

An aerial photograph of a lake at sunset. The sky is filled with colorful clouds in shades of orange, yellow, and blue. The water reflects the sky and the surrounding green forest. In the foreground, there are several docks and a small structure on the water. The text is overlaid on a semi-transparent white band across the middle of the image.

Lakeshore Design Intervention

Jacob R. Miller

Thesis 2020-2021

Project Justification

Overview

Following the Minnesota's State and County's regulations is a dominant factor in lakeshore design. It is important to follow them for the safety of the environment, and the properties foundation (Erosion control). Many people don't realize the importance of these regulations and why they are established, but with so many rules they don't seem to care, which can be harmful to wildlife habitats, their foundation, and they could face penalties by law enforcement in extreme conditions. This project will clearly show what can and can not be done in the Crow Wing County. As technology advances, there is potential for renewed laws and regulations that can be implemented in landscape designs. These ideas such as helical piers for example, can be used to push past these setbacks but remain environmentally friendly.

Personal Relevance

- Familiarity with the area
- Experience with designs and installations for the area that abide by the regulations

Professional Relevance

- Practice of healthy wildlife and ecosystem designs
- Relationship between landscape planning and sustainable development

Social Relevance

- Clientele happiness
- Landowner superiority

Project Impacts

- Re-imagined designs that can be used as an example for contractors
- Guides for proper development

Project Financing

- Wealthy lakeshore owners
- Government accountability



Brief History

This project has been conducted is to provide landowners in the residential and commercial shoreland districts with designs that illustrate maximum potential for their property that follow the state and county's regulations. Reasons why this project has been chosen include:



Limited development on lakeshore properties due to state and county jurisdiction



Illegal design installations that cause environmental and wildlife concerns



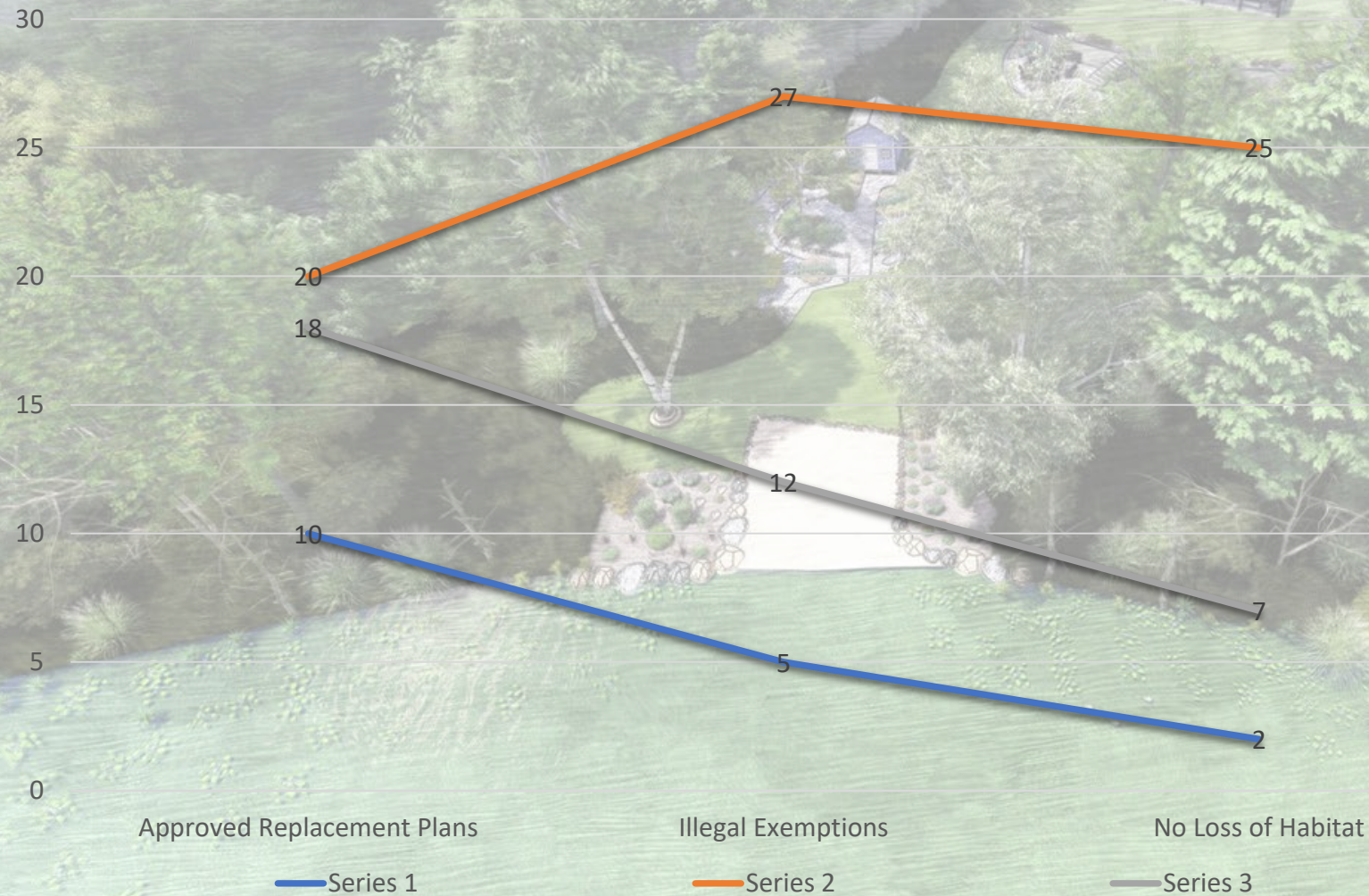
Lack of education that could help guild landowners with eco-friendly designs

I want to incorporate the wildlife concerns with private interests to create designs that satisfies the needs of both government and landowners. To be able to reduce the environmental risks in protected habitats and to create a more sustainable, yet still visually pleasing design that will satisfy the landowners and go by the laws of the protected area.



Statistics

Approvals Over The Past 5 Years



Approved Replacement Plans
Decline in plans to replace an existing landscape which could be frustrating for the owner.

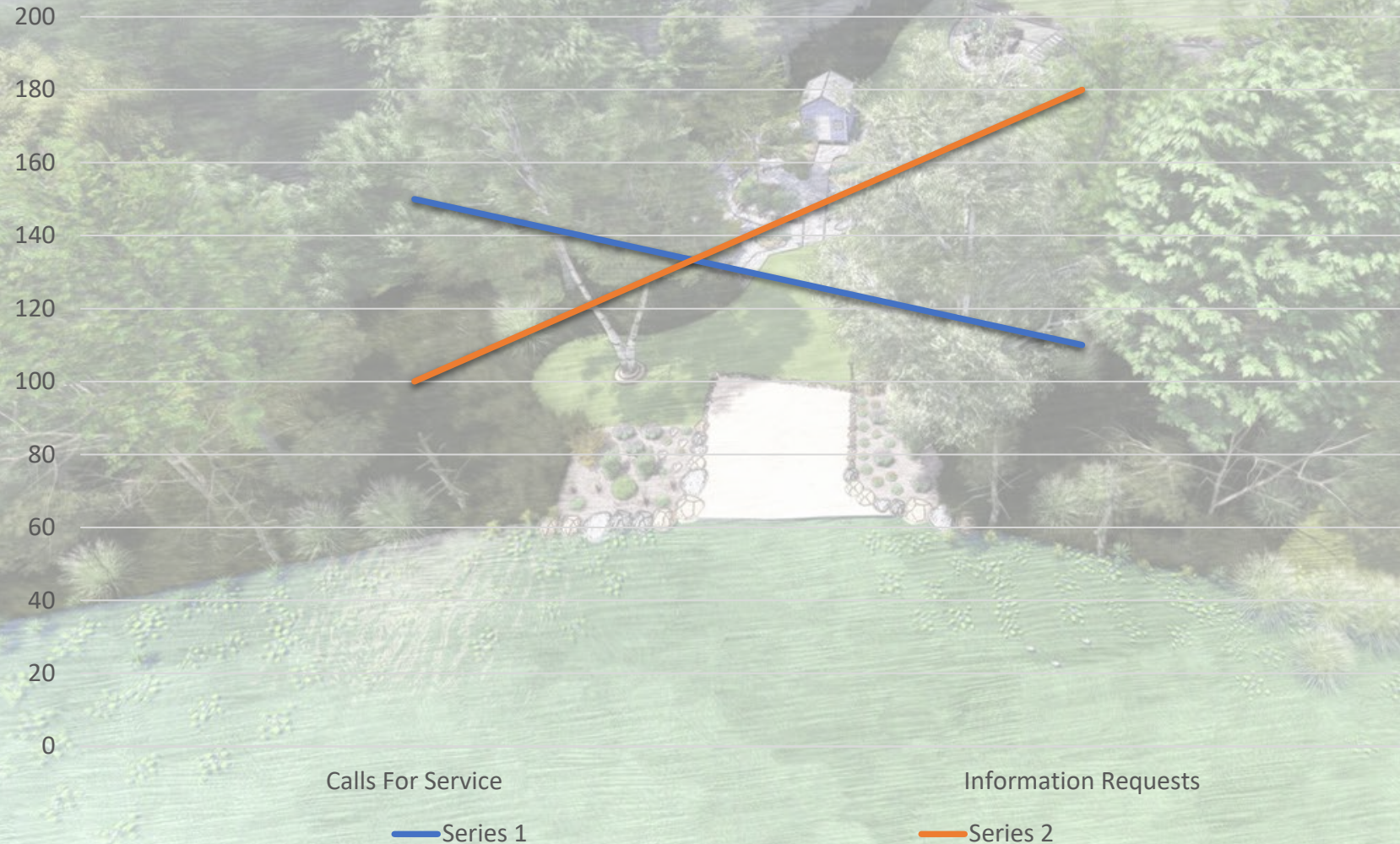
Illegal Exemptions
Mostly an increase in landowners who have illegally installed fill (Anything that fills the land with material, resulting in a change in SW runoff) that the government lets slide.

No Loss of Habitat
Steady decrease in properties undergoing construction that result in losing more of the existing habitat.



Statistics

Customer Service Over The Past 5 Years



Customer Service

This graph shows how landowners continue to seek information, but the decrease in the calls for service means they understand the probability of an approved design; therefore, they install it without a call for service.



Project Goals



Eco-friendly Designs



Redefine Habitat Safety in Designs



Law Abiding Installations



One Governing Wildlife Agency



Public & Private Common Ground



Proposed Client

Potential Clients for this project include:

- Minnesota Department of Natural Resources (MnDNR)
- Environmental Protection Agency (EPA)
- Information for Planning and Construction (IPaC)
- Landowner Associations
- General Contractors

This project is intended to be open to the public for Residential designs and for the MnDNR to use for mitigation strategies.



