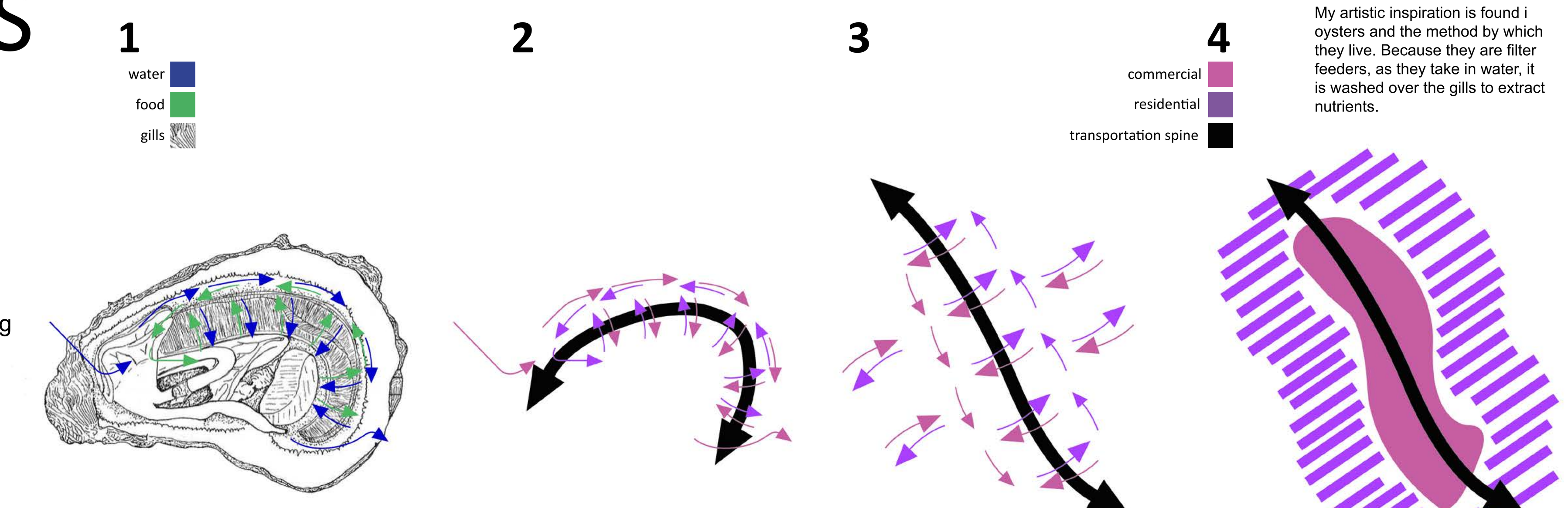
THE URBAN OYSTER FILTER A STORMWATER SOLUTION FOR PARK HEIGHTS

Using the living and breathing aspects of oyster gills, the design remediates urban runoff within the Central Park Heights Neighborhood and reinvigorates the community.

Much like how the oyster feeds and breathes, this site will breath through it's filtering spine in the center of the Central Park Heights neighborhood. The ecologically functioning portion of the site brings water in and passes it over the "gills" of the site through a series of bioretention beds. These will allow water collected on site to pass through a natural filter and either be used by people or returned to the natural processes of the water cycle. Additionally, the design works the idea of oyster gills by placing the important, nutrient absorbing properties in the center - this is the commercial district - and the nutrient using programs on the outskirts - residential. By using these two interpretations of concept, this design seeks to be environmentally beneficial and socially important. Central Park Heights will be a unique example neighborhood of stormwater management for Baltimore, and the United States.

CONCEPT DIAGRAM



My artistic inspiration is found i oysters and the method by which they live. Because they are filter feeders, as they take in water, it is washed over the gills to extract nutrients.

This plan illustrates the organizational pattern of the central transportation spine and the bio retention basins.

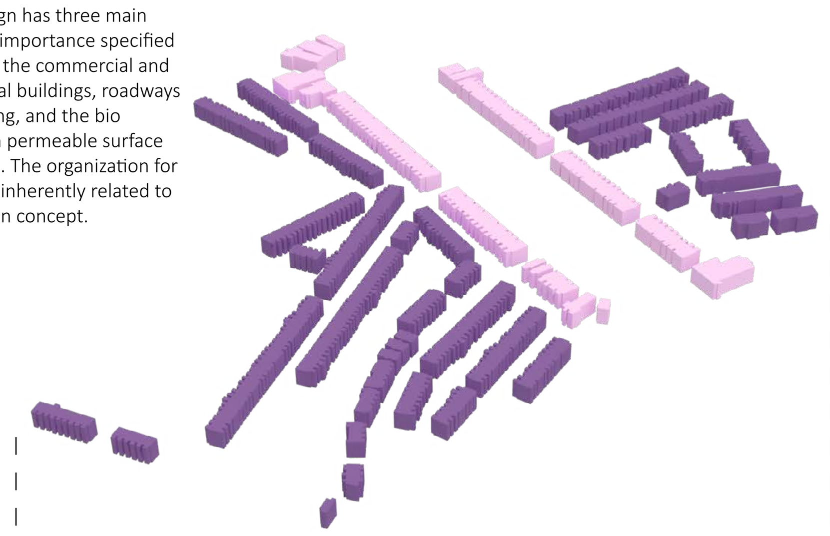
Stormwater is important because it relates to the integrity of the nation's stormwater goals. This can be viewed in a biological sense, physical, and chemical (National Research Council 2008). Some of the common contaminants found in urban soils and therefore runoff are nitrogen (Collins et al. 2010), lead, copper, cadmium, and zinc (Davis 2001). As the water flows over pavements, it can pick them up and pollute the Chesapeake bay (Finster, Gray, and Binns 2004). However, by remediating these waters close to the source they land on, pollution is reduced into the watershed.

The central spine provides an important example of how the redesigned community area is focused on maintaining 100% of stormwater infiltration or use. This is an example of how cities can rebuild their inner neighborhoods to be more sustainable.

PROGRAM DIAGRAMS

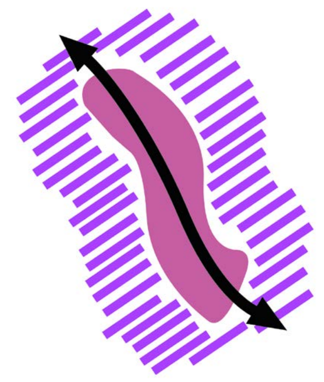
This design has three main layers of importance specified between the commercial and residential buildings, roadways and paving, and the bio retention permeable surface diagrams. The organization for each are inherently related to the design concept.

