



City of St. Joseph Coastal Engineering Study

August 17, 2012



City of St. Joseph, Michigan Coastal Engineering Study

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August 17, 2012

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PURPOSE

This report is intended to evaluate the Lake Michigan coast within the St. Joseph City Limits and to provide recommendations for shoreline management to best preserve the public trust property along the shoreline and protect private interests and property, taking into consideration the unique characteristics and circumstances of the shoreline in different areas of the city that will govern the shoreline management approach. The recommended shoreline management approach is intended to help city policy makers as they evaluate options to further public purposes such as protecting natural resources; preserving the Lake Michigan shoreline, advancing the economic and environmental well-being, health, safety, and general welfare of the City; and preserving/enhancing property values by preserving the natural character of the shoreline.

EXECUTIVE SUMMARY

AREA 1

Area 1 is bookended by public parks at either end that are connected by uninterrupted public trust property and to private property. To preserve this public trust property, reduce the risks of coastal hazards to private property, and maintain the natural shoreline, we recommend the implementation of a fixed setback line, based on coastal engineering principles. The setback line would prevent the construction of structures within a fixed area adjacent to Lake Michigan and prevent the need for shoreline protection structures that cause unnatural erosion and irreversible damage to the shoreline and adjacent property.

AREA 2

Area 2 contains public parks at both ends and publicly-owned shoreline along its entire length. The area is fully developed and shallow lots prevent structures from being built significantly further from the lake than existing structures. This area is already impacted by existing shore protection activity. To protect existing structures during periods of high water, more substantial shoreline protection structures may be required. We recommend the implementation of design guidelines to preserve public access, while allowing property owners to construct, if necessary, properly designed shoreline protection structures which could ultimately become one unified structure.

AREA 3

The entire shoreline of Area 3 contains existing shoreline protection structures, including stone revetments, sheet piling, groins, and timber structures. Steep bluffs containing cohesive soils line the shoreline and the structures are necessary for the protection of the bluffs against erosion. The steep bluffs and shoreline structures restrict public access. We do not recommend additional regulation of shoreline protection structures in Area 3.

STUDY AREAS

AREA I

Area I includes the St. Joseph shoreline from the south limit of Jean Klock Park to the north line of the St. Joseph River. The public trust property in this area varies in width and extends from the water line to the Natural Ordinary High Water Mark (NOHWM). Structures in this area are generally located at least 300 feet inland from the Ordinary High Water Mark (OHWM), with a few exceptions that are as close as 70 feet from the OHWM.



Figure 1: Area I Aerial

Area I is bordered on both ends by public parks, with Jean Klock Park to the north and Tiscornia Beach to the south. Between the parks, private properties exist and many of the lots extend several hundred feet southeast to the street known as Ridgeway. Currently, no shore protection structures exist within Area I, apart from the federal navigation structure at the southerly limit of the area. The entire shoreline here is sandy beach and the southern half of Area I is typically an accretion zone, but subject to erosion at times.

AREA 2

Area 2 includes the St. Joseph shoreline from the south pier of the St. Joseph River to the north limit of the St. Joseph Water Plant. This area includes two public parks, with Silver Beach located at the north end and Lions Park Beach located at the south end.

The entire shoreline here is publicly-owned with some existing federally-constructed shore protection structures and some private shore protection structures on adjacent private property. In some circumstances, the Lake Michigan water line can reach private property at the southern extents of the residential neighborhood.

Area 2 consists of sandy beach, with some coarse fill from past beach nourishment. This area receives beach nourishment from federal dredging operations on a regular basis, typically annually, because it is subject to erosion. Public access along the public trust property can vary, depending on lake conditions, erosion, and beach nourishment. Private properties that border Area 2 between Silver Beach and Lions Park Beach are fully developed and parcels are typically very shallow in comparison to those in Area 1, none exceeding 132 feet in depth.

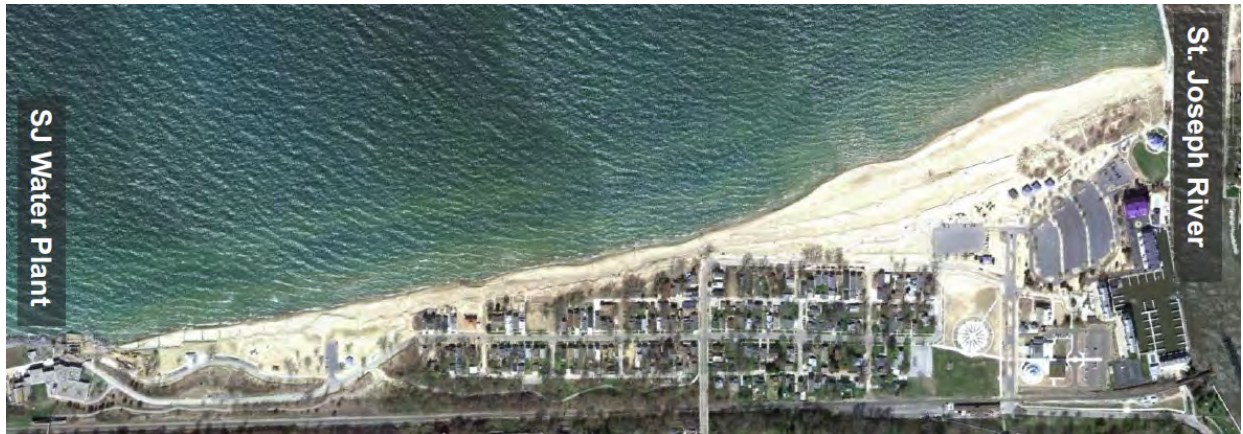


Figure 2: Area 2 Aerial

AREA 3

Area 3 includes the St. Joseph shoreline from the north limit of the St. Joseph Water Plant to the south City Limit, just south of Orleans Circle.



Figure 3: Area 3 Aerial

Little to no meaningful public trust property exists here due to limited access, high bluffs, stone revetments, and other existing shoreline protection structures. The shores within Area 3, in contrast to Areas 1 and 2 are composed of cohesive material and the entire shoreline here contains shore protection of varying types and states of repair.

DEFINITIONS & COASTAL CONSIDERATIONS

VERTICAL DATUM

All elevations within this study are in reference to the International Great Lakes Datum, 1985 (IGLD 85), unless otherwise noted. Some elevations within the study are converted from other datums which were referenced in original documents. A table summary of the key elevations and conversions is located in Appendix I.

WAVES

A wave is defined as the difference in elevation between the wave's crest to its neighboring trough. In order to standardize wave heights for statistical analysis, wave heights are generally referred to as significant wave heights. A significant wave height was originally defined as the average wave height of the largest third of the waves; it is now commonly defined as four times the standard deviation of the surface elevation of the water.

According to the U.S. Army Corps of Engineers Wave Information Studies (WIS) for St. Joseph, the 50-year event peak wave height is 7 meters, or 23 feet, and the 100-year event peak wave height is 7.5 meters, or 24.6 feet. A 50-year event has a 2% chance of being equaled or exceeded in any single year and a 100-year event has a 1% chance of being equaled or exceeded in any single year.

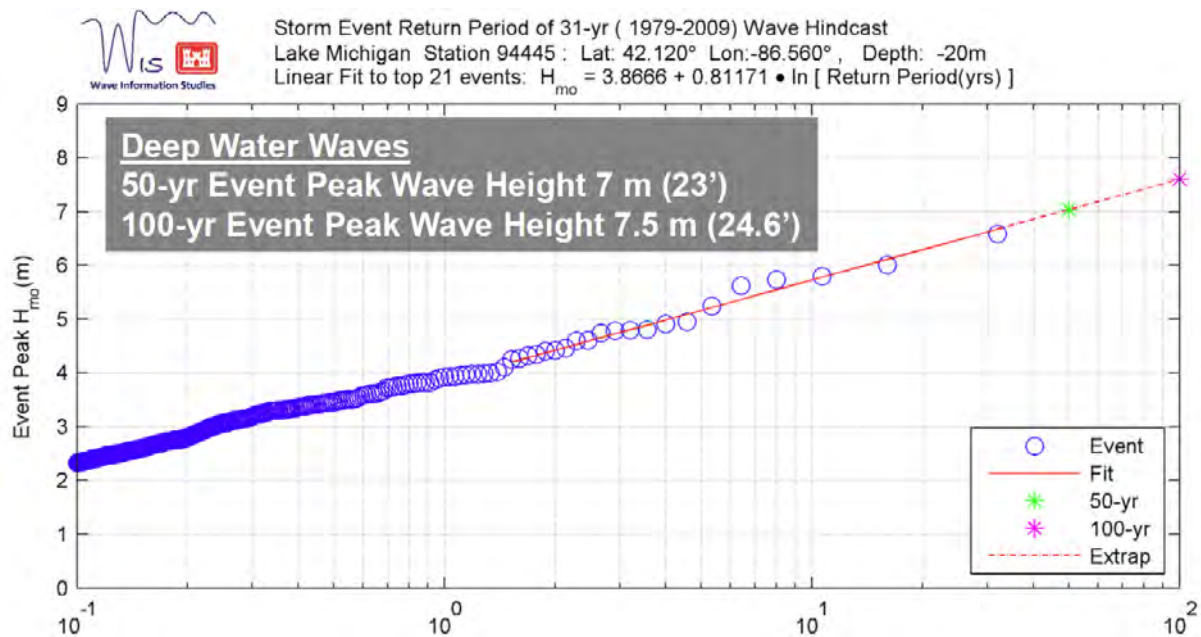


Figure 4: U.S. Army Corps of Engineers WIS Data

Also according to the Wave Information Studies, wind occurs most frequently from the south-southwest direction, and high frequencies of wind also occur from the southwest and north-northwest directions (Figure 6). The greatest frequency of wave occurrence, however, is from the north-northwest, due to the long wave fetch in the north-northwest direction (Figure 7). Wave fetch is the distance over which wave-generating winds travel. In St. Joseph, although winds come from the south-southwest most frequently, the fetch in that direction is only 25 miles, so waves have a relatively short distance to form. When winds come from the north-northwest, the fetch distance is 150 miles and extreme waves can be generated. Figure 5 illustrates the St. Joseph fetch distances for each of the two most predominant wind directions.



Figure 5: Fetch Distances for St. Joseph



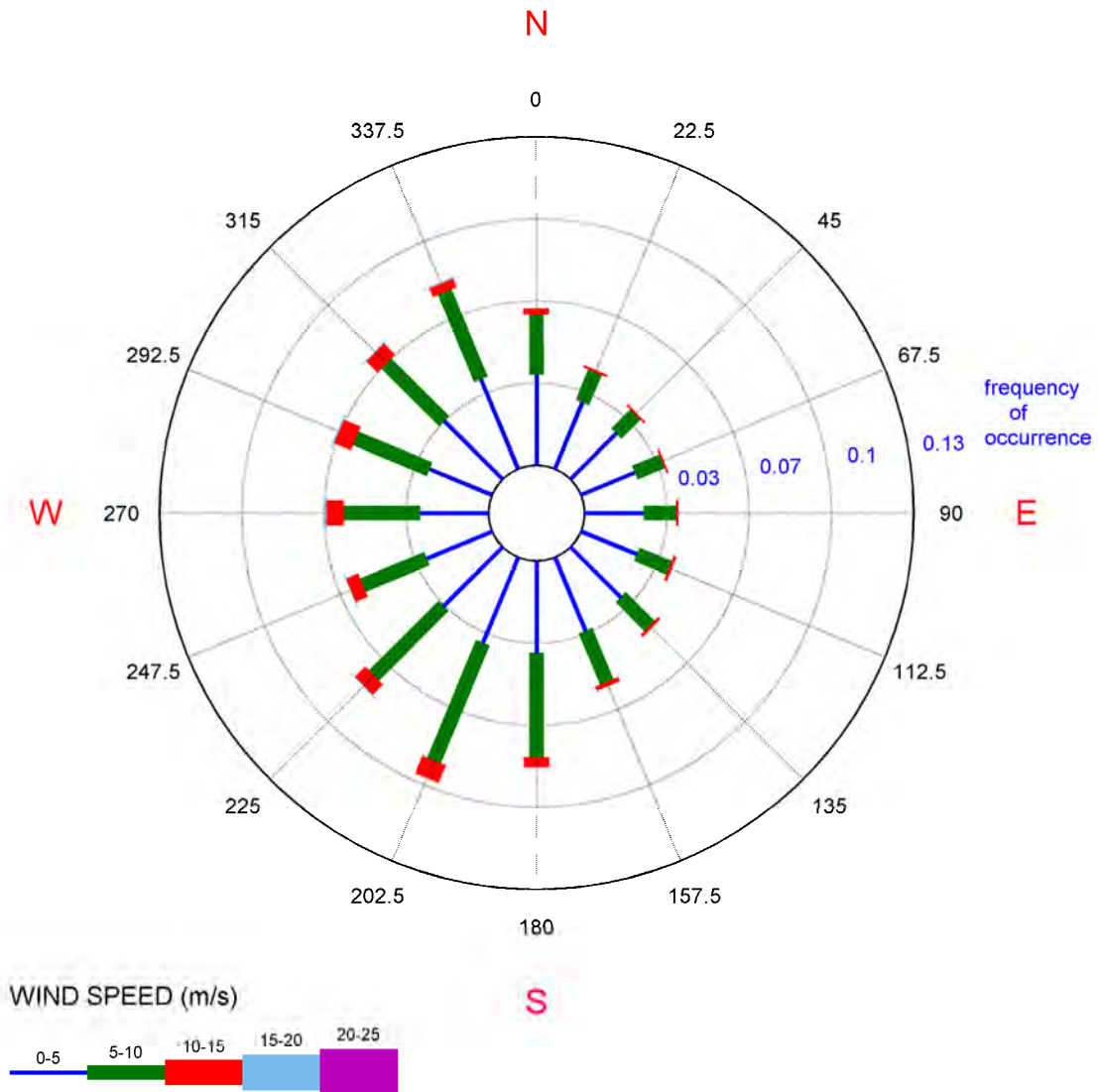
Lake Michigan WIS Station 94445

01-Jan-1979 thru 30-Dec-2009

Long: -86.56° Lat: 42.12°

Total Obs : 271728

WIND ROSE



US Army Engineer Research & Development Center

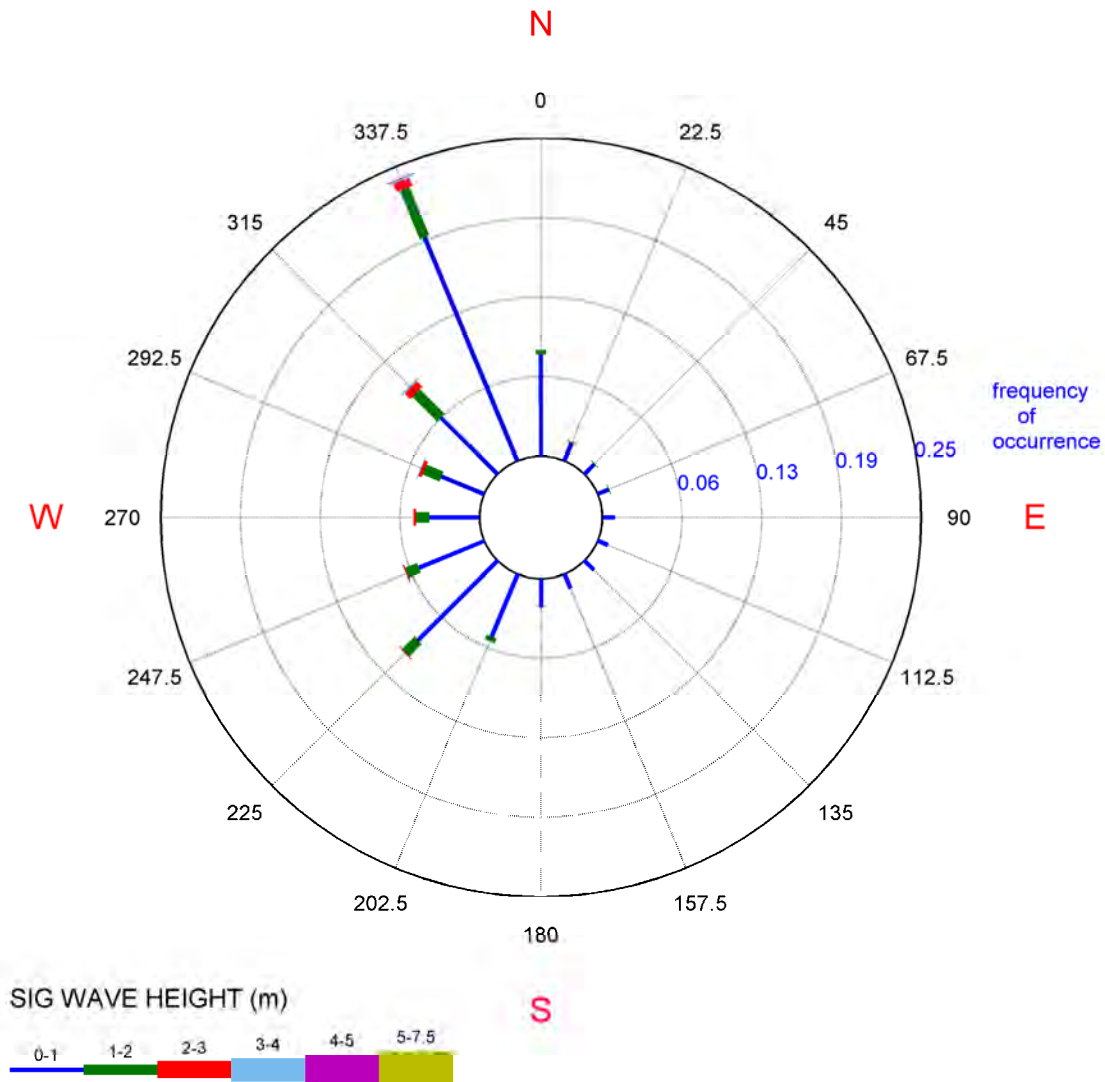
09-Mar-2012

Figure 6: U.S. Army Corps of Engineers WIS Wind Rose



Great Lakes WIS Station 94445
01-Jan-1979 thru 30-Dec-2009
Long: -86.56° Lat: 42.12° Depth: 20 m
Total Obs / Total Ice : 271728 / 11592

WAVE ROSE



US Army Engineer Research & Development Center

01-Mar-2012

Figure 7: U.S. Army Corps of Engineers WIS Wave Rose

As a strong, sustained wind with a large fetch blows across open water, some of its energy is transferred to the water. This energy transfer causes water to be dragged with the wind, causing a storm surge, or set-up, to occur on the leeward (downwind) side of the water body. This set-up inversely causes a set-down on the windward (upwind) side of the water body. This relationship is shown in Figure 8. Set-ups and set-downs can also be caused by sudden changes in atmospheric pressure on the lake. Since it is located on the side of Lake Michigan that is typically leeward, St. Joseph is highly susceptible to wave set-ups ranging from two to three feet. These set-ups, combined with large wave heights during a storm event, can create extreme shoreline conditions.

