AGENDA
Park Commission - Regular Meeting

VIRTUAL MEETING
To register and access the meeting online
https://global.gotowebinar.com/join/6896903702223943181
OR
to access the meeting by phone
United States: +1 (415) 655-0060
Access Code: 846-384-058
*note phone attendees will only be able to listen and not make public comment
Tuesday, March 2, 2021
5:00 PM

1. Call to Order

2. Roll Call

3. Virtual Meeting Instructions

4. Minutes of Meeting

   4.A February 2, 2021 Minutes
   Minutes

5. Citizen Comments (Please be advised per State Statute Section 19.84(2), information will be received from the public on items not on the agenda; however, no discussion is allowed and no action will be taken under citizen comments.)

6. Director of Public Works Report

7. New Business

   7.A Consider Resolution #21-01 for the approval of the Prairie Shores Coastal Resource Management & Restoration Study
   Prairie Shores Study
   Resolution #21-01 Approval of Prairie Shores Coastal Resource Mgmt. & Restoration Study

8. Park Commission Comments

9. Adjournment

The Village Hall is handicapped accessible. If you have other special needs, please contact the Village Clerk's Office, 9915 – 39th Avenue, Pleasant Prairie, WI (262) 694-1400

AGENDA ITEM COVER
Park Commission - Regular Meeting
March 02, 2021

AGENDA ITEM TITLE: **February 2, 2021 Minutes**	
PROPOSED BY: Public Works	**FISCAL IMPACT: No**
AGENDA CATEGORY: Action	**BUDGETED: No**
MEETING TYPE REQUIRED: **Regular**	**BUDGET TYPE:**
STRATEGIC INITIATIVE: No	
SUMMARY: **Approve February 2, 2021 Minutes**	
STAFF RECOMMENDATION: **Approve February 2, 2021 Minutes**	

Minutes

MINUTES
Park Commission - Regular Meeting

VIRTUAL MEETING
To register and access the meeting online
https://global.gotowebinar.com/join/4760841780372140816/101340866
OR
To access the meeting by phone
United States: +1 (914) 614-3221
Access Code: 303-399-748
*note phone attendees will only be able to listen and not make public comment
Tuesday, February 2, 2021
5:00 PM

1) Call to Order

2) Roll Call

PRESENT WERE: Dave Klimisch, Michealene Day, Kristopher Keckler, Dan Klemack, William Mills, Chris Bilik, Sandy Chhun-Genc.

3) Minutes of Meeting

3. A December 8, 2020 Minutes

Dave Klimisch MOVED TO approve December 8, 2020 Minutes; SECONDED BY Dan Klemack; MOTION CARRIED 7- 0.

4) Citizen Comments (Please be advised per State Statute Section 19.84(2), information will be received from the public on items not on the agenda; however, no discussion is allowed and no action will be taken under citizen comments.)

5) Director of Public Works Report

John Steinbrink Jr., Director of Public Works, gave an update on the purchase of land for Pleasant Prairie Park on 104th Ave.

John also gave an update on the Ingram Park sledding hill.

6) New Business

6. A Pleasant Prairie Park Expansion

Blake Theisen, from Parkitecture + Planning, presented the proposal for construction documents and bidding/CA assistance for Pleasant Prairie Park Expansion.

Dave Klimisch MOVED TO approve Parkitecture + Planning's proposal for construction documents and bidding/CA assistance for Pleasant Prairie Park Expansion.; SECONDED BY William Mills; MOTION CARRIED 7- 0.

7) Park Commission Comments

8) Adjournment

William Mills MOVED TO adjourn; SECONDED BY Dave Klimisch; MOTION CARRIED 7- 0.

AGENDA ITEM COVER
Park Commission - Regular Meeting
March 02, 2021

AGENDA ITEM TITLE: **Consider Resolution #21-01 for the approval of the Prairie Shores Coastal Resource Management & Restoration Study**	
PROPOSED BY: Public Works	**FISCAL IMPACT: Yes**
AGENDA CATEGORY: Action	**BUDGETED: Yes**
MEETING TYPE REQUIRED: **Regular**	**BUDGET TYPE:** **General Government**
STRATEGIC INITIATIVE: No	
SUMMARY: **Consider Resolution #21-01 for the approval of the Prairie Shores Coastal Resource Management & Restoration Study**	
STAFF RECOMMENDATION: **Consider Resolution #21-01 for the approval of the Prairie Shores Coastal Resource Management & Restoration Study**	

Prairie Shores Study

Resolution #21-01 Approval of Prairie Shores Coastal Resource Mgmt. & Restoration Study

REPORT

Prairie Shores Coastal Resource Management and Restoration Study

Prepared for: Village of Pleasant Prairie, WI

Project Number: P0200250

Prepared by: Clark Dietz, Inc.
Date: February 2021

Professional Consulting and Design Services

Clark Dietz
Engineering Quality of Life®

Table of Contents

TABLES

FIGURES

Executive Summary

Introduction

Prairie Shores Natural Area is a public natural area owned and maintained by the Village of Pleasant Prairie. The natural area is bounded by Lakeshore Drive on the west, 107TH Street on the north and roughly midway between 110TH Street and 113TH Street on the south. Overall, the natural area covers 2.64 acres with approximately 1,300 feet of Lake Michigan shoreline. The natural area is undergoing a transformation from a typical park to a conservancy.

In 2018, an evaluation of the natural area conditions was conducted by Clark Dietz, Inc. and reported on. In the evaluation the beach was reported to be in poor condition for the following reasons. The groins installed prior to 1990 have reached their potential and no longer functioning as means to capture sand along the shoreline. The treatment around the creek outlet has structural damage and provides little or no protection to ongoing channel erosion. The revetment on the north side functions to hold sand in place but has no ability to provide a natural dune environment or substrate vegetation. Furthermore, the revetment has provided no protecting for a natural beach north of the Tobin Creek outlet where the beach diminishes to nothing.

This study provides an examination of the existing conditions and follows up with recommendations for planning of upland restoration, habitat restoration, and finally shoreline erosion protection. The study starts with review of the upland restoration elements that form the basis of the habitat restoration. Finally, the study will review the shoreline erosion protection since mitigation of the wave action along the lakefront is an important step in the overall process that includes upland restoration of the dune and habitat restoration of the dune plantings.

The primary goal of this study is to present information that can be used as a framework for engineering design considerations and ultimately construction of a dune system, preparation of habitat for introduction of native plantings, and finally placement of a system of barriers and/or treatments that will have the effect of reducing wave action to the shoreline and assist with shoreline and habitat restoration. With increasing water levels and increasing of the frequency of damaging storms, a design including elements aimed at reducing wave action at the shoreline will have effects of reducing littoral transport of sand from the shoreline and will reduce the erosion of both the beach and dunes. Reducing wave action is known to be an effective mitigation practice that will assist with restoration of the naturally occurring dunes and restoration of habitat along the beach to the north and south of Tobin Creek.

This study was prepared for the Village of Pleasant Prairie by Clark Dietz, Inc. The Village of Pleasant Prairie Public Works Department managed the project and assisted in information gathering, public meeting organization, and final review of the study. Clark Dietz performed the site reconnaissance, review of existing conditions, and studied the opportunities for improvements of the Prairie Shores Natural Area.