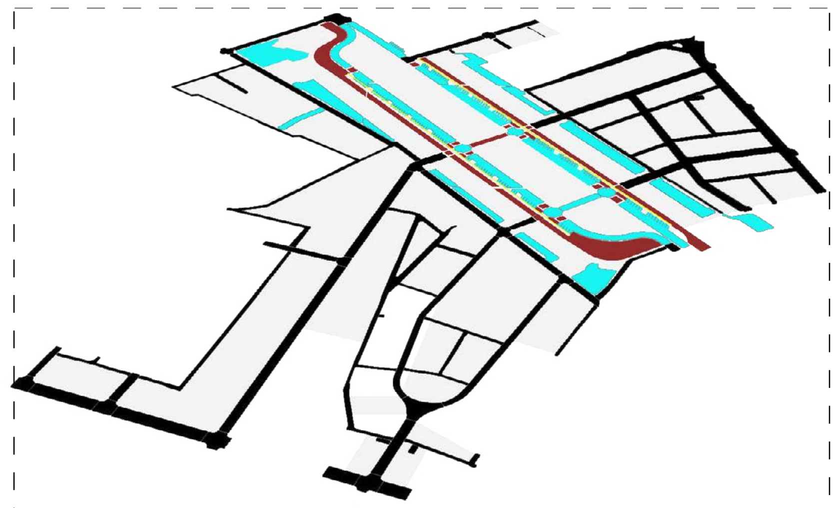
Concept Relationship



Commercial and Residential Buildings

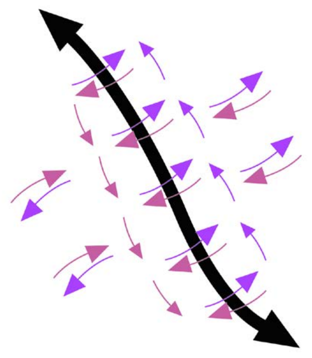
The organizational pattern of the redevelopment plan allows the benefits of economic stimulus in the central commercial zone to radiate outward to the adjacent communities.

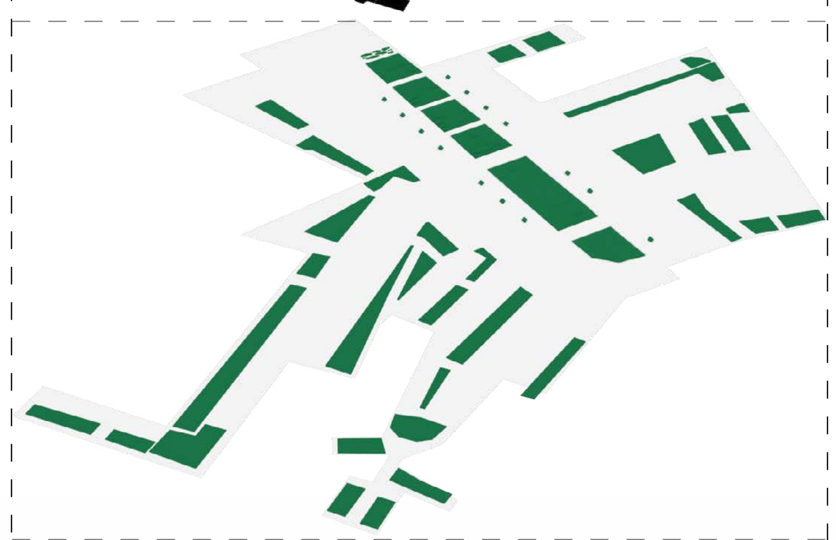




Roadways and Paving

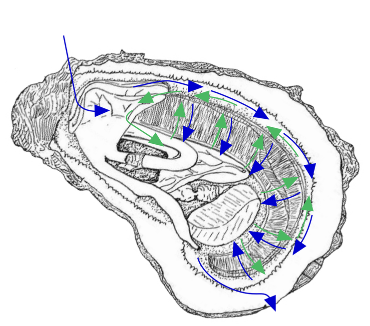
The organizational pattern of the roadways, pedestrian paving, and bike lanes allow for a strong, central commercial hub along the main gill. This will increase economic flow.

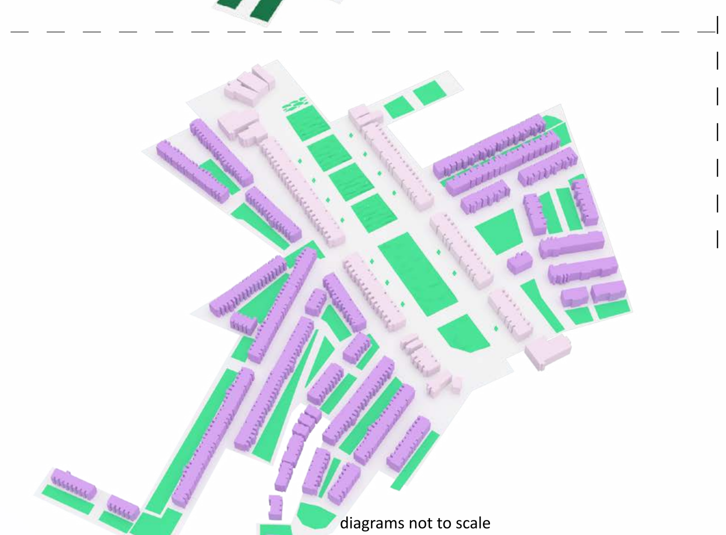




Bio Retention Permeable Surface

The organizational pattern of the bio retention basins allow for stormwater flow to move into any retention basin so that 100% of the stormwater will be remediated. This relates to the functional aspects of oyster filtration.





diagrams not to scale

Base

Diagram plan showing all layers of infrastructure.

I found that the continual flow system of the oyster and the gills was similar to how i might address ecologic and social conditions within the site.

The benefits of economic stimulus in the form of occupation and consumption will socially reinvigorate the community, while the physical remediation of urban runoff provides an example for Baltimore and other cities to follow.

The design will be completed in three stages to transition the community into 100% storm water runoff adsorption and inspire social change.

SITE PLAN

The bio retention basins are easy to maneuver around, and they provide an interesting focal point to the center of the transportation hub and commercial corridor.

QUANTITATIVE ASSESSMENT

COMMERCIAL
96 new buildings
47,250 ft² additional space
1st floor surface area
75% increase in impermeable surface

PEDESTRIAN PAVEMENT
114,717 ft² new
*larger pedestrian corridor
90% increase in impermeable surface

ROADWAY
165,119 ft² new + improved
30% increase in impermeable surface

RESIDENTIAL
415 new buildings
573,750 ft² additional space
1st - 3rd floor surface area
51% increase in impermeable surface

BIKE LANE
11,509 ft² new
*addition of new bike lane
100% increase in impermeable surface

698,288 ft² impermeable surface
total roof surface area + road surface area + pedestrian surface area + bike lane surface area
58,190.67 ft³ (30 min) storm event runoff
698,288 ft2 * 1" average rainfall for 30 min storm (NOAA webmaster)
=
435,296.39 gallons of runoff
or
about 5,581 bathtubs

BIO RETENTION
-1,284,000 ft³ bioretention volume
58, 190.67 ft³ (30min) storm event runoff
1,225,809.33 ft³ extra bioretention space
Enough to fill Oriole's outfield about 8.5 ft high with water!
(stadium about 143,260 ft² surface area)