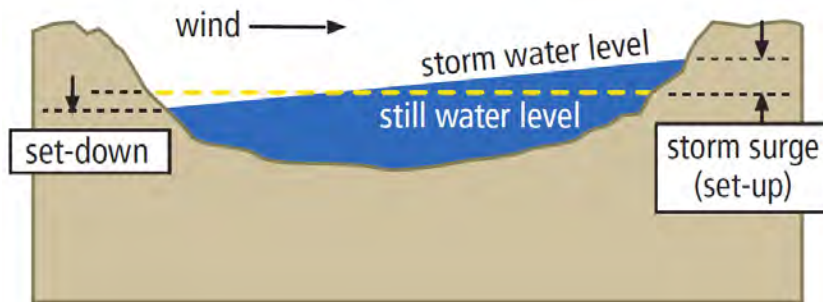
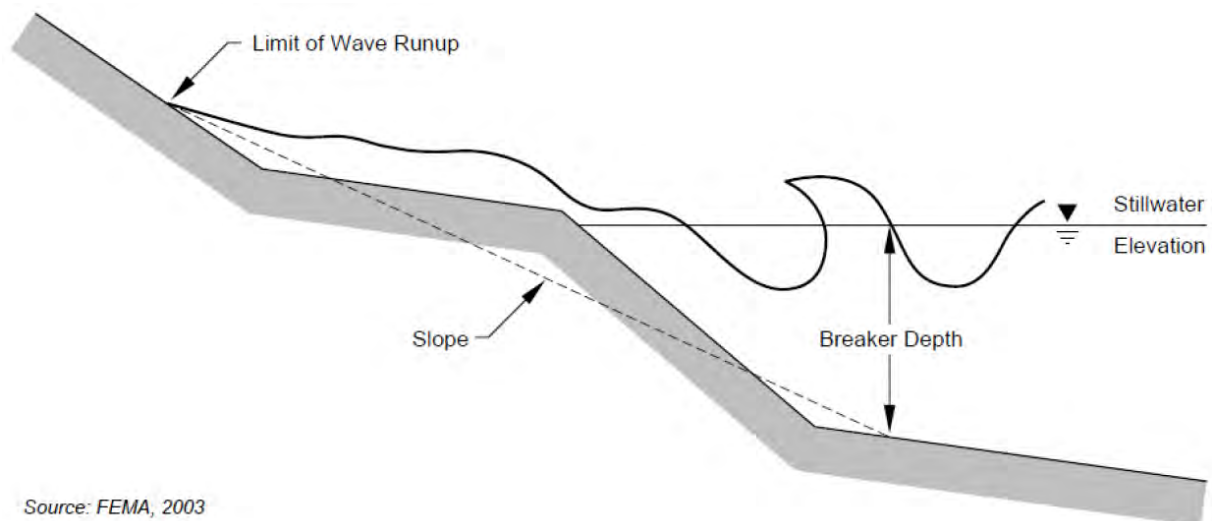


Figure 8: U.S. Army Corps of Engineers/University of Wisconsin. *Living on the Coast*. USA: U.S. Army Corps of Engineers/University of Wisconsin, 2003. Print.

WAVE RUNUP

Wave runup is defined as the landward extent of wave uprush measured vertically from the still water level (Figure 9). Runup is largely dependent on deep water wave height, wave period, slope of lake bottom, and slope of shoreline. The calculated 2% wave runup of a 50-year deep water wave that propagates to shore for Area 1 is 7.0 feet and the average calculated 2% wave runup for Area 2 is 6.0 feet, both relative to still water elevation. The primary difference in runup is attributed to slope/bathymetry differences between the areas.



Source: FEMA, 2003

Figure 9: FEMA Wave Runup Graphic

LAKE MICHIGAN WATER LEVEL

Water levels are typically expressed in reference to a static elevation referred to as low water datum (LWD). The low water datum of Lake Michigan is elevation 577.5' IGLD 85. As of the August 2012 U.S. Army Corps of Engineers (USACE) Lakes Michigan-Huron Water Level Bulletin (see Appendix), the current water level is +0.2' LWD. The long-term average level for August is +1.8' LWD, meaning that Lake Michigan is currently in a low lake level condition.

The USACE has monitored and recorded Great Lakes water levels since 1918 (Figure 10). Over this period, the long term lake water level fluctuates between -1.3' LWD and +4.9' LWD, a range of 6.4 feet. The all-time high occurred in 1986 and the all-time low occurred in 1964. On the date of survey, the Lake Michigan water level was +0.4' LWD. Figure 10 illustrates the horizontal movement of the water line in Area I resulting from long term water level fluctuations and accretion.

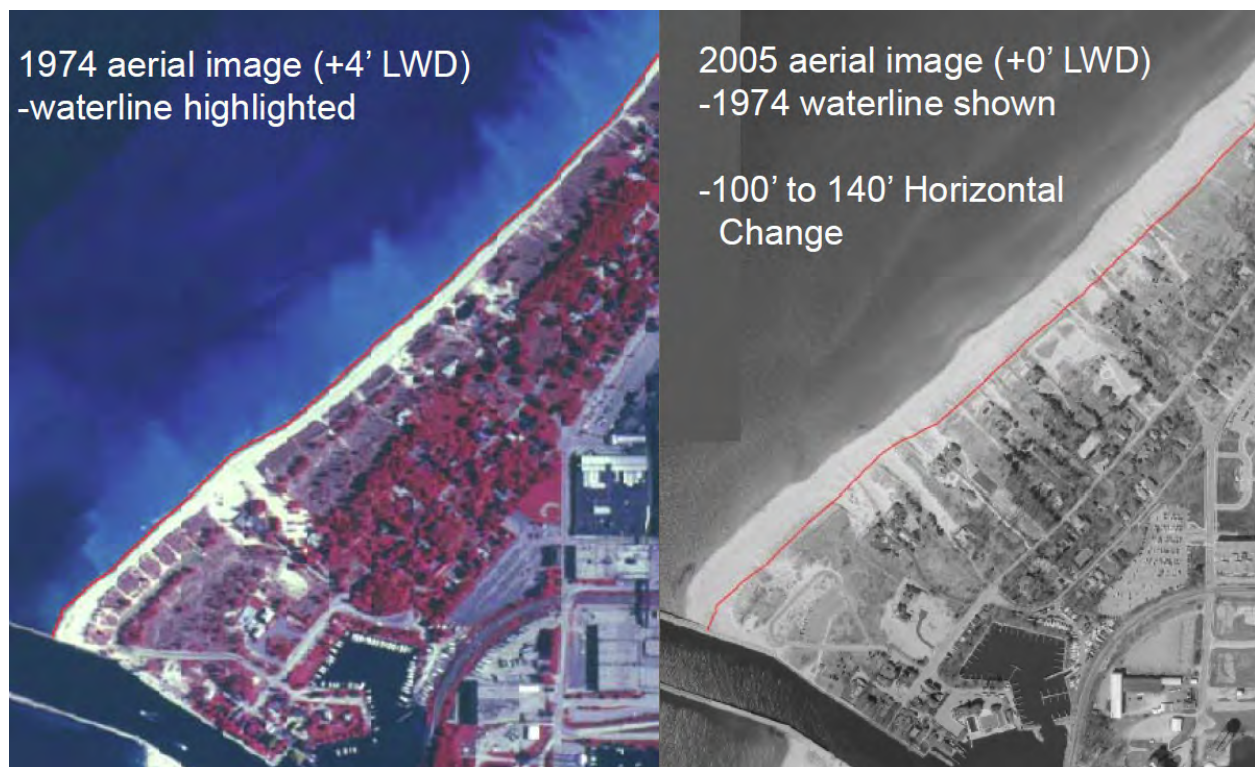


Figure 10: Aerial comparison of 1974 waterline and 2005 waterline

Although the records only extend back to 1918, they are still commonly referred to as “all-time high”/ “all-time low” and these terms will be used for the purposes of this study. However, prior to 1918, there are few records of Lake Michigan’s long term water level fluctuations. Record data from Milwaukee, Wisconsin suggests that in 1838 Lake Michigan may have reached an even higher level than the 1986 “all-time high”. The data indicates that a level of +6.6' LWD was reached in 1838, which is 1.7 feet higher than the 1986 level. Due to information such as the record from Milwaukee, a factor of safety is recommended as the basis of design is based on 90 years of water level data. Ideally, we would have additional/older historic data, but unfortunately this is not available. Therefore, it is important to

note that this report and its assumptions are based on the best information currently available (including existing studies, historic data, local, state and federal documentation) however there is no guarantee that unusual coastal conditions will not occur that could create conditions worse than projected herein.

Since 1918, data for Lake Michigan shows there have been three 10-year periods of low lake level, in which water levels are at least one foot below the long-term annual average (Figure 11). These periods occurred from approximately 1931 to 1942, from 1957 to 1967, and from 1999 to the present. Each of the two previously recorded low-level periods was followed by high water levels. Based on the long term fluctuations of the Lake Michigan water level, high water can be expected to occur again in the future.

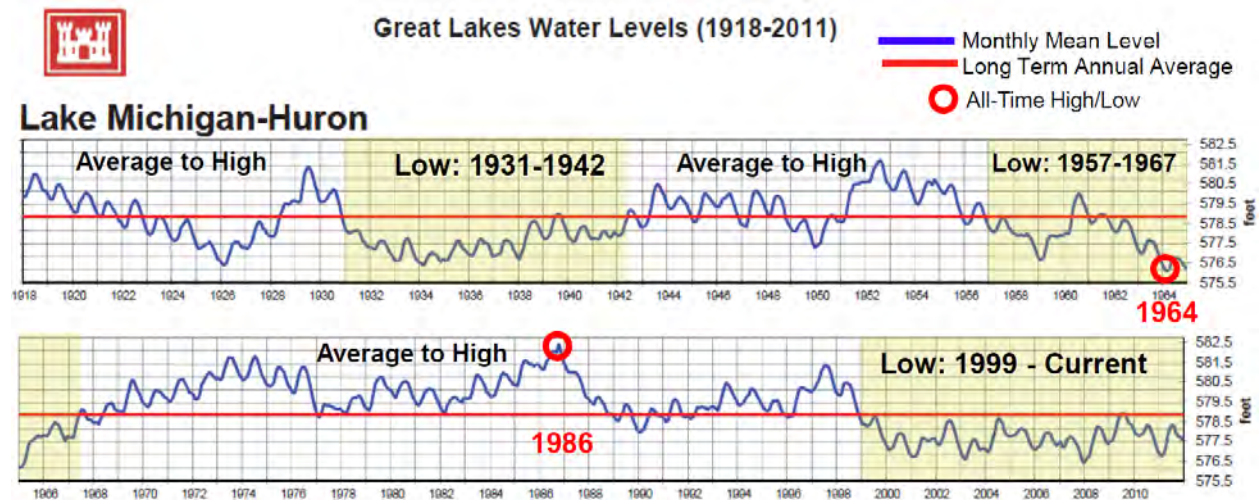


Figure 11: U.S. Army Corps of Engineers long term water level chart

In addition to long term fluctuations, Lake Michigan fluctuates on an annual cycle. Typically, water levels will fluctuate one to two feet per year, with lowest water levels in the winter and highest water levels in the summer. Figure 12 below depicts the annual cycle of the Lake Michigan water level and shows the relationship between the long term average water level, current water level, OHWM, all-time high water level, and all-time low water level.

LAKES MICHIGAN-HURON WATER LEVELS – JUNE 2012

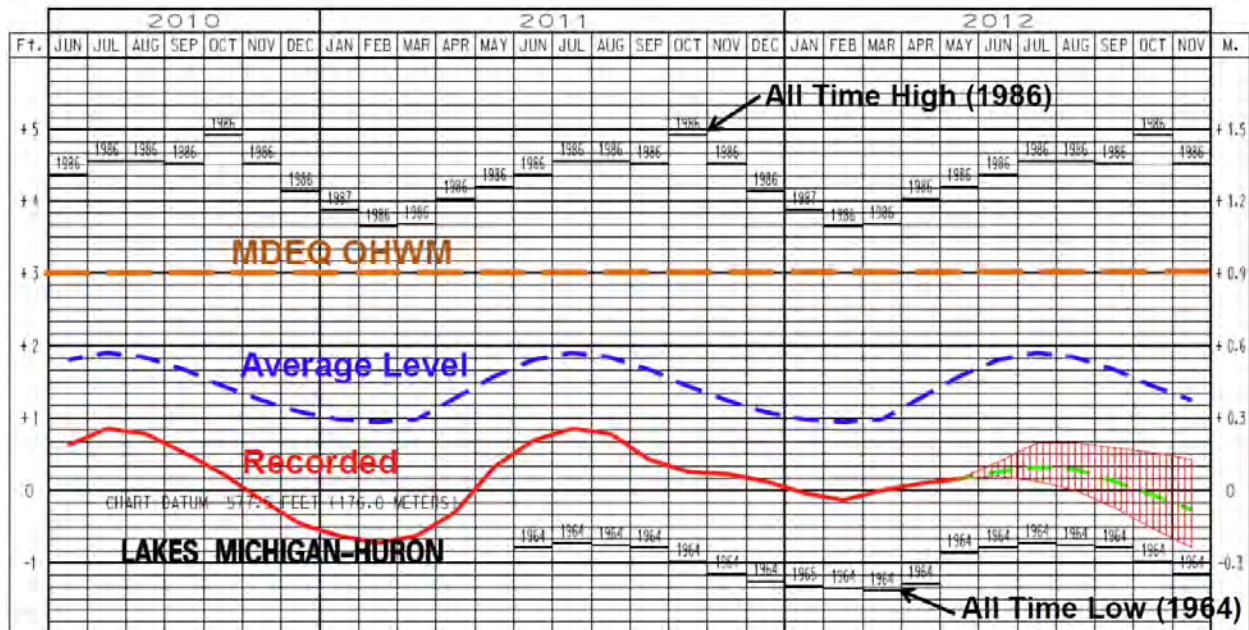


Figure 12: U.S. Army Corps of Engineers short term water level chart

FLOODPLAIN (FEMA)

According to the Federal Emergency Management Agency (FEMA), areas that will be inundated by the base flood, or 100-year flood, are identified as a Special Flood Hazard Area (SFHA). The base flood is the flood event that has “a 1-percent chance of being equaled or exceeded in any given year”. The base flood is defined by FEMA as a base flood elevation using historical flood events and floodplain studies. The elevations are published by FEMA Flood Insurance Studies (FIS) and on Federal Insurance Rate Maps (FIRMs). These maps also show areas that are outside of the SFHA, but still susceptible to other flood risks.

FEMA recommends and the State of Michigan requires that structures built in the SFHA are constructed at least one foot of freeboard (height) above the base flood elevation to lower the risk of flooding. FEMA’s freeboard recommendations increase when building near the coast to compensate for changing shoreline conditions, water levels and storm events. However, currently there are no FEMA requirements to account for these hazards on the Great Lakes beyond the base flood elevation, which is a still water level and does not account for waves, setup, or other coastal conditions.

Per the Berrien County Flood Insurance Study No. 26021CV000A, effective April 17, 2006, the 1% annual chance flood elevation is 584.0’ south of the St. Joseph River and 583.8’ north of the St. Joseph River (both elevations are IGLD 85, converted from NGVD 29). This document is the authoritative document for flood levels. FEMA Flood Insurance Rate Map Number 26021C0101C, revised March 1, 2007, indicates a Base Flood Elevation of 584.0’ IGLD 1985 (converted from 585.0’ NGVD 1929) along the shoreline, within the study limits. This map is shown as Figure 13.

FEMA is currently collaborating with the USACE, the Association of State Floodplain Managers (ASFP), and state partners to conduct a Great Lakes Coastal Flood Study. The study began in 2010 and will provide updated flood risk information serving the U.S. communities with Great Lakes shorelines. Currently, data collection and the application of modern analysis of historic storm and high water events are ongoing. The study will result in updated Flood Rate Insurance Rate Maps along the shorelines of the Great Lakes, with anticipated release during the period of 2014 to 2016. Berrien County is one of seven counties selected as pilot counties, so updated information for St. Joseph may be available for review sooner. The FEMA study is intended to address high water along the Great Lakes Coast due to flooding and wave and wind effects. Currently, the FEMA Base Flood Elevation is 1.6 feet above the all-time high Lake Michigan Water level however neither elevation accounts for wind and waves. The FEMA study may have results that could impact the recommendations in this analysis. Therefore this analysis should be updated once the FEMA findings are known.



Figure 13: Part of FEMA Flood Insurance Rate Map Number 26021C0101C, Revised March 1, 2007

ORDINARY HIGH WATER MARK

The Michigan Department of Environmental Quality (MDEQ) provides a guidance document for clarifying the authority of the MDEQ under Part 325 of the Natural Resources and Environmental Protection Act, also referred to as the Great Lakes Submerged Lands Act (GLSLA), as it relates to the

Ordinary High Water Mark (OHWM). The document refers to Section 324.32502 of the Michigan legislature, which says:

“For the purposes of this part, the ordinary high-water mark shall be at the following elevations above sea level, international Great Lakes Datum of 1955; ...Lakes Michigan and Huron 579.8 feet...”