State Laws & Regulations

Design Types	Permitted	Permit Required	Restricted
Sand Blankets	Yes		
Bluffs		Yes	
Storage Shed		Yes	
Bridge Crossing		Yes	
Fill		Yes	
Prohibited Planting			Yes
Work Below OHWT		Yes	
Rip-Rap		Yes	
Lawn Landscaping	Yes		
Shore/Aquatic Plant Removal		Yes	
Shoreland Tree Removal			Yes
Wildlife Pond or Rain Garden	Yes		
Sunken Log Removal			Yes
Wetland Activity		Yes	



Agency Approval

	Lead Time	Small Structure (Above OHWT)	Impervious Fill	Veg Removal (150' or Building Setback)	Patio	Retaining Wall	Revisors or International Waterways	Land Clearing
Federal	3 Months						Yes	
State	6 Weeks							
County	2 Weeks	Yes	Yes	Yes	Yes	Yes		Yes
Municipality	2 Weeks	Yes	Yes	Yes	Yes	Yes		Yes

	Lead Time	Rip-Rap	State Owned Land	Boardwalks	Sand Blanket	Dredging	Septic System	Dock Platform Over 120sq.ft.
Federal	3 Months						Yes	
State	6 Weeks		Yes			Yes		
County	2 Weeks	Yes		Yes	Yes	Yes		Yes
Municipality	2 Weeks	Yes		Yes	Yes	Yes		Yes



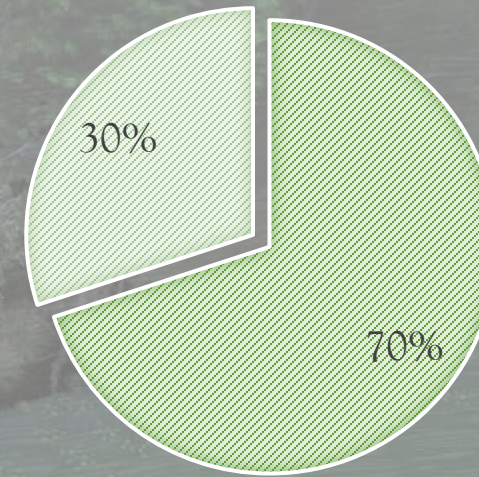
Law Improvements

These proposed improvements are to make construction of lakeshore properties easier for the owners and contractors. The implementation of environmental factors such as habitat, erosion control, native plantings, and stormwater management are all being considered in this.

One Jurisdiction

- One regulatory agency that covers all the building and construction permits
- Set of rules that cover the entire state and or different soil and moisture classes
- One website for the state of Mn for information regarding design and construction

LAKE FRONTAGE
INCREASED FROM
30% TO 70%



With an environmentally friendly replacement design

- Wetland manipulation
- Raingarden development



Law Improvements- Helical Piers

Proposal of structures or “fill” to be allowed further into restricted areas with it being elevated on helical piers. These piers thread into the ground, which allows only a small amount of disturbance. The piers raise structures above the ground, which allow stormwater runoff to pass underneath, resulting in no disturbance to the impact of shoreline erosion. Helical pier’s features include:

- Heavy and light loads
- Safely drive through 50 ft. or more
- Minimal disturbance to the surrounding environment
- Use in unsteady soil condition



Case Studies

WI Lakeshore Restoration



- Lakeshore Restoration
- Habitat Restoration Techniques
- Erosion Control
- Water Conservation
- Bioengineering
- Native Plantings
- Rain Gardens

Mirror Lake Remediation



- Habitat Restoration
- Sediment Restoration
- Wildlife Permits
- Chemical Contamination
- Bioaccumulation
- Wetland Planning

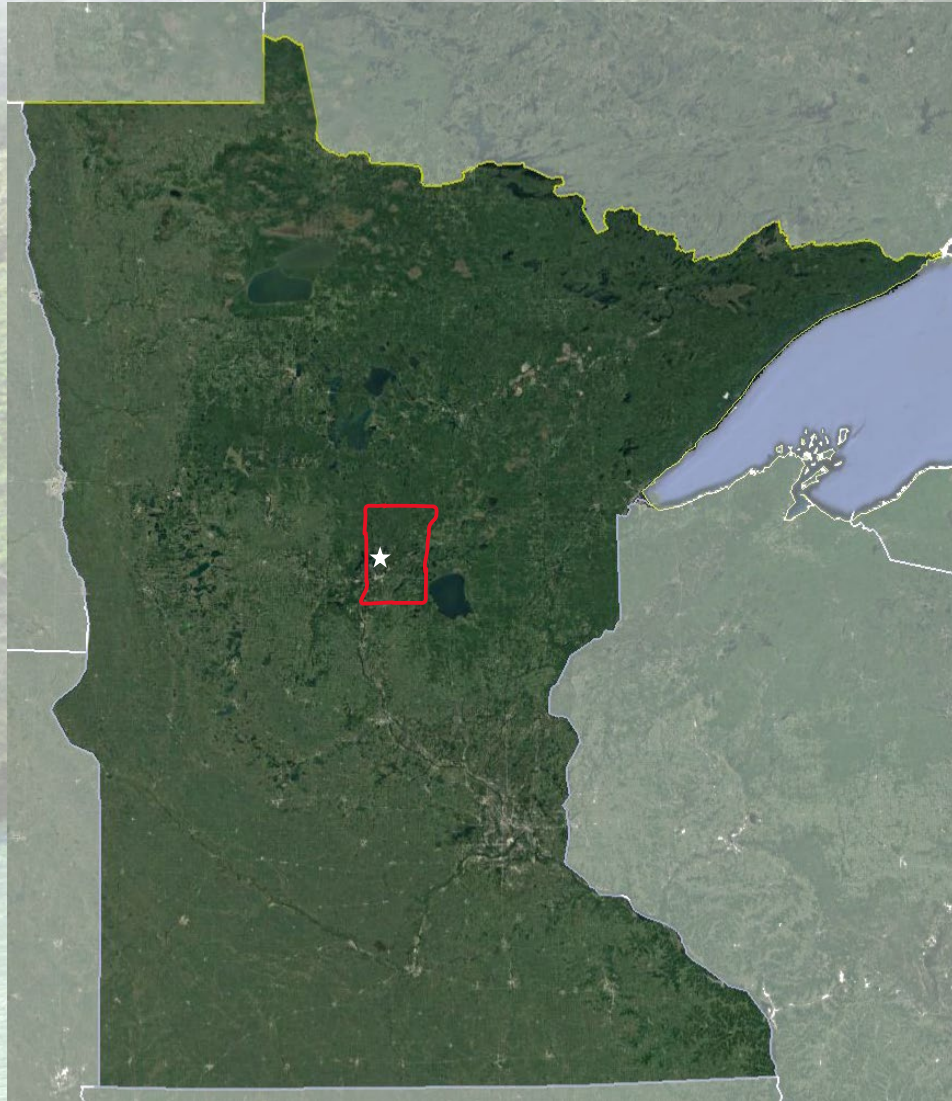
A Shoreline Re-Imagined



- Residential Lakeshore Design
- Social Choreography
- Ecology
- Native Plantings
- Boat House Uses
- Terraces
- Circulation
- Government Jurisdiction



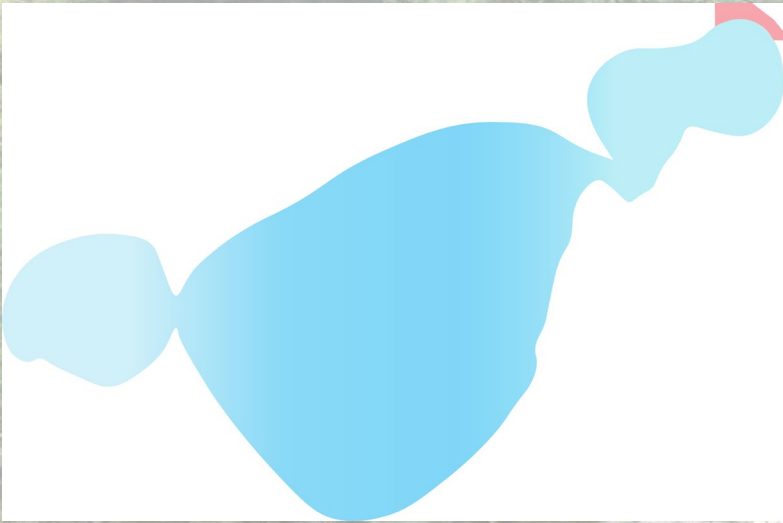
Site Analysis- Site Selection



Location:	Crow Wing County MN
Typology:	Rural Lakefront Residential Natural Coniferous Forests
Climate:	Warm-summer Humid Continental
Ecosystem:	Macro- Laurentian Mixed Forest Micro- Mille Lacs Uplands, Pine Moraines & Outwash Plains
Status:	The economy increases yearly, along with the amount of tourism. Campgrounds and landowners have less land every year due to erosion. Common lake water heights are at their lowest in the past 5 years due to poor dam management.
Note:	Soils are 8-18% clay and 45-65% fine sand or coarser material



Site Analysis- Site Selection



North Long Lake is located North of Brainerd but is still considered to be in the “Brainerd Lakes area”. This lake is full of residents who fish for walleye and bass, water sports, and leisure. There are two sand bars, one on the North and South channel, typically about 1’ to 5’ deep. There is one boat launch located on the North “Merrifield Bay” and one restaurant called “The Northern Cowboy”, located on the South “371 Bay”. My site location is on Merrifield Bay, which includes much private residential housing, the boat launch, and a resort on the far end located near the boat launch. This lake is more relaxed than some other popular lakes in the area such as “Gull Lake”. This is great for the residence on the lake, so they can appreciate their time here with very little boat traffic. North Long Lake’s opportunities are endless for residence and designers.



Site Analysis



Site Location & Topography

Throughout this site topography changes at most 24' in elevation from the road, and trail to the water's edge. The site creates four areas that makeup ponds, swamps, and marshes. Highlighting in red are the two site locations. The Residential District on the left is about 5-acres. The Commercial District on the right is about 4 acres.

Roads & Trails

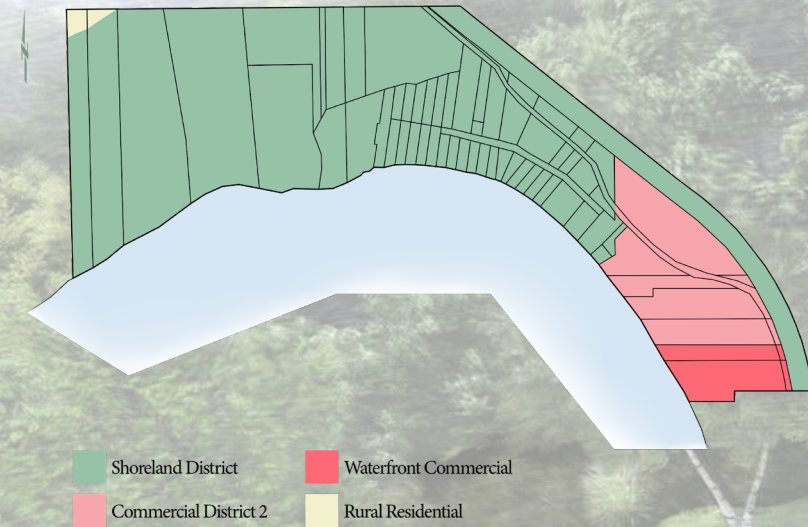
The site has few roads, but many driveways, and trails. The county only has one road that runs across the North of the site called County Road 127. The township has one road that enters the site that belongs to the township named Train Bell Rd. There are a few private roads as well, the northernmost are named Fern Leaf Ln., then below it is named Cottage Ln.



