Shabica & Associates, Inc.
WE BUILD BEACHES

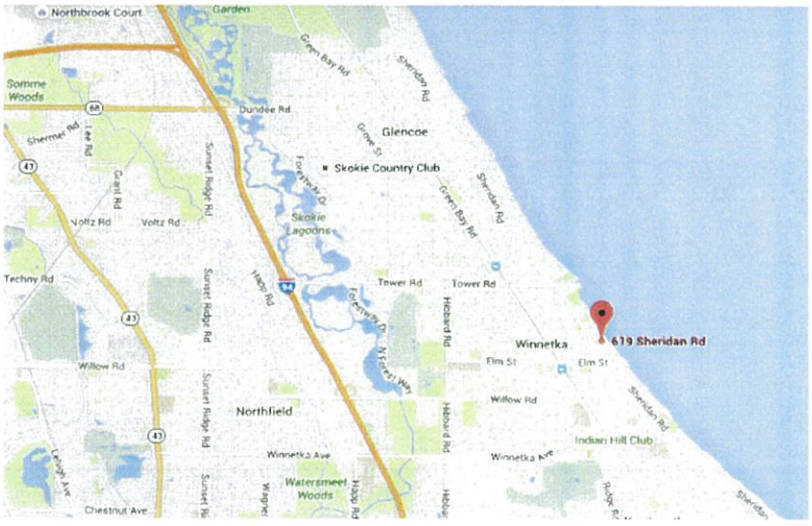
Federal Consistency Coordinator
Illinois Coastal Management Program
Illinois Department of Natural Resources
160 N. LaSalle Street, Suite 700
Chicago, IL 60601

To Whom It May Concern:

October 5, 2015

In compliance with the Illinois Coastal Management Federal Consistency Review Procedures, we provide the following information for a proposed quarrystone breakwater-protected beach for the property located at 619 Sheridan Road, Winnetka, Illinois 60093, owned by Joe and Janet Nolan.

Location of Project
The proposed quarrystone breakwater- protected beach will be built on the lakefront of the property located at 619 Sheridan Road, Winnetka, Illinois 60093, owned by Joe and Janet Nolan.



Project Start Date and Duration
Work will not begin until all necessary permits have been received. It is anticipated that the project can begin by June 1, 2016. This work will require approximately 8 weeks to complete.

550 Frontage Road • Suite 3735 • Northfield, Illinois 60093 • Tel 847.446.1436 • Fax 847.716.2007
www.shabica.com

Extent of Work to be Conducted

A quarrystone revetment will be constructed along the existing seawall to match the seawall crest elevation of approximately 588' with a slope of 1:1. At the north end of the revetment, the stone will continue lakeward encapsulating the existing steel groin. The stone crest will run abutting and south of the property line. The steel groin will be cut down as necessary to become encapsulated in stone. This section of breakwater will have a crest elevation of 588' landward tapering to 584' lakeward. At the lakeward end of the groin and not more than 125' east of the existing seawall, a breakwater extension will be constructed extending to the south approximately 60' to the toe. The breakwater will have a slope of 1:1.5 with a crest elevation of 584'. As required by the IDNR, 1,600 tons of clean sand will be placed.

Contact Information

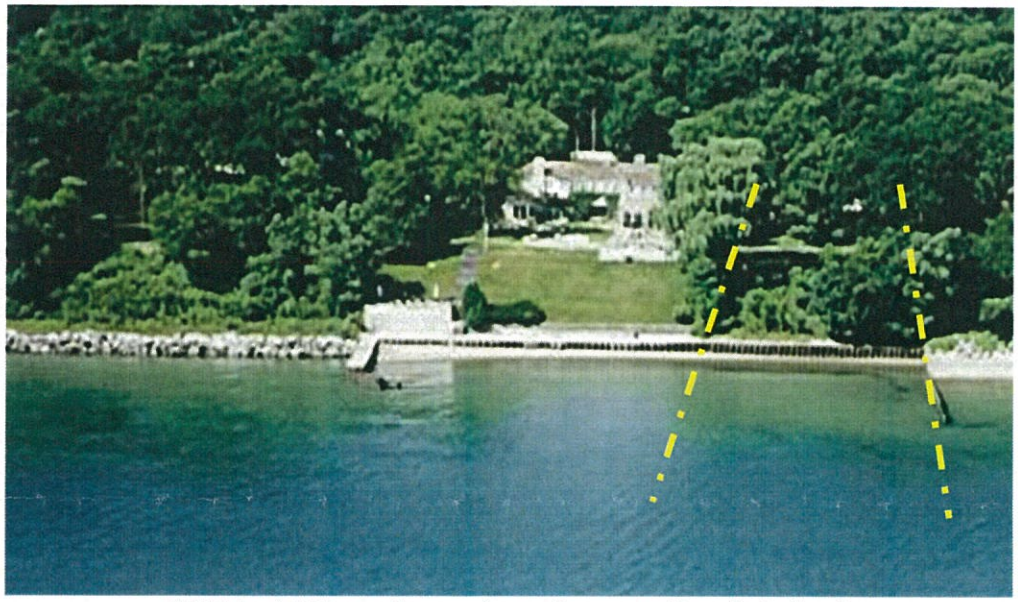
All questions pertaining to this project can be submitted to:

Jon Shabica
Shabica & Associates, Inc.
550 Frontage Road, Suite 3735
Northfield, IL 60093
jon@shabica.com
847-446-1436 Tel
847-716-2007 Fax

The proposed activity complies with Illinois' approved Coastal Management Program and will be conducted in a manner consistent with such policies.

Sincerely,

Jon Shabica
Vice President



1997 Aerial Photo (Approximate Property Lines in Yellow)

550 Frontage Road • Suite 3735 • Northfield, Illinois 60093 • Tel 847.446.1436 • Fax 847.716.2007
www.shabica.com

Shabica & Associates, Inc.
WE BUILD BEACHES

Ms. Kathy Chernich
East Section Chief, Regulatory Branch
Chicago District
U.S. Army Corps of Engineers
231 S. LaSalle Street, Suite 1500
Chicago, IL 60604

Dear Ms. Chernich:

October 5, 2015

Please find enclosed a permit application for shore protection for the property located at 619 Sheridan Road, Winnetka, Illinois, 60093, owned by Joe and Janet Nolan. Proposed work includes construction of a quarrystone breakwater, a quarrystone revetment and sandfill, as required. A letter of authorization is attached from the adjacent north property owners, Mr. Clyde McGregor and Mrs. Leann Pope, for the placement of stone around the steel groin and sandfill, as required for the project. This project is a joint project between the owners of the properties at 619 and 627 Sheridan Road. A separate permit application and drawings will be submitted for the portion of work on the 627 Sheridan Road property.

A *Design of Shoreline Erosion Protection* report has been attached to this cover letter as the coastal design specifications component of this permit. All references, photographs and figures referred to in the cover letter and the following report can be found in the Appendix.

The proposed activity complies with the approved Illinois Coastal Management Program (ICMP) and will be conducted in a manner consistent with such policies. A separate letter has been submitted to the ICMP office.

Project Purpose Statement
The property owner has retained Shabica & Associates (SA) to design and engineer a shore protection system for his property. This project will be constructed on the lakefront of 619 Sheridan Road, Winnetka, where, the new homeowner wants to reduce lakebed downcutting that will cause larger waves to break over the seawall and erode the bluff as well as eventually destabilize the existing steel groin and seawall. The sandy beach at this site has deflated over the years. Even with recent low lake levels, the beach is narrower during all lake levels with stormwaves overtopping the existing steel seawall and eroding the bluff landward.

The bluff at this site has a terraced vegetated face leading down to an earthen lower plateau west of the steel seawall. Lakeward of the lower plateau is a sandy beach that varies averaging about 40' wide during low to average lake levels. The property to the south is in the same beach cell. At its south property line, there is a short concrete

550 Frontage Road • Suite 3735 • Northfield, Illinois 60093 • Tel 847.446.1436 • Fax 847.716.2007
www.shabica.com

and steel pier (62' long) with a short steel groin extension (25' long) to the northeast. This structure helps to hold the beach that exists on the property at high lake levels.

A quarrystone revetment will be constructed along the existing seawall to match the seawall crest elevation of approximately 588' with a slope of 1:1. At the north end of the revetment, the stone will continue lakeward encapsulating the existing steel groin. The stone crest will run abutting and south of the property line. The steel groin will be cut down as necessary to become encapsulated in stone. This section of breakwater will have a crest elevation of 588' landward tapering to 584' lakeward. At the lakeward end of the groin and not more than 125' east of the existing seawall, a breakwater extension will be constructed extending to the south approximately 60' to the toe. The breakwater will have a slope of 1:1.5 with a crest elevation of 584'. As required by the IDNR, 1,600 tons of clean sand will be placed.

This section of coastline has historically lost sand due to large municipal structures, such as Tower Road Cooling Basin in Winnetka to the north, Wilmette Harbor to the south and several municipal beach structures in between, as well as lakebed downcutting especially during prolonged periods of low lake levels. Nearshore sand deposits are thin to non-existent here (Figures 1 and 2, Appendix) and scientists estimate that the rate of lakebed erosion averages 6 inches per year (Nairn, 1997). The net result is similar to the effects of global warming and rising sea level on marine coasts. This includes deeper water nearshore, larger stormwaves and progressively narrower beaches as the nearshore lakebed continues to erode.

The Illinois Lake Michigan shoreline is considered "sediment starved" by coastal scientists. This is in contrast to East Coast and Gulf Coast open ocean shores where tens of thousands of tons of sand are found in the nearshore system that provide a primary line of defense against stormwaves. On most Great Lakes shores including southern Lake Michigan, natural sand beaches are not able to protect the lakeshore (exceptions may be during very low lake levels like 1964 or 2004-07). Large quantities of sand have been trapped or diverted offshore by municipal structures that extend 900 feet or more into the lake. Today, the main sand supply is wave erosion of the nearshore glacial clay lakebed that contains only about 10% sand (Shabica and Pranschke, 1994). The result is that groins are losing their effectiveness at holding a sandy beach during average to high lake levels. To retain a sand covering of the shallow lakebed (where downcutting is most active), as well as to protect the revetment and bluff toe, SA has designed a pocket beach system to hold sand, as necessary, to protect the lakebed and bluff during higher lake levels.

If beach and nearshore sand is lost, degradation of the nearshore ecosystem will result. Meadows et al., (2005) reports an increase in zebra mussels *Dreissena polymorpha*, and a decrease in native zooplankton in waters where the lakebed is eroding clay and rocks. In comparison, a nearshore area with 100% sand cover supports a species-rich community. The report concludes, "it [is] nonetheless clear that sand-based areas were characterized by sufficient shallow water fish CPUE and species richness to suggest that these are important habitats within the context of the Great Lakes Basin and not simply 'wet deserts' as they are often considered."

