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

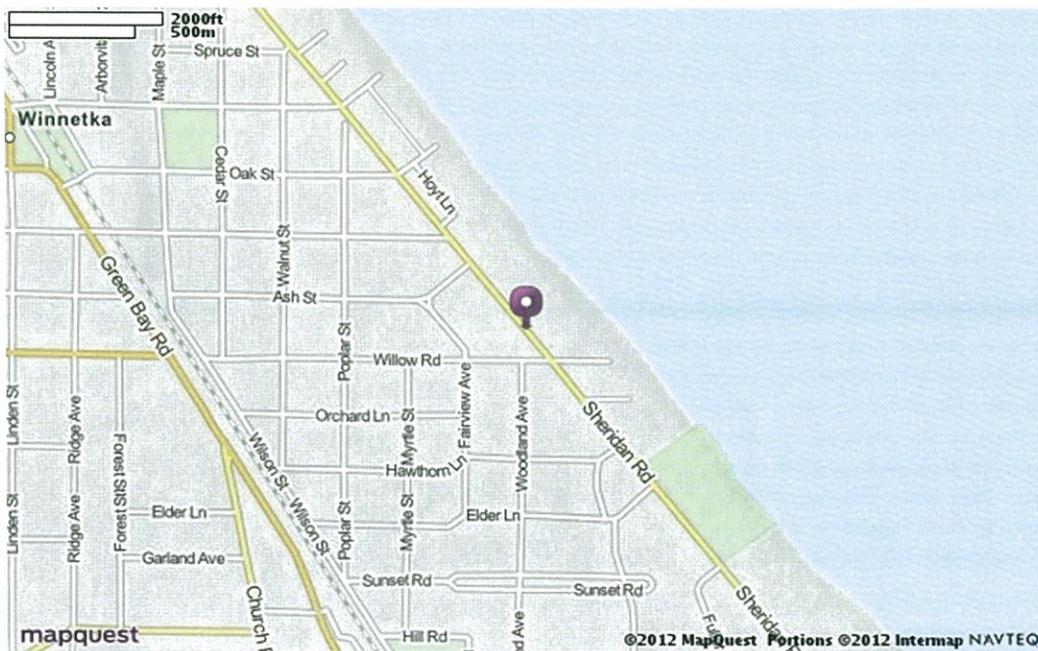
To Whom It May Concern:

May 22, 2015

In compliance with the Illinois Coastal Management Federal Consistency Review Procedures, we provide the following information for a proposed quarystone breakwater-protected beach for the properties located at 419 and 429 Sheridan Road, Winnetka, Illinois 60093, owned by Mr. Muneer Satter.

#### Location of Project

The proposed quarystone breakwater-protected beach will be built on the lakefront of the properties located at 419 and 429 Sheridan Road, Winnetka, Illinois 60093, owned by Mr. Muneer Satter.



### **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 November 1, 2015. This work will require approximately 12 weeks to complete.

### **Extent of Work to be Conducted**

The shoreline stabilization will be comprised of softening the two existing steel groins with stone. No work will be done further than 125' east of the existing concrete seawall. The existing north groin at 429 Sheridan Road will be lined with stone along the south side of the groin only with a spur breakwater extending to the southeast. North of the 419 south property line, a similar breakwater mirroring the north will be constructed over the existing steel groin. The breakwaters will have a crest elevation of 589' landward tapering to 583' at the lakeward ends (IGLD 1985 datum). The breakwaters will curve together on the east leaving a 77' wide gap (toe to toe). The slope of the breakwaters at the lakeward portion will be 1v:1.5h. Once they are more perpendicular to shore, the slope will be changed to 1:1. Quarrystone steps will be installed on both structures to provide pedestrian access over the breakwaters. Approximately 1,700 cu. yds of clean sand will be placed as required by the IDNR.

The proposed system is designed to help retain the sandy beach, move the locus of wave energy further offshore, help reduce lakebed downcutting, and provide safe access for pedestrians to Lake Michigan. The proposed work does not extend east to the barge scar location as it goes beyond the limits of new construction set by the IDNR.

### **Contact Information**

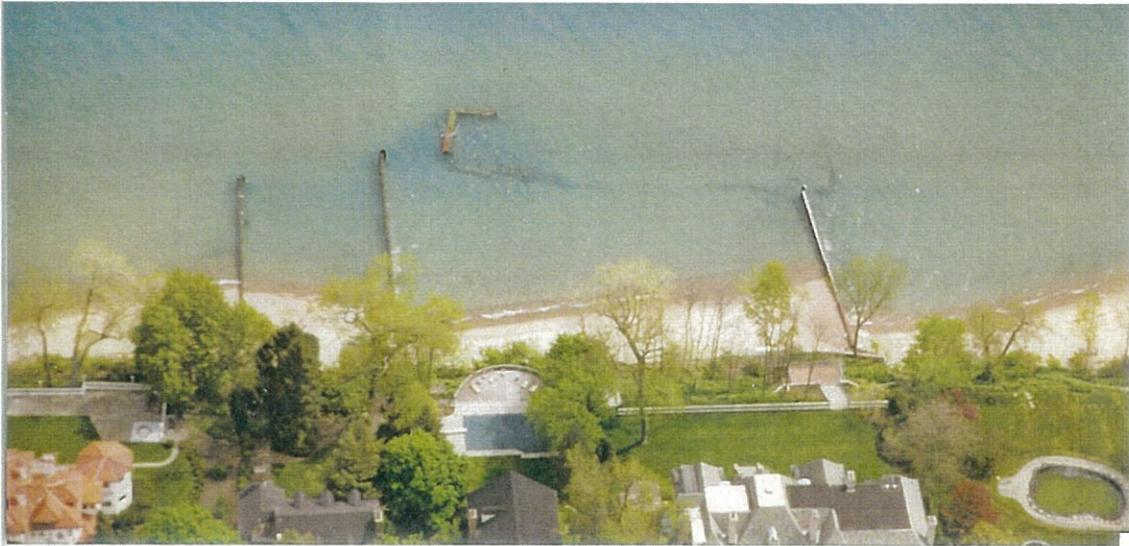
All questions pertaining to this project can be submitted to:

Jon Shabica  
Shabica & Associates, Inc.  
550 Frontage Road, Suite 3735  
Northfield, IL 60093  
[jon@shabica.com](mailto: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  
Managing Director



1997 Aerial Photograph showing the sunken barge



2007 Google Earth Photo; see approximate property lines and submerged barge



Shabica & Associates, Inc.  
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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

RECEIVED  
MAY 27 2015

OFFICE OF WATER RESOURCES  
DIVISION OF RESOURCE MANAGEMENT

Dear Ms. Chernich:

May 22, 2015

Please find enclosed a modified permit application for shore protection for the properties located at 419 and 429 Sheridan Road, Winnetka, Illinois 60093, owned by Mr. Muneer Satter. The shoreline stabilization will be comprised of softening the two existing groins with stone. The existing north groin at 429 Sheridan Road will be lined with stone along the south side of the groin only. A spur breakwater will be installed extending only to 125' offshore from the existing seawall to help dissipate wave energy and to narrow the gap between the two breakwaters. The existing south groin at 419 Sheridan Road will be torch cut to a lower elevation and encapsulated with stone to create a breakwater mirroring the one on the north groin. The quarystone breakwaters are designed to help reduce incident wave energy from eroding the sand and clay lakebed, to create a sustainable sand cover over the clay lakebed which reduces lakebed downcutting (deepening of the water) and helps to improve water quality caused by colloidal fines from the eroding clay being suspended in the water during storms.

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 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 and will be conducted in a manner consistent with such policies.

#### **Project Purpose Statement**

Mr. Satter has retained Shabica & Associates (SA) to help stabilize the existing beach on the Lake Michigan coastline at 419 and 429 Sheridan Road, Winnetka. The property currently has an older concrete seawall, two steel groins and a variable beach lakeward.

In 1987, the shoreline was protected by a sunken barge installed by the previous homeowner during higher lake levels. While the installation of the barge was authorized by the U.S. Army Corps of Engineers, it was never permitted by the Illinois Department of Natural Resources and was considered a violation. After careful review and scrutiny by the state regulators, the homeowner was allowed to keep the structure for the purpose of serving as shore protection and was not required by state or federal regulators to remove it.

In 2009, the current homeowner, Mr. Satter, removed the barge as continued deterioration was becoming a safety and environmental liability. The removal of the barge was approved by the state and federal regulators (permit by Paul Kakuris). Immediately after the barge was removed, the beach began to fluctuate and erode during average lakestorms. While the beach has remained intact with the prolonged low lake level over the past

few years, the sand elevation has deflated tremendously. A lakebed depression scar at the previous location of the barge has contributed to the exacerbated erosion causing deeper water, thereby allowing larger waves to be concentrated in this area. At the current average lake level, there have been stormwaves impacting the base of the existing concrete seawall at the toe of the bluff. The October 31, 2014 (Halloween) storm, with storm surges exceeding 2 feet and record winds and waves, did extensive damage to southern Lake Michigan shorelines. With a new understanding of the consequences of climate change, forecasters predict more frequent storms of high intensity and coastal damage.

With the water depth offshore, the loss of sand in the nearshore system, the recent deflation of the beach, and the inability of the steel groins to dissipate wave energy, it is necessary to install a shore protection system that will help to prevent additional erosion to the lakebed and beach during all lake levels. Working with the homeowner, SA designed a system that utilizes the existing groins as a foundation for a quarystone breakwater system.

### **PROJECT DESCRIPTION**

The shoreline stabilization will be comprised of softening the two existing steel groins with stone. No work will be done further than 125' east of the existing concrete seawall. The existing north groin at 429 Sheridan Road will be lined with stone along the south side of the groin only with a spur breakwater extending to the southeast. North of the 419 south property line, a similar breakwater mirroring the north will be constructed over the existing steel groin. The breakwaters will have a crest elevation of 589' landward tapering to 583' at the lakeward ends (IGLD 1985 datum). The breakwaters will curve together on the east leaving a 77' wide gap (toe to toe). The slope of the breakwaters at the lakeward portion will be 1v:1.5h. Once they are more perpendicular to shore, the slope will be changed to 1:1. Quarystone steps will be installed on both structures to provide pedestrian access over the breakwaters. Approximately 1,700 cu. yds of clean sand will be placed as required by the IDNR.

The proposed system is designed to help retain the sandy beach, move the locus of wave energy further offshore, help reduce lakebed downcutting, and provide safe access for pedestrians to Lake Michigan. The proposed work does not extend east to the barge scar location as it goes beyond the limits of new construction set by the IDNR.