Site Analysis

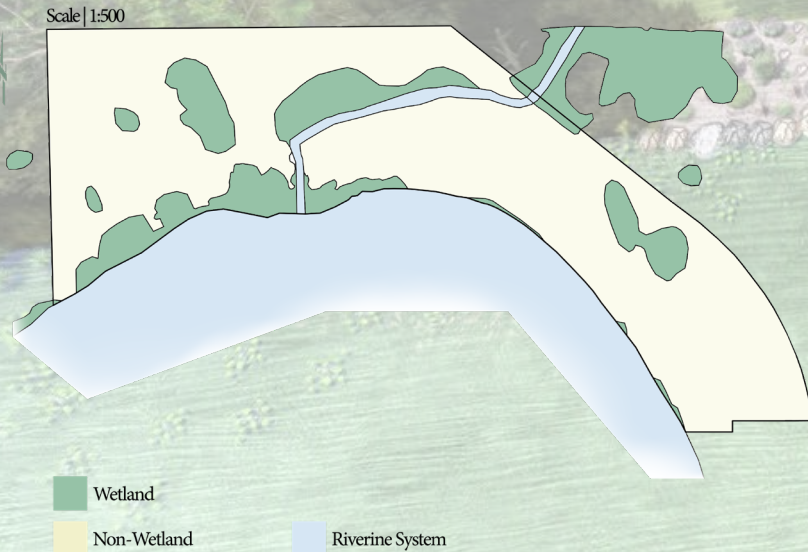
Parcels & Land Use

The area of this land is approximately 70 acres. Most of the site is made up of the Shoreland District, which will primarily be residents who live their lakeside. The next largest area is Commercial District 2, which are located along federal, state, county, or township roads. The next area is called the Waterfront Commercial District, which are used for marinas, resorts, and restaurants. The smallest area of the site is the Rural Resident District.

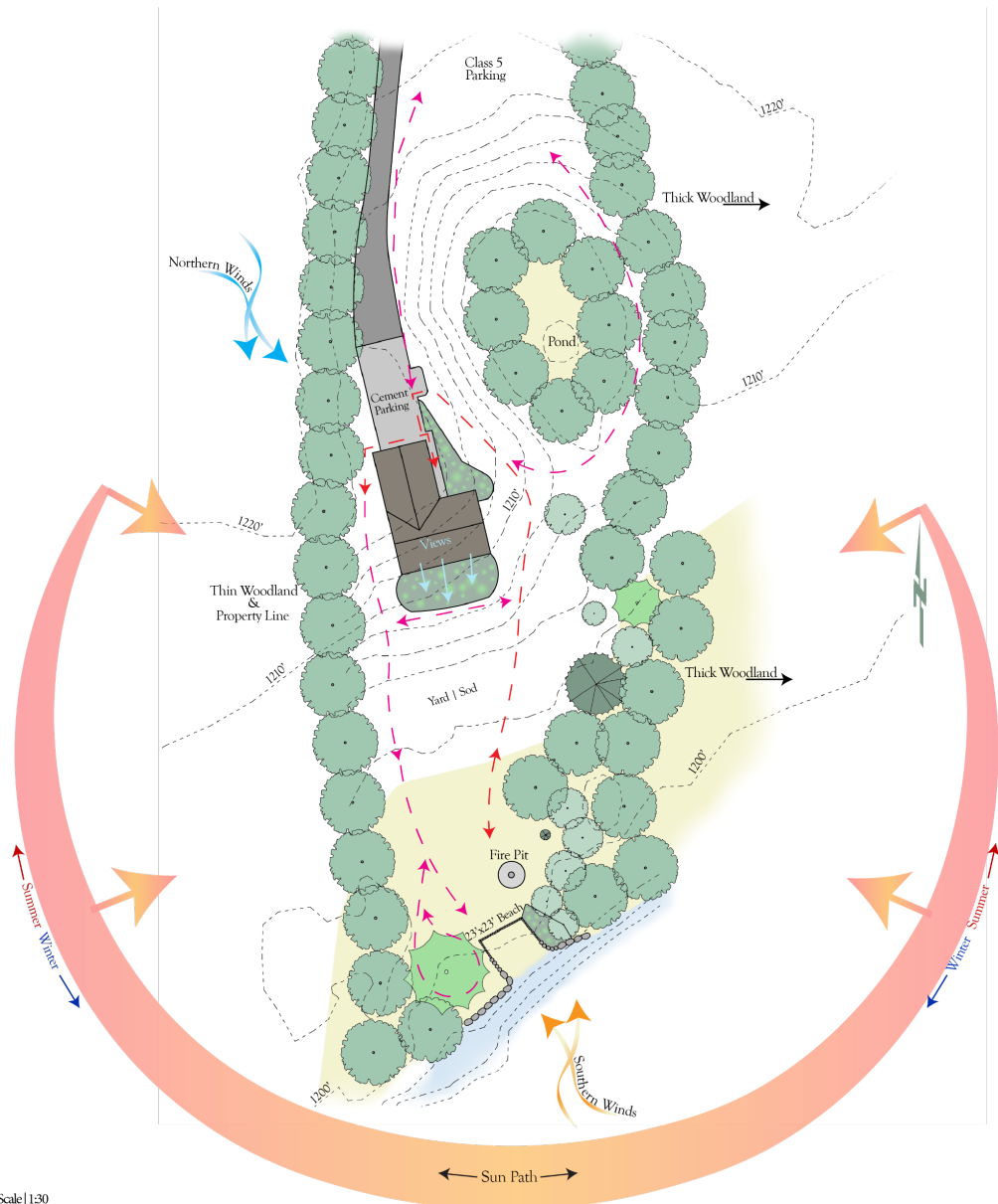


Wetlands

Of the approximate 70-acre site location, about 35% of it consists of wetlands or streams. Wetlands are classified as lands consisting of marshes, swamps, and saturated land. In these areas, the site should focus on preserving and restoring the natural habitat. Residents who have a wetland in their property should focus on a proper buffer zone. This would be the area maintained around the shoreline or edge of a stream or wetland.



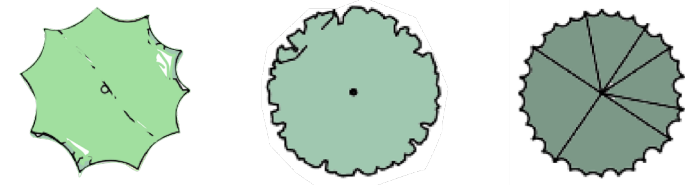
Site Analysis- Res. Shoreland District



The purpose of this district is to preserve and enhance the quality of surface waters, conserve the economic and natural environmental values of shorelands, protect drinking water sources, and provide for the wise use of water and related land resources. The primary use within this district is seasonal and year-round single-family residential.

Site Characteristics

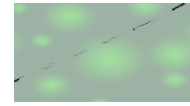
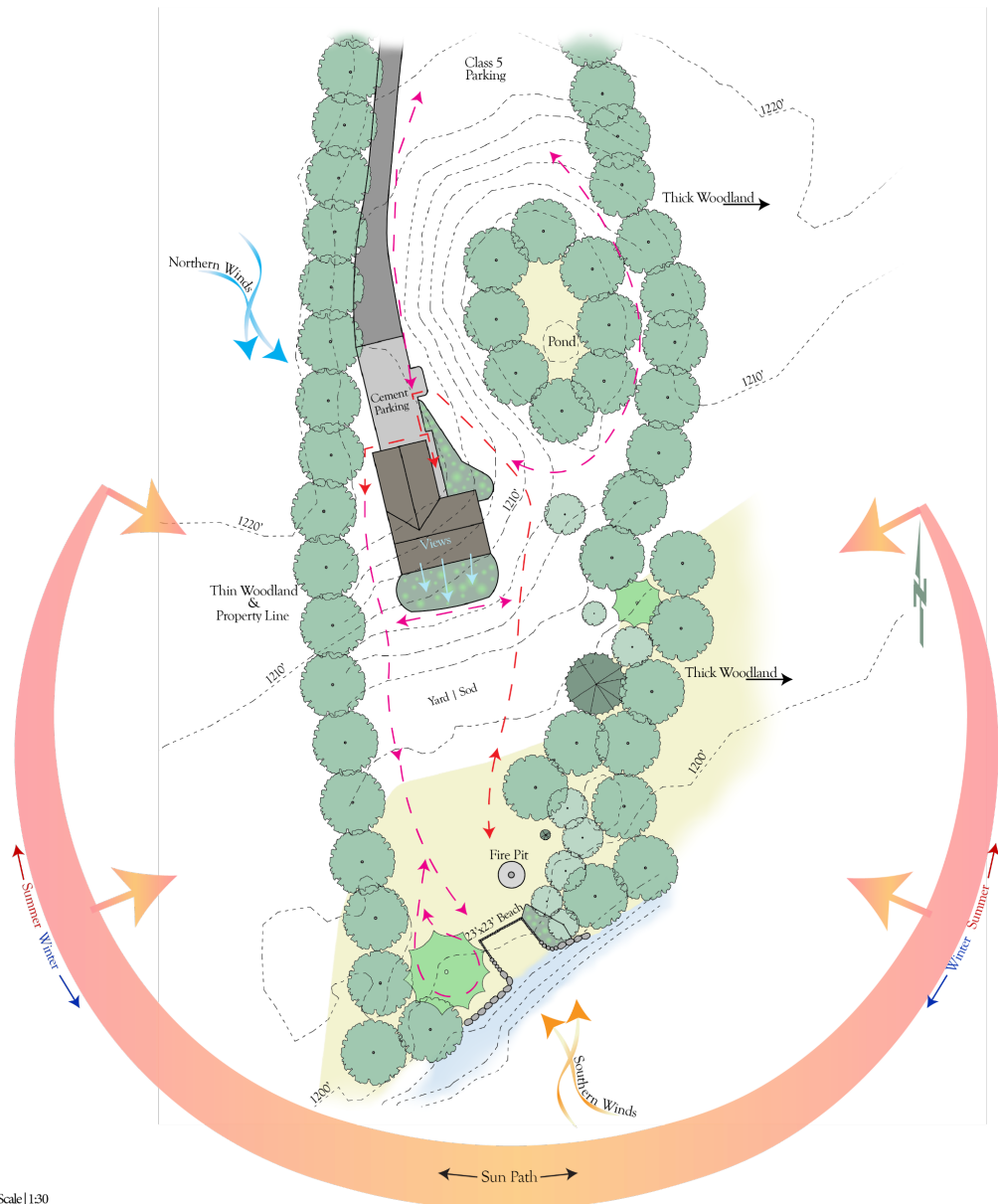
This parcel of land consists of heavy woodland surroundings with above-average slopes. Most of this area's yard is not far from the Ordinary High-Water Line (OHWL) and is in the wetland, meaning most of the lower areas of this property will be moist and may consist of moss, rather than grass. This property has previously removed the natural wetland has tried to replace it with sod. This will result in high water runoff into the lake, harming the water's ecosystem. In order to solve this, there will have to be an improved buffer zone. The views of this property are in well, therefore there will need to be no site clearing, only to reduce the size of the yard, and restore the wetland.