Design Options

The site at 619 Sheridan Road, Winnetka has been inspected and options for shore protection were determined using desktop coastal engineering, site conditions from the 2014 bathymetric survey, studying local prototypes, and several years of observations of the deteriorating shoreline conditions at this site. Given the sand loss over the last several years including during extreme low lake levels, as well as the uncertainty of future lake levels, it is prudent to engineer and design systems that will anticipate greater lakebed downcutting, higher amounts of beach erosion, more extreme storm events with larger waves, and potential loss of land. These four design options were considered:

OPTION 1
Do Nothing –

The first option of "Do Nothing" results in leaving the currently eroding beach in its existing state. This will allow lakebed erosion to continue allowing larger stormwaves to impact the coastline. Over time, the beaches along Illinois' North Shore coastline have continued to narrow due to being in a sand starved system. At this site, the beach continues to narrow even with lower lake levels. Now with the water level rising, Lake Michigan waves are impacting the seawall.

OPTION 2

Construct a Revetment –

The second option considered is to construct a quarrystone revetment. This option provides enhanced stormwater protection at the cost of the following:

1. Continued erosion of the lakebed, which will ultimately destabilize the revetment toe
2. The beach will erode over time, as there is less sand in the system.

OPTION 3

Preferred Option: Design a Small Breakwater Protected Beach System (125 ft offshore) –

The preferred option is to protect the property with a pocket beach breakwater system. Based on research of prototypes along the Illinois North Shore, structures that extend less than around 125 feet offshore with a wide gap opening between structures, do not dissipate enough wave energy to hold a stable beach with fluctuating lake levels. As this system meets the recommended 125 feet offshore, it will greatly enhance the level of shore protection at this property. The proposed breakwater will extend south from the property line 60' to the breakwater toe. The steel groin will be encapsulated in stone and a revetment will be constructed along the existing steel seawall. The proposed plan will help protect the glacial clay lakebed, as well as the beach and bluff, while allowing safe access to Lake Michigan. This option will help stabilize the sand on the adjacent beaches by reducing wave energy in the immediate area. With proper maintenance, a structure like this could be expected to continue functioning for 30 plus years.

OPTION 4

Encapsulate the Groin in Quarrystone –

This option would help to hold sand in the beach cell by softening the steel face of the groin but at a much reduced rate compared to the preferred option. The beach cell would still have a wide gap that will not help the center of the cell hold a beach wide enough to serve as proper shore protection.

Public Benefits of Sandy Beaches

The Great Lakes represent the most important natural resource in the United States. Sandy beaches play an important role in keeping the lakes clean and safely accessible. Furthermore, a sandy beach makes a better ecotone (transitional environment) for flora and fauna than seawalls and revetments. Summary arguments supporting a sandy beach system include:

1) Beaches are filters for non-point source runoff.
2) Beaches reduce lakebed downcutting, a source of fine clay pollutants.
3) Beaches support endangered species such as sea rocket, marram grass, and seaside spurge.
4) Beaches make better wildlife habitat than actively eroding bluffs or seawalls.
5) Stone headlands make better fish habitat than eroding lakebed clay.
6) Beaches protect the lakebed from erosion that causes larger stormwaves to impact the shore.
7) Beaches are far safer for swimmers and boaters than a coast lined with seawalls or revetments, especially in an emergency.
8) Beaches, unlike most steel or concrete seawalls, are not visual pollution.

Impacts to Downdrift Properties

The proposed project will have minimal impact on the property immediately downdrift of the subject property. The adjacent property to the south currently has a permit under review and the system is designed to work hand in hand with the breakwater system to the south.

Impact to Littoral Drift System
The proposed plan for this site includes the construction of a quarrystone breakwater and placement of sandfill as required for permit.

The section of Lake Michigan shoreline north and south of 619 Sheridan Road, Winnetka is fully engineered with steel groins, piers, seawalls, and quarrrystone breakwaters. Based on our experience, as the proposed structure will not extend beyond the existing structure to the south, it will not negatively impact the littoral system after the sandfill is placed (anticipated quantity plus 20% overfill). According to the Illinois State Coastal Geologist (Chrzastowski, 2005), "the design to contain placed sand is becoming necessary because of reduced volume of littoral sand in transport." He further states, "beach-cell systems may represent the future for beaches along much of the Illinois bluff coast from Waukegan south to Evanston."

The beach system will be nourished with sand including a 20% overfill placed north and south of the system. The new IDNR regulations for structures that will retain sand require pre- and post-construction surveys, as well as surveys at the one and five-year intervals. This new requirement will help assure that a sand equilibrium is met and that the new project is gaining and losing sand at a similar rate to neighboring properties.

Impact on Public Uses
Public access will be improved by the modifications to the existing system. Stairs will be constructed through the stone at the west end of the beach to provide access for beach walkers over the structure. The beach will provide a safe place for boaters and swimmers in distress. Fishing will not be impacted negatively, as the underwater area of the quarrystone protection will create an improved fish habitat. Additionally, navigation of water craft will not be impacted, as the proposed construction will not extend further east than the existing structure.

Impact on Natural Resources
Quarrystone structures in the nearshore waters of Lake Michigan and sandy beaches improve native species habitat. The LandOwner Resource Centre with support from the Canadian Wildlife Service and the Ontario Ministry of Natural Resources states that, "unstable shorelines can release silt that can choke nearby aquatic habitats." Additionally, underwater structures such as artificial reefs constructed of large boulders and clean riprap material "in large water bodies, such as the Great Lakes . . . are often the best method of creating habitat." As stated above, according to Meadows, et al., 2005, "a nearshore area with 100% sand cover support[s] a species rich community." As the design does not impact the bluff and vegetation, the local terrestrial wildlife will continue to inhabit this property.

Type of Permit
The scope of this project requires an individual permit.

Description and Schedule of Proposed Activity
All of the proposed work will be completed via marine access. A barge will deliver a backhoe to work on land to place the materials. All stone will be delivered by barge to the site. Sand will be delivered by truck. Work will not begin until all necessary permits have been received. This work will require approximately 8 weeks to complete.

Type and Quantity of Fill/Measures Taken to Avoid Impact/Erosion and Sediment Control Plan
All material will be clean and from inland quarries. 1,900 tons of quarried quartzite will be placed in the structures. 1,600 tons of clean sand will be placed on the existing beach. All clay displaced from the lakebed for installation of

the breakwater toe stone will be placed on the barge and removed from the site and disposed of properly. Acreage of stone placed on the lakebed east of the OHWM is less than 0.072 acres.

Summary
All of the above described activities and plans will follow IPP terms and conditions. All of the proposed work adheres to the guidelines prescribed by the Illinois Environmental Protection Agency and its Anti-Degradation Assessment. U.S. Fish & Wildlife Service and the Illinois Historic Preservation Association will be updated on all relevant correspondence.

If you have any questions please feel free to call me at the phone number below.

Sincerely,

Jon Shabica, Vice President

CC: IDNR (Casey)
IEPA (Heacock)
U.S. Fish & Wildlife Service
Illinois Historic Preservation Agency (Haaker)
Joe and Janet Nolan
Clyde McGregor

DESIGN OF SHORELINE EROSION PROTECTION

Introduction

The following report summarizes assumptions and design criteria for a quarrystone breakwater and sandfill mitigation to help reduce erosion and protect the property located at 619 Sheridan Road, Winnetka IL, 60093. The design is based on the drawings included in the permit application to the U.S. Army Corps of Engineers dated October 6, 2015.

The site lies within a fully engineered section of urban lakeshore that is typically protected with revetments, seawalls, impermeable piers, steel sheetpile groins and breakwater protected beaches that may hold narrow beaches. There are no naturally eroding bluffs in the area.

This section of coast is sand-starved due to municipal structures (littoral barriers) constructed over the past 100 years that extend lakeward beyond the littoral zone and reduce sand bypass. Although there is currently an exposed sandy beach due to extreme low lake levels, the beach width varies greatly due to the vulnerability of this location. According to the Illinois State Geological Survey, there is almost no sand moving along this section of coast. All structures in the area have been steadily losing their effectiveness at holding beach sand. This problem is exacerbated by lakebed erosion. In many cases where all the sand has been lost, the adjacent bluffs have begun to erode. To provide adequate protection for the upland property, solutions have typically been of two types: breakwater- or groin-anchored beaches to protect the bluffs, or large quarrystone revetments placed against the toe of the bluff that prevent stormwave erosion but at the expense of the beach.

Project Description

Construction of a quarrystone breakwater and sandfill mitigation are proposed that fulfill the design requirements of 20-year stormwave erosion protection. The proposed system is designed for all lake level conditions.

Summary Specifications

Using the Army Corps of Engineers Shore Protection Manual (1984), performance of nearby prototypes and other sources, the following specifications were developed for this site (elevations are based on IGLD 1985):

Stone Breakwater Specifications	
Lakeward Crest Elevation:	584 ft
Toe of Structure:	573 ft (average)
Crest Width:	7 ft
Average Armor Size:	3 tons
"B" Stone	200 lbs to 1000 lbs
Slope:	1:1.5
Tons/linear feet:	15 tons

Assumptions	
• Design High Water (DHW):	582.5 ft *
• Design Water Level:	580.0 ft
• Design Low Water (DLW):	577.5 ft *
• Existing clay till elevation at breakwater toe:	571.0 ft
• 20-yr lakebed erosion at toe of breakwater:	3 ft**
• Design wave height (Hs):	9.5 ft

Assumptions (continued)

- Nearshore Slope: ± 1:50
- Design Wave Period (T): 9.9 s ***
- Depth at Structure Toe DHW (Ds): 6'
- Design Deepwater Wave (Ho): 18.0'
- Design Wave Length (Lo): 501.8'
- Structure Porosity: 37%

* DHW includes 2 ft storm setup; DLW is equivalent to Low Water Datum
** 2.5 ft sand and gravel (thickness varies) plus 2 ft clay till, Nairn, 1997
*** Resio & Vincent, 1976

Stone Breakwater Stability, Armorstone

The proposed quarrystone breakwater will be constructed with a special placement armor layer of 1 – 5 ton armorstone built on a 1:1.5. Overtopping of the structure is expected during storms and higher water levels.

For a quarrystone breakwater, structural integrity may depend on the ability of the foundation to resist the erosive scour by the highest waves. Therefore, it is suggested that the selected design wave height H_s for such structures be based on the design wave height H being the average height of the top 10 percent of waves expected during an extreme event. Based on the deepwater significant wave height H_s corrected for refraction and shoaling.

The stability number (K_d) is primarily affected by the depth of the stone foundation and toe protection below the still water level and the depth of the structure.

The equation below is Hudson's formula and is used to determine the armor stone weight needed to support a particular structure.

$$W = (W_r * H_s^3) / ((K_d[W_r/W_w]-1) * \cot(\beta))$$

W = weight of individual armor units in lbs
W_r = Unit weight of armor units
W_w = unit weight of water
H_s = the design wave height for the structure
K_d = the design stability coefficient for rubble and toe protection
β = the angle of incline of the structure

Quartzite armorstone is recommended as it is highly durable and is locally available in most gradations under 5 tons. Hudson's formula was used to estimate armorstone size. As the breakwater will be built with special placement, an armorstone of 2.1 tons is predicted for special placement stone based on the design conditions.