Although Section 324.32502 does not provide a conversion between IGLD 1955 and IGLD 1985, the MDEQ Guidance Document Number 325-06-02 does. It specifically names an elevation of 580.5' IGLD 1985 as the OHWM of Lakes Michigan and Huron. This elevation will be used as OHWM for the purposes of this study and it is this elevation that constitutes the limit of the MDEQ's jurisdiction under the GLSLA. The OHWM is +3 LWD, which is 1.9 feet below the all-time Lake Michigan high water level. The USACE defines the OHWM and limit of USACE jurisdiction of Lake Michigan as elevation 581.5' IGLD 1985, which is one foot higher than the MDEQ OHWM elevation.

Additional definitions are provided within the MDEQ guidance document to explain what is commonly referred to as the Natural Ordinary High Water Mark (NOHWM). The NOHWM is the upland boundary of the public trust property. According to the guidance document, “prior to 1968 amendments to the Part 325, the rules contained the following definition:

‘Ordinary high water mark means the line between upland and bottomland which persists through successive changes in water levels, and below which the presence and action of the water is so common or recurrent as to mark upon the soil a character, distinct from that which occurs on the upland, as to the soil itself, the configuration of the surface of the soil and the vegetation. When the soil, configuration of the surface, or vegetation has been altered by man’s activity, the ordinary high water mark shall be located where it would have been if this alteration had not occurred.’

It is important to note that the horizontal locations of both OHWM and NOHWM change over time, depending on water level, waves, and coastal processes. For instance, after a period of erosion, although the determining elevation remains unchanged, the OHWM will intersect the shoreline at a more landward point than pre-erosion. After a period of accretion, the OHWM, likewise, will intersect the shoreline at a more lakeward point than pre-accretion. Figure 14 illustrates this concept.

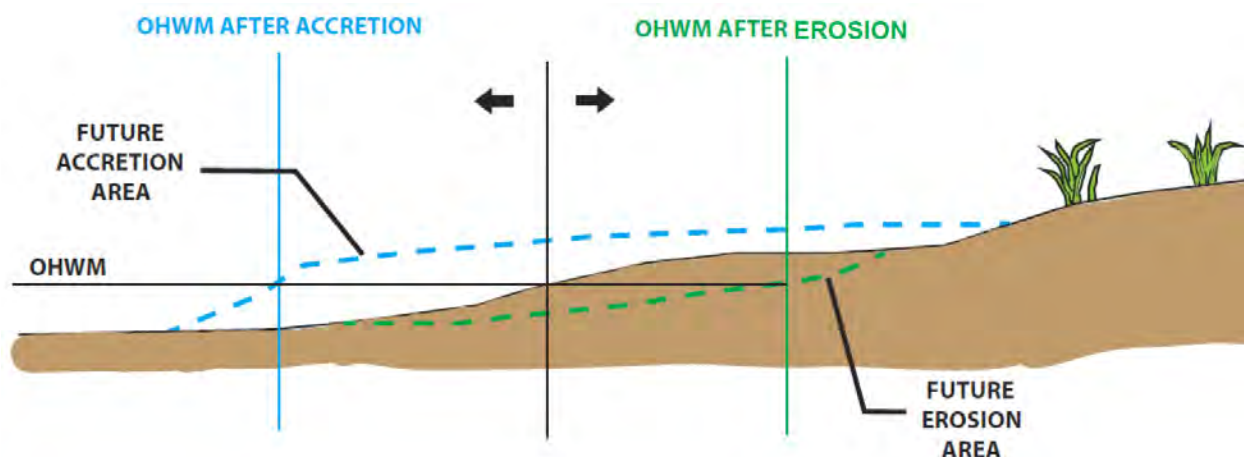


Figure 14: Illustration of OHWM movement

LITTORAL DRIFT

One of the key processes that affect the coastline of St. Joseph is littoral drift or longshore transport. Littoral drift is the transportation of sediment in the littoral zone of a water body. Littoral drift is a function of wind and wave direction, wind and wave amplitude, shoreline material, sediment supply, water circulation patterns, water level, and shoreline structures.

The creation of groins and piers create barriers that alter the sediment transportation process. This process has a major effect on a shoreline by adding material through accretion in some locations and by interrupting the supply of sediment in others, thereby resulting in an erosion-like process.

Generally, sandy shores are identified by what seems to be an unlimited supply of cohesionless beach material. Oppositely, cohesive shores are classified by having a cohesive sub layer (typically beneath a cohesionless surface) consisting of such materials as glacial till, soft rock and other various deposits. This cohesive sub layer determines the long-term shoreline condition. On cohesive shores, the thin surface layer of cohesionless (such as sand and gravel) material is eroded by coastal forces and replenished by littoral drift. When replenishment is interrupted, the cohesive sub layer can become exposed and susceptible to increased erosion.

Near the City of St. Joseph, the lake bed is comprised of cohesive material with a cohesionless surface layer with varying thickness of 0-4 meters (0-13 feet). Large deposits of sand accumulate near the mouth of the harbor and are dredged on a regular basis. Since the 1970s, this material has been deposited as beach nourishment on the designated feeder beach south of the St. Joseph River, typically south of Park Street, as shown in Figure 15. This material helps to protect the existing cohesive sub layer; however, since it is primarily fine to very fine grain, it is easily eroded by coastal forces. The quantity of dredging that is completed per year ranges from 20,000 to 150,000, cubic yards, although not all of the material is used for beach nourishment. It is important to consider that USACE funding is often an issue and that beach nourishment may not always be available. A summary of dredging quantities by year is included in Appendix 3.



Figure 15: 2012 photo of beach nourishment south of Park Street showing the dredge in background

Immediately north of the St. Joseph River, sand accumulates via littoral drift, creating an accretion zone. The piers act as a barrier, interrupting sediment as it is moved along the coast in a southerly direction. This accretion zone has grown during the recent 13-year period of low lake levels. This area, as well as Area 2, experiences short term erosion during significant storm events and is expected to experience erosion during the transition period from low to high water conditions (Figures 16-19).



Figure 16: January 24, 2012 - Area I short term beach erosion



Figure 17: January 29, 2012 - Area I short term beach erosion



Figure 18: October, 2004 - Area 2 short term erosion



Figure 19: December, 2004, Area 2 short term erosion

Based on the 1997 USACE study, “Effectiveness of Beach Nourishment on Cohesive Shores, St. Joseph, Lake Michigan”, Figure 20 illustrates the modeled longshore transport of sediment in Area I and Area 2 during the early 1990s. Net transport quantities are depicted, along with northerly and southerly components.



Figure 20: Graphic representation of longshore sediment transport

HIGH RISK EROSION AREA

The MDEQ identifies and designates High Risk Erosion Areas (HREAs) and defines them as:

Those shorelands of the Great Lakes and connecting waters where recession of the zone of active erosion has been occurring at a long-term average rate of one foot or more per year, over a minimum period of 15 years.

Within the study area, only one designated HREA exists, located at the southern extent of Area 3. The HREA has a projected 30-year recession of 65 feet and a projected 60-year recession of 115 feet (Figure 21). Based on aerial imagery, shoreline protection has been constructed in this area within the past five years, so recession projections will likely be revised as the HREA studies are revisited and updated.

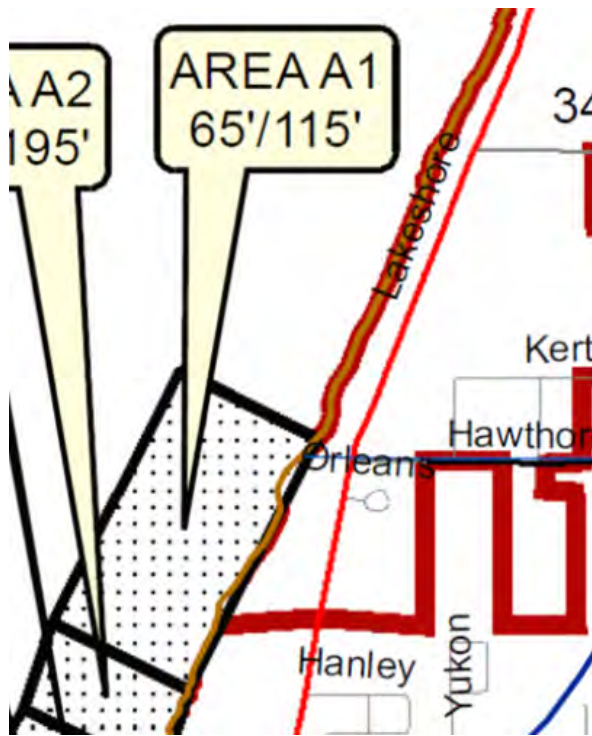


Figure 21: MDEQ High Risk Erosion Area Map



Figure 22: HREA Area A1 Aerial

SEICHES

According to the U.S. Army Corps of Engineers (Vol. 162 2006), a seiche is a periodic oscillation of lake levels caused by either a rapid change in air pressure or a rapid shift in wind direction as weather systems pass over the lakes. This process is often compared to water sloshing from side to side in a bathtub. A seiche can last anywhere from seconds to minutes, occurring at intervals of tens of minutes to multiple hours until stored energy is dissipated from the lake. In St. Joseph, seiches typically range from one to three feet in height.

Although data regarding seiche events is scarce, the following is a sample of events that have occurred in southern Lake Michigan since 1900:

- On August 24, 1900, a huge seiche like wave was reported hitting the shores of St. Joseph, washing away small boats and various other items along the shoreline. (1900 NY Times)
- In 1929, a seiche occurred in Grand Haven during a 4th of July Celebration with 20' waves sweeping people off of the piers. 10 people were killed by the event. (MSU Report)
- On August 3, 1960 a seiche temporarily raised the water levels in Chicago 2.5'-4' and St. Joseph residents were warned against 4'-6' waves. (1960 Lawrence Journal)
- On July 11, 2011, a seiche of unrecorded height hit near Holland causing significant damage. (2011 Holland Sentinel)

BERRIEN COUNTY COASTAL DAMAGE, 1957-1977

For the ten year period 1957 to 1967, Lake Michigan experienced low to average water levels, similar to the conditions experienced today. The ten year period that followed until 1977 saw water levels rise to high levels, reaching 581.8' (+4.3) in 1974, which is only 0.6' below the Lake Michigan all-time high water level. This water level fluctuation is part of the normal cycle of Lake Michigan as observed from 1918 to 2012 and discussed above.

High water conditions and severe storms culminated in 1973, when President Nixon declared Berrien County a disaster area, according to articles from the Herald Palladium. Damage that occurred during the early 1970s included the loss of beach, bluff erosion, damage to structures, and the loss of structures. Figures 23-26 illustrate some of the damage that occurred.



Figure 23: 1973 Herald Palladium photo of Jean Klock Park



Figure 24: 1973 Herald Palladium photo of Jean Klock Park sidewalk



Figure 25: 1970s Herald Palladium photo of bluff erosion south of St. Joseph, MI



Figure 26: 1970s Herald Palladium photo of bluff erosion south of St. Joseph, MI

The period of 1957-1977 is an important example of what can happen as the conditions of Lake Michigan change. During times of low water, building structures closer to the lake is a dangerous temptation for many property owners and leaves structures exposed to the risk of erosion, wave action, and damage when water levels rise again. Based on 94 years of Lake Michigan water level records and the cycles that have occurred in the past, water levels will rise again and coastal communities must plan and prepare for these ever-changing conditions.

OTHER GREAT LAKES STATES

Other Great Lakes states have developed standard setbacks and/or guidelines for various reasons. These states provide valuable examples of setbacks and coastal guidelines. This study will focus on the setbacks and guidelines that have been implemented in Wisconsin and in Ohio.

WISCONSIN

The State of Wisconsin implemented setbacks to “...conform to health, safety and welfare requirements, preserve natural beauty, reduce flood hazards and avoid water pollution”. Chapter NR 115 of the Wisconsin Administrative Code requires all buildings and structures to be setback a minimum of 75 feet from the OHWM of navigable lakes, rivers, and streams. This requirement applies to Wisconsin’s coastline on both Lake Michigan and on Lake Superior. In addition to the statewide setback, some counties have increased minimum setbacks. For instance, the setback in Sheboygan County is 225 feet from OHWM. Michigan does not currently have a similar setback.

Additional methods are provided within NR 115 for the reduction of setbacks for lots with minimal depth or for vacant lots between lots that were developed before setbacks. Some counties require new structures to be setback as far as lots allow. Others average the setbacks of adjacent developed substandard lots to provide a requirement to an undeveloped lot. The third and most flexible method for reducing setbacks is what is called “the formula approach”. This method allows limited reduction of a roadway setback first; then allows reduction of the shoreline setback until a 30 foot deep building envelope is created. Typically, when any setback reduction is allowed, mitigation measures are required to compensate for the reduction of buffers.

OHIO

In 2011, the Ohio Department of Natural Resources, Office of Coastal Management published the Ohio Coastal Design Manual to “promote better projects along the Ohio shore of Lake Erie”. It provides guidance in the design of commonly constructed structures for engineers, surveyors, and landowners, while attempting to balance erosion control needs with lake access and protection of natural resources.

The manual does not provide specific setback requirements but does include guidance for the design of shoreline structures, including considerations such as erosion, existing structures, geology, habitat, near shore bathymetry, wave climate, submerged lands, water levels, littoral drift, revetment flanking, and revetment materials.

Based on conversations with the Ohio Office of Coastal Management, setbacks have not been implemented. However, where a proposed structure is within a designated Coastal Erosion Area, plans must be submitted to the Office of Coastal Management for review and approval before construction can commence. In Ohio, the Coastal Erosion Areas are updated every ten years and are based upon recession rates observed from aerial photos, similar to Michigan’s High Risk Erosion Areas.

GREAT LAKES SHORELINE PROTECTION

According to the USACE Coastal Engineering Manual (Section III-5-13):

*(1) The two most important issues in the planning and management of cohesive shores relate to **implementing setbacks for development** and to managing human influences on the sediment supply.*

*(2) Many Jurisdictions along U.S. shorelines impose a setback for new development consisting of some multiple of the average annual recession rate (e.g., 30 to 100 times the average recession rate). The purpose of the setback is **to avoid the need for shore protection** within the life of the new development, **recognizing the irreversible and inevitable erosion that occurs** along cohesive shores (and some sandy shores as well).*

[emphasis added]

Shoreline protection structures reflect and accelerate wave energy, causing unnatural erosion and resulting in irreversible changes to the shoreline. Where possible, it is recommended to avoid the need for shore protection and in Area 1 this opportunity still exists. Most structures are set back from Lake Michigan and the public trust property is uninterrupted between two public parks.

However, in Area 2, structures are located closer to Lake Michigan, potentially requiring the construction of shoreline protection structures during periods of high water in addition to the existing shoreline protection structures.

In Area 3, cohesive bluffs would be exposed to erosion, were it not for the existing shoreline protection structures that line the shore. These structures are necessary to prevent erosion and protect property.

DESIGN CONSIDERATIONS

Shoreline protection must be designed with an awareness of the following considerations:

- Height: The top of the structure must be built to an elevation that will prevent wave overtopping.
- Surface: Irregular shapes and permeable materials absorb wave energy, whereas flat, planar surfaces reflect and accelerate wave energy.

- **Toe Protection:** Sufficient toe protection must be incorporated to prevent scour of the toe of the structure which can result in slip failure of the structure.

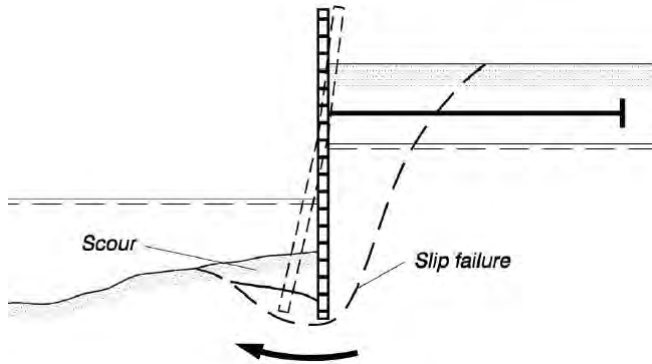
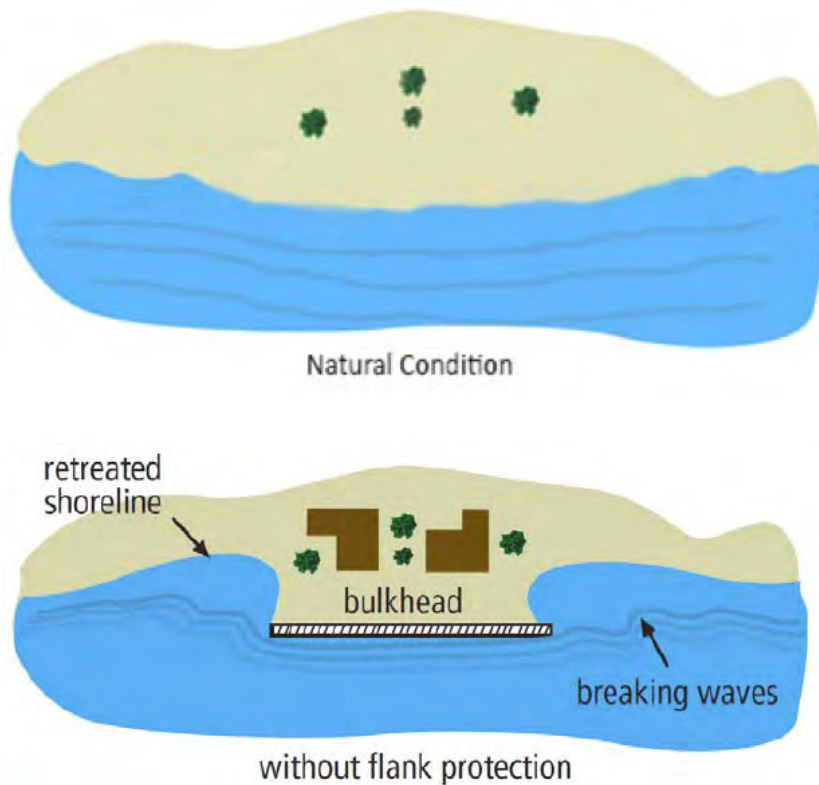
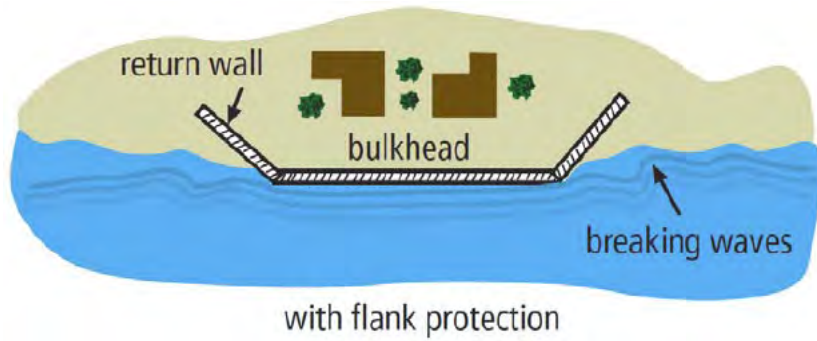


Figure 27: Graphic from USACE Coastal Engineering Manual

- **Length:** Sufficient structure length and/or return walls are required to prevent flanking of the structure and produce potential adverse effects on neighboring properties. As depicted in Figures 28-30, flanking is the erosion that occurs on either side of a shoreline structure caused by the reflection and acceleration of wave energy.