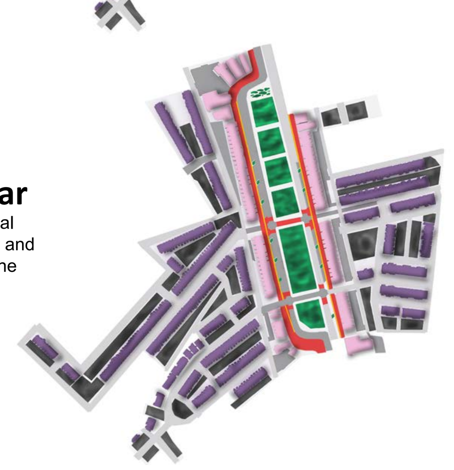
thus, **+100% stormwater infiltration**

** totals are throughout the entire redesigned area

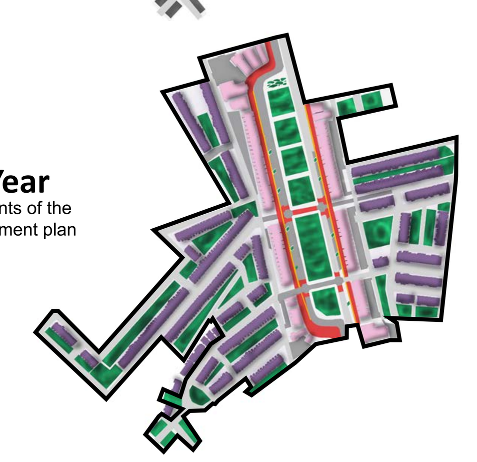
PHASING TIMELINE

This plan allows developers to implement the important and feasible elements of the design on a timeline that benefits residents.

5 Year
Residential development and pedestrian corridor



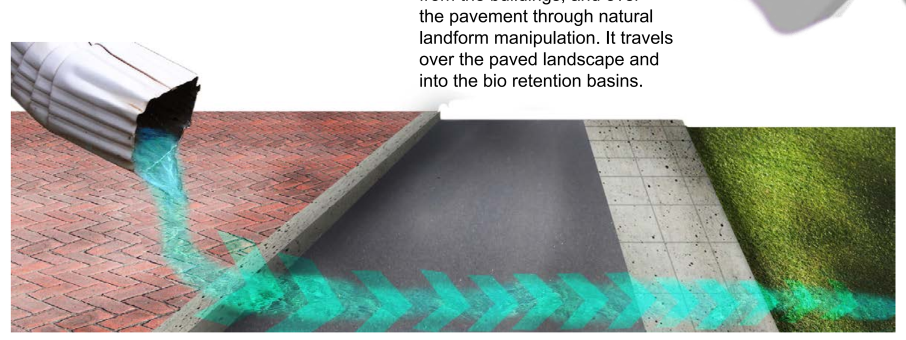
10 Year
Commercial development and central spine



20 Year
All elements of the redevelopment plan

DRAINAGE DIAGRAM

This shows how the water is washed through downspouts from the buildings, and over the pavement through natural landform manipulation. It travels over the paved landscape and into the bio retention basins.

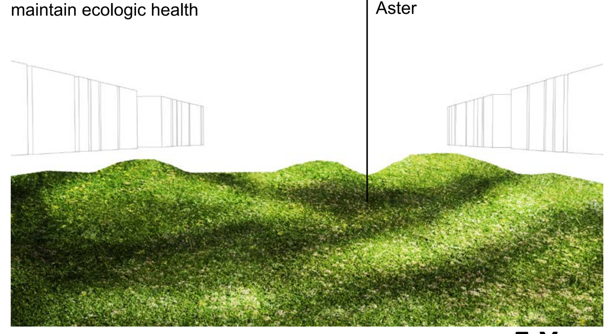


PHASING PROJECTIONS

A meadow is the predominant landscape typology. This does not have to be mowed, but occasionally burned to maintain ecologic health

Vegetation list:

Alfalfa
Grasses
Black Eyed Susan
Aster

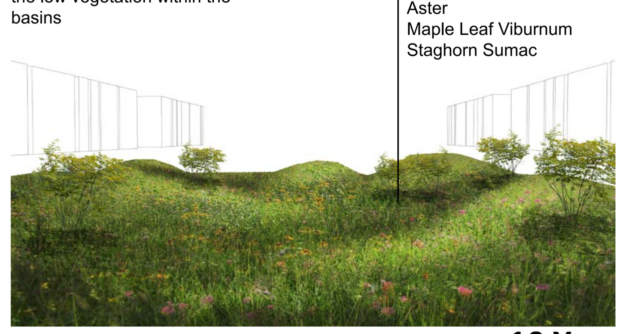


5 Year

As the landscape progresses, within 10 years of implementation and occasional burning, some shrubs can be planted, at this point, do not burn anymore to maintain the low vegetation within the basins

Vegetation list:

Alfalfa
Grasses
Black Eyed Susan
Aster
Maple Leaf Viburnum
Staghorn Sumac



10 Year

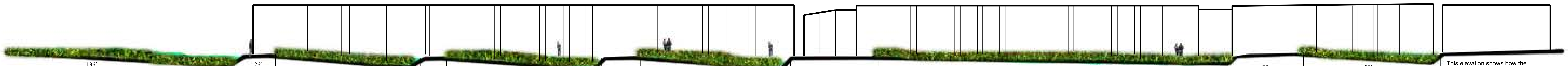
Within 20 years, the landscape can now include trees. These will provide more shade within the bio retention basins that help give people places to rest.

Vegetation list:

Alfalfa
Grasses
Black Eyed Susan
Aster
Maple Leaf Viburnum
Staghorn Sumac
Birch

20 Year

This series of illustrations show the amount of landscape change that the bio retention basins experience over 20 years after implementation



Scale:
0' 25' 50' 100'

SECTION B-B'

This elevation shows how the basins sit within the paved landscape. Each one slopes downward to hold a maximum amount of surface runoff.

Collins, K.A., T.J. Lawrence, E.K. Stander, R.J. Jontos, S.S. Kaushal, T.A. Newcomer, N.B. Grimm, M.C. Ekberg, Opportunities and challenges for managing nitrogen in urban stormwater: a review and synthesis. 36(11):1507-1519, 2010.

Davis, Allen P., Mohammad Shokouhian, and Shubei Ni, "Loading Estimates of Lead, Copper, Cadmium, and Zinc in Urban Runoff from Specific Sources." Chemosphere 44, no. 5 (August 2001): 997-1009.

Finster, Mary E., Kimberly A. Gray, and Helen J. Binns, "Lead Levels of Edibles Grown in Contaminated Residential Soils: A Field Survey." Science of The Total Environment 320, no. 2-3 (March 2004): 245-57.