Bathymetry

Bathymetric profiling was performed on 5/21/2014. Five transects were completed in the project area. The profiles extend up to 450 ft east of the existing seawall. Survey work was completed by Greengard, Inc.

Water Levels

The following table summarizes water level data representing daily highest extremes measured at Calumet Harbor, Illinois, approximately 27 miles to the south of Winnetka. Note: Low water datum = 577.5 ft (IGLD 1985).

Lake Level	LWD	IGLD 1985
Record High	+5.5	583.0
Record Low	-1.4	576.1

Project Supporting Data

To help facilitate project review, SA offers the following supporting data based on standard coastal engineering practices:

1. **Sediment Transport Around Structure** The structure is designed to lie within the surf zone (zone of breaking waves), therefore allowing sediment transport around the structure. The range of breaking wave heights is from 7.4 ft based on a 6-second wave with a wave length of 184 ft (using 1/25 Lo) to 18 ft based on a 9.9-second wave with a wave length of 501.8 ft (Resio and Vincent, 1976). The commonly accepted zone of sediment transport is to 18 ft (depth of closure) in this section of Lake Michigan, which is a function of the design wave parameters. Based on this data, once the structure has been filled with sand, it will continue to bypass littoral drift sand. Rod and transit survey monitoring will be conducted, as required by the IDNR, to assure that the system performs as designed.

   The IDNR requires sand fill in areas where sediment will be trapped by the new system. Sand volume quantities have been calculated as shown in the permit drawings. As required by the IDNR, a 20% overfill will be added to the calculated volume. Additionally, the new pre- and post-construction monitoring will be performed and submitted to the IDNR to verify the impacts to the system.

2. **Effect on Adjacent Shorelines** A wave diffraction diagram (Figure 4, Appendix) has been overlain on the proposed shore protection system. Using a refracted incident wave angle of 90 degrees (USACE, Shore Protection Manual), with average and design waves, there will be a decrease in wave energy on adjacent properties. The wave diffraction pattern shows that the coefficient of diffraction (K) reduces the wave energy to a distance of about ½ the wave length downdrift and does not have an impact further downdrift. For the average 6-second wave, that distance of reduced wave energy is about 90 ft and for the design wave, the protected distance is about 250 ft. This protected area close to the structure has diminished wave energy that will in turn reduce erosion in the area.

3. **Wave Reduction in Rubble-Mound Structures** The Iribarren number (ξ), or surf similarity number, is used to determine the wave reflection coefficient. For rubble-mound structures, wave reflection (and wave energy) is reduced by one half or more (0.2 to 0.53) (Figure 5, Appendix). For example, a wave reflection of 0.25 means that the wave energy is reduced by 75%. The range of wave reflection for beaches peaks at about 0.44. The range for plane slopes, however, quickly rises to 0.5 and peaks at .91. This illustrates that rubble-mound structures reduce wave energy almost as well as beaches.

Lakebed Erosion

Lakebed erosion, active in water depths of 10 ft or less, is a design component of this plan. This section of Winnetka lakeshore is considered sediment-starved. Sand deposits were measured near this site (Elder Lane Beach, Winnetka see Figures 1 & 2 in the Appendix) from the backshore to a depth of 6.7 m (22 ft) in 1989. In July of 2010, the clay depth and sand cover was resurveyed to a depth of 2m (6.3 ft). In 1989, the nearshore sand deposits averaged 1.6 to 2.0 ft thick from shore to 50 ft offshore and thinned to 0 feet thickness at 100 ft, and then thickening to 4.5 ft at 250 ft offshore. At 1,000 ft offshore, no sand was present through the end of the transect.

Farther offshore, the sand ranged from 1.8 to 2.9 ft thick (Shabica & Pranschke, 1994). In 2010, the nearshore sand deposits were typically 1 foot thick with the exception of a sandbar that averaged 2 feet thick. The site is underlain by highly-erodable, cohesive glacial clay-till. During the period from 1989 to 2010, erosion of the clay lakebed varied from negligible to 2.3 ft. The 2.3 ft of erosion occurred in the location where there was no sand cover in 1989. See Shabica survey data and cross-section (see cover letter dated June 23, 2011 and Figures 1, 2, and 3, Appendix) showing loss of lakebed sand from 1975 to 1989. Calculated sand deposits at this site in 1989 were 161 cubic meters per meter of lakeshore to a depth of 4 meters. According to Robert Nairn, approximately 200 m^3 of sand cover per meter of lakeshore (out to a depth of 4 m) is necessary to protect the underlying cohesive profile from lakebed erosion under most conditions. Sand and coarser sediments represent typically less than 15% of the material eroding from the lakebed and bluffs.

Using the historic rate of lakebed downcutting of 0.15 ft/yr (Nairn, 1997), an irreversible lowering of the nearshore lakebed clay of approximately 3.0 ft over a 20-year period is predicted in unprotected areas. With the stone breakwater, revetment and sandfill installed, the lakebed erosion will be reduced.

Project Monitoring

As the performance of shore protection structures cannot be predicted with absolute certainty, the shore protection system for 619 Sheridan Road, Winnetka will be inspected as required by IDNR guidelines. This includes topographic and hydrographic surveys beginning at an elevation of 581.5 ft (IGLD 1985) and progressing to 300 ft lakeward of the lakeward end of the project, within the north and south property lines. Additionally, all structures should be inspected to assure that they continue to meet design specifications.

References

Anglin, C.D., and K. J. Macintosh, *Southport Marina, Kenosha, Wisconsin: Design and Construction of Breakwaters, in Coastal Engineering for the Great Lakes,* a short course, University of Wisconsin, March 11-13, 1991.

W.F Baird & Associates and Warzyn Engineering, 1986, *Shoreline Development at Forest Park, Lake Forest, Illinois, Model Studies,* Unpublished Final Report to the City of Lake Forest.

Chrzastowski, M.J. and C.B. Trask, 1995, Illinois State Geological Survey, Open File Series, 1996-7, 57 p. plus eight appendices.

Chrzastowski, M.J. and C.B. Trask, 1996, *Review of the City of Lake Forest Final Report for the 1995 beach and nearshore monitoring program, Forest Park Beach, Lake Forest, Illinois*: Illinois State Geological Survey, Open File Series, 1996-6, 57 p. plus eight appendices.

Chrzastowski, M.J., 2005, *Chicagoland Geology and the Making of a Metropolis,* Illinois State Geological Survey Open File Series OFS 2005-9.

Johnson, Charles, 1997, USACE, Chicago, personal communication.

LandOwner Resource Centre, Canadian Wildlife Service, Ontario Ministry of Natural Resources, 1999, *Improving Fish Habitat,* Extension Notes: Ontario, LRC 45.

Meadows, Guy; Mackay, S.; Goforth, R.; Mickelson, D.; Edil, T.; Fuller, J.; Guy, D.; Meadows, L.; Brown, E.; Carman, S.; Liebenthal, D.; 2005, *Cumulative Habitat Impacts of Nearshore Engineering,* Journal of Great Lakes Research; vol.31, Supplement 1, 2005, pp.90-112.

Nairn, Robert B. 1997, *Cohesive Shores,* Shore & Beach Vol. 65 No. 2: 17-21.

Resio, Donald T. and Charles L. Vincent, 1976, *Design Wave Information For The Great Lakes: Technical Report 3, Lake Michigan.*

Shabica, C.W., F. Pranschke and M. Chrzastowski. 1991, *Survey of Littoral Drift Sand deposits Along the Illinois Shore of Michigan from Fort Sheridan to Evanston,* Illinois/Indi ana Sea Grant Program, IL-IN-SG-R-91-3.

Shabica, C.W., F. Pranschke, 1994, *Survey of Littoral Drift Sand Deposits Along the Illinois and Indiana Shores of Lake Michigan,* U.S. Geological Survey Symposium Volume, Journal of Great Lakes Research, vol. 20, no.1, pp 61-72.

Shabica, Charles and Assoc., 1997, *Lake Bluff Beach Monitoring and Mitigation Report 5,* US Army Corps of Engineers, Chicago District.

US Army Corps of Engineers, 1984, *Shore Protection Manual,* Coastal Engineering Research Center, Vicksburg, Mississippi.

PHOTO 1

1997 Aerial Photo (Approximate Property Lines in Yellow)

PHOTO 2

2008 Photo, note the extent of wave run-up on the sand and narrow beach at north end of the cell

FIGURE 1

Winnetka - Elder Lane Date:06/27/89 Time:

Enter lake surface 578.90 elevation for time of survey

Enter Graph: DATA A DATA B DATA C

Enter Dist. From Shore	Enter Water Depth	Enter Sand Thick ness	Top of Sand Elev. 1990	Bottom of Sand Elev. 1990	Enter Sand Thick. 1975	Top of sand 1975	Enter Hard- pan Type	Sand Volume Cu.Yd. Per ft. 1975	1990
-10.0	-1.0	2.0	579.9	577.9	10.0	587.9		1.9	0.4
0.0	0.0	1.8	578.9	577.1	10.0	587.1		6.5	1.2
25.0	0.8	1.6	578.1	576.5	10.0	586.5		9.3	1.5
50.0	1.9	1.9	577.0	575.1	10.0	585.1		13.9	2.6
100.0	3.3	0.0	575.6	575.6	10.0	585.6		18.5	0.0
150.0	5.9	0.7	573.0	572.3	10.0	582.3		27.8	1.9
250.0	6.5	4.5	572.4	567.9	10.0	577.9		64.8	29.2
500.0	9.8	2.9	569.1	566.2	7.0	573.2		64.8	26.9
750.0	13.3	1.0	565.6	564.6	5.0	569.6		46.3	9.3
1000.0	15.0	0.0	563.9	563.9	4.0	567.9		37.0	0.0
1250.0	15.9	2.6	563.0	560.4	3.0	563.4		27.8	24.1
1500.0	16.9	2.9	562.0	559.1	3.0	562.1		27.8	26.9
1750.0	20.3	1.8	558.6	556.8	2.0	558.8		18.5	16.7
2000.0			578.9	578.9		578.9		0.0	0.0
0.0			578.9	578.9		578.9		0.0	0.0
0.0			578.9	578.9		578.9		0.0	0.0
0.0									
							TOTAL	364.8	140.5
								CuYd/ft	CuYd/ft
								1975	1990

