KS ASSOCIATES

Civil Engineers + Surveyors

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February 18, 2019

City of Mentor
8500 Civic Center Blvd.
Mentor, OH 44060
Attn: Kenn Kaminski

RE: Mentor Coastal Habitat – Living Shorelines Project
KS Project #17304

Dear Mr. Kaminski:

Thank you for the opportunity to assist the City of Mentor with preliminary planning for the Mentor Marsh Coastal Habitat project. Please accept this report documenting anticipated project requirements and preliminary recommendations for design alternatives for nature-based shoreline stabilization at the Mentor Lagoons Nature Preserve

Project Overview

The Mentor Lagoons Nature Preserve and Marina includes approximately 450-acres of and over 1.5 miles of Lake Erie shoreline. The preserve is located along the shore of Lake Erie's central basin approximately 4 miles west of Fairport Harbor in Lake County. The project study area includes approximately 2,700 linear feet of Lake Erie shore and extends from a point about 600 feet northeast of the existing revetment protecting the Mentor Lagoons Marina to the headland known as Sawyers Point.

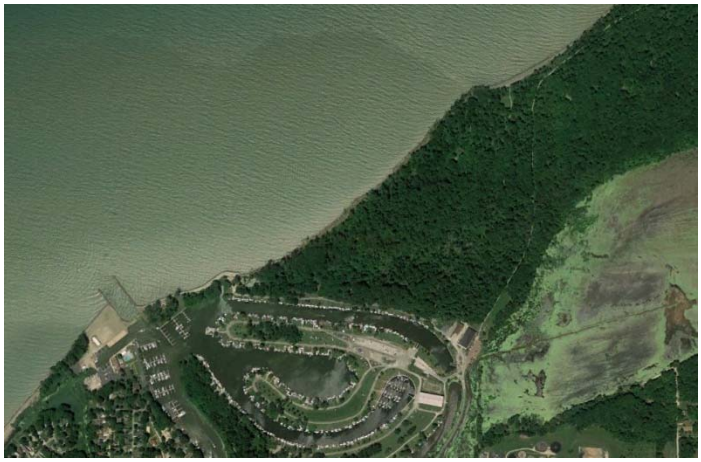

Figure 1: Aerial photo of Mentor Marsh project area (Google Maps)

The shoreline in the project study area is rapidly eroding and is in need of stabilization. The City of Mentor is considering nature-based techniques to stabilize the shore of the nature preserve. Nature-based shoreline management alternatives are typically actions that enhance, restore, and maintain natural coastal processes, aquatic habitats, and ecological functions that promote coastal and ecological resiliency. The wide variation of natural shorelines makes it difficult to specifically define nature-based shoreline measures, instead the Ohio Department of Natural Resources (ODNR) provides the following characteristics of nature-based shorelines.

1. Stabilize the shoreline and reduce erosion
2. Mimic natural shoreline habitat
3. Preserve the nearshore 1 to 3-foot water depth
4. Maintain or restore the natural land-water interface

5. Incorporate native material
6. Increase opportunities for species diversity and productivity
7. Improve water quality
8. Maintain coastal processes

Nature-based shorelines typically include a variety of measures to meet the characteristics listed above. The measures required for a stable shoreline are dependent on the forces contributing to erosion and may vary from solid-vertical structures to beach nourishment or planting vegetation in low energy environments.

Project Objective and Need

The primary project objective is to stabilize the eroding shoreline at the Mentor Lagoons Nature Preserve and Marina. This requires an understanding of the current site conditions and the forces contributing to the erosion. The following data was collected:

- Historical aerial photographs are beneficial in determining the extent of previous erosion at the project site. ODNR maintains georeferenced historical aerial photos dating back to 1954 along the shore of Mentor Lagoons Nature Preserve. Aerial Photos from 1954, 1968, 1973, 1980, 1986, 1989, 1993, 2003, 2004, 2006, 2011 and 2014 are included in Attachment B.
- The Ohio Department of Natural Resources maps shoreline recession along Ohio's Lake Erie Coast as part of the Coastal Erosion Area (CEA) regulatory program. CEA maps from 2010 and 2018 are included in Attachment D. The maps track the recession of the top of the bluff from high resolution aerial photos. Based on the current 2018 maps, bluff recession ranged from 0.0 feet near Sawyers Point up to 126.6 feet near the west end of the project area during the time period from 2004 to 2015.
- Site observations were compiled from a site visit performed by KS Associates on February 7, 2019 and photos provided by the City of Mentor from February 20, 2018 and November 5, 2018.
- Lake Erie water levels required for the preliminary design were obtained from the National Oceanic and Atmospheric Administration for Lake Erie Gage 9062053 at Fairport Harbor. Preliminary design wave heights were selected based on potential depth and fetch limited wave conditions and a review of wind and wave hindcast data from U.S. Army Corps of Engineers (WIS Station 92061).

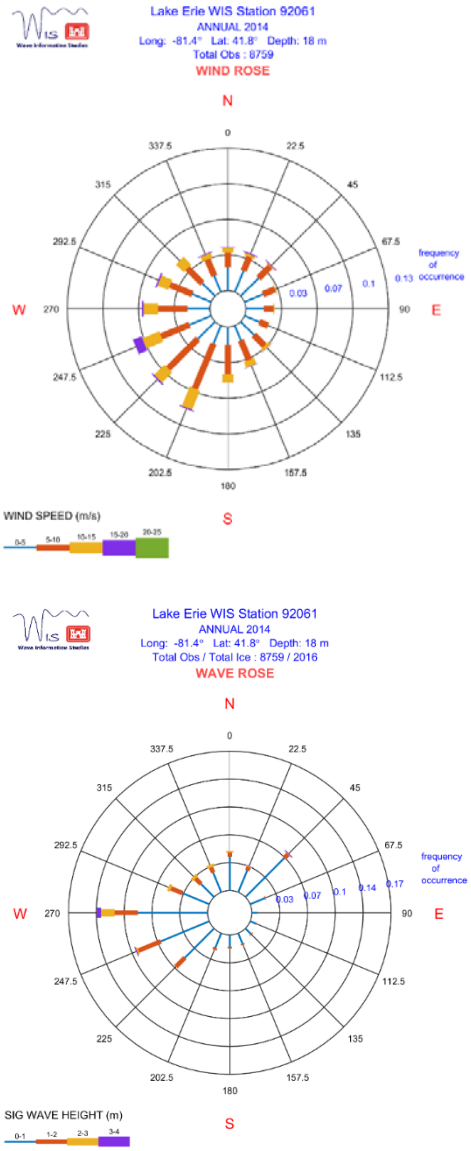

Figure 2: Wave and Wind Rose for WIS Station 92061

Preliminary Design Concepts

Based on the preliminary review of site conditions, KS prepared conceptual designs utilizing nature-based shoreline infrastructure to help prevent erosion and support habitat along the shore of the Mentor Lagoons Nature Preserve. The overall project area includes approximately 3,300 linear feet from the east end of the existing revetment protecting the Mentor Lagoons Marina to Sawyers Point.

The proposed alternatives include a combination of hardened shoreline stabilization techniques (such as armor stone revetments) and softer measures (such as beach nourishment with sand prefill). The overall approach is to limit the use of hardened structures to the areas with severe erosion or existing infrastructure to protect. In this case, hardened structures would be limited to the western end of the project area, the area where Woods Trail Road reaches the shore and Sawyers Points.

It should be noted that all of the alternatives will not be equally effective at stabilizing the shoreline and reducing erosion. The shore of the project site is exposed to significant energy from wave action, stormwater runoff, wind and ice forces. These forces have resulted in considerable erosion along the shore of the project area. A structural alternative, such as an armor stone revetment, will be most effective at stabilizing the shore. The purpose of the proposed project is to consider and develop alternatives to hardening the shore that will provide some shore stabilization and erosion reduction.