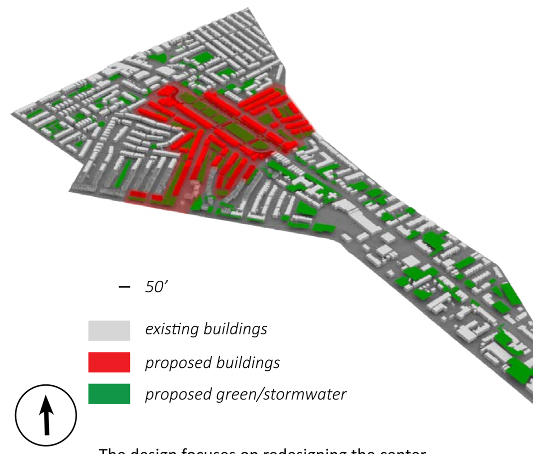
National Research Council, Urban stormwater management in the United States. National Academy Press. Washington, DC, 2008.

NOAA Webmaster, "NOAA Atlas 14 Point Precipitation Frequency Estimates: MD." Hydrometerological Design Studies Center. August 27, 2014. Accessed April 14, 2016. http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=md.

Some measurement calculations provided by Google Earth.

All map data provided by: Open Baltimore, accessed 2015-2016, https://data.baltimorecity.gov. Data sets: "building," "edge pave," "neighborhood_2000" and "contours".

CONTEXT PLAN



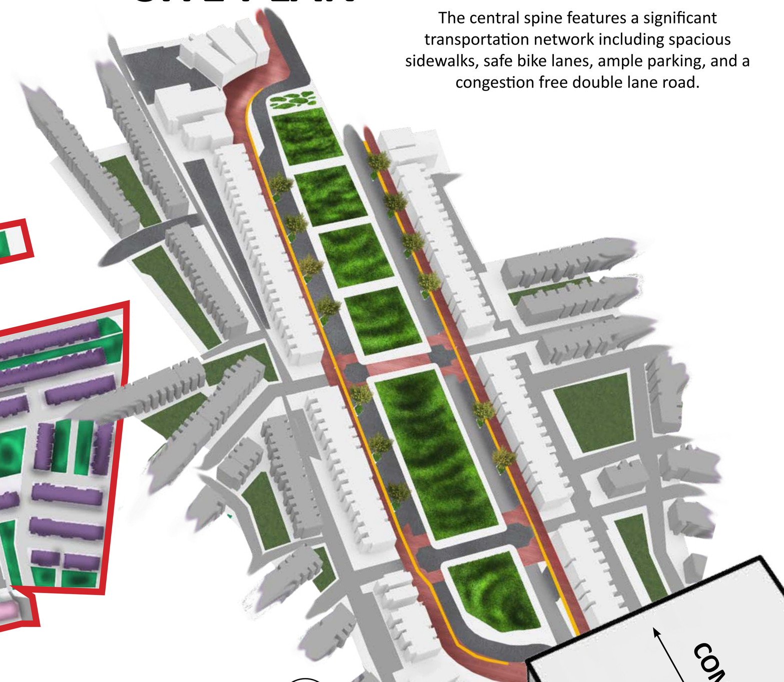
The design focuses on redesigning the center area, marked for rebuild while retrofitting other areas with stormwater management.

PLANNING PLAN

The central area, marked for rebuild, will focus on a large central transportation hub and spine to reinvigorate the adjacent residential communities.

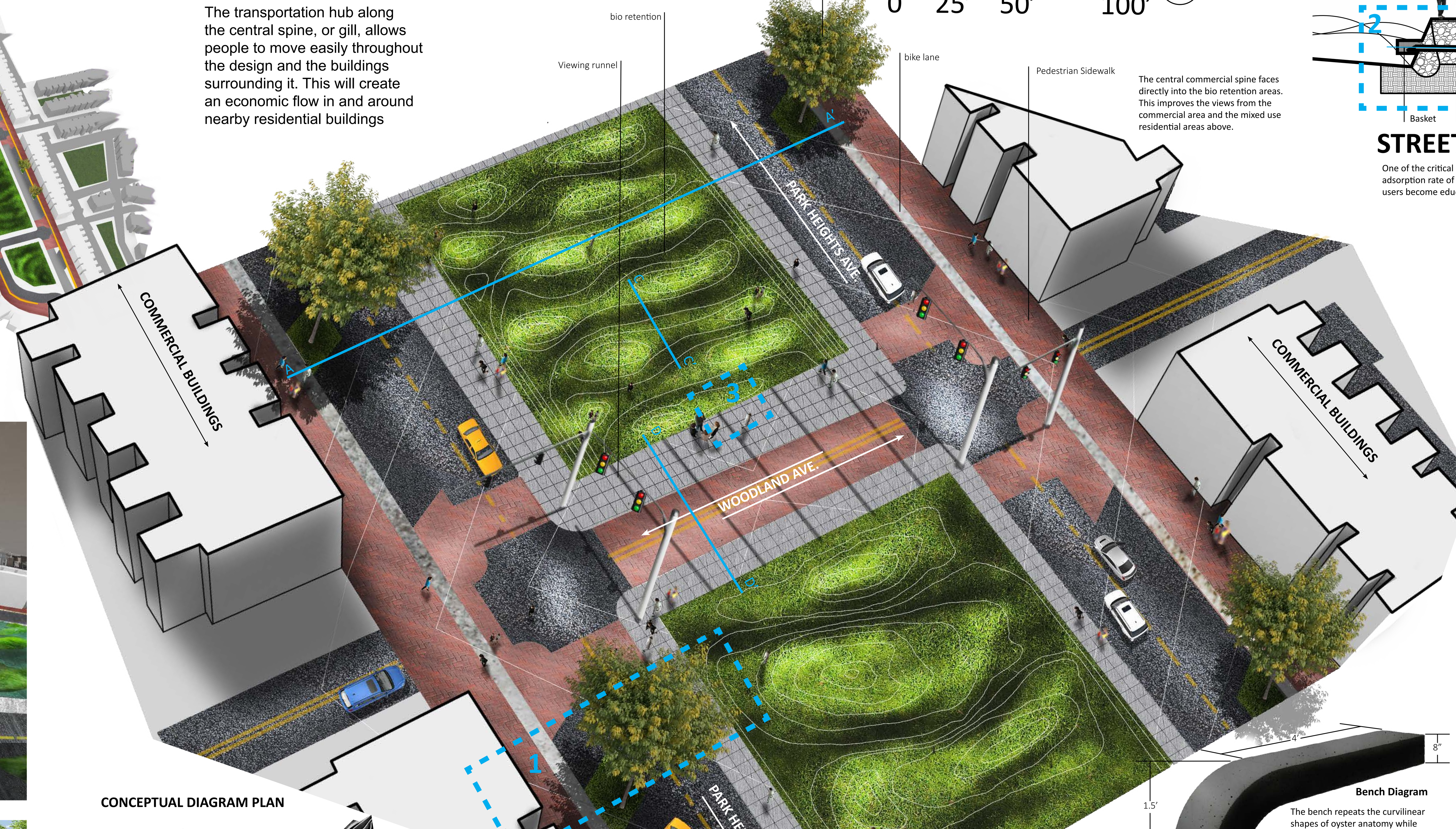
SITE PLAN

The central spine features a significant transportation network including spacious sidewalks, safe bike lanes, ample parking, and a congestion free double lane road.

