

# SUSTAINABLE LAKESHORE DEVELOPMENT

INTEGRATING LAKESHORE ECOSYSTEMS INTO THE URBAN ENVIRONMENT

BY JAMES KRAMVIK

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*Human Health & Well-Being  
Environmental Health  
Economic Vitality*



# PROBLEM STATEMENT

*How can sustainable design interventions revitalize overdeveloped lakeshore and restore it to a healthy social-ecological system while increasing urban development?*

## OVERDEVELOPED LAKESHORE

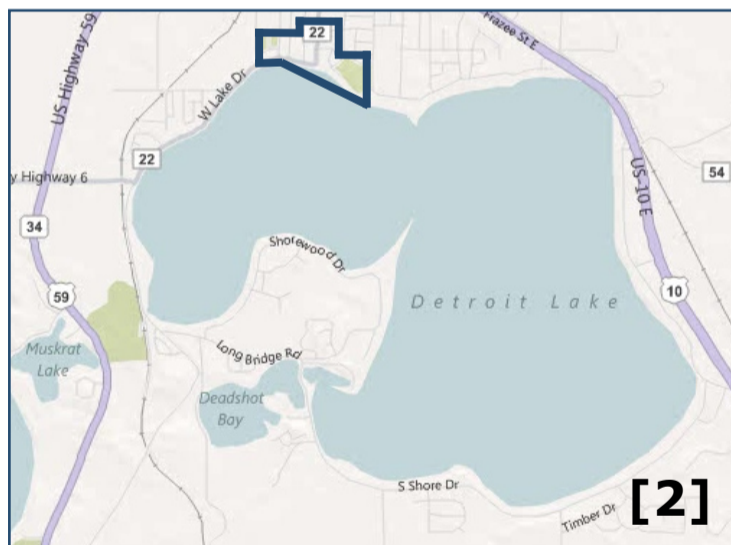
The Minnesota Department of Natural Resources defines *overdeveloped* as lakeshore alterations that damage or destroy important fish and wildlife habitat that includes native vegetation, bottom materials, and natural debris. Lakeshore alterations include excessive turf grass, building structures, and sandy beaches.

## PREMISE

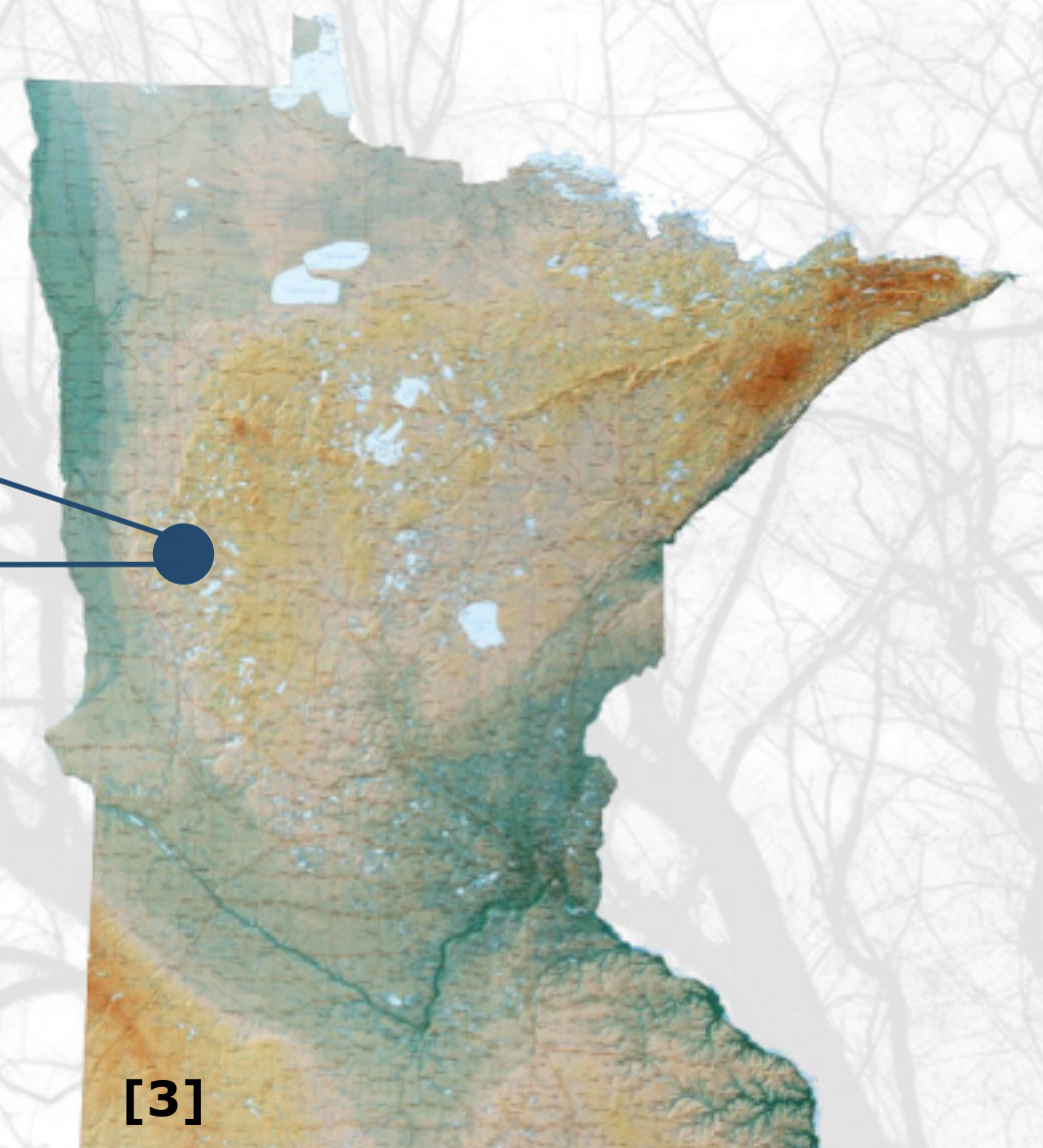
Ecological redesign of existing lakeshore will be important in helping the ecosystem recover from a polluted state. Sustainable management practices will be instrumental in ensuring that the lake will not exceed pollution levels that would restrict current recreational usage.

Natural plantings surrounding a water body will help reduce harmful pollutants, specifically nitrogen, phosphorous, and hydrocarbons, from entering the water source in conjunction with creating vital spawning and nesting areas for wildlife. An increase in wildlife will positively affect wildlife based tourism such as fishing and bird watching.

## LOCATION



## MINNESTOTA



## SITE LOCATION : DETROIT LAKES PUBLIC BEACH

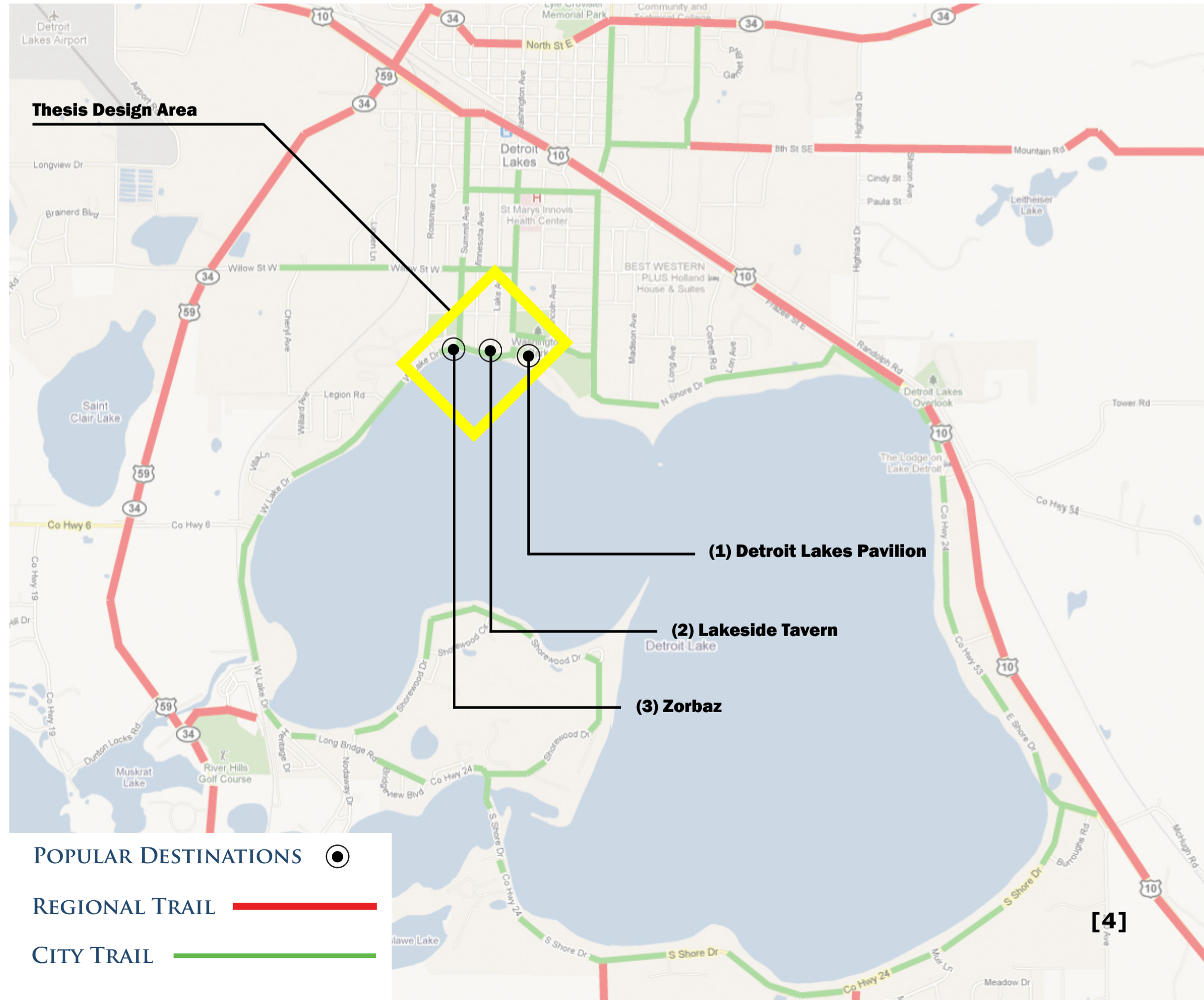
Detroit Lakes' population is estimated at over 8,200 residents, making it one of the largest cities in this region. The population greatly increases in the summer months as tourists and seasonal residents flood the city for the many summer activities. Detroit Lakes is a destination for summer tourism because of its proximity to over four hundred lakes within twenty five miles. Tourists are attracted to the city's special events, lake recreation, and public city beach.