### **Coastal Geology**

This section of coastline has historically lost sand due to lakebed downcutting especially during prolonged periods of low lake levels. Nearshore sand deposits are thin and less than one foot in some locations at this site (Figure 1, 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. While a narrow beach has been present at this site during higher lake levels, the small amount of sand held can be contributed to the presence of the barge which was removed in 2009. If ignored, the beach will continue to deflate even at the low lake level, the south steel groin may become destabilized leaving the seawall and bluff vulnerable to stormwaves and erosion.

One of the largest factors in determining the scope of a project is analyzing current lake levels and climactic conditions. Over the past year, larger-than-normal stormwaves have impacted the shoreline of Lake Michigan, despite the lower lake levels that have been seen in the past few years. Changes in weather patterns and lake levels affect the intensity of storms. Unfortunately, it is not possible to predict future Lake Michigan lake levels and how the changing lake levels will impact the shoreline. The **Illinois State Water Survey, Prairie Research**

Institute report on *Potential Impacts of Climate Change on Water Availability* ([http://www.isws.illinois.edu/iswsdocs/wsp/climate\\_impacts\\_012808.pdf](http://www.isws.illinois.edu/iswsdocs/wsp/climate_impacts_012808.pdf)) states that:

*“Scientists cannot predict future Illinois climatic conditions with confidence. The historical climate and hydrological records since the nineteenth century show that climate has changed significantly in the past and, even without human interference, could change significantly in the future.”*

The Illinois State Water Survey goes on to graph future precipitation models, illustrating conditions that are wetter or drier than previous historic extremes. Either scenario is likely to cause loss of property due to stormwave erosion from either lakebed downcutting and/or larger stormwaves. If dryer conditions are experienced, Lake Michigan will continue to reside at or around the current low lake level and the lakebed profile will steepen due to wave-induced erosion of the glacial clay till. This steeper, nearshore lakebed profile will allow larger waves to form (see attached USACE Shore Protection Manual diagram illustrating “Dimensionless design breaker height versus relative depth at structure”). The USACE chart shows that an increased slope of the lakebed will produce larger breaking waves. On the other hand, if wetter conditions are experienced, the impacts of increased lake levels will also be seen quickly, because deeper water allows larger waves to form.

### Design Options

The site at 419 and 429 Sheridan Road, Winnetka has been inspected and options for shore protection were determined using desktop coastal engineering, site conditions from 2009, bathymetric surveys from 2012, and more than 2 decades of observations of the shoreline conditions with and without the barge breakwater at this site. Given the beach erosion to the shoreline since the removal of the barge and during below-average 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 land erosion. These four options were considered:

#### OPTION 1

##### *Do Nothing –*

The first option of “Do Nothing” results in leaving the currently eroding beach in its existing state. Without the protection of the removed barge, the beach has frequently been severely eroded with evidence of wave action nearing the seawall. This condition exists now during extremely low lake levels. Continued deflation of the beach will allow stormwaves to impact and overtop the existing seawall at current lake levels and will cause increased vulnerability of the seawall and bluff during high lake levels. Current lakebed clay elevations at the lakeward end of the south groin may lead to destabilization of the groin by ice.

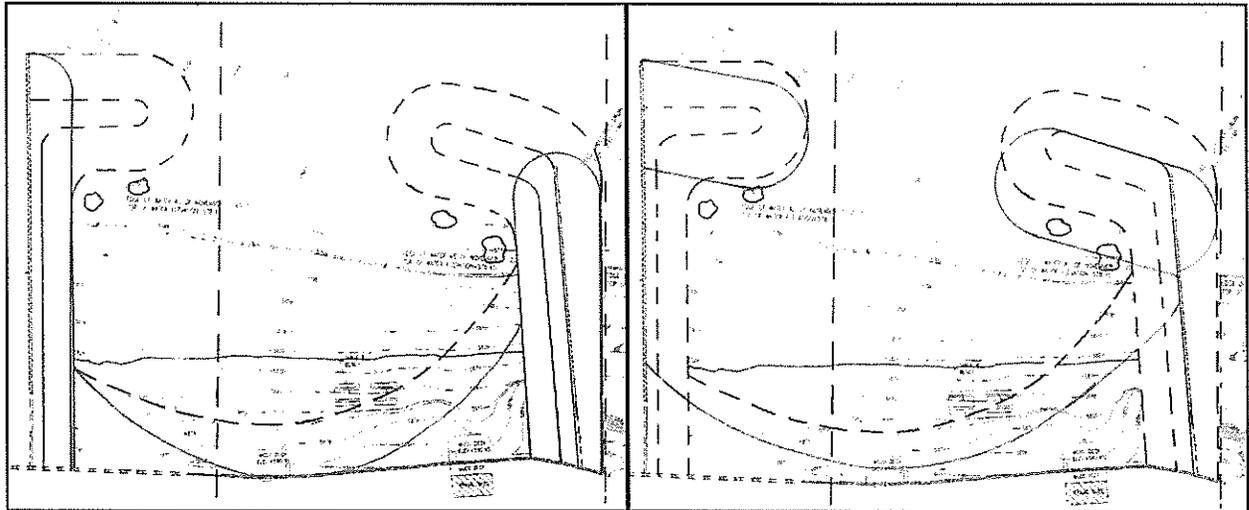
#### OPTION 2

##### *Encapsulate the Groins Only –*

By encapsulating the south side of the north groin and both sides of the south groin, both groins become more effective at dissipating wave energy and help to protect from toe scour at lakeward end. This option improves the ability of the groins to dissipate energy as well as help to hold sand within the system. However, as this option *does not* include breakwater spurs at the end the groins, the gap between the north and south groins remains too open to adequately protect the bluff of the two sites from erosion. Additionally, the deeper lakebed clay in the previous barge location will allow for larger stormwave impact and the deeper lakebed clay will continue to erode immediately west of the scar until the lakebed reaches a deeper equilibrium. *See illustration below.*

**OPTION 3****Close the Gap Only –**

This option includes installing two shore parallel breakwaters in-line with the groins to close off the system, but does not include encapsulating the steel groins in stone. By installing two shore parallel breakwaters, the gap will be narrowed between the two groins leaving the landward portions of the steel groins exposed. This option would help to hold a beach in the littoral cell, however the deeper water in the location of the barge scar, along with lakebed downcutting, would reduce the effectiveness and design-life of the structures due to the bigger waves overtopping and erosion of the lakebed at the structure toe. *See illustration below.*

**OPTION 2: Encapsulate the Groins****OPTION 3: Close the Gap**

Plans shown in red overlain on top of the proposed plan (dotted black)

**OPTION 4****Previous Preferred Option: Encapsulate the Groins and Narrow the Gap –**

The previously preferred option is to extend the shore protection system lakeward within the profile of the previously removed barge and in-line with adjacent structures. This includes encapsulating the south steel groin in stone, extending it lakeward to be in-line with the groin to the north, and then extending the structure, shore parallel, to the north. Additionally, the north groin would be clad with stone on the south side with a short breakwater extension to the south. The structure will then be filled with sand. The system will not extend beyond the steel groin to the north or the steel groin two properties to the south. It will provide a system that remains in-line with existing structures in the vicinity and will be overfilled with pre-mitigational sand. This breakwater system will provide groin toe protection as well as reduce the gap between the breakwaters to help maintain a more stable beach cell system. 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 would help stabilize the sand on the adjacent beaches by reducing wave energy in the immediate area. This plan was abandoned as the IDNR revised their guidelines to allow projects to extend a maximum of 125' lakeward of the bluff toe or seawall.



great resilience to changing lake-levels and decreased sediment-supply. After an intense storm such as the storm on Halloween, 2014, pocket beach recovery is fast. Further, net sand loss and renourishment costs are lower than for unprotected beaches on open Great Lakes coasts. And finally, a diverse coastal ecosystem dominated by American Beach Grass and native species like Sea-Rocket has been surprising resilient after severe shore erosion events. Planting of native species on the new beaches further improves the decreasing terrestrial habitat regionally. And with each beach, thousands of tons of new sand is brought in, not only to initially nourish the pocket beach but also to add 20% overfill sand to the adjacent lakeshore. Periodic sand re-nourishment has proven to be a successful management tool and provides additional sand for the entire Illinois coastal ecosystem.

### **Impact to Littoral Drift System**

The proposed plan for this site includes construction of a breakwater-protected beach system and placement of mitigational sandfill, as required for permit. The design of the proposed system, including the mitigational sandfill, will help assure no negative impact to the littoral drift system. The existing section of Lake Michigan shoreline at 419 and 429 Sheridan Road, Winnetka is completely engineered. This section of the coastline consists of breakwater-held beaches, groins and revetments. Due to the property line at 419 Sheridan Road being south of the existing steel groin, sand mitigation (as required by the IDNR) will be placed on the 419 property with a 20% overfill as required.

The proposed quarystone breakwater will extend approximately 125' offshore (35' less than the existing groin along the north neighbor's property line). The proposed structures have been designed to fit in with the adjacent structures. The littoral drift system should remain at an equilibrium once the mitigational sand is placed (anticipated quantity plus 20% overfill).

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 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 or mitigation may be required at the owner's expense.

### **Impact on Public Uses**

Public access will be implemented for the new structure, as required by state law, as pedestrians will be able to traverse the breakwater using stone steps at the landward end of the structure. This will allow pedestrian access across the beach. 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 quarystone 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 immediately to the north.

### **Impact on Natural Resources**

Quarystone 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**

This project will be completed via marine construction with a barge and crane delivering all materials and equipment to the site. The proposed work will be completed using a backhoe that will work from the beach to place the materials. Work will not begin until all necessary permits have been received. This work will require approximately 16 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. Approximately 2,750 cubic yards of clean quarried stone will be placed to construct the breakwater. Approximately 1,700 cubic yards of clean sand will be placed as sandfill in and around the system.

The amount of fill to be placed below the Ordinary High Water Mark (581.5 feet, IGLD 1985) is +/- 0.137 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, Water Resources (Casey)  
IEPA (Heacock)  
U.S. Fish & Wildlife Service  
Illinois Historic Preservation Agency (Haaker)  
Muneer Satter

## DESIGN OF SHORELINE EROSION PROTECTION

### Introduction

The following report summarizes assumptions and design criteria for a steel and quarystone breakwater system and sandfill to help retain a beach, provide lake access, and better protect the property located at 419 Sheridan Road, Winnetka. The design is based on the drawings included in the permit application to the U.S. Army Corps of Engineers dated May 11, 2015.