Figures 28-30: Graphics from USACE/University of Wisconsin, “Living with the Coast” Booklet

FAILURE EXAMPLES

Berrien County coastal structures are subjected to severe coastal conditions on a regular basis. Any weakness will be exposed by these conditions. The USACE Coastal Engineering Manual includes examples of the effects Lake Michigan can have on these structures in order to help guide the design process of future protection.



Figure 31: Example of flanking in southern Berrien County. Note how this failure has resulted in the loss of the public trust property lakeward of the NOHWM and public passage is only possible in the lake itself.



Figure 32: USACE CEM Photo, “A toppled concrete seawall along the Lake Michigan coast of Berrien County. Failure probably resulted from undermining of the underlying glacial till foundation, April 1991.”



Figure 33: USACE CEM Photo, “A steel sheet-pile wall and groin field has been ineffective at protecting this section of cohesive shore along the Berrien County shore of Lake Michigan, south of the town of St. Joseph, April 1994.”

SUCCESSFUL EXAMPLES

Within the study area, two successful examples of shore protection have been identified. The first is the shoreline that borders the St. Joseph Water Plant, located at the north end of Area 3. The structure consists of armor stone, laid on a slope of 1 vertical on 2 horizontal to a top elevation of 591.20 feet. The toe of the revetment extends several feet below the lake bottom to prevent scour.



Figure 34: St. Joseph Water Plant Revetment Oblique Photo



Figure 35: St. Joseph Water Plant Revetment, spring 2012

The stone revetment along South Lakeshore Drive provides another example of a successful shoreline protection structure. It is also comprised of armor stone set at a slope of approximately 1 vertical on 2 horizontal and protects the high bluffs on which South Lakeshore Drive is constructed.



Figure 36: Stone Revetment along South Lakeshore Drive Oblique Photo

However, although both of these stone revetments have been successful in protecting the water plant and South Lakeshore Drive bluff, respectively, from erosion, they have had a dramatic effect on the public trust property along the shoreline.

AREA I FINDINGS

CURRENT CONDITIONS

Area I is bordered by Jean Klock Park to the north and Tiscornia Beach to the south. Between the parks, private properties exist and many of the lots extend several hundred feet from the street known as Ridgeway to Lake Michigan. Currently, no shore protection structures exist within Area I. The entire shoreline is sandy beach. The southern half of Area I is typically an accretion zone, but subject to erosion as well. The public trust property in this area varies in width and extends from the water line to the NOHWM, connecting the public parks.



Figure 36: Area I typical shoreline

SHORELINE MANAGEMENT RECOMMENDATION

We recommend that the City of St. Joseph prohibit the construction, erection, or expansion of Structures, as defined by the Zoning Ordinance of the City of St. Joseph, within Area I by a fixed setback line as shown on the attached exhibit, “Area I Proposed Setback Line”. The definition of a Structure per the Zoning Ordinance of the City of St. Joseph is as follows:

“Anything fabricated, constructed or erected, the Use of which requires fixation or placement in, on or attachment to something having location on the ground including but not limited to all Buildings, independently supported Decks, satellite dishes and free-standing Signs; excepting anything lawfully in a public Right-Of-Way including but not limited to utility poles, sewage pumping stations, utility manholes, fire hydrants, electric transformers, telephone boxes, and related public facilities and utilities defined as essential public services. A paved, uncovered parking lot is not considered a structure.”

We recommend that the following Structure types be exempt from the setback ordinance:

- Walkways that are not attached to primary structures
- Staircases of wood construction only that are not attached to primary structures
- Free-standing signs

The location of the propose setback line is based upon the long-term cycles of Lake Michigan and therefore is a fixed line, not a line defined by elevation that may move during short term changes.

The setback would help preserve the public trust property along the shoreline, maintain the natural shoreline, and reduce the risk of coastal hazards to private structures. The location of the proposed setback is based upon the following factors:

- Lake Michigan all-time high water level + 5.0 LWD
(Rounded from +4.9 LWD)
- Storm surge of two feet + 2.0'
- 2% wave runup, 50-year deep water wave + 7.0'
+ 14.0' LWD = Elevation 591.5'
- Factor of Safety
 - Factor of Safety of 1.3 applied to average offset of the calculated runup elevation from current still water level. (50') Engineering design utilizes a factor of safety ranging from 1.2 to over 4.0, depending on what is being designed, data quality/accuracy and consequences of failure. Most designs use a factor between 1.2 and 1.8.
 - Reduces the likelihood that structures will adversely affect the public trust property and the natural shoreline
 - Provides space to account for the constantly-changing shoreline

The location of the setback line should be reviewed, at minimum, every ten years or with a change in the Lake Michigan water level of four feet or more from the current water level of +0.2' LWD to ensure it is performing its intended function based on continuing experience and then current conditions.

This recommendation is based on 94 years of Lake Michigan water level data and less than fifty years of wave data. Recognizing that we do not have data extending beyond these time periods, an even more conservative approach could be considered to account for future unpredictable events such as a 500-year event, which would consider layered design waves and higher lake levels, if that data were available.

AREA 2 FINDINGS

CURRENT CONDITIONS

Area 2 is fully-developed by homes along the shoreline, with the exception of the two public parks at its ends. Under most lake levels, the entire shoreline is publicly-owned and consists of a sandy beach. Area 2 is an erosion zone, but typically receives beach nourishment from the USACE on an annual basis. Existing structures are built on shallow lots that do not allow structures to move significantly closer or further from Lake Michigan. In order to protect structures, in reasonably foreseeable coastal conditions, shore protection may be required because limited lot sizes restrict private property owners' options.



Figure 37: Area 2 typical shoreline

SHORELINE MANAGEMENT RECOMMENDATION

To provide the best protection to private property while maintaining meaningful public access along the shoreline, we recommend that future shoreline protection structures within the area bounded on the north by the St. Joseph River, on the east by Lions Park Drive, and on the south by the St. Joseph Water Plant be subject to the following requirements:

- Design must be prepared by a licensed professional engineer experienced in coastal engineering to account for coastal engineering factors including, but not limited to wave overtopping, scour protection, and flanking prevention.
- Approval must be granted by the City of St. Joseph City Engineer prior to construction
- Vertical walls are prohibited
- Perpetual public access landward of the structure must be provided to ensure continued public access along the coast regardless of lake levels.
- Structures must not adversely affect other/neighboring properties and must connect to adjacent shoreline protection structures, if present, to eventually create one unified structure

Furthermore, we recommend that any shoreline protection structures be of the same type that has been successfully constructed, such as the stone revetments at the St. Joseph Water Plant. The attached exhibit, “Typical Proposed Shoreline Protection Section” contains a typical cross section of this type of shoreline protection. This type of protection would require that private property owners be permitted to construct all or part of the structure within public property.

We recognize that there are likely a number of issues that the City must or may wish to consider before implementing this recommendation, including but not limited to issues regarding ownership, maintenance, liability, cost of the structures, as well as the appropriate mechanism or procedure for permitting the construction on public property. Such issues are beyond the scope of this study.

AREA 3 FINDINGS

CURRENT CONDITIONS

The entire shoreline of Area 3 contains existing shoreline protection structures, including stone revetments, sheet piling, groins, and timber structures. Steep bluffs containing cohesive soils line the shoreline and the structures are necessary for the protection of the bluffs against erosion.



Figure 38: Area 3 typical shoreline

SHORELINE MANAGEMENT RECOMMENDATIONS

We do not recommend additional regulation of shoreline protection within Area 3, beyond the regulation already administered by both the USACE and the MDEQ. Because Area 3 contains little to no public shoreline access and existing shoreline protection structures extend across its full shoreline, additional regulation is unnecessary.

REFERENCE LIST

1. "Annual Report/ Contract Dredging Report, Detroit District." *St. Joseph Harbor*. USACE, 13 Dec. 2011. Web.
2. *High Risk Erosion Areas & Critical Dune Areas*. Digital image. *Great Lakes Shorelands Unit*. MDEQ, 3 Oct. 2007. Web.
3. Naim, Robert B., Peter Zuzek, and Andrew Morang. *Effectiveness of Beach Nourishment on Cohesive Shores, St. Joseph, Lake Michigan*. Rep. No. CHL-97-15. 1997. Print.
4. USA. Army Corps of Engineers. Detroit District. *Ordinary High Water Mark and Low Water Datum*. Great Lakes Information, 7 Oct. 2005. Web.
5. USA. Army Corps of Engineers. Coastal & Hydraulics Laboratory. *Wave Information Studies*. Web. June 2012.
6. USA. Army Corps of Engineers. Detroit District. *Great Lakes Water Levels*. USACE, 23 Mar. 2012. Web.
7. USA. Army Corps of Engineers. Engineering and Design. *Coastal Engineering Manual*. Vol. No. 1110-2-1100. 2002. Print.
8. USA. MDEQ. Land & Water Management Division. *Guidance Document 325-06-02*. 2006. Print.
9. USA. Wisconsin Department of Natural Resources. Wisconsin's Shoreline Protection Program. *Administrative Code*. Vol. NR 115. 2012. Print.

Appendices

APPENDIX I

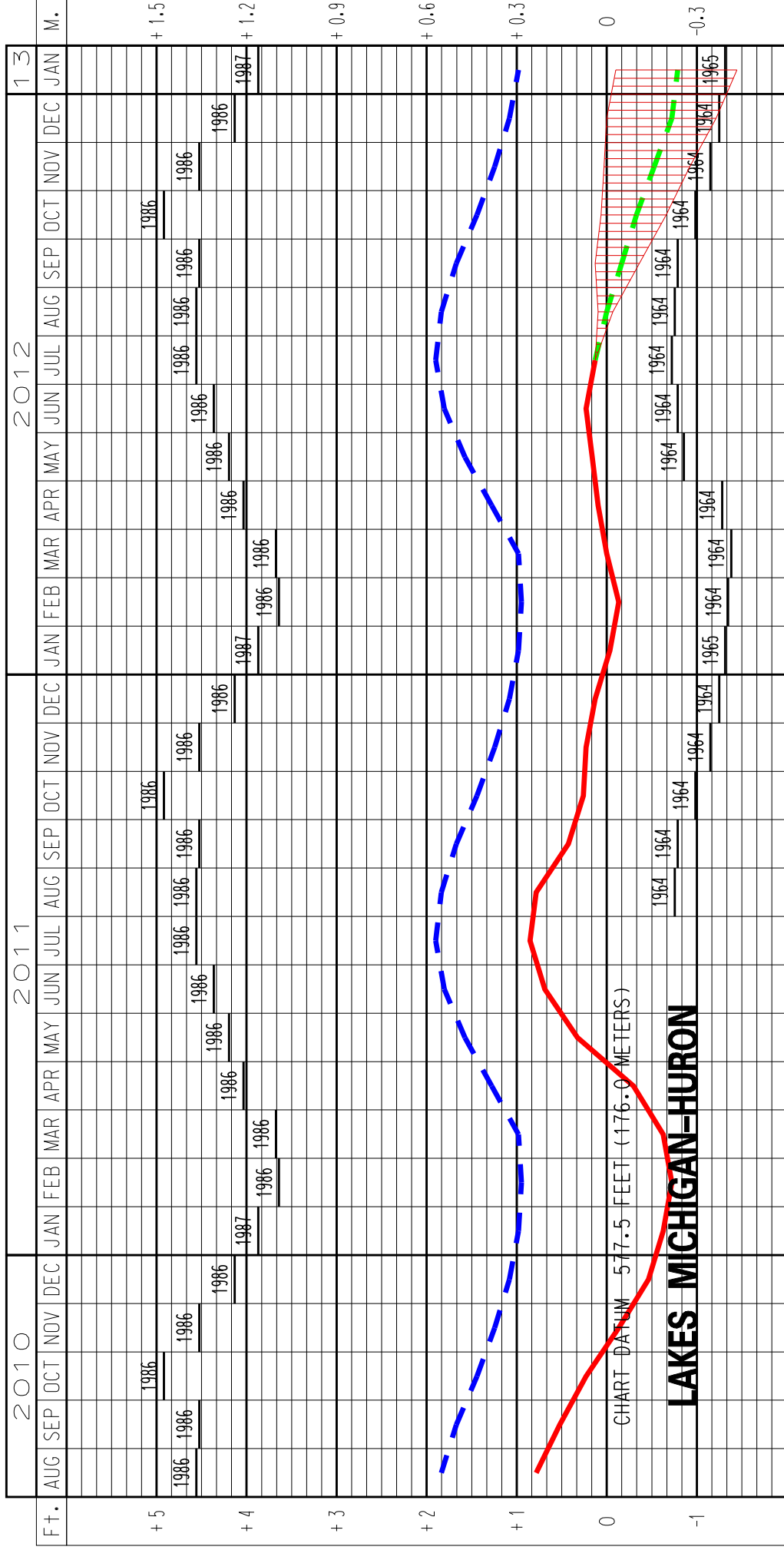
St. Joseph Coastal Study Datum Conversion Chart				
	IGLD 55	IGLD 85	NAVD 88	NGVD 29
Lake Michigan Base Flood Elevation, north of SJ River (<i>Berrien County FIS No. 26021CV000A, effective April 17, 2006</i>)	-	583.8	584.3	584.8
Lake Michigan Base Flood Elevation, south of SJ River (<i>Berrien County FIS No. 26021CV000A, effective April 17, 2006</i>)	-	584.0	584.5	585.0
Michigan Statutory OHWM for Lake Michigan (GLSLA Section 324.32502)	579.8	580.5	581.0	581.5
USACE OHWM for Lake Michigan	-	581.5	582.0	582.5
USACE Lake Michigan Low Water Datum	-	577.5	578.0	578.5
"All Time" record high water elevation (since 1918)	-	582.4	582.9	583.4
Study, Calculated elevation for Area I setback	-	591.5	592.0	592.5

Notes:

- 1.) Bold elevations indicate original/published elevation/datum.
- 2.) All elevations shown in feet.

APPENDIX 2

LAKES MICHIGAN-HURON WATER LEVELS - AUGUST 2012



LEGEND

LAKE LEVELS

RECORDED

PROJECTED

AVERAGE **

MAXIMUM **

MINIMUM **

** Average, Maximum and Minimum for period 1918-2011

APPENDIX 3



ANNUAL REPORT/CONTRACT DREDGING REPORT, DETROIT DISTRICT, OPERATIONS OFFICE

Tuesday, December 13, 2011

8:22:12 AM

FY	START	COMPLETION	CUBIC YARDS	COST	CPY	CONTRACTOR	CONTRACT NUMBER	PLACEMENT/DREDGE AREA
ST JOSEPH HARBOR, MI								
1963			19,325	\$27,917	\$1.44	GOVT/TOMPKINS		
1963			81,412	\$33,066	\$0.41	GOVT/HAINS		
1964			71,078	\$48,100	\$0.68	GOVT/HAINS		
1965			34,500	\$50,458	\$1.46	GOVT/TOMPKINS		
1965			51,149	\$22,543	\$0.44	GOVT/HOFFMAN		
1965			79,643	\$35,101	\$0.44	GOVT/HAINS		
1966			13,800	\$19,441	\$1.41	GOVT/TOMPKINS		
1966	4/21/1966	5/19/1966	75,917	\$51,546	\$0.68	GOVT/HAINS		
1967	4/27/1967	5/11/1967	99,244	\$48,639	\$0.49	GOVT/HAINS		
1967			16,450	\$20,319	\$1.24	GOVT/TOMPKINS		
1968	5/13/1968	5/22/1968	48,186	\$26,681	\$0.55	GOVT/HAINS		
1969	5/7/1969	5/20/1969	73,316	\$46,791	\$0.64	GOVT/HAINS		
1969	4/21/1969	5/8/1969	20,350	\$23,427	\$1.15	GOVT/TOMPKINS		
1970	12/13/1969	12/17/1969	46,483	\$37,539	\$0.81	GOVT/HAINS		
1971	5/23/1971	6/1/1971	33,225	\$24,557	\$0.74	GOVT/HAINS		
1972	5/17/1972	5/27/1972	52,292	\$46,611	\$0.89	GOVT/HAINS		
1973	3/28/1973	4/11/1973	47,828	\$59,222	\$1.24	GOVT/HAINS		
1974	5/4/1974	5/15/1974	65,428	\$54,040	\$0.83	GOVT/HAINS		
1975	5/9/1975	5/20/1975	69,638	\$89,754	\$1.29	GOVT/HAINS		OPEN WATER (15,260) BEACH OVER S PIER (54,026) 1.5 MI SOUTH AT 20'CNTR (352)
1976	5/27/1976	6/30/1976	94,185	\$86,477	\$0.92	GOVT/HAINS		BEACH (SILVER BEACH) (87,810) AND 500' SOUTH AT 18'CNTR (6,375)
1977	4/19/1977	5/29/1977	181,097	\$130,675	\$0.72	GOVT/HAINS		OPEN WATER (19,101) BEACH (SILVER BEACH) (160,236) .5 MI SOUTH AT 18'CNTR (1,760)
1978	5/8/1978	6/15/1978	118,658	\$345,055	\$2.91	GOVT/HAINS		BEACH (SILVER BEACH) (84,565) 7 MI SOUTH AT 18'CNTR (4,928) WHIRLPOOL CDF (38,735)
1979	5/12/1979	6/26/1979	147,512	\$365,958	\$2.48	GOVT/HAINS		BEACH (SILVER BEACH) (108,233) WHIRLPOOL CDF (39,279)
1980	4/28/1980	6/1/1980	92,348	\$387,338	\$4.19	GOVT/HAINS		BEACH (SILVER BEACH) (91,905) WHIRLPOOL CDF(24,359)
1981	6/9/1981	6/23/1981	64,110	\$262,083	\$4.09	GOVT/HAINS		OPEN WATER (3,975) BEACH 150-1200' SOUTH (65,767) WHIRLPOOL CDF (21,094)
1982	5/28/1982	7/3/1982	152,981	\$73,501	\$0.48	GOVT/HAINS		OPEN WATER (18,136) BEACH 1000-3000'S OF S PIER (116,895) WHIRLPOOL CDF (17,900)
1983	5/22/1983	6/30/1983	140,040	\$218,469	\$1.56	GOVT/HAINS		BEACH 1000-3000' S OF S PIER
1984	8/21/1984	8/27/1984	17,010	\$89,306	\$5.25	LUEDTKE	DACW35-84-C-0014	WHIRLPOOL CDF 30+00E - 40+00E



