ABSTRACT

Title of Thesis: REDEFINING THE ORILLA: COMMUNITY AWARENESS AT THE WATER'S EDGE IN BALTIMORE

Joyce J Kelley,
Masters Landscape Architecture, 2012

Thesis directed by: Dr. Victoria Chanse, Chair
Department of Plant Sciences and Landscape Architecture

This thesis proposes a redesign of a waterfront park in South Baltimore, Maryland. Middle Branch Park, located one mile south of Baltimore's Inner Harbor, offers a unique opportunity to restore a degraded shoreline in the context of watershed stewardship. This thesis strives to reestablish Middle Branch as a functional critical buffer within the urban fabric of Baltimore city by utilizing shoreline restoration techniques, stormwater management and floating wetlands. The issues of water quality within the Middle Branch and the surrounding area are reflected in the design decisions. The design focuses on visualizing the hydrology of water in the landscape and creates opportunities for people to be within the water-landscape. Moreover, within this design the dynamic overlap of water and land is used as design tool to interconnect education, health and community within the new park design.

REDEFINING THE ORILLA: COMMUNITY AWARENESS AT THE WATER'S EDGE IN BALTIMORE

by

Joyce J Kelley

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Advisory Committee:
Dr. Victoria Chanse, Chair
Professor Garth C. Rockcastle, FAIA
Associate Professor Jack Sullivan, FASLA

DEDICATION

to 'site analysis' Sam

ACKNOWLEDGMENTS

I would like to thank everyone who has offered their encouragement and support in kind words, coffee, drink and thoughtful critiques throughout the production of this thesis- you have been the steadfast rocks in my orilla.

I would especially like to thank my committee members Dr. Vicki Chanse, Jack Sullivan, and Garth Rockcastle for their perseverance and patience with me in this process, and their dedication to pushing me to produce better work.

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LIST OF ABBREVIATIONS

(ADA) American Disability Association
(CBF) Chesapeake Bay Foundation
(CWP) Center for Watershed Protection
(DNR) Department of Natural Resources
(EPA) Environmental Protection Agency
(FWIs) Floating Wetland Islands
(GIS) Geographical Information Systems
(LLC) Limited Liability Company
(MHW) Mean High Water
(MLW) Mean Low Water
(MDE) Maryland Department of the Environment
(NA) National Aquarium
(NOAA) National Oceanic Atmospheric Administration
(NSP) Natural Swimming Pool
(PAH) polycyclic aromatic hydrocarbon
(PCBs) polychlorinated biphenyls
(PET) Polyethylene terephthalate
(SAVs) Submerged Aquatic Vegetation
(TMDLs) Total Maximum Daily Loads
(USACE) United States Army Corps of Engineers
(WP) Waterfront Partnership

1- Introduction

PURPOSE and RATIONALE

Middle Branch Park is a waterfront park, located in Baltimore, Maryland. The park is bound to the North and the East by the Middle Branch waterway. From the South and the West, it is bound by the neighborhoods of Cherry Hill and Westport, respectively. This 76 acre park hosts an extensive shoreline of 8700 square feet — approximately one half of the perimeter of the park— and a 13-acre conservation area. It contains the largest length of 'natural'[1] shoreline of all of the waterfront parks in Baltimore city, and it holds one of the longest natural shorelines within Baltimore city. Middle Branch Park was selected to study for this thesis design due to its soft shoreline which creates a number of opportunities as a waterfront park that is unique to the urban fabric of Baltimore.

Recent efforts such as the Healthy Harbor Initiative[2], Let's Move[3] campaign, as well as legislation surrounding EPA mandates for Total Maximum Daily Loads (TMDLs)[4] for the Chesapeake Bay and the No Child Left Inside[5], provides a political and societal call to initiate efforts for cleaning up the bay, educating individuals about their watershed, and bringing children and adults outside to exercise and learn about the environment. A waterfront park, such as

[1] Shoreline without bulkheads, see further explanation of shoreline types in Chapter 2. Soft and natural shorelines refer to the same conditon within this document.
[2] An initiative started by the Waterfront Partnership of Baltimore, Inc. to make Baltimore's Inner Harbor fishable and swimmable by 2020.
[3] An initiative created by the first lady, Michelle Obama to end childhood obesity by 2020, but aims at increasing active living among adults and children by linking communities, education, parks, and exercise (Obama 2010).
[4] A federally supported mandate by the EPA to reduce pollutants entering the Chesapeake Bay, spanning seven states, including Maryland. (EPA 2010)
[5] A nationwide coalition, created in 200, to increase the public's awareness for the need of environmental education in the school systems (CBF 2011).

Middle Branch, provides the perfect opportunity to merge environmental health, personal health, and environmental education goals in an overlapping framework within a waterfront park design. Moreover, site analysis and background research identified specific issues in water quality, as well as an overarching disconnect from the ecological, educational, and health services available in Middle Branch Park.

By accessing the opportunities and constraints associated with Middle Branch Park (detailed in Chapter 4) a design framework has been proposed for Middle Branch park that would 1) improve community connection to the waterfront; 2) redesign the shoreline; 3) address water quality issues[6] with a new storm water design; 4) provide educational access to the environment; as well as 5) utilize park resources to create opportunities for personal health.

ORILLA AS A DESIGN METAPHOR

In order to address the demands of these overlapping goals from a design perspective, a metaphorical use of the term *orilla*[7] is utilized to explore different aspects of the design, primarily the juxtaposition of water to land. Orilla is a Spanish word meaning "water's edge" and refers here more specifically to the overlap of land and water. This concept of "orilla" is covered in more detail in Chapter 2.

[6] Water quality issues are trash, sedimentation, low dissolved oxygen, lack submerged aquatic vegetation, bacteria, and elevated phosphorus and nitrogen concentrations (DNR, 2011).

This 'land to water' overlap is what the designer explains as the *orilla*. This thesis explores not only the 1) physical redefinition of the *orilla,* but 2) the metaphorical redefinition of *orilla,* which encompasses the overlap of people within the *orilla.* This design exploration is a reinterpretation of the word *orilla* to expand the preconceived boundaries of the 'water-to-park-edge;' and to communicate the interconnectivity and interdependence of ecology, education, health and community.

Within the park design, the author seeks to dissolve the boundaries of the park wherever possible, thereby extending the definition of the *orilla* to include not only the overlap of water to land, but the overlap of people and community within the physically restructured *orilla* and as part of the overall park program.

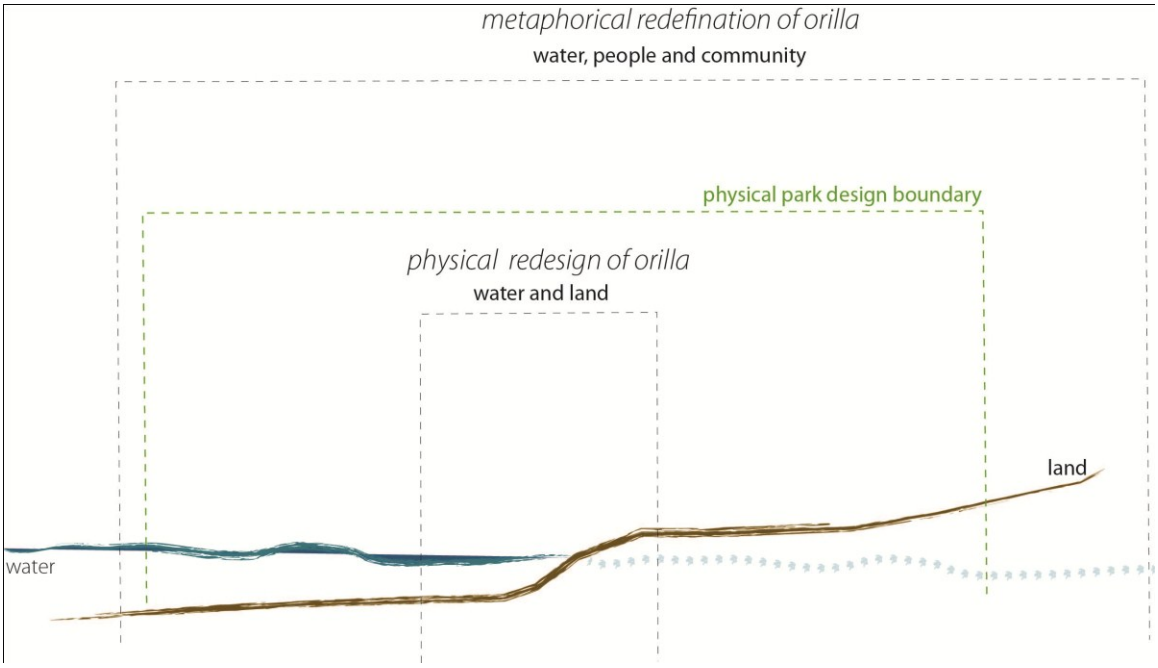

Figure 1-1. Illustrates use of the *orilla as a method of design. The physical redesign of orilla is the overlap of the water to land; all shoreline restoration and riparian edge improvements are examples of the physical redesign of the orilla. Whereas, all elements within the park design and*

programming that connect people and community, including plant and animal habitats within the water (and or park) are examples of the metaphorical use of the work orilla, to mean the overlap of water, people, and community. Illustration by the author.

CONNECTING WATER, LAND, AND PEOPLE

In brief, the overall park redesign encompasses the following. First, the shoreline is physically reconstructed to allow for the maximum contact between water and land: re-establishing the intertidal zones and connecting the water to the natural floodplain within the park's shoreline. Secondly, better connections to the park and accessibility to features within the park are created for people and the community to enjoy and recreate within these redesigned areas. The redesign allows greater access for schools and the community to reconnect to the park by utilizing green streets[8] and trails that literally and figuratively follow the process of water through the landscape. Furthermore, educational moments and places are designed into the fabric of the land and waterscape by visual cues and-or signage. Lastly the Harbor Hospital is given a front seat to the many amenities provided within the new park design, including a health trail that reinforces the relationship of the hospital to the park grounds.

[8] 'Green Streets' refer to streets and sidewalks that are redesigned to daylight and or manage stormwater by filtering it through vegetation and infiltrating it, rather than conveying it.

DESIGN PROCESS

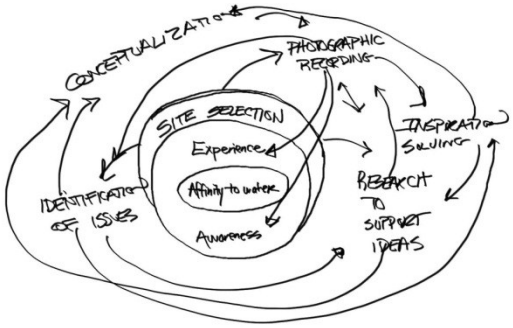

Fig 1-2. Represents flow of design process. Illustration by the author.

The design process for this thesis began with on-the-ground experiences by the author, recorded in photographs. The author continually returned to the site for over one year to record observations of the park— making observations for all four seasons within the park and all weather conditions. On-the-ground observations were conducted in tandem with desktop analysis as well as ongoing review of literature supporting the design process. This literature includes local and federal initiatives regarding water quality for the Chesapeake Bay, as well as community health and education. Additional literature reviews included existing master plans for Middle Branch Park and the surrounding neighborhoods, as well as technical information regarding proposed aspects of the design.

The primary driving factor behind all analysis and interpretation was to clarify the relationship of the water to the park. The analysis followed the path of water through, within, and adjacent (Middle Branch) to the park. The process of following water, and the juxtaposition of water to land not only led the site

analysis but became the critical element to the conceptual framework of the final design.

On-the-ground investigation of issues of storm water quality were observed and photographically recorded and compared to local and larger scale water quality analysis and reports. The park and Cherry Hill neighborhood's storm water issues were interpreted from comparing desktop analysis to on-the-ground observations, as they impacted Middle Branch Park. During this process of understanding the dynamics of water quality for the site, historical maps were utilized. Possibilities for educational improvements and health improvements were culled from census statistics, as well as on-the-ground observations of the neighborhood and site. Lastly, implications for future development within the adjacent neighborhoods were considered within the design process, as well as the role the park might play in watershed stewardship within the context of the entire Chesapeake Bay watershed.

THESIS FRAMEWORK

The remainder of this document is structured into seven chapters. Chapter 2: Background and Context of Issues, support the metaphorical construct of the orilla, and describe the thesis site in relation to the Baltimore waterfront, including environmental issues of water quality, trash, land use and the critical area. These issues are discussed in relation to how they impact Middle Branch Park, as well as the precedent studies sites investigating local waterfront parks.

Chapter 3: Background Research and Reports, includes the current master plan for Middle Branch Park as well as technical background information. This chapter compares and contrasts the authors' design conceptualization with the work by others. Chapter 4: Site Analysis and Design Method, details the work that was completed prior to design conceptualization, such as field observations and desktop analysis. This chapter concludes with the overall summation observations and illustrates how these observations led to the design goals for the site and beginning conceptualizations from those design goals. Chapter 5: Design outlines the interventions and overall redesign for Middle Branch Park, including a master plan and a conceptual green streets plan for the Cherry Hill community. This chapter divides the site into four main objectives 1) to enhance the critical buffer within and outside Middle Branch Park 2) to create access to the physical shoreline *3)* to create multi-functional social, educational, and recreational areas, and 4) to enhance public access to the park and features. Specific example of these elements of the programming are listed below and described in further detail later in this chapter. Descriptions of the interventions highlights the foreseen improvements to water, ecology, education, health, and community within each design feature, and how these improvements overlap and thereby give strength to one another within the design and implementation of the feature.

Chapter 6: Conclusion is a summation of the designer's perspective. It responds to the questions posed throughout the design conceptualization process and offers a critique of the design goals that the designer articulated.

2- City and Context Issues

This chapter places Middle Branch Park within the larger context of the water issues regarding the Chesapeake Bay and Baltimore city. This chapter begins with a discussion of the juxtaposition of the water-landscape within the general context of city waterfronts, defines functioning critical buffers, and addresses the environmental and social implications associated with the morphological relationship of the water to land edge.

SITE LOCATION

The Middle Branch is located within the city limits of Baltimore city, one mile south of the downtown Inner Harbor. It is oriented just north of the Anne Arundel County, Figure 2-1.

Figure 2-1. Shows Middle Branch Park (green line) in relation to Inner Harbor, Downtown Baltimore, and Middle Branch waterway. The dotted line represents the boundary of the Baltimore city line. Illustration by the author.

The underlying attraction of the movement of water and sand is biological. If we look more deeply we can see it as the basis of an abstract idea linking ourselves with the limitless mechanics of the universe.

Sir Geoffrey Jellicoe

In the following figure-ground study, Figure 2-1a, we can see water as the figure.

Figure 2-1. a) Represents water of Patapsco River in figure. b) Image of the city reflected in the water. Illustration and photo by the author.

These are the waters of the Inner Harbor, Middle Branch and Patapsco River. What surrounds these waters is the city of Baltimore. The image of the city is reflected in our water Figure 2-1b in the form of the water's edge. Note the obvious unnatural shape of the shorelines created by piers, wharfs, and bulkheads Figure 2-1a and b. The containment and constriction of the water can be seen on most of the shorelines. No longer is the natural morphology and soft juxtaposition of the land to water visible as is seen in the777 following Figure 2-2.

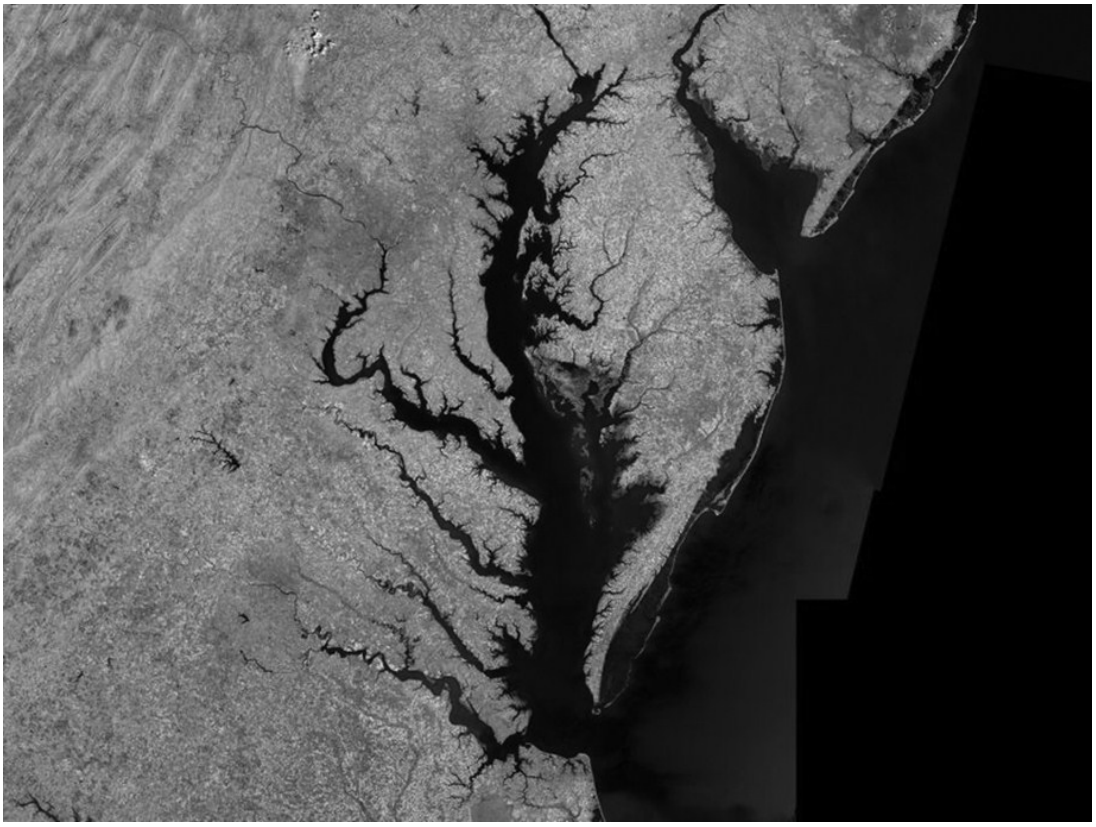

Figure 2-2. Shows the Chesapeake Bay. Illustration by the author, satellite image from Google.

Within this figure the archeological history of the Chesapeake Bay is still noticeable, as the melting of Laurentide Ice Sheet carved out the land and extended the Susquehanna Valley (Tillman, 2009). The water formed the land.

Thus, originally water dictated how and where civilizations have lived and survived. "We stake our cities on the coast and mighty rivers" (Kingsolver, 2010). and over time we (or civilization) attempt to reverse this process that dictated the placement our existence. Cities no longer occupy a place along the *mighty river* or water but drastically alter the space the water occupies.

The built environment of cities ignores the natural process in which water and land merge across the water-landscape. The functioning of the built environment is separated from the natural processes of hydrology. The separation of our built environment from the natural relationship of the water to the land has not only contributed to unhealthy estuarine and riverine environments (Booth and Bledsoe 2009), but disrupted the natural hydrological cycle (Sipes 2010) and removed the public from understanding the hydrological cycle due to the lack of presence and visibility of water within the landscape (Dreiseitl and Grau 2005).

PHYSICAL ORILLA

In the context of this design thesis, these changes to the morphology of the water's edge, in particular the Inner Harbor, are believed to be in the author's opinion an interruption or disconnection from the *orilla*. Although, an edge still exists within this morphology; the overlapping of water to land is lost and the hydrological functioning that once existed in that space has, as well, been lost.

The literal translation of the Spanish word orilla is the water's edge. However, the subtleties of the Spanish language suggest that the word means the ephemeral overlap of water to land. The orilla is not a static place that can be contained. The following illustration, Figure 2-3 depicts the ephemeral qualities of the orilla.

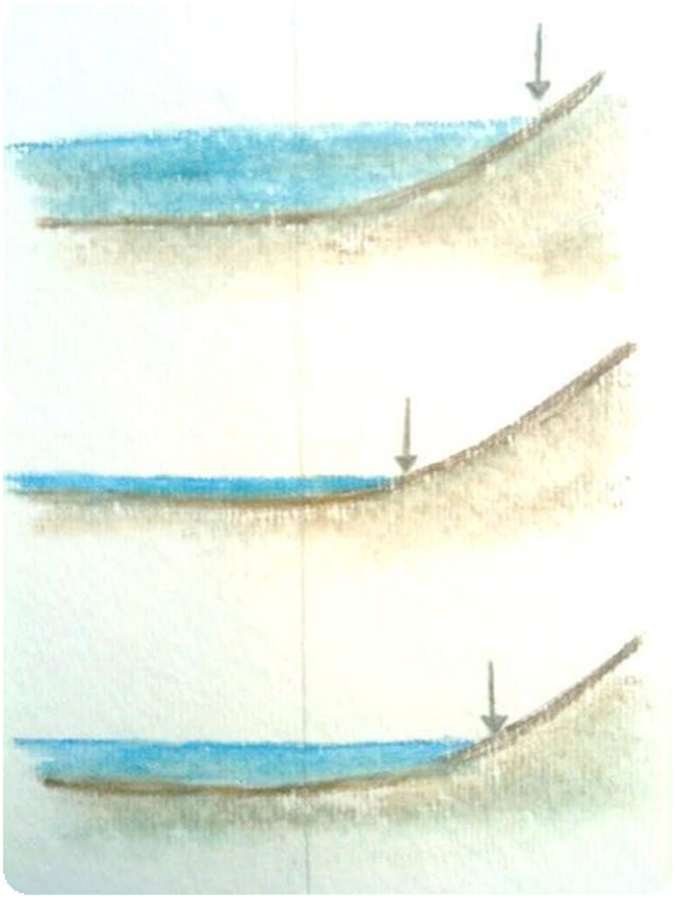

Figure 2-3. Illustration depicting the changing orilla. The arrow shows the ever changing 'edge.' Illustration by the author.