The site lies within a fully-engineered section of urban lakeshore that is typically protected with steel sheetpile groins, revetments and breakwater-protected beaches. This section of coast is sand-starved due to municipal structures (littoral barriers) constructed over the past 100 years that extend east past the littoral zone and reduce sand bypass, as well as armoring of the shoreline reducing erosion of the glacial clay bluffs. 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 a lower-cost system with a lower level of protection in the form of quarystone revetments placed against the toe of the bluff that prevents stormwave erosion but at the expense of the beach and pedestrian access.

### Project Description

The proposed design includes designing a headland bay beach with two quarystone breakwaters extending lakeward and two shore-parallel breakwaters to reduce the gap between the existing steel groins. The project will include sandfill mitigation that fulfills the design requirements of 20-year stormwave erosion protection. While the seawall at this site continues to provide shore protection for the bluff, continued erosion of the beach and lakebed downcutting could undermine the integrity of the seawall. When the lake rises, stormwaves may cause severe icing problems and impacts to the property, as well as cause deeper water in the nearshore. The breakwater-protected pocket beach is designed to help retain and enhance the beach that occurs on this property.

### 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):

#### Breakwater Specifications

Lakeward Crest Elevation:	583 ft
Toe of Breakwater:	573 ft
Crest Width:	10.8 ft
Average Armor Size:	4 tons
"B" Stone	400 - 1200 lbs
Slope:	1:1.5
Tons/linear ft:	17 tons

#### Assumptions

- Design High Water (DHW): 582.0 ft \*
- Design Water Level: 580.0 ft
- Design Low Water (DLW): 577.5 ft \*
- Existing clay till elevation at groin toe: 572.0 ft

- 20-yr lakebed erosion at toe of groin: 3 ft\*\*
- Design wave height: Hs = 10.8 ft
- Nearshore Slope: 1:20
- Design Wave Period (T): 9.9 s \*\*
- Depth at Structure Toe DHW (Ds): 9.0'
- Design Deepwater Wave (Ho): 18.0'
- Design Wave Length (Lo): 501.8'
- Stone Porosity: 37%

\* DHW includes 2 ft storm setup, DLW is equivalent to Low Water Datum

\*\* Resio & Vincent, 1976

### Bathymetry

Bathymetric surveying was performed in November 7, 2011. Six transects were completed in the project area and on adjacent properties. The survey data points were taken to approximately 300 feet east from the seawall. The survey was performed using an electronic total station with a diver in the water and a licensed survey crew on land. Reference benchmark: Per Monument Records for the Center of Section 21-42-13 on file with the Village of Winnetka, benchmark is the top of brass plug in concrete witness monument in the north parkway of Willow Road near the east line of Residence #467. Elevation = 613.21' NAVD 1988 Datum.

### Water Levels

The following table summarizes water level data representing daily highest extremes measured at Calumet Harbor, Illinois, approximately 30 miles to the south of Highland Park. Note: Low water datum LWD = 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, Shabica & Associates 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 8.3 ft based on a 6-second wave with a wave length of 184 ft (using  $1/25 L_o$ ) 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 sandfill 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 2, 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 ( $\xi$ ), 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 3, 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 in Winnetka). Sand deposits were thin to a distance of 160 ft from shore (Shabica, 2010) and sand was non-existent in areas to a distance of over 1000 ft from shore (Shabica & Pranschke, 1994). Also, the site is underlain by highly-erodible, cohesive glacial clay-till. This condition increases the rate of irreversible lakebed erosion that causes deepening of the water and larger waves to impact the shoreline. According to Robert Nairn, approximately 200 m<sup>3</sup> 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, 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 breakwater and sandfill installed, the lakebed erosion will be reduced.

### **Stone Stability, Armorstone**

The proposed shore parallel section of the quarystone breakwater will have two layers of 2 to 6-ton armorstone placed on a 1:1.5 slope. Overtopping of the breakwater is expected during high water levels. Design conditions include:

- Lakeward breakwater crest elevation at 1.0 ft above DHW, 5.5 ft above DLW
- Depth-limited breaking waves will break on the stone groin and sand beach
- Depth at the toe of the structure is 9ft (573.0) at DHW
- Incident wave directions: NE, E and SE
- Wave period for DHW: T = 9.9 seconds
- Wave period for average conditions T = 6 seconds

Quartzite armorstone is recommended as it is highly durable and is locally available in most gradations under 6 tons. Hudson's formula was used to estimate armorstone size. Using the design conditions, an armorstone of 4.1 tons is predicted for single layer special placement.

**Project Monitoring**

As the performance of shore protection structures cannot be predicted with absolute certainty, the shore protection system for 419 and 429 Sheridan Road, Winnetka, will be inspected as required by IDNR guidelines. This includes topographic and hydrographic surveys beginning at an elevation of 581.5 feet (IGLD 1985) and progressing to 300 feet 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*.

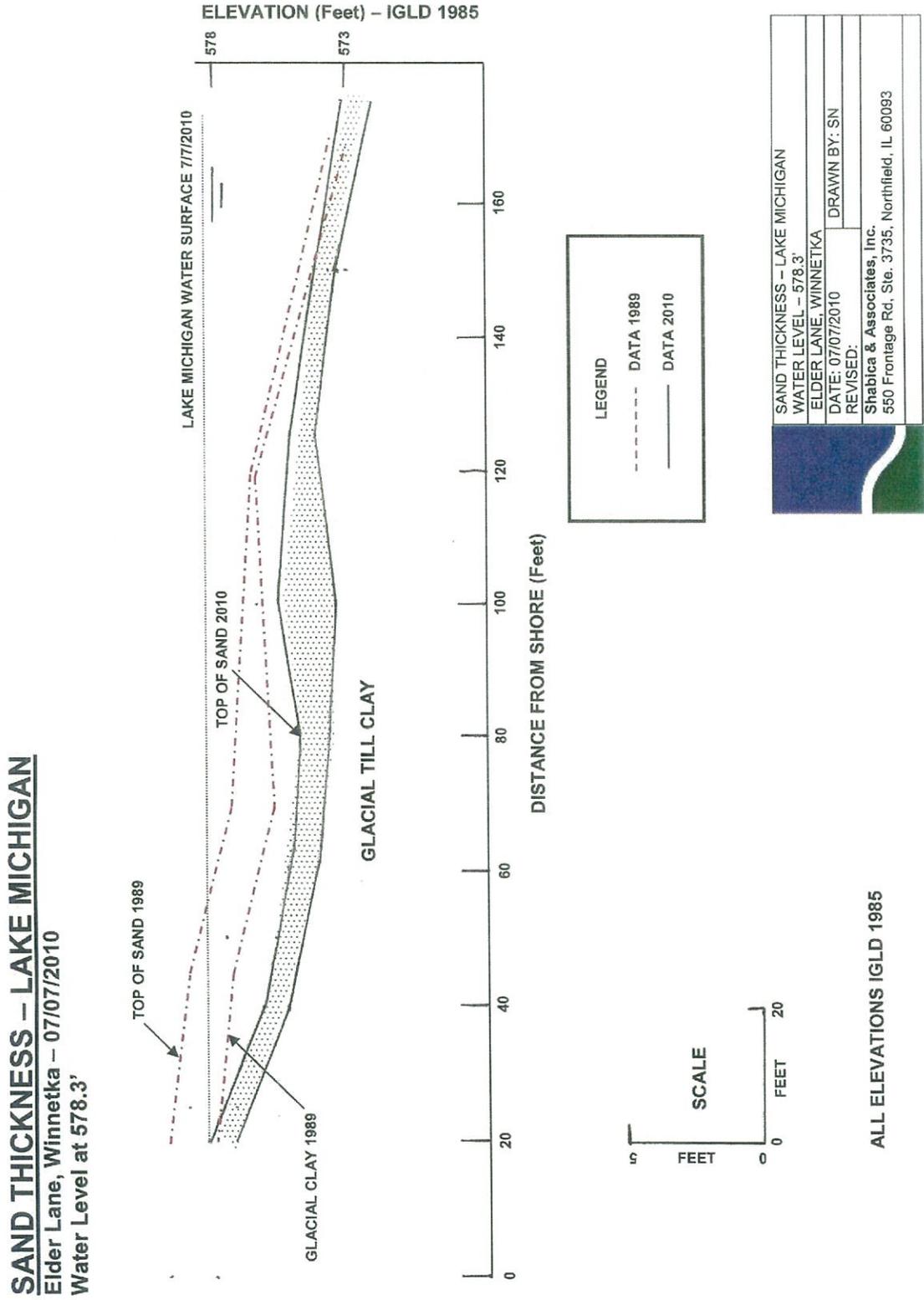
Shabica, C.W., F. Pranschke and M. Chrzastowski. 1991, *Survey of Littoral Drift Sand deposits Along the Illinois Shore of Michigan from Fort Sheridan to Evanston*, Illinois/Indiana Sea Grant Program, IL-IN-SG-R-91-3.

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.