Note all measurements in feet

FIGURE 2

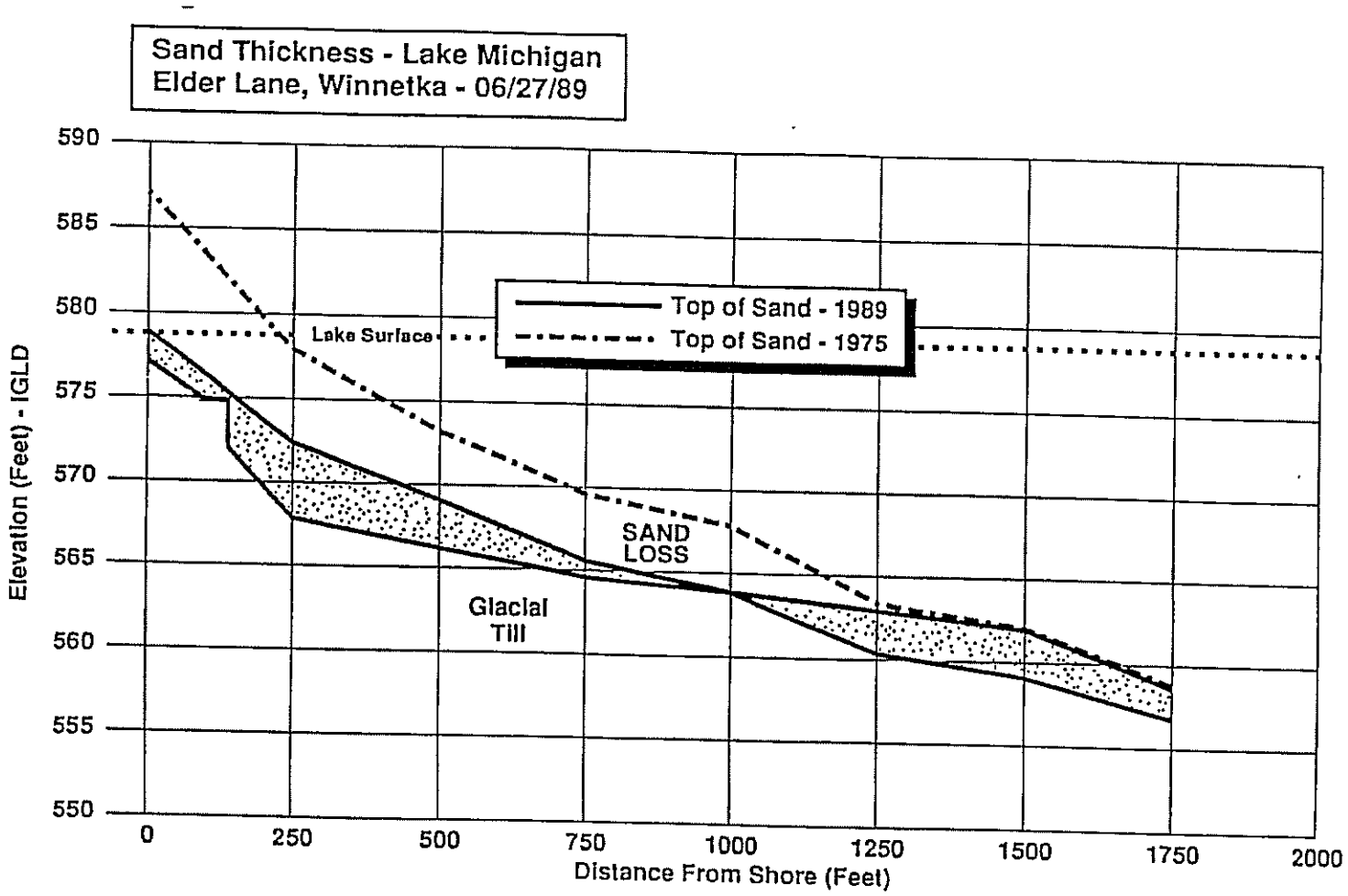
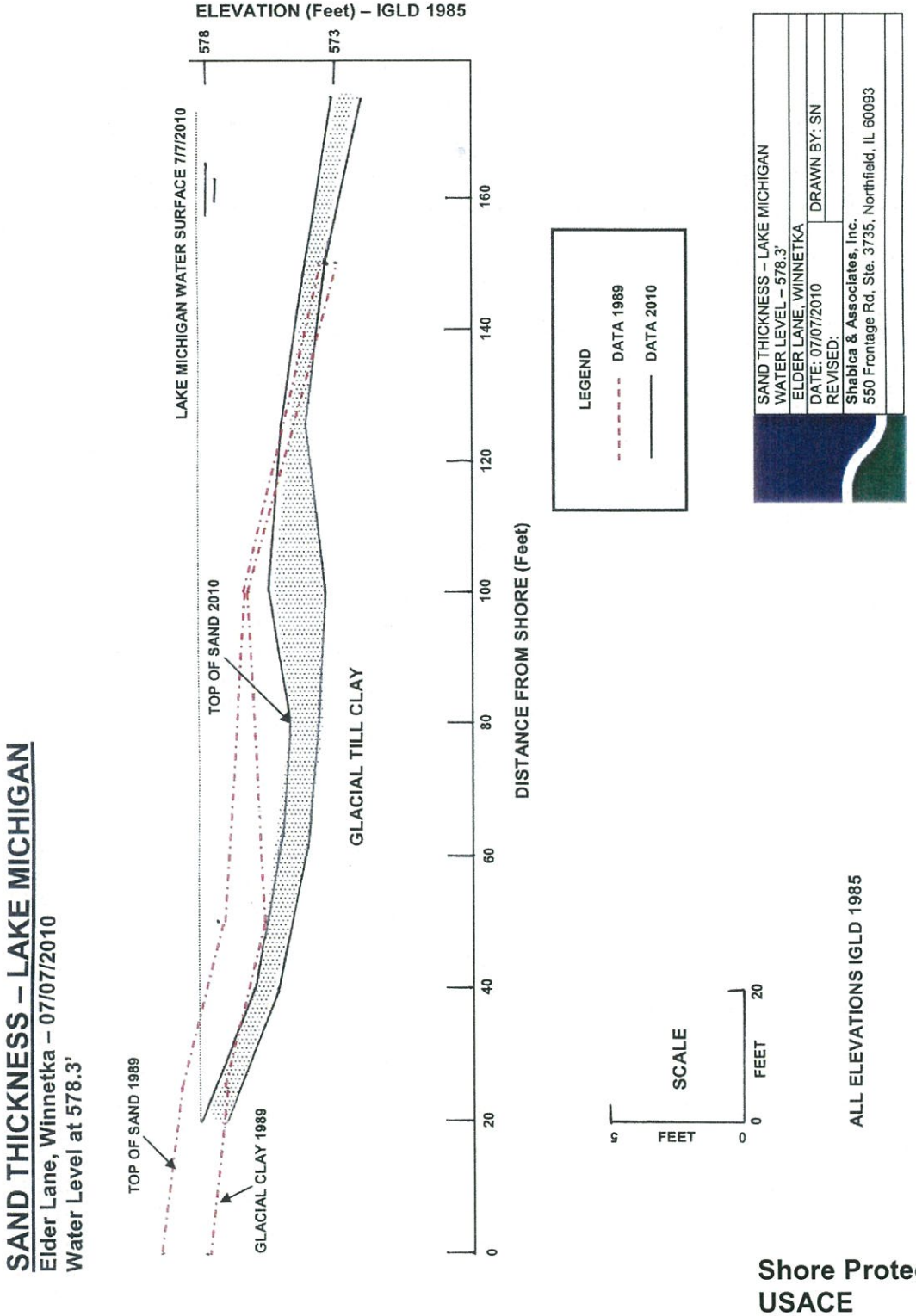

Sand Thickness - Lake Michigan
Elder Lane, Winnetka - 06/27/89
Top of Sand - 1989
Top of Sand - 1975
Lake Surface
SAND LOSS
Glacial Till
Elevation (Feet) - IGLD
590
585
580
575
570
565
560
555
550
0
250
500
750
1000
1250
1500
1750
2000
Distance From Shore (Feet)