# EXISTING CONDITIONS



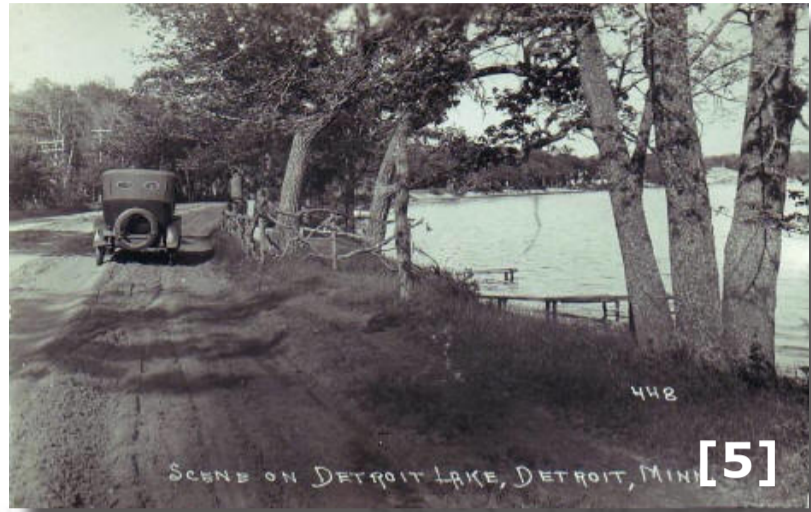
## TRAIL MAP

The **Pine to Prairie Birding Trail** is 200 miles in length and stretches from Fergus Falls to Warroad along US Highway 59 and Minnesota State Highways 32 and 11. Along the trail there are public sites where birders can identify more than 275 species. The **Lake Country Scenic Byway** follows Minnesota State Highway 34 from Detroit Lakes to Walker and allows people to see the Northwoods as it once was.



# EXISTING CONDITIONS

## SITE HISTORY



**West Lake Drive in the 1920's**



**Small Public Beach of the 1940's**



**West Lake Drive post 1960  
1/4 Mile Long Beach**

## LAKE DISTURBANCE

### Disturbance

natural	15
minimal	8
moderate	68
great	227

### Shore Features

wetland	0
emergent	94
bulrush	5
steep slope	56

<b>Parcels</b>	329
<b>Surface Acres</b>	2076
<b>Shorline Length</b>	40900 ft
<b>Docks &amp; Lifts</b>	683
<b>Watercraft</b>	474
<b>Greatly Disturbed</b>	69%

## PROJECT JUSTIFICATION

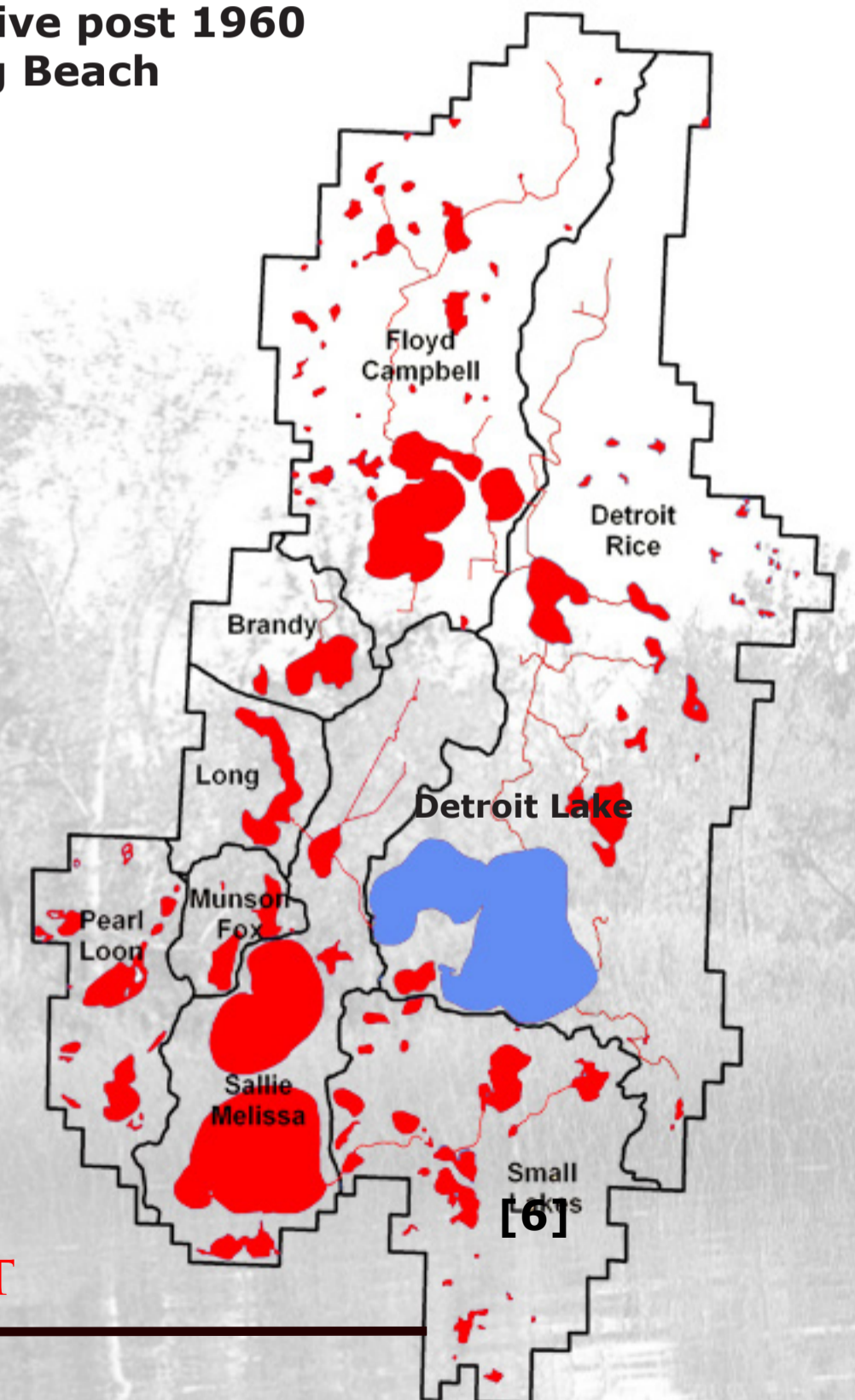
Detroit Lake is connected to a chain of surrounding lakes forming the Pelican River Watershed.

The Minnesota DNR says that by redesigning existing lake shore and enforcing sustainable policies, the lake will be able to recover from a polluted state and benefit many other water bodies.

The United Nations states that clean usable water continues to dwindle from our earth through pollution and overdevelopment.

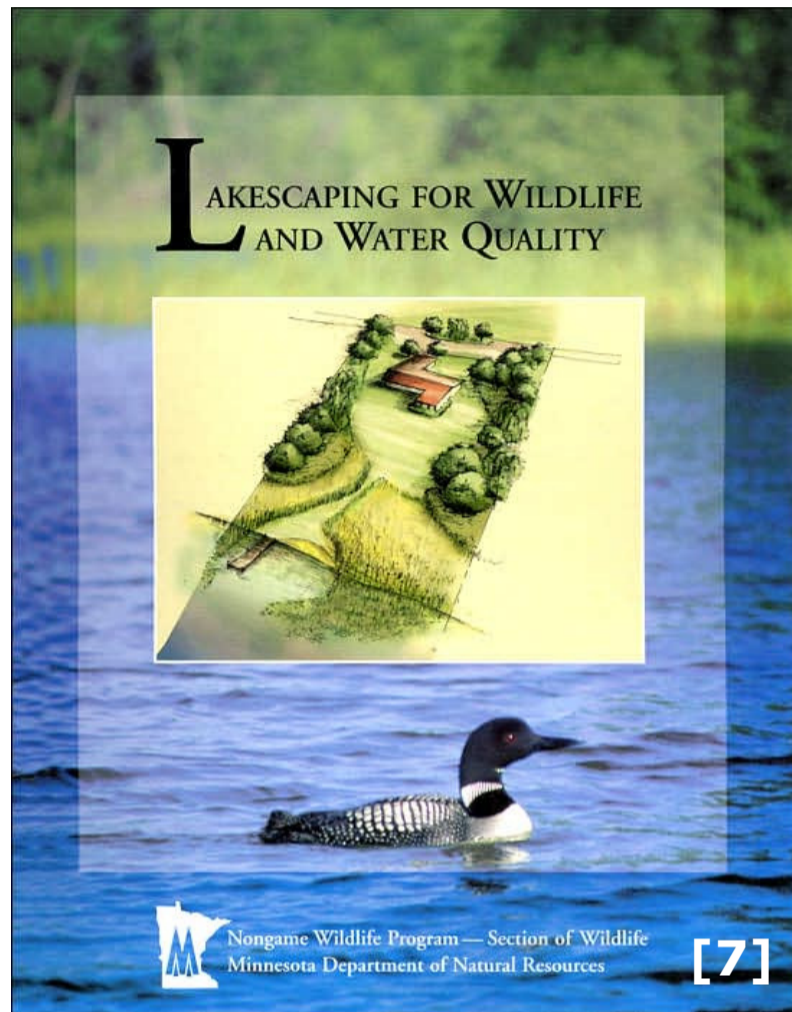
This project will demonstrate how a community can act in the present to benefit future inhabitants to ensure that this public resource will continue to be healthy and usable.

## PELICAN RIVER WATERSHED DISTRICT



# THESIS RESEARCH

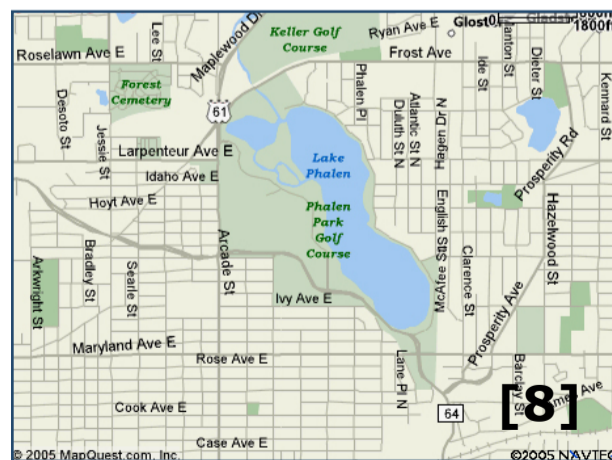
## LAKESCAPING FOR WILDLIFE AND WATER QUALITY



- ▶ Native plant communities in the water and on the shoreline, filter rainwater and melting snow that drain into the lake from the surrounding watershed. When that water contains pollutants, the vegetation helps purify it. (p.10)
- ▶ Lakeshore plants help protect the shoreline by absorbing the energy of waves that might otherwise erode the soil. (p.10)
- ▶ Broadleafed cattail, bulrush, arrowhead, and duckweed create underwater habitat important for spawning fish. (p.10)
- ▶ The natural vegetation serves as a filter strip that helps prevent lawn fertilizers and pesticide runoff from reaching the lake. (p.12)
- ▶ Aquatic vegetation helps purify the lake water by removing contaminants and by calming water, which allows suspended soil particles to settle to the lake bottom. (p.12)
- ▶ Submergent and emergent plants provide underwater cover for fish, amphibians, birds, insects, and many other organisms. (p.16)

### CASE STUDY 1 : LAKE PHALEN, ST. PAUL, MINNESOTA

#### Location



Phase 1 - Excavation



Phase 2 - Shoreline Stabilization



Phase 3 - Shoreline Restoration

### BEFORE IMPROVEMENTS

- 80% of the Phalen lakeshore was in a degraded state
- Various blends of rip-rap
- Bank slumping
- Decreasing Water Clarity
- Invasive species

### AFTER IMPROVEMENTS

- 1.8 km of shoreline restored to natural vegetation
- Reduction in bank erosion
- Improved Water Clarity
- Wildlife Viewing Areas
- Increase in spawning beds for fish
- Increase in wading bird Species
- Increase in frog species
- Decrease in maintenance

# INVENTORY MAP : ECONOMIC VITALITY



## VACANT LOT

This property is at a major node between West Lake Drive and North Shore Drive and should be a focal point of the community.