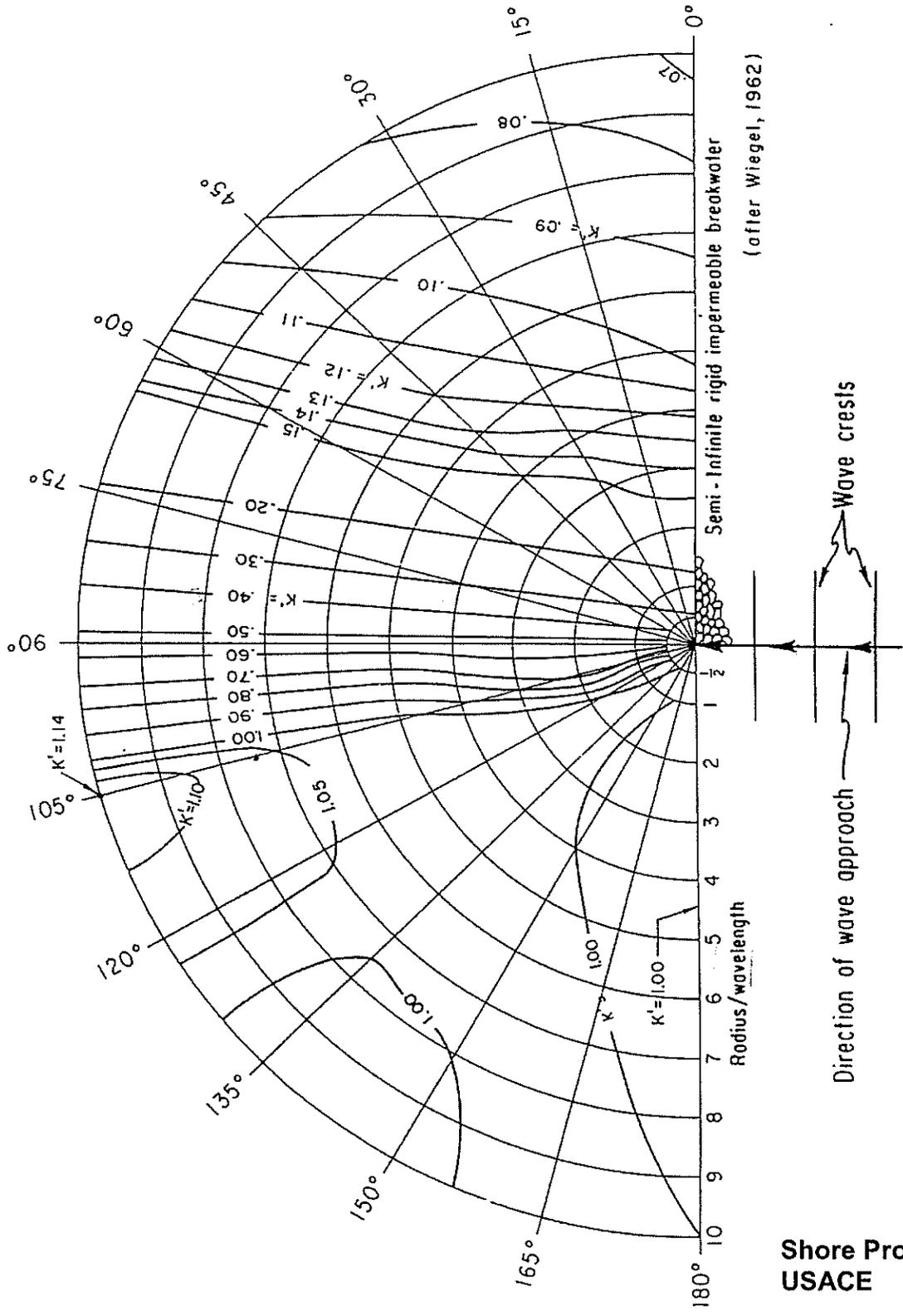
US Army Corps of Engineers, 1984, *Shore Protection Manual*, Coastal Engineering Research Center, Vicksburg, Mississippi.

**FIGURE 1**



Typical cross-section of Winnetka lakebed and sand cover  
 (From Shabica et al., 1991)

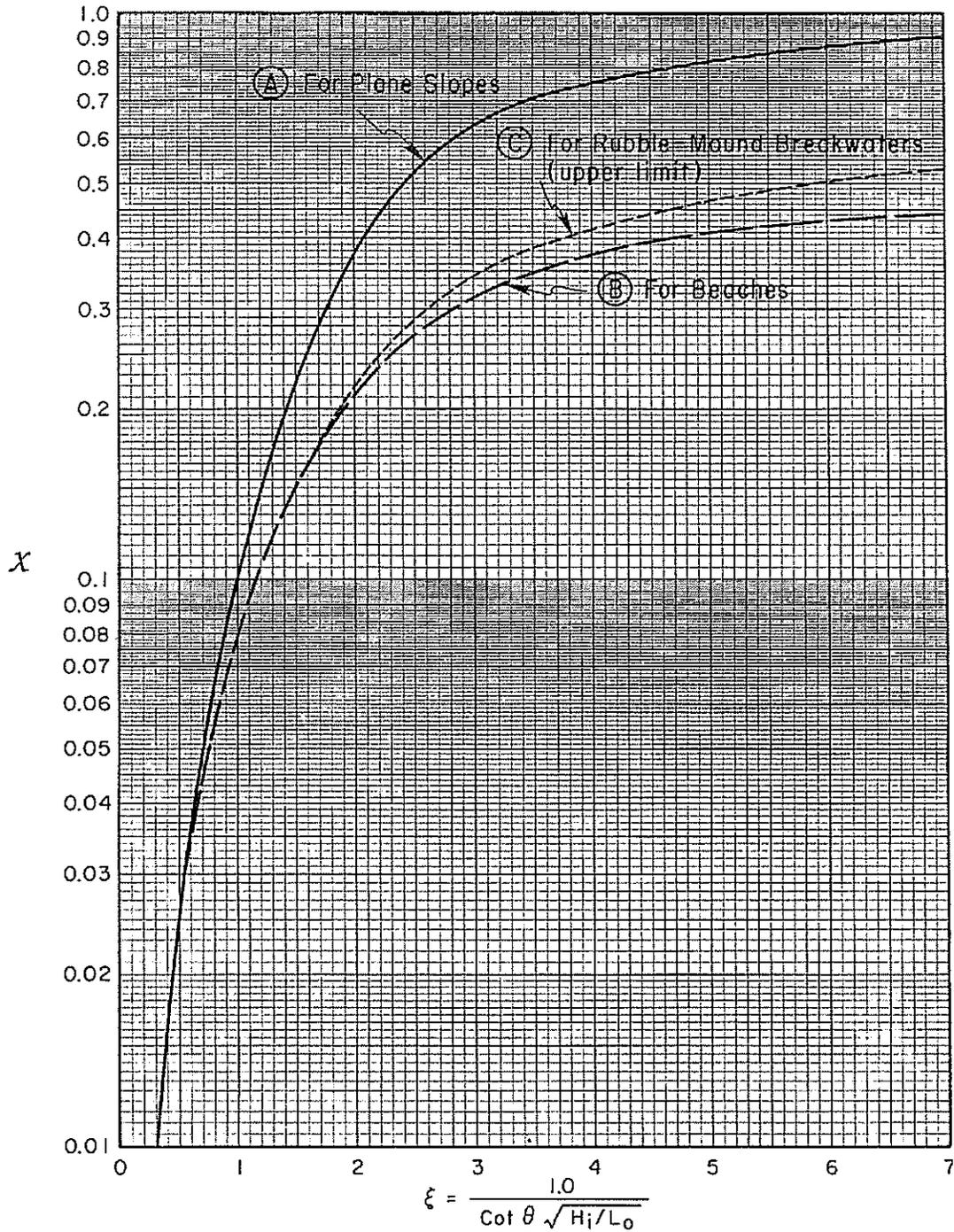
FIGURE 2



Wave diffraction diagram--90° wave angle.

Shore Protection Manual  
USACE

**FIGURE 3**



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

**Shore Protection Manual  
 USACE**

**APPENDIX**

419 & 429 Sheridan Road, Winnetka – May 22, 2015



1997 Aerial Photograph showing the sunken barge (yellow arrow)



2007 Google Earth Photo; see approximate property lines and submerged barge

## JOINT APPLICATION FORM FOR ILLINOIS

ITEMS 1 AND 2 FOR AGENCY USE

1. Application Number <div style="font-size: 1.5em; font-family: cursive;">C20150012</div>	2. Date Received <div style="font-size: 1.5em; font-family: cursive;">5/27/15</div>
---	--

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

3a. Applicant's Name: <b>Muneer Satter</b> Company Name (if any): Address: 419 Sheridan Road Winnetka, IL 60093 ----- Applicant's Phone Nos. w/area code Business: 312-655-4887 Residence: 847-446-8437 Cell: Fax:	3b. Co-Applicant/Property Owner Name (if needed or if different from applicant): Company Name (if any): Address: ----- Applicant's Phone Nos. w/area code Business: Residence: Cell: Fax:	4. Authorized Agent (an agent is not required): <b>Shabica &amp; Associates, Inc.</b> Company Name (if any): Shabica & Associates, Inc. Address: 550 Frontage Road Suite 3735 Northfield, IL 60093 ----- Agent's Phone Nos. w/area code Business: 847-446-1436 Residence: Cell: Fax: 847-716-2007
---	--	--

**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.

-----  
 Applicant's Signature [Signature] Date 5/11/15

**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 list		
b.		
c.		
d.		

**6. PROJECT TITLE:**  
**Breakwater-Protected Beach**

**7. PROJECT LOCATION:**  
 419 & 429 Sheridan Road, Winnetka, IL 60093

LATITUDE: 42.10286 °N LONGITUDE: 87.72062 °W	UTM's Northing: 4661445.21 Easting: 16T440425.14										
STREET, ROAD, OR OTHER DESCRIPTIVE LOCATION Sheridan Road	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 15%;">LEGAL DESCRIPT</th> <th style="width: 15%;">QUARTER</th> <th style="width: 15%;">SECTION</th> <th style="width: 15%;">TOWNSHIP NO.</th> <th style="width: 15%;">RANGE</th> </tr> <tr> <td></td> <td style="text-align: center;">NW</td> <td style="text-align: center;">21</td> <td style="text-align: center;">42N</td> <td style="text-align: center;">13E</td> </tr> </table>	LEGAL DESCRIPT	QUARTER	SECTION	TOWNSHIP NO.	RANGE		NW	21	42N	13E
LEGAL DESCRIPT	QUARTER	SECTION	TOWNSHIP NO.	RANGE							
	NW	21	42N	13E							
<input checked="" type="checkbox"/> IN OR <input type="checkbox"/> NEAR CITY OF TOWN (check appropriate box) Municipality Name Winnetka	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 75%;">WATERWAY Lake Michigan</td> <td style="width: 25%;">RIVER MILE (if applicable)</td> </tr> </table>	WATERWAY Lake Michigan	RIVER MILE (if applicable)								
WATERWAY Lake Michigan	RIVER MILE (if applicable)										
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%;">COUNTY</th> <th style="width: 25%;">STATE</th> <th style="width: 50%;">ZIP CODE</th> </tr> <tr> <td style="font-size: 1.2em;">Cook</td> <td style="font-size: 1.2em;">IL</td> <td style="font-size: 1.2em;">60093</td> </tr> </table>	COUNTY	STATE	ZIP CODE	Cook	IL	60093					
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

RECEIVED BY AGENCY  
 PROJECT MANAGER

8. PROJECT DESCRIPTION (Include all features):

A sunken barge, serving as shore protection, was removed from this site in 2009-2010. After the barge was removed, the beach eroded severely leaving a scarp at the toe of the bluff at the current low lake level. The inability of the existing steel groins to dissipate wave energy, as well as a deep lakebed dredge scar, leave this property vulnerable to erosion. The shoreline stabilization will be comprised of softening the two existing steel groins with stone. No work will be done further than 125' east of the existing concrete seawall. The existing north groin at 429 Sheridan Road will be lined with stone along the south side of the groin only with a spur breakwater extending to the southeast. North of the 419 south property line, a similar breakwater mirroring the north will be constructed over the existing steel groin. The breakwaters will have a crest elevation of 589' landward tapering to 583' at the lakeward ends (IGLD 1985 datum). The breakwaters will curve together on the east leaving a 77' wide gap (toe to toe). The slope of the breakwaters at the lakeward portion will be 1v:1.5h. Once they are more perpendicular to shore, the slope will be changed to 1:1. Quarrystone steps will be installed on both structures to provide pedestrian access over the breakwaters. Approximatel y 1,700 cu. yds of clean sand will be placed as required by the IDNR.