Site Tree Species

Oak | Ash | Maple | Beech | Birch | Aspen | Spruce
White & Red Pine

Site Analysis- Res. Shoreland District



Existing Planting Bed

Many plants are invasive and or do not serve the ecosystem. Planting bed will be removed or improved in the design stage.



Wetland

This area's design will be of the most importance, due to its involving characteristics on the environment.



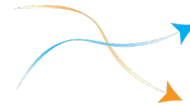
Main Circulation

Primary foot paths, most likely will utilize throughout design.



Secondary Circulation

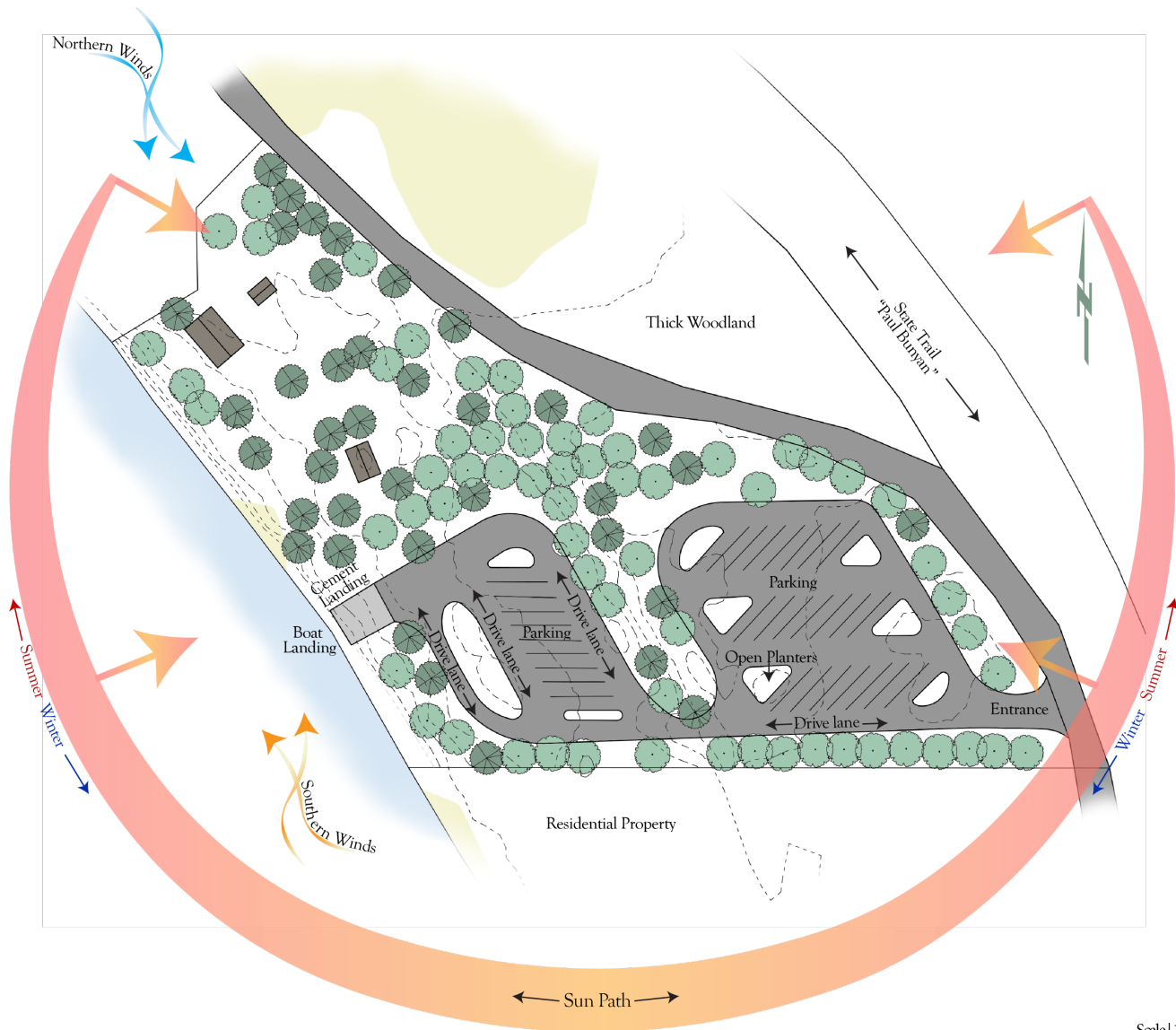
Foot paths are only used when needed, not as important to include these into the overall design.



Prevailing Winds

The Southern wind will bring warm air from the South. These winds will primarily be coming from the lakefront, which in some cases, the lake water will cool the air. The Northern winds will bring cooler air from the North. These winds are extremely reduced because of the thick woodland that surrounds the site. Although, some of these Northern winds may wrap around the lake, and blow through the lakefront from across the lake.

Site Analysis- Waterfront Com. District



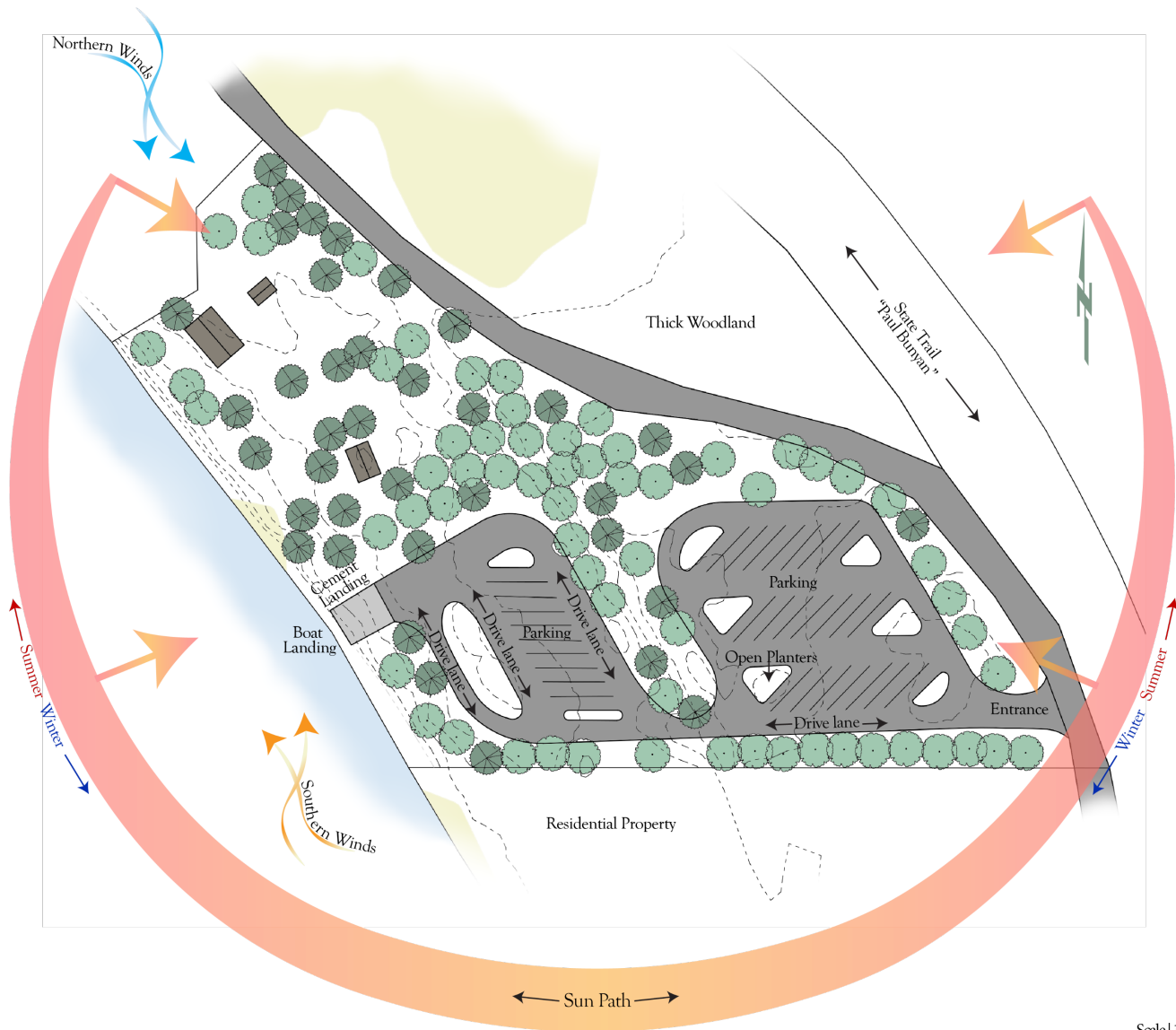
Scale | 1:75

The purpose of this district is to accommodate commercial uses in the shoreland district where access to and use of a surface water feature is an integral part of the business. The primary uses in this district are marinas, resorts, and restaurants with transient docking facilities.

Site Characteristics

This parcel of land consists of a lightly woodland area, with limited development. The state owns only the parcel of land that consists of the boat launch and parking, but the Northern neighboring land can be transitioned into a commercial property, if need be, by buying off segments of the land. This site has generic parking lots that are equipped for truck and trailer parking and movement. The site lacks landscaping, and all the planters are outgrown with weeds and prairie grass. There are very few wetlands to incorporate into designs, which will give an opportunity for more futures.