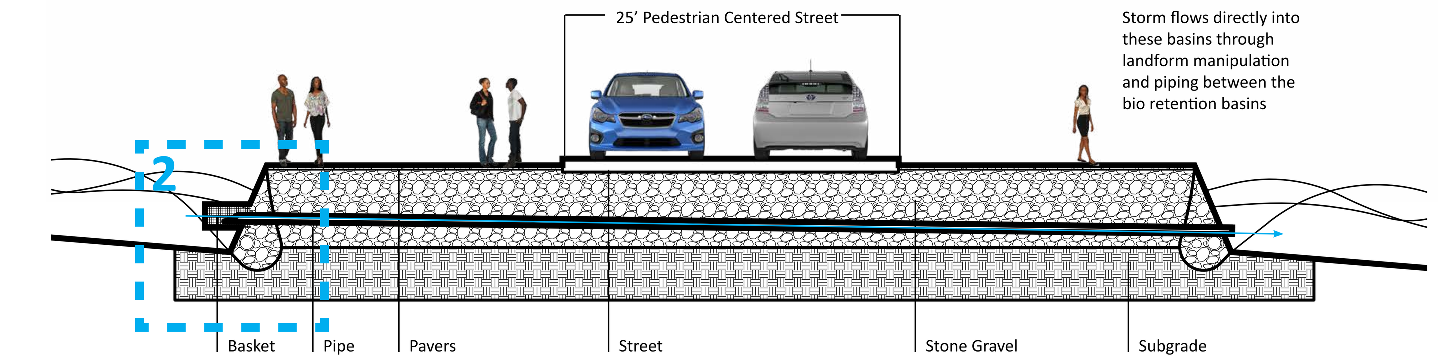


SITE DETAIL PLAN

The transportation hub along the central spine, or gill, allows people to move easily throughout the design and the buildings surrounding it. This will create an economic flow in and around nearby residential buildings



The central commercial spine faces directly into the bio retention areas. This improves the views from the commercial area and the mixed use residential areas above.



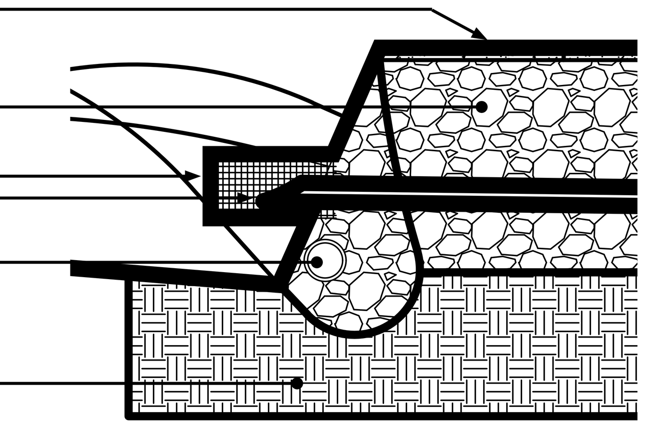
STREET AND RUNNEL SECTION D-D'

Scale 1: 1/4

0' 25'

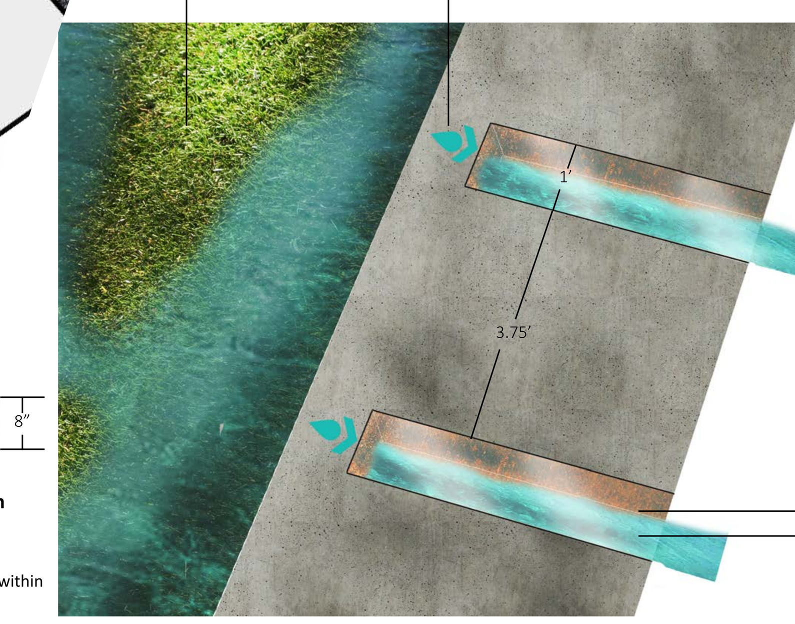
One of the critical components of the design is its sensitivity to water and how the city is able to maintain the adsorption rate of the bio retention basins. The details here show the pipe and grate basket system that helps users become educated about the processes and how low-maintenance clean up works

Litter will move throughout the design when water flows. It is up to the community to pick up small pieces of trash and maintain the design. However, when pieces are missed, they have the possibility to flow into the next basin or get caught in the pipe. The baskets at the ends of the pipes prevent this from happening and reduce city maintenance to almost nothing.



PIPE DETAIL 2

Scale 0' 6" 1' 2'



EDUCATIONAL WATER-WAY 3

This design is able to show people how the bio retention water moves through the system to be remediated. The waterway in the plan showcases that the runnels connecting the bioretention basins look like after a storm event. By providing signage indicators and visible water pathways, people will understand how the methods work and learn how their community remediates water.

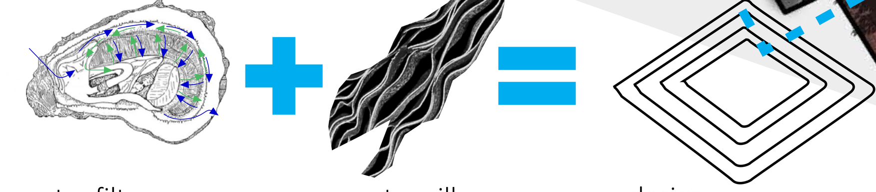
This is critical to the understanding and improvement of storm water infiltration processes; when the community sees value in the efforts it becomes a part of the culture and life of the people there.

Scale 0' 6" 1' 2'

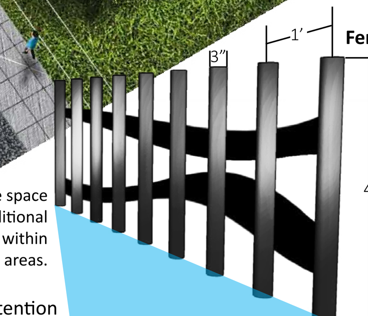
Bench Diagram

The bench repeats the curvilinear shapes of oyster anatomy while providing places for people to sit within the central hub.