For the purpose of developing preliminary design alternatives, the project area was divided into four areas:

Figure 3: Project Areas

A. The area of Severe Erosion at the western end of the project area.
B. The area where the Woods Trail Road reaches the shore.
C. Sawyers Point.
D. The stretches of sand beach between Areas A, B and C.

The following concepts are proposed for each project area:

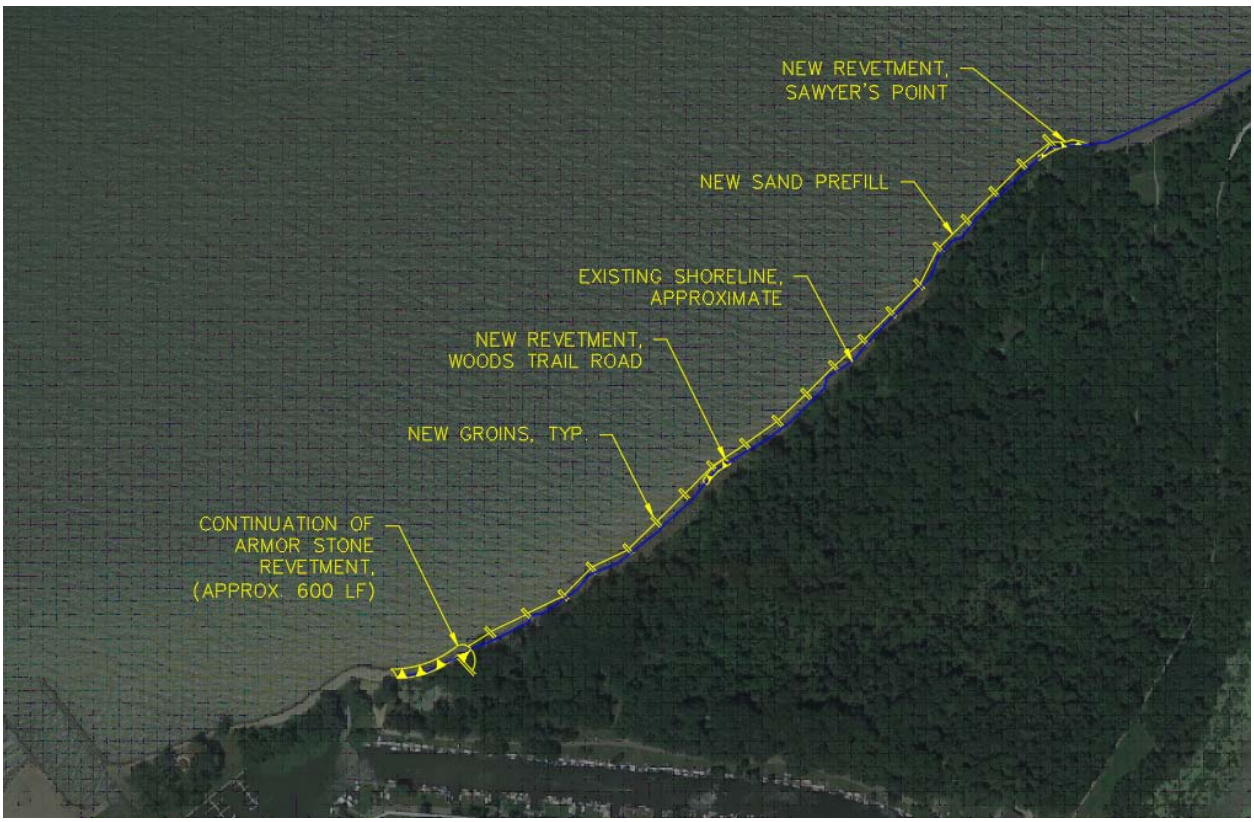

Figure 4: Conceptual Designs

Area A

KS understands that the City of Mentor intends to construct approximately 600 linear feet of additional armor stone revetment as an extension to the existing Mentor Lagoons revetment constructed in 2016. If this plan is executed, KS recommends installing additional structures to help transition from the revetment to the adjacent beach area. Two alternatives are proposed for the transition.