## VACANT MOTEL


The Capri Motel is in a state of disrepair and can no longer be used for its original purpose. This property in conjunction with the other vacant lot should be redeveloped to take full advantage of the favorable location.



## ECONOMIC VITALITY

*Economic Vitality along West Lake Drive is integral for urban sustainability.*

# INVENTORY MAP : LAND USE MAP

-  Retail / Dining
-  Resort Motels
-  Office
-  Service
-  Civic
-  Residential/ Multi-Family
-  Residential
-  Public Facility
-  Vacant
-  Public Beach

## RESORT PLANNING

According to the Detroit Lakes Redevelopment Plan, weekend tourists provide an abundance of economic revenue for the town and support restaurant and stores. Resorts along the beach are integral to the economy and must be included in the redevelopment plan.

### WEST LAKE DRIVE

*Detroit Lakes, MN*



# INVENTORY MAP : ENVIRONMENTAL HEALTH



## ① Flowering Rush

This invasive plant species forms dense stands that interfere with recreational lake use such as swimming, boating, and fishing. In 2010 the city of Detroit Lakes spent 50,000 dollars removing Flowering Rush weeds from the city beach.










## ② Storm Sewers

The current sewer system backs up during heavy rains and stormwater flows directly into the lake.

## ENVIRONMENTAL HEALTH

*Environmental Health is integral for assuring recreational use of the Detroit Lakes for future generations.*

### Map Legend

-  Pollution Points
-  Storm Drain
-  Low Elevation
-  Flowering Rush
-  Sand Beach
-  Turf Grass
-  Storm Outlet Watershed



## ③ Storm Outfall

Storm Outfalls that directly drain into the lake are still used during heavy summer rains when the system cannot meet the demands of the stormwater runoff.



# INVENTORY MAP : HUMAN HEALTH & WELL-BEING



Existing 4 ft Beach Sidewalk



[11]  
Students from Rossman Elementary






## PEDESTRIAN SAFETY

West Lake Drive should be redesigned to accommodate a pedestrian-friendly environment. Current parking lanes can be removed and the street width shortened to provide a prominent boardwalk for bike riders, joggers, and pedestrians.

## OUTDOOR CLASSROOM

The proximity of Rossman Elementary and Detroit Lakes High School make this public beach a perfect location for students to immerse themselves in a natural environment. Experiencing a functioning ecosystem, rather than textbook learning, will allow students to improve their knowledge of the natural world. In addition to student learning, private lake owners can learn to practice sustainable aspects of landscaping to improve their own lakeshore property.

### Map Legend

-  Connection to School
-  Arterial Road
-  4 ft Beach Walk
-  Crosswalk Intersections
-  Possible Connection





## HUMAN HEALTH & WELL-BEING

*Human Health & Well-Being is integral for pedestrian safety and comfort along with educating the city's youth.*

# ANALYSIS & PROGRAMATIC ELEMENTS

OUTDOOR LEARNING FACILITY  
MIXED-USE DEVELOPMENT  
STORMWATER MANAGEMENT  
PEDESTRIAN CONNECTIONS  
SHORELINE RESTORATION  
MULTI-USE BEACH

## WEST LAKE DRIVE ANALYSIS MAP

-  The addition of two 8 ft. pedestrian boardwalks would enhance the shopping experience and lakeshore experience, while making it safe and ADA accessible.
-  The connection of North Shore Drive and People Street would help alleviate traffic congestion along West Lake Drive during peak use days.



1

Bioswales should be properly placed in the park in areas with storm drains and low elevations.

2

The new urban center for West Lake Drive will be strengthened by extending North Shore Drive to People Street. This location is under-used property based on the inventory map. This area can become a major focal point of the city and attract tourists from surrounding communities.

3

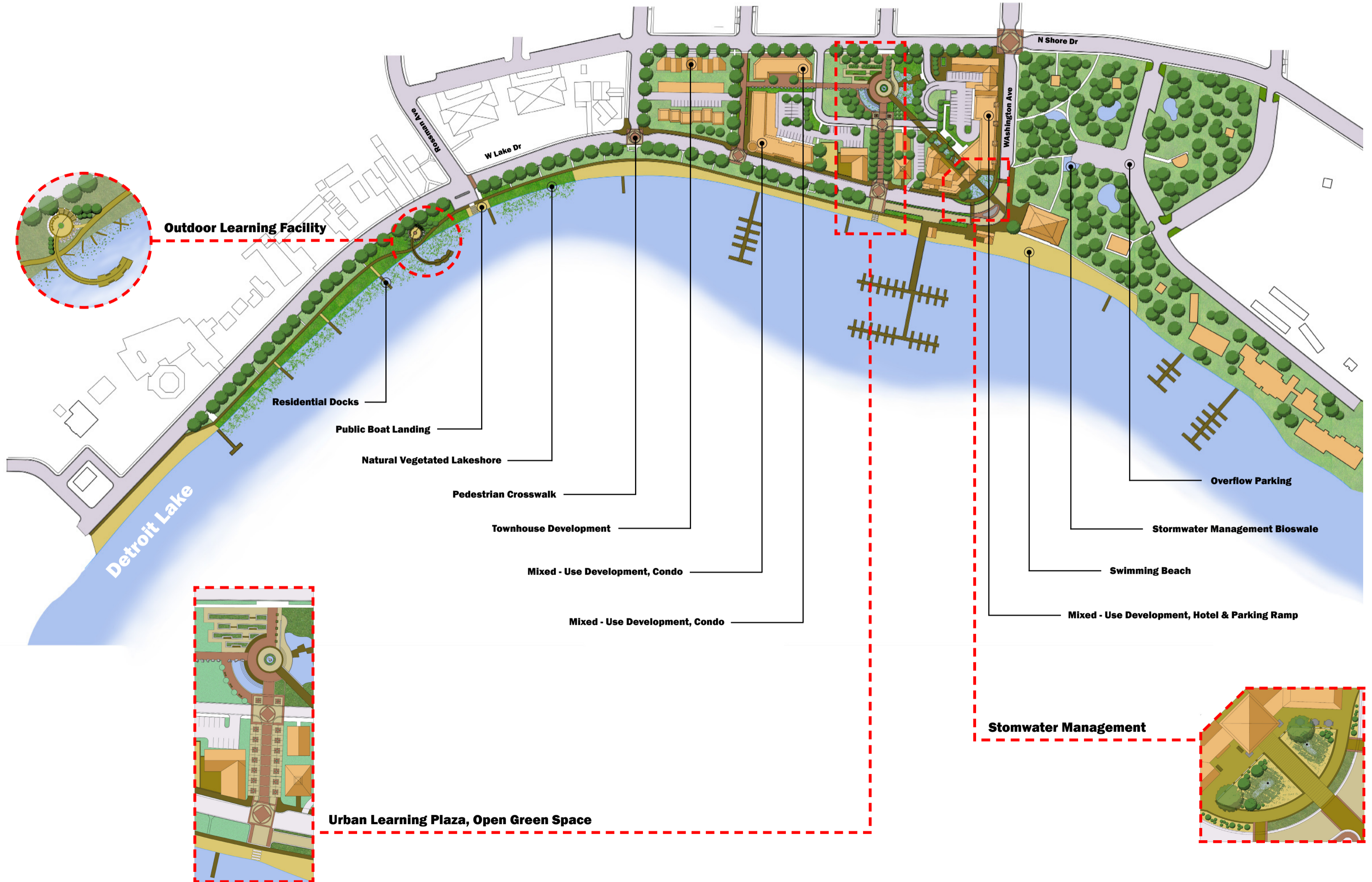
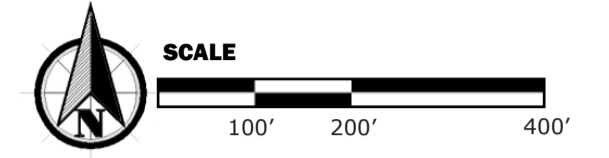
The urban plaza will add a large green space to enhance any visit to the new West Lake Drive retail center. The addition of this area meets city code by allocating space for vegetation while also creating a gathering space between major shopping nodes.

4

This area exhibits the best qualities for the installation of the new outdoor learning facility. The low-use beach section coincides with the connection to Rossman Elementary School.

# MASTER PLAN

## WEST LAKE DRIVE, DETROIT LAKES, MN



# LAND USE PLANNING

## MIXED USE DEVELOPMENT

Mixed use development will be important for creating density along West Lake Drive. A mixture of residential and commercial real estate will be ideal for the economy of this area year round.