CHAPTER 1 - EXISTING SHORELINE CONDITIONS

1.10VERVIEW

As stated above, the Prairie Shores Natural Area (Prairie Shores) covers approximately 2.64 acres of waterfront east of Lake Shore Drive between 107th Street on the north and 113th Street on the south. The overall length of lakeshore is approximately 1,300 feet. The follow provides an overview of the current status of the natural area along with observations taken during a site visit conducted in mid-summer 2020. Figure 1: Prairie Shores Natural Area Existing Conditionbelow provides a visual reference for the descriptions noted.

Figure 1: Prairie Shores Natural Area Existing Condition

1.2 NORTH SIDE

The northern portion of Prairie Shores is considered to be all public lands lying north of the Tobin Creek outlet. The north side of this natural area is dominated by the large stone revetment installed to protect the shoreline against wave action. The revetment starts approximately 100' north of the Tobin Creek outlet, south of the intersection with 108th Street and Lakeshore Drive and continues beyond the north property boundary.

The revetment is effective at reducing erosion by armoring the shoreline however the revetment will neither reduce severity of wave action nor promote or allow for natural formation of a beach. The existing revetment extending from the Tobin Creek discharge to the north end of the natural area does not provide for dune development or mitigation and restoration of natural habitat.

Figure 2: Existing Revetment Looking Southbelow is a photo of the existing revetment looking south.

Figure 2: Existing Revetment Looking South

1.3 TOBIN CREEK OUTLET

Between the 108th St and 110th St intersections the Tobin Creek discharges to Lake Michigan. Tobin creek flows through two large culverts under Lakeshore Drive and a wooden walking bridge that connects the current parking area and natural area to the south. Along the south side of the creek discharge there is a retaining wall constructed of "deadman" concrete blocks and rip rap. The concrete retaining wall ends at the west extent of a concrete block groin also constructed along the south side of the creek. Based on observation of historical aerial photos, the deadman concrete wall was installed between 2002 and 2005. On June 30, 2020, a site reconnaissance was completed, the water level in the creek was almost to the crown of the culverts. Furthermore, the water level noted during that visit was at the level of the end of the groin. Wave action was moving sand around the end of the groin. Figure 3: Tobin Creek Discharge Looking Southwest & Figure 4: Tobin Creek Discharge and Groin Looking East below are photos of the creek discharge looking west and east showing the treatments along the creek bank leading to Lake Michigan.

Storms between January 10 to January 12, 2020 caused significant damage to the natural area including the creek. As a result of this storm event, the mouth of Tobin Creek underwent emergency excavation to reestablish flow after sand and gravel had pushed into the creek outlet during the storm surge. The excavated material was moved to the north side of the creek and graded as a temporary measure. The Figure 3 photo shows the graded material on the right side of the creek.

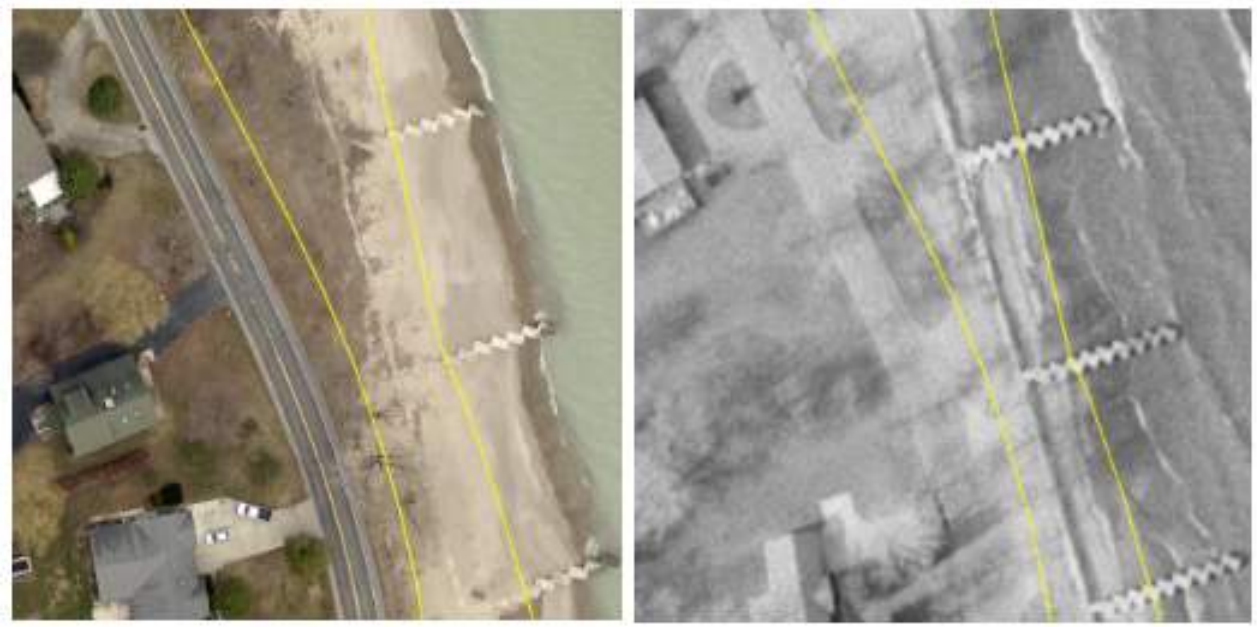
Figure 3: Tobin Creek Discharge Looking Southwest

Figure 4: Tobin Creek Discharge and Groin Looking East

1.4SOUTH SIDE

South of Tobin creek, there were a total of eight groins installed to help protect the southern portions of the natural area from longshore transport of sands. Six of the groins are located within the public shoreline property. Inspection of aerial photos from the Kenosha County Mapping system reveal that the groins were installed between 1985 and 1990. The existing groins are constructed using concrete blocks placed in a row perpendicular to the waterline. The groins extend only a short way into the existing waterline and depending on the year and water level, may not extend into the water. As a

result, the existing groins have reached their potential and will no longer have the continuing effect of mitigating longshore transport of sand. The aerial photo from 1990 shows the groins extending out into the lake. Groins installed into the water will allow sand and sediment deposits on one side dependent on the direction of longshore flow.



2015 1990

Figure 5: 2015 Aerial Photo versus 1990 Aerial Photo

Figure 5 photos above have a side by side comparison of the 2015 and 1990 aerial photos from the Kenosha County Mapping application. The yellow line represents the public property boundary. In the center of the property on the 1990 photo the retaining wall appears clearly at the termination of the groins at the back of the beach. Comparing the aerial photo from 1990 to the aerial photo from 2015, it appears that the groins were effective in assisting with retention of sand and overall growth of sand lakeshore. Furthermore, the retaining wall at the back of the groins is mostly buried with sand.

Figure 6: Existing North Groin Looking East

As discussed, the groins have an ability to retain some sand, however they have no effect on reduction of wave action, retention of the dune, or establishment of habitat. Furthermore, the sand has filled in beyond the end of the groins thereby making the groins ineffective at reducing or further mitigating littoral transport of sand.

Figure 6 is a photo of the existing groin due south of the Tobin Creek discharge looking east. This groin is the northern most of the groins installed in the Prairie Shores Natural Area.

1.5 LOCAL DRAINAGE DISCHARGE

Along Lakeshore Drive south of Tobin Creek there is a storm sewer system that discharges to the lake approximately 650 feet south of the creek culverts. The discharge of the local storm sewer system is a corrugated metal pipe with a Tideflex™ check valve over the end section. It was observed during the site investigation that the discharge of this culvert area appeared to have been excavated leading up to the waterline. Since then, wave action has pushed sand onto the backshore area partially closing off this drainage way creating a pool between the culvert outlet and the waterline. Figure 7 shows the Tideflex™ valve at the bottom of the photo and the pool which has formed looking toward the lake. The drainage way is located just south of southern most concrete groin in the Prairie Shores Natural Area.