ANNUAL REPORT/CONTRACT DREDGING REPORT, DETROIT DISTRICT, OPERATIONS OFFICE

FY	START	COMPLETION	CUBIC YARDS	COST	CPY	CONTRACTOR	CONTRACT NUMBER	PLACEMENT/DREDGE AREA
ST JOSEPH HARBOR, MI								
1984	8/4/1984	9/14/1984	68,533	\$246,719	\$3.60	LUEDTKE	DACW35-84-C-0014	BEACH SOUTH CL OF PARK STREET EXTENDED THENCE 3400'S 8'CNTR-OHWM OUTER FLARE AREA
1985	7/17/1985	8/5/1985	37,701	\$209,405	\$5.55	HARBOR MARINE	DACW35-85-C-0006	BEACH SOUTH CL OF PARK STREET EXTENDED THENCE 3400'S OUTER CONTOUR - 2+00E
1985	8/17/1985	8/26/1985	15,446	\$92,796	\$6.01	HARBOR MARINE	DACW35-85-C-0031	WHIRLPOOL CDF 52+00 - 43+00 AND 38+00 - 32+00
1986	7/24/1986	8/15/1986	14,564	\$195,001	\$13.39	KING	DACW35-86-C-0028	WHIRLPOOL CDF 35+00N - 38+00N 28+00N - 17+00N
1986	6/16/1986	8/14/1986	14,533	\$101,004	\$6.95	KING	DACW35-86-C-0013	BEACH SOUTH CL OF PARK STREET EXTENDED THENCE 3400'S 4'CNTR-OHWM 25+00W - 0+00
1987	6/27/1987	7/11/1987	24,227	\$131,910	\$5.44	KING	DACW35-87-C-0025	WHIRLPOOL CDF 30+00E - 52+00E INCL TB 52+00 - 44+00 OUTER
1987	6/26/1987	7/11/1987	3,320	\$36,636	\$11.03	KING	DACW35-87-C-0025	UPLAND - SHORELINE SOUTH OF HARBOR AT LECO CORP 52+00 - 44+00
1988	5/31/1988	7/28/1988	43,725	\$291,446	\$6.67	KING	DACW35-88-C-0016	BEACH SOUTH CL OF PARK STREET EXTENDED THENCE 3100'S 8'CNTR-OHWM 27+84W-16+50W
1989	5/24/1989	6/22/1989	18,745	\$147,725	\$7.88	LUEDTKE	DACW35-89-C-0021	BEACH SOUTH CL OF PARK STREET EXTENDED THENCE 2700'S 8'CNTR-OHWM 0+00-27+00W
1990	5/22/1990	6/22/1990	58,314	\$317,067	\$5.44	KING	DACW35-90-C-0009	BEACH SOUTH CL OF PARK STREET EXTENDED THENCE 2700'S 7'CNTR-OHWM CRITICAL SHOALS 0+00 - 28+00W
1991	5/3/1991	5/22/1991	10,225	\$35,519	\$3.47	KING	DACW35-91-C-0010	WHIRLPOOL CDF 31+00-43+00 AREA NEAR TURNING BASIN
1991	5/3/1991	5/22/1991	52,513	\$278,160	\$5.32	KING	DACW35-91-C-0010	BEACH CL OF PARK STREET EXTENDED THENCE 2700'S 7'CNTR-OHWM 0+00 - 28+00W 3' ALLOWABLE OVERDEPTH
1992	5/22/1992	6/9/1992	33,644	\$123,324	\$3.67	ANDRIE	DACW35-92-C-0018	BEACH CENTERLINE OF PARK STREET EXTENDED THENCE 2700' SOUTHWARD 7'CNTR-OHWM 28+00W-32+00W
1992	6/23/1992	6/30/1992	24,182	\$293,097	\$12.12	KING	DACW35-92-C-0021	WHIRLPOOL CDF 16+66-52+00
1993	6/18/1993	6/30/1993	2,360	\$13,185	\$5.59	MCM MARINE	DACW35-93-C-0017	BEACH 50' SOUTH OF THE CENTERLINE OF PARK STREET EXTENDED THENCE 2700' SOUTHWARD 7'CNTR-OHWM 0+00-32+00W
1994	6/3/1994	7/8/1994	31,469	\$439,744	\$13.97	KING	DACW35-94-C-0023	BEACH AT SHOREHAM COMMENCING AT OHWM- 8'CNTR 0+00-28+00W
1995	5/3/1995	5/10/1995	33,335	\$185,008	\$5.55	KING	DACW35-95-C-0010	BEACH 50'-2550'S OF PARK STREET 8'CNTR-OHWM 0+00-32+00W
1996	6/10/1996	6/28/1996	24,918	\$199,738	\$8.02	TNT	DACW35-96-C-0008	BEACH 50'-3050'S OF CL OF PARK STREET 4'CNTR- OHWM 0+00-32+00
1997	5/14/1997	6/6/1997	35,042	\$158,877	\$4.53	KING	DACW35-97-C-0004	BEACH 50'-1550'S OF PARK STREET 4'CNTR-OHWM 12+50W-30+00W 24' + 1' OD
1997	5/27/1997	6/17/1997	30,696	\$373,870	\$12.18	MCM MARINE	DACW35-97-C-0002	WHIRLPOOL CDF 17+00-54+50
1998	4/30/1998	5/7/1998	24,285	\$147,154	\$6.06	MCM MARINE	DACW35-98-C-0003	BEACH 500'-3300'S OF PARK STREET 4'CNTR-OHWM 31+00W-20+00W 23'+1'OD & 6+00W-2+00W 21'+1'OD
1999	4/27/1999	5/7/1999	22,482	\$171,376	\$7.62	MCM MARINE	DACW35-99-C-0005	BEACH 500'-3200'S OF CL OF PARK STREET 4'CNTR- OHWM 0+00-32+00
1999	6/28/1999	7/11/1999	23,189	\$157,413	\$6.79	MCM MARINE	DACW35-99-C-0005	WHIRLPOOL CDF CRITICAL SHOALS



ANNUAL REPORT/CONTRACT DREDGING REPORT, DETROIT DISTRICT, OPERATIONS OFFICE

FY	START	COMPLETION	CUBIC YARDS	COST	CPY	CONTRACTOR	CONTRACT NUMBER	PLACEMENT/DREDGE AREA
ST JOSEPH HARBOR, MI								
2000	4/28/2000	5/5/2000	39,472	\$258,931	\$6.56	MCM MARINE	DACW35-99-C-0005	BEACH 100'-2800'S OF PARK STREET OHWM TO SHORELINE WHEN POSSIBLE 32+00-0+00
2001	6/8/2001	6/20/2001	36,897	\$262,709	\$7.12	MCM MARINE	DACW35-99-C-0005	BEACH
2001	8/5/2001	8/15/2001	29,498	\$168,614	\$5.72	MCM MARINE	DACW35-99-C-0005	WHIRLPOOL CDF
2002	6/15/2002	6/24/2002	27,117	\$193,587	\$7.14	MCM MARINE	DACW35-02-C-0007	BEACH 1200'-1300'S OF PARK STREET CENTERLINE 4'CNTR-OHWM 16+00E-20+00N
2003	5/28/2003	6/2/2003	10,440	\$126,885	\$12.15	MCM MARINE	DACW35-02-C-0007	BEACH CRITICAL SHOALS
2004	6/28/2004	7/13/2004	35,774	\$286,336	\$8.00	MCM MARINE	DACW35-02-C-0007	BEACH CRITICAL SHOALS
2005	4/13/2005	5/9/2005	48,089	\$325,445	\$6.77	KING	W911XK-04-D-0002	BEACH 1200'-2500'S OF PARK STREET 0+00-32+00W
2005	9/18/2005	10/3/2005	14,322	\$333,776	\$23.31	LUEDTKE	W911XK-04-D-0004	CONFINED SOUTHWEST REGIONAL AIRPORT 31+00-43+00 DREDGING TO 20+1FT OVERDEPTH
2006	4/14/2006	4/30/2006	24,612	\$510,100	\$20.73	LUEDTKE	W911XK-06-D-0002	UPLAND AT SOUTHWEST REGIONAL AIRPORT 39+89-51+92
2006	4/10/2006	4/22/2006	52,120	\$278,188	\$5.34	KING	W911XK-06-D-0001	BEACH 1200'-2500' S OF PARK STREET ALONG EXISTING SHORELINE 32+00W-0+00
2007	3/29/2007	4/30/2007	35,565	\$257,850	\$7.25	KING	W911XK-06-D-0001	BEACH 50'-1350'S OF PARK STREET 32+00w-0+00
2008	5/30/2008	10/17/2008	113,190	\$1,974,614	\$17.45	GREAT LAKES DOCK	W911XK-08-C-0012	UPLAND AT SOUTHWEST MICHIGAN REGIONAL AIRPORT AND HARBOR SHORES DEVELOPMENT 9+00-51+00 TO 22' +1' AND 51+00-53+00 TO 18' +1'
2009	4/16/2009	5/8/2009	120,093	\$1,081,609	\$9.01	KING	W911XK-08-D-0001	BEACH 50'-1350' S OF PARK STREET 4'CNTR-EXISTING SHORELINE 0+00-32+00W
2010	3/26/2010	5/7/2010	59,478	\$0	\$0.00	MORRISH-WALLACE	W911XK-09-D-0010	BEACH CRITICAL SHOALS
2010	5/10/2010	5/22/2010	64,433	\$0	\$0.00	KING	W911XK-09-D-0003	BEACH 50'-1,350' SOUTH OF PARK ST CL 4'CNTR-EXIST SHORELINE 32+00W-16+00W
2011	7/14/2011	7/30/2011	0	\$0	\$0.00	MCM MARINE	W911XK-09-D-0011	BEACH CRITICAL SHOALS
TOTAL			3,365,753	\$13,129,432				

APPENDIX 4

**CITY OF ST. JOSEPH
BERRIEN COUNTY, MICHIGAN
ORDINANCE NO. 39-1-2
SPECIAL ORDINANCE**

THE CITY OF ST. JOSEPH ORDAINS:

Chapter 39 of the Code of Ordinances of the City of St. Joseph, Michigan is hereby amended by amending Special Ordinance No. 39-1-2 to read as follows:

AN ORDINANCE TO IMPOSE A TEMPORARY MORATORIUM ON ANY SHORE PROTECTION STRUCTURES, SEAWALLS OR SIMILAR IMPROVEMENTS FOR CERTAIN PARCELS ABUTTING LAKE MICHIGAN.

Sec. 1. Intent and Purpose.

Consistent with its adopted Comprehensive Master Plan, the City desires to preserve and encourage open space along Lake Michigan and to maintain the integrity and character of the Lake Michigan shoreline. The City recognizes that the beach areas adjacent to the Ridgeway neighborhood and the south end of Lions Park Drive have distinctive characteristics and locations within the City, each with a large, open beach area along Lake Michigan and each located between and connects two public parks upon which the public has a right to unimpeded pedestrian use of as part of the public trust. The south end of the Lions Park Drive area also contains some public land located between the shore of Lake Michigan and private properties.

The City intends to conduct a review of various City regulations to further the maintenance and encouragement of open space, preservation of private property, and preservation of public trust areas along Lake Michigan in the above described neighborhoods. That review will include an analysis of the placement of, shore protection structures, seawalls, or other like improvements in this area and may include a request that the City Planning Commission also review this issue and make recommendations regarding possible zoning or other regulations.

The City Commission finds that there is a need to enact a temporary moratorium and that it is necessary for the preservation of the public safety and private property. Failure to enact this Ordinance while the City Commission and/or the Planning Commission actively reviews this matter will likely result in irreparable harm to the welfare of City residents and their properties given the domino-like impact that will occur if improvements adversely change erosion, etc. on the beach, the likely adverse impacts upon neighboring properties and the rights of the public to use the public portions of the beach due to the placement of, shore protection structures, seawalls, or similar fixed improvements along this area, and the fact that once such improvements are made and the public beach areas are impacted, such effects cannot be undone.

Sec. 2. Moratorium.

1. A moratorium is hereby adopted until July 30, 2012, prohibiting the construction, erection or expansion of all shore protection structures, seawalls, and similar fixed improvements on parcels of property located within the following boundaries: (1) all properties located on the west side of the street known as Ridgeway within the area bounded on the south by the St. Joseph River and on the north by the northerly boundary of the City of St. Joseph and (2) those properties that are located on the west side of Lions Park Drive within the area bounded on the north by Silver Beach County Park, on the north by Park Street, and on the south by Lions Park.. This moratorium includes, without limitation, all shore protection structures, seawalls, retaining walls, break walls, groins and jetties along or parallel to the shore of Lake Michigan within the above-described area.
2. In addition, a moratorium is hereby adopted until July 30, 2012, prohibiting the construction, erection or expansion of any Structure as defined by the Zoning Ordinance of the City of St. Joseph, within two hundred feet landward of the Ordinary High Water Mark for all parcels of property located on the west side of the street known as Ridgeway within the area bounded on the south by the St. Joseph River and on the north by the northerly boundary of the City of St. Joseph. Pursuant to the Natural

Resources and Environmental Protection Act, Public Act 451 of 1994, Part 325, as amended, the Ordinary High Water Mark for Lake Michigan is 580.5 feet above sea level, International Great Lakes Datum of 1985.

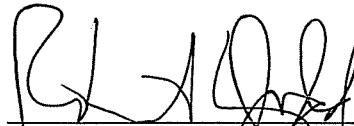
3. These moratoria may be extended by resolution of the City Commission for a period up to six (6) additional months if the City Commission determines it necessary to protect and promote the public health, safety and welfare.

Sec. 3. Effective Date.

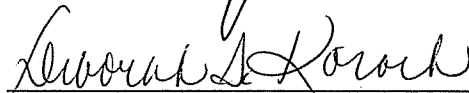
This Ordinance shall be effective 10 days from the date of its final passage.

CERTIFICATION

The Mayor and Clerk of the City of St. Joseph, Berrien County, certify that this ordinance was passed by the St. Joseph City Commission on March 26, 2012, and that notice of its adoption or a copy of the ordinance was published in *The Herald-Palladium* newspaper on April 1, 2012.



ROBERT L. JUDD, Mayor



DEBORAH S. KOROCH, Clerk

APPENDIX 5

**CITY OF ST. JOSEPH
BERRIEN COUNTY, MICHIGAN**

**AN ORDINANCE TO AMEND THE ZONING ORDINANCE OF
THE CITY OF ST. JOSEPH, MICHIGAN**

THE CITY OF ST. JOSEPH ORDAINS:

The Zoning Ordinance of the City of St. Joseph, Michigan, is hereby amended by adding the following Section 9.7 to Article IX of the Ordinance:

“SECTION 9.7 “EB-OD” EDGEWATER BEACH OVERLAY DISTRICT

9.7.1 Intent. The Edgewater Beach Overlay District (EB-OD) is an overlay District intended to preserve the character of the public trust land along the shore of Lake Michigan, which is found to be a valuable public resource of the community, to prevent damage to the public trust land and to prevent damage to private property.

Based on the record presented the City finds that during periods of low Lake Michigan water levels, sand accretion in this District tends to significantly enlarge the beach and to enlarge affected parcels in this District. This additional land area can be seen by property owners as permanent and attractive for development. The character of the public trust land along the Lake Michigan shoreline, as well as viewsheds along the shoreline from public parks included in and adjacent to this District, is compromised by development in immediate proximity to the public trust land.

Based on the record presented the City further finds that the beach and property area near the shoreline is subject to submergence and erosion during periods of higher Lake Michigan water levels and resulting from weather conditions. It has been demonstrated that current state and federal development standards for the Lake Michigan shoreline, such as the Ordinary High Water Mark (OHWM) and the Base Flood Elevation, do not ensure that property shoreward of those locations is protected from erosion, inundation, or damage during such periods of time and/or weather events. The OHWM is not intended to reflect these periods of peril, and the Base Flood Elevation is a still water elevation that does not take into account the effect of wave action. The City further understands that revised federal floodplain regulations are being developed to take into account additional environmental factors such as waves and to provide an improved standard of floodplain development protection, but implementation of these regulations will not likely occur for several years.

When erosion threatens a Structure legally built near the shoreline, a natural reaction for the owner is to attempt to construct a seawall or other shore protection structure. Shore protection structures in this District would diminish significantly the character of the public trust land and pose an increased threat of erosion and damage to the public trust land as well as to adjacent private property.