From an ecological sense this overlap or changing edge, is defined as the intertidal zone. This area of the waterfront is where bottom dwelling species, such oysters and mussels, thrive in the changing tide (McLarney, Ryther and Bardach 1973). This area is where wetlands and marshes flourish. In healthy environments these zones have some of the highest diversity of species and therefore are essential to supporting the natural food web (Kendeigh 1974). These zones also clean and filter water as part of their living cycle (B. e. Halpern 2007).

WATER QUALITY and CRITICAL BUFFERS

In an effort to protect the Chesapeake Bay, the Maryland General Assembly passed the Critical Area Act in 1984 to protect 'water quality, habitat protection, and growth management goals" (Sullivan, 1989).

The act defines, the critical area as:

> "The Chesapeake Bay, its tributaries to the head of tide, tidal wetlands, plus all land and water areas within 1,000 feet beyond the landward boundary of these waters and wetlands".
>
> Code of Maryland Regulations, Title 27; and the Annotated Code of Maryland, Natural Resources Article, Title 8, Subtitle 18 (CAC n.d.)

The definition of the critical area includes regulation on how and what is built within critical areas that will ultimately affect water quality. Adequate critical buffers are mandated within these areas in most cases. Critical buffers reduce adverse impacts of stormwater run-off from adjacent areas (Bentrup Sept 2008) and conserve vital fish, wildlife, and plant habitats (Hasset 2005).

Land use changes, such as increases in impervious surfaces (buildings and pavement) change the overall hydrology of the land and lead to increased sediment and nutrient run-off (Brown and Schueler 2004). Mandates are required for the amount and type of vegetation that will act as a critical buffer for the waterway (DNR 2011). Moreover, the construction of buildings, parking lots, and roads, contribute to sediment loading in nearby coastal environments (Booth and Bledsoe 2009); and removal of existing forest and vegetative cover directly or indirectly alter the existing ecosystem within that region. By destroying

native habitat or by inducing environmental stressors, land use changes can have deleterious effects on an ecosystem's overall health (CWP 2003).

In Figure 2-6, the critical area for Baltimore City is highlighted in orange. This is the first 1000' of the land use, inland of the waterfront. The second map, Figure 2-7 shows the critical area in relation to the built environment of Baltimore city. The lighter orange shading show areas without buildings or infrastructure and are possibly 'pervious surfaces', whereas the darker orange areas denote hard infrastructure. It should be noted that even though areas may be free of infrastructure, the soils of these areas are still highly urbanized and may or may not be serving as a functioning critical buffer. To serve as a functioning critical buffer, the soils needs to be intact (not eroding), permeable (not compacted) and vegetated (Polyakow 2005). The majority of the critical area of Baltimore City is not functioning as critical buffer.

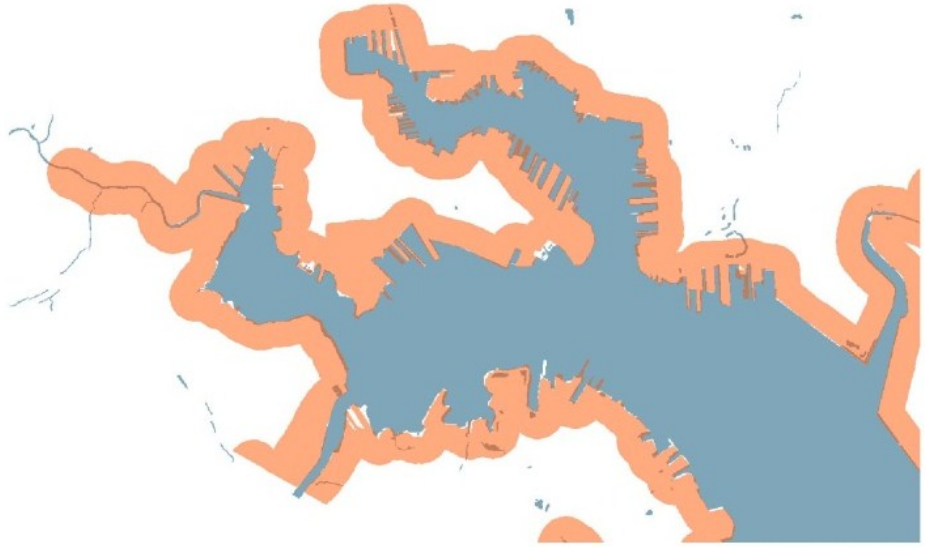

Figure 2-6. Identification of the critical area of 1000'. Illustration by the author.

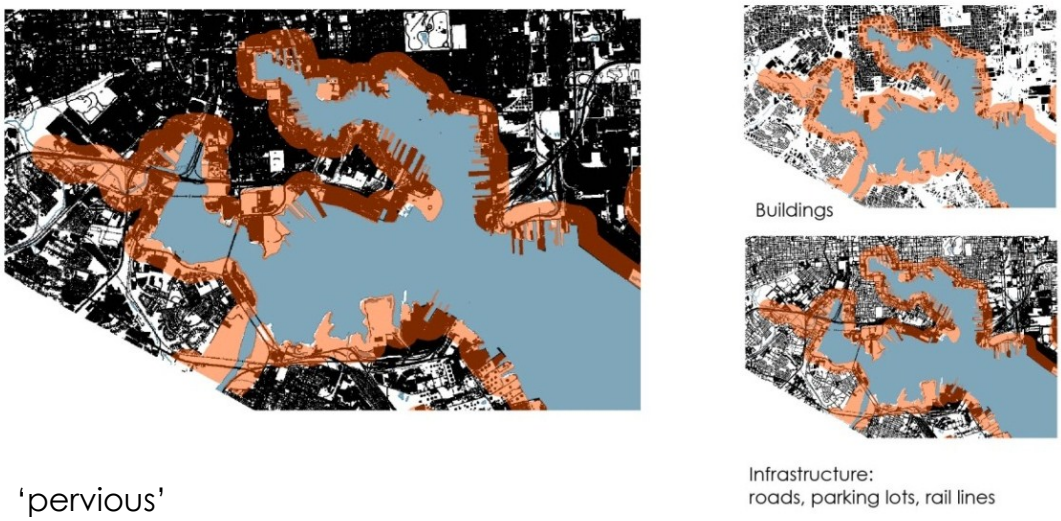

Figure 2-7. Identification of the critical area in relation to the built environment. The dark black areas show the built environment in total (left image) and as only building (top right) and as transportation infrastructure only (bottom right). Illustration by the author.

WATER QUALITY and THE CITY

The alterations of the water to landscape in Baltimore have contributed to issues of water quality. The hydrological process has been altered from upstream to the waterfront in Baltimore and as a result the water quality in Baltimore's Inner Harbor, the Middle Branch, the Patapsco River, and the Chesapeake Bay has suffered.

The ubiquitous qualities of water give it, its magic and charm; and certainly a part of the *charm*[9] of Baltimore. The water in the Middle Branch is

[9] Baltimore is known as the 'Charm City'.

also the water in the Inner Harbor; and therefore unfortunately the Inner Harbor and the Middle Branch although not identical, suffer from many of the same water quality issues. Although many of these measures of water quality are invisible— such as low dissolved oxygen, no benthic organisms, turbidity, excess nitrogen and phosphorous, toxins and bacteria—the repercussions of their existence are not. These failed quality measures equal water less suitable for fish habitat, and more likely to cause algal blooms, fish kills, and result in water that is unsafe and 'unswimmable' for people.

WATER QUALITY and TRASH

The Middle Branch and the Inner Habor have issues with excessive sedimentation, trash, low dissolved oxygen concentrations, non-existentence of submerged aquatic vegetation (SAVs) as well as excessive levels of nutrients and chemical pollutants (DNR, 2011).

The most visible issue that can be seen by anyone, is the excessive amounts of trash. In 2008, the state and federal governments announced Baltimore's harbor impared by trash (Wheeler, 2011) as detailed in Chapter 5: Site Anaylsis. The same issues of water quality in the Inner Habor are evident within the Middle Branch. Floating trash washes into the Patapsco River, which includes the waterbodies of both Inner Harbor and the Middle Branch primarily

from the Gwynn Falls and from the Jones Falls. Although trash is more likely to be deposited closer to its outfall areas, tides and currents effect the deposition of the trash on the surface and within the water column (Commission, Middle Branch Master Plan Sept 2007).

Trash is carried from upstream locations within the watershed and deposited downstream. Trash from Baltimore, Anne Arundel , and Howard Counties finds its way to the Patapsco River and can becoming part of the pollution within the water or landscape of the Inner Harbor and the Middle Branch (Waterfront Partnership Conference, 2011).

Although, trash interceptors have been installed on the Gwynn Falls, the Jones Falls, and recently on the Harris Creek (Sustainability, 2010); trash is still visible in the Patapsco River. In less than two months a waterwheel installed along a tributary feeding the south Harbor of Baltimore City collected 10.25 tons of trash (Sustainability, 2010). Trash interceptors, may help reduce the amount of trash that ultimately enters the bay but it does nothing to help reduce the source of the trash.

In summary, 'the qualities that make a location good for a city often make it an important location for biological conservation. For example, river mouths are good sites for cities because of the access to transportation. However, estuaries are widely polluted and wetland and riparian zones are eliminated over large areas." (Botkin and Beveridge 1997) The following chapters will begin to illustrate how Middle Branch Park and the Inner Harbor are

only a shore length apart, and how water if brought to the forefront in this thesis design will have environmental impacts well beyond its shoreline.

3 Local Precedents and Context

This chapter discusses the relationship of Baltimore's parks within the critical area of the city limits. It outlines differences and similarities between Middle Branch and these other parks, described herein.

CRITICAL AREA and PARKS

The author investigated parks within the critical area of Baltimore city identified Middle Branch Park as one of seven parks located within the critical area. Figure 1-9 shows parks (green) in relation to the waterfront and critical area. Middle Branch can be identified in the dark green, as the only park within the critical area other than its neighboring park of Cherry Hill that has natural shoreline, unadulterated with bulkheads. Middle Branch is also the largest waterfront property of these parks. Due to the novelty of its shoreline, size and location within the critical area, Middle Branch has the potential to serve as a model for integrating both a functioning critical buffer and watershed stewardship within waterfront park design.

Figure 3-1. Identification of parks in relation to the critical buffer. The dark orange outline represents the delineation of the critical area in relation to the waterfront. The light green areas show all city park land. The only park land not represented is the federal park land, Fort McHenry; location for later reference is shown in this figure by a green star. The dark green areas represent Middle Branch Park. Illustration by the author.

FORT MCHENRY NATIONAL PARK

Figure 3-2. Shows Ft. McHenry wetlands as it exists in 2011. These wetlands were reconstructed in 2004. Photo by the author.

The following study site was used as an example of wetland restoration with one mile of the thesis study site. Maintenance[10] and community involvement[11] were considered as important factors to be considered in the proposed design. Furthermore, the general and specific successes of this wetland restoration such as the wildlife habitat these wetlands supported and the viability of particular plant species were noted for design decisions.

[10] Continual removal of trash in the wetlands is needed to keep the wetlands functioning properly on this site. Therefore, trash problems in the Middle Branch present maintenance challenges for any new restoration efforts.
[11] Community volunteer organizations help maintain FtMchenry's wetlands (NA 2011). Community involvement is considered as design element for the new proposal in Middle Branch.

The Fort McHenry wetlands were constructed due to mitigation for the construction of Interstate-95 in 1984 (NOAA 2011). Dredge material was used to create the10 acres of tidal wetlands. From 1985 to 2004, sedimentation filled in portions of the wetlands and prevented the natural flooding conditions that support an active tidal marsh habitat (NOAA 2011). Restoration efforts were undertaken in 2004 to restore the tidal marsh (NOAA 2011).

The site conditions prior to restoration were complicated by excessive stands of *Phragmites australis* and trash that needed to be removed prior to replanting with native salt marsh grasses (NOAA 2011). In total 305,600 pieces of debris were removed and replaced by 55,000 units of *Spartina cynosuroides* (giant cordgrass), *S. alterniflora* (smooth cordgrass), and *S. patens* (salt meadow cordgrass) (CCA 2011). The site now hosts additional volunteer plant species such as *Scirpus americanus* (olney three-square), and *Cyperus strigosus* (umbrella sedge) (CCA 2011)

This site is used extensively by the National Aquarium (NA 2011), and relies almost entirely on the efforts of volunteers that routinely remove trash and debris from the site, as well as invasive plant species. Since the 1999 volunteers through the stewardship organization by the National Aquarium have removed over 600,000 pieces of trash (NA 2011).

The success of the restoration project can be realized by the amount of wildlife that has been observed on the site, 217 bird species, 10 mammals, 7 fish and 9 reptiles (Commission, Middle Branch Master Plan Sept 2007). Restoration projects such as these offer unique opportunities for organizations to collaborate with local volunteers and community organizations. The Ft. McHenry restoration has brought together the efforts of National Oceanic and Atmospheric Administration (NOAA) Chesapeake Bay Office, the National Aquarium Baltimore, the National Park Service (CCA 2011), as well as over 1000 volunteers since 1984[12].

Although these wetlands provide ecological services (B. e. Halpern 2007) like valuable habitat for a variety of species and improvement to water quality, these wetlands like most are not accessible to foot traffic and must be admired from afar. In many instances this is a more practical arrangement; wherein the general public is removed from the 'wild' or conservation areas of parks (Bartlett, 2005). Other than by those volunteer groups that have special access during maintenance (NA 2011), the general public does not experience the wetland site but by signage, and view through a grove a bald cypress. Although, these wetlands can provide educational services as they are, this design thesis proposes that closer contact with the wetlands may serve as a better educational tool in which to instruct the public about the function of wetlands for increasing water quality. Chapter 5: Design, will discuss in more

[12] Tallied from numbers available on website.

detail the authors contrasting proposal for wetland design in relation to public access.

SOUTH CANTON WATERFRONT PARK

Figure 3-3. Shows Caton South Waterfront Park located in Baltimore. Photos by the author.

South Canton Waterfront Park is located in Baltimore, to the east of the Inner Harbor. The park has a small lawn area and bricked promenade along

the waterfront. The shore topography is a stepped bricked bulkhead, as shown in Figure 3-4. As shown in these photos there is little vegetative buffer adjacent to the shoreline. A few scattered trees can be observed in these photos.

The shoreline is comprised of rip-rap and bulkheads. The lack of connection between land and water offers no ecological value to the waterfront. Although this park exists within the critical area, the park does not offer the services that critical buffers should provide. Little places for habitat exist within rip-rapped shorelines or bulkheads and sparse vegetation (Bentrup Sept 2008). Moreover, without specialized engineering, such as pervious paving and sand infiltration basin, paved promenades rarely afford any infiltration for stormwater. In contrast, vegetative buffers provide storm water infiltration, stormwater cleaning and valuable habitat space (Booth and Bledsoe 2009).

This bulkhead shoreline is seen throughout most of Baltimore city from the Inner Harbor east to South Canton Park and south to Swann Park (see Chapter 5 for images of Swann Park and Inner Harbor). Although the public has the ability to stand at the water's edge, there still exists a sense of removal from the natural juxtaposition of the water to land. In contrast, in Middle Branch Park where water naturally meets the land, where waves can lap over the shoreline a different aesthetic sense of water within the landscape is visualized. This difference in aesthetic and ecological function of the water overlapping the land is what is sought to be highlighted and preserved in the new site design of Middle Branch Park.

4-Site context

NEIGHBORHOOD AND DEVELOPMENT CONTEXTS

People and Housing

Middle Branch Park sits between the neighborhood of Cherry Hill and Westport. For this thesis design connections to the proposed development within Westport's new waterfront were considered for making the park more accessible not only to the community of Cherry Hill, but integrating the future design to fit within the proposed development of Westport. Future linkages to the surrounding neighborhoods outside of Cherry Hill are discussed in Chapter 5. However, for the purposes of detailing the design concepts, community refers to the residents of Cherry Hill, when not referring to community in the sense of habitat niches.

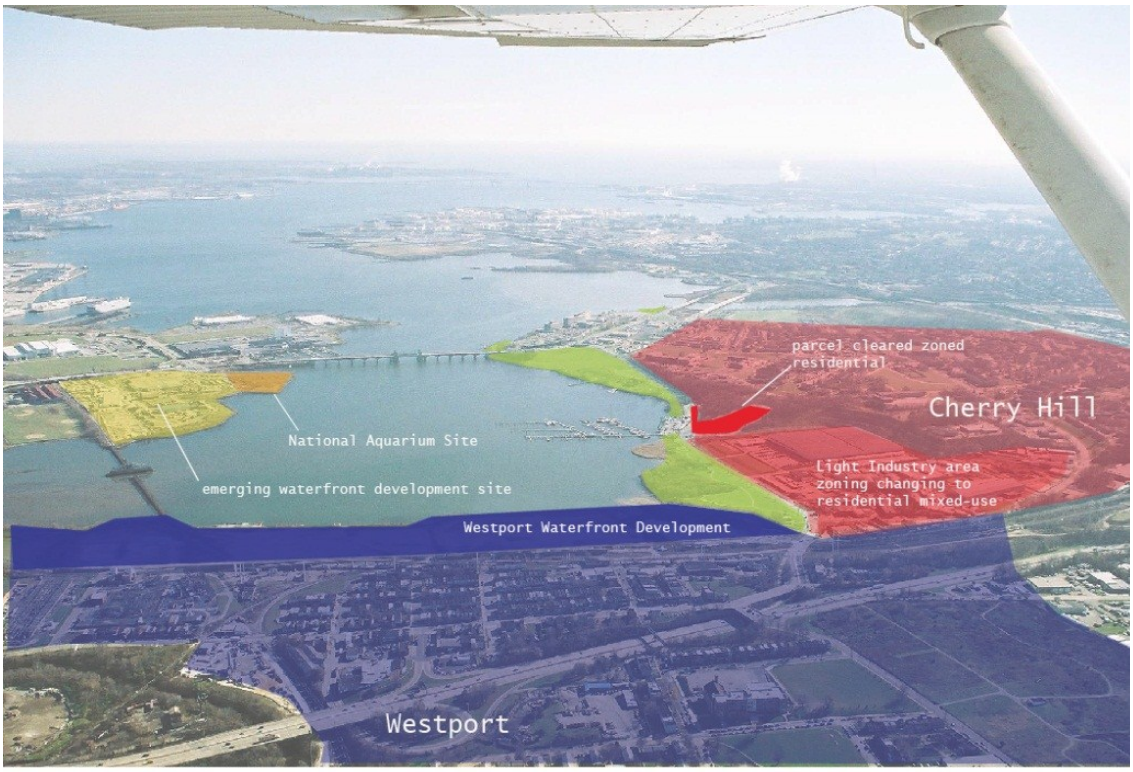

Figure 4-1. Shows the proposed future development in relation to the neighborhoods surrounding Middle Branch Park. Cherry Hill to the South and Westport to the Northwest.
Illustration by the author. Aerial photo courtesy of Parameter, Inc.

In brief, both neighborhoods historically supported the industry of the areas. As industry within the area has left, the vacancy rate within the area of Westport has declined. The vacancy rate of Westport is 20% compared to 8% for Cherry Hill (U.S. Census Bureau, 2000).

The community of Cherry Hill's population has historically been primarily African-American, as the area was the first African-American housing project designed as a suburban community in 1943 (Commission, Cherry Hill Community Master Plan 2008)The United States War Housing Department and Authority of Baltimore City Housing Administration built the homes in mid-1940s for African-

American war workers. The population in 2000 was 96% African -American. The Census data shows the majority of housing types is attached rowhomes at 70% and 79% of all housing is renter-occupied (U.S. Census Bureau, 2000).

Employment and Income

The neighborhood suffers from a high unemployment rate with only 50% of people in the labor force (U.S. Census Bureau, 2000). The individual poverty rate for Cherry Hill is 43% (U.S. Census Bureau, 2000).

Education

Six schools exist within Cherry Hill. Two high schools that exist within the same building sit just above Middle Branch Park: Southside Academy and New Era Academy. There are four elementary–middle schools: Cherry Hill Elementary/ Middle, Dr. Carter G. Woodson Elementary/ Middle, Patapsco Elementary/Middle, and Arundel Elementary/Middle. Fifty-nine percent of the childhood population of Cherry Hill attends Southside Academy / New Era Academy that sits directly above Middle Branch Park (U.S. Census Bureau, 2000). The location of the neighborhoods schools is shown in the following Figure 4-2. In Chapter 5: Design, the author utilizes the location of the schools to create a connection to the park following stormwater management interventions.

Figure 4-2. Illustrates the relationship of the five schools in Cherry Hill in relation the park. The relationship of the schools to the park and sites of stormwater problems in the neighborhood led to the development of the 'green streets' proposal detailed in Chapter 6.

Community Health and Harbor Hospital

The Harbor Hospital is flanked to the north and south by Middle Branch Park. The Gwynn Falls trail that winds through Middle Branch Park passes between the shoreline and the hospital. Although the park feels bifurcated by the hospital, and opportunity exists to visually connect the park to the hospital, and to encourage hospital patrons to utilize the park within the master plan for Middle Branch Park, see Figure 4-3.

The population of Cherry Hill suffers from obesity, diabetes, and heart disease in statistical proportion to the population of Baltimore city (Commission, Cherry Hill Community Master Plan 2008). Incentive for community residents to exercise and use the park, as well as walk rather than drive in the neighborhood of Cherry Hill, is a practical goal of this thesis design.

FIGURE 4-3 Illustrates the hospital grounds to the park. Note the bisection of the park by hospital. Illustration by the author.

FUTURE DEVELOPMENT CONTEXT

Since, Middle Branch Park and the surrounding communities of Cherry Hill and Westport all have waterfront access; they have not escaped the pressures of new development of these waterfront properties or properties with waterfront views. Due to the current economic downturn, the majority of the development has been placed temporarily on hold (Scharpe, 2011). However, the following illustration shows the proposed future developments in the areas surrounding Middle Branch Park. The area within the Westport's waterfront, denoted as red buildings, represents the proposed layout by Turner Development Group consisting of a variety of mixed-use buildings, water view condominiums, retail shops, restaurants, and office buildings. The development will host 2000 residential units; 300,000 square feet of retail space, 500 hotel rooms, and two million square feet of office space; as well as 10,000 or more parking spaces. This influx of residents, tourists, and employees will drastically change the amount of people that could utilize Middle Branch Park in the future.