Site Analysis- Waterfront Com. District



Scale | 1:75

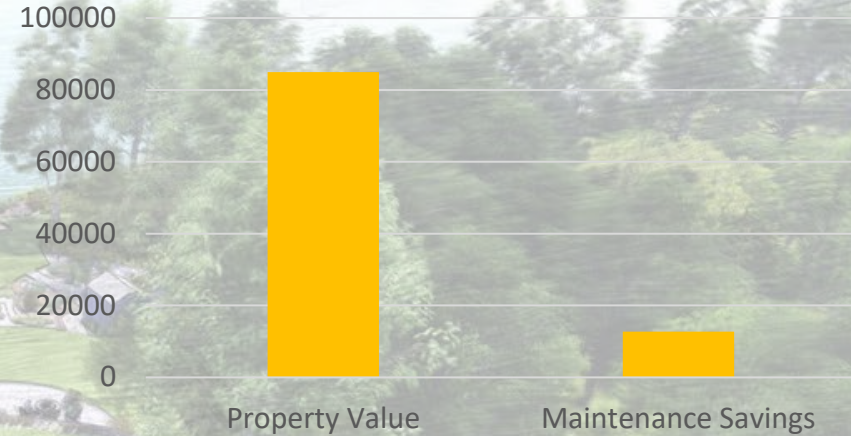
Site Promotions

- Promote business property by enhancing the attraction of the commercial district to residents, visitors and tourists with uniform lot width and area, and setbacks from the lake
- Improvement of appearance through good landscaping and natural trees for screening
- Manage storm water runoff to provide for the protection of natural and artificial retention areas, and public waters
- Establish a reasonable design, construction, installation, and maintenance of the site
- To alleviate potential traffic on local streets and adjacent highways to provide adequate parking, traffic circulation, and safety. The adjacent road consists of a multi-use vehicular and pedestrian traffic that is shared along the road.
- A potential redesign may be suitable to enhance pedestrian safety along the road and coming from the Paul Bunyan Trail

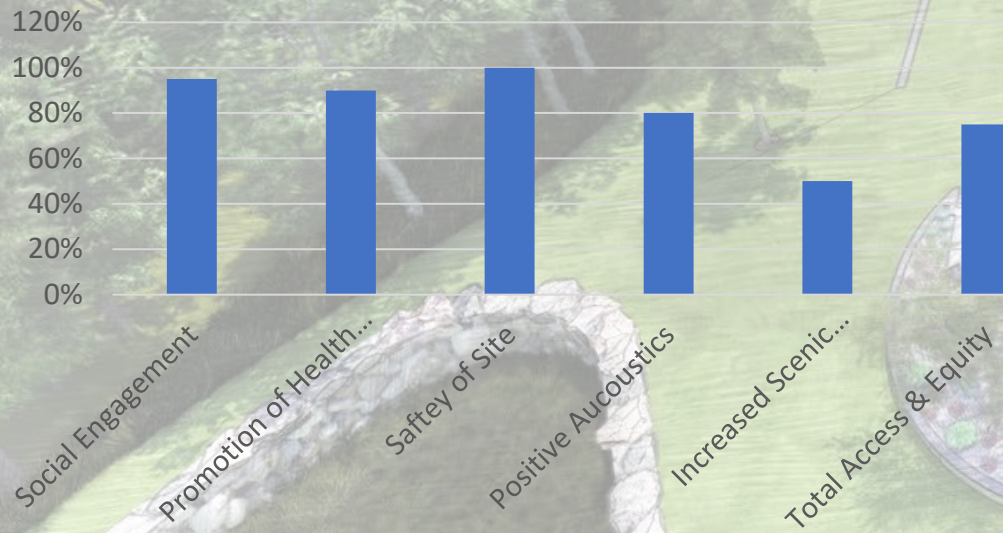
Performance Measure- Residential

The graphs shown are the residential project's increased impacts for the site that will measure the effectiveness of this project's landscape solutions to fulfill their intended purpose to contribute to sustainability.

Economic Impact



Social Impact



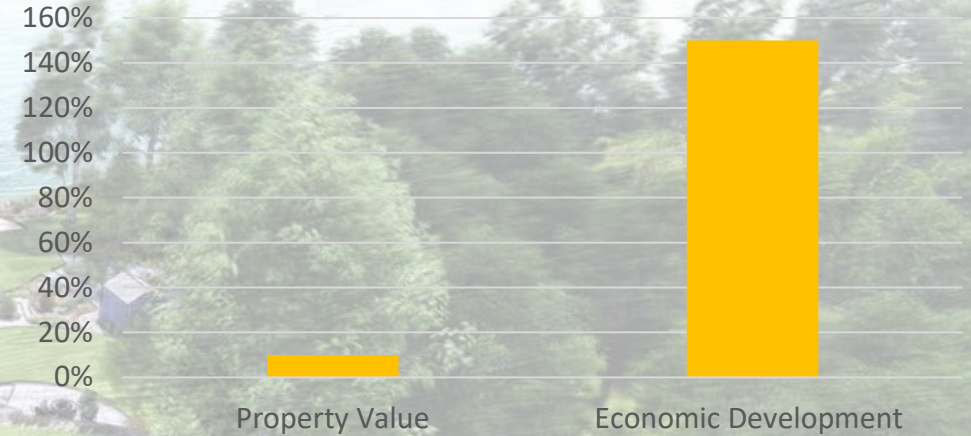
Environmental Impact



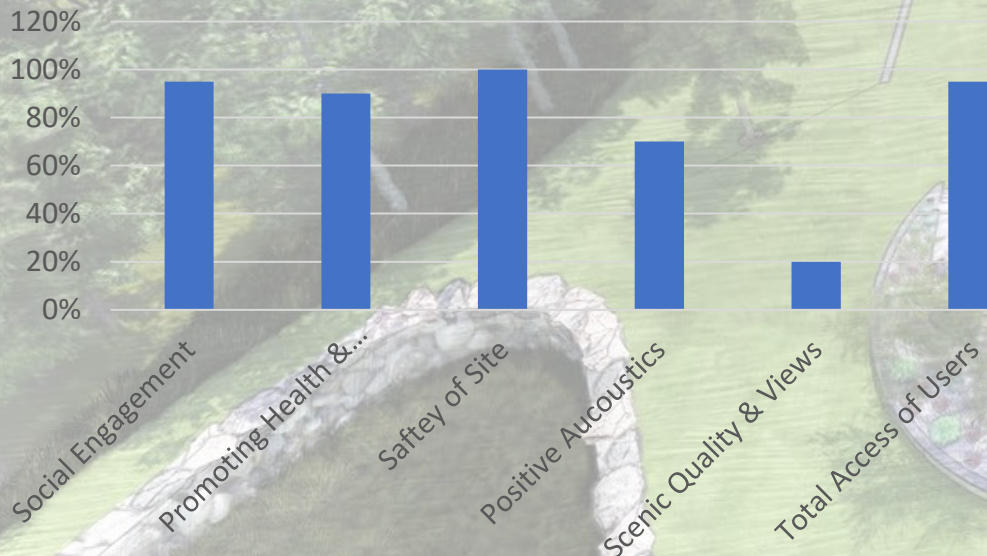
Performance Measure- Commercial

The graphs shown are the commercial project's increased impacts for the site that will measure the effectiveness of this project's landscape solutions to fulfill their intended purpose to contribute to sustainability.

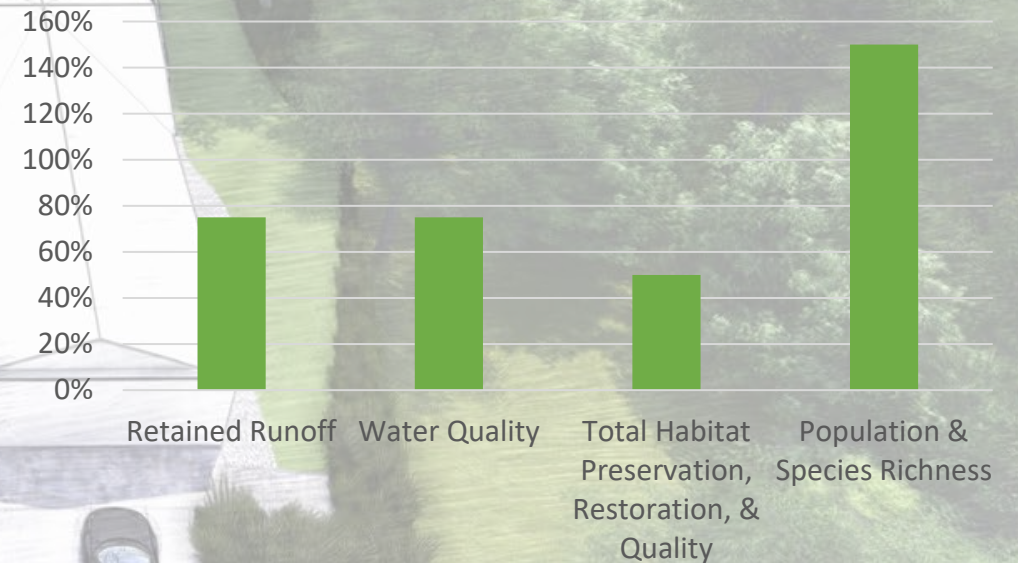
Economic Impact



Social Impact



Environmental Impact



Planting Pallet

Lakeshore ecosystems contain a wide variety of plant species, the following will need to be included in the design, evaluation, and selection:

- Trees
- Shrubs
- Grasses, Sedges & Aquatic Plants

The following characteristics have been selected as a useful wildlife and aquatic restoration for lakeshores in the Crow Wing County:

- Mature Height & Width
- Hardiness Zone
- Moisture
- Stabilization
- Growth Rate
- Native Selection
- Fall & Winter Interests
- Landscape Value

Trees

- Sugar Maple
- Beech
- Red Oak
- River Birch
- Balsam Fir
- Pussy Willow
- Flowering Plum

Shrubs

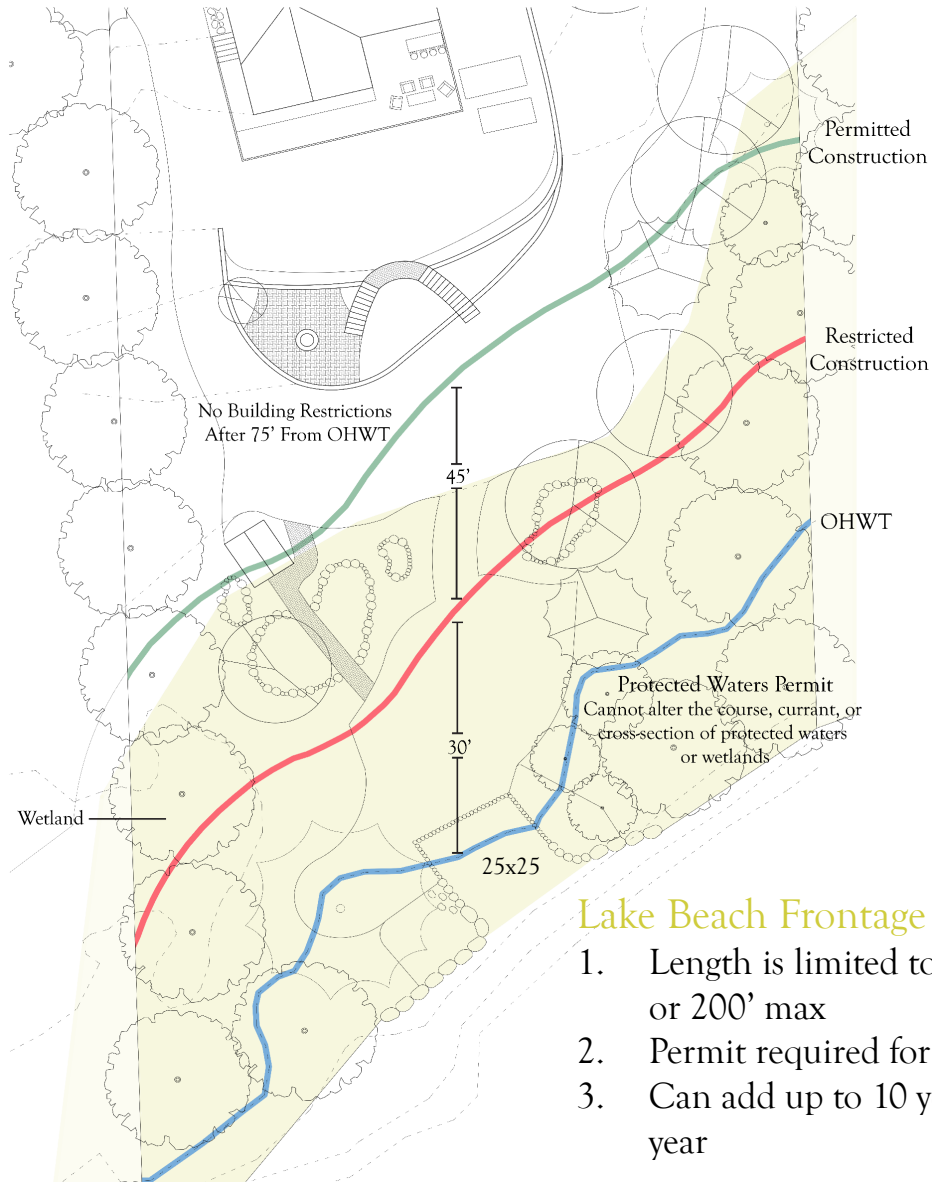
- White Snowberry
- Yellow, Arctic Fire, & Red Dogwood
- Tor Spirea
- Sumac
- False Indigo
- Winterberry
- Blueberry
- Hemlock
- Hosta
- Ninebark
- Old Field Juniper
- Arrowwood