Figure 7: Local Drainage Discharge Looking East

CHAPTER 2 - EARLY MITIGATION ATTEMPT

2.1 INTRODUCTION

In the 1980's the shoreline had significantly eroded from the extent observed in aerial photos from early part of the century and the first attempts to save the natural area and mitigate further erosion were implemented. From the descriptions above, several attempts were made to implement some mitigations including a retaining wall, groins, and the revetment.

2.2 EXISTING RETAINING WALL

A concrete wall was installed parallel to the water line and is currently between 80 to 100 feet from the water. The concrete wall is more visible to the south with some areas projecting out of the existing dune. Proceeding north, the wall has been obscured by the sand. The wall appears to begin south of Tobin Creek and extend beyond the public property to the south, roughly 850 feet as measured off historic aerial photos. The wall itself has little effect on maintaining the dune other than creating a solid barrier for collection of windblown sand. Dune grasses and vegetation appear to be taking hold on the west side of the wall away from the lake while the east side toward the lake is mostly sand with little vegetation. Figure 8 is a photo of the existing retaining wall buried in the remnant of the dune looking north.

Figure 8: Existing Retaining Wall Looking North

2.3 EXISTING GROINS

The existing groins as described earlier extend to the waterline and act in some minimal fashion to maintain the sandy shoreline. There are a total of 8 concrete block groins extending approximately 90 feet from the concrete retaining wall. The short comings of the groins are clear in that they are no longer effective to protect against continuing littoral transport of sand due to longshore flow. As a result, the groins have reached their potential for retention of shoreline sands. More importantly, the groins do not provide protection to the backshore area in a manner that will mitigate wave action or continue growth of a natural dune, associated vegetation, and habitat. Figure 9 is a photo of an existing groin looking south.

Figure 9: Existing Groin Looking South

2.4 EXISTING REVETMENT

The existing revetment to the north consisting of heavy rock rip rap (4 to 5ft size) which has the effect of armoring the northern shoreline against wave action. The existing revetment extends approximately 1,500 feet from Tobin Creek well beyond the northern extent of the public property. The revetment, as it is installed, does not encourage creation and growth of a sand dune structure at the rear of the shoreline area nor does it assist with maintenance of dune vegetation. The vegetation behind the revetment is generally grasses and weeds, however some trees have taken root and have been allowed to grow and mature over the years. Figure 10 is a photo of the existing revetment looking north.

Figure 10: Existing Revetment Looking North

As seen in this picture, the rock revetment can act as an accelerator to erosion of the shoreline sand. The revetment will armor the foredune area of the shoreline but will not protect the beach itself. The revetment does not dissipate energy from incoming waves but instead will cause waves to reflect off the rocks thereby moving sand back into the lake. Studies targeting sand movements have been

conducted on similar seawall structures in other parts of the world. (Dyer, M.: 1994, Beach profile change at St. Clair beach, Dunedin, Master's thesis, University of Canterbury)

Fortunately, the area behind the revetment has seen the growth of several small to large mature trees along the shoreline. The trees and root systems do have the effect of retaining sands and soils within the root system in the natural area in the complex root systems. The trees should be allowed to remain since they are well established and rooted. The trees will continue to act as sand dune retention if the revetment is removed. Studies of coastal vegetation around the world have been conducted to determine the effectiveness of coastal forests or dense vegetation along a shoreline. The consensus is that healthy coastal forests can act as a coastal defense system not only to retain soils but act as a natural wind barrier. The wind barrier has some minimal effectiveness at reducing wave action.

CHAPTER 3 - PRAIRIE SHORES RESTORATION PLAN

3.1 INTRODUCTION

The shoreline restoration is the overall goal and objective behind this study. Various improvement options will be explored that will enhance the shoreline, encourage growth of the natural dune and upland areas, provide habitat restoration that includes establishment of native plantings, and review methodologies to protect the shoreline against damaging wave action.

3.2 RECOMMENDED IMPROVEMENTS

Subsequent chapters will discuss in greater detail the plan for improvements. Figure 11 below provides a visual reference and overview for the improvements.

- Removal of revetment – includes removal of the existing boulder revetment then construction and grading to move and add sands for establishment of a natural dune
- Dune restoration – includes construction and grading of sands over the existing sea wall and groins to promote growth of the limited yet existing dune.
- Restoration of habitat – includes removal of invasive species prior to grading, then planting of native species of grasses and dune vegetation at the completion of grading activities.
- Establishment of the Tobin Creek discharge – grading and placement of some of the rock revetment removed from the shoreline as armoring to maintain consistent flow of the creek.
- Artificial reef – includes placement of stone sufficiently large to withstand wave action with minimal movement in the general location and shape shown.

Figure 11: Recommend Improvements

CHAPTER 4 - SHORELINE RESTORATION PLAN

4.1 INTRODUCTION

The first goal of the shoreline restoration plan is to present information that can be used for design and construction of dunes just off the shoreline area that will have an impact on maintaining the shoreline. Upland restoration of the Dunes will provide the substrate for establishment of natural vegetation to assist in protection the shoreline features and natural environment. Figure 12 presents a diagram of a typical profile and the terms used to describe different areas of the shoreline.