CONCEPTUAL DIAGRAM PLAN

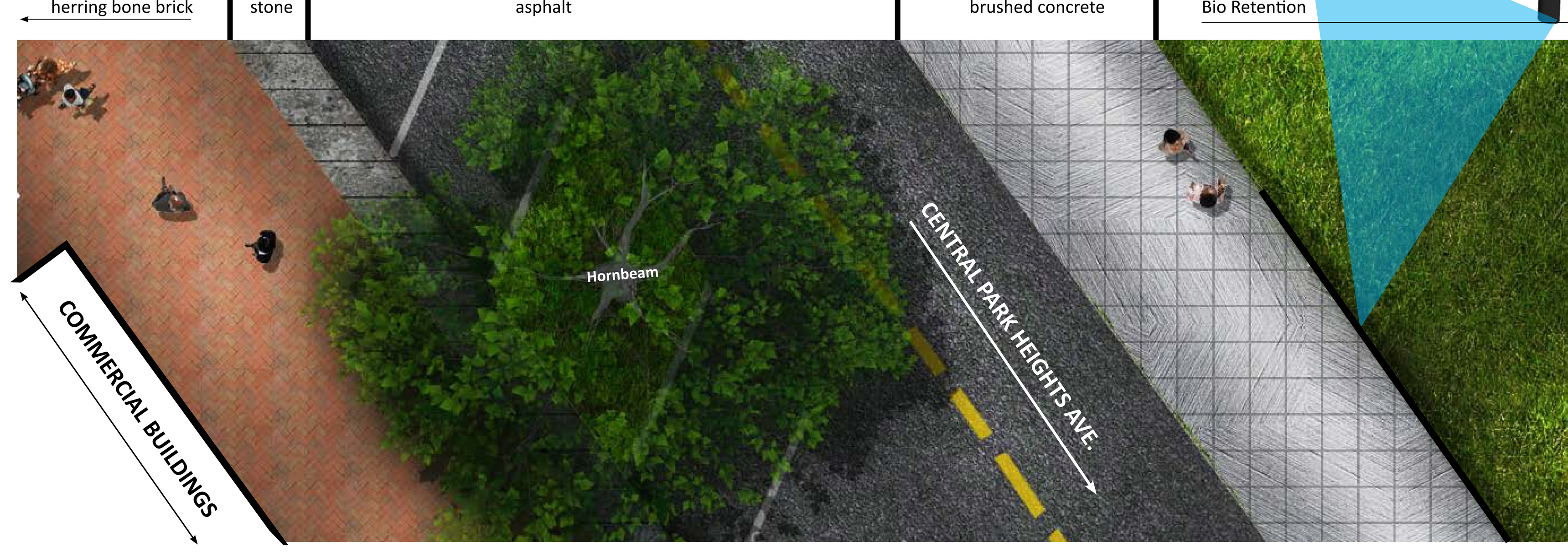


The filtering process of oysters and their gills form undulating layers within the oyster itself. When this pattern is projected onto the landscape, it gives an exciting form that allows people to interact with each other and the land.

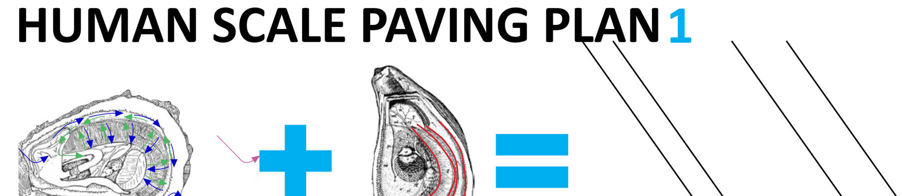


Fence Diagram

Fences delineate space and provide additional safety measures within the bio retention areas.

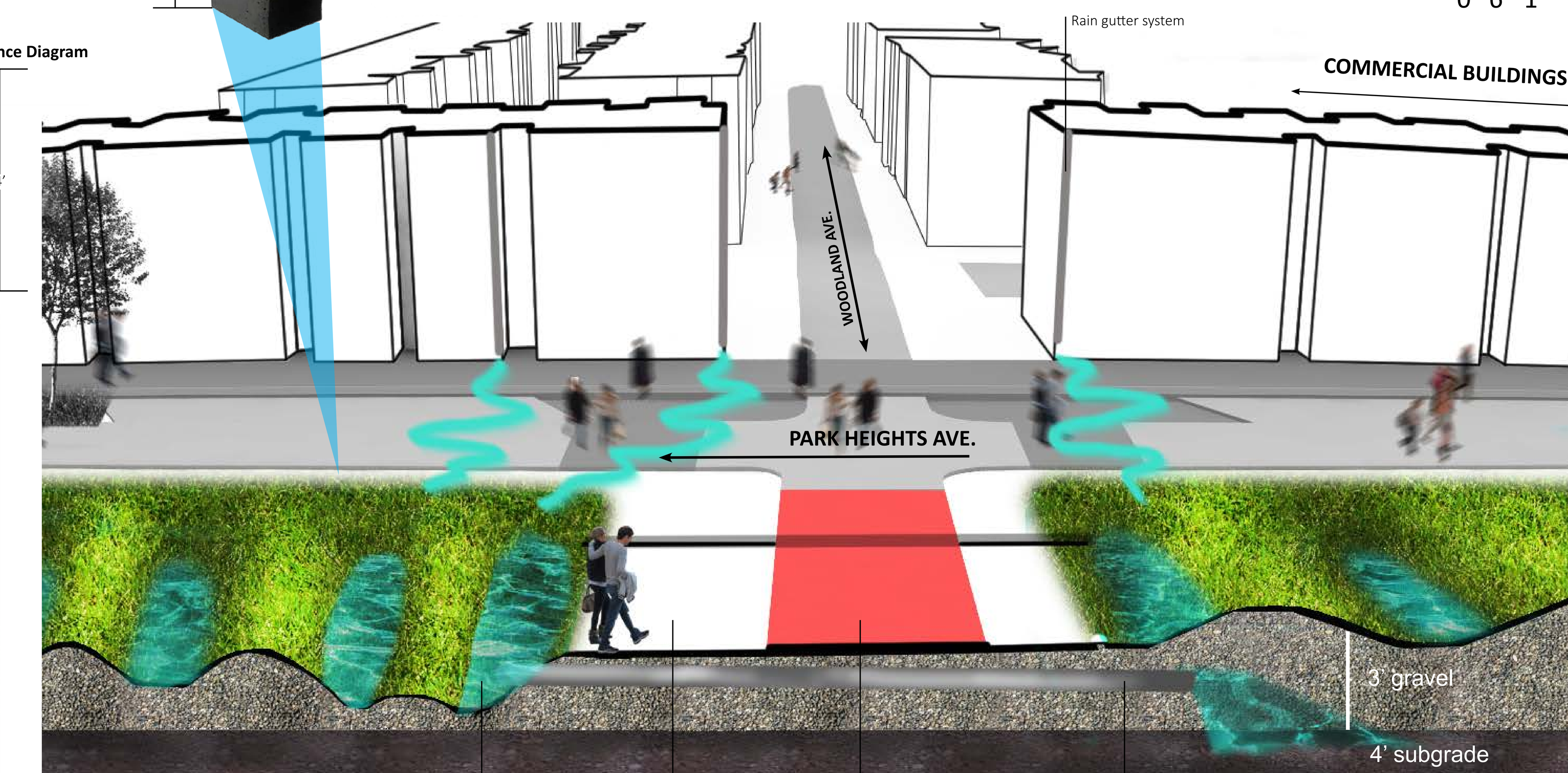


HUMAN SCALE PAVING PLAN 1



0' 25'

The layers of an oyster that provide protection to the gills inspires the layered aspects of the transportation hub as it starts with a brick pedestrian sidewalk, stone bike lane, asphalt road, brushed concrete sidewalk, and bio retention vegetation.