## REVISED LAND USE

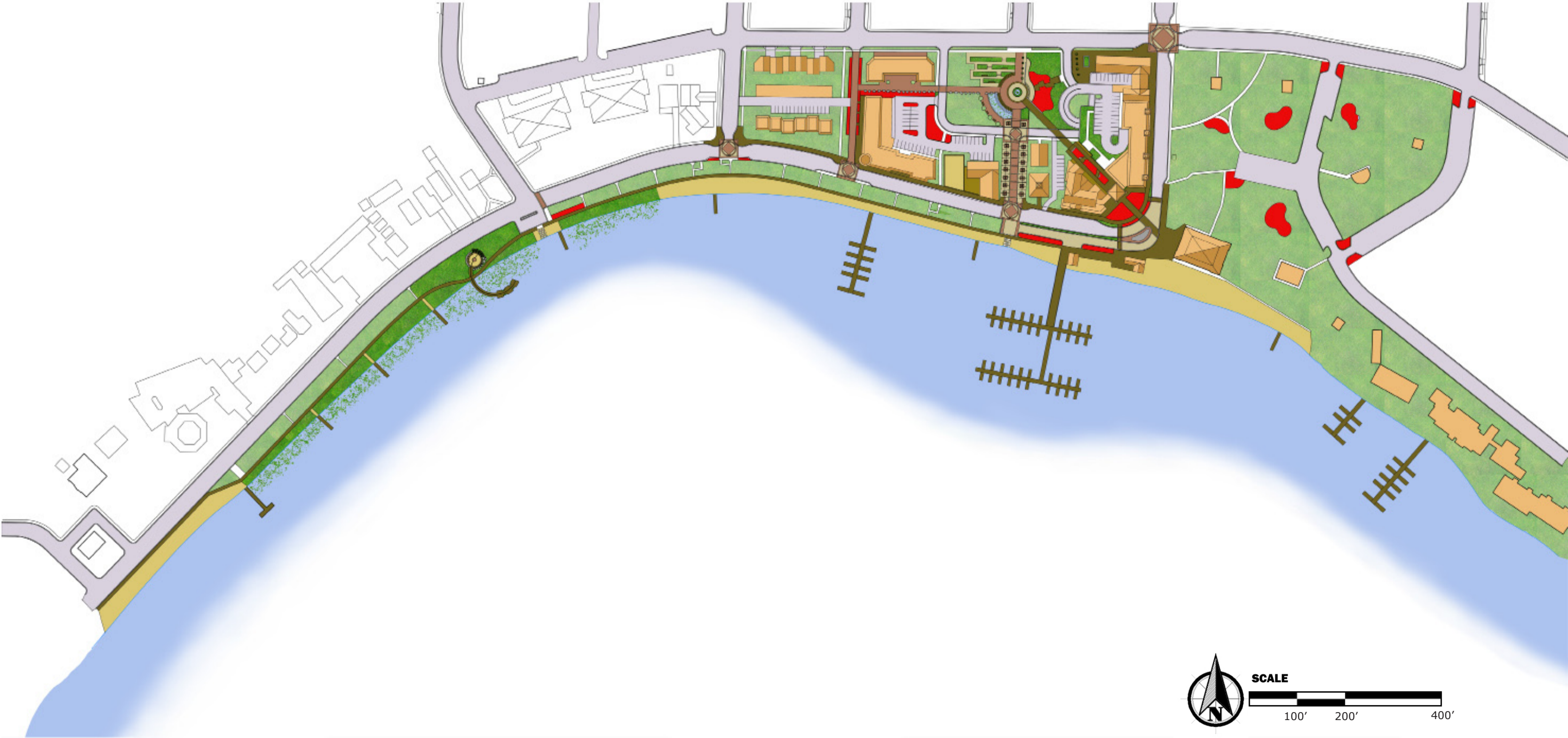
-  Retail / Dining
-  Residential
-  Mixed-Use
-  Existing



# BIOSWALE RETENTION AREAS

## SURFACES

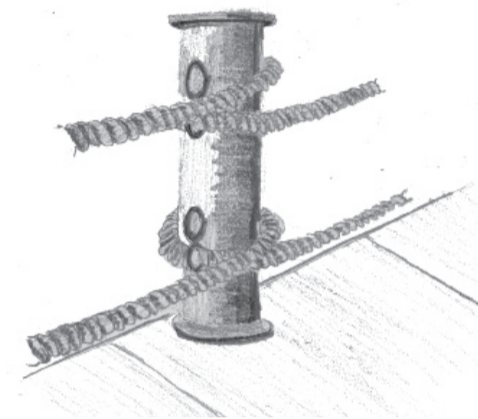
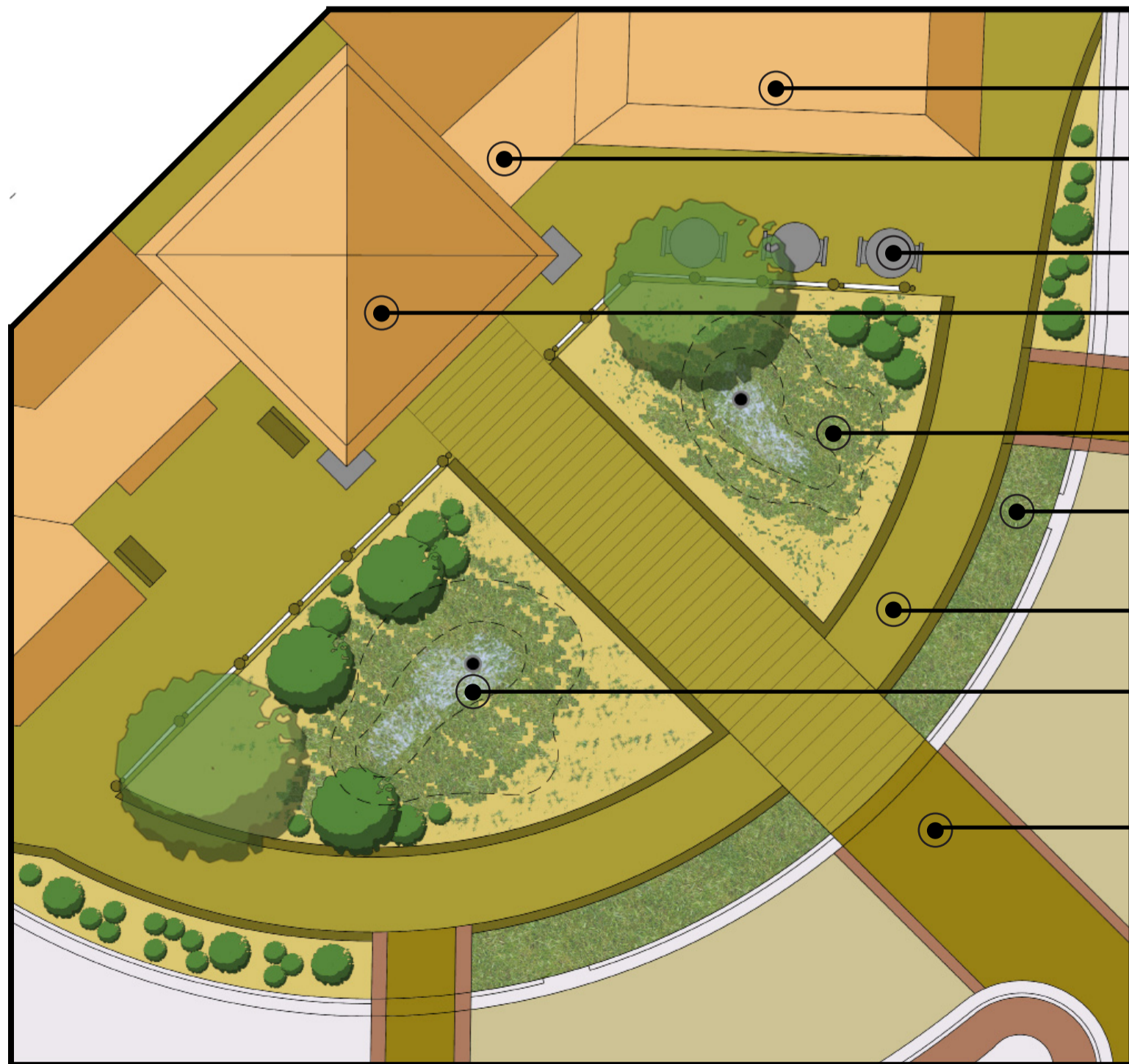
-  Bioswale Sites
-  Natural Vegetation
-  Turf Grass
-  Sand



# STORMWATER MANAGEMENT

## STORMWATER MANAGEMENT PRACTICES

According to the Detroit Lakes shoreline district policy, storm water management practices are an integral part of sustainable lakeshore development. By managing stormwater runoff completely from the same properties, the amount of development along West Lake Drive can increase while the pollution levels entering the watershed decreases. This area collects water from the adjacent street and diverts it to the large ponding area. If the water becomes too high the existing storm drains channel the water to area wetlands. The integration of lakeshore vegetation helps manage stormwater while enhancing the pedestrian landscape.



CHARACTER SKETCHES

**Hotel / Mixed-Use**

**Sky Walk**

**Outdoor Seating**

**Plaza Tower**

**Bioswale**

**Bioswale**

**8 ft Shopping Boardwalk**

**Emergency Storm Drain**

**Pedestrian Crosswalk**



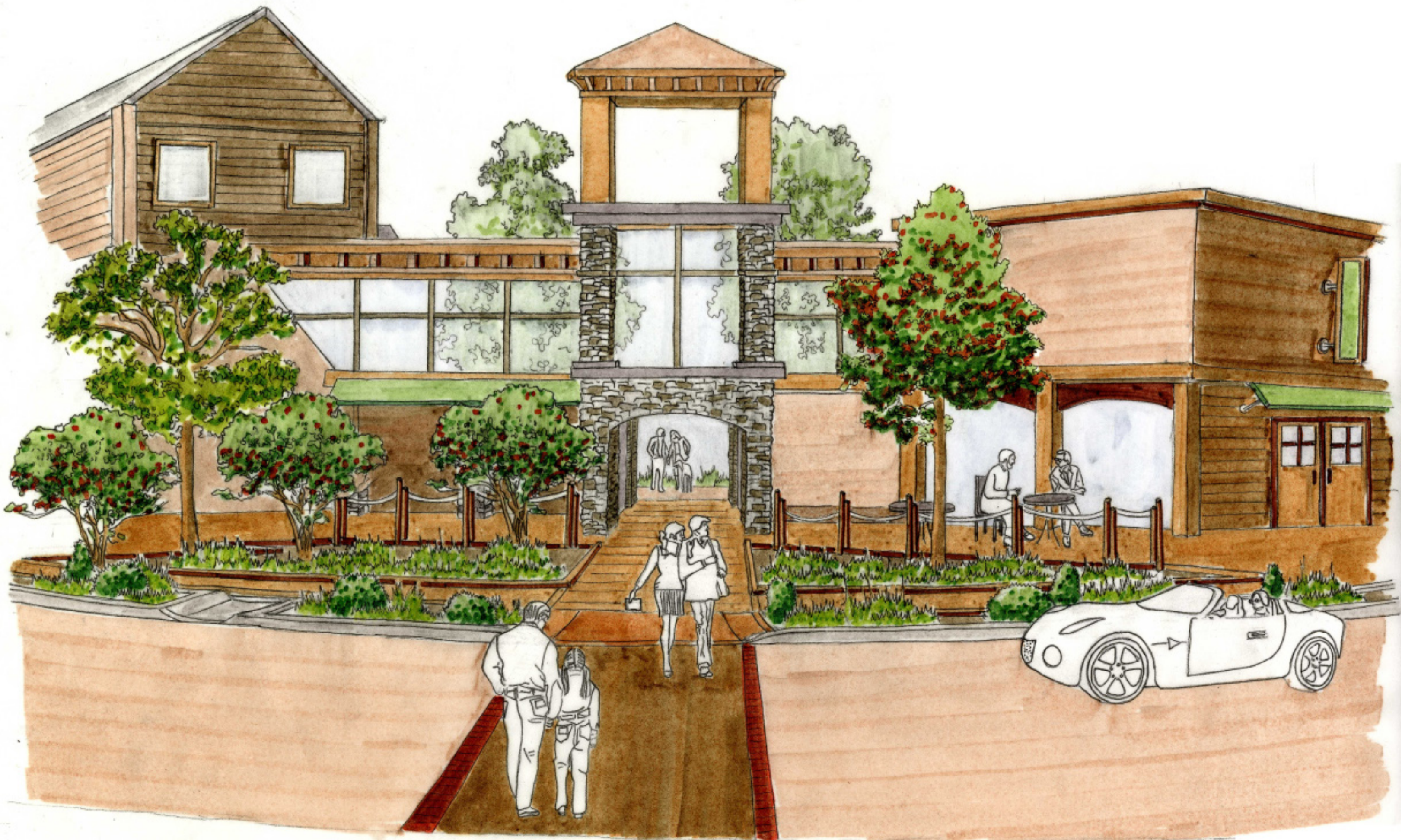
**SCALE**



15' 30' 60'