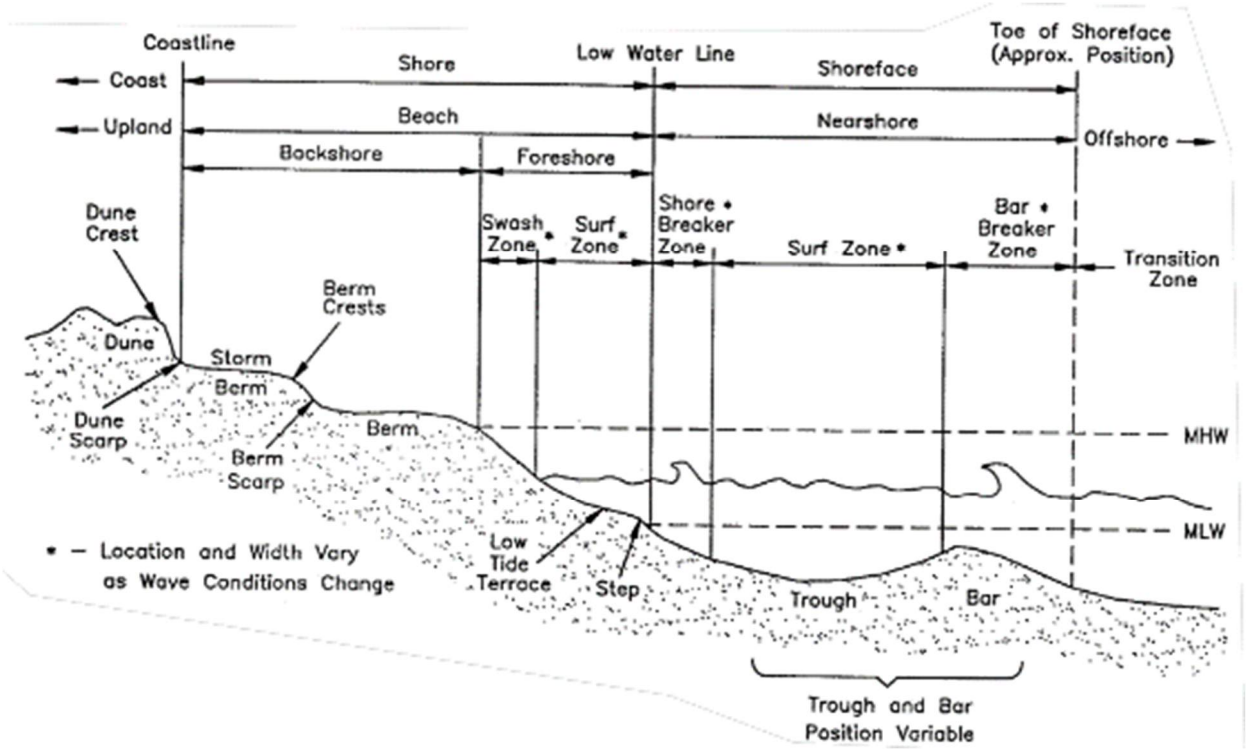


Figure 12: Typical Shoreline Profile and Terminology

4.2 REMOVAL OF EXISTING REVETMENT

The areas north of Tobin Creek will be converted back to a natural shoreline cross section similar to the typical section presented above. There is approximately 500 lineal feet of revetment on the north side of the natural area with an estimated volume of massive rip rap stone in the range of 1500 cubic yards. The work will consist of heavy equipment removing the large stone revetment and will include removal of the non-beach environment grasses and vegetation in the upland areas. After removal of the revetment, the sand shore will be graded to shape the backshore and upland area. The large trees with established root systems will remain in place as an additional means to return this shoreline back to a natural state. During the design phase, small areas of large stone rip rap will be maintained around selected trees to hold the berm and root system in place while the natural shoreline and dunes reestablish as a result of this mitigation effort.

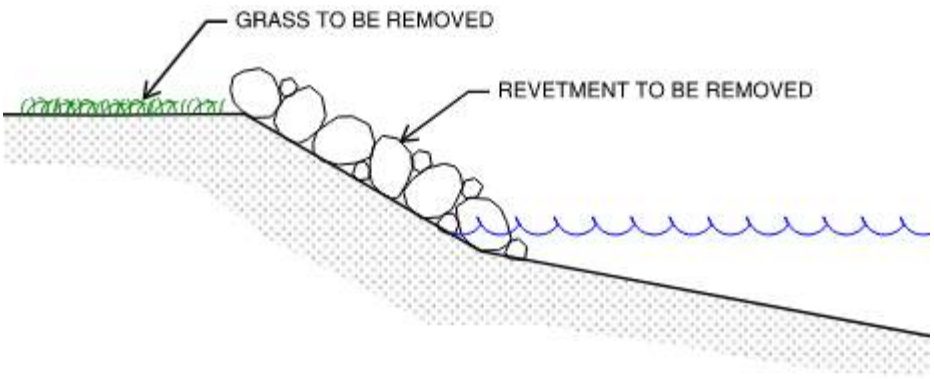


Figure 13: Removal of Revetment

4.3 SHORE RESTORATION

Once removals are completed on the north side, this natural shoreline area will consist of foreshore, backshore, and upland areas. The dune restoration will include mainly graded sand material already on shore but will be supplemented with imported sand material. The imported sand material will be uniform sand having small grain quartz particles similar to the native shoreline sands.

On the south side, sand material will be added and shaped around the existing seawall and groins. It is not advisable to remove these structures since they would not be a determent to the overall purpose of preparing a natural dune. Rather, the existing seawall and groins will create and underpinning and foundation for the dune to retain sands and vegetation. Coupled with natural wind movement of sand, the restoration efforts recommended here will encourage natural growth and maintenance of the sand dune environment.

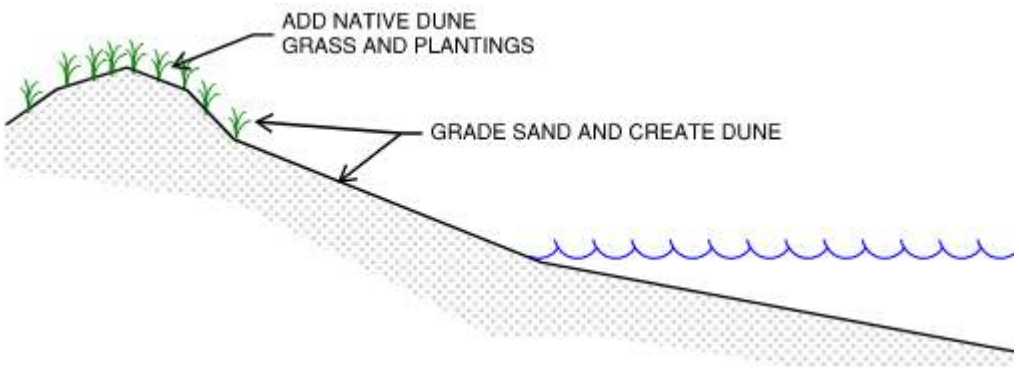


Figure 14: Restoration of Natural Dune

4.4 TOBIN CREEK DISCHARGE

The Tobin Creek discharge mitigation design and subsequent construction will be included with a FEMA Disaster Recovery Funding request. The FEMA funding request is the direct result of storms that occurred between January 10 – 12, 2020. Under this proposed work scope, the mouth of Tobin Creek will be graded to better define the north side the existing bank and reinforce the south side bank in order to maintain a defined channel leading to the lake. Recommendations for additional mitigation and protection of the channel into the lake will be included as part of the disaster recovery request.

4.5 DRAINAGE CULVERT OUTLET

The culvert discharge at the far south end of the property needs to have a clearly defined channel with treatments to hold the side slopes of the channel to within 20 feet of the normal water level of the lake. And it is recommended to replace the drainage piping under the dune and install a new check valve at the end of the culvert. The check valve does help to prevent water from backing up through the culvert during a storm surge. Maintenance of the culvert outlet will be ongoing since wave and wind action will naturally move sand around on the shoreline periodically closing up the channel.

CHAPTER 5 - HABITAT RESTORATION

5.1 INTRODUCTION

The second goal of this study is to present information that can be used for design of restoration and stabilization of the constructed dune to protect against of natural erosive forces. Habitat restoration is vital for protection of the dune sands against erosion from both wind and wave action. Habitat restoration is presented in the form of recommended plantings for the various sections of the dune.

For recommendations on native plantings, the report will focus in on two main areas of the dune, the foredune and transition dune. The foredune is the area leading directly from the backshore where the face of the dune slopes to the water. The foredune area is subject to high winds and even wave action during a violent storm event. The transition dune area is the top of the dune where the wind will still have an effect, but wave action is unlikely. The transition dune is often where vegetation is heavier providing better ground cover to the dune sand. The back dune zone of the natural area is already well vegetated and should receive minimal treatment.

5.2 NATIVE SHORELINE GRASES – FOREDUNE

5.2.1 AMERICAN BEACHGRASS OR MARRAM GRASS (AMMOPHILA BREVILIGULATA)

Typical dune grass for the Great Lakes region is known as American Beachgrass or Marram Grass. Marram grass is the primary grass seen on the shoreline in the fore dune area at the top of the dune or on the down slope to the waterline. Marram Grass is a bunch grass that grows in a clum and will naturally spread. One defining characteristic is the strong underground stem growth which extend spreads and gives rise to many new plants. Marram grass grows at a tremendous pace enabling the plant to withstand sand deposits from wind and be able to grow up through it. Beachgrass is effective in use as erosion control primarily for stabilization of dunes or non-dune areas of sandy and dry soils. Figure 15 is a photo of a mature American Beachgrass culm.