The City has long experience with the detrimental effects of seawalls and shore protection structures constructed over a period of many years in response to erosion south of the St. Joseph River. These shore protection structures were and are necessary to protect previously developed areas of the City which are otherwise subject to regular and ongoing erosion. However, given the physical, environmental, and developmental characteristics of the EB-OD, including generally large lots which need not be developed near to the water's edge to be economically viable and that the area is generally benefitting from accretion rather than persistent erosion, the City believes that shore protection structures should not be necessary in this area and that would be detrimental to the public health, safety and welfare for reasons further identified and set forth in the City of St. Joseph, Michigan Coastal Engineering Study, dated August 17, 2012, a copy of which is on file with the City.

The City believes the most appropriate, effective and reasonable method to further the public interests of protecting natural resources; preserving the economic and environmental well-being of the community; to protect the health, safety and general welfare of the community; and the general preservation or enhancement of property values is to restrict the construction of structures so near to the water's edge as to be detrimental to the character of the public trust property and/or the vistas from neighboring public parks; and/or to be susceptible to damage resulting from inundation or erosion or to create an apparent future need for seawalls or other shore protection structures in order to protect these structures from damage resulting from inundation or erosion; and/or to be potentially built in a location that will render the structure nonconforming under the future federal floodplain protection regulations currently under development.

These regulations are intended to preserve the character of the public trust property along the shoreline, protect the vistas from neighboring public parks, and prevent the construction of structures and shore protection structures which would have deleterious effects on the public trust property as well as neighboring private property.

These regulations are also supported by the Comprehensive Plan, as the Future Land Use Map indicates lakefront property in this area should be used as open space and the supporting text indicates that open space areas should be maintained and encouraged along the shoreline.

9.7.2 Description of District. The EB-OD includes all lands in any zoning District located north of the St. Joseph River and situated lakeward of a line sequentially connecting the following points described by Michigan State Plane Grid Coordinates, South Zone, Grid, NAD 83, U.S. Survey Feet and as illustrated in Map 9-3, Area of Edgewater Beach Overlay District:

Point	Northing	Easting
A	231408.65'	12547511.47'
B	231835.41'	12547625.92'
C	232647.21'	12548673.22'
D	232952.85'	12549032.86'
E	233537.35'	12549657.47'
F	233846.96'	12549969.52'
G	234468.24'	12550591.09'
H	234820.85'	12550921.86'

9.7.3 Structure Development. For the reasons set forth in Subsection 9.7.1 and elsewhere in this Ordinance, the installation, construction and operation of Structures, which for the purpose of this section includes seawalls and shore protection structures, within the EB-OD shall be subject to the following:

- A. No Structure shall be installed or constructed in the EB-OD. The following are not considered a Structure for purposes of this section only:
 - 1. Public recreational equipment in public parks;
 - 2. Open, unroofed walkways, including those constructed of pavers or similar objects;
 - 3. Stairs and similar open, unroofed structures that are set on the surface of the ground and which are not attached to a Structure; and
 - 4. Freestanding signs.
- B. In the event the provisions of the EB-OD prevents the development or use of a Lot existing on the effective date of this amendment for the purposes permitted in the Zoning District, or creates practical difficulties or unnecessary hardship for the use of such a Lot, the property owner may seek a Hardship Planned Unit Development or Variance under the terms of this Ordinance.
- C. If any Lot within or partially within the EB-OD is divided or the subject of a boundary adjustment after the effective date of this amendment such that any resulting parcel is nonbuildable due to the regulations of this section, except for a boundary adjustment that has the effect of lessening a Nonconformity with respect to this section, it will be deemed a voluntary action of the property owner and will disqualify the resulting nonbuildable parcel from receiving a Variance or Hardship Planned Unit Development.
- D. In the event the provisions of the EB-OD render Nonconforming any Structure which is existing or which is the subject of a valid building permit and under construction on the effective date of this amendment, this shall not be deemed a voluntary action of the property owner and will not disqualify the parcel from receiving a Variance or Hardship Planned Unit Development under the procedures described in this Ordinance.
- E. To the extent of any conflict between the regulatory provisions contained in this section and other provisions of the Zoning Ordinance, the restrictions contained in this section shall control.

This ordinance shall take effect 10 days after its final passage.

The Mayor and Clerk of the City of St. Joseph, Berrien County, certify that this ordinance was passed by the St. Joseph City Commission on _____, 2012, and that notice of its adoption or a copy of the ordinance was published in *The Herald-Palladium* newspaper on _____, 2012.

ROBERT L. JUDD, Mayor

DEBORAH S. KOROCH, Clerk

APPENDIX 6

August 19, 2012

Robert L. Judd, Mayor
City Commission
City of St. Joseph
City Hall
700 Broad Street
St. Joseph, MI 49085

Re: Coastal Study Review and Implementation

Dear Mayor Judd and Members of the City Commission:

The City of St. Joseph ("City") has asked for our opinion concerning the legality of adopting and enforcing potential new ordinances regulating designated areas of the Lake Michigan shoreline, specifically with regard to setbacks and the construction of shoreline protection structures.

In preparing this opinion, we have reviewed the report and recommendations for shoreline management prepared by the City's consultants. It is our understanding after reviewing the "St. Joseph Coastal Study" ("Report") that the City's consultants are recommending separating the Lake Michigan shorefront into three distinct areas based on identifying characteristics: Area 1 (Jean Klock Park to North Pier), Area 2 (South Pier to the St. Joseph Water Plant), and Area 3 (St. Joseph Water Plant South to City Limits). The consultants have recommended the following:

- Area 1: An ordinance (proposed by the City to be a zoning ordinance amendment) prohibiting all structures, including shoreline protection structures (i.e., seawalls or similar structures), within a fixed setback of 130' to 180' (depending on location) landward of the statutory ordinary high water mark.
- Area 2: An ordinance establishing the location where shoreline protection structures may be constructed, and setting forth certain design standards (e.g., stone revetment) for such structures.
- Area 3: No ordinances are proposed for this area because no further regulation is recommended.

In the course of its review of these recommendations, an assertion was made to the City that such regulations would constitute a "taking" of private property by, presumably, unduly restricting the ability of a property owner to develop or protect his or her property. The remainder of this letter addresses this and similar issues.

Initially, it must be noted that as of the date of this letter, the only proposed ordinance language that we have reviewed is a draft ordinance amending the City's Zoning Ordinance to add Section 9.7, entitled "EB-OD" Edgewater Beach Overlay District. We previously provided our comments and revisions regarding the proposed ordinance language to the City, and our opinion, as expressed in this letter, is based in part on the proposed language. Our opinion is subject to change depending upon the language that is actually proposed or adopted by the City (whether it be a zoning ordinance, regulatory ordinance or both), or if the facts conveyed to us are later discovered to be incomplete or incorrect.

I. PRELIMINARY ISSUES

A. General Authority to Adopt Local Ordinances

As a home rule city, the City has broad powers under the Michigan Constitution to enact ordinances for the benefit of municipal concerns. Const. 1963, art. 7, §§ 22. The Home Rule City Act ("HRCA"), MCL 117.1 *et seq.*, further defines the authority of cities to enact and enforce local ordinances. Laws (such as the HRCA) that concern local governments "shall be liberally construed in their favor." Const. 1963, art. 7, §§ 34.

"Among the powers that may properly be exercised by a home rule city is the police power." *Belle Isle Grill Corp v Detroit*, 256 Mich App 463, 481; 666 NW2d 271 (2003); see also MCL 117.3(j) (requiring city charters to include provisions for the "public peace and health and for the safety of persons and property"). It is clear that the City has the authority to enact ordinances for the public health, safety, and welfare of its citizens.

Zoning regulations constitute a valid exercise of governmental authority when they have a rational relation to the public health, safety, welfare and prosperity of the community. *Comer v City of Dearborn*, 342 Mich 471, 477; 70 NW2d 813 (1955); see also MCL 125.3201 (authorizing a local unit of government to adopt zoning ordinances regulating the use of land and structures "to promote public health, safety, and welfare"). The Michigan Zoning Enabling Act, being MCL 125.3201 *et seq.*, ("MZEA") specifically allows a local unit of government to regulate land development "to achieve specific land management objectives and avert or solve specific land use problems, **including the regulation of land development and the establishment of districts in areas subject to damage from flooding or beach erosion.**" MCL 125.3201(3) (emphasis added).

Michigan courts further recognize that local governments are generally permitted to regulate water or riparian rights (such as the right to erect docks and moor boats) as part of their zoning power. *Twp of Yankee Springs v Fox*, 264 Mich App 604, 606; 692 NW2d 728 (2005). In fact, the Michigan Supreme Court has recognized that in order to accomplish the goals of zoning, riparian rights cannot be excluded:

In a state such as Michigan, with its abundant bodies of water, there would be no way to ensure that land uses are compatible with surrounding properties unless water activities are evaluated. Similarly, the conservation of natural resources, which clearly includes water, cannot be undertaken if there is no means for

regulating riparian rights. [*Hess v W Bloomfield Twp*, 439 Mich 550, 563; 486 NW2d 628 (1992).]

The Court has recognized that by granting the authority to municipalities to promote the public health, safety, and general welfare through enactment of zoning ordinances, the Legislature was complying with a “*constitutional mandate* to protect the environment, including bodies of water, from impairment or destruction.” *Id.* at 564 (emphasis added).¹

Thus, in our opinion, the City has the authority to adopt local ordinances—both police power and zoning ordinances—that promote public health, safety, and welfare, even if the ordinances impact riparian rights or other property rights of lakeshore owners.

As indicated, we have reviewed a proposed Zoning Ordinance amendment that would be applicable to Area 1. We understand that the City may be considering a stand-alone police power ordinance that would be applicable to Area 2; however, we cannot express an opinion at this time regarding whether the proposed regulations for Area 2 are more properly considered zoning or police power ordinances,² as we have not reviewed any proposed language. (“The question whether or not a particular ordinance is a zoning ordinance may be determined by a consideration of the substance of its provisions and terms, and its relation to the general plan of zoning in the city.” *Square Lake Hills Condo Ass’n v Bloomfield Twp*, 437 Mich 310, 233; 471 NW2d 321 [1991].)

B. Ordinary High Water Mark

Because the Report’s recommendations implicate the statutory ordinary high water mark (“OHWM”), a brief discussion of the OHWM is relevant.

The OHWM constitutes the limit of the Department of Environmental Quality’s (“DEQ’s”) jurisdiction under Part 325 of the Natural Resources Environmental Protection Act (“NREPA”), MCL 324.32501 *et seq.*³ Thus, the DEQ has jurisdiction to require permits under Part 325 concerning lands “lying below and lakeward of the natural ordinary high-water mark....” MCL 324.32502.

In the recent case of *Burleson v Dep’t of Environmental Quality*, 292 Mich App 544, 549; 808 NW2d 792 (2011), the Michigan Court of Appeals affirmed that the scope of the DEQ’s regulatory authority under Part 325 is set by the statutorily-defined elevations. For example, the

¹ Article 4, §52 of the Michigan Constitution states:

The conservation and development of the natural resources of the state are hereby declared to be of paramount public concern in the interest of the health, safety and general welfare of the people. The legislature shall provide for the protection of the air, water and other natural resources of the state from pollution, impairment and destruction.

² Zoning ordinances are generally recognized as such if they regulate the use of land and buildings according to districts, areas, or locations. In contrast, an ordinance that regulates an “activity” is generally considered a police power ordinance. *Square Lake Hills Condo Ass’n v Bloomfield Twp*, 437 Mich 310, 323-25; 471 NW2d 321 (1991).

³ Part 325 of NREPA is sometimes referred to as the Great Lakes Submerged Lands Act, or GLSLA. It regulates the use of land below or lakeward of the statutorily-defined ordinary high water mark.

OHWL for Lake Michigan is statutorily set at 579.8 feet of elevation above sea level. MCL 324.32502. Thus, for example, when the water recedes below the OHWM, the riparian owner may not generally place any permanent structures or do any dredging or filling on that land without a permit from the DEQ. Part 325; OAG, 1977-1978, No. 5327.

The OHWM should not be confused with the common law natural ordinary high water mark (“NOHWM”) discussed in *Glass v Goeckel*, 473 Mich 667, 683; 703 NW2d 58, 67 (2005). In *Glass*, the Court held that the boundaries of the public trust are not limited by the statutory elevations in MCL 324.32502. Instead, the public trust (which permits, for example, pedestrians to walk along the Great Lakes) extends to the common law NOHWM, which the Court defined as where “the presence and action of the water is so continuous as to leave a distinct mark either by erosion, destruction of terrestrial vegetation, or other easily recognized characteristic.” *Id.* at 674.⁴ The NOHWM would generally need to be determined on a property-by-property basis.

Because the statutorily-defined OHWM differs from the common law NOHWM, the City should use caution in incorporating one or both terms into its ordinances so that the City’s intent is clear from the chosen language. In addition, the OHWM used in the Coastal Engineering Study (“Study”) is 580.5 feet, which is different from the statutory OHWM of 579.8 feet in MCL 324.32502.⁵ Thus, for clarity’s sake, we recommend that any references to an OHWM in the ordinance(s) be clearly defined. Further, to the extent the City chooses to reference a NOHWM in one or more of the ordinances, the City must be aware that the NOHWM varies and that the location of the NOHWM on a particular property may be subject to debate.⁶

C. Preemption

Because the OHWM delineates the primary landward limit of the DEQ’s permit jurisdiction, it raises a question as to whether a local ordinance intended to regulate land between the OHWM and the water’s edge would be preempted (i.e., precluded) by state law. (This issue does not arise with regard to an ordinance that applies only to property landward of the OHWM.)

In Michigan, a municipality may not enact an ordinance if (a) the ordinance directly conflicts with the state statutory scheme, or (b) the state statutory scheme preempts the ordinance by occupying the field of regulation, even where there is no direct conflict between the two schemes of regulation. *Frericks v Highland Twp*, 228 Mich App 575, 585-86; 579 NW2d 441, 447 (1998). In that regard, preemption may be established “(1) where state law is expressly preemptive; (2) by examination of the legislative history; (3) by the pervasiveness of the state regulatory scheme, although this factor alone is not generally sufficient to infer preemption; or

⁴ The State of Michigan holds in trust the navigable waters of the state in behalf of its citizens, and riparian owners hold “the right to use and enjoy” their riparian property “subject to the public right of navigation....” *Hall v Alford*, 114 Mich 165, 167; 72 NW 137 (1897). “As trustee, the state must preserve and protect specific public rights below the ordinary high water mark and may permit only those private uses that do not interfere with these traditional notions of the public trust.” *Glass v Goeckel*, 473 Mich 667, 694; 703 NW2d 58 (2005).

⁵ The Study uses 580.5 feet as the OHWM based upon DEQ Guidance Document No. 325-06-02, which provides a conversion between IGLD 1955 (utilized in MCL 324.32502) and IGLD 1985 (utilized in the study).

⁶ “[I]t is abundantly clear that ‘the precise location of the ordinary high water mark at any given site on the shores of our Great Lakes remains a question of fact.’” *United States v Marion L Kincaid Trust*, 463 F Supp 2d 680, 694 (ED Mich, 2006), quoting *Glass*, *supra* at 694.

(4) where the nature of the subject matter regulated demands exclusive state regulation to achieve the uniformity necessary to serve the state's purpose or interest." *Id.* at 585-586.

We have not located any appellate court decisions addressing whether local units of government have concurrent jurisdiction involving the Great Lakes with the DEQ lakeward of the OHWM or whether local ordinances pertaining to such land are preempted. However, in our opinion, a court would likely find that such a local ordinance is not preempted as a matter of law.

Part 325 is not expressly preemptive in that nothing in the statutory scheme expressly prohibits a local unit of government from adopting or enforcing local ordinances regulating land, uses or activities that fall within the scope of the state's regulatory jurisdiction. In fact, the state administrative rules promulgated under NREPA state that the DEQ "may require such permit conditions as it deems reasonable and necessary to protect the public trust and private riparian interests, including any of the following conditions:...(e) That the project be in compliance with local zoning ordinances." R 322.1011(1)(e). In addition, the rules explicitly state that the issuance of a permit under Part 325 (i.e., for a seawall, bulkhead, or other permanent revetment structures) "does not obviate the necessity of receiving approval from the United States army corps of engineers and, where applicable, other federal, state, or local units of government." R 322.1011(4).

Furthermore, the types of regulations recommended in the Report would not be preempted as a matter of law by federal law. Under federal law, the Great Lakes are considered navigable waters. 33 CFR § 328.3(a)(3). The federal government's jurisdiction over the Great Lakes (in the absence of adjacent wetlands) "extends to the ordinary high water mark", 33 CFR § 328.4; *United States v Rands*, 389 US 121, 123 (1967). The federal regulations define the "ordinary high water mark" as:

that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas. [33 CFR § 328.3(e).]

While we believe local regulations that interfere with the federal navigational servitude may be preempted, it does not appear on the face of the Report that the regulations recommended in the Report would interfere with the construction or maintenance of federal navigational structures such as piers. Further, in our opinion, because the federal and state laws represent a coordinated effort between the state and federal government, and because the state law allows for more restrictive regulations on the local level, federal law does not *per se* preempt local regulation of the Lake Michigan shoreline.

In fact, the Coastal Engineering Manual published by the Army Corps of Engineers ("ACOE") recognizes several alternatives for shore protection, including but not limited to armoring (i.e., seawalls, protective revetments) and the "do nothing" approach. The ACOE manual states that "[n]ational plans for beach management and shore protection do not exist" and that each project must consider several factors, including but not limited to public health, safety and social well-being, community cohesion, and state, regional and *local* plans for coastal zones.

The ACOE manual recognizes that “[s]everal states have established construction setback lines to reduce damage in areas subject to coastal erosion and shoreline retreat.” Further, as stated in the manual:

Some states (North Carolina, Maine) have passed laws banning the use of armored structures (seawalls, bulkheads, revetments) and shore protection on their ocean coasts. South Carolina only bans armored structures and other coastal states are considering similar laws. Florida and California have adopted sand mitigation policies and procedures to permit seawall construction but require the annual placement of sand to compensate for that trapped behind the structure.

The ACOE manual does not suggest in any way that these types of state regulations are preempted by federal law, nor does it suggest that similar local regulations would be preempted by federal law.

Based on the above, it is our opinion that a local ordinance regulating land, use or activities between the OHWM and the water’s edge would not be preempted as a matter of law. Whether a specific ordinance would be preempted for the reason that it creates a direct conflict with state or federal law would need to be determined after a review of the proposed ordinance language.

