fairfield and Bridgeport Wetland Agencies and/or other appropriate municipal agencies and commissions. To better understand this opportunity, the comprehensive restoration plan should identify stand alone restoration projects that may be implemented individually.

2. **Develop planting specifications and design alternatives for the St. Mary's Barrier spit.** Because the City of Bridgeport appears to have a rapid timeline for the restoration of the Barrier spit, ACCA should develop detailed planting and design specifications in the near future to ensure the Spit's restoration adheres to the recommendation of this report.

3. **Encourage land-use practices that protect, maintain, and enhance the sand dunes on the St. Mary's Barrier spit.** The barrier spit plays an important role in the function of the creek, notably by providing a unique ecology and biodiversity to the area, and by protecting the creek from erosive wave action during storm events. The sand dunes are a vital component to the landscape of the spit and should be protected along with the natural processes that create them. Excessive human disturbances should be minimized, and land-use practices which allow the continued trapping of sand and which promote vegetational stability should be encouraged.

4. **Downstream water quality can be improved in multiple ways through modifications to the upstream sewershed.** These might include increasing the quantity and coverage of urban/maritime forest. Trees reduce runoff, cool pavement, and increase time of concentration to drainage inlet. Promote stormwater capture using bioswales and rain gardens to filter and slow stormwater.

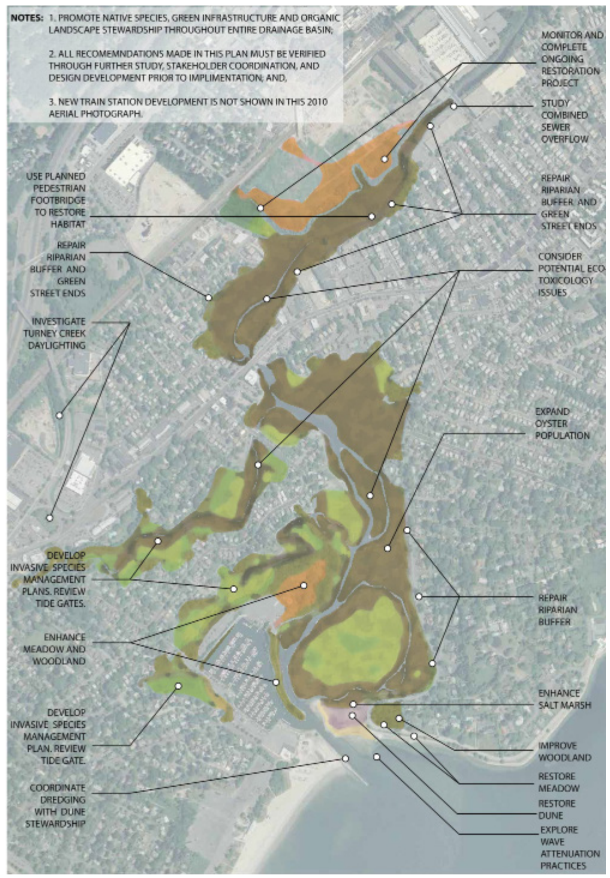
5. **Investigate restoration opportunities in upper reaches of Turney Creek.** The headwaters of the creek are unclear at this time, but appear to be on the west side of the Kings Highway exit on Interstate 95. The creek then appears to run primarily underground until emerging at the Old Post Road. It may be possible to enhance or restore the creek in certain sections. This could have important implications on water quality and would undoubtedly restore important habitat to the area.

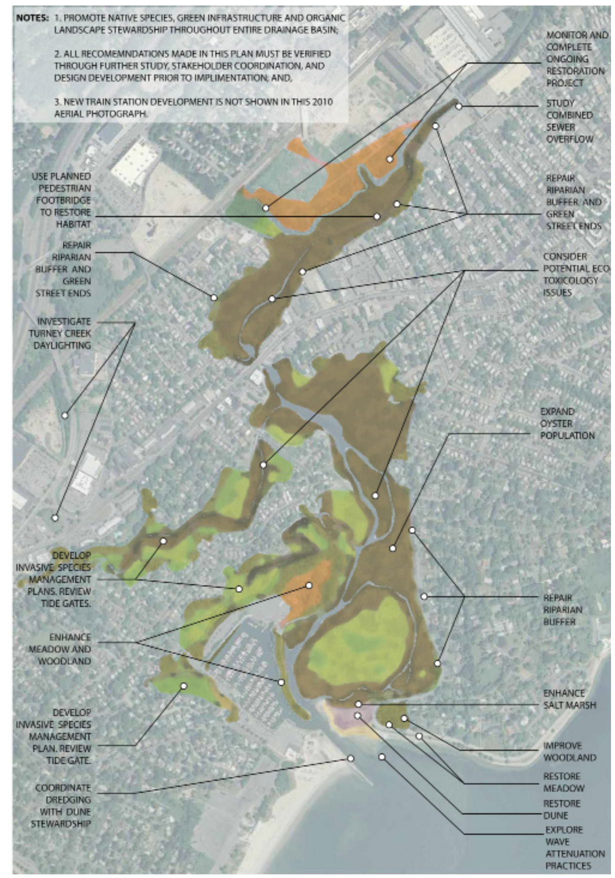
6. **Wildlife/Biodiversity. Habitat to conserve/restore/preserve in the Estuary:**
   - Continued protection of Aristida tuberculosa and Sporobolus cryptandrus habitat;
   - Continued restoration and expansion of the oyster reef;
   - Encourage native plantings in green spaces and residential lawns surrounding the Estuary; and
   - Protection of migrating bird habitat within the Estuary.