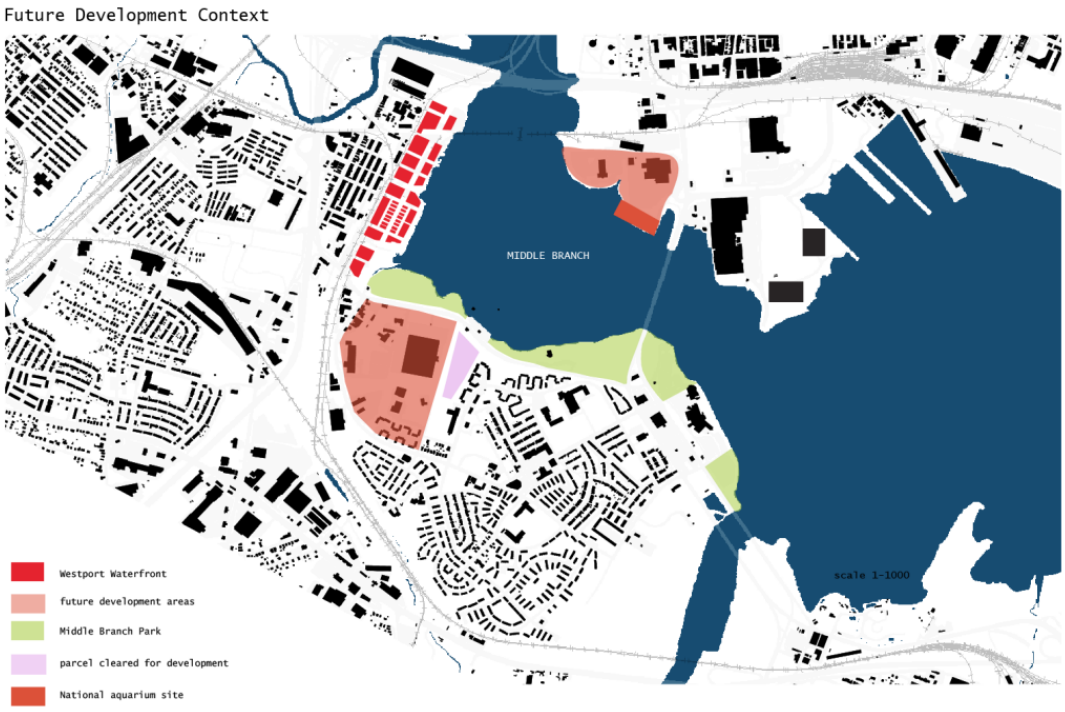

Figure 4-4. Shows Middle Branch Park in relation to future development. Illustration by the author.

The Turner Development site, hereafter referred to as the Westport development, stands on the previous site of the Glass-Lowry Factory the facilities were demolished by Turner Development Group over three years ago leaving large expanses of land barren. The most recent work on the site was preparation for mitigation work done along the shoreline, which planted Spartina alternifolia along the property's shoreline adjacent Smith Cove (Whelan 2008).

The National Aquarium was given property by the city (T. Wheeler 2010) directly north of Middle Branch Park on the opposing shoreline, depicted in bright orange in Figure 4-4. The site is slated to become an extension of the National Aquarium in the Inner Harbor, housing 'sick' animals as well as being an

educational outreach center for the aquarium. The areas adjacent to this site, depicted in light orange are areas that are available for redevelopment.

The other area identified as a possible location of future development is directly adjacent to Middle Branch Park and south of Waterview Avenue. Approximately one-half the properties in this area are currently vacated and available for sale (Sernovitz 2009). The area is currently zoned industrial but has been recently changed to accept mixed-use development (Commission, Middle Branch Master Plan Sept 2007).

Lastly, depicted in purple, was a completely forested area acting as a riparian buffer for a small tributary that runs through Middle Branch Park. This area was as an upland critical buffer for Middle Branch. The cleared land now suffers from extensive soil erosion see Figure 5-5. The property was later sold at auction after, due to accounts of unstable subsoil. The author surmised by investigating older Google maps and GIS data[13] that this may have been the largest stands of forest canopy within the Baltimore City's critical buffer, other than possibly a few areas adjacent to the tidal waters of the Gwynn Falls. However, the majority of the areas along the lower Gwynn Falls are small patches of degraded and eroded stream buffer canopy, wrought with invasive species.

In this thesis, the context of future development was incorporated into the design schemes, building on existing shared infrastructure of the surrounding

[13] See references for GIS data information

communities and extending the design program to possibly connect to these sites of future development. These possible connections are outlined further in Chapter 5: Design.

5 The Site

SELECTION

WHY THIS PLACE?

Middle Branch Park was selected to study for this design for the following reasons:

1) As previously detailed, the park is one of only two parks within Baltimore city that has a natural shoreline, see Figure 5-1. An opportunity was seen to preserve this unique amenity for the city of Baltimore.
2) The amenities and challenges with the site, discussed in detail within this chapter create an opportunity to create a series of interventions highlighting hydrological dynamics within the landscape.
3) The author has personal history with the park, described in the following subsection.

In summary, Middle Branch Park was selected as the prime location to revitalize an existing waterfront park that would make visible the connection between landscape and clean water, and to connect people to a unique and rare and restored shoreline within Baltimore's urban fabric.

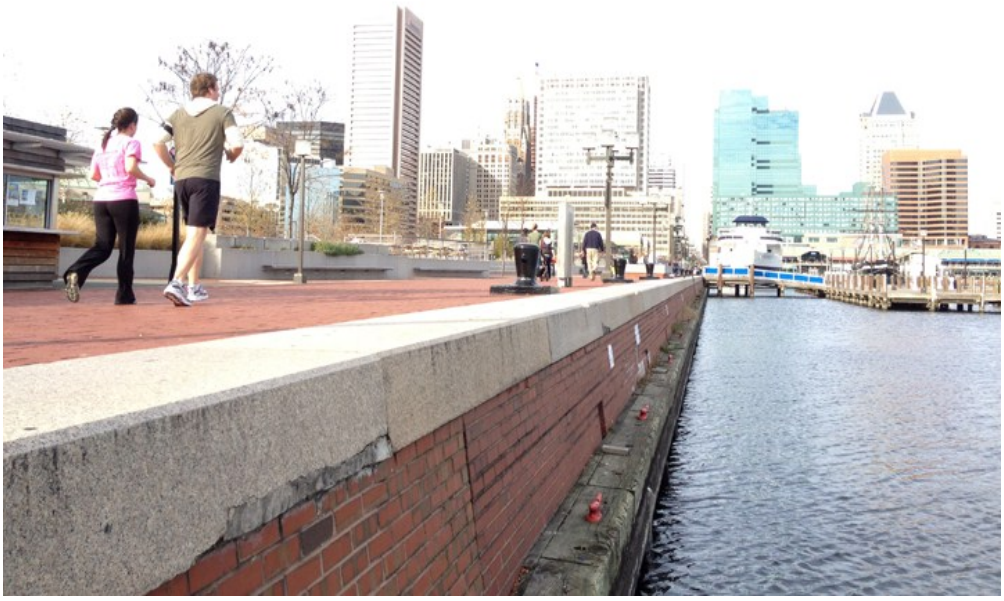

Figure 5-1. Top photos shows the Inner Harbor edge where people are disconnected from the water by a substantial bulkhead. The lower photo shows an area of the Middle Branch Park north of the Harbor Hospital at low tide the 'beach' is exposed and accessible to park visitors. Photos by the author.

AUTHOR'S EXPERIENCE WITH THE MIDDLE BRANCH

The site was in part selected because the author had firsthand experience rowing on the Middle Branch at different times over the course of the last 15 years. The following is a personal narrative of her experience in 1995, when she recalls the water to be much more polluted than its current state.

> It had rained in the hours before, and the tide was high with plastic bottles strewn along the water's edge. In the predawn dark of the morning, she stepped onto the dock with a boat nicknamed the *white whale* and was greeted by the wafting smell of gasoline. For the last two hours this boat– the *white whale*, herself, and her teammates, coursed through the inky black waters of the Middle Branch. The only sounds were blades of the oars cutting the water, faint sounds of the Domino sugar factory, and her coxswain steady, bellowing "ROW".
>
> She had watched dawn break over the water, revealing oil rainbows coating the surface of the water. She had caught glimpses of an osprey dive into the water for breakfast. Occasionally her oar emerged with a bright blue, lifeless grocery bag clinging to the blade.
>
> She stood on the edge of dock, the boat resting on her shoulder and those of her teammates. To its namesake, the *white whale* reminded her of a dead Valdez whale, so heavy and oiled from the water that she had nearly dropped it as she hoisted it from the water.

INVENTORY

SITE RESOURCES

Middle Branch Park is a 76 acre park located in the farthest shores of south Baltimore, just south of the Hanover Street Bridge. The primary features of the park are an expansive shoreline of approximately 7070 feet[14], four wooden fishing piers, three concrete fishing piers, one floating pier primarily used by the Baltimore Rowing Club, the Baltimore Rowing clubhouse, the Gwynn Falls trail, approximately 10 picnic tables, 2 stone fire pits 20' or less from the shoreline with low stone seating walls, a series of new metal Dasani benches, a scattering of a few older wooden benches, an expansive lawn sloping to the water's edge, a conservation area with two raised wooden trail areas connecting to raised wooden platforms, and three parking lots. The main activities that exist within the park are: fishing, rowing from the Baltimore Rowing Club, and use of the Gwynn Trail primarily by cyclists.

[14] Calculated by author using GIS tools. See Chapter 7 for GIS information.

Figure 5-2. Photos representing park amenities and resources, identified and located in Fig-2. From top-left, clockwise: 1) Concrete fishing piers, 2) Vietnam Memorial 3) Wooden fishing piers, adjacent Harbor Hospital and Hanover Street Bridge, 4) Gwynn Falls Trail 5)Wooden fishing piers, 6) Floating boat launch and Baltimore Rowing Club boathouse. Photos by the author.

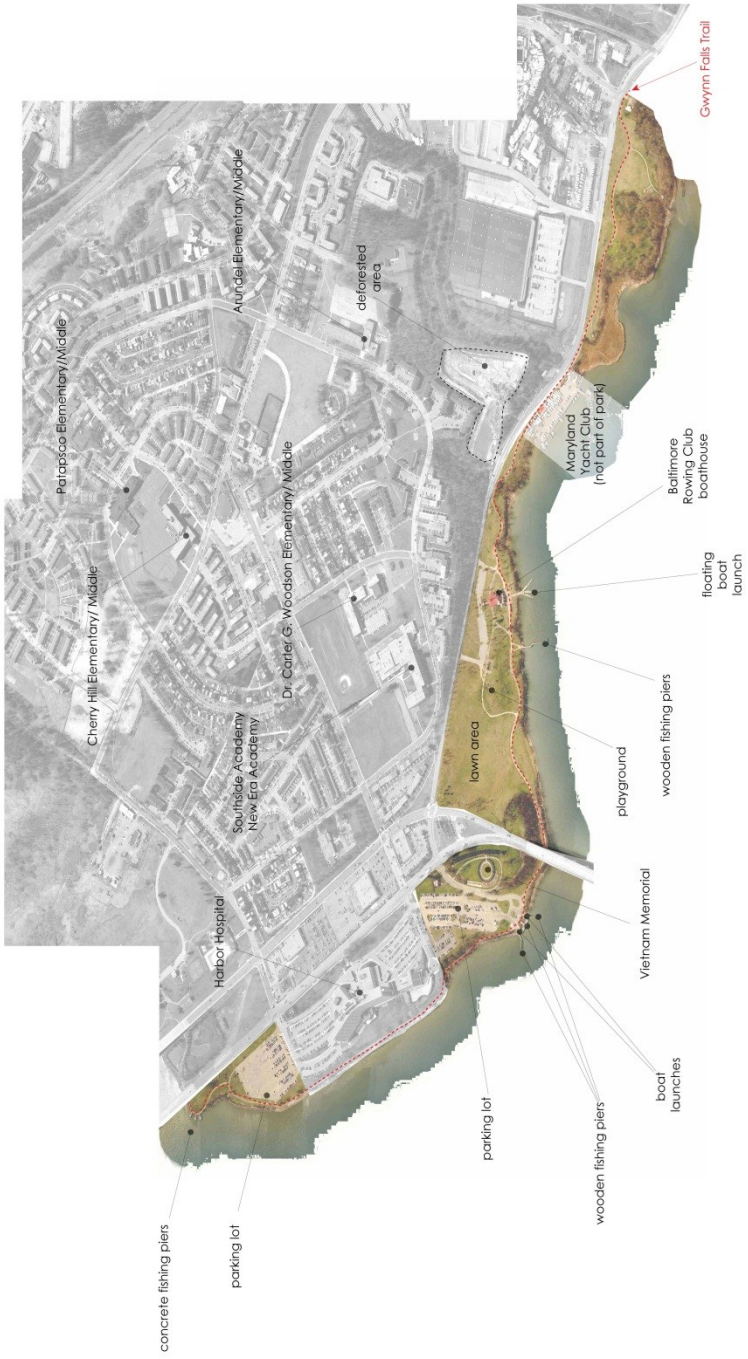

Figure 5-3. Illustration showing existing conditions. Middle Branch Park land is left in color. The remainder of Cherry Hill neighborhood is left in black and white. Significant resources within the park and neighborhood are identified. Illustration by the author.

SITE and WATERSHED

The Middle Branch watershed is separated from the Baltimore Inner Harbor watershed, by the body of land containing Federal Hill and Locust Point. The Middle Branch is part of the direct Harbor Watershed and is directly affected by Gwynn Falls Watershed, totaling 17.1 hectares, see Figure 5a. Baltimore county, Howard county, and Baltimore City fall within the Gwynn Falls Watershed and have the capacity to effect the water quality of the Middle Branch and of course, the Chesapeake Bay. From site analysis it was determined, that the Gwynn Falls is the primary source of non-channelized water that feeds into the Middle Branch[15], see Figure 5-4a. Two smaller tributaries feed the Middle Branch in grounds adjacent and within the Middle Branch Park[16]. One tributary leads into Smith Cove at the most southwest corner of the Middle Branch, adjacent the proposed Westport Development area and the other just east of the Middle Branch Marina[17].

[15] From site analysis this was determined by GIS records, Google maps, and on the ground investigation.
[16] From site analysis this was determined by GIS records, Google maps, and on the ground investigation.
[17] From site analysis this was determined by GIS recs, Google maps, and on the ground investigation.

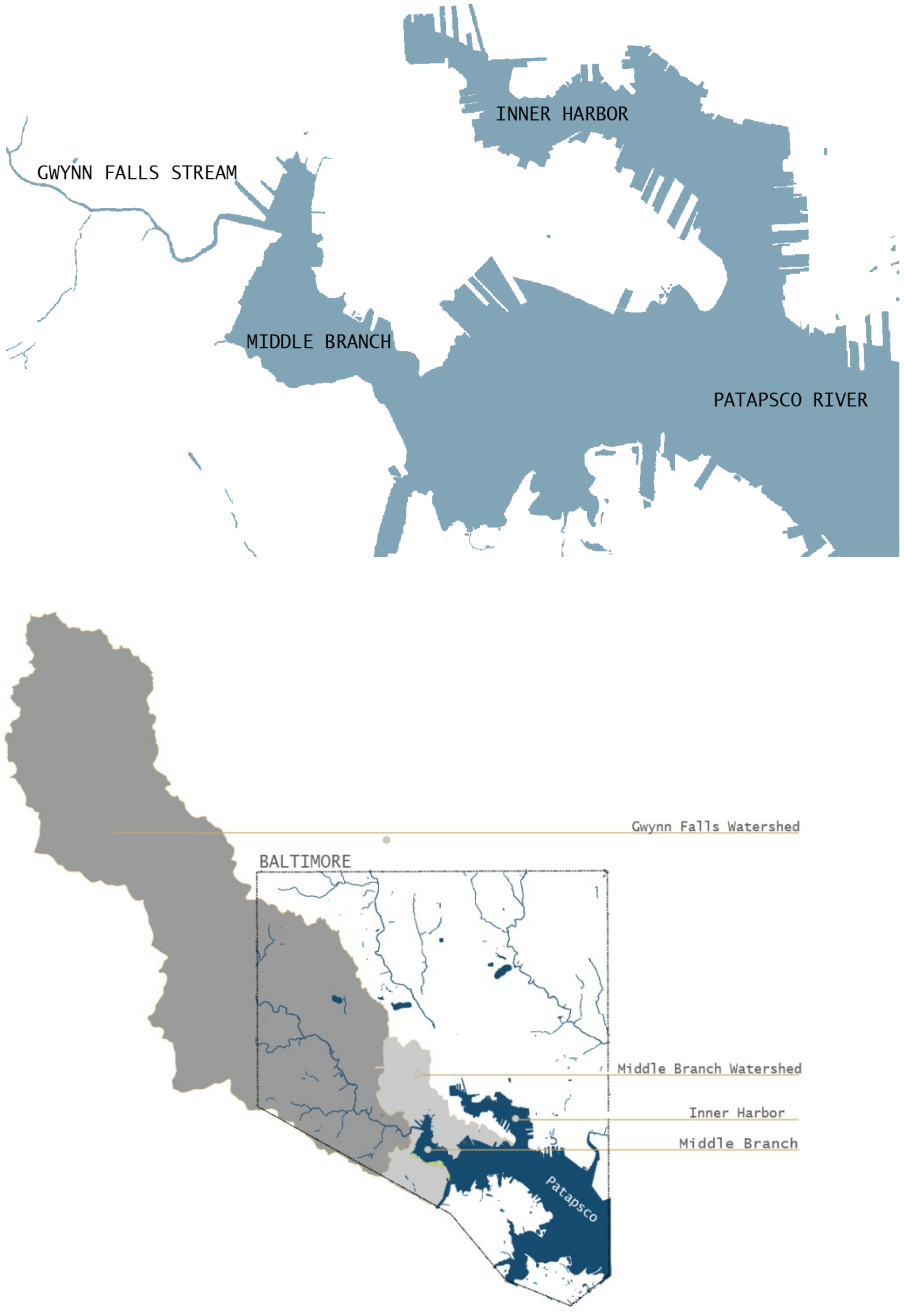

Figure 5-4 a. The Middle Branch subwatershed is 4.8 hectares is part of the Direct Harbor watershed, the larger Gwynn Falls watershed totals 17,150 hectares. Both Direct Harbor watershed and the Gwynn Falls directly and indirectly affect the water quality of the Middle Branch. Illustration by the author.

TRASH

As previously discussed in Chapter 2, problems with trash exists beyond Middle Branch park were visible from Middle Branch waterways and the surrounding communities. Trash, was embedded in the bottom most layer of the water column, in the form of plastic water bottles embedded in the mud. The uppermost layer of the water column contained layers of trash from plastic bottles to bits of Styrofoam. Trash was found covering the banks of the waterways of the lower Gwynn Falls as well as in the surrounding neighborhoods. The following photo documentation, Figure 5-5 shows the gravity and extent of the problem.

Figure 5-5. Photo collage of the extent of trash found within the park and shoreline of Middle Branch Park. Photo collage by the author.

WATERSHED CONTEXT and TRASH

As briefly mentioned, the trash deposited upland is primarily carried into the Middle Branch through the Gwynn Falls and Direct Harbor Watershed. A graphic representation, Figure 5-6 shows the numerous examples of trash deposited in the areas described in Middle Branch and the one location of the trash interceptor for this watershed at Warner Street. Trash is evident upland within the adjacent neighborhoods of Cherry Hill and Westport. Trash washes into storm drains into the Middle Branch and surrounding waterways. Litter blows across the land, from the surrounding highway overpasses and from adjacent shorelines, such as the park. Note the mass of plastic bottles along Swan Park's shoreline beneath with the highway overpasses in the immediate background. It is evident from observation at all of the waterfront parks in Baltimore, including Middle Branch that the general public is not aware of their placement within the watershed. But the author has watched people in Baltimore, kick garbage into the storm drains on more than one occasion. With the amount of trash lodged in storm drains in Baltimore, it does not appear that the general public is aware that whatever is discarded into a storm drain eventually becomes part of the Chesapeake Bay.

Figure 5-6 . Illustrates trash deposition in relation to the Middle Branch waterway. Illustration by the author.

ANALYSIS

Conclusions from this sub-section were drawn from analysis of a combination of GIS and Google imagery, as well as on-site observations and photo documentation by the author.

STORMWATER AND EROSION

On the ground investigation by the author led to the discovery of problems with erosion along the Middle Branch Park's shoreline. Areas along the branch of the Middle Branch with stormwater outfalls were found to be experiencing the greatest extents of erosion, which encompasses the majority of the north shoreline of the Middle Branch from the Hanover Street Bridge to Smith Cove. Measured distances by the author on the ground estimated that erosion may have removed 15 feet of shoreline from the last GIS survey records.[18] Along the eroded banks storm culvert outfalls have become exposed and the difference in the height of the shoreline to low tide can be over 10 ft. in many locations along the park edge on the north shore. The erosion along these banks appears to be exacerbated by lack of vegetated buffer adjacent the shoreline. Erosive condition along the banks is reducing the vegetative buffer. Trees roots are continually exposed and collapsing into the bank, only further

[18]

exacerbating the erosive forces of the stormwater discharge sites and that of tidal action.

The banks along the Middle Branch are continually exposed to tidal actions. Tidal fluctuations vary on average of 2' and the highest tidal fluctuations at a maximum of 4' during the normal lunar cycle. During storms common to the area, water fluctuations can exceed these values. During the last hurricane, water elevations on the site were approximated to 4-6'from onsite observations by the author. Stormwater discharge outfalls on the site coupled with combination the lack of stable and vegetated shoreline lead to erosion (Brown and Schueler 2004), see Figure 5-7.

The banks along the Harbor Hospital have been rip-rapped and do not appear to be experiencing erosion. Erosion was found along the banks of the small tributaries that feed into the Middle Branch and pass through the park. Details of the stream bank erosion are described following subsection.