SECTION D-D'

Scale

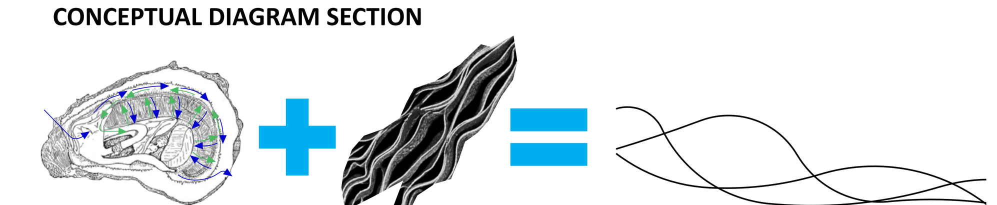
0' 25'

The bio retention basins are not always filled because the undulating landscape pattern traps water as it spreads out and quickly infiltrates it into the ground

As you can see from the section, water collects inside the gills and moves down the sets of retention basins as well as through the soil profile.

These insertions will bring in visitors to increase economic stimulus within Central park Heights. By implementing these insertions, the Central Park Heights neighborhood can become an example to Baltimore and the United States to follow on careful stormwater management.

CONCEPTUAL DIAGRAM SECTION



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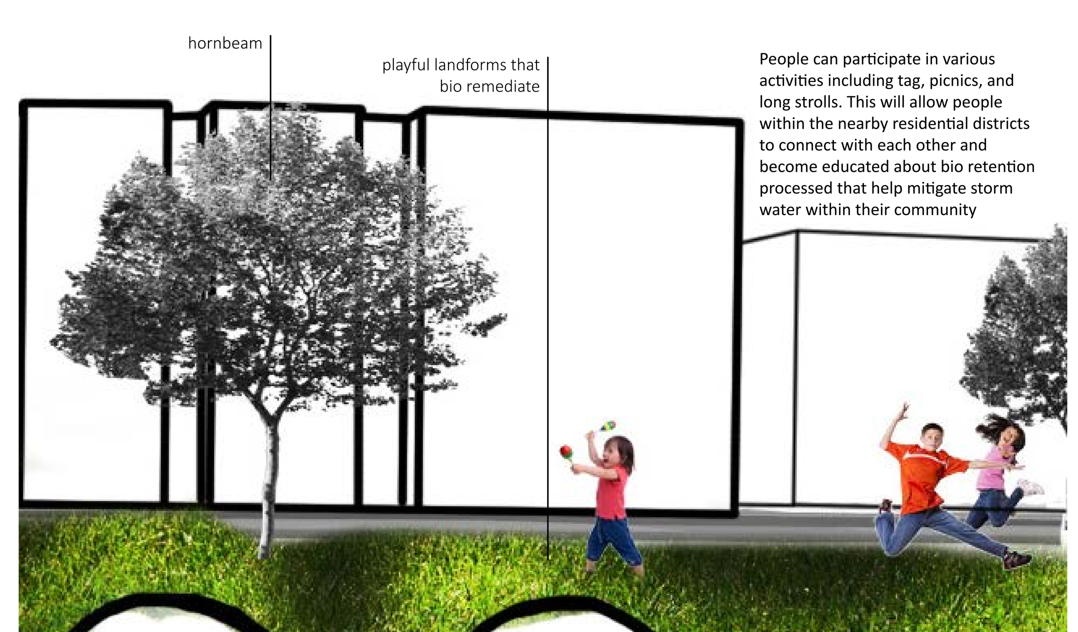
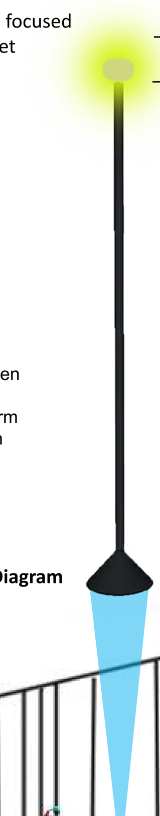


People can participate in various activities including tag, picnics, and long strolls. This will allow people within the nearby residential districts to connect with each other and become educated about bio retention processed that help mitigate storm water within their community

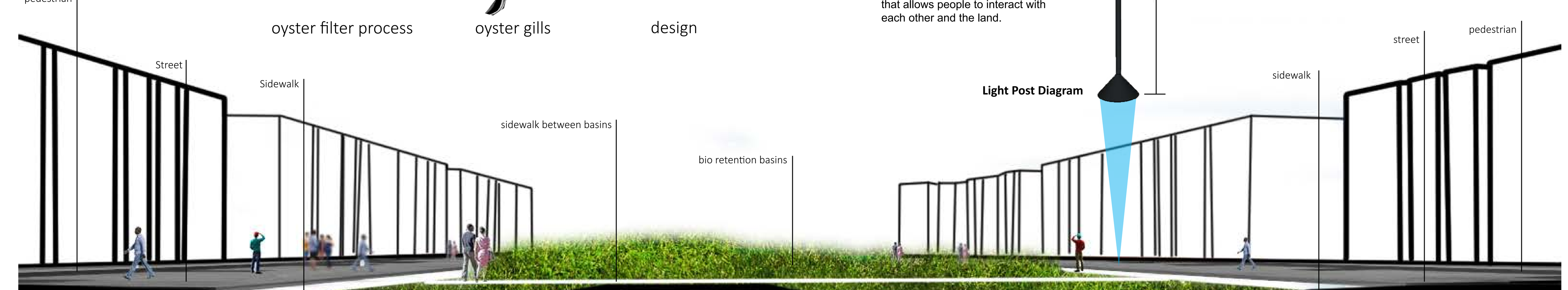
Scale

0' 3' 6' 9'

ELEVATION C-C'