9. PURPOSE AND NEED OF PROJECT:

To maintain a stable beach and protect the toe of the bluff and lakebed after the removal of a sunken barge serving as shore protection (removed in 2009-2010).

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

10. REASON(S) FOR DISCHARGE:

To provide adequate shore protection within an existing steel groin system.

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:

Stone: 2750 cu. yds; Sand: 1700 cu. yds.

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

Stone will cover +/- 0.137 acres

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

Due to site conditions, this project needs to extend into the lakebed scar left behind from the barge removal. Wetland Mitigation Banking Credits will be purchased according to regulatory requirement.

14. Date activity is proposed to commence

November 1, 2015

Date activity is expected to be completed

12 weeks

15. Is any portion of the activity for which authorization is sought now complete? Yes  No

Month and Year the activity was completed

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

5/22/2015  
\_\_\_\_\_  
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 Agency

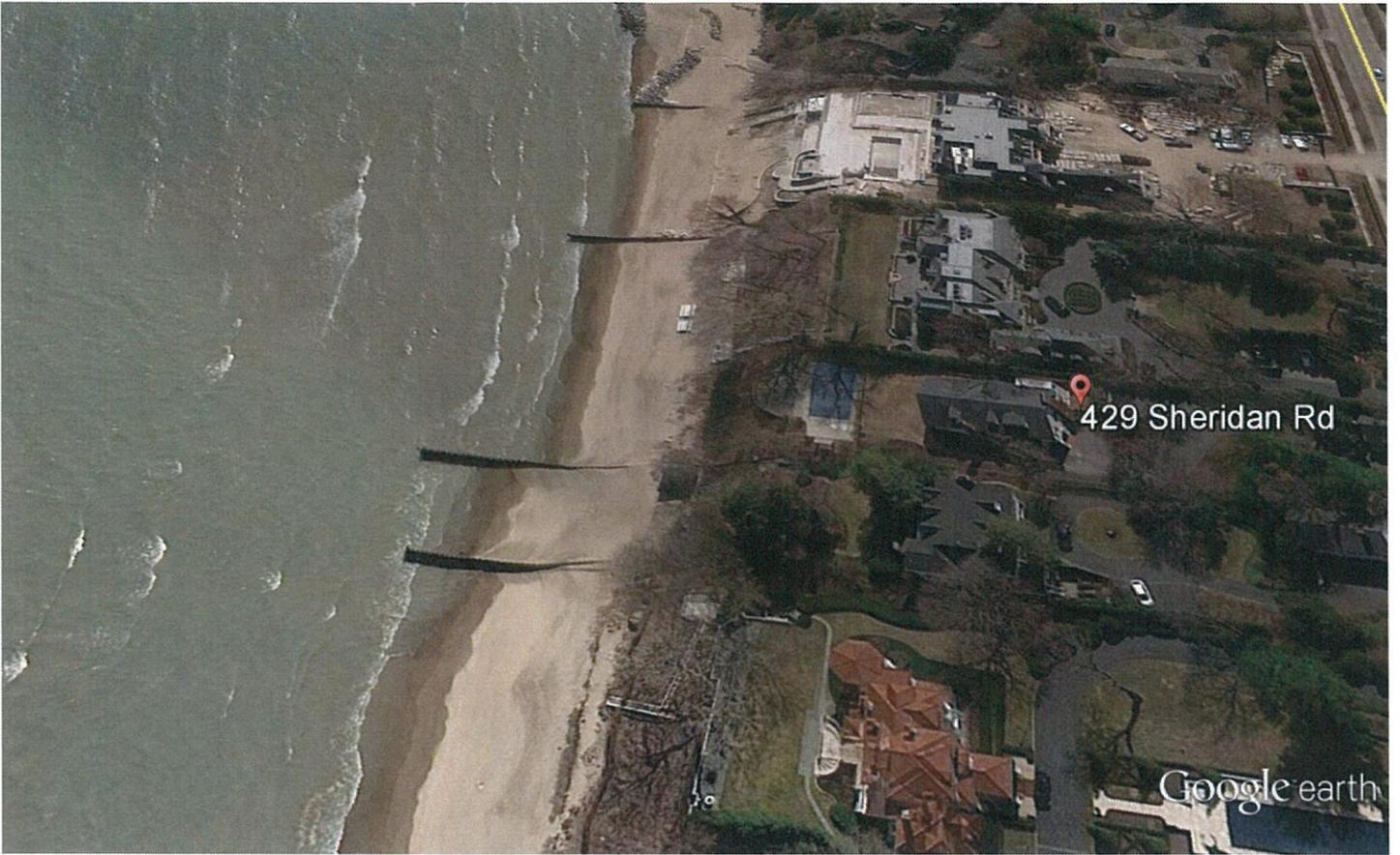
SEE INSTRUCTIONS FOR ADDRESS

# Vicinity Map



Breakwater-Protected Beach

419 and 429 Sheridan Road  
Winnetka, IL 60093



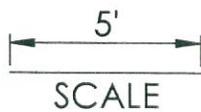
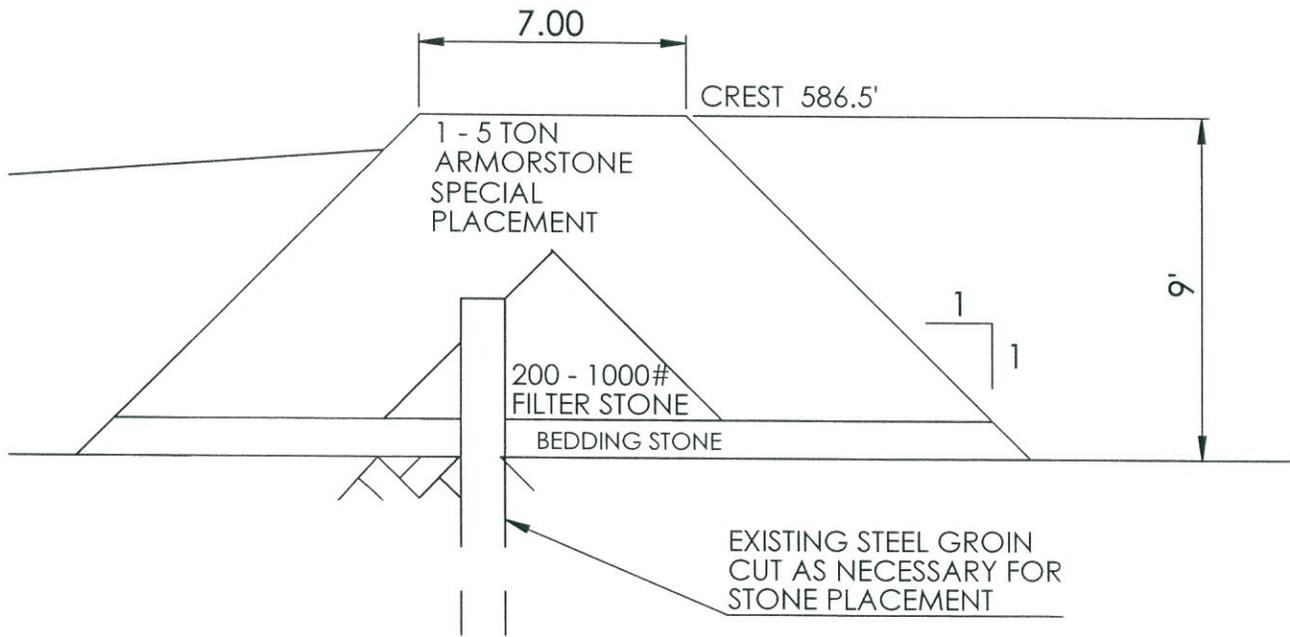
Google earth