II. CONSTITUTIONAL ISSUES

As discussed above, one issue already raised is whether the recommended regulations could withstand constitutional scrutiny. Below is our analysis of the proposed regulations under the three primary types of constitutional challenges to land-use ordinances.

At the outset, it is important to note that all ordinances are presumed to be constitutional and are construed so unless their unconstitutionality is clearly apparent. *Kenefick v City of Battle Creek*, 284 Mich App 653, 654-655; 774 NW2d 925 (2009). “The foundation for this presumption is our recognition that elected officials generally act in a constitutional manner when regulating within their particular sphere of government.” *Truckor v Erie Twp*, 283 Mich App 154, 162; 771 NW2d 1 (2009). Thus, the party challenging the ordinance has the burden of rebutting the presumption that the ordinance is constitutional. *Id.* The Michigan Court of Appeals has recognized that zoning ordinances come clothed “with every presumption of validity.” *Adams Outdoor Advertising, Inc v City of Holland*, 234 Mich App 681, 692; 600 NW2d 339 (1999).⁷

A. Substantive Due Process

Both the United States and Michigan Constitutions guarantee that no state shall deprive any person of “life, liberty or property, without due process of law.” *People v Sierb*, 456 Mich 519, 522; 581 NW2d 219 (1998). The due process provisions encompass procedural fairness, but also have a substantive component that protects individual liberty and property interests

⁷ See also *Rental Prop Owners Ass’n of Kent Co v Grand Rapids*, 455 Mich 246, 253; 566 NW2d 514 (1997) (“enforcement of ordinances related to municipal concerns is a valid exercise of municipal police powers as long as the ordinance does not conflict with the constitution or general laws”).

against certain government actions. “The underlying purpose of substantive due process is to secure the individual from the arbitrary exercise of governmental power.” *Id.* at 523.

A party arguing that an ordinance violates his or her substantive due process rights has the burden of showing that the ordinance is arbitrary and unreasonable. *Conlin v Scio Twp*, 262 Mich App 379, 390; 686 NW2d 16 (2004). This is a high burden, as the challenger must negate “every conceivable basis which might support the legislation.” *TIG Ins Co v Dep’t of Treasury*, 464 Mich 548, 558; 629 NW2d 402 (2001). Under a substantive due process analysis, an ordinance will be upheld if it is “rationally related to a legitimate government interest.” *Conlin*, *supra*, 262 Mich App at 389.⁸

The government interests advanced by the City to justify the proposed ordinances include, among others, the protection of natural resources, preservation of the public way, and protection of property. Presumably, the City would further contend that the economic and environmental well-being, health, safety and general welfare of the City is dependent upon and related to the preservation of the Lake Michigan shoreline within the City’s boundaries; that property values will generally be enhanced by the preservation of the natural features of the shoreline; and that it is obligated to prevent or help minimize the impairment or destruction of the shoreline and the adjacent bottomlands.

In our opinion, these interests are legitimate government interests and should be sufficient to justify the constitutionality of the proposed regulations, as long as the regulations are rationally related to one or more of these interests.

By way of example, in the recent case of *Grucz v City of New Baltimore*, Michigan Court of Appeals Docket No. 302860; 2012 WL 2402011 (June 26, 2012), a property owner challenged a city ordinance that prohibited fences within 30 feet of water, after the city stopped her from erecting a fence on the lake side of her waterfront property. The Court found that the ordinance was constitutional, even though it impacted the owner’s property rights.

In the *Grucz* case, the Court of Appeals reaffirmed that aesthetics and public safety are legitimate governmental interests that are sufficient to justify the constitutionality of a zoning ordinance. *Id.*, slip op at 3, citing *Adams Outdoor Advertising*, *supra* at 693. The Court held that “protecting and promoting public health, safety, and general welfare are legitimate governmental interests...and protecting aesthetic value is included in the concept of the general welfare.” *Norman Corp v City of East Tawas*, 263 Mich App 194, 200-201; 687 NW2d 861 (2004).

In our opinion, the interests advanced by the City in this matter are significantly stronger than a government’s interest in protecting only aesthetic value. Thus, in our opinion, it is unlikely that a court would strike down the proposed regulations on substantive due process grounds unless there was no rational basis between the City’s stated interests and the adopted

⁸ Property owners sometimes argue that they have a fundamental right to develop their property. However, the United States Supreme Court has consistently applied the reasonable and legitimate state interest test to land-use decisions and has not treated land-use issues as involving fundamental rights. *Dolan v City of Tigard*, 512 US 374; 114 S Ct 2309 (1994); *Euclid v Ambler Realty Co*, 272 US 365, 395; 47 S Ct 114 (1926) (stating that before a zoning ordinance can be declared unconstitutional, the provision must be clearly arbitrary and unreasonable, having no substantial relation to the public health, safety, morals, or general welfare).

ordinances. See e.g., *Young v American Mini Theatres, Inc*, 427 US 50, 71; 96 S Ct 2440; 49 L Ed 2d 310 (1976) (stating that a municipality's interest in attempting to preserve quality of life is accorded high respect). See also *Bevan v Brandon Twp*, 438 Mich 385, 399-400; 475 NW2d 37 (1991) (upholding an ordinance restricting lakefront property, finding that it was rationally related to the legitimate government purpose of ensuring access for emergency personnel); *Cummins v Robinson Twp*, 283 Mich App 677, 702; 770 NW2d 421 (2009) (the township's enforcement of flood-resistant building code requirements advanced legitimate state interests in protecting the health, safety, and welfare of the public and protected property located in flood-prone areas).

This conclusion is consistent with cases in other jurisdictions as well. For example, in the case of *Samson v City of Bainbridge Island*, 202 P3d 334, 349 (2009), the Court of Appeals for the State of Washington upheld an amendment to city's shoreline master program that prohibited the construction of single-family private docks in a harbor. The court noted that the amendment was adopted "to protect the aesthetic, navigational, and recreational values that would be diminished by multiple docks in the harbor" and that the amendment did not violate due process rights because "[i]t defies logic to suggest an ordinance is unduly oppressive when it regulates only the activity which is directly responsible for the harm."

Nevertheless, it is not the municipality that is obligated to justify an ordinance by affirmatively showing that it has a reasonable governmental interest in the ordinance—which we believe the City would have in this case—rather, "it is plaintiff who is required to affirmatively prove that defendant does not have a reasonable governmental interest." *Grucz, supra* at 4. Moreover, courts are not to sit as a "superzoning commission," *Brae Burn, Inc v Bloomfield Hills*, 350 Mich 425, 430; 86 NW2d 166 (1957), and will not adjudicate the wisdom of zoning ordinances beyond evaluating them for a rational basis. Thus, the Due Process Clause cannot be invoked by a disgruntled property owner simply because he or she disagrees with the regulation. "The Due Process Clause is not a guarantee against incorrect or ill-advised [governmental] decisions." *Cummins v Robinson Twp*, 283 Mich App 677, 702; 770 NW2d 421 (2009) (citations omitted).

Further, the fact that the local ordinance(s) may impose restrictions that exceed federal or state regulations would not necessarily render the ordinance(s) unconstitutional. In *Frericks v Highland Twp*, 228 Mich App 575, 599; 579 NW2d 441 (1998), the Court of Appeals upheld a township zoning ordinance requiring septic tanks and tile fields to be constructed at least 125 feet from the high water mark of any subaqueous area. The plaintiffs argued that the setback regulation was unreasonable and unnecessary because county and state regulations were adequate. The Court noted there was testimony in the case that the township generally had extremely porous soil, which justified adopting a setback requirement greater than county or state standards as an additional "safety" measure to protect water resources. The Court said, "[g]iven this evidence, while there may be a difference of opinion concerning the need for a 'safety' factor, we are not persuaded that the trial court erred in finding that the setback regulation...was reasonable."⁹

⁹ To the extent the City seeks to adopt regulations that are more stringent or restrictive than the state (or federal) requirements, it would be beneficial for the City to be able to present (prior to enactment of the regulations)

Based on the information presented to date, it is our opinion that the proposed ordinances would likely withstand a constitutional challenge under a substantive due process argument because they appear to directly advance legitimate government interests—as long as the ordinances that the City adopts are rationally related to those interests.

B. Equal Protection

Property owners sometimes challenge ordinances arguing that the ordinance violates his or her right to equal protection.¹⁰ In determining whether application of an ordinance violates equal protection, courts apply the following principles set forth in *Shepherd Montessori Center Milan v Ann Arbor Charter Twp*, 486 Mich 311, 318-319; 783 NW2d 695 (2010):

When reviewing the validity of state legislation or other official action that is challenged as denying equal protection, the threshold inquiry is whether plaintiff was treated differently from a similarly situated entity. The general rule is that legislation that treats similarly situated groups disparately is presumed valid and will be sustained if it passes the rational basis standard of review: that is, the classification drawn by the legislation is rationally related to a legitimate state interest. Under this deferential standard, “the burden of showing a statute to be unconstitutional is on the challenging party, *not* on the party defending the statute[.]” [Citations omitted; emphasis in original.]¹¹

Based upon our understanding of the proposed regulations, it does not appear that there would be any disparate treatment among similarly situated property owners. The ordinances would be generally applicable, would not single out any waterfront property owners for special treatment, and would treat all persons of the same class alike. In other words, no immunities or privileges would be extended to an arbitrary or unreasonable class while denied to others of like kind.

If a challenger is unable to meet his or her burden of proving different treatment, and as long as there is no evidence of discriminatory intent in the enforcement of the ordinance, then a court would not even apply the rational basis test to determine whether the ordinance is rationally related to a legitimate state interest. *Shephard, supra* at 323 (“because plaintiff has

evidence or testimony, if necessary, that there are factors or characteristics unique to the area that justify the additional “safety measures.”

¹⁰ The Equal Protection Clause requires that all persons similarly situated be treated alike under the law.

¹¹ When legislation treats similarly situated groups differently on the basis of a suspect classification (e.g., race, alienage, or national origin), or infringes on a fundamental right protected by the Constitution (e.g., the free exercise of religion), “the legislation must pass the rigorous strict scrutiny standard of review: that is, the government bears the burden of establishing that the classification drawn is narrowly tailored to serve a compelling governmental interest.” *Shephard, supra* at 319. If legislation treats similarly situated groups differently on the basis of a quasi-suspect classification (e.g., gender), then the intermediate scrutiny test is applied and “the burden is on the government to show that “the classification serves important governmental objectives and that the means employed are substantially related to the achievement of those objectives.” *Id.* Where, as here, an ordinance is facially neutral, the burden is on the challenging party—not the government—to show that the challenging party “was actually treated differently from others similarly situated and that no rational basis exists for the dissimilar treatment.” *Id.* at 319-320.

failed to demonstrate that it was treated differently from similarly situated entities, we need not apply the rational basis test”).

Even assuming for argument’s sake that there was evidence of dissimilar treatment, courts will uphold legislation as long as it is “rationally related to a legitimate government purpose.” A reviewing court need only determine if there is “any reasonably conceivable state of facts that could provide a rational basis for the classification.” *Kenefick v City of Battle Creek*, 284 Mich App 653, 658; 774 NW2d 925 (2009). The finding may be based on “rational speculation unsupported by evidence or empirical data.” *Id.*

The person challenging the ordinance has an extremely high burden—“the challenger must ‘negative [sic] *every conceivable basis* which might support’ the legislation.” *Id.* (citation omitted). See also *Risko v Grand Haven Charter Twp Zoning Bd of Appeals*, 284 Mich App 453, 465; 773 NW2d 730 (2009) (“[T]he party raising the equal protection challenge has the burden of proving that the challenged law is arbitrary and thus irrational”); *Houdek v Centerville Twp*, 276 Mich App 568, 585; 741 NW2d 587 (2007) (“When an ordinance is challenged on the basis of equal protection guarantees, the ordinance is presumed constitutional, and the challenging party has the burden to show that the established classification is not rationally related to a legitimate state interest”).

Lakefront property owners are not a protected class. Thus, based on the information presented to date, it is our opinion that the proposed ordinances would likely withstand a constitutional challenge under an equal protection argument, so long as the ordinances are rationally related (or bear a reasonable relationship) to a legitimate governmental interest, they treat similarly situated individuals alike, and they do not single out any property owner for special treatment. We believe that if the ordinances meet these requirements, it is unlikely that a court would conclude that the ordinances are arbitrary and irrational, or that a challenger could overcome the substantial burden to negate *every conceivable basis* which might support the ordinances.

C. Regulatory Taking

Finally, it is not unusual for property owners to challenge an ordinance claiming that the ordinance restricts the use of their property in an unreasonable manner, and, as a result, constitutes an impermissible “taking” of private property for public purposes without compensation.

The United States and Michigan Constitutions provide that private property shall not be taken for public use without just compensation. The government may effectively “take” a person’s property by overburdening that property with regulations. However, a “land-use regulation does not effect a taking if it substantially advances legitimate state interests and does not deny an owner economically viable use of his land.” *Nollan v California Coastal Comm*, 483 US 825, 834 (1987).

Courts have found that land use regulations effectuate a taking where the regulation denies an owner economically viable use of his land. *K & K Const, Inc v Dep’t of Nat Res*, 456 Mich 570, 576-77; 575 NW2d 531(1998). This type of taking encompasses two types of

situations: (1) a “categorical” taking, where the owner is deprived of “all economically beneficial or productive use of land,” *Lucas v South Carolina Coastal Council*, 505 US 1003, 1015 (1992); and (2) a taking recognized on the basis of the application of the traditional “balancing test” established in *Penn Central Transp Co v New York City*, 438 US 104 (1978).

Based upon our understanding of the proposed ordinances, it is highly unlikely that the ordinances would force a property owner to sacrifice *all economically beneficial uses* of his or her land, except perhaps if the proposed setback requirement rendered a currently buildable vacant lot *unbuildable* or would cause an existing building to be destroyed by coastal conditions without the ability to rebuild. Thus, before adopting any setback requirements, the City should investigate what effect the proposed setbacks would have on existing vacant lots (if any), as well as on any lots on which existing structures may be destroyed in the future by fire or natural disaster. Depending upon the results of the investigation, the City may determine that it is highly unlikely that a “categorical” taking would result.

With regard to the second type of “taking,” courts analyze such a claim using three factors: (1) the character of the government’s action, (2) the economic effect of the regulation on the property, and (3) the extent by which the regulation has interfered with distinct, investment-backed expectations. *Penn Central*, *supra* at 124.

The first factor evaluates whether a property owner is being singled out or whether an ordinance applies broadly and equally. *Chelsea Inv Group LLC v Chelsea*, 288 Mich App 239, 261; 792 NW2d 781 (2010). As discussed above, it appears based upon the information presented to date that the City has the authority to adopt the proposed ordinances, that the ordinances could be rationally related to legitimate governmental interests, and that the ordinances would apply broadly and equally. Assuming that to be true, this factor would weigh in favor of the City.

To the extent a challenger claims that the economic effect of the ordinances amounts to a taking under the second factor, it is well established that mere diminution in value is not enough to establish a taking. “The Taking Clause does not guarantee property owners an economic profit from the use of their land.” *Frericks v Highland Twp*, 228 Mich App 575, 616; 579 NW2d 441, 460 (1998). Further, in applying a “taking” analysis, the full bundle of property rights associated with land is generally viewed in its entirety. *Bevan v. Brandon Twp.*, 438 Mich. 385, 395-397, 475 N.W.2d 37 (1991). As a result, restrictions on the use of only limited portions of a parcel, such as setback ordinances, are not generally considered regulatory takings. *Tahoe-Sierra Pres Council, Inc v Tahoe Regl Planning Agency*, 535 US 302, 327 (2002) (“where an owner possesses a full ‘bundle’ of property rights, the destruction of one ‘strand’ of the bundle is not a taking”); *Gorieb v Fox*, 274 US 603 (1927).¹²

Finally, under the third factor, courts consider whether the challenger has made any investments in the property that were subsequently lost because of the ordinance. To the extent a challenger contends that the ordinances interfere with distinct, investment-backed expectations

¹² Indeed, it is our understanding that one of the purposes for the proposed ordinances is to protect private property and to, in fact, enhance the value of that property. Enhancing property values serves legitimate governmental interests including but not limited to increasing the tax base and, therefore, property tax revenues.

concerning riparian rights, the expectations must be viewed in light of the public trust doctrine discussed above. Our Supreme Court has articulated the following standard with regard to the taking of riparian rights: “Riparian rights are property, for the taking or destruction of which by the State compensation must be made, *unless the use has a real and substantial relation to a paramount trust purpose.*” *Peterman v Dep’t of Nat Resources*, 446 Mich 177, 213-214; 521 NW2d 499 (1994), citing *Hilt v Weber*, 252 Mich 198, 225; 233 NW 159 (1930).

In the *Peterman* case, landowners brought an action against the Department of Natural Resources (“DNR”), alleging that the DNR’s construction of a boat launch and jetties—which resulted in the destruction of the plaintiffs’ beachfront property as a result of erosion and filtration of sand—was an unconstitutional taking. The court found that

defendant’s [the DNR’s] actions were the proximate cause of the destruction of plaintiffs’ beachfront property. Assuming that defendant did not directly invade plaintiffs’ land, it undoubtedly set into motion the destructive forces that caused the erosion and eventual destruction of the property. Defendant was forewarned that the construction of the jetties could very well result in the washing away of plaintiffs’ property, and the evidence reveals that the destruction of plaintiffs’ property was the natural and direct result of the defendant’s construction of the boat launch. The effect of defendant’s actions were no less destructive than bulldozing the property into the bay. [*Peterson, supra*, at 191.]

The court noted that as a result of erosion from the DNR’s construction of the boat launch and jetties, the plaintiffs had lost a significant amount of “fast land.” Fast land is property that is “above the high water mark.” *Id.* at 181. The court then concluded—citing to several earlier court decisions—that fast land cannot be taken without just compensation. See also *United States v Rands*, 389 US 121, 123 (1967), in which the United States Supreme Court stated that “when fast lands are taken by the Government, just compensation must be paid.”