Alternative A would require constructing a timber groin that would extend landward into the beach and tow of the bluff. The groin could be constructed with any of the three techniques described for Area D. The groin would help terminate the revetment into the bluff face in this area and would help prevent flanking of the revetment if the adjacent beach continues to erode. In this case, KS recommends installing additional armor stone to the east of the groin as toe protection for the groin. Based on the preliminary

review of site conditions, the 2 to 4-ton armor stone supported by 4 to 6-ton toe stone would likely be required.

Alternative B would terminate the proposed new revetment with a sloped armor stone return to prevent flanking. This alternative would likely provide a more permanent solution than the timber cribbing but would require more excavation into the existing bluff face and would not likely extend as far south as a timber groin could.

Figure 5: Area A Conditions (July 2018)

Alternative C includes the construction of a nearshore detached breakwater instead of the proposed 600 linear feet of armor stone revetment. This alternative would provide similar shoreline stabilization benefit as the armor stone revetment but would leave a sand beach along the shore, more closely mimicking the natural shoreline habitat and preserving shallow nearshore areas (landward of the breakwaters). This alternative was identified during preliminary discussions with the ODNR Office of Coastal Management regarding the west end of the project site. Detached breakwaters have been used for shore stabilization with considerable success along the south shore of Lake Erie. The drawback of this type of structure is the potential to impact littoral transport resulting in accretion of sand landward or updrift of the structure and erosion downdrift. In this case, the risks are minimal due to the large shore perpendicular structures at the entrance to Mentor Harbor, the armored shoreline to the west, and the minimal sand resources in the area. This alternative would also allow for future beach nourishment landward of the detached breakwater to reduce erosion along the shore to the east.

Conceptual drawings of the alternatives for Area A are included in Attachment E.

Area B

Three alternatives have been developed for the area where Woods Trail Road reaches the shoreline.

Alternative 1 provides the maximum protection in the area where Woods Trail Road reaches the shoreline. This alternative would be required if the City plans to construct any future improvements (such as a lookout) at this location. Alternative 1 includes the construction of approximately 200 linear feet of armor stone revetment and a 50-foot long timber groin near the trail. The timber groin would be constructed with one of the three alternatives provided for Area D to provide short-term beach stabilization along the shore immediate west

Figure 6: Area B Conditions (July 2018)

of the structure. The armor stone revetment would provide long-term erosion protection in this area. If this alternative is implemented, a small headland would likely gradually develop in this area (due to erosion of the beach to the east and west).

Alternative 2 includes construction of an approximately 50-foot long timber groin with a reduced area of armor stone protection to the east. The net direction of littoral current in the project area is from west to east. Therefore, sand is expected to accumulate on the west side of groins, leaving the area east (downdrift) of the groins more susceptible to erosion. An armor stone revetment would stabilize the shore east of the groin and protect the area where Woods Trail Road reaches the shoreline.

Alternative 3 includes the construction of an approximately 50-foot long timber groin without additional armor stone protection. This alternative would extend the stabilization proposed for Areas D through Area B.

Conceptual drawings of the alternatives for Area B are included in Attachment E.

Area C

Remnants of submerged stone groins are visible in the nearshore lakeward of Sawyers Point. The groins are also visible in the historical aerial photos. The stone groins are likely the reason the point has been stable as the beaches to the east and west have gradually eroded. The primary objective is to preserve Sawyers Point without constructing structures that will substantially impact the shore to the east or west. To minimize changes to nearshore processes, KS proposes leaving the remains of the existing groin structures in place in each of the following alternatives.

Alternative 1 includes the construction of a new approximately 50-foot long timber groin near the existing tip of Sawyers Point. This groin would be intended to supplement the existing currently submerged groins at Sawyers Point during periods of higher water levels. Alternative 1 also includes the construction of a limited area of armor stone revetment to stabilize the point.