STORMWATER AND SEDIMENTATION

From Google images and on the ground analysis problems with sedimentation and erosion exist at outfall sites along the Middle Branch Park shoreline. Sites of excessive sedimentation, visible at from Google are created by incised streams and currently being exacerbated by soil disturbance at nearby construction sites with substantial land clearing. Two such examples are Smith Cove and the stream adjacent the Middle Branch Marina. The stream

feeding into Smith Cove has banks estimated by the author to be approximately 20ft. Stormwater loading occurs in this site from Cherry Hill Road, where approximately one third of the storm water of Cherry Hill discharges into this cove. Piped stormwater become day lighted into the tributary feeding Smith Cove after it crossed under Waterview Avenue. Sedimentation from eroding banks and as well as sedimentation from Cherry Hill Road, mix with trash brought from the same storm drains, to create a mix of sedimentation, phragmites, and plastic water bottles, Figure, 5-8.

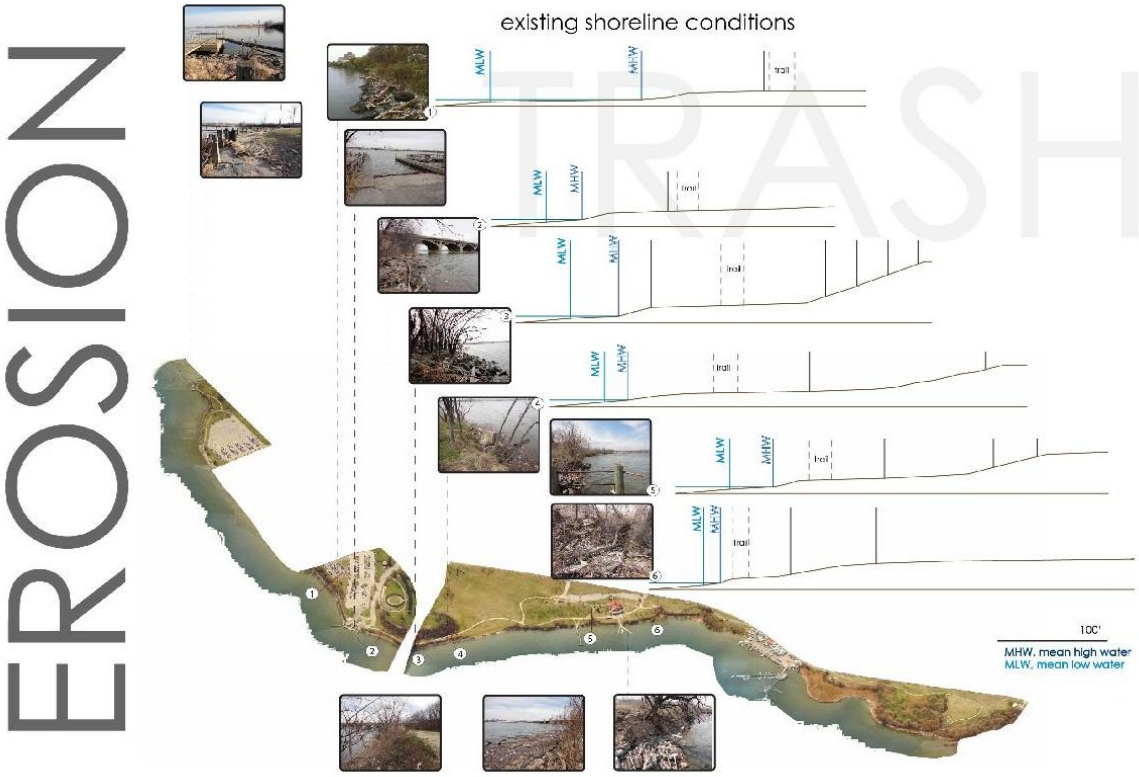

Figure 5-7. Illustration shows the existing erosion, as well as the trash condition within Middle Branch Park. Illustration by the author.

Figure 5-8. Trash mixed with phragmites at Smith Cove at the Northeastern end of Middle Branch Park. Photo by the author.

The second most visible area, adjacent to the Middle Branch Marina is from a stream that cuts through the narrowest section of the park. The stream is adjacent to the area of recent deforestation above Waterview Avenue. As previously, mentioned a sizeable area of forest canopy was cut and the land cleared for new development. The site is experiencing extreme erosion and land subsidence Figure 5-9. The small tributary as it opens into the Middle Branch is experiencing erosion along the banks, but in the author's opinion the majority of sedimentation visible from Google images is occurring as a result of the

adjacent construction site, as sedimentation is visible within the Waterview Avenue.

Figure 5-9. Shows topography and stormwater outfalls in relation to sedimentation and erosion. Illustration by the author.

HISTORICAL SHORELINES

To place the shorelines around the Middle Branch Park in an historical perspective the author, investigated historical photos and maps of the site. In the following images it can be seen that as early as the 1930's the shoreline and majority of the upland area adjacent the Middle Branch remained forested, in contrast to the industrial areas that surrounded the site. Historically, the shorelines during this time and earlier were used for recreational purposes, as either yacht clubs and or bathing beaches. The current Middle Branch Marina moved three times along the existing shoreline of Middle Branch Park, before its current Based on site analysis from historical maps from 1836 to 1908, the following overlaid map montage was created; and the conclusion was made that although the Middle Branch shoreline is currently experiencing issues with erosion, it has not historically experienced the same erosion and changes[19] as the surrounding shorelines that have been historically subject to land clearing and industrial uses. It is the authors' primary assumption, that the upland forested buffer and natural conditions of the shoreline have preserved the integrity of the shoreline. From these assumptions the author, concludes that the techniques outlined in *Chapter 5: Design* may be appropriate to restore the current shoreline.

[19] Concluded from site analysis. Maps 1836, 1890, and 1908 Enoch Pratt Free Library Map Archives, Baltimore MD.

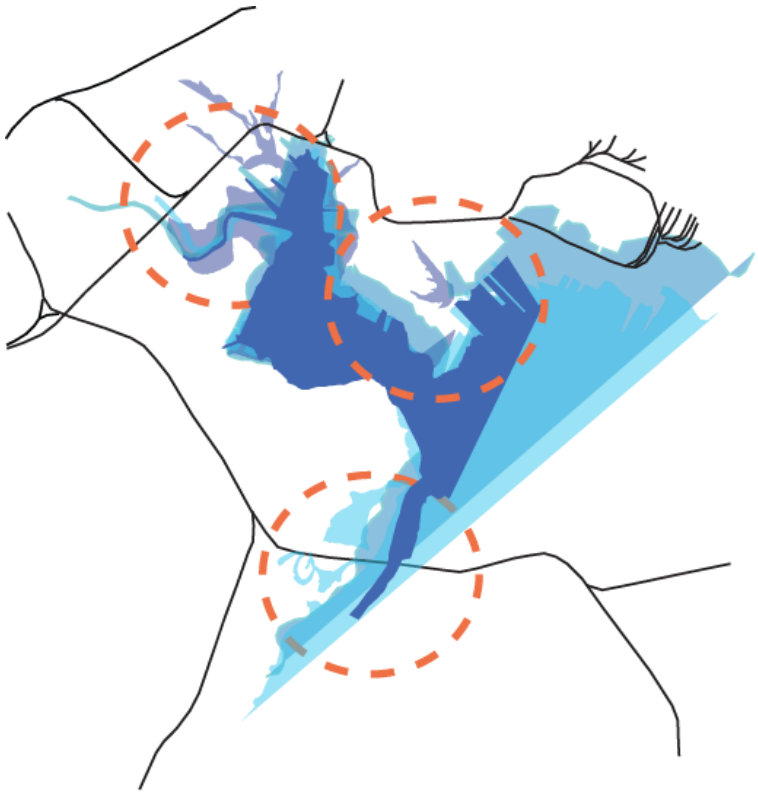

Figure 5-10. Interpretation of sedimentation process along the Middle Branch and local tributaries, by comparison of historical maps, Google maps, and on ground accounting. The graphic map shows the filling and sedimentation of the Middle Branch waterway from 1836 to 1908. The darkest blue representing the 1908 condition and the light purple representing the 1936 conditions. Note at 1836 more finger tributaries feeding into the waterway were visible, that were later filled and diverted. Dotted orange circles highlight areas of most change. Illustration by author.

IS THIS A FUNCTIONING CRITICAL BUFFER?

As discussed previously in the Introduction, land located within the critical area that is classified by default as pervious, should be more accurately described as 'not impervious'. This classification of 'pervious' does not necessarily mean the land is permeable to stormwater, vegetated, or functioning as a critical buffer. All three factors of soil composition, type of

vegetation, and shoreline topography determine whether or not a shoreline is functioning in its full capacity as a critical buffer. In urban environments such as these, it is generally assumed that the land is not functioning to its full capacity as a critical buffer (Booth and Bledsoe 2009).

The Figure 5-11 below shows impervious and presumed 'pervious' cover within Middle Branch Park in relation to the critical buffer

Figure 5-11. Shows Middle Branch Park in relation to the critical buffer. Illustration by the author.

Middle Branch Park (Figure 4-8) is composed of 20% impervious surface[20]. These surfaces are primarily asphalt parking lots. The Baltimore Rowing Club and the asphalt Gwynn Falls trail make up the remainder of the impervious surface.

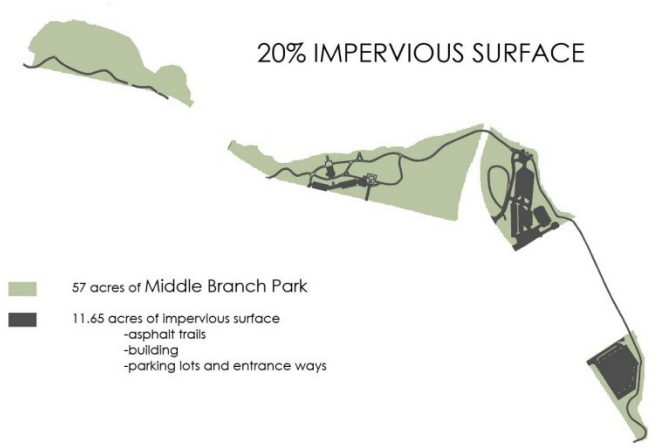

Figure 5-12. Shows the percent of impervious cover within Middle Branch Park. Illustration by the author.

Although the park can be categorized as having 80% 'pervious' surface cover[21], only 1% of the total acreage of the park area has vegetation containing trees and shrubs (see Figure 5-13), of which the majority along the shorelines consists of collapsing trees from eroded shore banks and invasive species. The majority of the 'pervious' surface is accounted for by open lawn.

[20] Impervious cover was calculated from GIS record data by author. The square feet of buildings, entrance drives, asphalt paths, and parking lots were tallied and calculated as a percentage of the total square feet of park land, shown in the Figure 4-8.

[21] Pervious cover was calculated from GIS record data by author. The square feet of land not accounted for by buildings, entrance drives, asphalt paths, and parking lots were tallied and calculated as a percentage of the total square feet of park land. The total square feet of vegetative cover (GIS layer) was tallied and calculated as a percentage of the total square feet of pervious park land in the Figure 4-9.

Issues of stormwater, trash, sedimentation, erosion and lack of vegetative cover in the form tree canopy, as well as shrub and native herbaceous cover are inhibiting Middle Branch from functioning as a critical buffer.

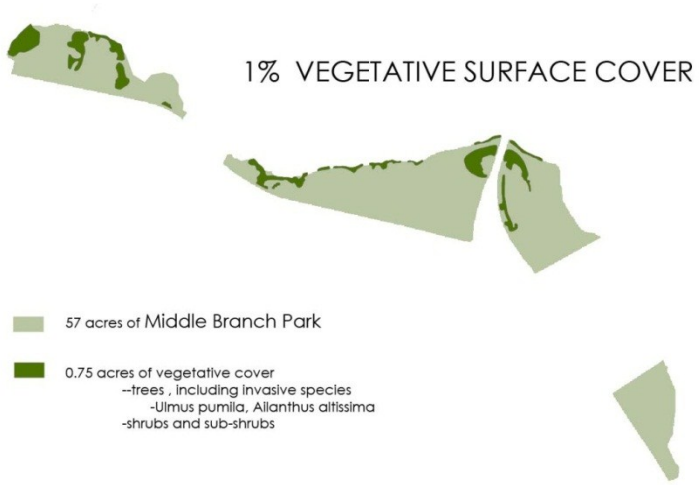

Figure 5-13. Shows the percent of vegetative cover within Middle Branch Park. Illustration by the author.

DISCONNECTION

Two types of disconnection are observed within Middle Branch Park site. The disconnection is concluded to be a result of 1) a **disconnection of people** from the park and waterfront and from an awareness of the hydrology 2) a disconnection of **land to water** topography by shoreline and stormwater design.

First, topographical challenges surrounding the park decrease the accessibility of the park from neighborhood of Cherry Hill. Lack of connections in the form of crosswalks and sidewalks leading to the park created a more car-dependent user group and reduce pedestrian access to the park. The lack of proper placement of trash in trash receptacles within the park and neighborhood, suggest that there is a lack of environmental stewardship and an awareness of hydrology in the landscape. Overall there is a **disconnect of people to water** The lack of awareness in the general public to the hydrological cycle is a result of a visual disconnect between the storm drain inlet and outfall, which is a result of stormwater design that makes the process hidden from view, which is part of the **second type of disconnect of land to water.**

This second type of disconnection of land to water within Middle Branch Park is also a result of the removal of the natural flood plain. Changes in topography of the shoreline due to erosion and lack of adequate floodplain in the original park design, as well as excessive storm drain discharge contribute to the shoreline erosion and disconnection of water from the land. The following graphic illustration reiterates these types of disconnection.

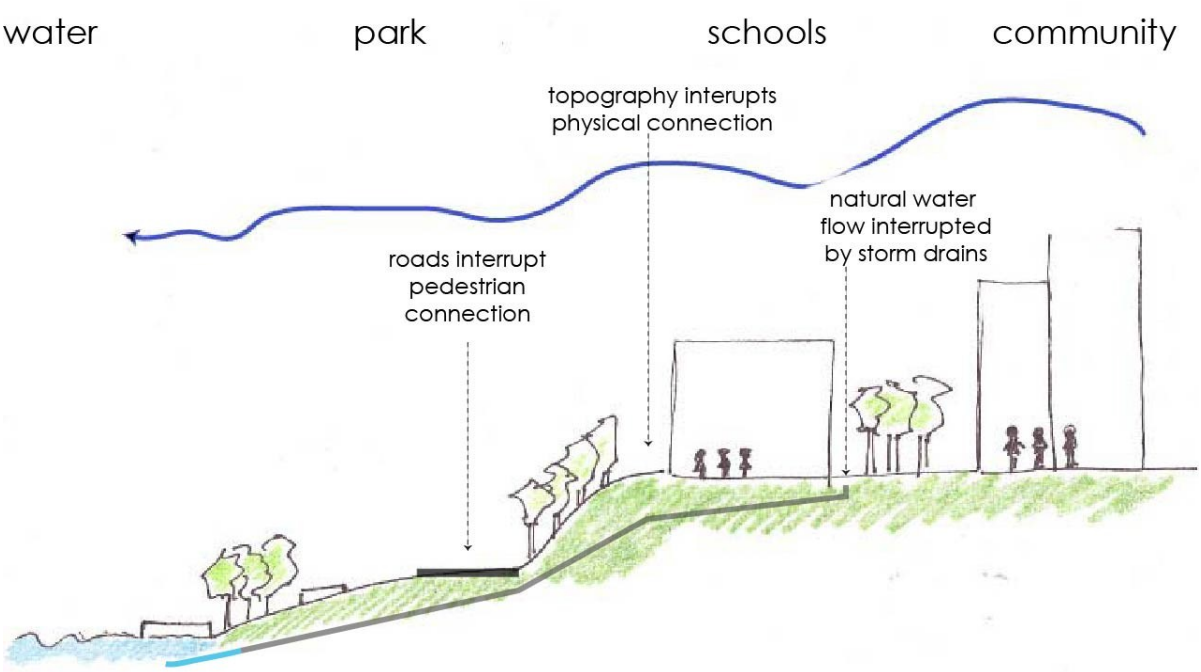

Figure 5-14. Illustrating disconnections. Illustration by the author.

CONSTRAINTS

1- TRASH, SEDIMENTATION, EROSION, and LACK OF VEGETATIVE COVER contribute to poor water quality within the Middle Branch and the inability of the Middle Branch in its current state to function as a critical buffer

2- DISCONNECTION between people and water, as well as land and water are contributing and cyclically exacerbating the above conditions (trash, sedimentation, erosion, lack of vegetation, and reduced efficiency of critical buffer).

OPPORTUNITIES

A redesign of Middle Branch Park could address the issues associated with the two types of disconnection: by reconnecting the water to the land by new stormwater and park design; and by reconnecting people with Middle Branch Park, its waterfront, and the water that flows to the Middle Branch.

From this site analysis it is concluded that an opportunity exists to redesign Middle Branch Park, to function optimally as a critical buffer: cleaning stormwater prior to its entry into the Middle Branch, providing improved space for habitat, and a recreational and educational space. A summary of the site analysis and beginning map of the design interventions can be seen in Figure 5-15.

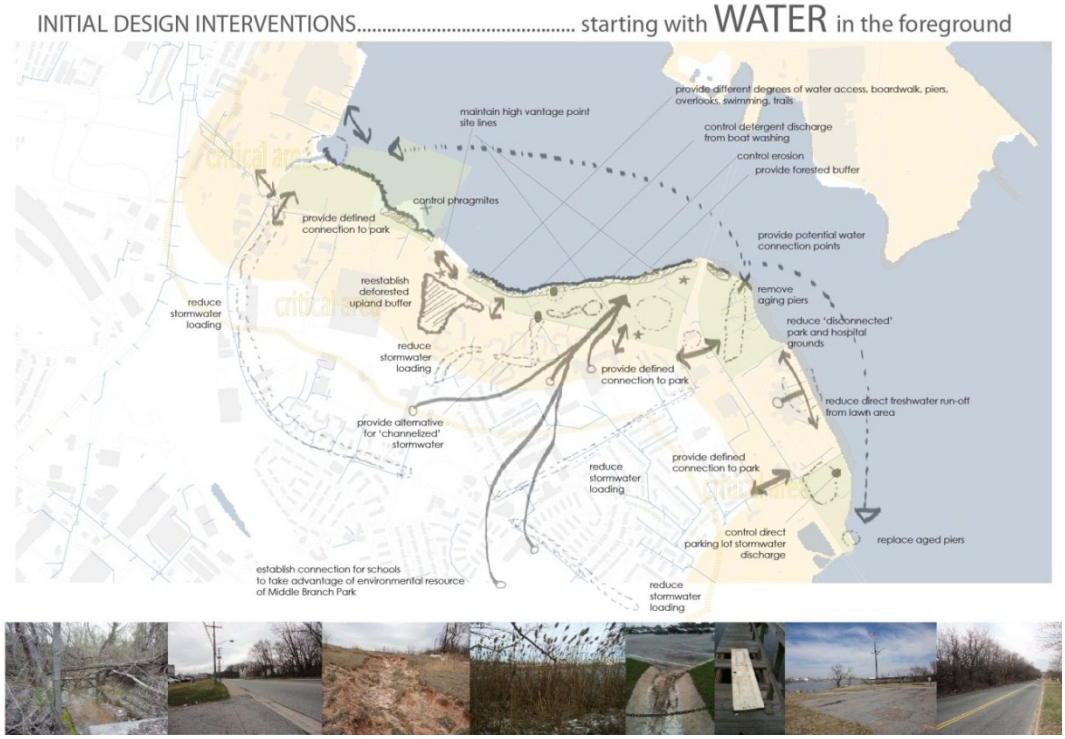

Figure 5-15. Illustration showing initial design interventions focusing on water quality. Bottom row of photos shows existing conditions. Illustration and photos by the author.

6 Design Proposal

This chapter will explain the design goals set for the redesign of Middle Branch Park. A brief overview the master plan will be presented. The master plan will be continually referenced in enlargements and detailed illustrative of the plan. Four scaled-graphic sections follow the master plan and again will be discussed in more detail throughout the chapters as enlargements of the cross-sections and illustrations. Each detail of the master plan is numbered so that it can be cross-referenced to the master plan, Figure 5-3. The details of the master plan will be discussed in numerical order but following the four major programing elements of the master plan.

From the conclusions drawn from the background and context issues (presented in Chapter 2) and the Site Analysis (presented in Chapter 4) the author decided on five design goals.