Grasses, Sedges & Aquatic Plants

- Feather Reed
- Flame Grass
- Little Bluestem
- Prairie Dropseed
- Awl Fruited Sedge
- Knotted Rush
- Labrador Tea
- Meadowsweet
- Asclepias
- Eupatorium
- Rudbeckia
- Phlox
- Aster
- Iris
- Lillie
- Hemerocallis
- Astilbe



Site Setbacks- Residential



Lake Beach Frontage

1. Length is limited to 30% of shoreline or 200' max
2. Permit required for <10% slope
3. Can add up to 10 yds of sand each year

Setbacks

State shoreland rules establish minimum setbacks from the Ordinary High Water Table (OHWT) of lakes and rivers, and from the top of bluffs.

Non-Wetland

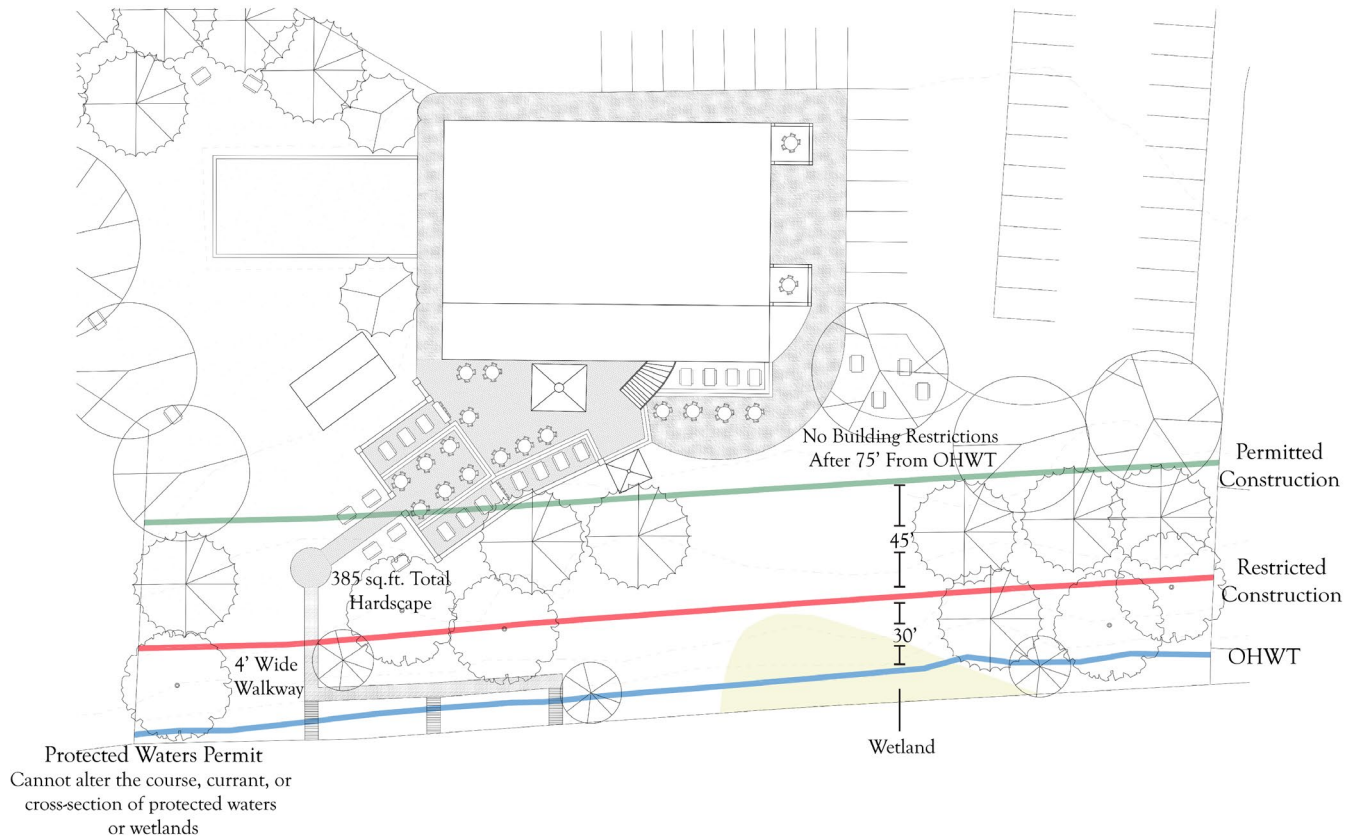
1. Shed or structure is at least 20' from the OHWT (with permit)
2. Shed or structure can be 120 sq. ft. but the front must be behind the setback
3. No building restrictions after 75' from the OHWT
4. A 4' wide walkway or stairway within the lake setback is allowed with a permit

Wetland

1. For structures and hardscapes, 20 sq. ft. is allowed within 20' of the OHWT (with permit)
2. For structures and hardscapes, 400 sq. ft. allowed after 75' from OHWT (with permit)
3. An 8' wide elevated boardwalk for the lake access over wetlands is allowed (with permit)

Note- The development of these will be considered as fill or an impervious service

Site Setbacks- Commercial



Patios

1. Permitted 250 sq. ft. but can be up to 400 sq. ft. with implemented SW management plan (Article 41)
2. Cannot be 1' below or above the natural ground level

Note- Patios are allowed behind the structure setback without a permit

Setbacks

State shoreland rules establish minimum setbacks from the Ordinary High-Water Table (OHWT) of lakes and rivers, and from the top of bluffs.

Non-Wetland

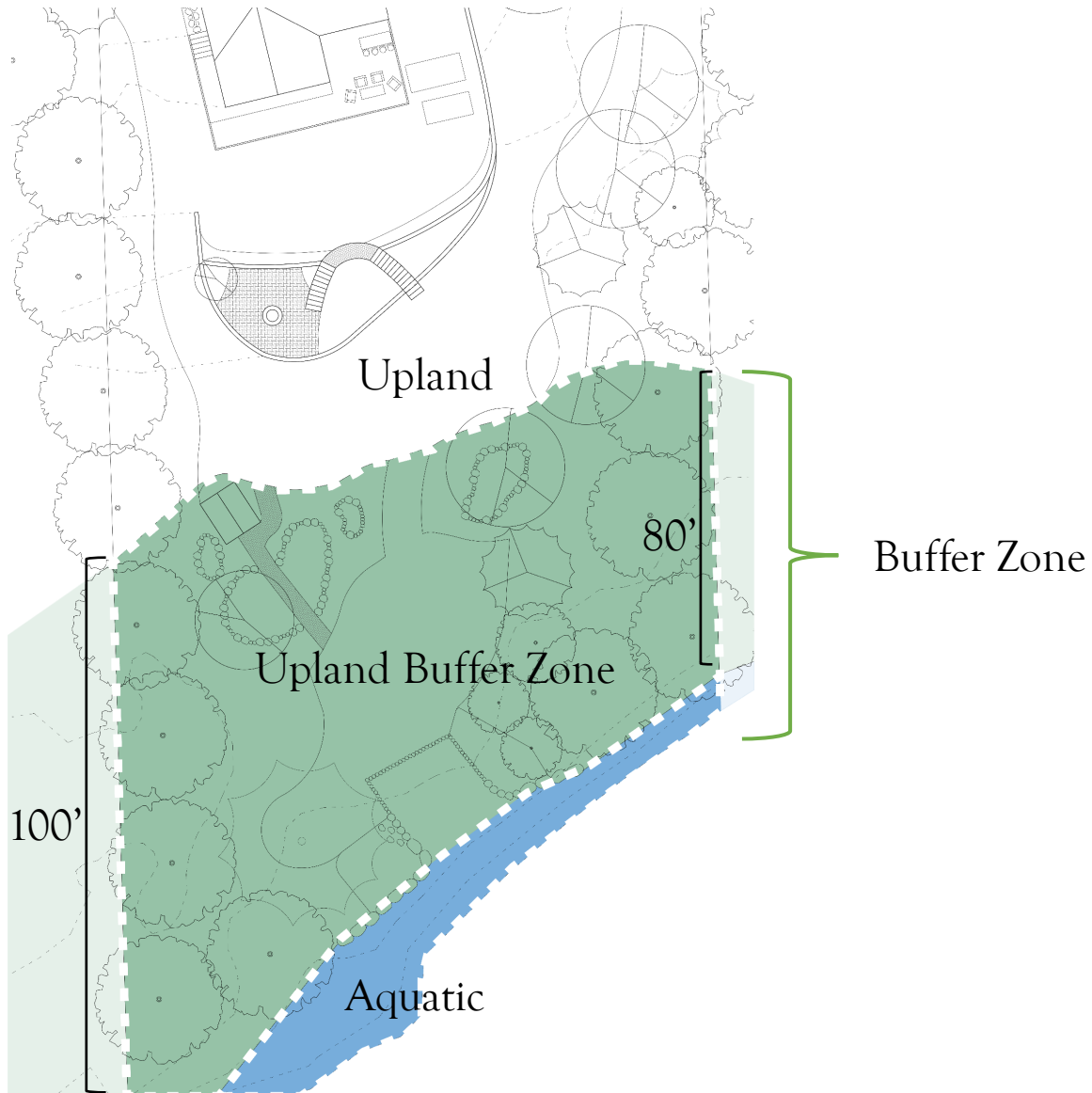
1. Shed or structure is at least 20' from the OHWT (with permit)
2. Shed or structure can be 120 sq. ft. but the front must be behind the setback
3. No building restrictions after 75' from the OHWT
4. A 4' wide walkway or stairway within the lake setback is allowed with a permit