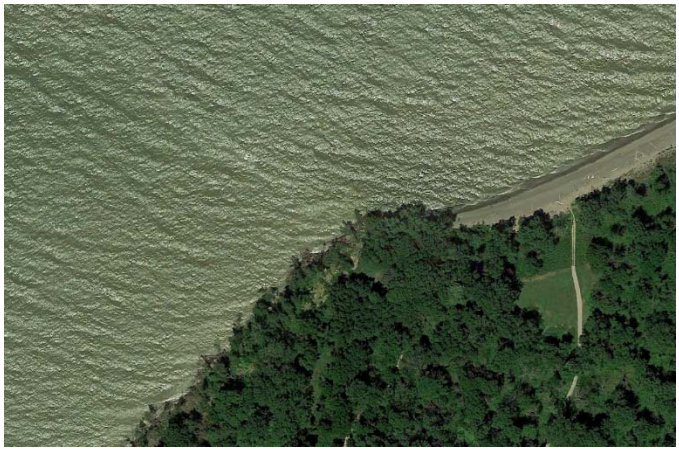

Figure 7: Area D Conditions (July 2018)

Alterative 2 is similar to Alternative 1 but reduces the extent of the proposed armor stone revetment to only include the area immediately downdrift of the new groin.

Alternative 3 includes the construction of an armor stone revetment to stabilize the shore at Sawyers Point (without the construction of any new groins). This alternative would have minimal impacts to nearshore processes but would stabilize the point to preserve the distinct beach cells that have formed to the east and west.

Conceptual drawings of the alternatives for Area C are included in Attachment E.

Area D

Figure 8: Area D Typical Conditions (July 2018)

Area D includes approximately 2,400 linear feet of shore both to the east and west of the Woods Trail Road. This area is generally fronted by a natural narrow beach that is supplemented with sand bluff erosion as the bluff gradually retreats. The primary objective for this area is to stabilize the natural sand beach. This can be accomplished by increasing sand resources in the area (beach nourishment) and adding structures to help stabilize the beach (groins). A total of 18 groins are proposed along the shore of Area D (7 to the west of Woods Trail Road and 11 to the east of Woods Trail Road). The detailed design of the groins will require a metocean analysis, selection of design conditions, sediment budget, analysis of littoral processes and structural design. For the conceptual design, 50-foot long groins spaced at approximately 150 feet on center were estimated. The conceptual design also includes an estimated 2 cubic yards of sand prefill per linear foot of shore as beach nourishment.

Three alternatives were proposed for constructing the groins. As a pilot project for the development of nature-based shoreline stabilization in Lake Erie's Central Basin, KS recommends implementing each of the alternatives so that the effectiveness and longevity of each can be studied. Several options are available for planting vegetation on the timber groin structures by constructing plating pedicles or installing coir logs anchored to the groins.

Conceptual drawings of the alternatives for Area D are included in Attachment E.

Alternative Comparisons

The following table summarizes the shore stabilization alternatives proposed and the extent to which the techniques meet the defined characteristics of nature-based shorelines:

Alternative	Characteristics of Nature Based Shorelines (defined above)							
	1	2	3	4	5	6	7	8
Armor Stone Revetment	X					X		X
Detached Breakwater	X			X		X		
Timber/Stone Groin (Alt.1)	X	X	X	X	X	X		
Vegetated Timber Crib Groin (Alt. 2)	X	X	X	X	X	X		
Fallen Timber Groin (Alt. 3)	X	X	X	X	X	X		
Beach Nourishment (Sand Pre-fill)	X	X	X	X	X			X

While stone naturally occurs along many areas of Lake Erie, armor stone is not considered a native material along this stretch of shore. None of the proposed alternatives are anticipated to effect water quality.

Regulatory Considerations

The project will require authorization from the U.S. Army Corps of Engineers (USACE) pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. Due to the complexity of the project and the potential to impact nearshore processes, it is anticipated that the project will require and Individual Permit from the USACE and an Individual Water Quality Certification (401 WQC) will also be required from the Ohio Environmental Protection Agency (OEPA) pursuant to Section 401 of the Clean Water Act. The USACE and OEPA applications will require coordination with the Ohio Historic Preservation Office, U.S. Fish and Wildlife Service and ODNR Division of Wildlife. A Shore Structure Permit (SSP), Submerged Lands Lease (SLL) and Federal Consistency Concurrence (FCC) will also be required from the Ohio Department of Natural Resources pursuant to ORC Section 1506.