DESIGN GOALS

The following design goals (see Figure 6-1) were created to address the needs of community, health, education, and ecology:

1) To provide places to connect the community to the park and water.
2) To provide places for park visitors to make a connection between their personal and environmental health and empower them to change both
3) To provide a place for students and the public to participate in monitoring and improving water quality and ecological functioning

4) To provide a cleaner waterway along the Middle Branch by increasing the ecological functioning of the water-landscape

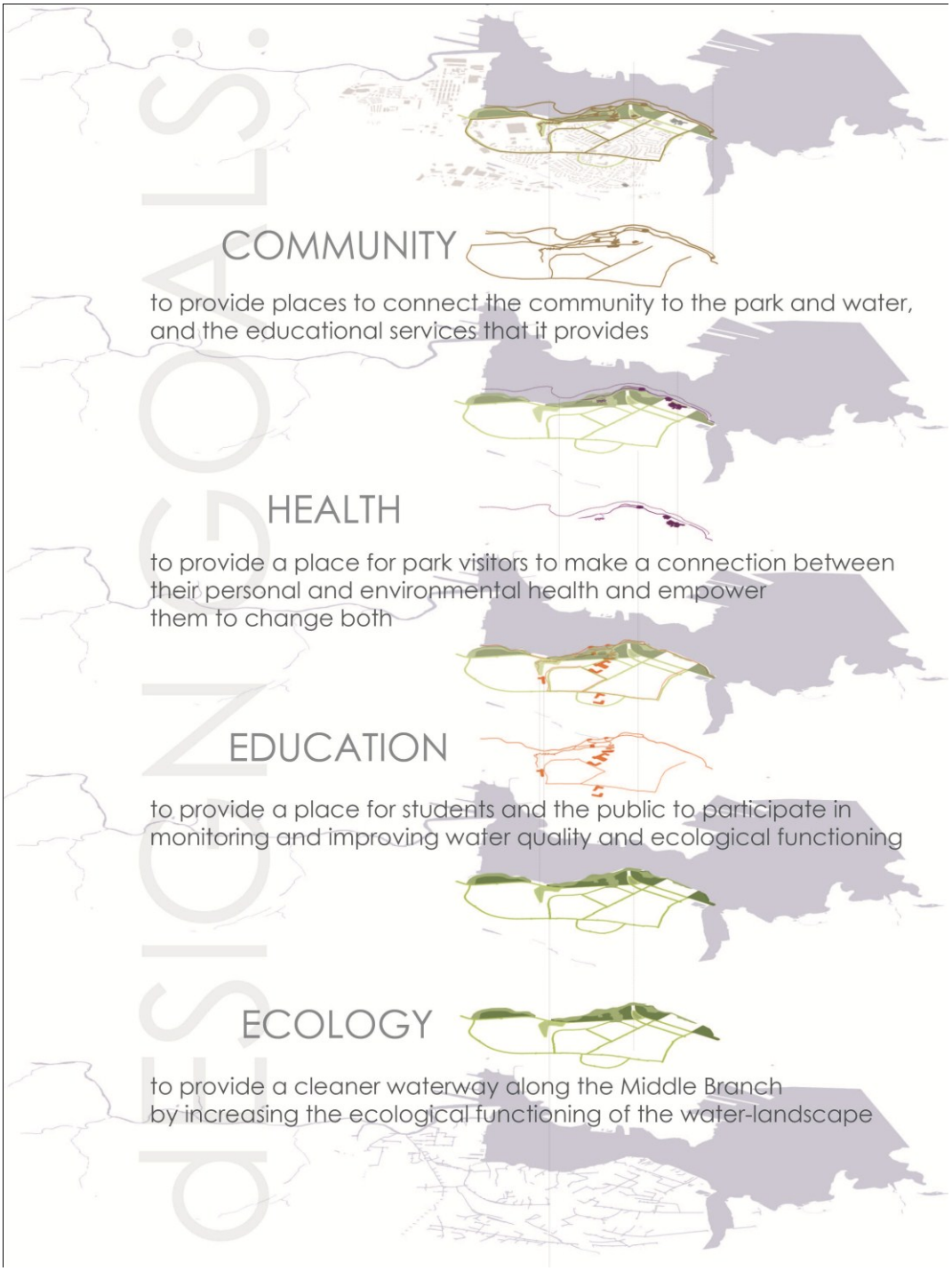

Figure 6- 1. Graphic representation of design goals showing connections between water, ecology, education, health, and community. Illustration by the author.

For the final design moves, the author continually referred back to the design metaphor of the orilla. The orilla represented the overlap of design interventions implemented throughout the park that responded to the design goals set for community, health, education, and ecology, and are graphically shown below in Figure 6-2.

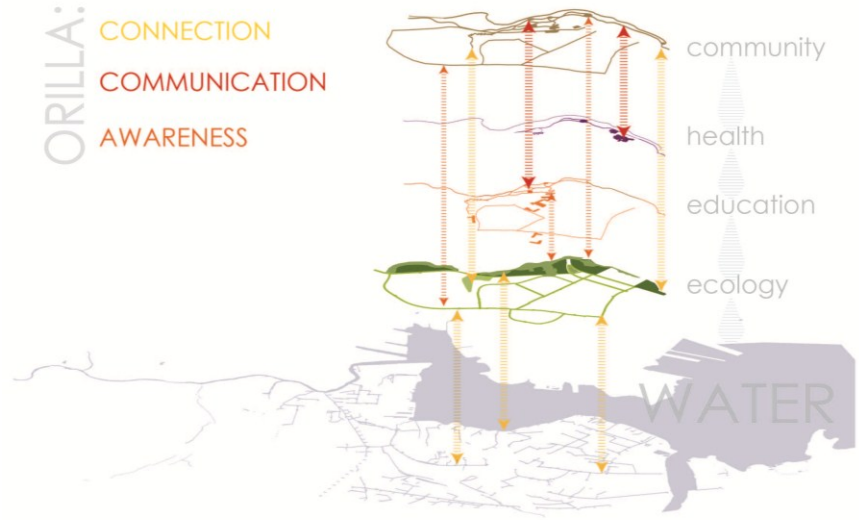

Figure 6- 2. Graphic representation of orilla as way to overlap programming elements of water, ecology, education, health, and community within the park design. Illustration by the author.

OVERVIEW OF MASTER PLAN

The design approach concentrated on improving water quality within the park and making the hydrological processes visible in the water-landscape design. The primary starting point in discussing the park design begins at the water's edge (see Figures 6-3 to6-7). Interventions within the park extend out into the Middle Branch in the form of floating wetlands and also extend into the fabric of the community and education system by replacing a reforested upland buffer area and creating an education-trail within the reforested upland buffer. Interventions along the shoreline are the majority of the design and interventions of the new park design. More landward elements of the park design are linked one way or another to the majority of the interventions on the shoreline. These interventions will be described in more detail in the following sections. Note design features are italicized throughout the text, as the interrelation of design features is discussed.

PROGRAMMING

The programming for the park can be divided into four main objectives 1) to enhance the critical buffer within and outside Middle Branch Park 2) to create access to the physical *orilla 3)* to create multi-functional social, educational, and recreational areas, and 4) to enhance public access to the

park and features. Specific example of these elements of the programming are listed below and described in further detail later in this chapter.

1) Enhanced critical buffer within and outside Middle Branch Park

-floating wetlands
-emergent shoreline
-riparian edge
-reforested upland buffer
- stormwater management within roadways, sidewalks, and park

2) Enhanced access to the *orilla*
-floating boardwalk
-fixed boardwalk
-raised trails through and beside riparian edge

3) Create Social gathering- Educational - Recreational areas

-educational pavilion and rain-garden
-terraced view and lounge
-wet-art feature
-floating overlooks
-school and community garden
-park and community center
-health trail
-playgrounds
-picnic area
-natural swimming pool
-washboard beach
-sand beach

5) Enhanced pedestrian access to the park and features
-green streets to park
-additional crosswalks along Waterview Avenue
-enhanced crosswalks at Potee and Hanover Streets
-community and education trail, ADA accessible
-terraced view and lounge access, enables ADA accessibility
-ADA ramp at natural swimming pool

Figure 6- 3. The master plan for Middle Branch Park. Illustration by the author.

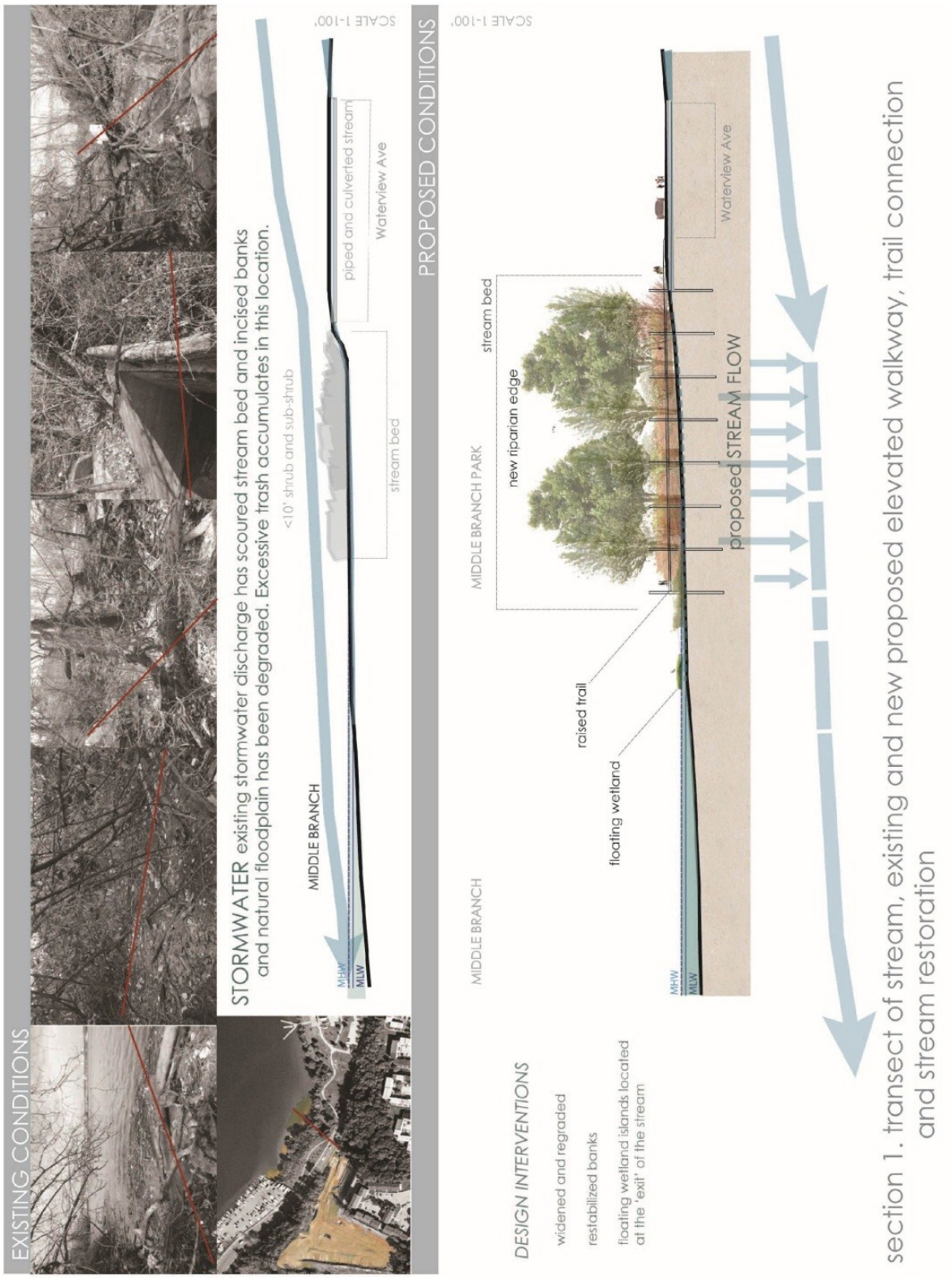

Figure 6-4. Section 1 showing connection with new stream bed and raised trail. Illustration by the author

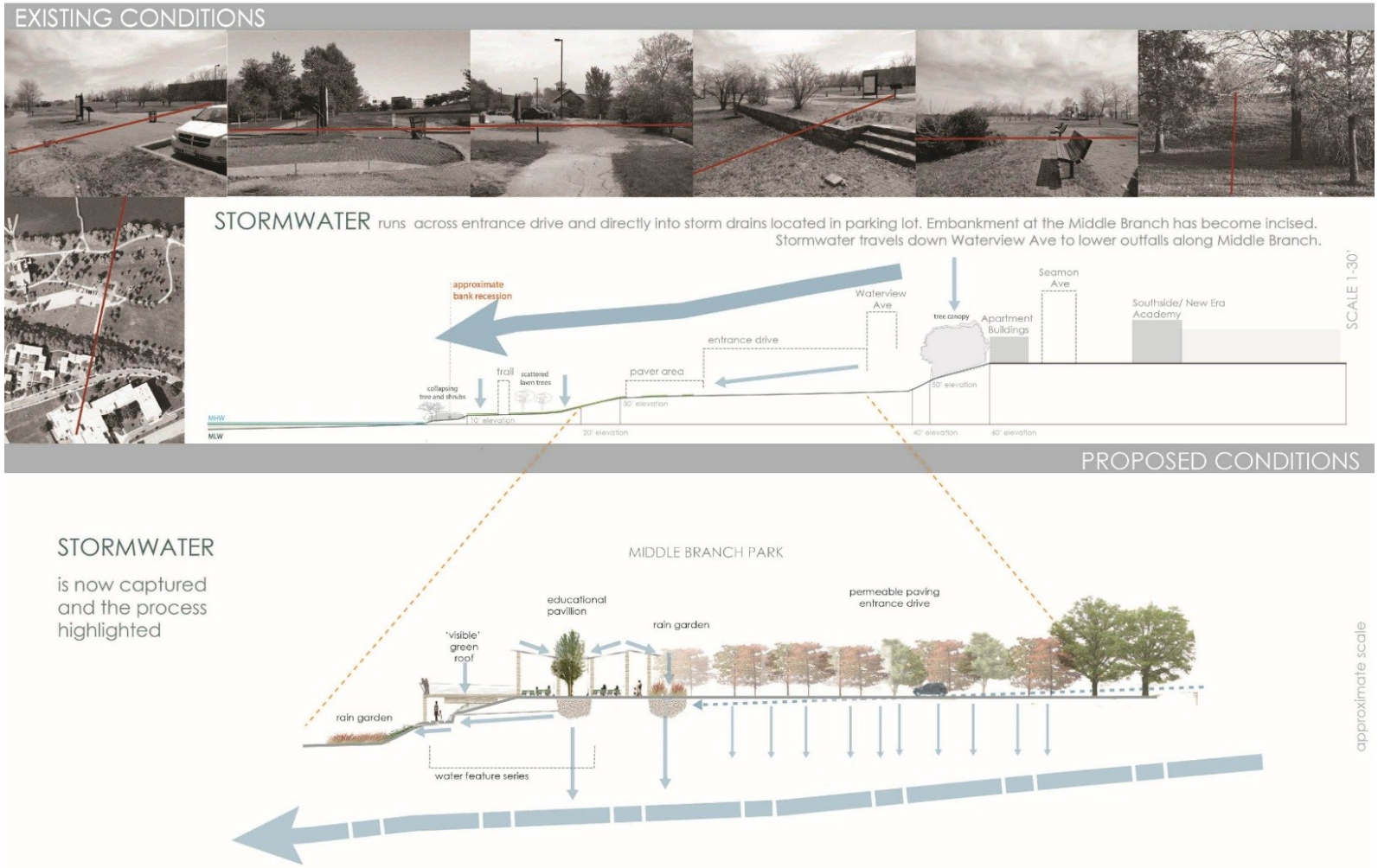

Figure 6- 5. Section 2 showing educational pavilion. Illustration by the author.

section 2. park transects series of educational elements making visible the cleansing of stormwater

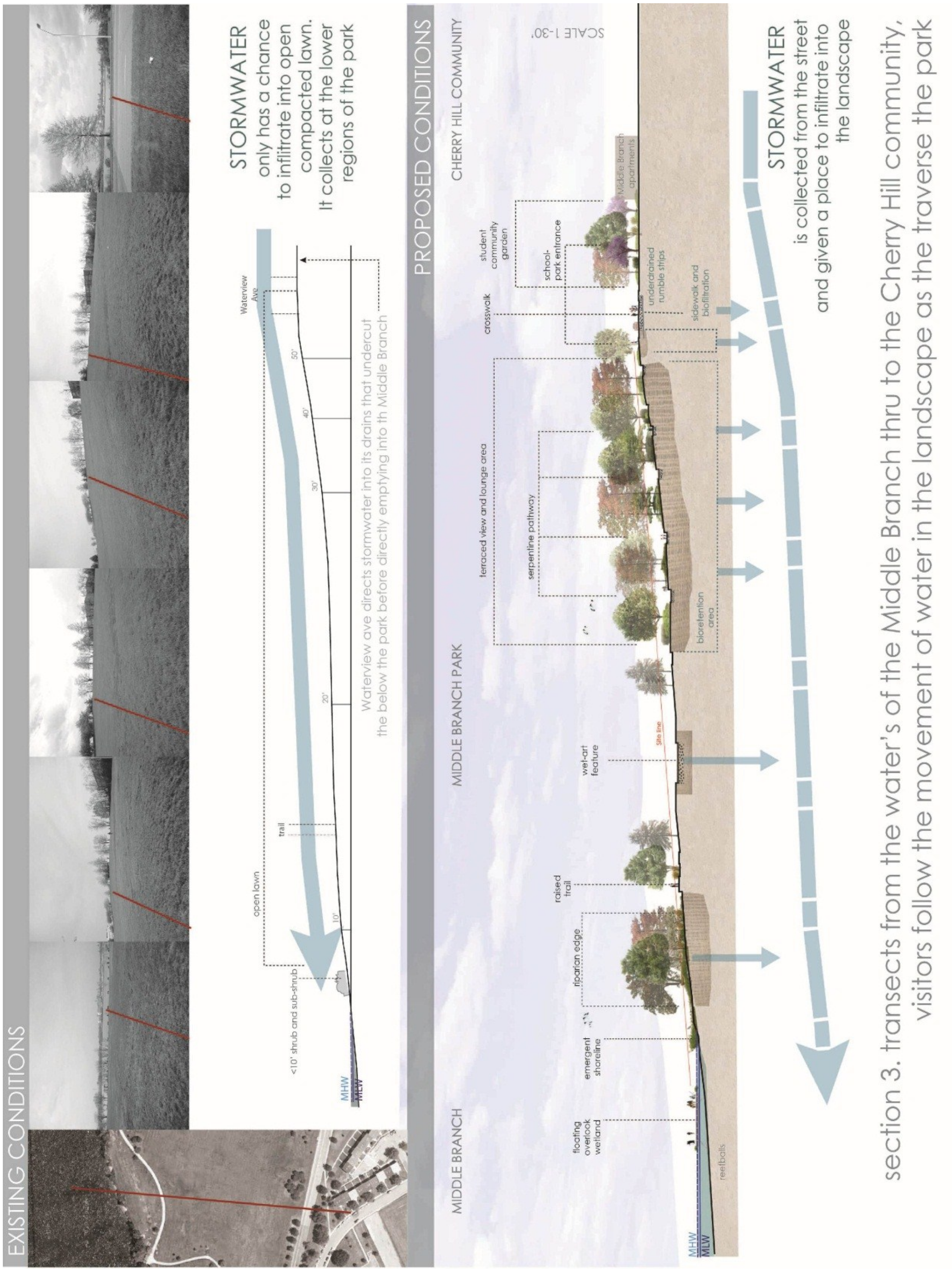

Figure 6- 6 Section 1 showing terrace lounge and connection with high school. Illustration by the author.

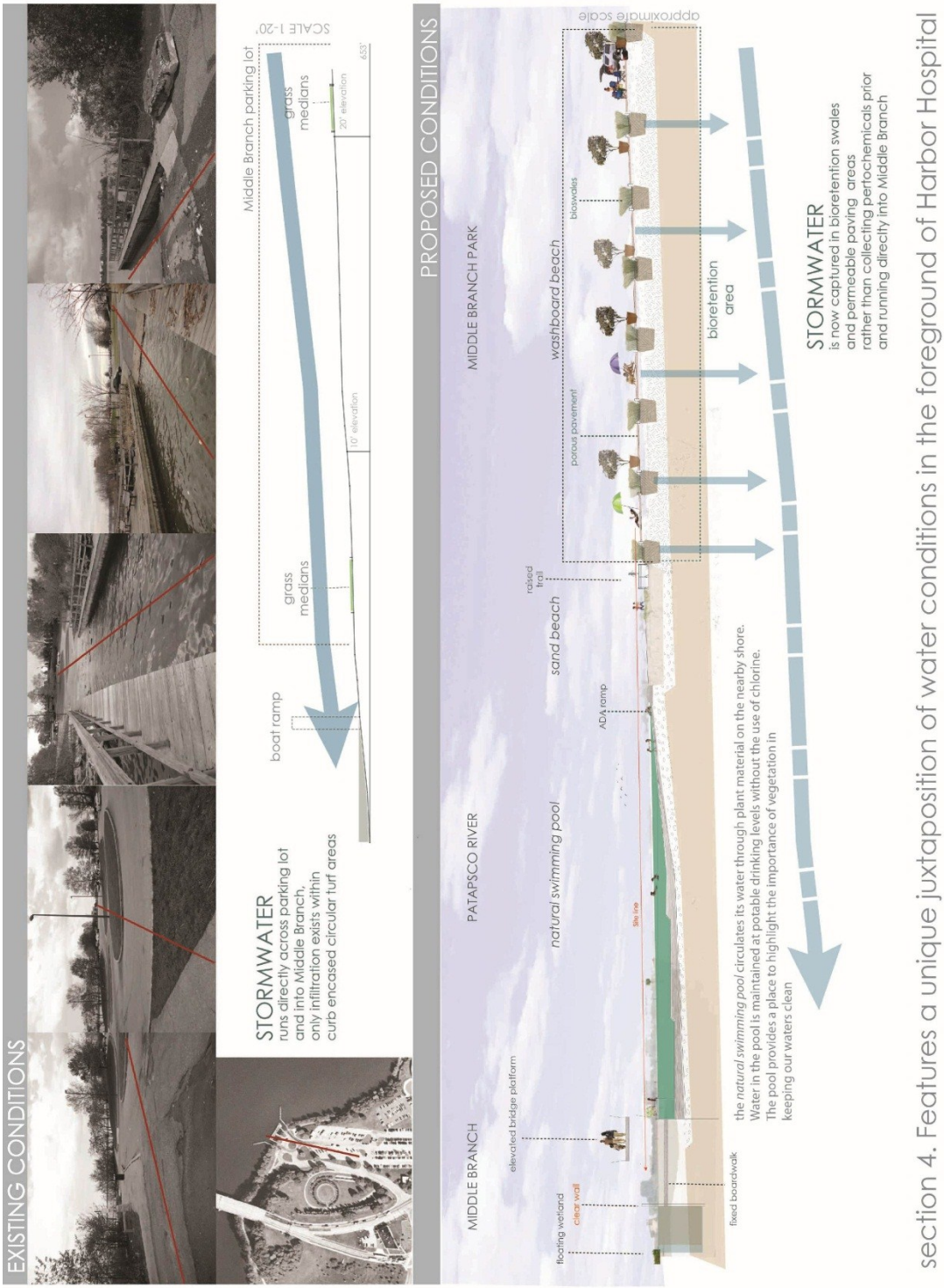

Figure 6- 7 Section 1 showing washboard beach and natural swimming pool. Illustration by the author.