feet  
meters



4/2013

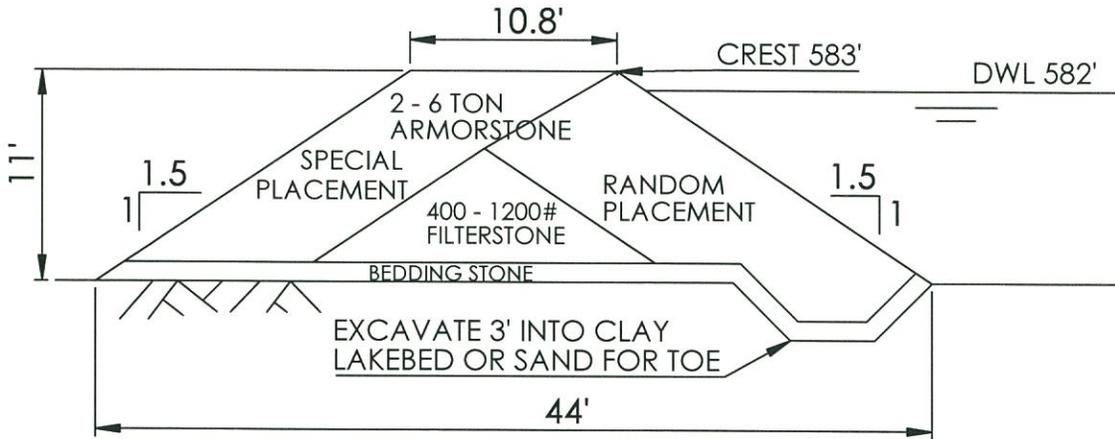
CROSS SECTION C-C



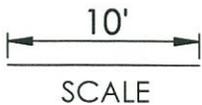
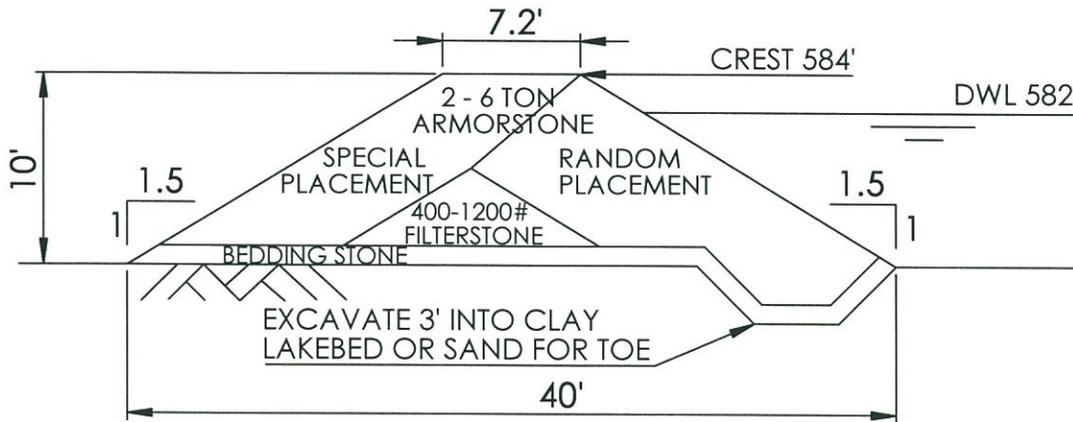
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DRAWN	SN	3/17/15	419 SHERIDAN RD, WINNETKA
CHECKED			
COMMENTS:			 <b>Shabica &amp; Associates, Inc.</b> 550 Frontage Rd., Suite 3735 Northfield, Illinois 60093 847-446-1436 www.shabica.com
DIMENSIONS ARE IN FEET TOLERANCES: +.5', -.1' ALL ELEVATIONS IN IGLD 1985			
SIZE	A		CROSS SECTIONS C-C
SCALE	1"=5'		REV.

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CROSS SECTION A-A



CROSS SECTION B-B

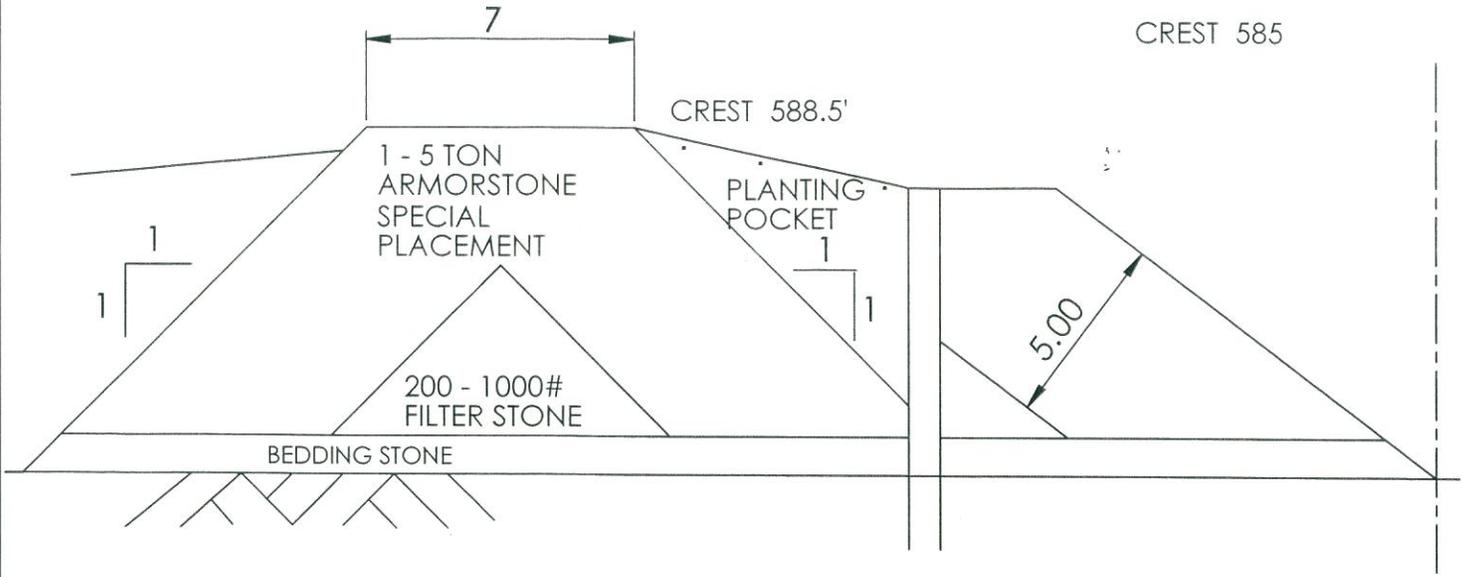


NOTE: ALL CLAY REMOVED FROM THE LAKEBED WILL BE HAULED OFFSITE VIA BARGE AND DISPOSED OF PROPERLY

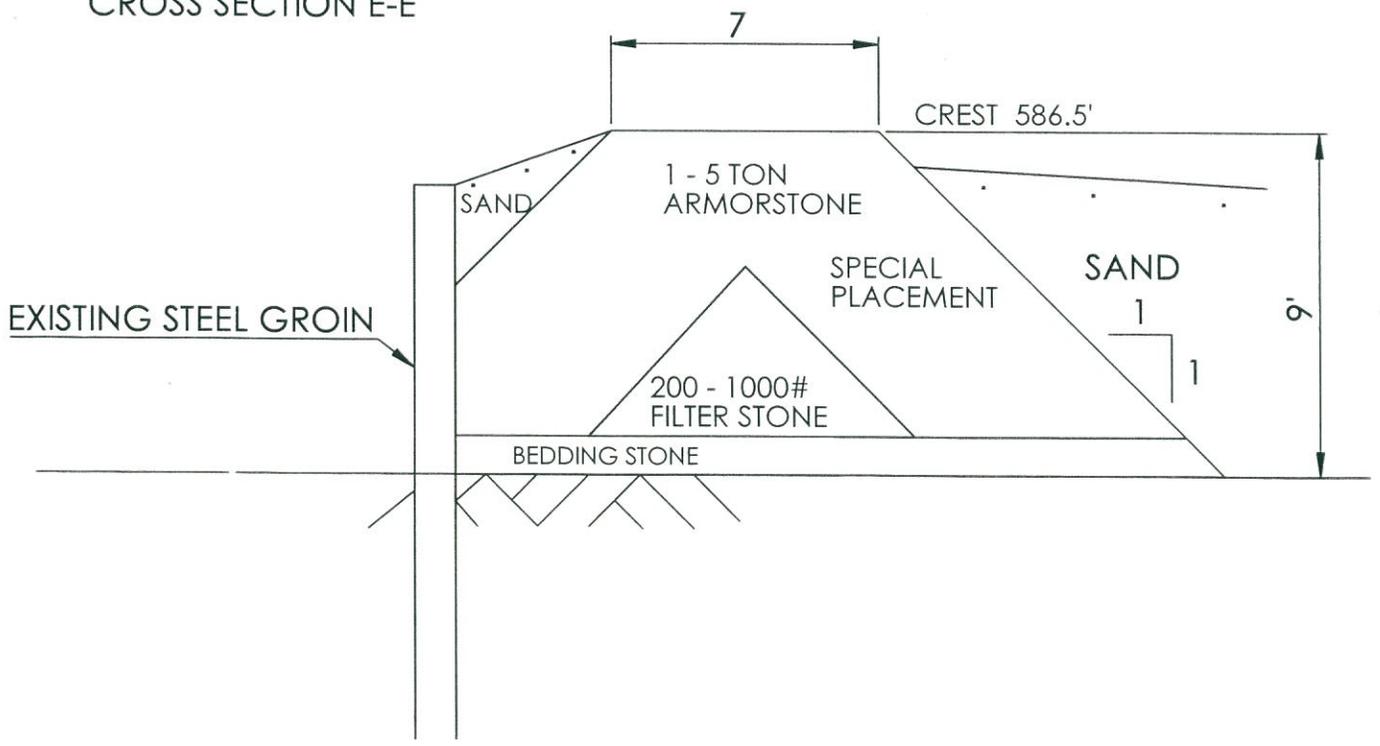
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DRAWN	SN	3/17/15	419 SHERIDAN RD, WINNETKA
CHECKED			
COMMENTS:			 <b>Shabica &amp; Associates, Inc.</b> 550 Frontage Rd., Suite 3735 Northfield, Illinois 60093 847-446-1436 www.shabica.com
DIMENSIONS ARE IN FEET TOLERANCES: +.5', -1' ALL ELEVATIONS IN IGLD 1985			
SIZE		CROSS SECTION A-A, B-B	
SCALE 1"=5'		REV.	