STORMWATER MANAGEMENT  
MIXED-USE DEVELOPMENT







# CONNECTING PEDESTRIAN CORRIDORS

## URBAN LEARNING CENTER

There are four levels of plants to consider when restoring a natural lakeshore habitat that include; trees, woody shrubs, upland grass, and aquatic vegetation.

### TREES

#### Quaking Aspen

*Populus tremuloides*

#### Bur Oak

*Quercus macrocarpa*

#### River Birch

*Betula nigra*



### WOODY SHRUBS

#### Sandbar Willow

*Salix exigua*

#### Silky Dogwood

*Cornus amomum*

#### Nannyberry

*Viburnum lentago*



### UPLAND GRASS

#### Caterpillar Sedge

*Carex crinita*

#### Lake Sedge

*Carex lacustris*

#### Canada Blue-Joint Grass

*Calamagrostis canadensis*



### AQUATIC VEGETATION

#### White Water Lily

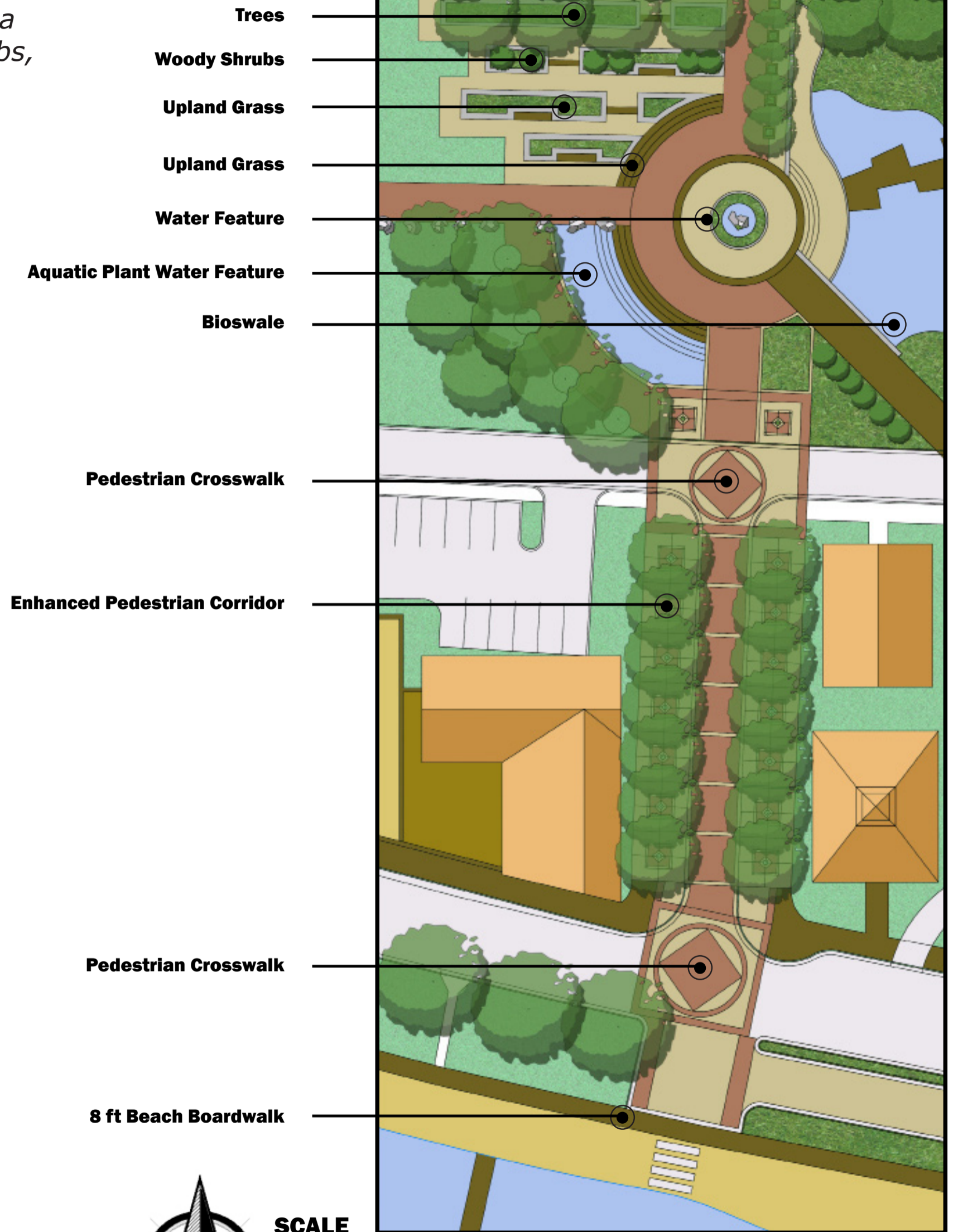
*Nymphaea tuberosa*

#### Softstem Bulrush

*Scirpus validus*

#### Soft rush

*Juncus effusus*



SCALE

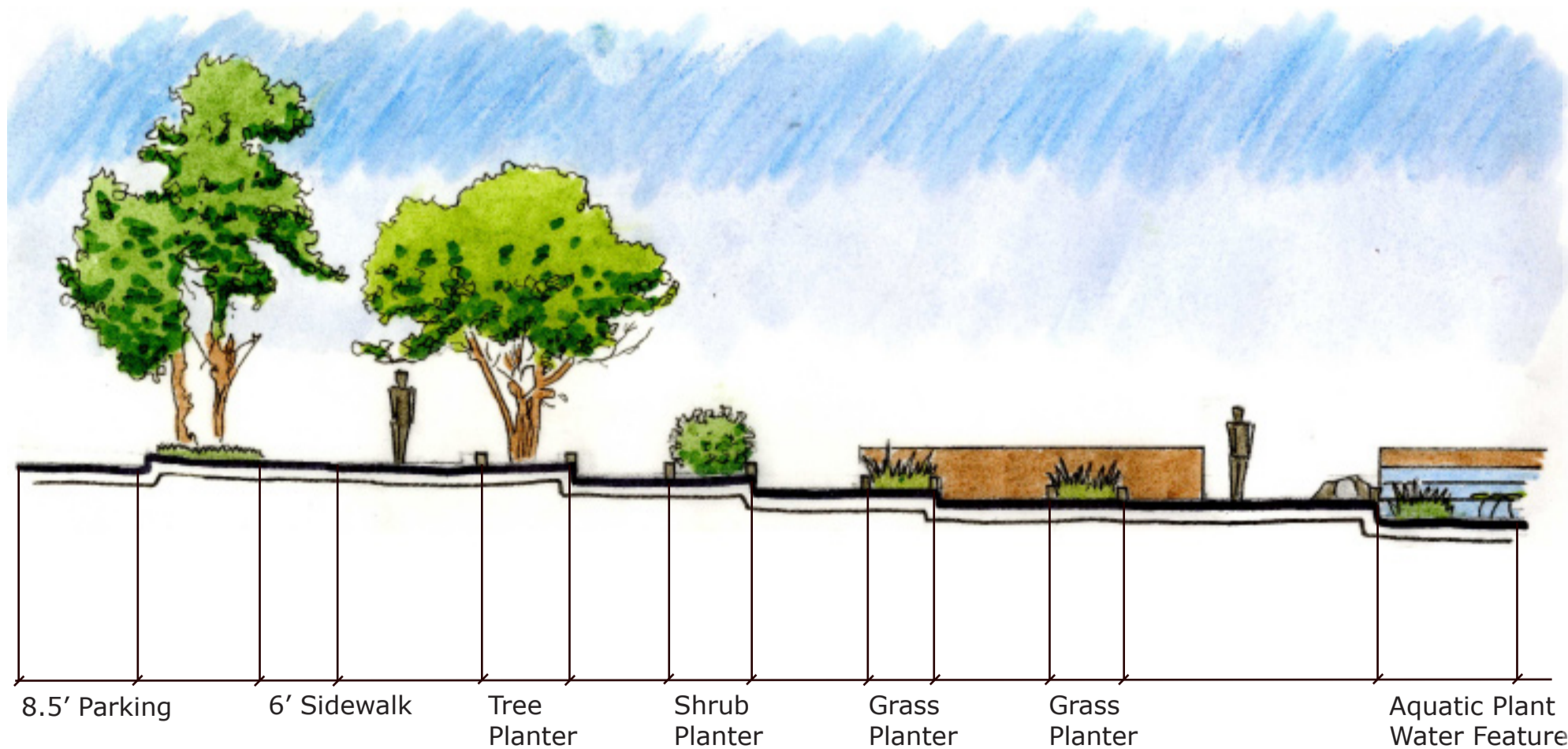




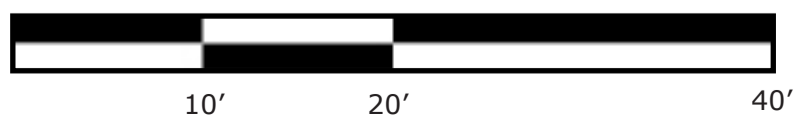
## URBAN LEARNING PLAZA

The urban learning plaza is an interactive walk-through exhibit that displays the four different varieties of plants in the lakeshore environment; trees, woody shrubs, upland grasses, and aquatic vegetation. As one navigates their way from north to south in this space, they can encounter and learn the many beautiful plants that exist in the lakeshore with each elevated area. The walk-through ends with a water feature that is planted with bulrushes and water lilies. This is an ideal resting spot in the summer because of a cool micro-climate created from the running water and the shade trees.