Permit requirements are anticipated to be similar for each of the proposed alternatives in Areas B, C and D. The permit requirements may be different for Area A. The proposed armor stone revetment extension can likely be authorized by the USACE under a Nationwide Permit. In this case, an individual 401 WQC may not be required. Based on preliminary discussions, the armor stone revetment alternative may not be the alternative preferred by ODNR for this area.

A matrix of permit considerations for each alternative is included below:

Alternative	USACE	OEPA	ODNR
Armor Stone Revetments	May be authorized under a Nationwide Permit 13 if conditions are met. (Sand prefill required)	Not required if authorized under a Nationwide Permit 13.	SSP Required, SLL Required if improvements extend lakeward of natural shoreline, FCC Required.
Detached Breakwaters	Individual Permit Required (Sand prefill required) (Monitoring plan required)	Individual Permit Required	SSP Required, SLL Required if improvements extend lakeward of natural shoreline, FCC Required.
Timber Groins	Individual Permit Required (Sand prefill required) (Monitoring plan required)	Individual Permit Required	SSP Required, SLL Required if improvements extend lakeward of natural shoreline, FCC Required.
Sand Prefill/Beach Nourishment	Required as a permit condition.	Required as a permit condition.	Required as a permit condition.

It should be noted that a design that includes more than one of the alternative in the table above will likely be complex enough to require individual permits from the USACE and OEPA. The permit requirements will be similar for all three timber groin alternatives.

Cost Comparison

Area A*	Alternative 1	Alternative 2	Alternative 3
Armor Stone Revetment	$25,000	$60,000	$0
Detached Breakwater	$0	$0	$100,000
Timber Groin**	$20,000	$0	$0
Sand Pre-Fill	$55,000	$55,000	$75,000
Total	**$100,000**	**$105,000**	**$175,000**
*Area A costs exclude the proposed 600 linear feet of armor stone revetment			
**Timber groin costs are dependent on the groin construction alternative selected.			
Area B	Alternative 1	Alternative 2	Alternative 3
Armor Stone Revetment	$200,000	$100,000	$0
Timber Groin	$20,000	$20,000	$20,000
Sand Pre-Fill	$18,000	$30,000	$18,000
Total	**$238,000**	**$150,000**	**$38,000**
**Timber groin costs are dependent on the groin construction alternative selected.			
Area C	Alternative 1	Alternative 2	Alternative 3
Armor Stone Revetment	$200,000	$100,000	$200,000
Timber Groin	$20,000	$20,000	$0
Sand Pre-Fill	$18,000	$32,000	$18,000
Total	**$238,000**	**$152,000**	**$218,000**
**Timber groin costs are dependent on the groin construction alternative selected.			
Area D	Alternative 1	Alternative 2	Alternative 3
Timber Groins***	$450,000	$630,000	$270,000
Sand Pre-Fill	$190,000	$190,000	$190,000
Total	**$640,000**	**$820,000**	**$460,000**
*Assumes 75% of timber material must be imported to the site.			

The cost listed above do not include contractor mobilization or construction or improvement of haul roads for material and equipment delivery.

Construction costs for the overall project are anticipated to range from about $850,000 to $1,600,000 (in current costs, subject to increase over time). These costs will be dependent on potential phasing for the project. The cost listed above also do not include professional services fees for site investigation, design, permitting or construction administration. These costs should be anticipated to be about 20% of construction costs.

While each alternative proposed is expected to provide some benefit, the recommendations should not be considered equal in terms of shore stabilization and erosion protection. The recommendations generally increase in cost with complexity and structural resilience in a wider range of water level and wave conditions. The overall effectiveness of the recommended alternatives generally increases with cost. Providing a range of alternatives provides the opportunity to review the potential construction costs and decide on a strategy that both meets the project needs and anticipated construction budget.