Wetland

1. For structures and hardscapes, 20 sq. ft. is allowed within 20' of the OHWT (with permit)
2. For structures and hardscapes, 400 sq. ft. allowed after 75' from OHWT (with permit)
3. An 8' wide elevated boardwalk for the lake access over wetlands is allowed (with permit)

Note- The development of these will be considered as fill or an impervious service

Planting Zones- Residential



Buffer Zone

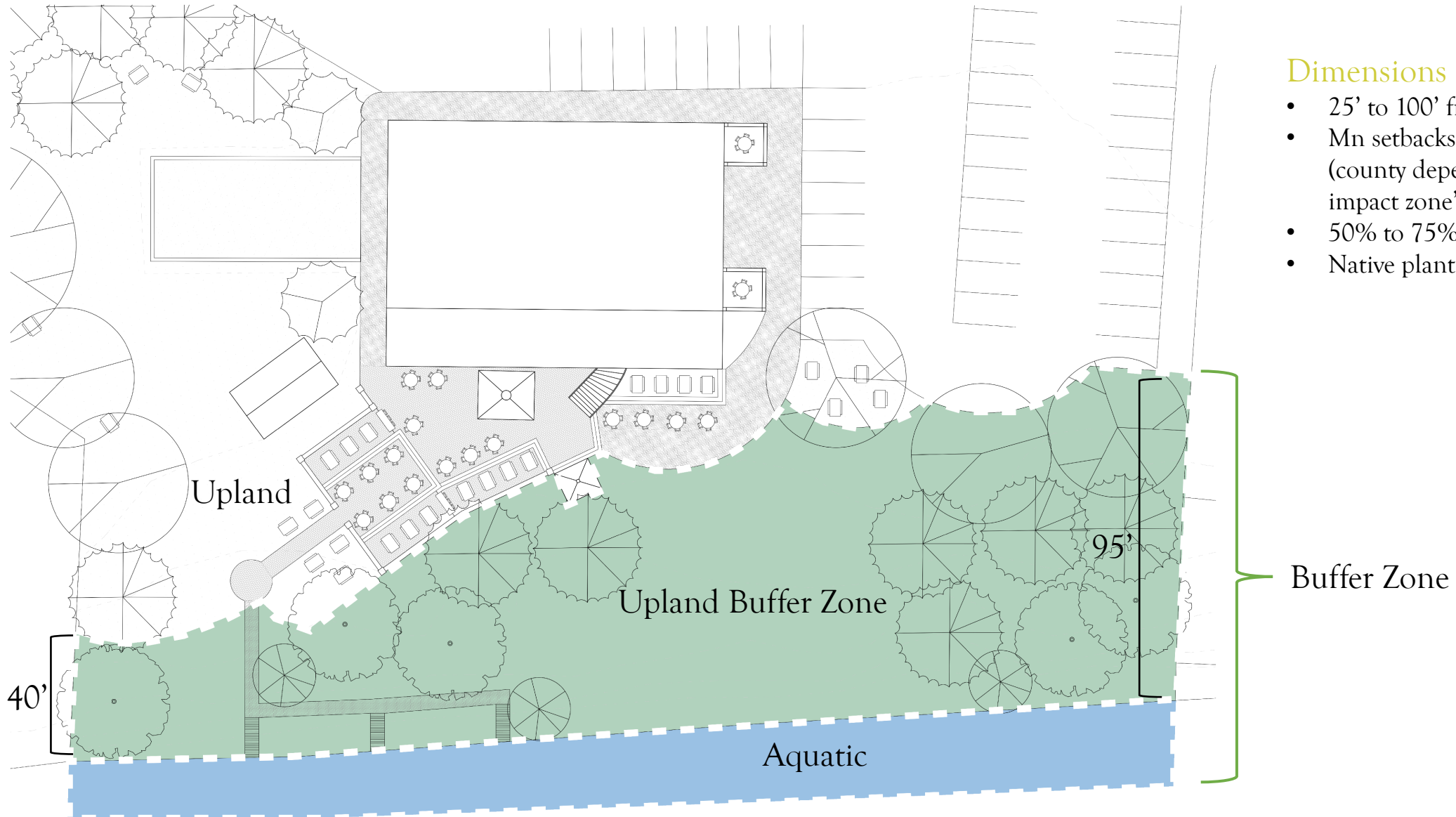
This zone is the main component of landscaping for wildlife and water quality. It restores ecological functions and have other structural benefits such as erosion control, pollution control, and stabilization. There is a three-step process to construct this

1. Identify the improvements
2. Design a natural buffer zone at least $\frac{3}{4}$ of the lake frontage
3. Restore native plants in the area

Dimensions

- 25' to 100' from the water's edge
- Mn setbacks require at least 25' (county dependent) called the "shore impact zone"
- 50% to 75% of shoreland frontage
- Native plantings

Planting Zones- Commercial



Dimensions

- 25' to 100' from the water's edge
- Mn setbacks require at least 25' (county dependent) called the "shore impact zone"
- 50% to 75% of shoreland frontage
- Native plantings

Design Concept- Commercial

This concept consists of upgrading the boat launch landing with better grades, and planting beds with a new surface layer. The other section is a proposed Zorbaz restaurant location. The restaurant location is more important to have an enhanced buffer zone due to the larger yard spaces and patios that will have more surface runoff. Each area is placed to help circulation, frame the views from the dining and gathering areas, and will enhance the overall economic, social, and environmental impact to North Long lake.

1. Boat launch landing entrance
2. Truck & trailer parking
3. Updated planting beds
4. Boat launch
5. Boat launch & restaurant plant divider
6. Restaurant entrance
7. Drop off zone
8. Zorbaz restaurant
9. Private dining
10. Amphitheater
11. Gazebo
12. Runner's shack
13. Sand volleyball
14. Open yard space with area seating
15. Dining & entertainment plaza
16. Dining & entertainment plaza
17. Green picnic seating space
18. Formal Landscape



Design Concept- Commercial cont.

19. Zorbaz photography patio
20. Natural pathway
21. Natural plantings (waters edge to upland dry)
22. Natural landscape
23. Wetland herbaceous landscape
24. Natural woodland

Note- The planting scheme of the site transitions from each buffer zone with natural plants. This large planting scheme will enhance the surrounding habitat while also absorbing harmful chemical and stormwater runoff. Without this, it would allow sediments to runoff into the lake and cause unwanted algae blooms which can be harmful the lake ecosystem.



Commercial Site Plan

This detailed site plan is an accurate representation of the plantings and materials used in the site. The site is ADA accessible with alternative routes and at most 3% slopes on the hardscaped paths. All plants are chosen for their hardiness zone, stabilization, native selection, and landscape value. The follow are more in-depth site characteristics:

1. Zorbaz restaurant with optional indoor and sheltered outdoor seating
2. Private seating which is elevated to the second story with overhead string lights and optional acoustics
3. Staircase from the second story to the main outdoor plaza
4. Gazebo which will serve as an outdoor bar for the plaza
5. Runner's shack for the people serving food



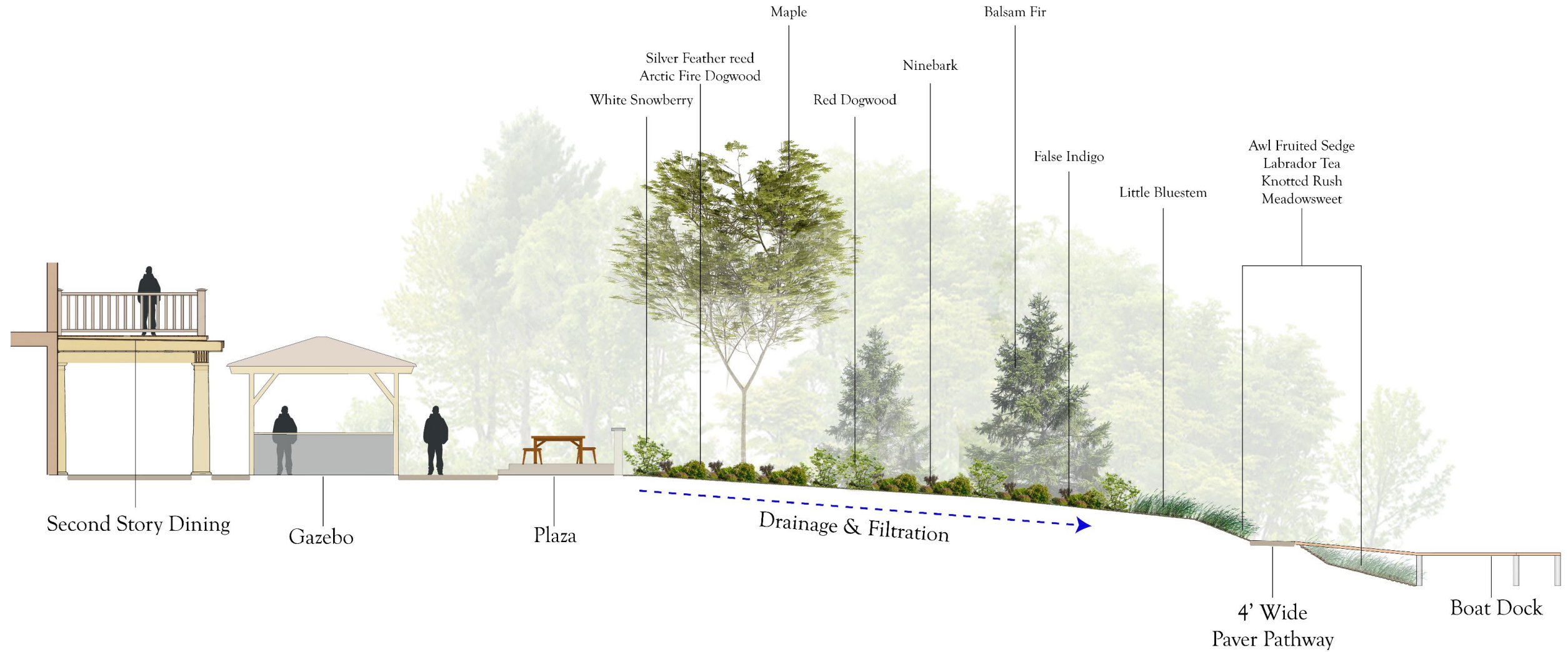
Commercial Site Plan cont.

13. Zorbaz parking and circulation
14. Formal planting beds near high traffic areas
15. Natural pathways through the landscape to help with circulation to boat dock and desired entry
16. Natural landscape with selected planting for landscape value
17. Natural planted landscape used for filtration of yard pollutant runoff
18. Wetland herbaceous planting for soil stabilization
19. Boat dock access

Note- Materials chosen for this site are selected by the common materials used at Zorbaz restaurants



Commercial Site Section



Design Concept- Residential

This concept consists of designing the yard to benefit the environment by following the buffer zone rules while also giving the property owner the most potential for their yard. Each area is carefully placed to help circulation, frame the views from the house to the lake, and enhance the overall economic, social, and environmental impact.