FIGURE 3



Shore Protection Manual
USACE

Figure 4

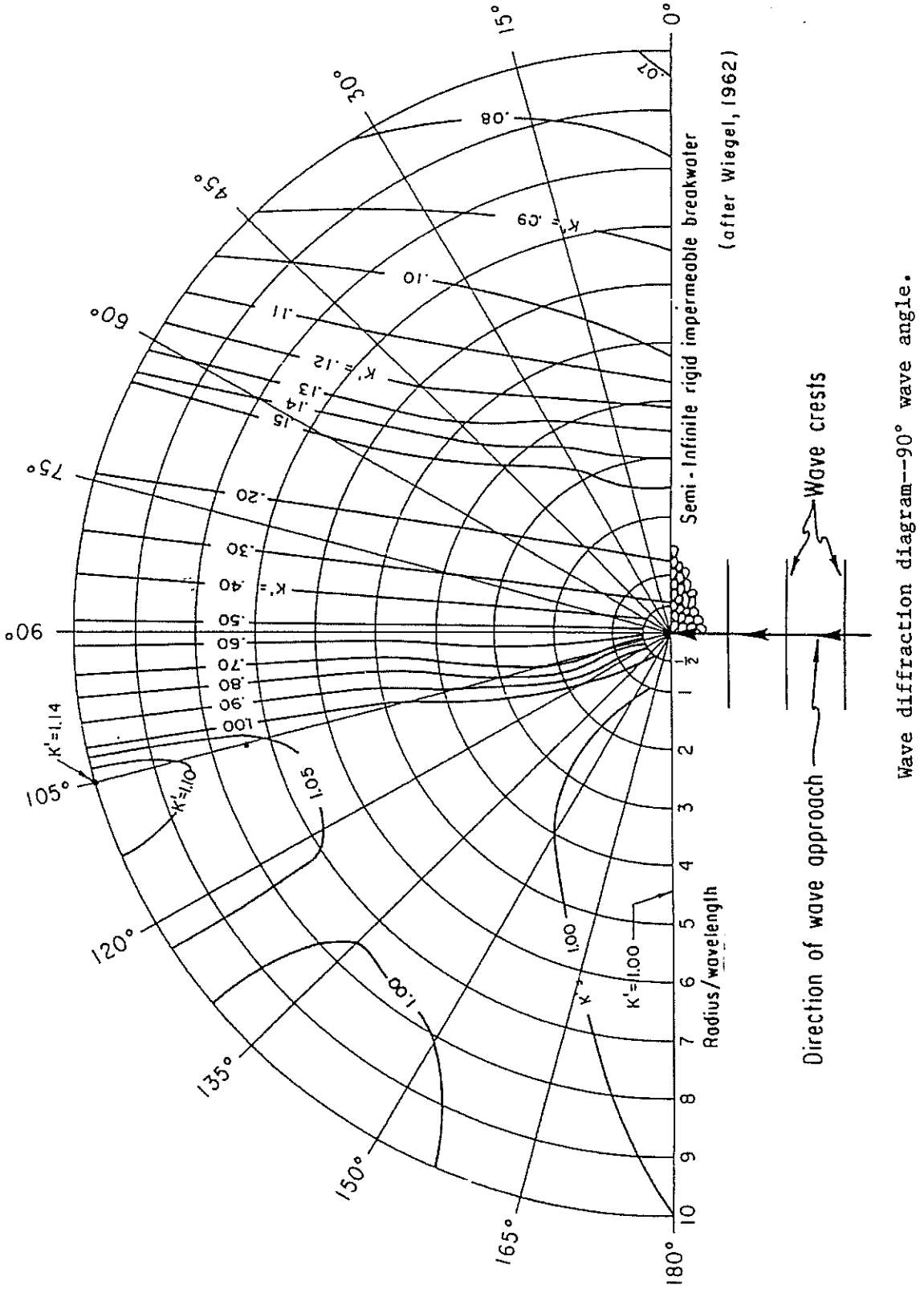
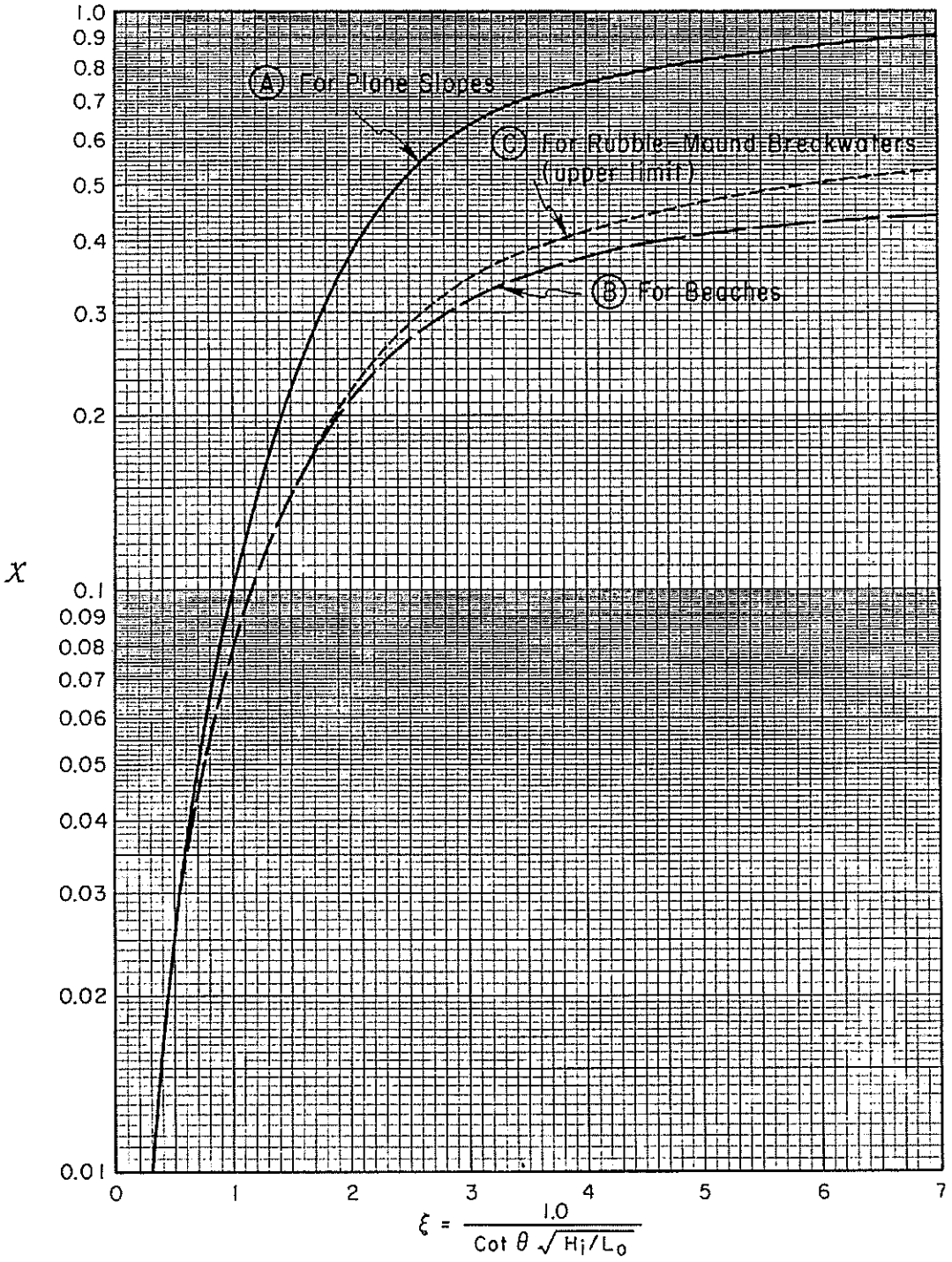

Wave diffraction diagram--90° wave angle.
Direction of wave approach
Wave crests
Semi-Infinite rigid impermeable breakwater
(after Wiegel, 1962)
Radius/wavelength
K'=1.00
K'=1.05
K'=1.10
K'=1.14
0°
15°
30°
45°
60°
75°
90°
105°
120°
135°
150°
165°
180°

FIGURE 5



Wave reflection coefficients for slopes, beaches, and rubble-mound breakwaters as a function of the surf similarity parameter ξ .

Shore Protection Manual USACE

JOINT APPLICATION FORM FOR ILLINOIS

ITEMS 1 AND 2 FOR AGENCY USE

1. Application Number	2. Date Received
C20150024	10/13/15

3. and 4. (SEE SPECIAL INSTRUCTIONS) NAME, MAILING ADDRESS AND TELEPHONE NUMBERS

3a. Applicant's Name:	3b. Co-Applicant/Property Owner Name (if needed or if different from applicant):	4. Authorized Agent (an agent is not required):
Joseph and Janet Nolan		Jon Shabica
Company Name (if any) :	Company Name (if any):	Company Name (if any): Shabica & Associates, Inc.
Address: 619 Sheridan Road Winnetka, Il 60093	Address:	Address: 550 Frontage Road Suite 3735 Northfield, IL 60093
Email Address:	Email Address:	Email Address:
Applicant's Phone Nos. w/area code	Applicant's Phone Nos. w/area code	Agent's Phone Nos. w/area code
Business:	Business:	Business:
Residence:	Residence:	Residence:
Cell:	Cell:	Cell:
Fax:	Fax:	Fax:

STATEMENT OF AUTHORIZATION

I hereby authorize, Shabica & Associates, Inc. to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

10/2/15
Date

5. ADJOINING PROPERTY OWNERS (Upstream and Downstream of the water body and within Visual Reach of Project)

Name	Mailing Address	Phone No. w/area code
a. see attached vicinity map		
b.		
c.		
d.		

6. PROJECT TITLE:
Breakwater-Protected Beach

7. PROJECT LOCATION:
609 Sheridan Road, Winnetka, IL 60093

LATITUDE: 42.10879 °N	UTMs
LONGITUDE: -87.72573 °W	Northing: 4662100.00
	Easting: 16T440000.00

STREET, ROAD, OR OTHER DESCRIPTIVE LOCATION	LEGAL DESCRIPT	QUARTER	SECTION	TOWNSHIP NO.	RANGE
619 Sheridan Road		NE	21	42N	13E

☒ IN OR ☐ NEAR CITY OF TOWN (check appropriate box) Municipality Name	WATERWAY	RIVER MILE (if applicable)
Winnetka	Lake Michigan	

COUNTY	STATE	ZIP CODE
Cook	IL	60093

Revised 2010

☐ Corps of Engineers ☐ IL Dep't of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy

8. PROJECT DESCRIPTION (Include all features):

A quarrystone revetment will be constructed along the existing seawall to match the seawall crest elevation of approximately 588' with a slope of 1:1. At the north end of the revetment, the stone will continue lakeward encapsulating the existing steel groin. The stone crest will run abutting and south of the property line. The steel groin will be cut down as necessary to become encapsulated in stone. This section of breakwater will have a crest elevation of 588' landward tapering to 584' lakeward. At the lakeward end of the groin and not more than 125' east of the existing seawall, a breakwater extension will be constructed extending to the south approximately 60' to the toe. The breakwater will have a slope of 1:1.5 with a crest elevation of 584'. As required by the IDNR, 1,600 tons of clean sand will be placed.

9. PURPOSE AND NEED OF PROJECT:

To stabilize the site as well as reduce deepening of the lakebed caused by lakebed erosion.

COMPLETE THE FOLLOWING FOUR BLOCKS IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

10. REASON(S) FOR DISCHARGE:

Shore protection in the form of a breakwater-protected beach.

11. TYPE(S) OF MATERIAL BEING DISCHARGED AND THE AMOUNT OF EACH TYPE IN CUBIC YARDS FOR WATERWAYS:

TYPE: Stone and Sand

AMOUNT IN CUBIC YARDS:

Sand: 1220 cu. yds Stone: 750 cu. yds

12. SURFACE AREA IN ACRES OF WETLANDS OR OTHER WATERS FILLED (See Instructions)

0.072acres

13. DESCRIPTION OF AVOIDANCE, MINIMIZATION AND COMPENSATION (See instructions)

The project is designed to incorporate existing structures into the design. Work will be completed via barge on Lake Michigan and machinery working from the becah to reduce impacts to water quality (bluff disturbance).

14. Date activity is proposed to commence June 1, 2016			Date activity is expected to be completed July 25, 2016	
15. Is any portion of the activity for which authorization is sought now complete? Month and Year the activity was completed	Yes ☐	No ☒	NOTE: If answer is "YES" give reasons in the Project Description and Remarks section. Indicate the existing work on drawings.	

16. List all approvals or certification and denials received from other Federal, interstate, state, or local agencies for structures, construction, discharges or other activities described in this application.

Issuing Agency	Type of Approval	Identification No.	Date of Application	Date of Approval	Date of Denial

17. CONSENT TO ENTER PROPERTY LISTED IN PART 7 ABOVE IS HEREBY GRANTED. Yes ☒ No

18. APPLICATION VERIFICATION (SEE SPECIAL INSTRUCTIONS)

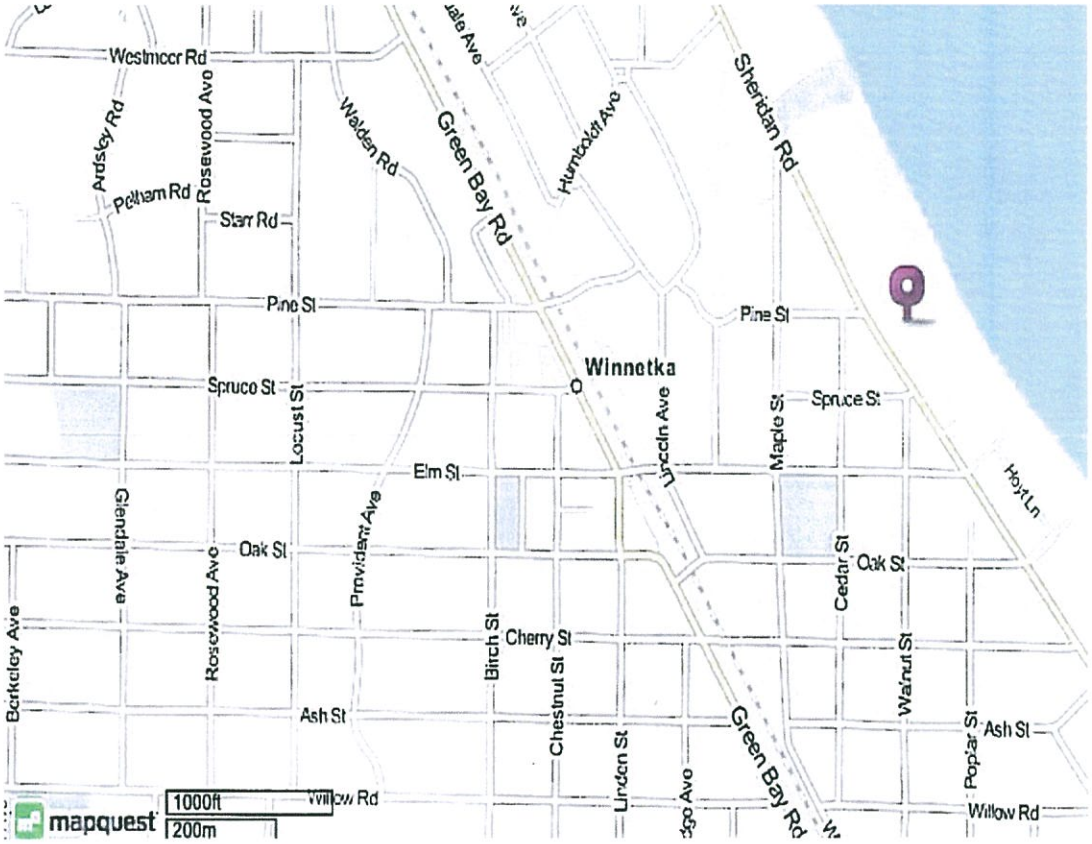
Application is hereby made for the activities described herein. I certify that I am familiar with the information contained in the application, and that to the best of my knowledge and belief, such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