Light Post Diagram

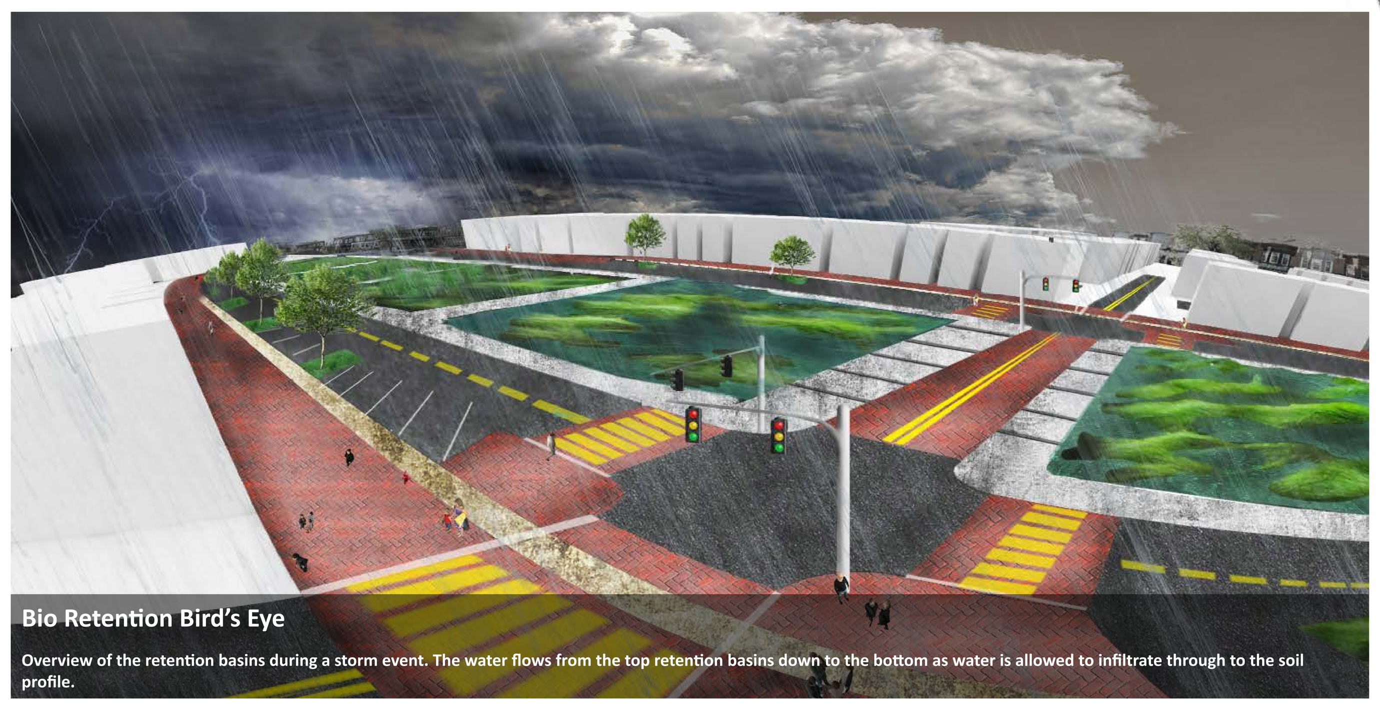


Scale:

0' 25'

ELEVATION A-A'

This section shows the interaction the basins have with the street, the people nearby and the business this attraction provides for the commercial corridor.

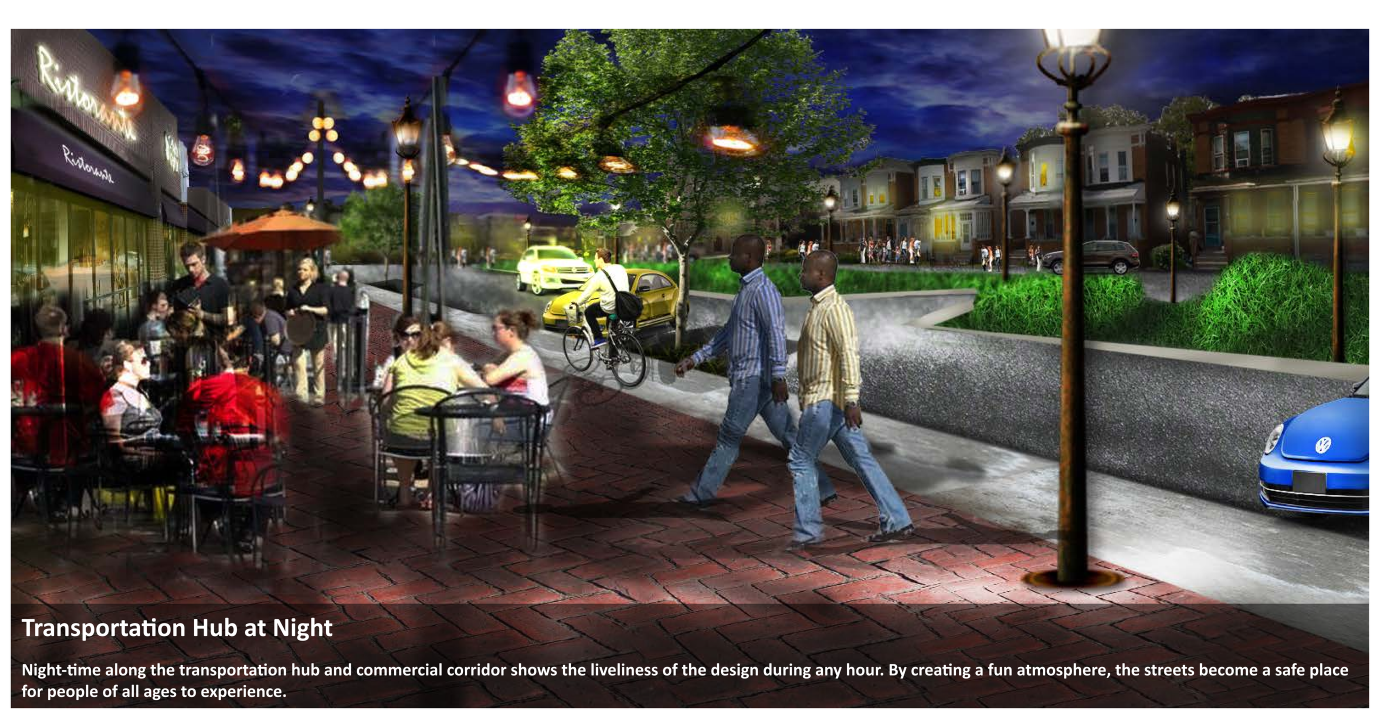


Bio Retention Bird's Eye

Overview of the retention basins during a storm event. The water flows from the top retention basins down to the bottom as water is allowed to infiltrate through to the soil profile.

Bio Retention Basin from the Sidewalk

Looking from the outer sidewalk into one of the retention basins. People can participate in various leisure activities that connect the commercial corridor and the residential areas beyond.



Transportation Hub at Night

Night-time along the transportation hub and commercial corridor shows the liveliness of the design during any hour. By creating a fun atmosphere, the streets become a safe place for people of all ages to experience.

Inside the Bio Retention Basin

A fall day within one of the bio retention basins shows the various activities that can occur within the spine. Since there is a strong connection between the parks and the nearby commercial and residential districts, there is continual stimulus within the park.