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CROSS SECTION D-D



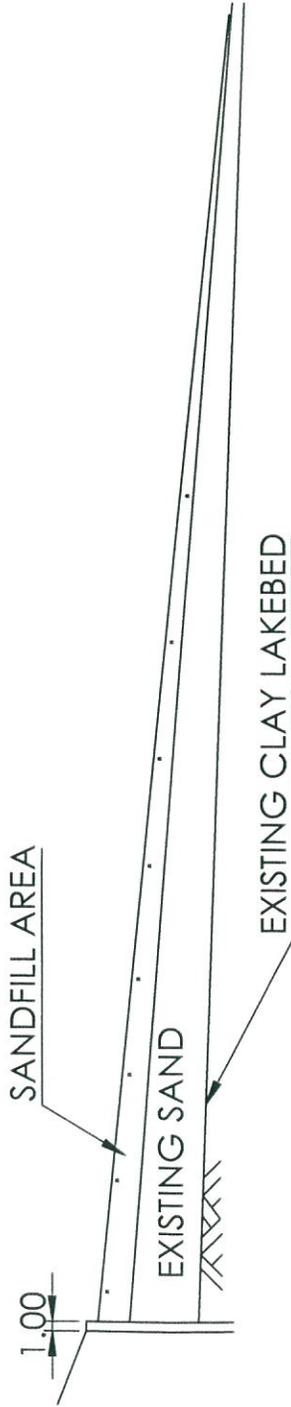
CROSS SECTION E-E



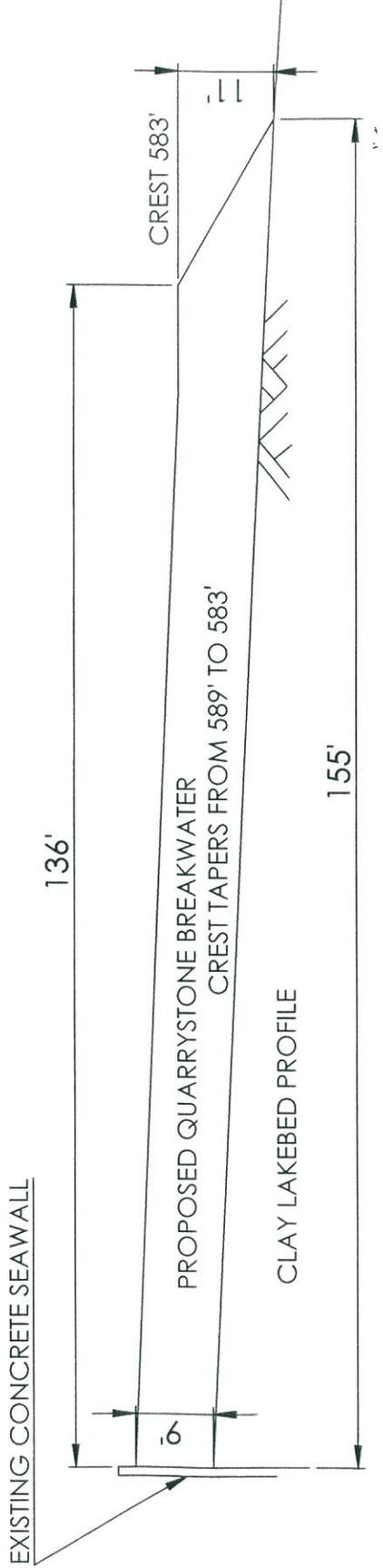
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DRAWN	SN	3/17/15	419 SHERIDAN RD, WINNETKA
CHECKED			
COMMENTS:			 <b>Shabica &amp; Associates, Inc.</b> 550 Frontage Rd., Suite 3735 Northfield, Illinois 60093 847-446-1436 www.shabica.com
DIMENSIONS ARE IN FEET TOLERANCES: +.5', -1' ALL ELEVATIONS IN IGLD 1985			
SIZE	A		CROSS SECTION D-D, E-E
SCALE	1"=5'		REV.

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CROSS SECTION F-F  
SAND PROFILE



PROFILE THROUGH CENTER OF BREAKWATER  
(NORTH AND SOUTH)



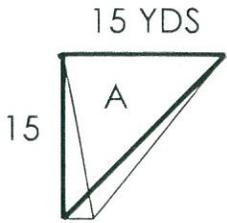
SCALE

ALL ELEVATIONS IN IGLD 1985

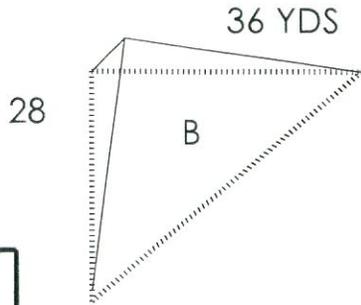
Project Location:		419 SHERIDAN ROAD, WINNETKA	
NAME	DATE	 <b>Shabica &amp; Associates, Inc.</b> 550 Frontage Rd., Suite 3735 Northfield, Illinois 60093 www.shabica.com	
DRAWN	SN		
REVISED			COMMENTS: DIMENSIONS ARE IN INCHES TOLERANCES: +.5", -1.0" ALL ELEVATIONS IN IGLD1985
		SIZE	A
		CROSS SECTION F-F	
		REV	

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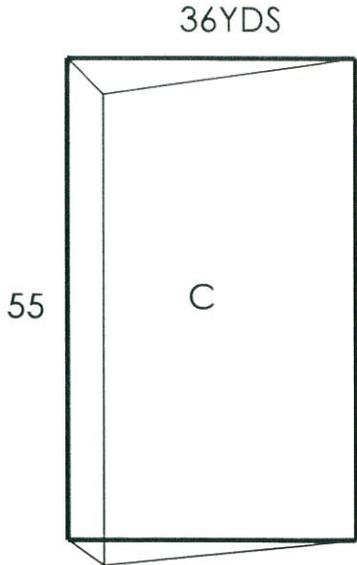
# SAND CALCULATIONS



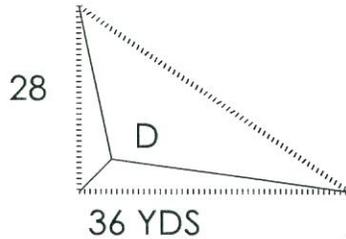
$$\frac{15 \times 15 \times 1}{6} = 37.5 \text{ CU. YDS.}$$



$$\frac{36 \times 28 \times 1}{6} = 168 \text{ CU. YDS.}$$



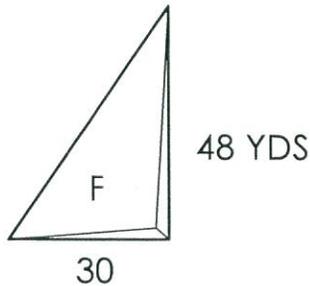
$$\frac{36 \times 55 \times 1}{2} = 990 \text{ CU. YDS.}$$



$$\frac{36 \times 28 \times 1}{6} = 168 \text{ CU. YDS.}$$



$$\frac{17 \times 10 \times 1.5}{6} = 42.5 \text{ CU. YDS.}$$



$$\frac{48 \times 30 \times .5}{6} = 13 \text{ CU. YDS.}$$

$$37.5 + 168 + 990 + 168 + 42.5 + 13 = 1419 \text{ CU. YDS.}$$

$$1419 \text{ CU. YDS.} \times 1.25 \text{ YDS./TON} = 1774 \text{ TONS}$$

$$1774 \times 20\% \text{ (OVERFILL)} = 355 \text{ TONS} + 1774 = 2129 \text{ TONS}$$

**PLACE 2150 TONS OF CLEAN SAND**

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NAME	DATE	Project Location:
DRAWN SN	3/17/15	419 & 429 SHERIDAN, WINNETKA, IL
REVISED SN	8/25/15	
COMMENTS:		 <b>Shabica &amp; Associates, Inc.</b> 550 Frontage Rd., Suite 3735 Northfield, Illinois 60093 847-446-1436 www.shabica.com
DIMENSIONS ARE IN FEET TOLERANCES: +.5', -.1' ALL ELEVATIONS IN IGLD 1985		
SCALE 1"=5'		SIZE <b>A</b> SAND CALCULATIONS SHEET 8 OF 8

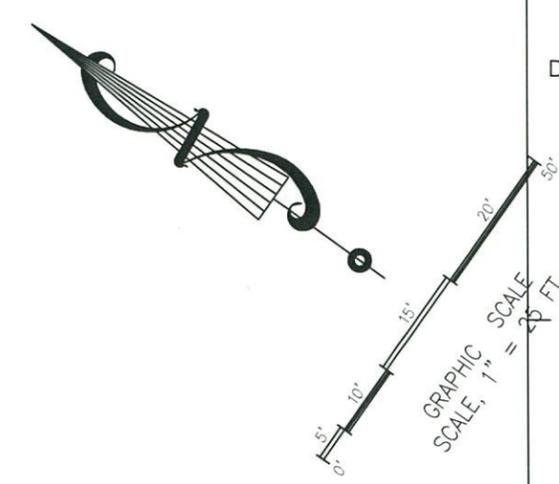
# LAKE MICHIGAN

PROPOSED BREAKWATER

EXISTING STEEL GROIN TO BE CUT DOWN AS NECESSARY FOR CONSTRUCTION AND TO REMAIN CONCEALED FROM VIEW

D (includes full rectangle)

STEEL SHEET PILE GROIN w/ 1.25' STEEL CAP



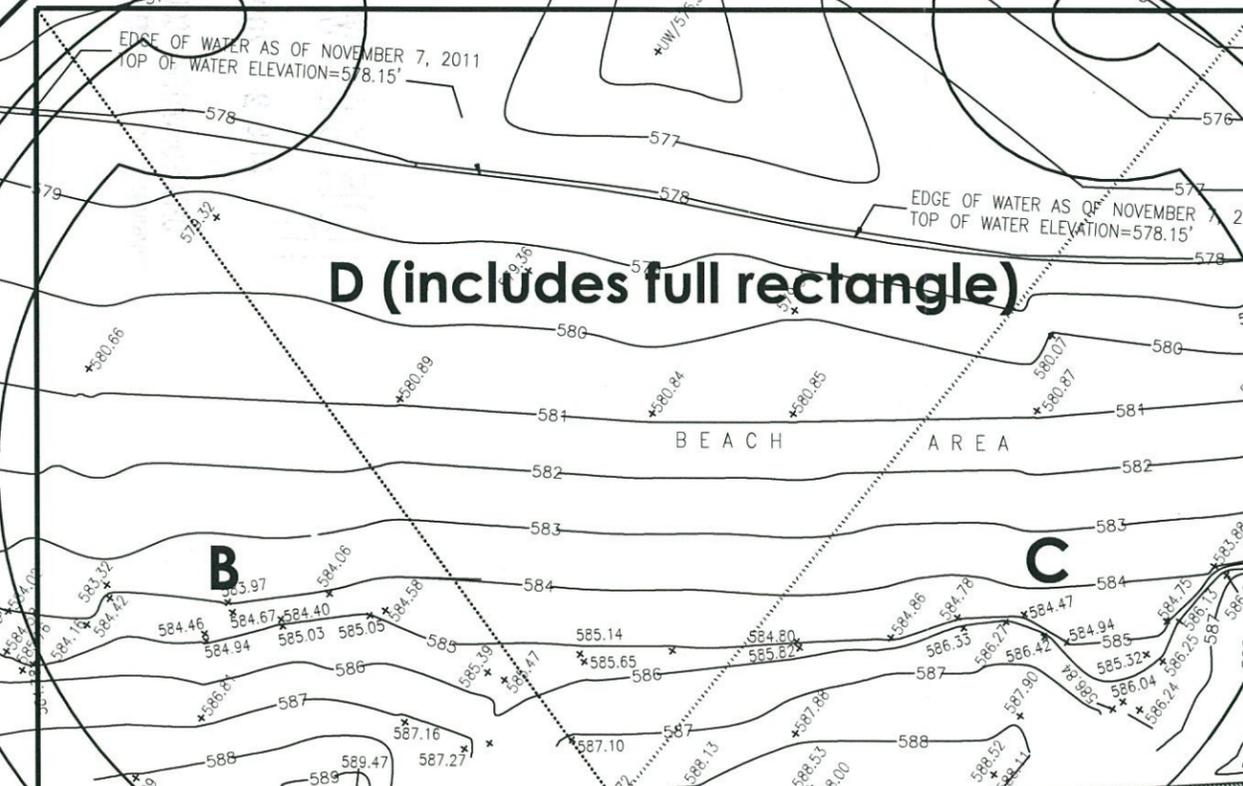
**A**

**B**

**C**

**E**

**F**



RESIDENCE 411

RESIDENCE 435

RESIDENCE 429

RESIDENCE 419

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	NAME	DATE
DRAWN	SN	3/17/15
REVISED	SN	8/25/15