## LEARNING PLAZA SECTION

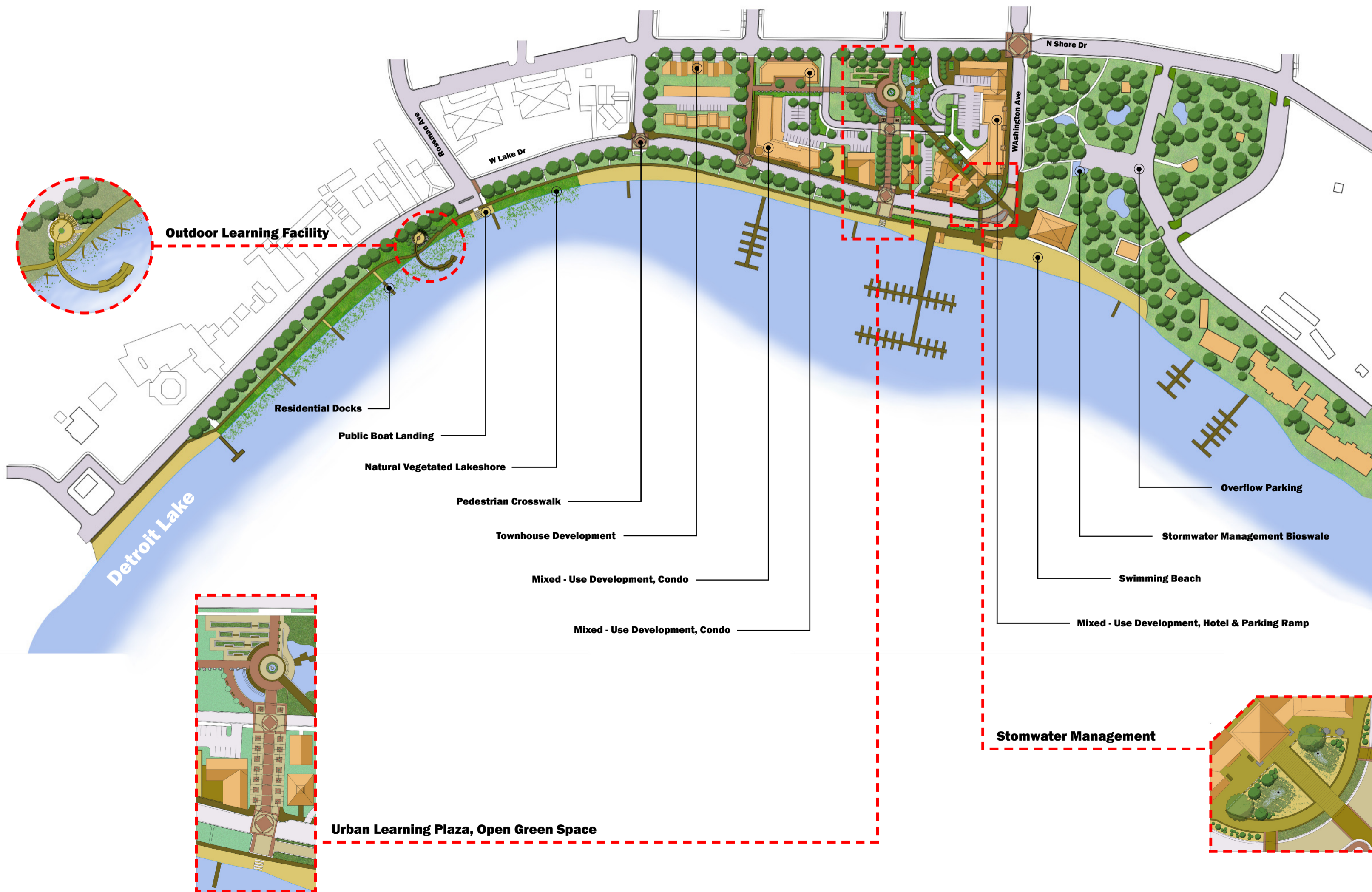
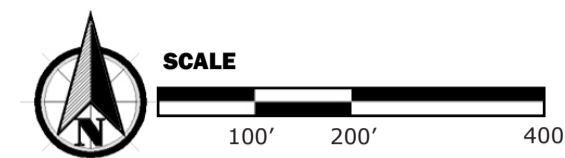


### SCALE



# MASTER PLAN

## WEST LAKE DRIVE, DETROIT LAKES, MN



# OUTDOOR LEARNING

## MULTIUSE BEACH

A multiuse beach could incorporate current use with other attractions such as; fishing, wildlife viewing, outdoor learning facilities, pedestrian friendly boardwalk, and shopping.

**Pergola / Education Boards**

**Retaining Wall**

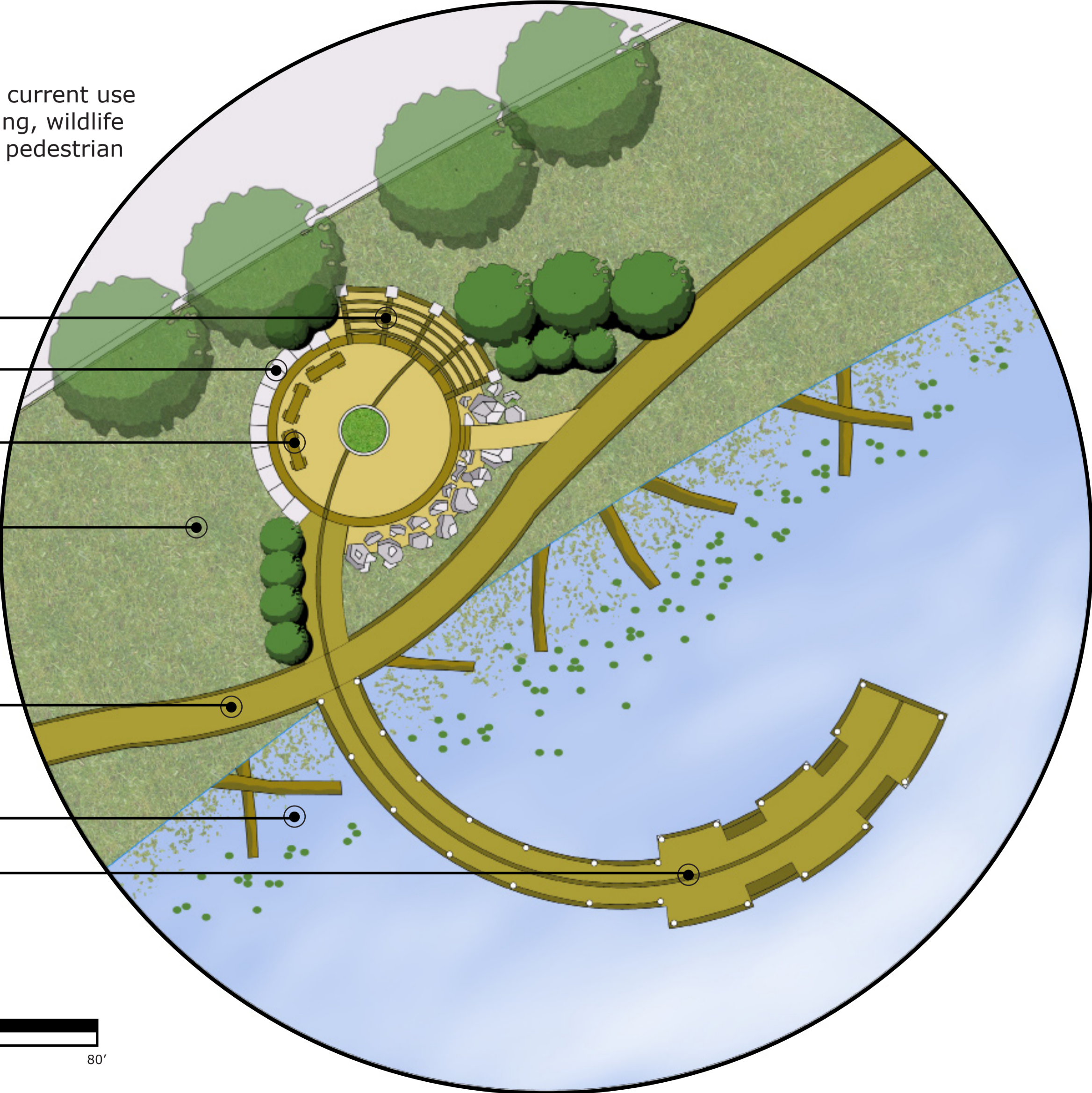
**Half -Log Seating**

**Upland Grass**

**8 ft Beach Boardwalk**

**Aquatic Vegetation**

**Fishing Pier**



**SCALE**



# OUTDOOR LEARNING

## UPLAND GRASSES

- Canada blue-joint grass**  
*Calamagrostis canadensis*
- Big bluestem**  
*Andropogon gerardii*
- Blue grama**  
*Bouteloua gracilis*