Signature of Applicant or Authorized Agent	10/6/2015 Date
Signature of Applicant or Authorized Agent	Date
Signature of Applicant or Authorized Agent	Date

☐ Corps of Engineers Revised 2010 ☐ IL Dep't of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy

SEE INSTRUCTIONS FOR ADDRESS

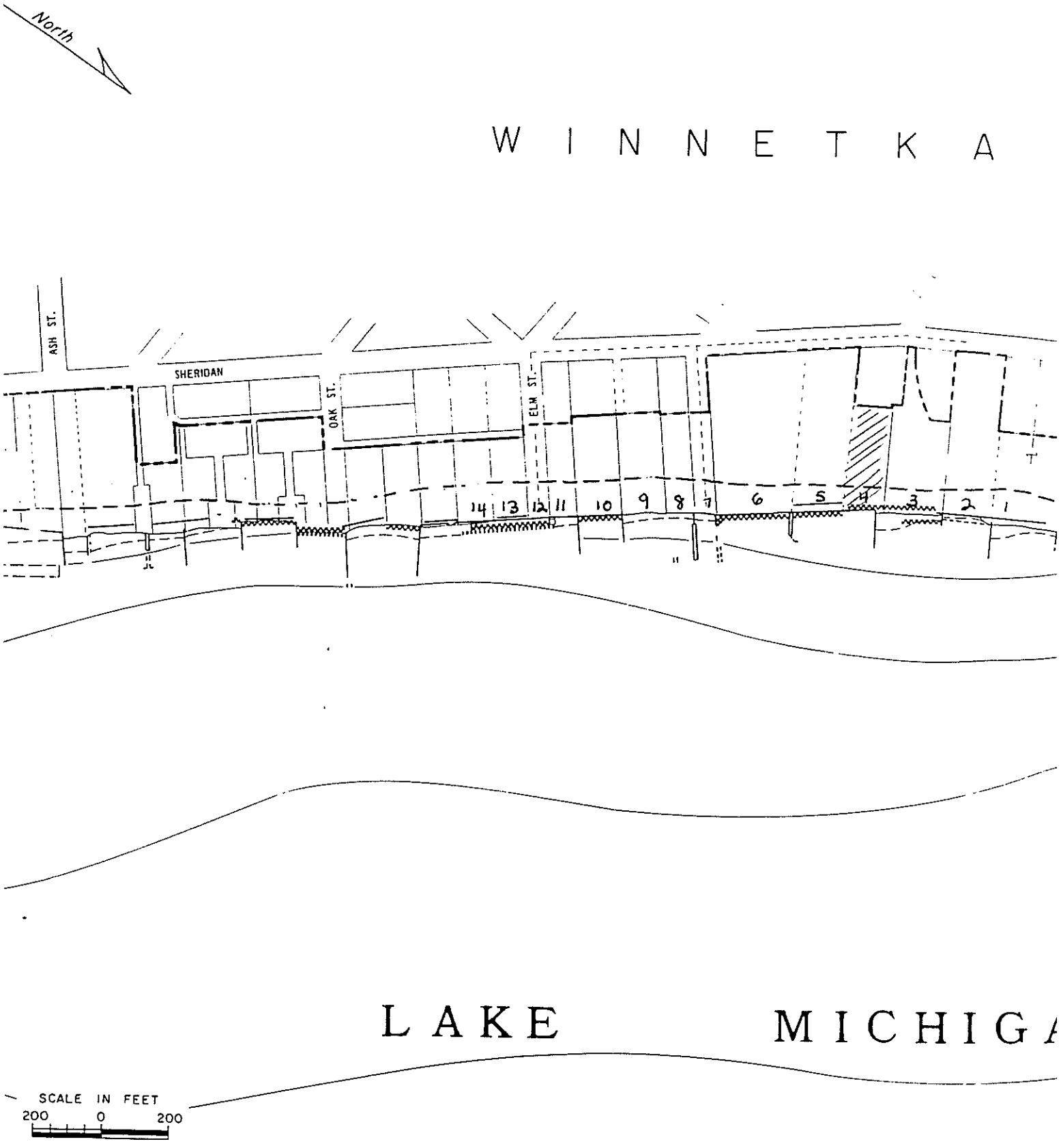
Vicinity Map



Breakwater-Protected Beach

619 Sheridan Road
Winnetka, IL 60093

NCR FORM 426
10 AUG 95

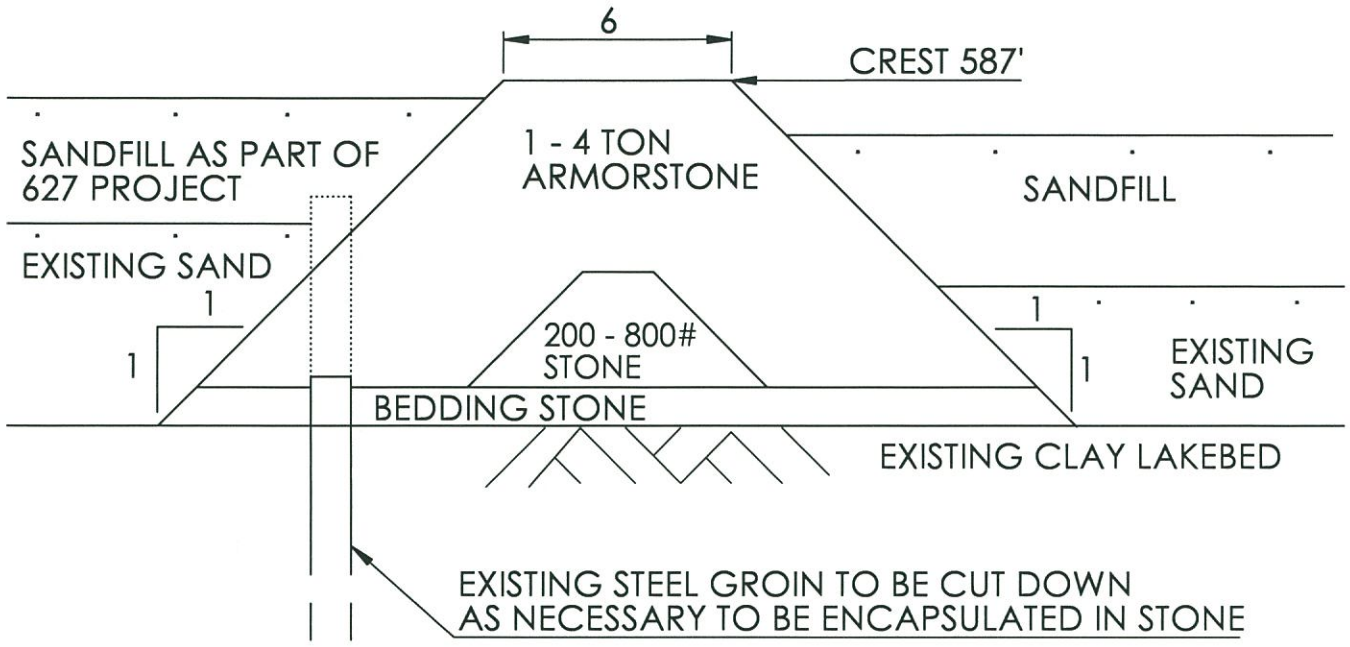

North
WINNETKA
ASH ST.
SHERIDAN
OAK ST.
ELM ST.
14 13 12 11 10 9 8 7 6 5 4 3 2 1
LAKE MICHIGA
SCALE IN FEET
200 0 200

Shabica & Associates, Inc.
WE BUILD BEACHES

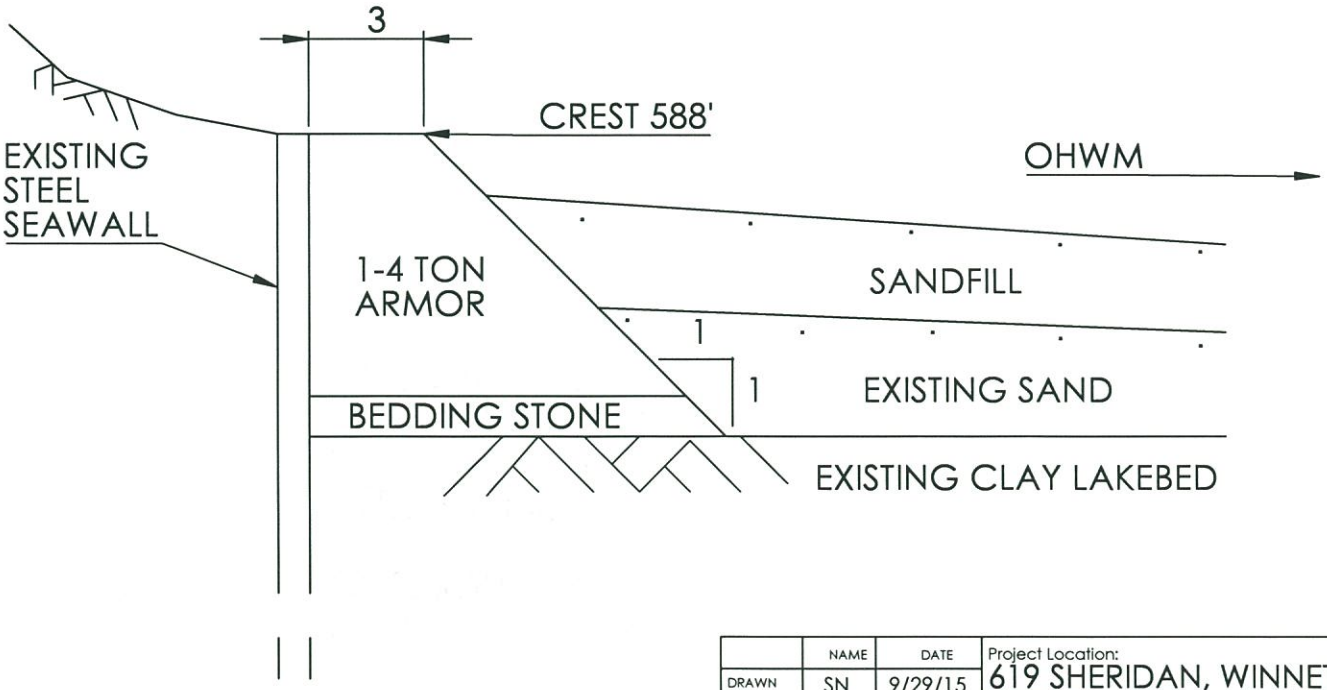
Title:	Construction of a quarrystone breakwater along Lake Michigan Joseph and Janet Nolan 619 Sheridan Road Winnetka, Illinois 60093
Submittal Date:	October 5, 2015
Plan Sheets:	2015.9.28 Nolan Plan View Over Bathymetry – Sheet 1 of 6 2015. 9.29 Nolan Breakwater Section – Sheet 2 of 6 2015. 9.29 Nolan Cross Sections – Sheet 3 of 6 2015. 9.29 Nolan Beach Profile – Sheet 4 of 6 2015. 9.28 Nolan Plan View • Sand – Sheet 5 of 6 2015. 9.29 Nolan Sand Calculations – Sheet 6 of 6