MASTER PLAN DETAILS

1 *Emergent shoreline*

As part of the re-grading of the riparian edge, the shoreline will be extended in sections to create the appropriate grade to the water's edge to slow further erosion. Biologs[22] will be filled with the earth removed from the grading process and planted with a variety of aquatic grasses, of the Spartina species. The biologs will be stacked, and allow for additional sediment to accumulate behind them on the upward landward side, creating additional shoreline. As the grass species spread, they will continue to trap sediment creating additional land and habitat. These marshy areas that once ringed the Middle Branch will help to prevent further erosion, and absorb stormwater run-off from upland areas. The new space for aquatic grasses will bring habitat space for fish, and eventually mollusks to attach to the aquatic grasses. Residents and students will be able to see the emergence of this new habitat and extension of the shoreline. The floating wetlands will work in tandem with the new emergent shoreline, cleansing stormwater entering the Middle Branch as well as the existing water within the Middle Branch. The quick establishment of the floating wetlands (MDE 2011) will aid in the establishment of the emergent shoreline.

[22] Biologs are earthed filled sacks. The sacks are usually made of coconut fiber that eventually biodegrade. The sacks are can be planted with vegetation that will hold the earthen material once the sack biodegrades.

The meandering floating boardwalks traversing this space will place people within this new emerging shoreline, a dynamic juxtaposition of water to land with the possibility to create unforeseen educational moments.

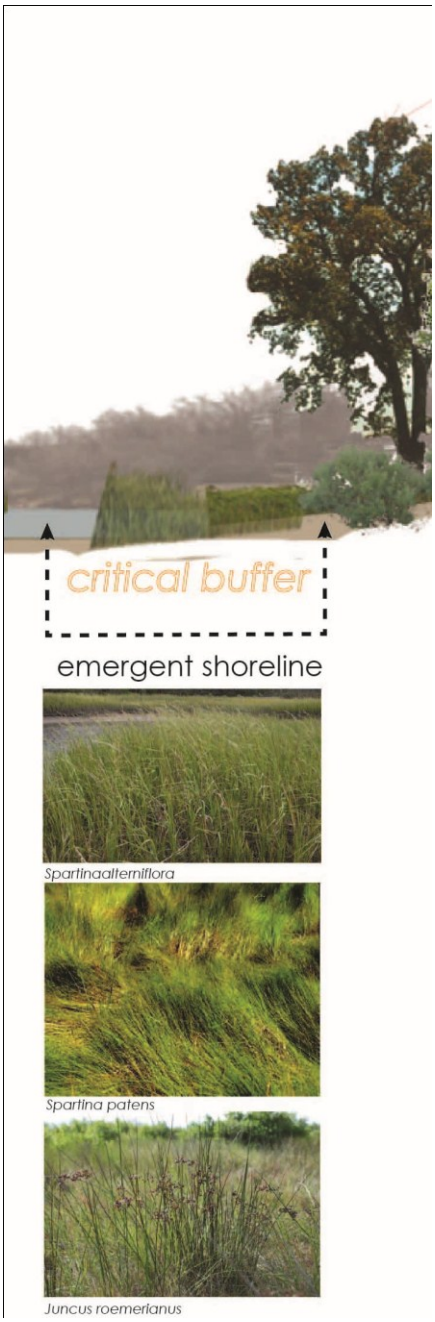

Figure 6-8. Illustration of emergent shoreline constructed of biologs. Selection of primary native grass species that will be planted. Illustration by the author.

2 *Riparian edge*

Reaching from the Smith Cove along to the Hanover Street Bridge, along the water a riparian edge will be established to repair the degraded shoreline. The riparian edge will extend back in to the park's landscape a minimum of 100' and a maximum of 200'. The Gwynn Falls trail that winds currently thru the landscape will need to be slightly realigned in segments of the park to create the minimum 100-200' buffer[23]. Furthermore, shoreline will be graded to a maximum of a 16% grade to circumvent further erosion. This new grading will allow a reestablishment of the floodplain and intertidal zone along the shoreline, which will establish places for new habitat. The vegetation within the new edge will purify stormwater as prior to its entering the Middle Branch, reducing nitrogen, phosphorous, and sediment loads to the waterway.

The majority of the riparian edge will not be designed to be accessible by regular foot traffic. However a raised trail will weave through sections of the riparian edge and connect to the floating boardwalks. This trail will allow people to experience and observe the habitat and hydrological process at work within these areas, see *Raised Trail* and *Floating Boardwalk* for further description. Design features such as overlooks and vistas within the park will give visitors visual access to the riparian edge and waterfront.

The riparian edge will be replanted (see Figure 6-10 for conceptual drawing and planting sample) with a variety of native woody shrubs and

[23] The minimum 100' was established based on criteria presented in Chapter 2 regarding functioning critical buffers.

herbaceous materials, suitable for flooding conditions and shoreline stabilization. Larger trees such as *Platanus occidentalis* and *Quercus bicolor* will also be incorporated; however some areas will be less densely covered with tree canopy to allow view sheds to the waterfront from more interior sections of the raised trail and or boardwalk. Invasive species, such *as Phragmites Australis, Celastrus orbiculatus, Lonicera japonica* [24] will be removed from the riparian

[24] Identified by author during site inventory. This is not a complete list of invasive species on site.

edge and replaced with more appropriate vegetation.

Figure 6-9. Illustrates the look of the new riparian edge acting as a functional critical buffer. Illustration by the author.

4 *Floating wetlands*

Organically shaped floating wetlands islands (FWIs) will be created using Biohaven™ floating wetland systems, see Figure 5-8. The wetlands will be secured underwater to reef balls[25] that are hollowed out, concrete balls that create underwater habitat for mollusks as well as refuge for fish. The use of reef balls will prevent the need for drilling into the thick contaminated, sediment bottom that lines the Middle Branch. Floating wetlands will be planted with a variety of aquatic water species, primarily Spartina species. The floating wetlands will not only add to the aesthetic qualities of the shoreline, but will expand the habitat. Fish species find feeding grounds and protection beneath the floating wetlands; small mollusks attach to the fibrous roots and the mat material used to create the floating wetlands; and bird species and turtles use the cover of the grass for nesting places (MDE 2011). Documentation of this habitat developing in less than a season was described in Chapter 3.

Plant material within FWI's will help to immediately uptake pollutants, such as heavy metals, balance phosphorus and nitrogen[26] loads within the water, and reduce turbidity within the water column (Tanner and Headley 2011) that

[25] Reef balls are hollowed out concrete balls that can be either purchased or made on site. See http://www.reefball.org/ for more details. Reef ball construction can be accomplished by volunteers as a method for engaging the community.

[26] Excessive nitrogen increases the risk of invasive species such as Phragmites australis taking over native vegetation.

may prevent wetlands grass species from successfully establishing or returning subsequent seasons[27].

In this design park visitors will be able to see these wetlands and their emerging habitat from the *floating boardwalks* that will wind thru the floating wetlands. The neighboring schools will be able to utilize the floating wetlands as part of their curriculum.

[27] Conference, Healthy Harbor Initiative, December 14, 2011, coordinator of Living Classrooms, contributes the need to replant native aquatic grasses yearly in wetlands at Living Classrooms Foundation, on pollutant loads within harbor water.

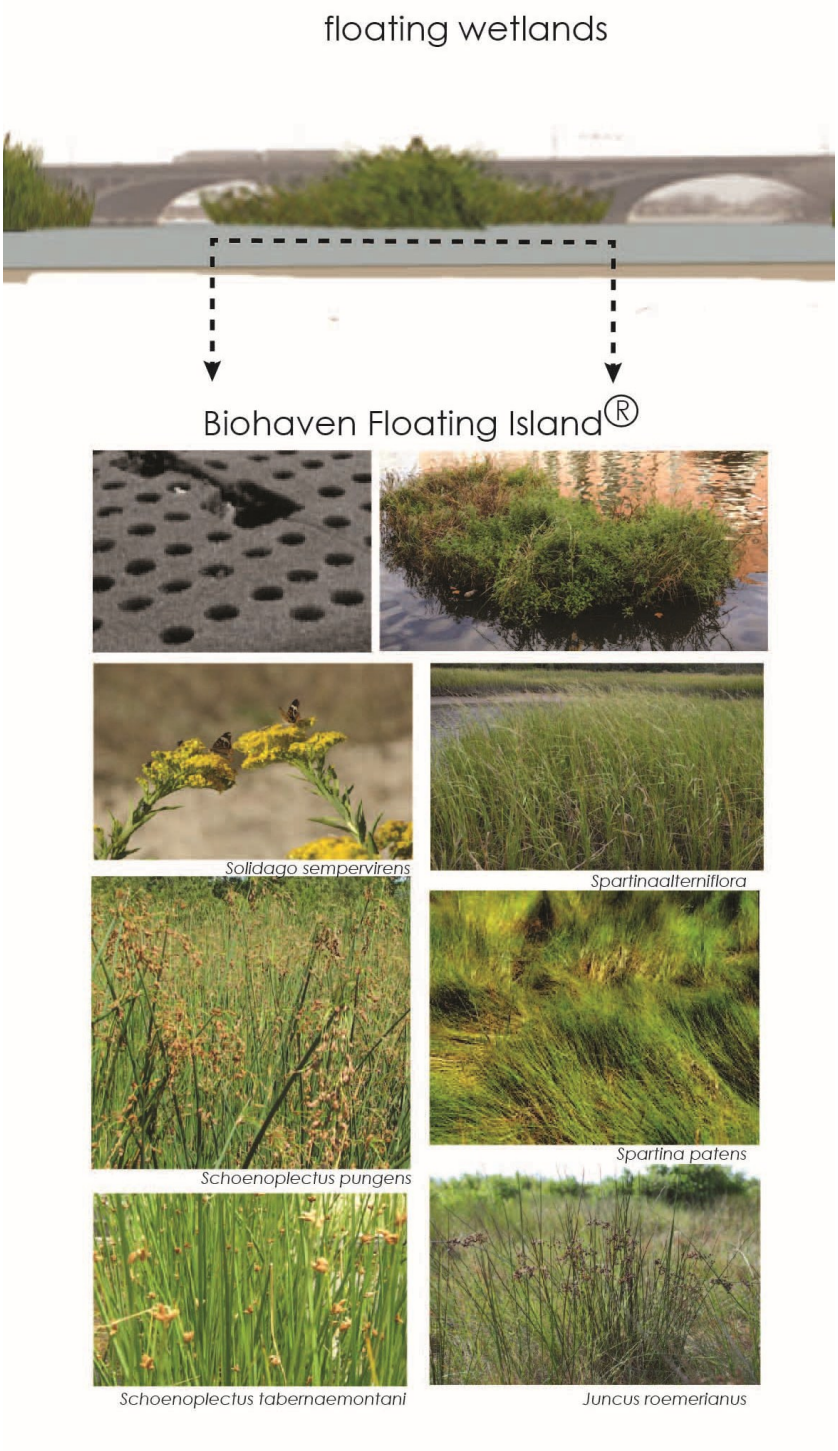

Fig 6-10. Illustrate floating wetlands installed along Middle Branch. Photos within Figure, top row left foam Biohaven™ matrix with hollow cores for plant material; top right photo island successful installed in Inner Harbor; images of native plant material that showed successful growth in National Aquarium report for FWIs. Illustration by the author.

21 *Sidewalk rain gardens*

A series of sidewalk bio-retention areas will be installed along Waterview Avenue, see Figure 4-12. These bio-retention areas will filter run-off that travels down Waterview Avenue to storm drains located at the lower elevations along the roadway. Stormwater traveling along Waterview Avenue can incorporate particulates from the roadway, pollutants from vehicular traffic, and increase sedimentation within Middle Branch (CWP 2003), exacerbating the two focal points of sedimention along the shoreline previously discussed[28]. These rain gardens will be installed in tandem with a new sidewalk that will run the course of Middle Branch Park, connecting it to the existing sidewalk that begins in front of the Middle Branch Marina. The sidewalk will extend along the northern side of Waterview Avenue.

These bioretention areas, will not only serve the purpose of ameliorating the effects of stormwater run-off but create a aesthetically pleasing visual link to the park grounds. In tandem with the new sidewalk alignment (described herein, later in this Chapter) pedestrians approaching the park will be pulled away from the traffic on Waterview Avenue and brought physically closer to the park. Random signage describing the purpose of the rain gardens will help educate local residents and the general public about stormwater, and will become part of the educational trail linking the schools and community to the

[28] Two major places of sedimentation where discussed in Chapter 4, one adjacent Middle Branch Marina and the other at Smith Cove.

park (described herein, later in this Chapter).

Figure 6- 11. Shows bioretention rain gardens along Waterview Avenue. Illustration by the author.

22 *Reforested upland buffer*

Figure 6- 12. Representative sampling of pioneer native upland tree species used for reforesting the upland buffer. These species grow quickly, curb erosion, and can compete with invasive species such as *Ailanthus altissima*. The evergreen, *Pinus virigniana* will provide winter cover for the large amount of migratory birds in the area. Illustration by the author.

A previously clear-cut area (discussed in Chapter 4) to the south of Waterview Ave and directly above the Middle Branch Marina will be reforested

with fast growing trees and shrubs as well as slower growing hardwoods, to create a successional forest. Liriodendron tulipifera, Celtis occidentalis, see Fig. 4-13 and varieties of sumac will be planted to create immediate bank stabilization. Evergreen tree species, such Pinus virginiana (shown Figure 5-13) and Ilex opaca will also be planted as winter cover for migratory birds that inhabit the Middle Branch (USACE 2008).

A handicap accessible, *community- educational trail* will be incorporated within the reforestation area. This educational trail will give the Cherry Hill community greater additional accessibility to the waterfront park, and more scenic delivery to the park. An overlook will be established at the higher elevation of the upland area, that will maintain views to the city skyline (Figure 5-14), as well as the Middle Branch. The view from this overlook is framed by a tree canopy and therefore offers a unique vista of Baltimore: a combination of tree foliage, water, and city skyline.

In the context of future development, it is recommended that this *Reforested upland buffer* area be established as a protected area for two reasons. First the area affords a large section of forested tree canopy for upland species, which is not readily available elsewhere within Cherry Hill. Secondly, protection of the area affords public access, to a place that could easily become private. In the author's opinion the public views of the water are fundamental to public awareness of the function of water in the landscape,

therefore the views should not become only for those that can afford waterfront property.

Figure 6- 13. Photo showing possible views of water from educational-trail and or overlook. Photos by author.

14 *Washboard beach*

In the new design the parking lot at the northeast entrance to the park, between the Vietnam Memorial and the Harbor Hospital has been redesigned to include a 'wash board beach'. Currently, the parking lot is mainly used for boat launch parking and occasional tail gating. The author observed people on more than one occasion sitting next to their cars in lawn chairs watching the water. Due to the relocation of the boat launch to the park parking lot south of the Harbor Hospital, the parking lot adjacent to the current location of the boat launch, is a prime location to create a more aesthetic place, give park visitors a view of the water from something other than a parking lot, and prevent run-off from the parking lot directly washing into the Middle Branch. Hence, a 'wash board beach' has been designed. The beach consists of alternating strips of planted vegetation and permeable paving.

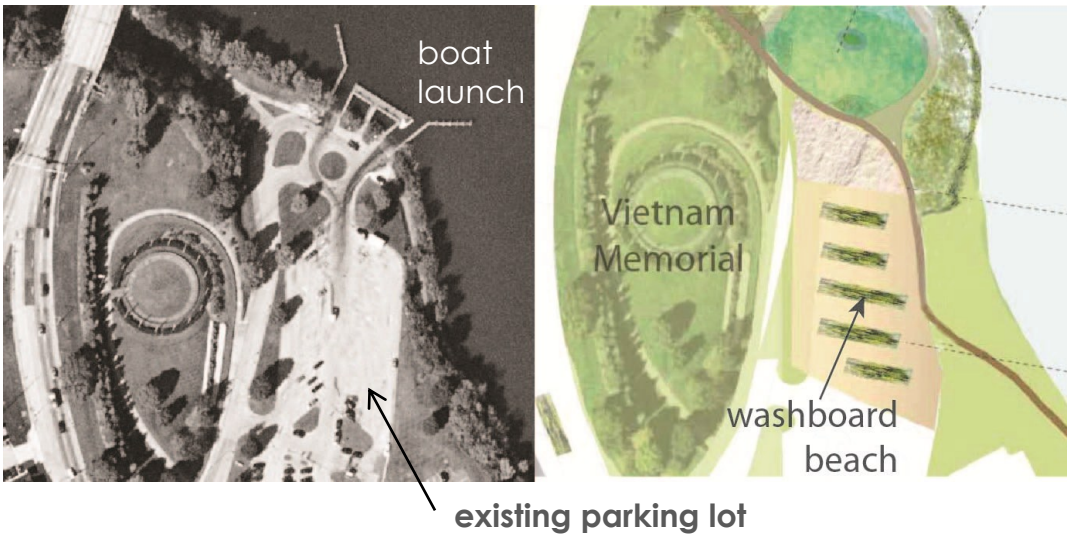

Figure 6-14. Image on left shows aerial of existing conditions. Illustration on right, shows proposed changes. Image and illustration courtesy of author.

Ample space is provided for cars to park and tail gate at the upper tiers of the 'beach' (see Figure 6-7 Section Illustration). More importantly the space is designed so that individuals can enjoy the new space without a car.

Stormwater running off the adjacent parking lots will be collected and cleaned before it enters the Patapsco River. Stormwater will pass through the permeable paving and also be collected within the bioretention swales. These swales will be planted with native grasses that will clean and infiltrate the water, see Figure 6- 15b.

The washboard park will also create a visual connection to the *sand beach* adjacent the *natural swimming pool*. The new space serves as a improved gathering space for the park visitors and the neighborhood residents, that replaces an asphalt parking lot with a more aesthetic place, Figure 6- 16 and dually serves as a functioning critical buffer. The name alone, 'washboard beach,' notifies visitors as to the processes at work. Additional signage could accompany the design feature, explaining the purpose of the grass bio-retention strips within the beach, explaining to park patrons the importance of the plant material in cleaning the stormwater.

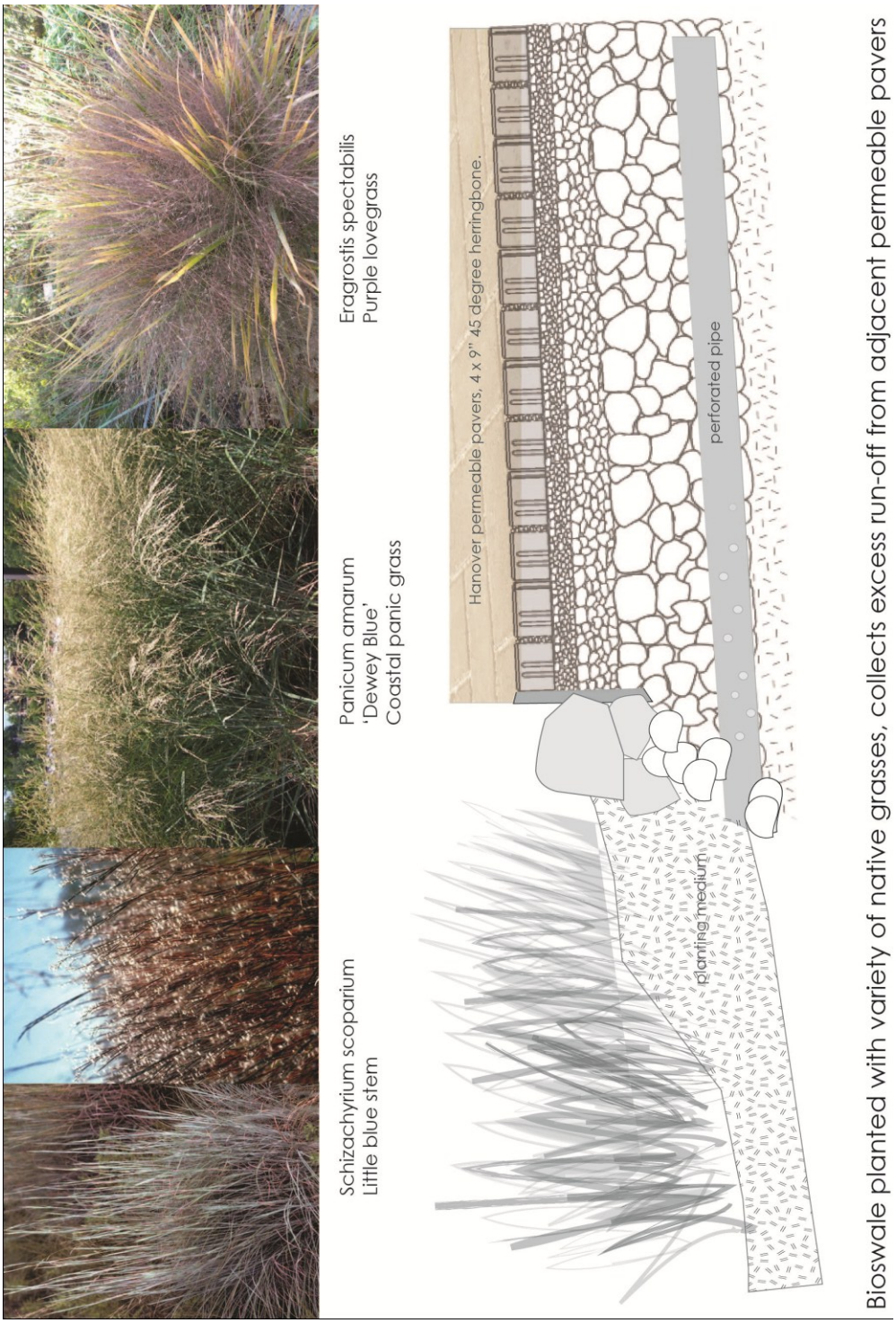

Figure 6-15. Shows a detailed cross-section of the bioswales of the'washboard' beach. Native grasses are used to absorb and purify stormwater run-off from adjacent parking lot. Illustration by the author.