Beachgrass is naturally a low maintenance plant that will thrive in a sandy soil environment such as the Prairie Shores in Pleasant Prairie. Beachgrass is a hardy plant that does not require fertilization or irrigation and prefers sunny locations with well drained soils (sand).

Beachgrass grows in sprigs called clums. Mature grasses can grow between 24 to 48 inches tall. The plant has an extensive horizontal growth area when planted in suitable conditions.

Planting and management information can be found in the American Beachgrass plant fact sheet created by the United States Department of Agriculture Natural Resources Conservation Services (USDA). The guide outlines the proper planting method and gives tips as to keep the plant healthy and thriving. The USDA planting guide can be found at the following web address https://plants.usda.gov/plantguide/pdf/pg_ambr.pdf.

Figure 15: American Beachgrass, Marram Grass

5.2.2 SAND REED GRASS (CALAMOVILFA LONGIFOLIA)

Another typic grass species found in the dunes of the Great Lake areas is the Sand Reed, also known as the Prairie Sandreed. This perennial grass can grow to be about 2-6' high. It spreads in tall branched culms that are largely covered by sheaths of leaves. Along the entire length of each mature culm, there are 5-10 loose leaf blades. The coloration of leaf is a grayish green or grayish blue, linear in shape. The Sand Reed spreads by shallow rhizomes in very dry, sandy soils and has an extensive fibrous root system making it effective in stabilizing sand dunes and preventing sand blowouts. Figure 16 is a photo taken of a mature Sand Reed plant.

Planting and management information can be found in the Sand Reed Grass plant fact sheet created by the NRCS. The guide outlines the proper planting method and gives tips as to keep the plant healthy and thriving. The USDA planting guide can be found at the following web address: https://plants.usda.gov/factsheet/pdf/fs_calo.pdf

Figure 16: Mature Sand Reed Grass

5.3 NATIVE HERBS AND VINES – FOREDUNE

5.3.1 COMMON MILKWEED (ASCLEPIAS SYRIANCA)

Milkweed is a widespread and somewhat weedy species known through most of the United States. It grows best in large open areas with well drained soils. It commonly grows near fence rows, on roadsides, in fields, and in prairies and pastures but can also be found growing in sandy soils such as the shorelines of the Great Lakes. The plant grows readily from seed and spreads quickly by deep rhizomes. As mentioned before the common milkweed can be weedy and difficult to remove, care should be used to establish the plant only in places where spread can be tolerated. The fast spreading plant is helpful to establish vegetation coverage for a newly formed dune system. The milkweed grows to about 5 feet tall and typically grows clusters. Figure 17 is a photo of the milkweed in bloom.

The common milkweed is a main food source for many insects. Over 450 insects are known to feed on the plant. In the mid-west, it is one of the most important plants for monarch caterpillars.

Information source:
http://plants.minorsgardencenter.com/12100004/Plant/8359/Common_Milkweed/; https://www.fs.fed.us/wildflowers/plant-of-the-week/asclepias_syriaca.shtml

Figure 17: Common Milkweed with Flowers

5.3.2 AMERICAN SEA ROCKET (CAKILE EDENTULA)

The American sea rocket is a planting that is native to seashore areas in North America. The sea rocket is a member of the mustard family and has waxy, thick, lobed green leaves that produces a pale-lavender flower cluster. The stems grown between 1 to 2 feet from the long taproot. This planting is considered edible but is not easily cultivated. The taproot and coverage of the plan make this a great choice to hold and stabilize sandy soils. Figure 18 is a photo of a typical see rocket plant. Information source: https://dnr.wi.gov/topic/EndangeredResources/Plants.asp?mode=detail&SpecCode=PDBRA0F025

Figure 18: American Sea Rocket

5.3.3 HAREBELL OR BLUEBELL (CAMPANULA ROTUNDIFOLIA)

The Harebell, also known as the Bluebell, is a delicate perennial with grows in clusters, ranging in height from 4-15 inches. The stems are weak so that the entire plant slumps over. Blue-violet bell-shaped flowers hang from the stems and grow in small patches.

It prefers the dry, sandy, well-drained soils of the foredune. It is easily grown and does well in a variety of conditions. The Harebell fits the criteria since it is a native species that would provide erosion control that will also enhance the beauty of the dune with long lasting flowers. The flowers have the additional benefit of attracting hummingbirds. The Harebell is a sightly option compared to the other species on the list due to the bell flowers produced by this plant. A cluster Harebell in bloom can be seen in Figure 19

Figure 19: Cluster of Harebell in Bloom

5.3.4 SAND CHERRY (PRUNUS PUMILA)

Sand cherry is regarded as a great a dune building species for the sand dunes of Lake Michigan. Its deep root network assists in soil stabilization and helps other plant species thrive by colonizing “soil building" invertebrates such as ants. Sand cherry is an important for the creation of dunes and therefore highly recommended.

Sand cherry is a native shrub that grows from 1.5 to 9.0 feet tall. The shrub foliage stretches outward and flat to the ground when growing on dunes or other wind-blown sites. The leaves are generally small being 0.4 to 0.8 inch in wide. The shrub flowers occur in clusters of 2 to 4 and grows fruit that is 0.4 to 0.6 inch in diameter. It grows on sandy, gravelly, and rocky soils in dunes, sandy shorelines, and outwash plains. Soils that support the shrub are typically dry and well drained. Figure 20 is a photo of a flowering sand cherry.

Figure 20: Sand Cherry Branch in Bloom

5.3.5 PRAIRIE DUNEWORT (BOTRYCHIUM CAMPESTRE)

The Prairie Dunewort is a small perennial having a single above ground shoot or stalk that splits into two segments. The Prairie Dunewort is a small planting, only 2 to 4 inches above the ground surface. This planting emerges in May through June and has short life before die-back in July or August. This planting is natural to sandy dune areas in the Midwest but has limited populations in Wisconsin.

Figure 21: Prairie Dunewort

5.3.6 SEASIDE SPURGE (EUPHORBIA POLYGONIFOLIA)

The seaside spurge is an annual plant that spreads arounds the surface forming a low mat of leafy stems up to 12" across all coming from one central stem. This planting prefers full sun, dry conditions, and very sandy soils. The seaside spurge is the type of plant that can withstand hot dry conditions such as a sandy dune.

Figure 22: Seaside Spurge

5.3.7 DUNE GOLDENROD (SOLIDAGO SIMPLEX VAR. GILLMANII)

The Dune Goldenrod (*Solidago simplex var. gillmanii*), a Wisconsin Threatened plant, is found on semi-stabilized dunes along Lake Michigan. Blooming occurs early August through early October; fruiting occurs late September through late October. The optimal identification period for this species is late August through early September.

The habitat consists of sand dunes, drier areas of beaches, and rocky shorelines along Lake Michigan and Lake Huron. This wildflower is usually found on semi-stabilized sand dunes that are several hundred feet away from the lake shoreline; it can be located on the lower slope, upper slope, or the flattened top of a dune, usually in proximity to Beach Grass.

Figure 23: Seaside Spurge

5.4TRANISITION DUNE

Further from the lake than the foredune, are dunes in transition. Plants are affected less by wind and the lake in this area. Vegetation common to the transition dune can also be typical of open dune communities. Like the previous section, several main species will be explored.