In our opinion, regulations of the type proposed are distinguishable from government-caused erosion or flooding due to government improvements or construction. In the *Peterson* case, the government (there, the DNR) actually undertook activity that caused the property damage. In contrast, the City in this case is simply seeking to regulate and/or prevent the development of shoreline property by the property owner. And, in our opinion, prohibiting a property owner from constructing a seawall, in and of itself, does not amount to an unconstitutional taking.

However, we cannot conclude that the City would be insulated from an action by one or more property owners alleging that the City ordinances prohibiting the construction of certain shoreline protection structures caused increased erosion or the loss of fast land for which compensation must be paid. If such an action were to be filed against the City, expert testimony would, quite obviously, be critical with respect to the effects of building/prohibiting shoreline protection structures.

The case of *Shell Island Homeowners Association, Inc v Tomlinson*, 517 SE2d 406 (1999) is instructive on this issue. In that case, the Court of Appeals of North Carolina upheld a state regulation that prohibited permanent erosion control structures, including seawalls. The

court rejected the property owners' argument that the regulation amounted to a "taking," finding that the property owners failed to show that they had any legally cognizable property interest that had been taken by the state. The court explained:

The invasion of property and reduction in value which plaintiffs allege clearly stems from the natural migration of Mason's Inlet, and plaintiffs have based their takings claim on their need for "a permanent solution to the erosion that threatens its property," and the premise that "[t]he protection of property from erosion is an essential right of property owners...." The allegations in plaintiffs' complaint have no support in the law, and plaintiffs have failed to cite to this Court any persuasive authority for the proposition that a littoral or riparian landowner has a right to erect hardened structures in statutorily designated areas of environmental concern to protect their property from erosion and migration. [*Id.* at 228.]

The court in the *Shell Island* case stressed that there was no actual interference with the plaintiffs' property rights. Rather, the alleged injuries were merely consequential or incidental and "allegations of mere incidental or consequential interferences with property rights are insufficient to maintain an action for inverse condemnation." *Id.* at 229. The court found that the alleged damages to the plaintiffs' property were not caused by the government's regulatory action, but by "naturally occurring phenomena" of the migration of the inlet and the resulting erosion of the property. *Id.* at 229-230.

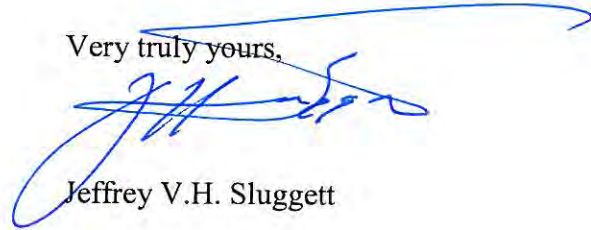
Similarly here, the City's enforcement of the proposed regulations (i.e., a ban on shoreline protection structures in Area 1) would be incidental to naturally occurring events. Thus, as long as the regulations would not cause a property owner to lose all economically beneficial or productive use of their property (as opposed to suffering a mere reduction in value), we believe that the regulations could withstand constitutional scrutiny under a takings analysis, even if as a result of the regulations a property owner suffered incidental damage from naturally occurring phenomena.

In sum, it is our opinion that City has the legal authority under state law and federal law to enact and enforce the types of ordinances it is considering. Further, it is our opinion that such ordinances can withstand constitutional scrutiny if they apply broadly and equally, do not single out any property owners, and do not deprive a property owner of all economically viable uses of his or her property.¹³

¹³ We note that depending on how the City decides to proceed with regard to the Area 2 recommendations, there may be additional areas requiring additional research. For example, what are the ramifications, if any, of requiring property owners to construct shoreline protection structures on public property (realizing that with regard to most parcels in Area 2, there may be no alternative)? This raises questions regarding ownership and maintenance of the structures, as well as governmental liability and the appropriate mechanism/procedure for granting property owners permission to construct the structures, while at the same time minimizing the City's exposure to liability.

Thank you for allowing us the opportunity to work with the City. If there are additional questions regarding these matters, or if we can be of further assistance, please do not hesitate to contact us.

Very truly yours,

A handwritten signature in blue ink, appearing to read "Jeffrey V.H. Sluggett", with a long horizontal flourish extending to the right.

Jeffrey V.H. Sluggett

Exhibits

EXHIBIT I
Area I Proposed Setback Line



TISCORNIA PARK TO 2,650' NORTH



2,650' NORTH TO 4,575' NORTH

LEGEND:

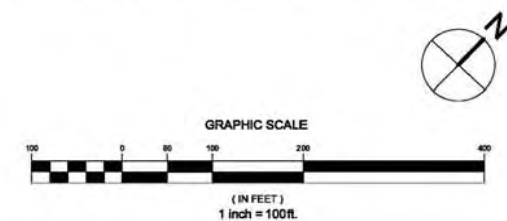
PARCEL LINE
BUILDING LINE

POINT	NORTHING	EASTING
A	231408.65'	12547511.47'
B	231835.41'	12547625.92'
C	232647.21'	12548673.22'
D	232952.85'	12549032.86'
E	233537.35'	12549657.47'
F	233846.96'	12549969.52'
G	234468.24'	12550591.09'
H	234820.85'	12550921.86'

LINE	DISTANCE	BEARING
AB	441.84'	N 15° 00' 46" E
BC	1451.11'	N 52° 13' 10" E
CD	471.91'	N 49° 38' 27" E
DE	855.44'	N 46° 54' 01" E
EF	439.58'	N 45° 13' 29" E
FG	878.83'	N 45° 00' 48" E
GH	483.46'	N 43° 10' 12" E

NOTES:

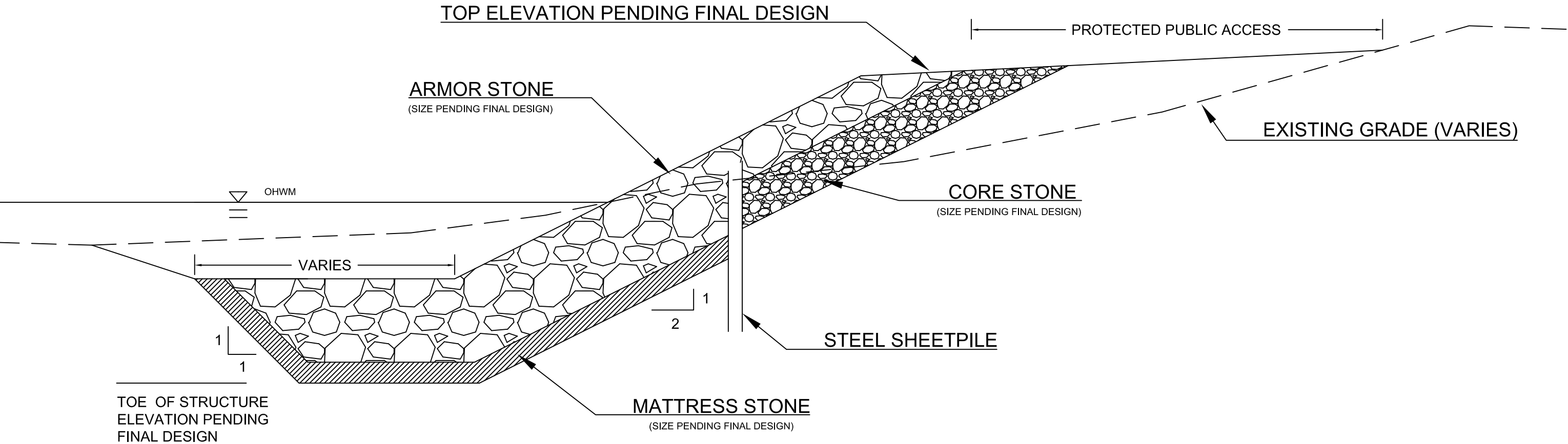
- COORDINATES SHOWN ARE BASED ON MICHIGAN STATE PLANE COORDINATE SYSTEM (GRID, NAD 83, US SURVEY FEET)
- PARCEL LINES ARE ILLUSTRATIVE AND ARE BASED ON BERRIEN COUNTY G.I.S. RECORDS
- AERIAL PHOTOGRAPH WAS TAKEN IN 2011
- PROPOSED SETBACK LINE IS BASED ON COASTAL ENGINEERING PRINCIPLES (SEE 2012 ST. JOSEPH COASTAL STUDY) AND 2012 SURVEY DATA (ABONMARCHÉ)
- VERTICAL DATUM IS INTERNATIONAL GREAT LAKES DATUM 1985 (IGLD 85)



NO. REVISION DESCRIPTION: BY: DATE:

EXHIBIT 2

Area 2 Shoreline Protection Concept Section



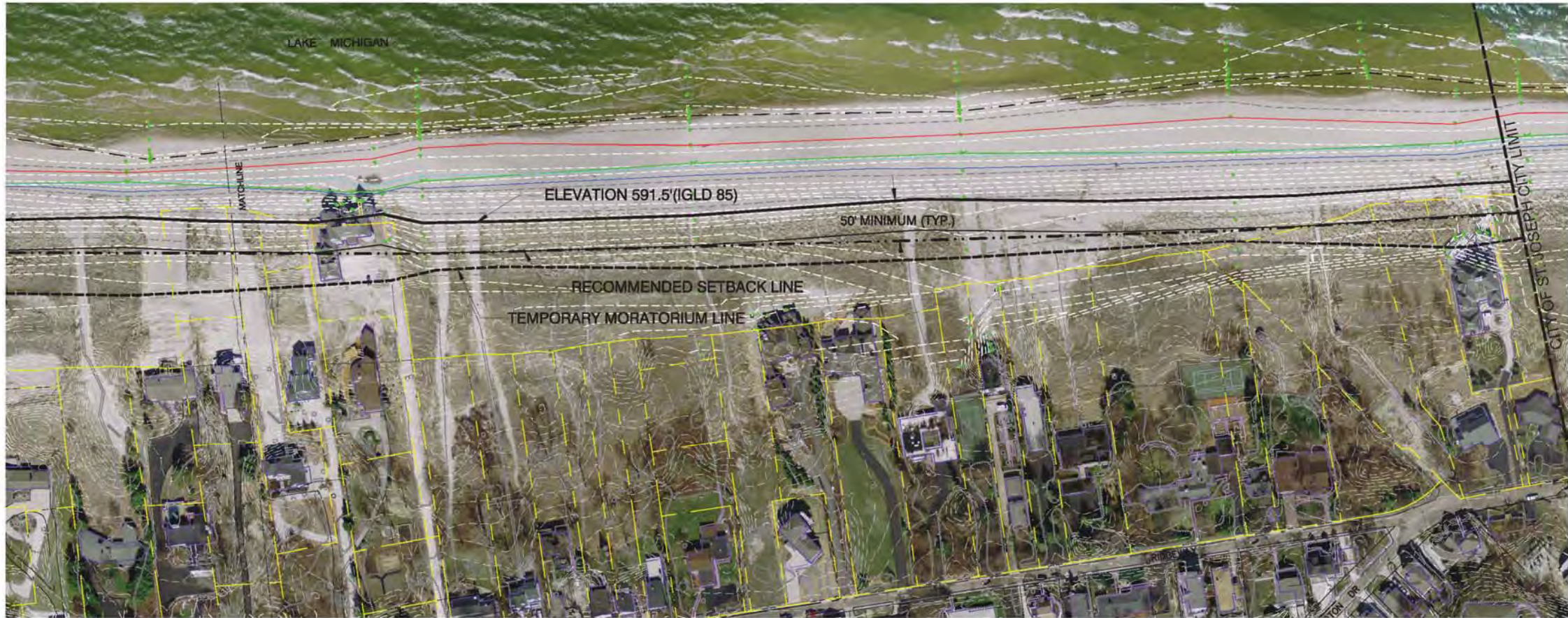
AREA 2 SHORELINE PROTECTION CONCEPT SECTION

EXHIBIT 3

Working Overall Maps, Areas 1-3



TISCORNIA PARK TO 2,650' NORTH



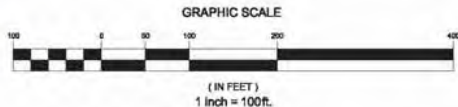
2,650' NORTH TO 4,575' NORTH

LEGEND:

- EDGE OF WATER (578.0' (+/- 5' LWD) ON 4/19/2012)
- MDEQ O.H.W.M. (580.5') +/- 3.0' LWD
- ALL TIME HIGH WATER (582.4') +/- 4.9' LWD
- TEMP. MORATORIUM LIMIT PER ORDIN. 39-1-2
- VEGETATION LINE
- FEMA BASE FLOOD ELEVATION (584.1') +/- 6.6' LWD
- PARCEL LINE
- BUILDING LINE

NOTES:

- VERTICAL DATUM IS INTERNATIONAL GREAT LAKES DATUM 1985 (IGLD85)
- PARCEL LINES ARE APPROXIMATE AND ARE BASED ON BERRIEN COUNTY G.I.S. RECORDS
- AERIAL PHOTOGRAPH WAS TAKEN IN 2011
- CONTOURS ARE APPROXIMATE AND BASED ON A COMBINATION OF DATA SPACED AT WIDE INTERVALS AND 2005 CONTOURS PROVIDED BY OTHERS
- STATE OF MICHIGAN ORDINARY HIGH WATER MARK ELEVATION 579.8' (IGLD55) (PER STATUTE) EQUALS ELEVATION 580.5'
- NATIONAL FLOOD INSURANCE PROGRAM FLOOD INSURANCE RATE MAP 26021C0101C EFFECTIVE DATE: APRIL 17, 2006 (LOMR MARCH 1, 2007) BASE 100-YEAR FLOOD ELEVATION 585.0' (NGVD29) EQUALS ELEVATION 584.02' (IGLD85)



SHEET TITLE:

DRAWN BY:

CH

DESIGNED BY:

MM

PM REVIEW:

QA/QC REVIEW:

DATE:

JUNE 2012

SEAL:

SIGNATURE:

DATE:

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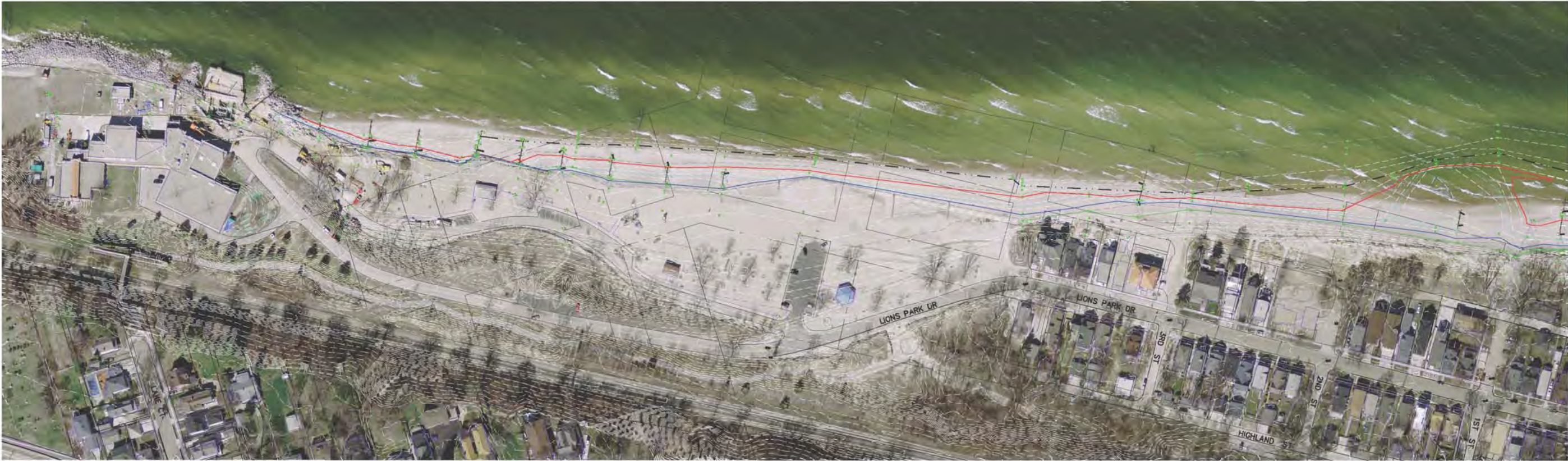
12-06 SJC

SHEET NO.

1 of 3



SILVER BEACH TO LIONS PARK

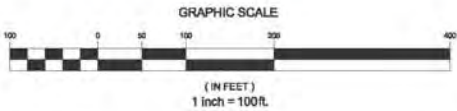


- LEGEND:
- EDGE OF WATER (578.0'(+/-5' LWD) ON 4/19/2012)
 - MDEQ O.H.W.M. (580.5')+3.0' LWD
 - ALL TIME HIGH WATER(582.4')+4.9' LWD
 - VEGETATION LINE
 - FEMA BASE FLOOD ELEVATION (584.1')+8.6' LWD
 - PARCEL LINE
 - BUILDING LINE

NOTES:

- SEE SHEET 1

LIONS PARK TO ST. JOSEPH WATER PLANT



NO.	REVISION DESCRIPTION:	BY:	DATE:

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F 269.803.9432

CITY OF ST. JOSEPH
COASTAL ENGINEERING STUDY
AREA 2 OVERALL MAP

SHEET TITLE:

DRAWN BY: CH

DESIGNED BY: MM

PM REVIEW:

QA/QC REVIEW:

DATE: JUNE 2012

SEAL:

SIGNATURE:

DATE:

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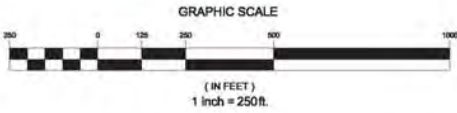
12-06 SJC

SHEET NO.

2 of 3



ST. JOSEPH WATER PLANT SOUTH TO CITY LIMITS



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P 268.322.3442

**CITY OF ST. JOSEPH
COASTAL ENGINEERING STUDY
AREA 3 OVERALL MAP**

SHEET TITLE:

DRAWN BY: CH

DESIGNED BY: MM

PM REVIEW:

QA/QC REVIEW:

DATE: JUNE 2012

SEAL:

SIGNATURE:

DATE:

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VERT: N/A

JOB #

12-06 SJC

SHEET NO.

3 of 3