7. **Erosion. Erosion is a major issue with the barrier spit and the Estuary. Erosion can be reduced or slow downed with the following improvements:**
   - Adding dredged material to the sandspit; and
   - Living shoreline.

STRUCTURAL IMPROVEMENTS

1. **Modify drainage inlets so that fewer pathways exist for large debris to enter the pond (such as aluminum cans, water bottles, plastic bags, etc);**
2. **Increase the budget for cleanout of catch basins to increase the frequency of cleanouts;**
3. **Increase the use of permeable pavements;**
4. **Incentivize rain barrel installation at private residences;**
5. **Engineering review of tide gates;** All tide gates in the Estuary should be inspected to ensure they are operating according to their design requirements. Alternative types of tide gates should be considered to encourage greater salinity within tidal creeks.
6. **Implement wayfinding, environmental kiosks, and signage;** Consistent signage is an excellent way to create a sense of place and ownership around a natural resource. To execute this best, an overall look and feel should be established by a professional design company. The tone set by the signage should respect cultural and ecological integrity. It should be obvious, but not intrusive. Signage should rely on universal graphic symbols understandable to people from multiple cultural backgrounds. All signage should be integrated with educational kiosks in look and feel
7. **Oyster Aquaculture;**
8. **Temporary dock/ramp construction for kayaks as an alternative to permanent structures; and**
9. **No motorized vehicles/boats in the waters of the Estuary – this would reduce need for docks, as well as decrease erosion and other wave impacts**





COMMUNITY COORDINATION

1. **Perform community outreach to improve citizen understanding and stewardship of the Estuary.** This might include, for example, installation of signage and educational kiosks, information placed on the ACCA website, public presentations, and environmental education work.

2. **Joint management of the Estuary by Fairfield and Bridgeport by a non-profit organization (such as the ACCA).** Coordination between the two cities is needed in order to address joint issues and identify avenues of cooperation.

3. **Continue to work with the City of Bridgeport to enhance their capabilities to manage the Estuary from an ecological perspective.** The City has indicated its willingness to work with community groups such as Ash Creek towards a common goal of environmental stewardship. ACCA is uniquely positioned to offer additional technical and policy advisory support to the City, and should continue to develop its ties with the town government and its land-use commissions. Furthermore, the Black Rock NRZ Strategic Plan has developed some good recommendations with regard to the municipal management of Ash Creek which deserve consideration. These include:

   - Adoption of a city ordinance that requires substantive review of any construction, such as docks and piers, built out into Ash Creek.
   - Adoption of a conservation overlay for any proposed project that involves property adjacent to Ash Creek. This conservation overlay should address any issues of run-off control, non-point pollution remediation, erosion, and invasive species plantings.
   - Support the planting of native species and low-impact landscaping along the outlet of Ash Creek and into the St. Mary's by the sea area.
   - The formation of a Bridgeport Conservation Commission separate from the Wetland Agency with an independent, elected Chair, to review as appropriate any and all development activities proposed for the city and then to issue advisory comments to the appropriate landuse board. The specific make-up and function of this commission should be based on best practices already established by many Connecticut cities.

4. **Re-enforce and develop more extensive relationships with environmental education organizations, including local school districts.** The Estuary is already studied by students at numerous surrounding schools. These relationships should be continued. Relationships with higher education facilities should also be considered.

5. **Work with stakeholders to prioritize above recommendations.** Under ACCA's leadership, a series of meetings to be held with key local, state, and national stakeholders to review the proposals made herein.

6. **Continue to work with the Town of Fairfield to enhance their capabilities to manage the Estuary from an ecological perspective.** Fairfield has historically been very aggressive in favor of environmental management of the creek. ACCA is uniquely positioned to offer additional technical and policy advisory support to the Town, and should continue to develop its ties with the town government and its land-use commissions.

ADDITIONAL STUDIES

Investigate whether a River Commission or a Harbor Management Plan for Ash Creek is an appropriate approach to protecting the Ash Creek tidal estuary. Public Act 95-333 enables municipalities to establish river commissions for the goal of coordinating and managing the development, protection, and preservation of important natural resources in river corridors bordering or lying within these municipalities. Such an inter-municipal commission would provide a valuable joint municipal vehicle towards management of the creek. Alternatively, a Harbor Management Plan could be developed. Currently no harbor management plan exists that focuses specifically on Ash Creek alone. Such a plan could be important to the continued health of the creek as it can contain CT DEEP approved regulations and environmental policy specific to the creek on issues such as appropriate recreational boating practices and future user conflicts. ACCA is uniquely positioned within the community to play a vital role in coordinating and codifying such a plan. Both options (the River Commission or the Harbor Management Plan) should be further investigated to determine which would promote the best joint municipal approach to protecting the Ash Creek tidal estuary.

Develop detailed, “shovel-ready” projects as called for in the Ecological Restoration Plan. Under ACCA’s leadership, these documents should be created in response to funding opportunities. These efforts may require advanced levels of scientific and regulatory analysis.

Develop a Green Infrastructure Plan. All drainage areas that lead to the Estuary should be thoroughly mapped to identify potential impacts. Green infrastructure technologies should be identified that are appropriate for watershed and sewershed. A strategic implementation plan should be enacted to over time.

Update Rooster River Watershed Plan – The current plan is 9 years old as of 2022.

ENDNOTES

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