5.4.1 LITTLE BLUESTEM (SCHIZACHYRIUM SCOPARIUM)

Little bluestem is tufted, perennial grass native to the U.S. and Canada. It averages 1 to 3 feet in height with slightly flattened culms. Little bluestem grows best on dry upland sites, especially on ridges, hilltops, and steep slopes such as the top of a dune. The ideal soils range from sandy to clay-loam in texture.

Little bluestem is adapted to grow in diverse sites. It can form mats from short rhizomes on wetter sites but usually grows in clumps on dry, upland sites. It has a deep root system and can be somewhat slow to establish from seed. The USDA planting guide can be found at the following web address: https://plants.usda.gov/plantguide/pdf/pg_scsc.pdf

Figure 24: Little Bluestem

5.4.2 SAND CRESS (ARABIDOPSIS LYRATE)

Sand cress is a biennial/perennial herb that grows to approximately 4 to 16 inches tall. The stems are rigid with many weak branches and a hairy base. It blooms a small white cluster of flowers and produces a long, thin, flat pod that spreads outward and upward.

The sand cress prefers rocky, sandy soil and found in dry open sandy ground, including savannas but mainly on dunes along the Great Lakes. The sand cress has a short reproductive cycle and is easy to maintain. This allows the plant to establish itself quickly which is ideal for a new dune system.

Figure 25: Sand Cress

5.4.3 WILD WORMWOOD (ARTEMISIA CAMPESTRIS)

Wild wormwood also known as field sagewort are biennials or short- lived perennials that produce stems which grow to reach 4.9 feet at the most. Growth patterns can differ from mounded to spreading dependent on the site conditions. The leaves are tightly spaced and range from 0.8 to 4 inches long and are very thin in width. The wormwood produces a taproot and little to no lateral root supporting system.

Wormwood grows best in sandy soil well drained soils in direct sunlight. It is typically seen growing in the early stages of a new sand dune vegetation and lake shore sites but can be present throughout the entire lifecycle of a dune.

Figure 26: Wild Wormwood

5.4.4 BEACH PEA (LATHYRUS JAPONICUS)

The beach pea is perennial growing to 2ft at its height. It will flower from May to August and the seeds ripen from August to October. The beach pea prefers sandy coast areas in a temperate climate.

The beach pea is suitable for light sandy well-drained soils. It also prefers direct sun and tolerates dry or moist soils. This plant is also known to tolerate maritime exposure.

Figure 27: Beach Pea

5.4.5 BUGSEED (CORISPERMUM SP.)

The Bugseed is an annual growing herb that grows to about 1-3 feet in hight. The leaves are a narrow, linear, folded blades and are topped with blossoms of flowers with long pedels. Underground growth is a taproot which extends deep beneath the plan.

The Bugseed grows in a dry, sunny area with low water. Sand dunes and sandy soils is preferred. The bugseed is a hearty plant having high resistance to drought and is cold and heat tolerant.

Figure 28: Bugseed

5.4.6 PITCHER'S THISTLE OR DUNE THISTLE (CIRSIUM PITCHER)

Pitcher's Thistle also known as dune thistle grows mainly along the shores of the Great Lakes. This is small thistle only growing to a max height of 3-4 feet when flowering. It is native to the Great Lake dune system and therefore thrives in sandy, will drained soils. Deep taproots of up to 6 feet are used by the thistle to secure itself and to obtain water. Pitcher's Thistle typically grows in clusters. It can be identified by its deeply toothed, wooly leaves and by the presence of spines at the tips of each point on the leaf.

The Pitchers Thistle, although native, is has become a scarcer species due to continued development and overuse of the Great Lakes. It is highly abundant in areas of undisturbed habitat but is highly vulnerable to habitat destruction and therefore must be planted in an area where building development is unlikely. Figure 29 is a photo of a Pitchers Thistle late in season.

Figure 29: Pitchers Thistle

5.4.7 DWARF LAKE IRIS (IRIS IACUSTRIS)

Dwarf Lake Iris (*Iris lacustris*), a Wisconsin Threatened and Federal Threatened plant, is found near Lake Michigan on beach ridges, stabilized dunes, limestone ridges, forest gaps and edges, and ditches. Blooming occurs early May through early July; fruiting occurs late June through late July. The optimal identification period for this species is late May through early July.
https://dnr.wi.gov/topic/EndangeredResources/Plants.asp?mode=detail&SpecCode=PMIRI090H0

Figure 30: Dwarf Lake Iris

5.4.8 SUMMER GRAPE (VITIS AESTIVALIS)

Summer grape or pigeon grape is a species of vine that is native to most of North America. This woody vine climbs trees and shrubs up to a length of 35 feet. The vine uses twining tendrils to climb any adjacent vegetation or fences. The mature vine can reach up to 6 inches in diameter with a reddish-brown bark peal. Young vines are a yellowish-green to reddish-green. Leaves occur sporadically along the vine spreading out into a 3 to 8 inch long oval shaped leaf with lobes. Small flowers are replaced by berries arranged in 3 to 8 inch long panicles.

The vine prefers full to partial sun, moist to dry conditions. The suitable soil containing is a loamy, sandy loamy, or rocky material. It will also grow on clay soil if it is sufficiently drained. Like all vines, it can smother and even kill shrubs and small trees if unmanaged. Production of berries requires exposure to sunlight. Figure 31 is a photo of the Summer Grape with berries.

Figure 31: Summer Grape

5.4.9 BEARBERRY OR KINNIKINICK (ARCTOSTAPHYLOS UVA-URSI)

Bearberry also known as Kinnikinick is an extremely dense shrub with heights rarely taller than 6 inches. Finely textured white to whitish-green branches mature into brittle red-brown limbs. Leaves are simple broadleaf alternating along the branches. The leave is a deep green with a leathery texture that change to purple in the fall months. Clusters of pink urn-shaped flowers bloom at the ends of each branch.

This shrub grows best dry to medium, well-drained, sandy, or rocky soils in full sun. It can tolerate light shade if required. Usually grows well in poor infertile soils so the plants should not be fertilized. It is drought tolerant once established but grows poorly in hot and humid summer conditions. This plant will thrive in a transitional dune area if properly planted.

Bearbearry is a dual-purpose plant, serving the role of a critical soil stabilizer as well as a beautiful landscaping plant. This is a very popular plant for many due to its functionality, heartiness and looks. Figure 32 is a photo of a Bearberry in full bloom.

Figure 32: Bearberry or Kinnikinick

5.4.10 BLUELEAF WILLOW (SALIX MYRICOIDES)

The Blueleaf willow is a fast-growing perennial shrub the grows 7-16 feet tall. The leaves are oblong to lance-like, toothed, base rounded to heart-shaped. It grows best in moist to wet conditions such as streambanks and lowlands. The benefit of the blueleaf willow is its fast growth rate. It can help establish vegetation in a transitional zone quickly which will stabilize soils.

Figure 33: Blueleaf Willow

CHAPTER 6 - SHORELINE RESTORATION PLAN

6.1 INTRODUCTION

The two practices have been used around the world in various capacities to mitigate wave action along a shoreline area. These practices include construction of an offshore breakwater or construction of an artificial reef structure. Offshore breakwaters would generally be categorized as an above water feature while an artificial reef structure would be below the normal water surface.