550 Frontage Road • Suite 3735 • Northfield, Illinois 60093 • Tel 847.446.1436 • Fax 847.716.2007
www.shabica.com

GROIN ENCAPSULATION - CROSS SECTION A-A



REVETMENT - TYPICAL CROSS SECTION



5'

SCALE

	NAME	DATE
DRAWN	SN	9/29/15
CHECKED	JS	9/29/15

COMMENTS:

DIMENSIONS ARE IN FEET
TOLERANCES: +.5', -1'
ALL ELEVATIONS IN
IGLD 1985

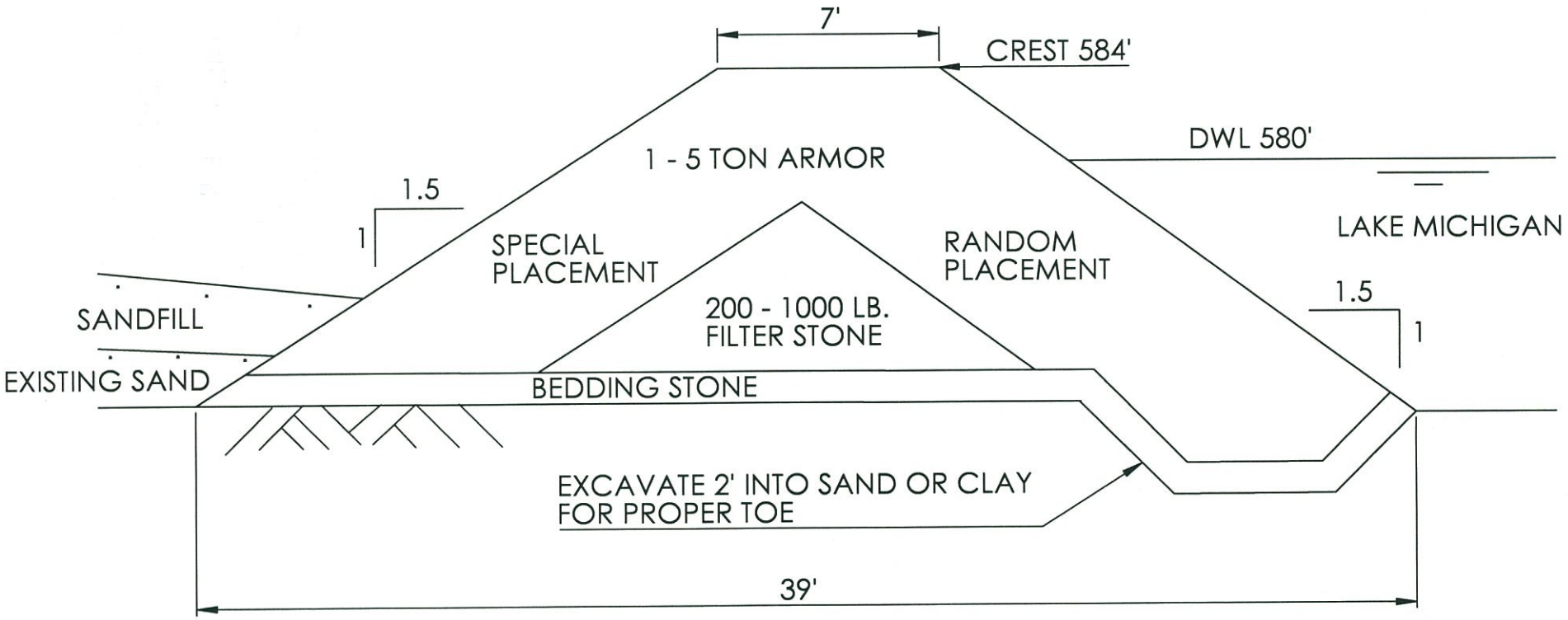
Project Location:
619 SHERIDAN, WINNETKA, IL

Shabica & Associates, Inc.
550 Frontage Rd., Suite 3735
Northfield, Illinois 60093
847-446-1436
www.shabica.com

SIZE A | CROSS SECTIONS | REV.

SCALE 1"=5' | SHEET 3 OF 6

BREAKWATER - TYPICAL CROSS SECTION



5'
SCALE

	NAME	DATE
DRAWN	SN	9/29/15
CHECKED	JS	9/29/15

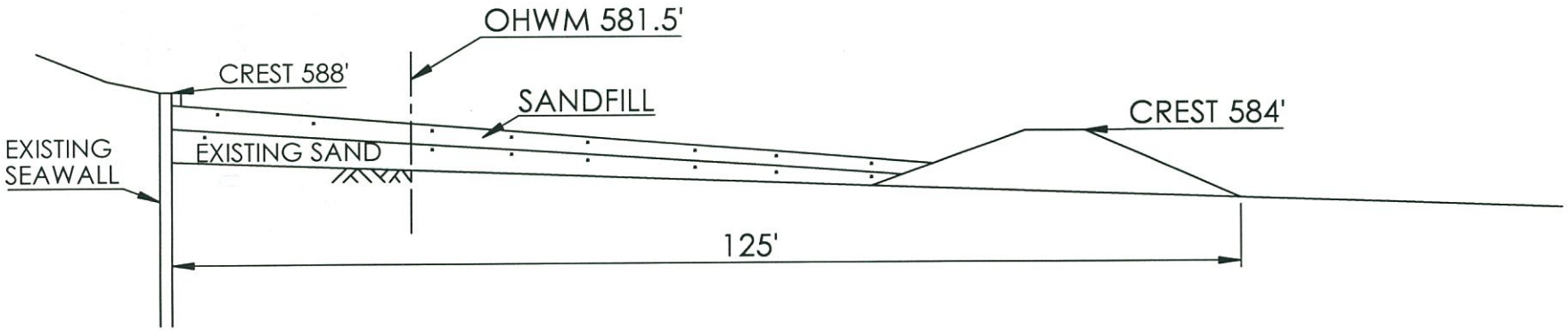
COMMENTS:
DIMENSIONS ARE IN INCHES
TOLERANCES: +.5', -1.0'
ALL ELEVATIONS IN IGLD1985

Project Location:
619 SHERIDAN RD, WINNETKA, IL

Shabica & Associates, Inc.
550 Frontage Rd., Suite 3735
Northfield, Illinois 60093
www.shabica.com

SIZE A | BREAKWATER SECTION | REV

PROFILE THROUGH BEACH: B-B



20'

SCALE

	NAME	DATE
DRAWN	SN	9/29/15
CHECKED	JS	9/29/15

COMMENTS:

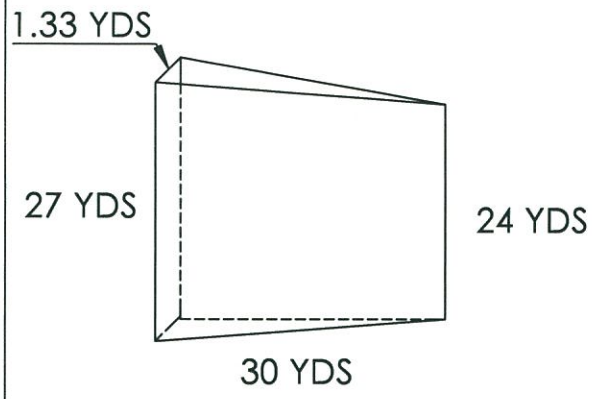
DIMENSIONS ARE IN INCHES
TOLERANCES: +.5', -1.0'
ALL ELEVATIONS IN IGLD1985

Project Location:
619 SHERIDAN RD, WINNETKA, IL

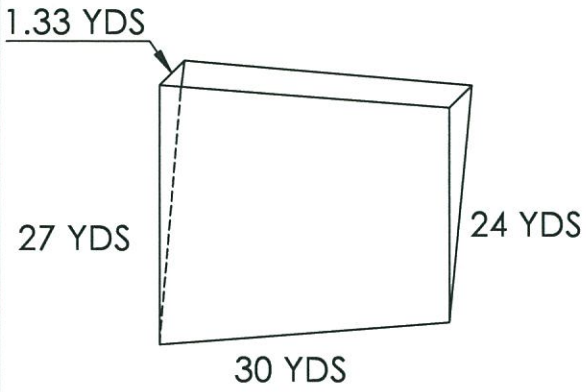
Shabica & Associates, Inc.
550 Frontage Rd., Suite 3735
Northfield, Illinois 60093
www.shabica.com

SIZE A | BEACH PROFILE | REV

SAND CALCULATIONS



$$\frac{25.5\text{YDS} \times 30\text{YDS} \times 1.33\text{YDS}}{2} = 509\text{YDS}$$



$$\frac{25.5\text{YDS} \times 30\text{YDS} \times 1.33\text{YDS}}{2} = 509\text{YDS}$$

509YDS + 509YDS = 1018YDS

1018 YDS X 1.25 YDS/TON = 1272 TONS

1272 TONS X 20% (OVERFILL) = 254 TONS

1272 TONS + 254 TONS = 1526 TONS

PLACE 1600 TONS OF CLEAN SAND

	NAME	DATE
DRAWN	SN	9/29/15
CHECKED	JS	9/29/15

COMMENTS:

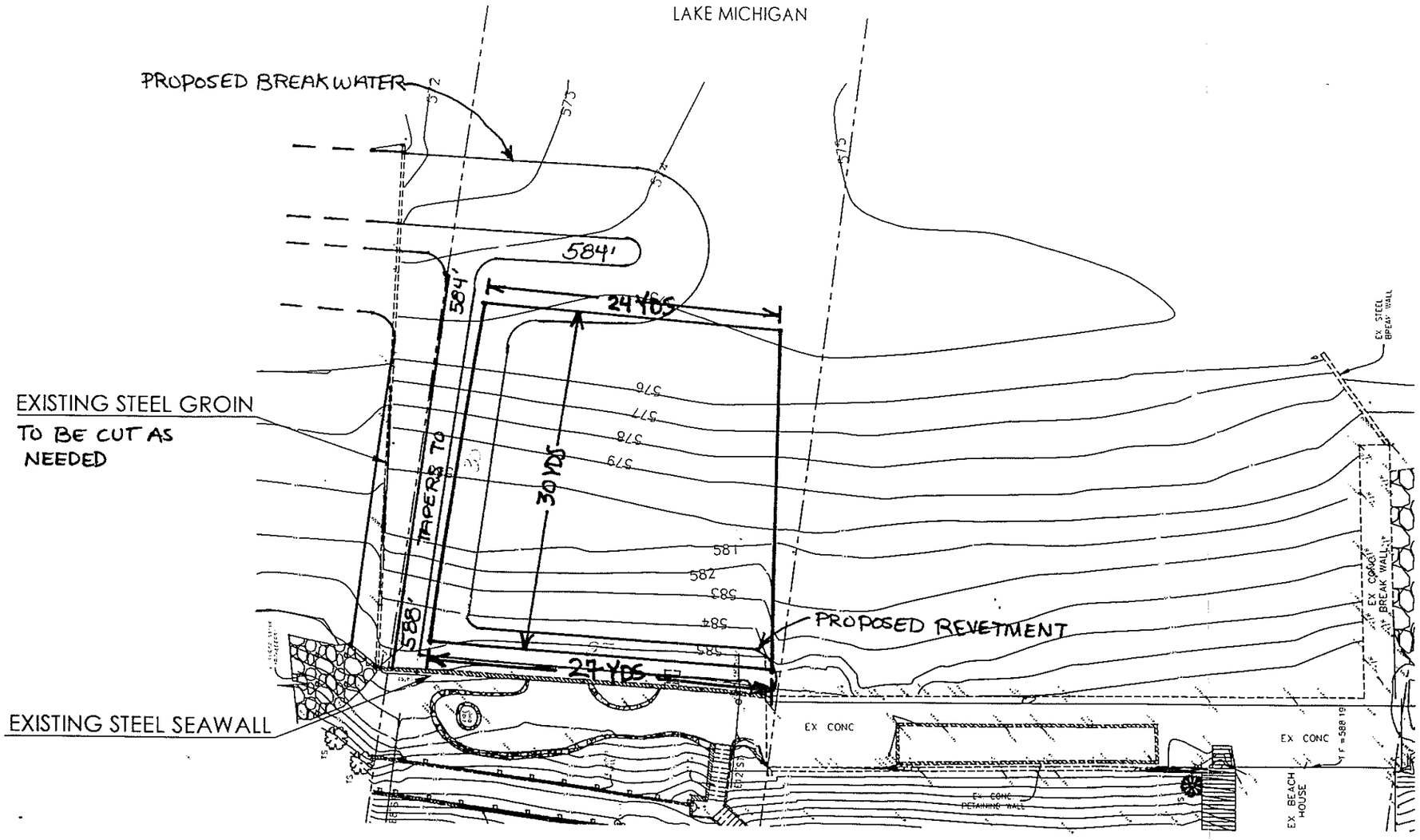
DIMENSIONS ARE IN FEET
TOLERANCES: +.5', -1'
ALL ELEVATIONS IN
IGLD 1985

Project Location:
619 SHERIDAN RD, WINNETKA, IL

Shabica & Associates, Inc.
550 Frontage Rd., Suite 3735
Northfield, Illinois 60093
847-446-1436
www.shabica.com

SIZE A | SAND CALCULATIONS | REV.

SCALE 1"=5' | SHEET 6 OF 6



0 FEET 30
SCALE

	NAME	DATE
DRAWN	SN	9/28/15
CHECKED		

PROPRIETARY AND CONFIDENTIAL

THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF SHABICA & ASSOCIATES. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF SHABICA & ASSOCIATES IS PROHIBITED.

COMMENTS:

DIMENSIONS ARE IN FEET
TOLERANCES: ± .5'
ALL ELEVATIONS IN IGLD 1985

Project Location:
619 SHERIDAN RD, WINNETKA, IL

Shabica & Associates, Inc.
550 Frontage Rd., Suite 3735
Northfield, Illinois 60093
847-446-1436
www.shabica.com

SIZE B

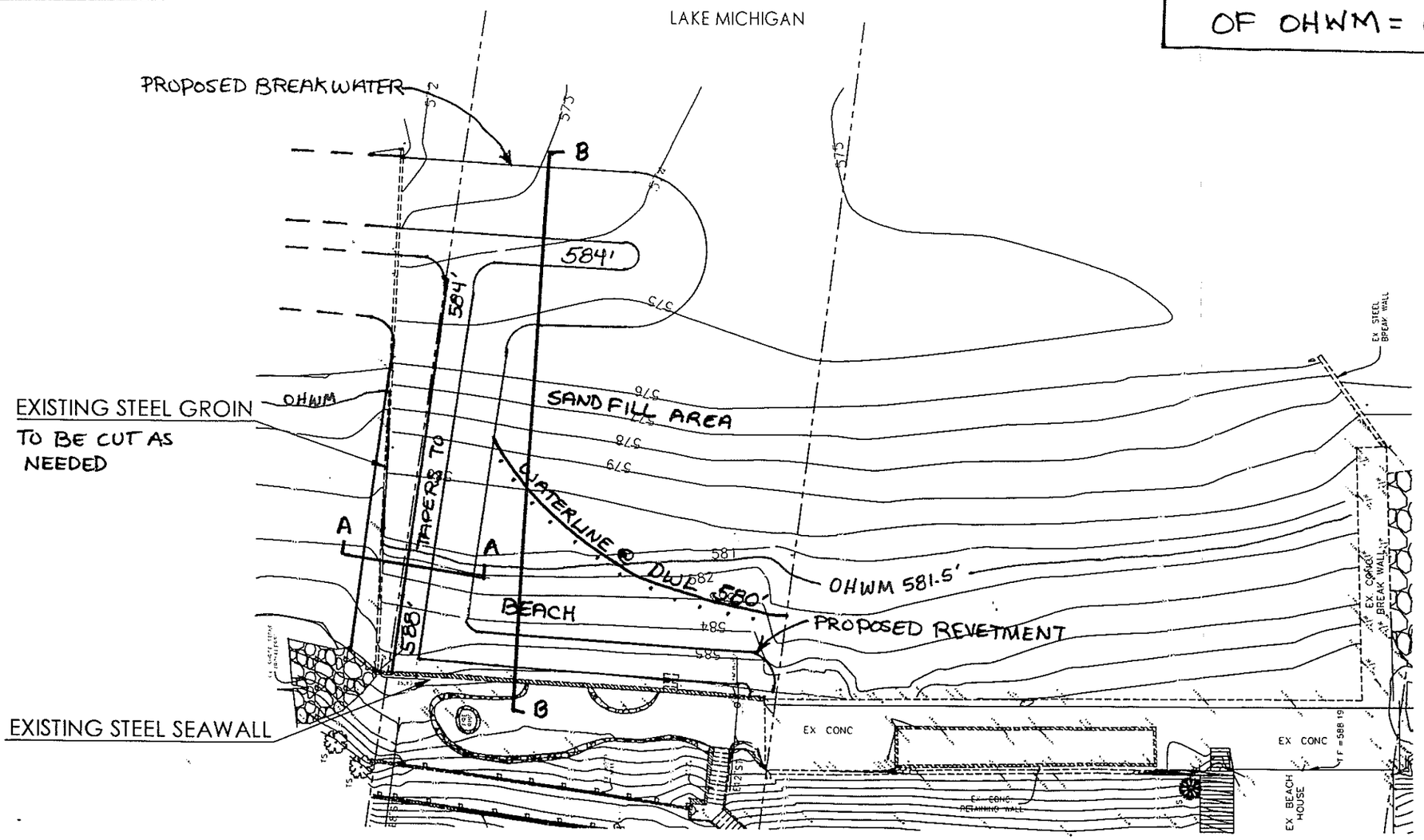
PLAN VIEW- SAND

REV

SHEET 5 OF 6

PLAN VIEW

ACREAGE OF FILL LAKEWARD OF OHWM = 0.072 ACRES



0 FEET 30
SCALE

	NAME	DATE
DRAWN	SN	9/28/15
CHECKED		

COMMENTS:

DIMENSIONS ARE IN FEET
TOLERANCES: +.5', -1'
ALL ELEVATIONS IN IGLD 1985

Project Location:
619 SHERIDAN RD, WINNETKA, IL

Shabica & Associates, Inc.
550 Frontage Rd., Suite 3735
Northfield, Illinois 60093
847-446-1436
www.shabica.com

SIZE B

PLAN VIEW OVER BATHYMETRY

REV

LAKE MICHIGAN

ACREAGE OF FILL LAKEWARD OF THE OHWM = .13 ACRES

PROPOSED BREAKWATER

t/w 581.71

EXISTING STEEL GROIN TO BE CUT DOWN AS NEXCESSARY AND ENCAPSULATED IN STONE

584'

584'

584'

125'

SANDFILL AREA

SAND FILL AREA

TAPERS TO

12'

OHWM 581.5'

t/w 583.42

WATERLINE AT DWL 580'

WATERLINE @ DWL 580'

OHWM 581.5'

EXISTING STEEL GROIN

BEACH

BEACH

PROPOSED REVETMENT

APPROXIMATE STAIR LOCATION

588'

t/w 585.57

EXISTING REVETMENT

645 SHERIDAN

EXISTING DECK AND STAIRS

627 SHERIDAN

619 SHERIDAN

609 SHERIDAN

EX CONC

EX CONC

EX STEEL & CONCR BREAK WALL

30'

SCALE

PROPRIETARY AND CONFIDENTIAL

THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF SHABICA & ASSOCIATES. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF SHABICA & ASSOCIATES IS PROHIBITED.

	NAME	DATE
DRAWN	SN	10/6/2015
CHECKED	JS	10/7/15
REVISED	SN	1/28/16

COMMENTS:

DIMENSIONS ARE IN FEET
TOLERANCES: +.5', -1'
ALL ELEVATIONS IN IGLD 1985

Project Location:
619 & 627 SHERIDAN, WINNETKA

Shabica & Associates, Inc.
550 Frontage Rd., Suite 3735
Northfield, Illinois 60093
847-446-1436
www.shabica.com

SIZE **B**

PLAN VIEW OVER BATHYMETRY

REV

SHEET 1 OF 8