Figure 6- 16. Shows conceptual perspective 'washboard' beach. Illustration by the author.

5 6 *Floating boardwalks and overlooks*

As means to enable park pedestrians access to the waterfront, floating boardwalks have been designed to weave access through the length of the Middle Branch shoreline. The floating boardwalks extend from approximately the Middle Branch Marina to the Hanover Street Bridge. As the boardwalks meander thru the shoreline they connect with the raised boardwalk within the park.

Overlooks within of the boardwalk are incorporated in the design to create areas where park visitors can linger and engage in the surroundings. These areas also will serve as educational places for monitoring water quality and habitat by the local schools. Floating overlooks are proposed to be constructed from a Profloat dock system®, which consist of concrete poured into the floating forms[29]. This system can be constructed into a variety of shapes, and provides a very sturdy platform that can host a variety of activities.

Figure 6- 17. Illustrates conceptual section of floating overlooks and boardwalks, as well as construction materials and detail. All overlooks and boardwalks would have safety railings. Illustration by the author.

[29] Profloat dock system® is manufactured by a Baltimore owned company.

Different methods of building floating boardwalks and piers were investigated for this thesis. Stationary piers were decided to be outdated. Newer construction of piers within the area our generally floating piers due to damages suffered by storm surges by extreme hurricanes in last decade. Floating piers can be constructed to allow for storm surges of 15'. Increasing sea level rise is also a factor considered in construction of boardwalks and piers in the Chesapeake Bay.

For this thesis design, the possibility of moving the piers with an emerging shoreline was considered. Designs for floating boardwalks that were not entirely bound to piers, were considered and chosen. Pile driving of piers was also considered non-advantageous due to the nature of the bottom of Middle Branch, as there is evidence of heavy metal sedimentation (USACE 2008). Two possible alternatives were considered, large helical anchors that are used in ocean moorings, require less bottom disturbance and reef balls. Reef balls in combination with floating boardwalks are depicted in the following, Figure 5-19. Reef balls could be used in tandems with the other methods, described herein, to reduce the installation costs and provide habitat.

Figure 6- 18. Shows a conceptual drawing of the construction of the floating boardwalk. Illustration by the author.

3 *Boat Access*

Three boat access points will be maintained within the park redesign. The current boat launch that is maintained by the Baltimore Rowing Club will be kept in approximately the same location directly in front of the Rowing Club, as

this is necessary for the loading and unloading of boats from the storage facility within the boathouse.

The washing area will be redesigned, to prevent detergent from the washing of the boats directly entering the Middle Branch. To do this the asphalt area in front of the boathouse with be replaced with permeable paving which will be under-drained to infiltration areas flanking both sides of this circular paved area.

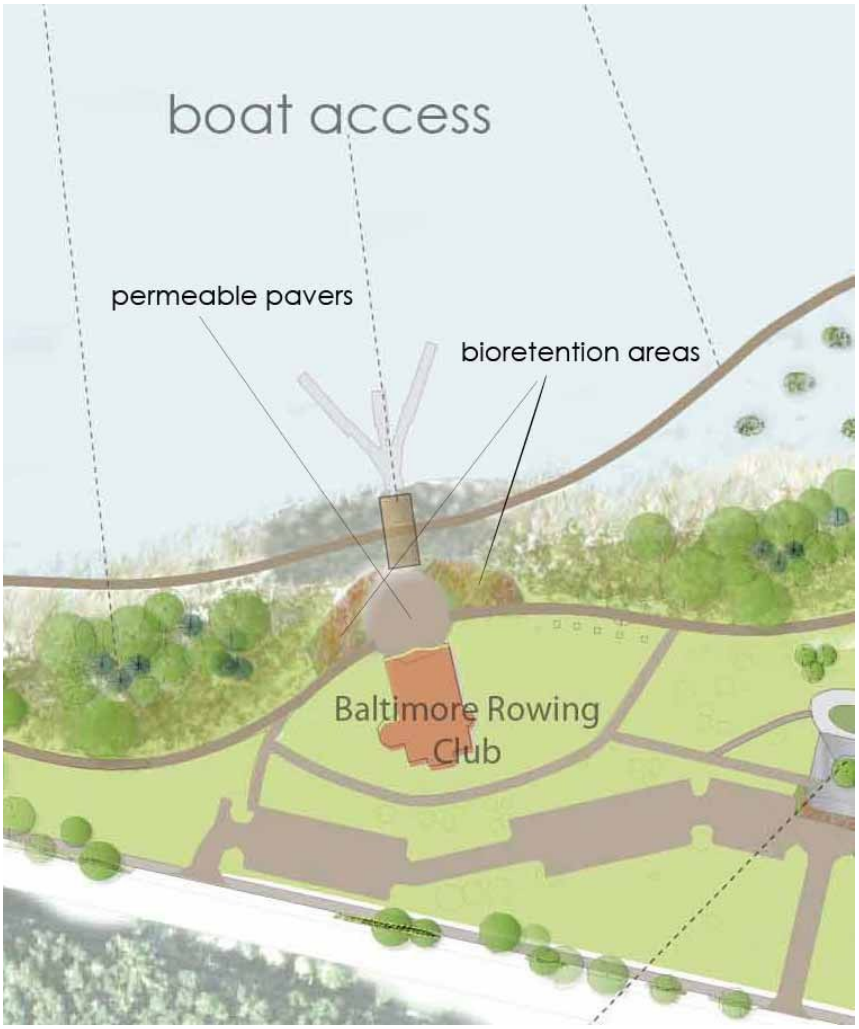

Figure 6- 19. Master plan enlargement showing improvements to area around rowing club. Illustration by the author.

The shoreline adjacent to the boat house will be regraded and structurally stabilized to prevent further erosion. The floating docks and boat viewing area will connect to the floating boardwalk and the raised- on shore trail that continues, as the Gwynn Falls trail, through lower shoreline portions of the park.

The boat access ramp, that is currently housed at the base of the northeast parking lot at Harbor Hospital will be removed and incorporated as part of the *natural swimming pool* and *sand beach* feature of the park. The new boat ramp will be added to the southeast parking lot, below Harbor Hospital and replace the existing and degrading concrete fishing platform. By relocating this boat access, an exploratory loop is created where kayakers can have several places to get out and launch, 1) access, just described, at the Baltimore Rowing Club, 2) at the Westport Development, and 3) south of the Harbor Hospital (see Figure 5-15). Trailered boats will only have access at the new south access boat launch, below Harbor Hospital.

Figure 6- 20. Shows master plan in relation to proposed development with possible boat access connections. Blue dots represent boat launch points and dotted line connections. Illustration by the author.

15 *Health trail*

Extending from the grounds of Harbor Hospital to the natural swimming pool is the health trail see Figure 6-22 . The path encourages hospital staff and patients to engage in the waterfront park. Along the trail, native plants are identified as to their health benefits or medical uses in the past and present, see Figure 6-23.

Figure 6- 21. Shows the location of the health trail in the master plan. It connects the Harbor Hospital with ADA accessible natural swimming pool. Illustration by the author.

Black Willow *Salix Nigra, contains aspirin-like chemicals. It has been used to medically for the following:*

* rheumatoid arthritis
* fevers
* headaches
* thinning the blood
* acne

Figure 6- 22. Shows an existing willow tree adjacent the Harbor Hospital. Signage for native, existing and proposed that has medicinal properties will be given signage. Illustration by the author.

By redeveloping the grounds around the Harbor Hospital to unify them within the landscape of Middle Branch Park, the hospital grounds will feel more like an extension, rather than a bisection of the park grounds.

10 *Natural swimming pool*

The natural swimming pool (NSP) will be constructed within the current area of the boat launch and fishing piers, adjacent to the Vietnam Memorial Park and to the east of the Hanover Street Bridge. An exterior wall will be constructed to house the NSP and divide the pool waters of the Middle Branch. The exterior wall of the pool will have a glass section, allowing patrons to see a clear differentiation in water clarity: 'naturally' filtered water of the pool and the less filtered waters of the Middle Branch and Patapsco River. The 'naturally' filtered water will be cleansed by an intensified *water filtration zone* along the banks adjacent the Hanover Street Bridge, using standard methods for natural swimming pools. More or less the same methods of plant material filtering water will be practiced within the floating wetlands, but a different scale. The public will be able to see this differentiation and scale while visiting the park; and understand the hydrological processes at work via signage and educational programming within the park.

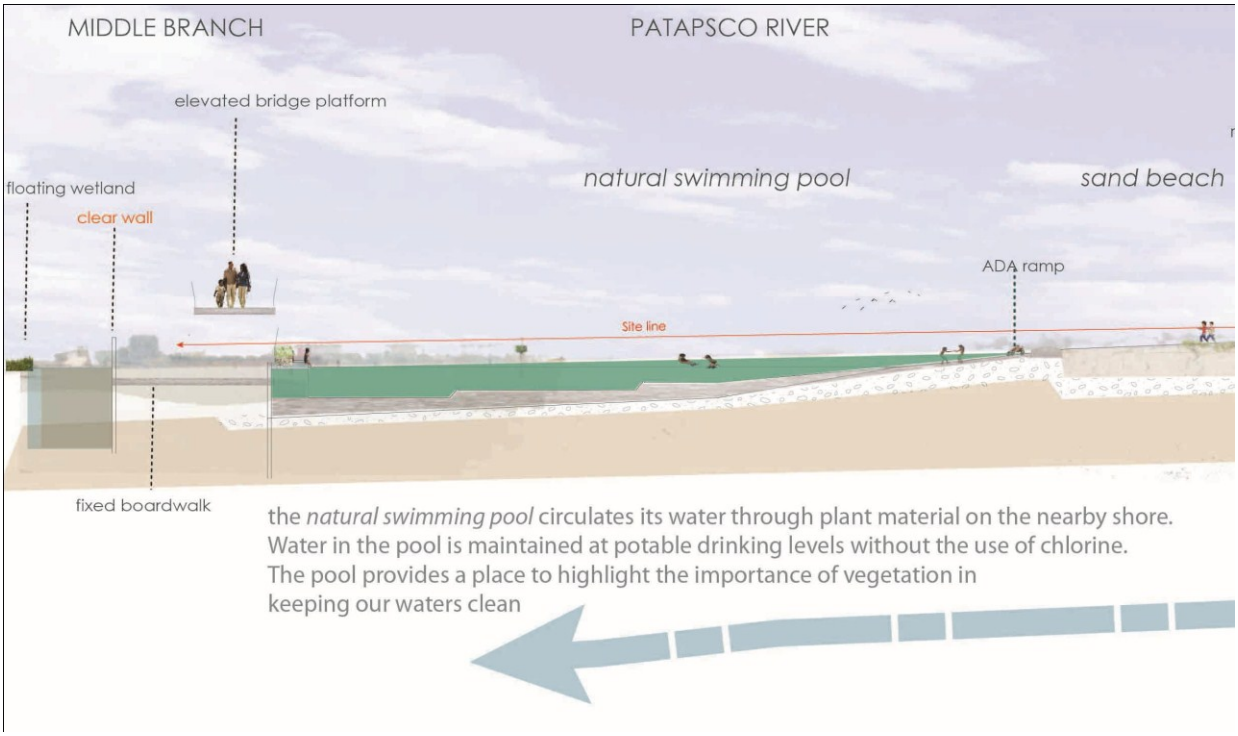

Figure 6- 23. Shows ADA accessible natural swimming pool. Illustration by the author.

In brief, water is filtered and pumped via solar powered pumps through emergent and non-emergent plant material. Nutrients are 'naturally' extracted from the water before it enters the pool. Water in an NSP can be maintained as potable water, and is cleaner than the water in most public swimming pools using chlorine.

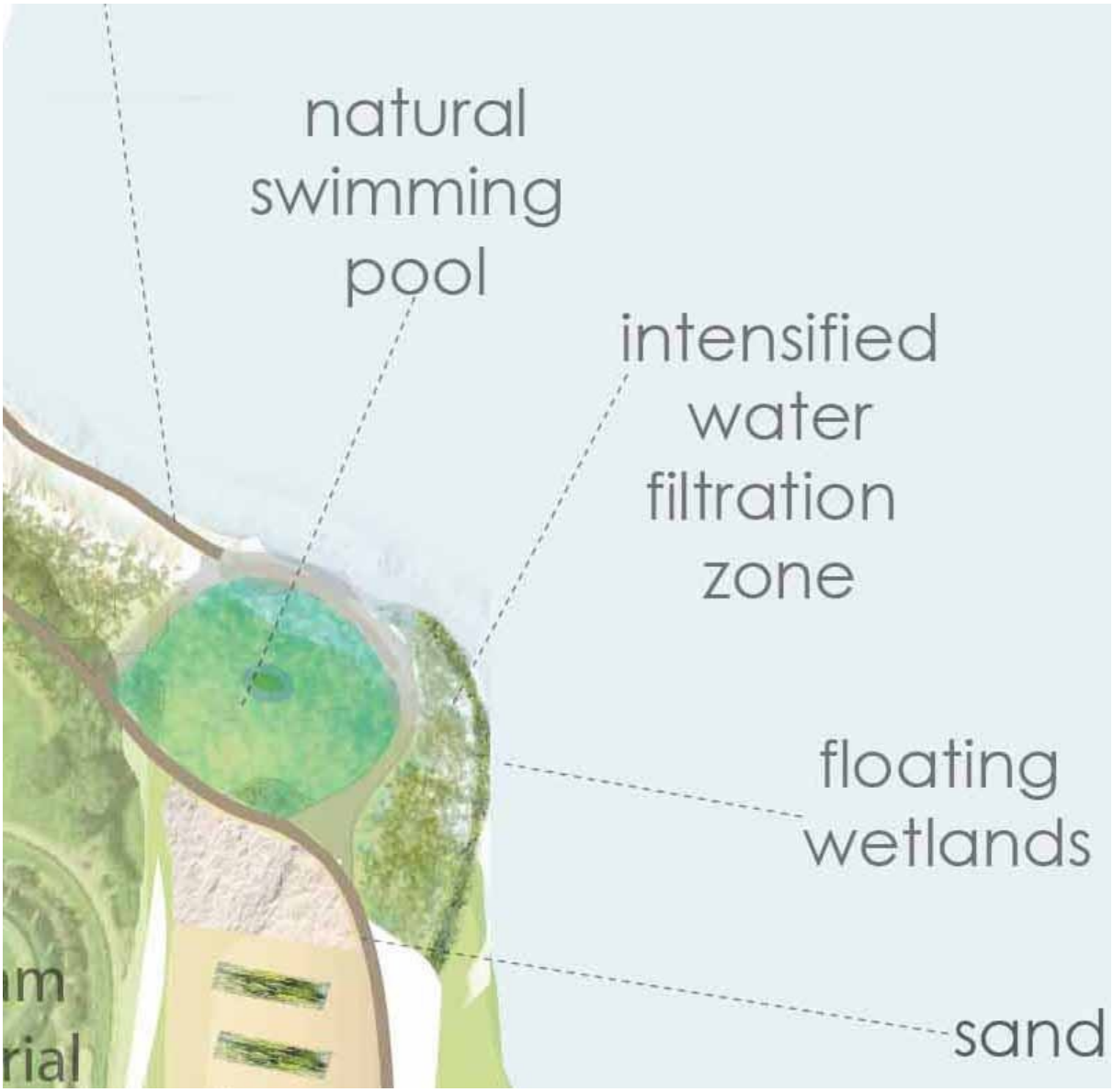

Figure 6- 24. Shows master plan enlargement of natural swimming pool. Illustration by the author.

The NSP will be handicap accessible with a paved access ramp, similar to the existing boat launch. The dividing wall of the swimming pool will also act a large promenade that will extend beneath the Hanover Street Bridge, before connecting back to the shoreline.

Figure 6- 25. Early conceptual perspective of natural swimming pool. Image does not reflect glass wall or elevated and sunken walk. Illustration by the author.

13 *Sand beach*

A sand beach will be installed at the end of the washboard beach and will act as a visual transition zone to the NSP. This feature is mostly an aesthetic feature. It will have the ability to filter stormwater, but will not be connected to the floodplain, therefore it will not have the capabilities to serve as a natural tidal beach.

16 *Park and community center*

At the intersection of Potee Street and Hanover Street are an underutilized median strip and a check-cashing center with a sizeable parking lot. It is

proposed that this be recreated as a community center for the park. The reconfiguration of this median area would create an entrance point from the Hanover Street Bridge and could be beautified to not only signal the Middle Branch Park entrance, but a welcoming to Cherry Hill Park community. This glorified entry to the park and Cherry Hill could facilitate the community to take pride as stewards to Middle Branch Park. This area also is designed to house a more prominent crosswalk from Waterview Avenue to the Vietnam Memorial and East side entrance to Middle Branch Park, as previously mentioned.

18 *Terraced view and lounge*

The *terraced view and lounge* can best be visualized in Figure 5-6, Section 3. This feature acts as a main entrance point to the park, and connects it to the newly designed crosswalk (described later is this chapter) from Southside and New Era Academy. The *terraced view and lounge* is designed to create a handicap accessible entrance to the park that gives patrons the opportunity to meander into the park following a serpentine path. The serpentine path is used again in this design feature, to symbolize the path of water in the landscape and to address the issue of grade change so that ADA accessibility to the park

from the school can exist where currently cannot.

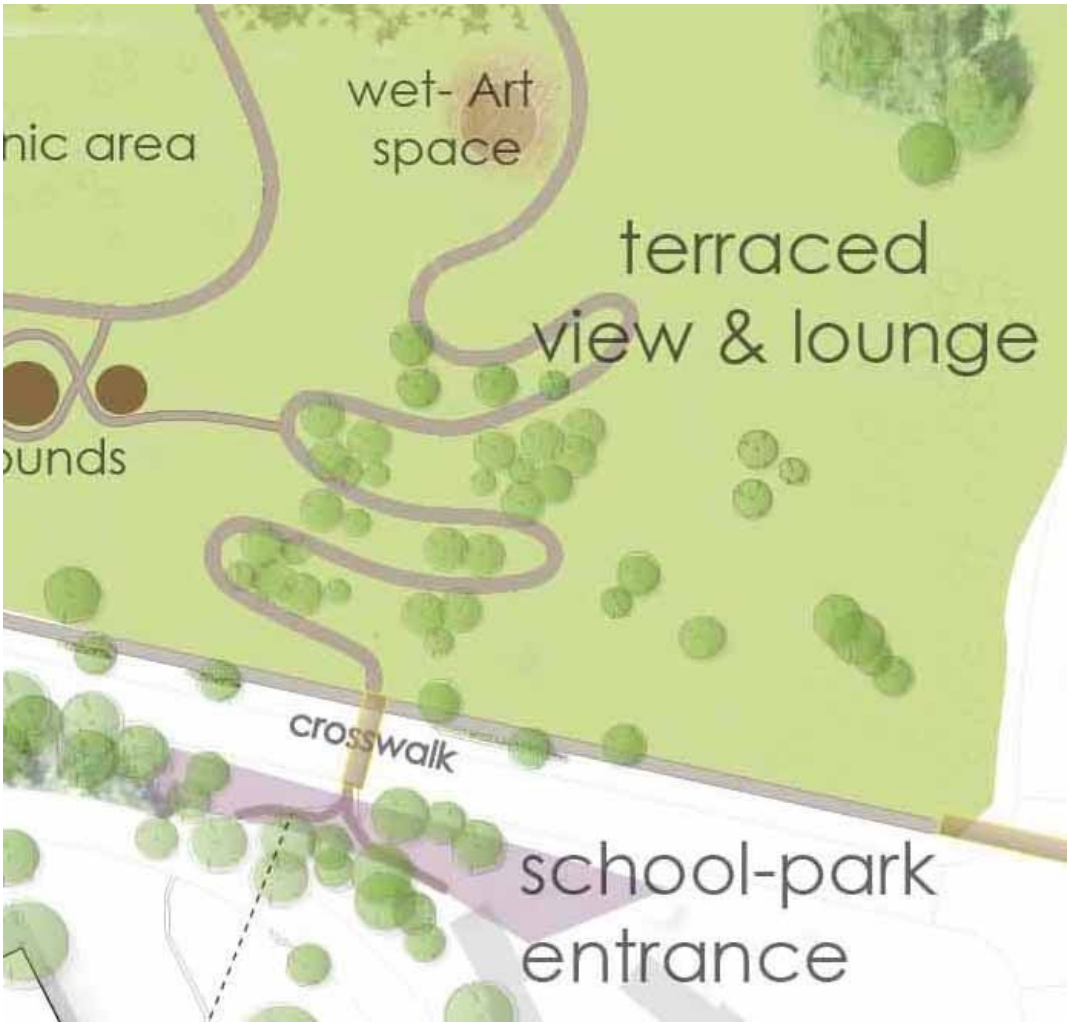

Figure 6- 26. Enlargement from masterplan of terraced view and lounge. Illustration by the author.

Low, terraced walls cut into the landscape and act as retained planting beds for trees and shrubs as well as seating walls for park patrons. The new terracing and planting beds absorb direct stormwater and do not create any impervious surfaces within their design. The planting scheme consists primarily of Nyssa sylvatica and Cornus alternifolia for trees, and primarily Rhus aromatic 'low

grow' and Arctotaphylus uva-ursi as shrub cover. The plantings are placed within the terraces to maintain views down through the center of the terracing, which is represented in Figure 5-28 as the red line thru the section image.