6.2 OFFSHORE/DETACHED BREAKWATER – ABOVE WATER

Offshore or detached breakwaters are generally considered above water practices. The breakwater is designed and constructed with rock boulders, concrete, or sheet pile retaining wall. The breakwater is designed to be several feet above the normal water elevation to manage and stop most wave action from extending to the natural shore. The breakwater can stop wave action between 4 to 5 feet high depending on design and would significantly limit waves from overtopping except for during more serious storm activity.
An example of a breakwater that is common to the Lake Michigan shoreline is a breakwater set up to create a harbor area for a planned marina as seen in various municipal areas along the lake shore. The breakwaters in these situations are considered attached breakwaters since they are connected to a shoreline. The attached breakwaters have the effect of creating and/or protecting the harbor and marina area from most wave action for commercial and recreational uses and provide for safer navigation into and out of the harbor area.

Offshore or detached breakwaters will have the effect of reducing wave action but generally do not eliminate natural wave action. The detached breakwaters cause a reflection of waves and diffraction of waves causing flow around the breakwater. The detached breakwaters have been known to have an effect of encouraging sand deposits collecting in the center between the breakwater and the shoreline. Over time, sand deposits will collect behind the breakwater to form what is called a salient. Depending on the wave action and sand transport, the salient can continue to grow and become connected to the breakwater in a feature called a tombolo. (Johnson, C.M.: 2009, The Effect of Artificial Reef Configuration of wave breaking intensity relating to recreational surfing conditions, Stellenbosh, Master's thesis, University of Stellenbosch).
Figure 34 gives a graphical representation of the formation of salient and tombolo features behind breakwater structures.

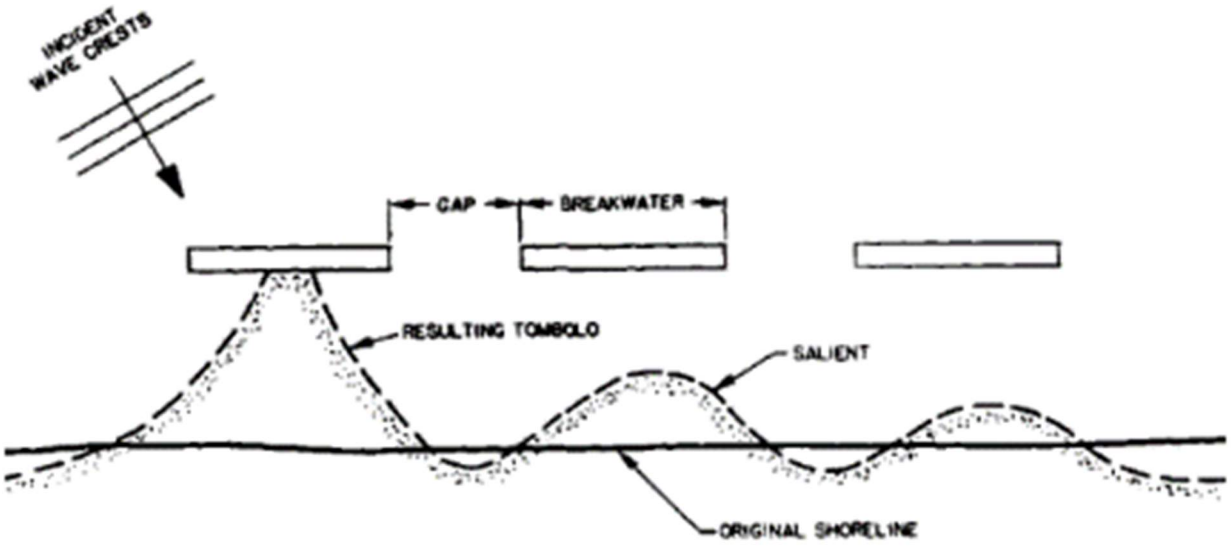


Figure 34: Salient and Tombolo Features

6.3 ARTIFICIAL REEF BREAKWATER (WAVE TRIPPER) – BELOW WATER

Another form of an offshore breakwater is an artificial reef. The artificial reef is designed and constructed with a sill that is typically 4 to 5 feet below the normal low water surface elevation depending on design. A reef (natural or artificial) has many benefits, one of which is an effectiveness to reduce energy of the waves as waves approach a shoreline. The artificial reef will be designed specifically to provide a similar manner of protection to the shoreline as a natural reef, to reduce wave energy yet not fully eliminate natural wave action.

Artificial reefs can go by other descriptive names, two of which are wave trippers and submerged sill. Since artificial reefs have the effect of slowing down or tripping the incoming waves thereby reducing the wave energy, the term wave tripper is sometimes adopted. Furthermore, artificial reefs are designed to have a top of structure 4 to 5 feet, or more, below the normal low water elevation of a given area. The artificial reef structure is typically a trapezoidal shape constructed of large stone or heavy rip rap 6 to 8 foot diameter or more to protect against unwanted movement. The top of the trapezoidal structure is referred to as a sill. The approximate size of a single structure is 25 to 35 feet wide at the base and 60 to 80 feet long. The shapes will very as construction proceeds with the primary objective being to provide stable structures with offset gaps to slow and break wave energy.

The artificial reefs have been used in various ways around the globe. One method of artificial reefs is a system of submerged heavy rip rap barriers designed at intervals to simulate a natural reef, see Figure 35 below. The layout is meant to reduce the wave energy by creating a series of underwater barriers to reduce under currents and decrease the overall wave energy. Furthermore, the wave trippers will act as an artificial barrier assisting to collect sand and sediments over time. And finally, an artificial reef will help support and improve marine habitat and spawning areas. Figure 36 and Figure 37 provides an example of the artificial reef cross section.

Studies performed around the world on both artificial and natural reefs suggest that an artificial reef designed close to shore (less than 200 feet) can cause currents between the reef and the shore that

would promote erosion while reefs further from the shore are best at protecting and promoting shoreline maintenance and dune growth. A series of reefs as shown in Figure 35 would mitigate wave reflection and interrupt longshore flows.

Figure 35: Layout of Offshore Breakwaters

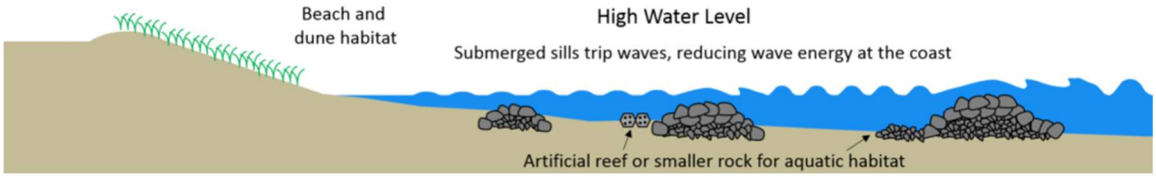


Figure 36: High Water Offshore Breakwaters

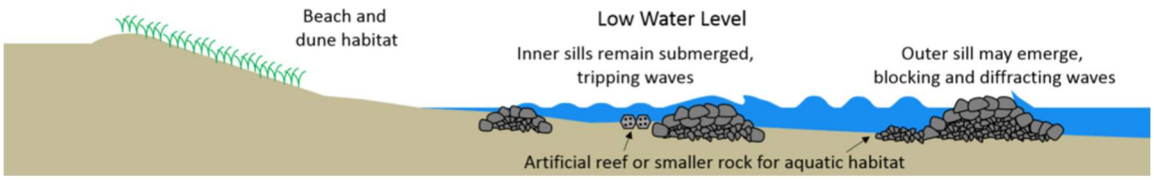


Figure 37: Low Water Offshore Breakwater

6.4 BREAKWATER CONCLUSION

Other projects along the Lake Michigan shoreline have been designed using an artificial reef with a system of submerged sills to protect both the beach and the dune habitat. The objective is the same here, reduce the amount and frequency of high energy waves at the shoreline. High energy waves occur with greater frequency in the absence of a breakwater structure or artificial reef. Without question, high energy wave action is more erosive to the natural shoreline, can adversely impact the Tobin Creek outlet, and can be damaging with reflection of the wave energy due to the existing

revetment. Ultimately the reduction of wave energy will provide longevity to the other mitigations proposed in this report and ultimately allow a natural beach to remain while protecting and preserving the existing shoreline.