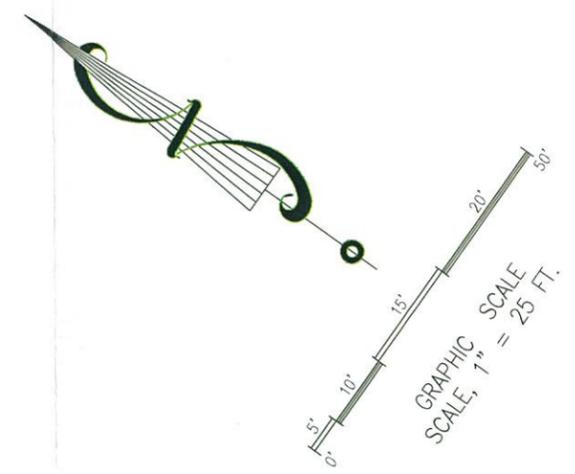
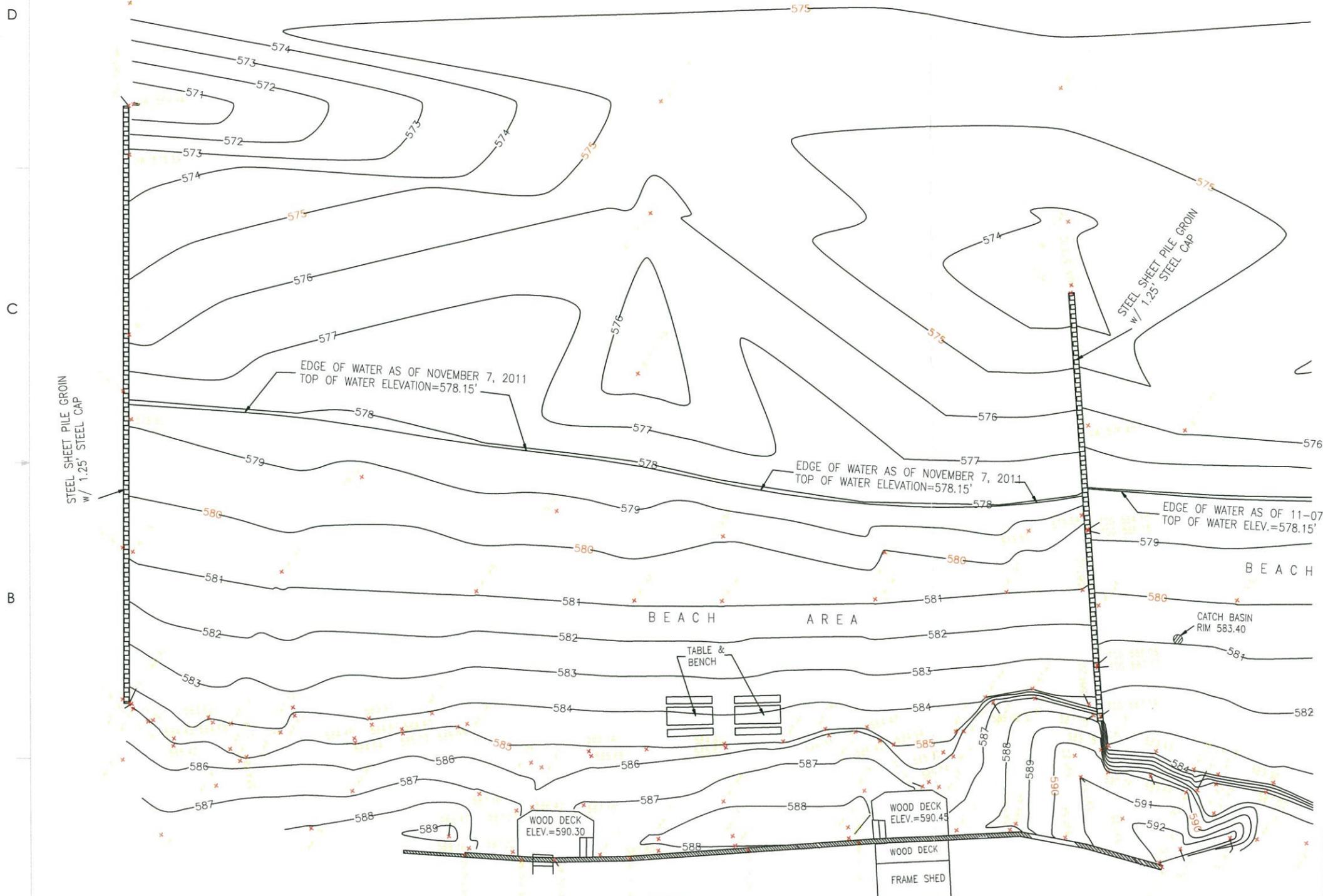
COMMENTS:  
DIMENSIONS ARE IN FEET  
TOLERANCES: +.5', -.1'  
ALL ELEVATIONS IN IGLD 1985

Project Location:  
419 SHERIDAN ROAD, WINNETKA

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

SIZE	SAND PLAN VIEW	REV
<b>B</b>		

# LAKE MICHIGAN



**RESIDENCE # 419**

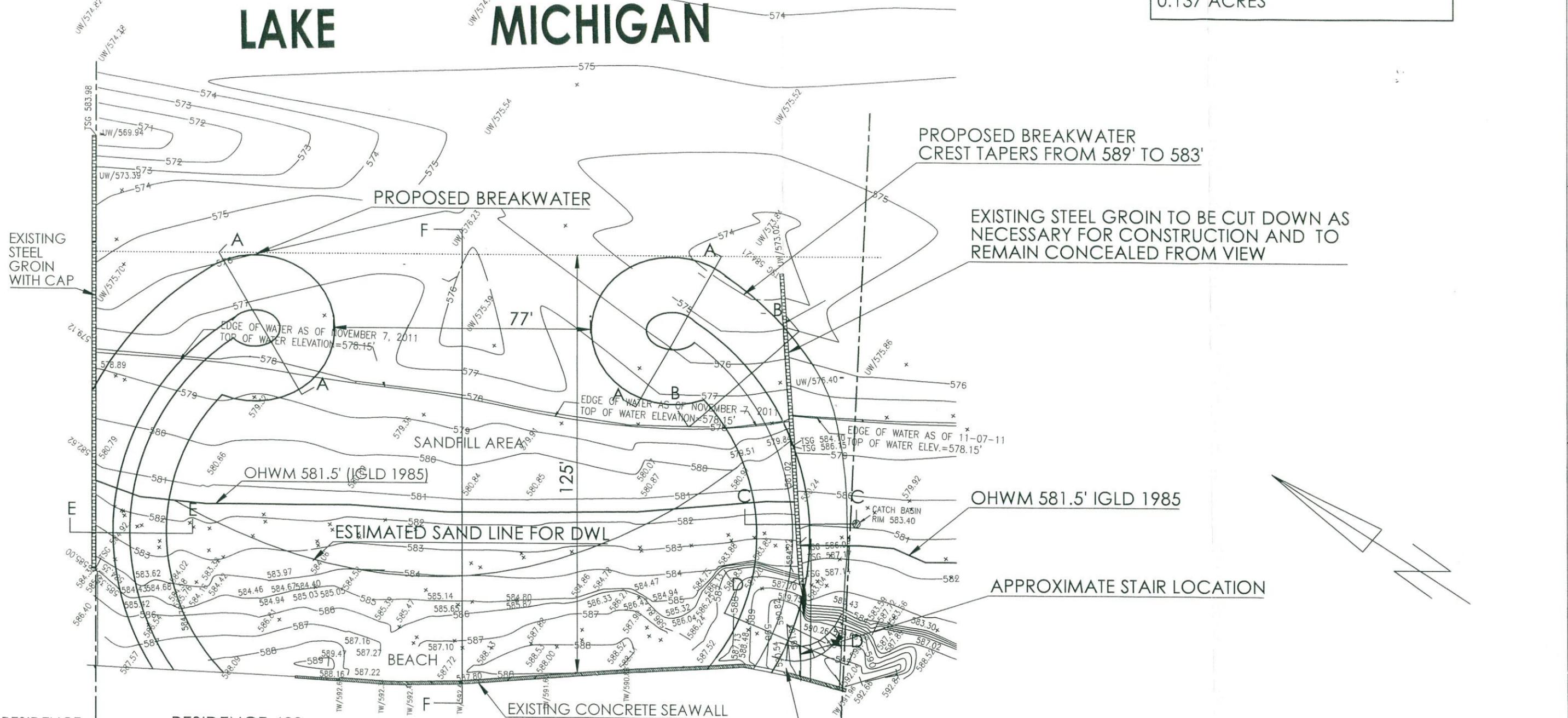
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	NAME	DATE	Project Location:
DRAWN	SN	5/19/15	419-429 Sheridan Road, Winnetka
CHECKED			
			<b>Shabica &amp; Associates, Inc.</b> 550 Frontage Rd., Suite 3735 Northfield, Illinois 60093 847-446-1436 www.shabica.com
COMMENTS:	SIZE	REV	
DIMENSIONS ARE IN FEET TOLERANCES: +.5', -1' ALL ELEVATIONS IN IGLD 1985	<b>B</b>	EXISTING CONDITIONS	

# LAKE MICHIGAN

IMPACTED LAKEBED COVERAGE  
0.137 ACRES



PROPOSED BREAKWATER  
CREST TAPERS FROM 589' TO 583'

EXISTING STEEL GROIN TO BE CUT DOWN AS  
NECESSARY FOR CONSTRUCTION AND TO  
REMAIN CONCEALED FROM VIEW

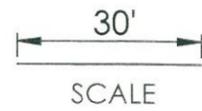
OHWM 581.5' IGLD 1985

APPROXIMATE STAIR LOCATION

RESIDENCE 435      RESIDENCE 429

RESIDENCE 419

RESIDENCE 411



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CHECKED			
			<b>Shabica &amp; Associates, Inc.</b> 550 Frontage Rd., Suite 3735 Northfield, Illinois 60093 847-446-1436 www.shabica.com
COMMENTS:			SIZE
DIMENSIONS ARE IN FEET TOLERANCES: +.5', -1' ALL ELEVATIONS IN IGLD 1985			<b>B</b>
			PLAN VIEW
			REV
			SHEET 2 OF 8