1. Wetland/pond with bolder retaining wall
2. Concrete Parking Platform
3. Neighboring pathway
4. Entryway/greeting area
5. Entertainment bar, seating, & gas fireplace under the finished deck with 4 season porch
6. Septic tanks
7. Drain field/yard space
8. Landscaped retaining wall with dual floating stairs directed towards the fireplace patio and the lake entry. Will contrail a lighted waterfall in the center for lakeside attraction



Design Concept- Residential cont.

9. Fireplace patio
10. Transitional yard space draining towards the raingarden
11. Landscaped yard boarder for visual appeal, fading into the natural landscape
12. Green bridge with drainage pipes underneath for water flow
13. Raingarden
14. Boathouse, electrical, & irrigation controls
15. Paver pathway for boathouse entrance and lake access
16. Transitional yard space draining back towards the raingarden
17. Open space for irrigation pump
18. Lakeside landscape for visual appeal
19. Lakeside landscape for visual appeal
20. Lake beach frontage
21. Natural landscape



Residential Site Plan

This detailed site plan is an accurate representation of the plantings and materials used in the site. All plants are chosen for their hardiness zone, stabilization, native selection, and landscape value. The follow are more in-depth site characteristics:

1. Entertainment bar, seating & gas fireplace. This will be underneath a finished deck that will have understory lights and air circulation. The plant selection of hasta's are chosen for their shade resistance and color interests. This are will have a direct view over the diverted stairs for an excellent lake view
2. Second story deck entrance that will also have dining and elevated views towards the lake entrance.



Residential Site Plan cont.

3. Open yard space over the drain field that will be used for entertainment and other activates
4. Landscapes retaining wall with dual floating stars directing circulation towards the fireplace patio or the lake entry. The placement of this retaining wall serves the purpose for holding in the drain field and septic system. Diverting the staircase contains a lighted waterfall for acoustics and boat traffic attraction
5. Fireplace patio for entertainment and more lakeside views. This are will also have wood storage and hidden electrical outlets from the retaining wall
6. Transitional yard space for activities and space between the different site elements to reduce congestion



Residential Site Plan cont.

7. Paver pathway to direct traffic from the West side of the site and for boat house entrance. This pathway will also have drainage pipes for rainwater flow
8. Boat house which will contain electrical components, lake activity storage, and irrigation controls
9. Raingarden filled with a variety of natural plants and will also direct the water flow from East to West. This area will consume and filter the stormwater from the North and South sides of the site
10. Green bridge that will be used for main traffic to the lake and easy access for portable coolers and other items. It will also have drainage pipes underneath for water flow from East to West



Residential Site Plan cont.

11. Transitional yard space for activities closer to the lake. This space also drained back towards the raingarden, which is why this space is allowed. In most cases their won't be a green space this close to the lake because of harmful pollutant runoff
12. Landscaped yard boarder for visual appeal and a boarder transition from formal to natural landscape

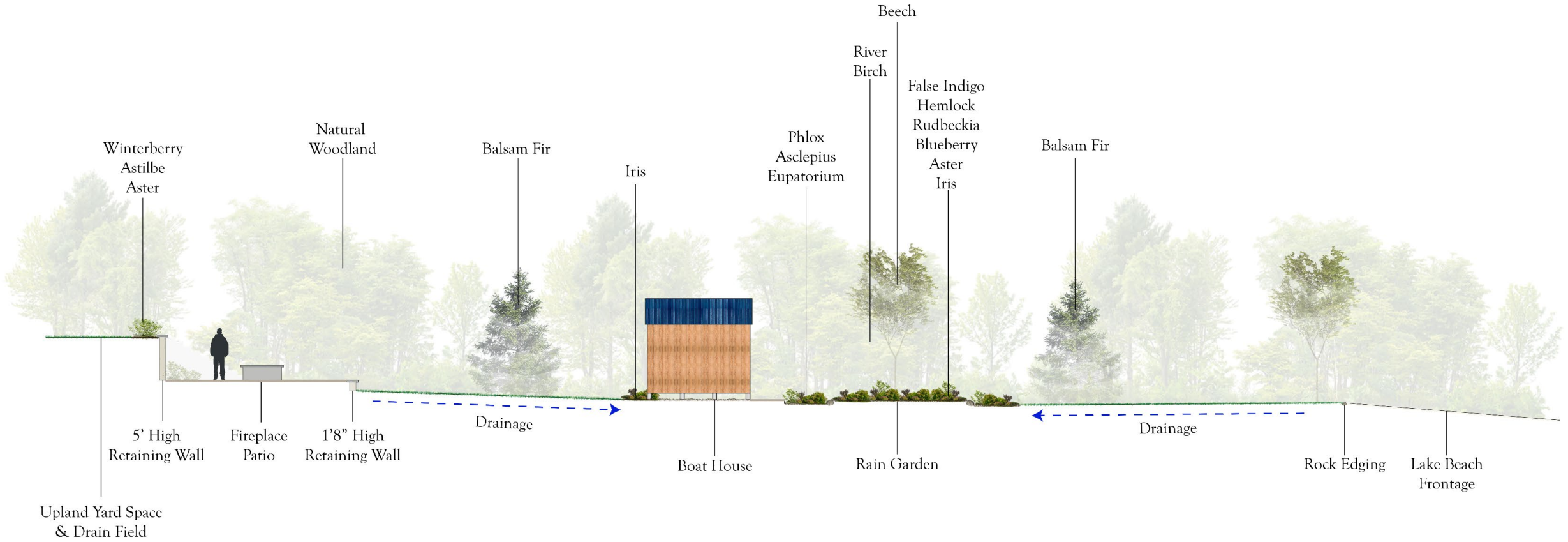
Note- The materials chosen for this site are:

- black coping unit caps and versa-lock standard units colored bronze blend retaining wall blocks
- The patio block is willow creek slate stone colors shore blend with a willow creek black brick stone accent row.
- The stair treads are versa-lock standard color

Note- The site consists of a light plan which will be used to guide circulation and safety, and enhance the visual qualities of the plant selection



Residential Site Section



Res. Entrance & Greeting Area (Day)



Res. Bar, Seating, & Gas Fireplace (Night)



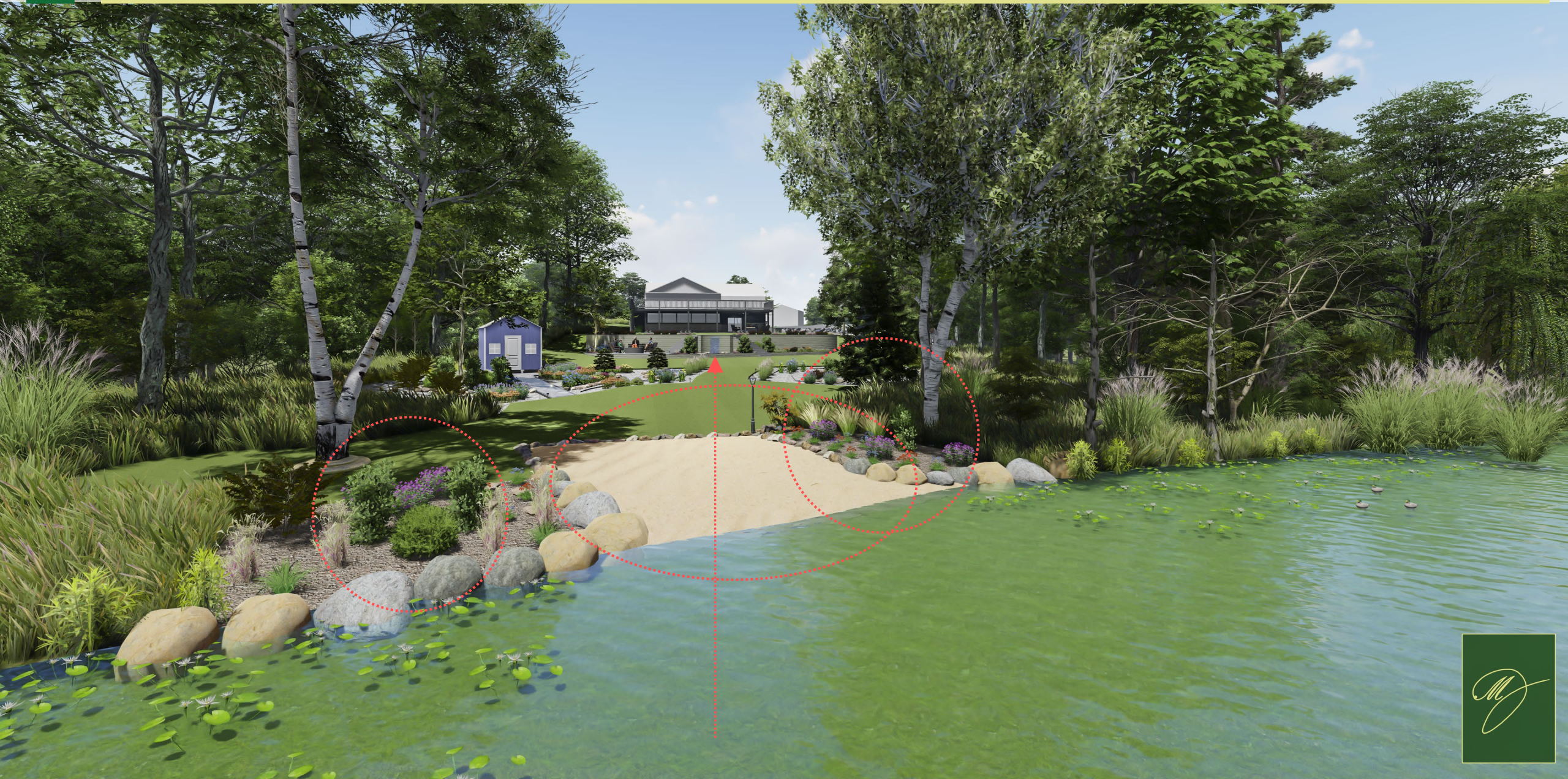
Res. Patio, Retaining Wall & Waterfall (Night)



Res. Rain Garden & Boathouse (Day)



Res. Beachfront & Boat View (Day)



Res. 2nd Story Deck Scenic View (Night)



Conclusion

This study concludes how important and correct techniques and examples on how to design for the Minnesotan Residential and Commercial shoreland district. It has provided how to improve lakeshore properties with the jurisdiction the government has over each property. This study will be used to show the public the possibilities they have when design their lakefront property and will hopefully put an end to illegal installations that negatively effect the habitat, ecosystem, and possibly their foundations. The major points I have made in this presentation are:

- How to design with limited development because of laws and regulations (Law abiding installations)
- Law Improvements
- Educate the public on the importance of correct plantings and construction
- Statistics of the increase in potentially harmful landscape installations, and how we can potentially solve this
- Redefine designs for a better habitats, environments, and ecosystems





Thank you