CHAPTER 7 - COST CONSIDERATIONS

7.1 DESIGN AND CONSTRUCTION COST

Ultimately, the restoration and mitigation options described under the recommendation section of this study will have costs associated with development of plans and construction. The cost considerations for the recommended improvements are noted here.

Table 1: Restoration Cost

Mitigation	Construction	Engineering	Const. Engineering	Totals
Artificial Reef	$1,100,000	$100,000	$110,000	$1,310,000
Shoreline Restoration	$250,000	$25,000	$25,000	$300,000
Dune Stabilization	$150,000	$15,000	$15,000	$180,000
Totals	$1,500,000	$140,000	$150,000	$1,790,000

Costs for the Tobin Creek restoration that will be submitted to FEMA for consideration are estimated at $115,000.

7.2 FUNDING CONSIDERATIONS

There are several sources for potential funding to assist with design and construction of the proposed improvements. The following is a listing of known funding sources and deadlines for grant applications:

- Wisconsin Costal Management Grant – request for proposals opens August 2021 for funding during 2022 – 2023
- Fund for Lake Michigan – grant decisions made quarterly each year. Two step grant process involves a pre-proposal followed by an invitation for a full proposal submittal. www.fundforlakemichigan.org
- Cooperative Endangered Species Conservation Fund (CESCF) Traditional Conservation Grant Program (Service Legacy Region 3) – Applications due May 12, 2021. Will require a cooperative agreement with a State agency prior to application. https://www.fws.gov/endangered/grants/
- Great Lakes Fish and Wildlife Restoration Act FY2021 – Habitat restoration within the Great Lakes Basin that would impact fish or wildlife species present and eligible for funding. Applications due February 16, 2021. https://www.fws.gov/midwest/fisheries/glfwra-grants.htm
- Great Lakes Restoration Initiative – Forest habitat restoration around the Great Lakes. Grant offering expected to open in spring 2021. https://www.fs.usda.gov/naspf/working-with-us/grants/great-lakes-restoration-initiative

REFERENCE

Figures not credited here are all by Clark Dietz.

Figure 12 Source: Appendix A EM 1110.2.1100 Glossary of Coastal Terminology www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-1100_App_A.pdf?ver=2014-03-10-140035-443 Appendix A Glossary of Coastal Terminology A-1. https://www.publications.usace.army.mil/Portals/76/Publications /EngineerManuals/EM_1110-2-1100_App_A.pdf

Figure 15 source: https://www.illinoiswildflowers.info/grasses/plants/beach_grass.html

Figure 16 source: https://www.illinoiswildflowers.info/grasses/plants/sand_reed.html

Figure 17 source: https://www.fs.fed.us/wildflowers/plant-of-the-week/asclepias_syriaca.shtml

Figure 18 source: https://www.illinoiswildflowers.info/prairie/plantx/sea_rocket.html

Figure 19 source: https://www.wildflower.org/plants/result.php?id_plant=caro2

Figure 20 source: https://www.fs.fed.us/database/feis/plants/shrub/prupum/all.html

Figure 21 source: https://dnr.wi.gov/topic/EndangeredResources/Plants.asp?mode=detail&SpecCode=PPOPH010W0

Figure 22 source: https://www.illinoiswildflowers.info/prairie/plantx/seaside_spurge.html

Figure 23 source: https://www.illinoiswildflowers.info/prairie/plantx/dune_goldrod.html

Figure 24 source: https://archewild.com/species-spotlight-schizachyrium-littorale/

Figure 25 source: http://wisflora.herbarium.wisc.edu/taxa/index.php?taxon=12842

Figure 26 source: https://www.fs.fed.us/database/feis/plants/forb/artcam/all.html#99

Figure 27 source: https://pfaf.org/user/Plant.aspx?LatinName=Lathyrus+japonicus

Figure 28 source: https://www.wildflower.org/plants/result.php?id_plant=COAM8

Figure 29 source: https://www.fs.fed.us/wildflowers/plant-of-the-week/cirsium_pitcheri.shtml

Figure 30 source: https://dnr.wi.gov/topic/EndangeredResources/Plants.asp?mode=detail&SpecCode= PMIRI090H0

Figure 31 source: https://www.minnesotawildflowers.info/shrub/summer-grape and https://www.illinoiswildflowers.info/trees/plants/summer_grape.html

Figure 32 source:
https://www.missouribotanicalgarden.org/PlantFinder/FullImageDisplay.aspx?documentid=2900
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Figure 33 source: https://gobotany.nativeplanttrust.org/species/salix/myricoides/
http://wisflora.herbarium.wisc.edu/taxa/index.php?taxon=4953

Figure 34 Source: Detached Breakwaters for Shore Protection by W. R. Dally and J. L. Pope. January 1986, USACE, Waterways Experiment Station, Vicksburg, MS.

Figures 36 and 37 Source: Southeastern Wisconsin Costal Resilience, Restoring Kenosha Dunes. University of Wisconsin Sea Grant Institute, 2020. https://sewicoastalresilience.org /local-initiatives/restoring-kenosha-dunes/

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RESOLUTION #21 - 01
VILLAGE OF PLEASANT PRAIRIE PARK COMMISSION
CONSIDER THE APPROVAL OF THE PRAIRIE SHORES COASTAL RESOURCE MANAGEMENT AND RESTORATION STUDY

WHEREAS, the Village of Pleasant Prairie currently owns and maintains the Prairie Shores Natural Area; and

WHEREAS, the overall natural area is undergoing a transformation from a typical park to a conservancy; and

WHEREAS, an evaluation from Clark Dietz done in 2018 shows the groins installed have reached their life, the treatment around the creeks have structural damage and the revetment on the north side that functions to hold sand back no longer provides protection; and

WHEREAS, the Prairie Shores Coastal Resource Management and Restoration Study will exam the existing conditions and follow up with recommendations for planting of upland restoration, habitat restoration and shoreline erosion protection; and

WHEREAS, the primary goal of the study is to present information that can be used as framework for engineering design considerations and ultimately construction of a dune system, preparation of habitat for introduction of native plantings, and finally placement of a system of barriers and/or treatments that will have the effect of reducing wave action to the shoreline and assist with shoreline and habitat restoration.

NOW, THEREFORE, BE IT RESOLVED, that the Village of Pleasant Prairie Park Commission hereby approves the Prairie Shores Coastal Resource Management and Restoration Study.

Considered and adopted this 2nd day of March, 2021.

VILLAGE OF PLEASANT PRAIRIE

_____
Michaelene Day
Park Commission Chairperson

ATTEST:

_____
Lora Laas
Park Commission Clerk