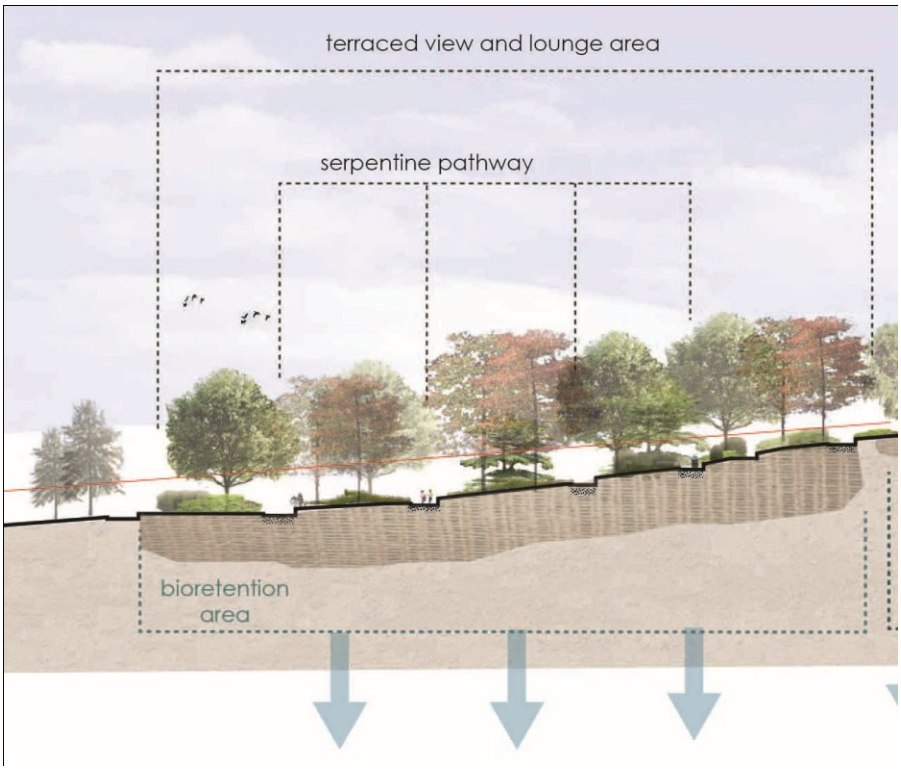

Figure 6- 27. Enlarged section view of terraced view and lounge. Illustration by the author.

It is proposed that concrete removed from the shoreline as part of the site preparation for the establishment of the emergent shoreline , be reutilized for creating the walls of the terracing. The *terraced view* path, like all of the new hardscaping within the park design is constructed from permeable paving, see Figure 6-29.

Figure 6- 28. Conceptual image of terraced walk, left. Concrete on existing shoreline used as rip-rap will be repurposed as seating-retaining walls within terraced walk and lounge. Illustration by the author.

7 *Wet-art space*

The *wet-art space* is a feature that connects the area of the *terraced view and lounge* with the raised trail of the park. This feature acts as a lingering point within a descent from the *terraced lounge* to the water's edge. The space provides a place for people to socialize. This area is designed with low concrete seating walls that take a curved shape. The low walls or benches disappear in and out of the ground plane, mimicking the way that water disappears into the ground only to become visible elsewhere in the landscape. The seating faces toward a center point within the space. Tall native grasses are used to frame the seating area.

Figure 6-29. Shows wet-art space, a gathering space the filters water to an ephemeral water feature and showcase environmentally oriented local artists. Illustration by the author.

The circular area is constructed of permeable paving with parts of the area collecting rain water which drains to a underground cistern in the center point. An underground fountain with a sunken water head is installed within the center of the space. The ephemeral fountain only functions when enough rain water has collected. The seating walls act as raised viewing platforms for local artist to display environmentally oriented work. The ephemeral qualities of water are expressed within this landscape space.

20 *Educational pavillions*

The educational pavilion, see Figure 5- 31, is located at the north end of the main parking lot. This location makes the pavilion easily accessible by school children brought to the park by bus. The space is handicap accessible as well.

Figure 6- 30. Master plan enlargement of education pavilion. Illustration by the author.

The design of the education pavilion is three-fold. First, the pavilion acts as space for teachers to instruct science-education classes. Secondly, features of the pavilion collect and clean stormwater run-off. Thirdly, the same features that collect and clean stormwater, act as educational tools that overtly visualize and indirectly draw attention to the processes at work for cleaning stormwater.

The pavilion is designed to be an open structure. Views of the surrounding environment are maintained. At the entrance of the pavilion, adjacent the parking lot is a rain garden approximately 10' by 50' that filters stormwater from the entrance drive. A roof overhang drains into this rain garden, demarcating the trail that crosses under the pavilion, creating a 'rain garden arcade'. The roof line continues on the other side of the trail to become part of the educational pavilion roof line that slopes inward to another infiltration area that sits in the center of the pavilion. This area is planted with three *Betula nigra* trees. The process of trees absorbing rainwater is visualized with this space. See Figure 5-32 for more detail. The metal roof of this pavilion also creates an auditory experience during rain events.

The floor of the pavilion extends 40 feet from the pavilion, creating a terrace that affords visitors a vista to the water over the tree canopy in the new riparian edge. In the center of the concrete floor of the terrace is an educational sunken green roof. Below this structure a trail runs beneath the roof line and allows patrons to see the layers and function of the green roof, through a 'cut-away' window. When visitors observe the green roof 'cut-way' they also pass over a stone slab that exposes the overflow of under-drain of the bioretention area. This tandem event experience of both the roof and the drain give park visitors a visualization of how water moves through our built and natural landscape.

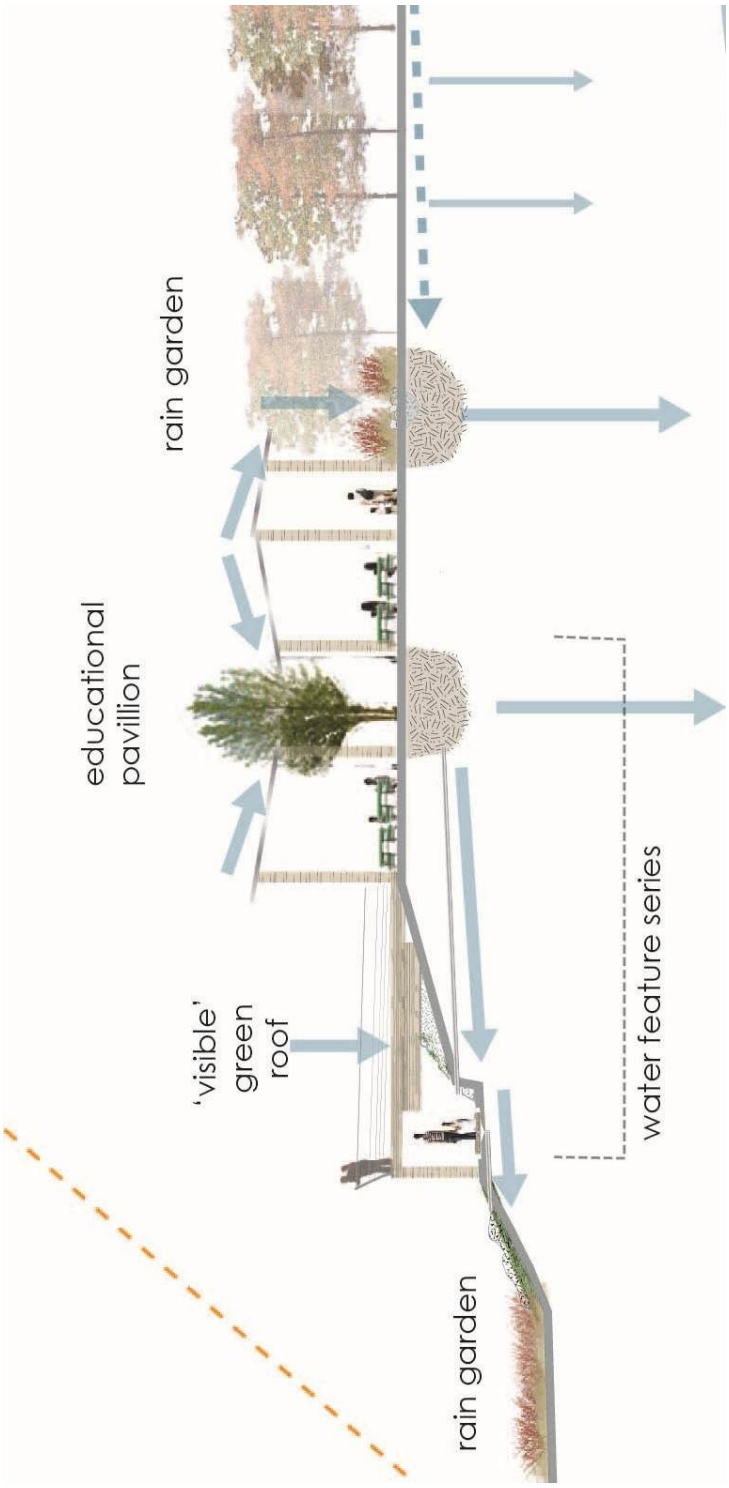

Figure 6-31. Shows the features of the visible hydrology in the education pavilion. Illustration by the author.

Green Streets

Supplemental to the master plan, a larger scale proposal is suggested for the neighborhood of Cherry Hill. It is proposed that a green streets program be created for the roadways shown in Figure 5-33. In analysis presented in Chapter 4, it was concluded that the excessive stormwater loading along Cherry Hill Road is most likely causing erosion and sedimentation along the shoreline of the Middle Branch at Smith Cove, and exacerbating poor water quality in the Middle Branch. The streets are redesigned to connect students to the park; community residents to the park and hospital; and ameliorate problems with the stormwater in the community.

It is proposed that a series of curb –cuts and bump-out bioretention areas be installed in key locations along Cherry Hill Road, Cherryland Road, Waterview Avenue, and Seamon Avenue. Signage and visual cues will be incorporated in the design to educate pedestrians. The series of bioretention gardens will provide a new 'pathway' to Middle Branch Park, as well as Cherry Hill Park. Areas along the northwestern section of Cherry Hill Road will also have sidewalks installed where they do not exist. Students at the five local schools and the general public will have an educational path to follow, highlighting the path of water in the landscape and directing them to the parks. In the context of the new development, discussed in Chapter 3, the additional connections to the park and pedestrian-friendly sidewalks will become a greater asset to the community of Cherry Hill.

Figure 6- 32. Shows master plan in context of green streets plan that manages stormwater, as well as connects people to the park while educating them about hydrology. Illustration by the author.

Sidewalk continuation

As previously described, sidewalks have been added along Waterview Avenue, removing pedestrians away from traffic and allowing pedestrian access along the entire length of the park that flanks Waterview Avenue. The new design of the sidewalk still connects directly to access points along the length of Gwynn Falls trail that currently circumvent the park currently. Tree

canopy over the sidewalk has been added in some locations to create shade and a more enjoyable walking experience, while maintaining views into the park.

17 19 *Park entrances/ crosswalks*

To better enhance the accessibility of the park, three crosswalks (see Figure 5-34) have been added to the park along the length of Waterview Ave, creating additional access points and encouraging neighborhood residents to walk to the park rather than drive to the park. The crosswalks are also used as methods to slow traffic along Waterview Ave and to divert stormwater run-off that travels down the slope of Waterview Avenue towards the intersection of Cherry Hill Road and Waterview Avenue, during heavy rainfall events. Crosswalks contain permeable paving rumble strips, with underground runnel channels, that channel water to rain gardens that have been incorporated into the beautification of the new sidewalks along the length of Waterview Avenue. An enlargement of Section 4 shows this detail, below.

Figure 6- 33. Shows new connections to the park, highlighted in with orange circles. Illustration by the author.

23 *Community education trail*

The community education trail, briefly described previously in this chapter, traverses the upland buffer and begins at the southwest corner of Seamon Road, behind Anne Arundel Elementary Middle. The trail will become an integrated part of the science and physical education program within the school. The trail will be handicap accessible, and will vary from 6-10' wide. Educational information regarding the emerging vegetation and the wildlife along the trail will be made accessible by signage. In order to maneuver the steep grade through the site, the trail will be laid out in a switch back formation, 'design experiences' along the trail will place the visitor, in an experience of understanding how water carves and flows across the land. As previously described an overlook will be established at the higher elevation above,

Waterview Avenue which affords an excellent view of the Middle Branch Basin and Baltimore city skyline to the residents and school children of the Cherry Hill community, as well as the general public.

5 CONCLUSIONS

This design thesis sets out to address problems of water quality in the waterfront park redesign of Middle Branch Park. The park although in the critical area, lacks the ability to function as a critical buffer to the Middle Branch waterway, given issues of erosion, trash, loss or lack of vegetation, and poor stormwater design. Furthermore, the park due to topographical and design challenges does not function as a full asset to the community.

Due to its prime location the park has the ability to become model of watershed stewardship, by connecting the community, area schools, and the general public to a redesigned park that highlights watershed stewardship, and the intersection of the water-landscape herein referred to as the *orilla*. The park links together overt, educational elements such as the 'peek-in' green roof within the educational pavilion and 'see-thru' glass walls at the natural swimming pool to subtle design features like trash partitions at the end of the raised trail, over the newly repaired stream or the meandering pathways that follows the course of water in the landscape. The park acts as a connecting layer between educational and health institutions within the community of Cherry Hill, with design elements like the natural swimming pool at the end of the health trail. The park acts as a connecting layer between community, environmental health, and education; with design elements such as a wet-art space which gives the park visitors a place to mingle among environmentally-oriented art and an ephemeral fountain. Lastly, the new park design connects

community, education, health, and ecology in the true *orilla*. In this newly defined public *orilla*, are emerging shorelines, floating wetlands, overlooks, and boardwalks which give everyone a place to communicate, connect, and become aware of their place within the *orilla*: their part in the water-landscape .

Richard Marshall wrote that in cities 'one tends to think of land/water relationships in terms of opposites, or the edge between the two' (2001). To cease the existence of this duality was the primary goals of this thesis. By merging water and land and people in the same space, a place was created for public awareness and stewardship of the water to develop along with the new shoreline. Within this redesign of the orilla , where water flows across the land, people learn to take care of the environment while nature heals itself.

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If you could tomorrow morning make water clean in the world, you would have done, in one fell swoop, the best thing you could have done for improving human health by improving environmental qualtity.
William C. Clark[30]

[30] William Clark is the Harvey Brooks Professor of International Science, Public Policy and Human Development at Harvard University's John F. Kennedy School of Government.

APPENDIX: BACKGROUND AND RESEARCH REPORTS

EXISTING MASTERPLAN FOR MIDDLE BRANCH

Middle Branch Park has an existing master plan[31], designed as part of a master plan for the entire Middle Branch waterway (Baltimore City Planning Commission, 2007). This section will briefly summarize the key components of the 2007 master plan that are similar in topic to the proposed re-design of Middle Branch Park. Similarities exist between the existing master plan the proposed master plan by the author. The major similarity is accessibility to the waterfront and issues of water quality of the Middle Branch. The author did not intentionally decide to align the new proposed master plan with the existing goals of the current master plan, but from site analysis concluded the need for some of the same goals, as the current master plan.

Within this section *master plan* only refers to the 2007 master plan of Middle Branch (area) it does not refer the proposed re-design of Middle Branch Park by the author. The boundary of the 2007 master plan is shown in the following Figure 3-1. The master plan is divided into seven topic areas, 1) Water Quality and Habitat, 2) Open Space and Recreation, 3) Design and Development, 4)Transportation, 5)Heritage and Tourism, 6)Sustainable Communities, 7)Management and Maintenance.

[31] The full version of the master plan is available on Baltimore City's Department of Planning Website.
http://www.baltimorecity.gov/Portals/0/agencies/planning/public%20downloads/Full%20Document-Middle%20Branch%20Master%20Plan.pdf

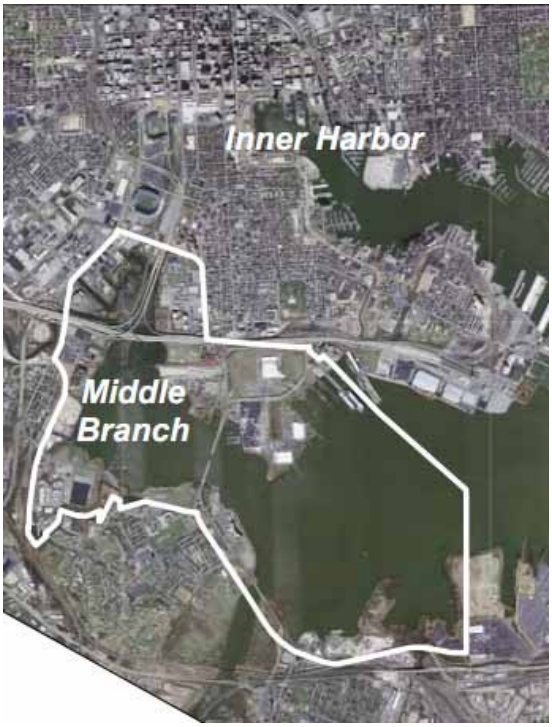

Figure A-1. Shows the boundary of the Middle Branch Master Plan, in white (Commission, Middle Branch Master Plan Sept 2007).

In retrospect, the goals of sub-sections 'Water Quality and Habitat', as well as 'Open Space and Recreation' have the most similarity to the proposed re-design. The goals of these two topic areas will be discussed herein. The guiding principles of Water Quality and Habitat are: 1) Restore degraded habitat for marine and upland species 2) Improve water quality to fishable and swimmable levels by 2020. The guiding principles for Open Space and Recreation are: 1) Ensure public access along the waterfront, 2) Increase environmental education opportunities, 3) Create a continuous open space system 4) Protect and enhance natural resources and 5) Create unique recreational opportunities.

The overall vision encompassing Water Quality and Habitat, created the following recommendations.

1) Create a comprehensive monitoring program that includes an education component
2) Manage floating debris
3) Incorporate Advanced Stormwater Techniques.
4) Restore Habitat Areas
5) Enforce environmental regulation
6) Create new tidal marshes

The overall vision encompassing Open Space and Recreation created the following recommendations.

1) To possibly expand the current rowing center
2) Create friends group for Middle Branch and Reed Park
3) Implement the USACE Tidal Middle Branch Project
4) Create a task group to determine the location and expansion of water based recreational facilities
5) Create a new comprehensive recreational path system that links existing and new communities, the waterfront, downtown, Mason Cove, and the Gwynn Falls

The topics and recommendations of Water Quality and Habitat, as well as Open Space and Recreation resemble many of the aspects of programming

presented by the author's redesign. Later in this thesis the author will briefly discuss the similarities and contrast from the proposed new-design and the existing master plan.

A U.S. Army Corps of Engineers Feasibility Report and Integrated Tidal Middle Branch Project was referenced within the Middle Branch master plan. A feasibility plan was completed in 2008, estimating engineering and construction costs of approximately 4 million dollars. The habitat improvement to cost ratio, was concluded to be unfavorable and too costly. Geotechnical and aquatic considerations mentioned in the feasibility report are discussed in regards to design decisions made by the author in the re-design of Middle Branch Park.

BIOHABITATS AND NATIONAL AQUARIUM FLOATING WETLANDS

Figure A-2. Floating wetlands sponsored and maintained by the National Aquarium. Photos by the author.

Two different types of Floating Wetlands Islands (FWIs) were installed in Baltimore's Inner Harbor in August 2010 (MDE 2011). The National Aquarium sponsored the placement of a Biohaven® Floating Island measuring 200 ft^2 . This was designed by BlueWing Environmental Services LLC and installed by Patriot Land and Wildlife Management[32]. The Waterfront Partnership sponsored Biohabitats and Living Classrooms to design and construct several wetlands that in total created approximately 195 ft^2 of wetland divided into 10 separate wetlands (MDE 2011).

The Floating Wetland Islands were installed by the National Aquarium (NA) and the Waterfront Partnership (WP) are different in their construction material. The NA, FWIs were constructed from manufactured Biohaven® Floating Island matrix[33]. The matrix in these islands is a black plastic mesh manufactured from recycled PET water bottles[34]. This plastic mesh resembles the kitchen scrubber that many of use to wash pots and pans. These large plastic 'sponges' have uniformly cored holes throughout the matrix. Some of the holes are filled with marine foam and others left open for plant material. Once planted, the root system of the aquatic plants quickly fills the FWIs. The roots of the plant material add additional available surface volume for biofilm to adhere to, increasing the ability of the FWI to cleanse the water column.

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[32] This information was learned from conversations with respective companies, Kevin Hedge and Ted Gattino owner and partner of Blue Wing Environmental Service LLC, as well as Joe Brown- owner of Patriot Fish and Wildlife Management and an engineer at Biohabitats, Inc.
[33] Conversation with Joe Brown, owner of Patriot Fish and Wildlife Management, LLC.
[34] See the following website for more product information.
http://www.floatingislandinternational.com/products/biohaven-technology/

In contrast, to the FWI installed by NA, the WP installed 7 smaller FWIs that were constructed by students and volunteers. The report from the Maryland Department of the Environment (MDE 2011)was conducted to compare the functionality of the FWIs installed in the Inner Harbor (MDE, 2011). Six different plant species in total were employed to colonize the FWIs, Spartina alterniflora, Spartina patens (WP only), Hibiscus moscheutos, Solidago sempervrirens (NA only), Schoenoplectus tabernaemontani, and Schoenoplectus pungens. Spartina alternifolia showed to the most robust of the species planted, spreading vigorously and showing flowering and seed production on both FWIs. The only plant that did fair well was the Hibiscus moscheutos. The FWIs of the WP also recruited volunteer plants of the species Poygonum pensylvanicum abundantly. The NA FWI saw an abundance of the native mussel species, Mytilopsis leucophaeata. Assumed concentrations on the FWI were calculated to be a total of 500,000 mussels (MDE, 2011). These benthic species are estimated to filter 30ml of water/ hour. It was further calculated as probable that increasing the amount of surface area of these FTWs in the Inner Harbor could filter the entire harbor every few days (MDE 2011).

Floating island wetlands can provide many of the ecological services that natural wetlands provide (LePage 2011). However, they offer unique opportunities to provide wetland functions in places that are unsuitable for constructing natural wetlands, for example a bulk-headed Inner Harbor (LePage 2011). Furthermore, the ability of the FWIs to float in the water column allows

aquatic grasses as well as benthic organisms a more 'controlled' environment[35]. In natural conditions, especially degraded conditions, impacted by sedimentation, turbidity, and low water clarity these FWIs suspension height can be optimized in the water column to help circumvent the challenges of these degraded systems.

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[35] Personal communication with Joe Brown, owner of Patriot Fish and Wildlife.

7 RESOURCES

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