## WETLAND SEDGES

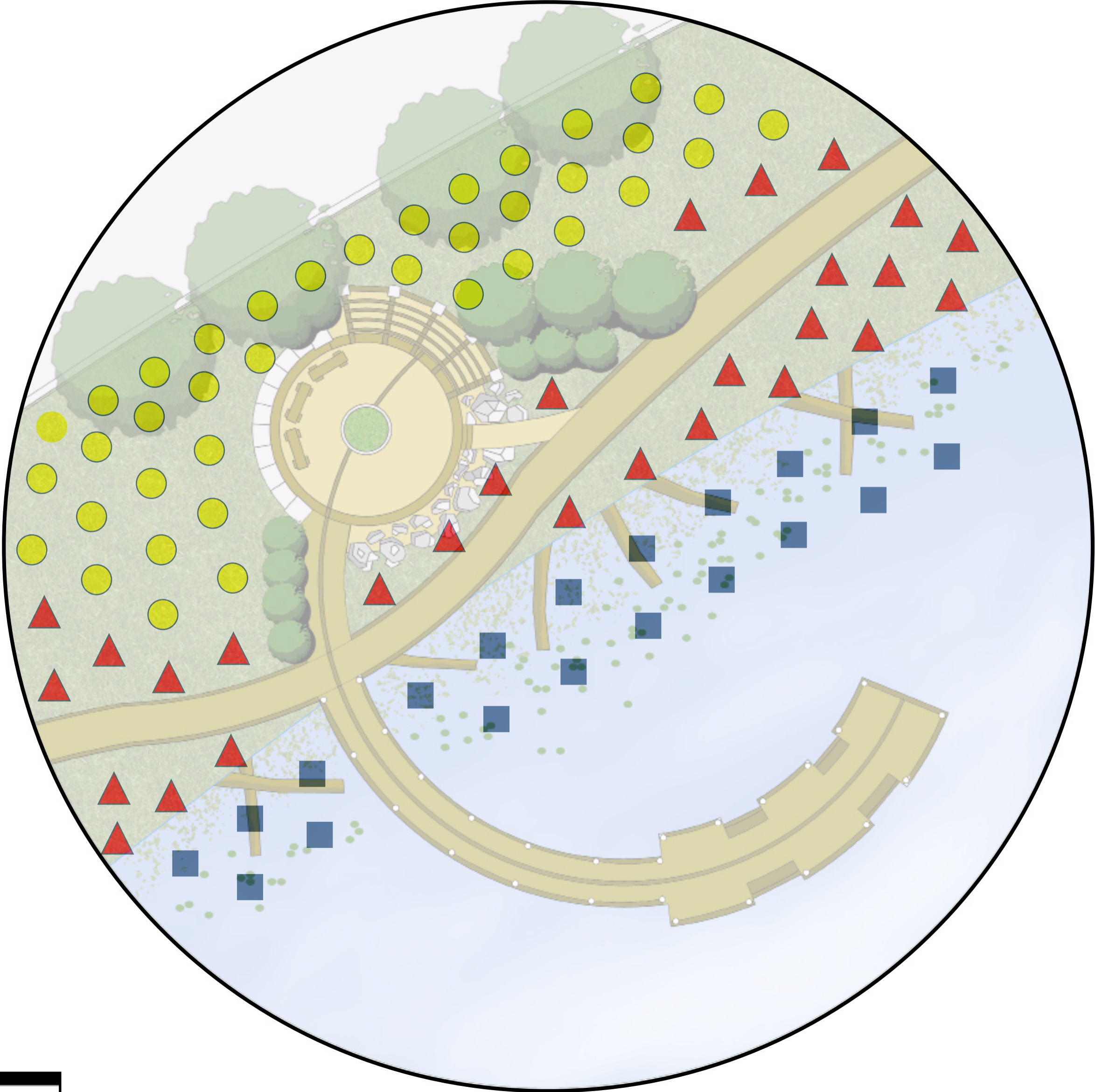
- Caterpillar sedge**  
*Carex crinita*
- Lake sedge**  
*Carex lacustris*
- Tussock sedge**  
*Carex stricta*

## AQUATIC VEGETATION

- White Water Lily**  
*Nymphaea tuberosa*
- Softstem Bulrush**  
*Scirpus validus*
- Soft rush**  
*Juncus effusus*

## PLANTINGS

-  Upland Grass
-  Wetland Sedges
-  Aquatic Vegetation



### SCALE



# OUTDOOR LEARNING

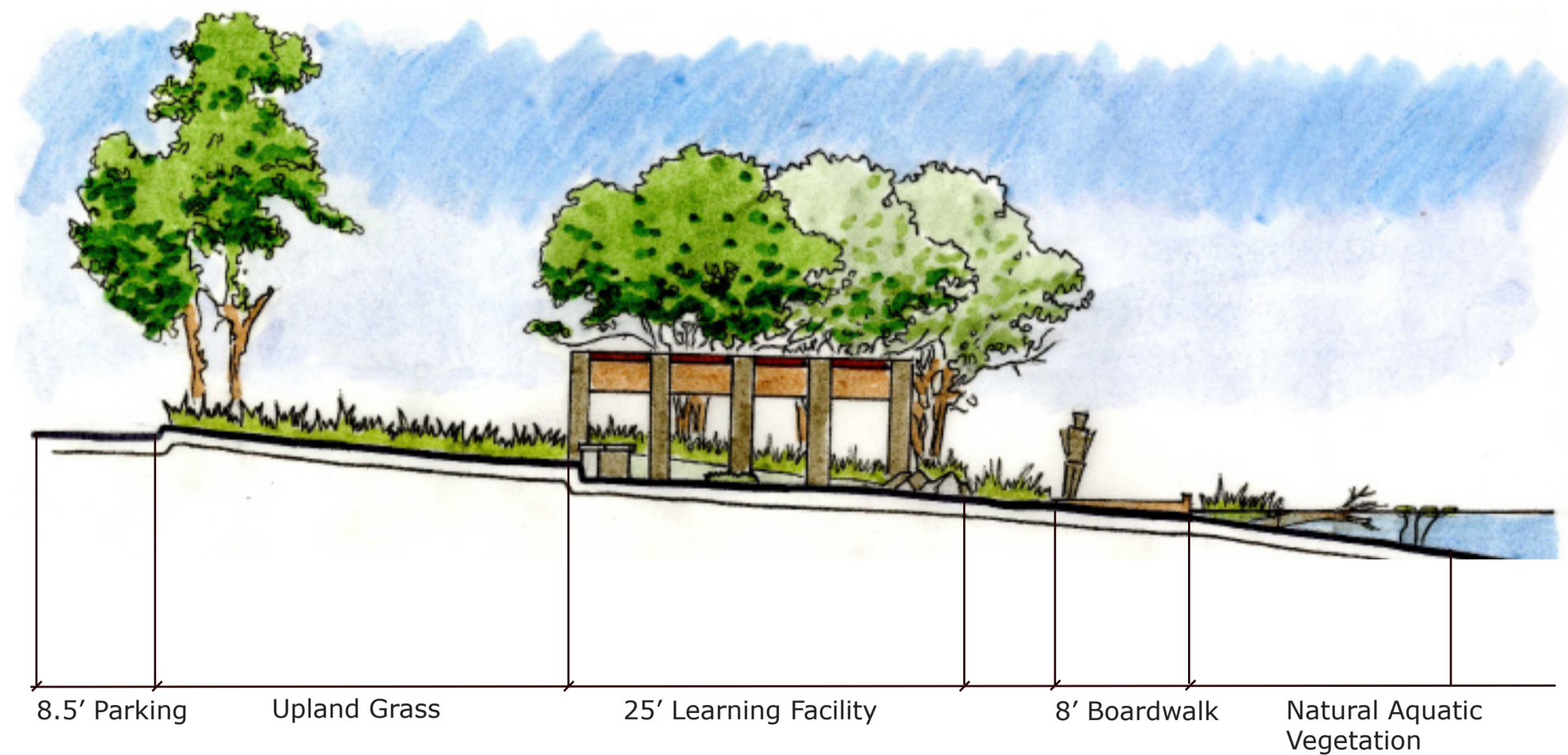
## DESIGNATED FISHING AREA

The beach currently lacks proper habitat to support large quantities of fish. The implementation of native aquatic vegetation near the fishing pier will create vital spawning areas for fish species and attract food sources for larger fish. The beach can become a destination for community residents and a great place to teach kids fishing techniques.

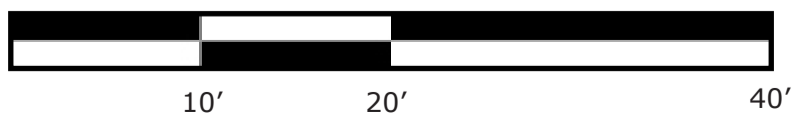
## OUTDOOR LEARNING FACILITY

Area students will use the restoration site to learn about a functioning lake ecosystem through self discovery and outdoor class sessions. Students who experience the natural environment will have a better understanding of ecology and learn the importance of lakeshore habitat. The learning facility integrates natural shoreline vegetation and creates an ideal environment for learning. Area residents can learn about the implementation of natural lake shorelines and its benefits through education boards.

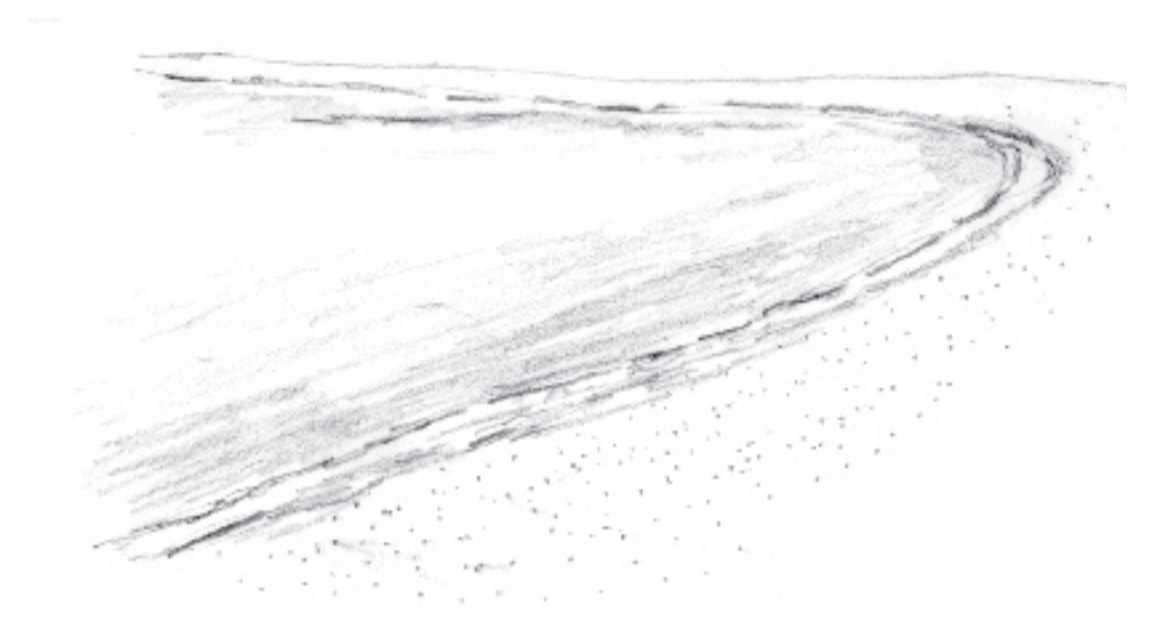
## OUTDOOR LEARNING FACILITY SECTION



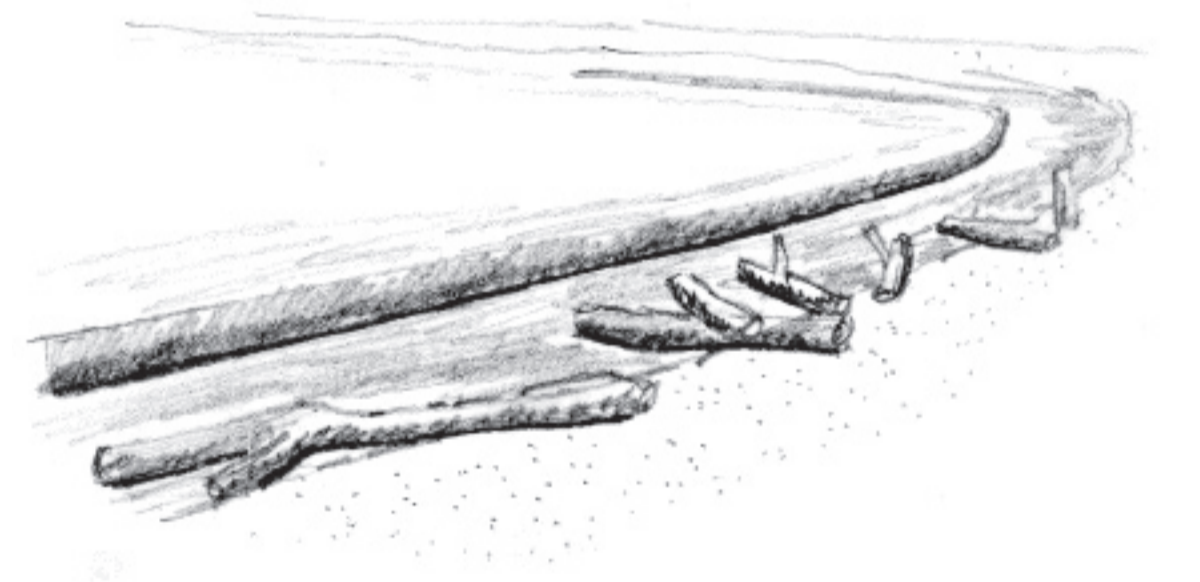
### SCALE



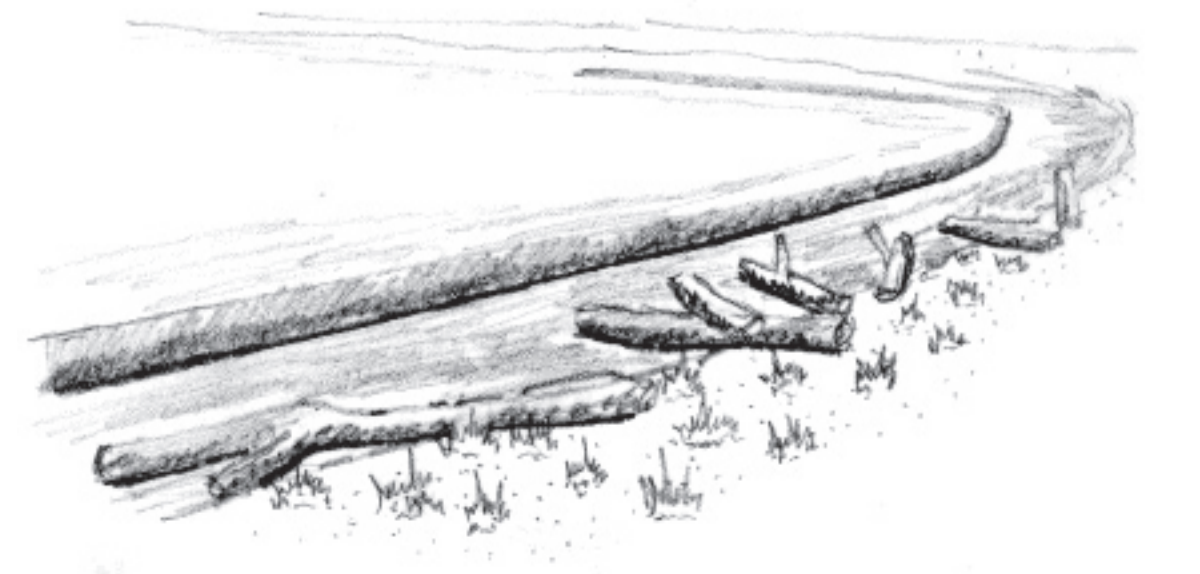
## PHASE 1 SKETCH : ERADICATION



## PHASE 2 SKETCH : EROSION CONTROL



## PHASE 3 SKETCH : PLANT



OUTDOOR LEARNING FACILITY  
FISHING PIER



# RESOURCES

## READINGS

State of Minnesota, Department of Natural Resources. (2009). The water's edge. Retrieved from <http://files.dnr.state.mn.us/assistanee/backyard/shorelandmgmt/savewateredge.pdf>

Detroit Lakes Regional Chamber of Commerce. (2010). Visit detroit lakes. Retrieved from <http://www.visitdetroitlakes.com/>

Henderson, Carol L., Dindorf, Carolyn J., & Rozumalski, Fred J. (1998). *Lakescaping for wildlife and water quality*. Minnesota: Department of Natural Resources

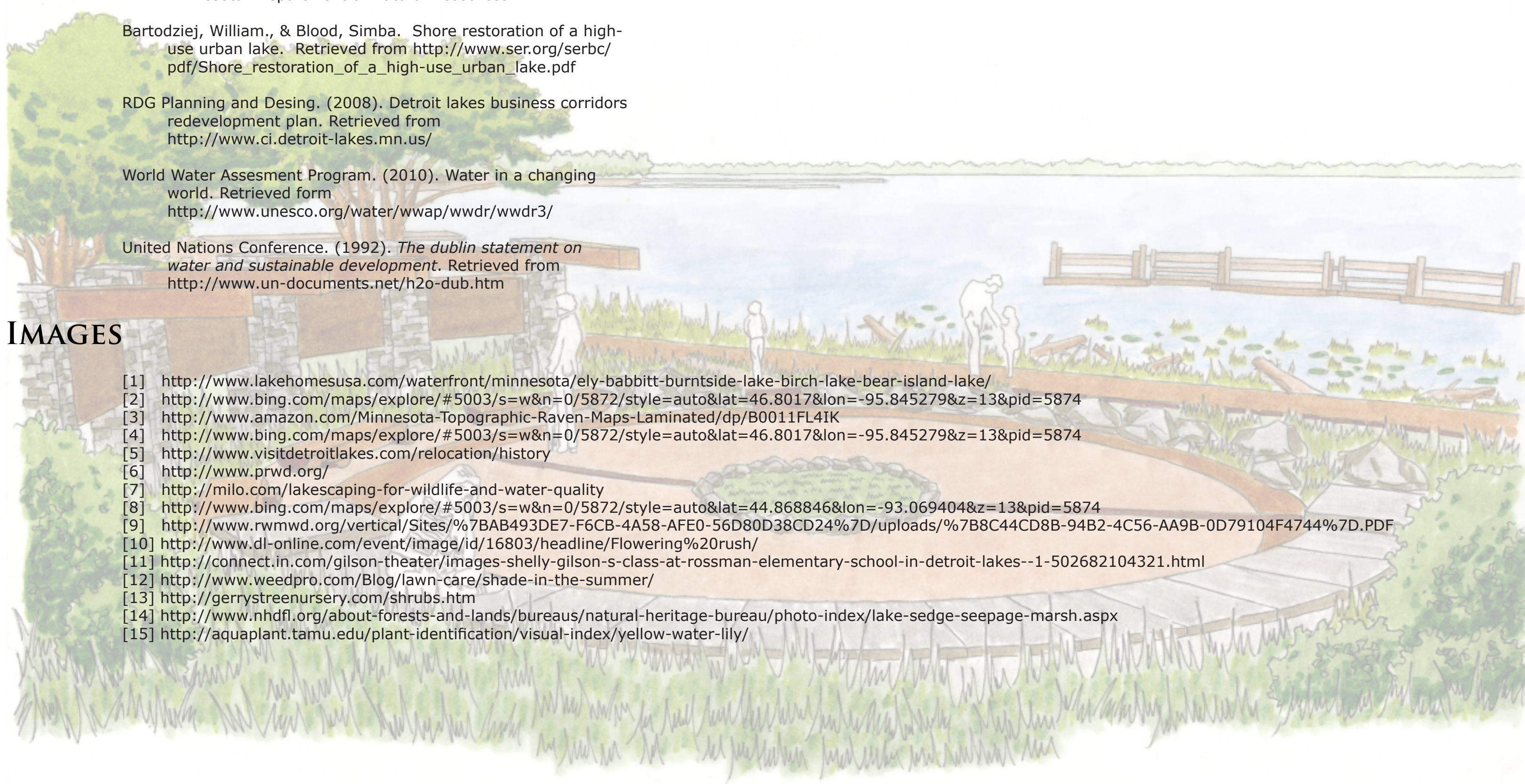
Bartodziej, William., & Blood, Simba. Shore restoration of a high-use urban lake. Retrieved from [http://www.ser.org/serbc/pdf/Shore\\_restoration\\_of\\_a\\_high-use\\_urban\\_lake.pdf](http://www.ser.org/serbc/pdf/Shore_restoration_of_a_high-use_urban_lake.pdf)

RDG Planning and Desing. (2008). Detroit lakes business corridors redevelopment plan. Retrieved from <http://www.ci.detroit-lakes.mn.us/>

World Water Assesment Program. (2010). Water in a changing world. Retrieved form <http://www.unesco.org/water/wwap/wwdr/wwdr3/>

United Nations Conference. (1992). *The dublin statement on water and sustainable development*. Retrieved from <http://www.un-documents.net/h2o-dub.htm>

## IMAGES

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- [1] <http://www.lakehomesusa.com/waterfront/minnesota/ely-babbitt-burntside-lake-birch-lake-bear-island-lake/>
  - [2] <http://www.bing.com/maps/explore/#5003/s=w&n=0/5872/style=auto&lat=46.8017&lon=-95.845279&z=13&pid=5874>
  - [3] <http://www.amazon.com/Minnesota-Topographic-Raven-Maps-Laminated/dp/B0011FL4IK>
  - [4] <http://www.bing.com/maps/explore/#5003/s=w&n=0/5872/style=auto&lat=46.8017&lon=-95.845279&z=13&pid=5874>
  - [5] <http://www.visitdetroitlakes.com/relocation/history>
  - [6] <http://www.prwd.org/>
  - [7] <http://milo.com/lakescaping-for-wildlife-and-water-quality>
  - [8] <http://www.bing.com/maps/explore/#5003/s=w&n=0/5872/style=auto&lat=44.868846&lon=-93.069404&z=13&pid=5874>
  - [9] <http://www.rwmwd.org/vertical/Sites/%7BBAB493DE7-F6CB-4A58-AFE0-56D80D38CD24%7D/uploads/%7B8C44CD8B-94B2-4C56-AA9B-0D79104F4744%7D.PDF>
  - [10] <http://www.dl-online.com/event/image/id/16803/headline/Flowering%20rush/>
  - [11] <http://connect.in.com/gilson-theater/images-shelly-gilson-s-class-at-rossman-elementary-school-in-detroit-lakes--1-502682104321.html>
  - [12] <http://www.weedpro.com/Blog/lawn-care/shade-in-the-summer/>
  - [13] <http://gerrystreenursery.com/shrubs.htm>
  - [14] <http://www.nhdfi.org/about-forests-and-lands/bureaus/natural-heritage-bureau/photo-index/lake-sedge-seepage-marsh.aspx>
  - [15] <http://aquaplant.tamu.edu/plant-identification/visual-index/yellow-water-lily/>