The Engineer's opinions of probable Construction Cost are made on the basis of the engineer's experience and qualifications and represent the engineer's best judgment as an experienced and qualified professional generally familiar with the construction industry. However, because the engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over contractors' methods of determining prices, or over competitive bidding or market conditions, the engineer cannot and does not guarantee that proposals, bids, or actual Construction Cost will not vary from opinions of probable construction cost prepared by the engineer.

Next Steps

The alternatives listed above are not exclusive. KS recommends a full alternatives analysis during the detailed design of the shore stabilization measures for the shore of the Mentor Lagoons Nature Preserve. Additional alternatives or combinations of alternatives should be considered. KS also recommends that the City of Mentor consider developing and installing multiple alternatives so that the effectiveness and resiliency of each can be tested for this pilot project.

If you have any questions or would like to pursue the recommendations listed above, please contact me at 440-365-4730 ext. 395 or cencerm@ksassociates.com.

Sincerely,

KS ASSOCIATES, INC.

Mark P. Cencer, P.E.
Director of Coastal Engineering

c: John Matricardi, P.E., KS Associates

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Attachments:

Attachment A: Scope of Services
Attachment B: ODNR Historical Aerial Photography
Attachment C: Site Photography, February 7, 2019
Attachment D: ODNR Coastal Erosion Area Maps
Attachment E: Conceptual Drawings

KS ASSOCIATES

Civil Engineers + Surveyors

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January 14, 2019

City of Mentor
8500 Civic Center Blvd.
Mentor, OH 44060
Attn: Kenn Kaminski

RE: Professional Services Proposal for OLEC Grant for Mentor Coastal Habitat – Living Shorelines Project, Project #17304

Dear Mr. Kaminski:

Please accept this proposal for professional engineering services that may be required to meet your objective.

Project Objective:

We understand that the City of Mentor wishes to have KS assist with preparation of preliminary designs for nature-based shoreline stabilization at the Mentor Lagoons Nature Preserve as part of the Mentor Coastal Habitat – Living Shores Project which was funded by a Lake Erie Protection Fund Grant. In order to accomplish this objective, we recommend the following scope of services:

Engineering Services for Preliminary Design for Mentor Coastal Habitat – Living Shores Project

- KS will collect and review existing historical data for the shoreline at the Mentor Lagoons Nature Preserve including erosion photos available from the City of Mentor and previous Shore Structure Permits, Coastal Erosion Area Maps and historical aerial photos from the ODNR Office of Coastal Management.

- KS will attend one site visit to review existing conditions along the shore of the Mentor Lakeshore Preserve.

- KS will prepare conceptual designs utilizing nature-based shoreline infrastructure to help prevent erosion and support habitat along the shore of the Mentor Lakeshore Preserve. Nature-based / green infrastructure alternatives will be prepared for approximately 3,000 linear feet of shore extending from about 600 feet east of the existing Mentor Lagoons revetment to Sawyers Point.

  KS will prepare conceptual designs for up to three alternatives for nature-based shoreline infrastructure along approximately 3,000 linear feet of shore. The conceptual designs will include considerations for erosion prevention and coastal habitat elements at the following locations:

  - The eastern terminus of the new approximately 600 linear feet of armor stone revetment proposed as an extension to the existing Mentor Lagoons revetment.
  - At the toe of the bluff in the vicinity of the Woods Trail Road.
  - In the vicinity of Sawyers Point.

  Deliverables for conceptual designs will include plan view sketches of design layouts and features overlaid onto aerial photographs.

- KS will prepare a preliminary Engineer's opinion of probable Construction Costs for each alternative proposed. The Engineer's opinions of probable Construction Cost will be made on the basis of the engineer's experience and qualifications and represent the engineer's best judgment as an experienced and qualified professional generally familiar with the construction industry. However, because the engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over contractors' methods of determining prices, or over competitive bidding or market conditions, the engineer cannot and does not guarantee that proposals, bids, or actual Construction Cost will not vary from opinions of probable construction cost prepared by the engineer.

- KS will prepare a matrix comparing the likely effectiveness of the proposed alternatives in terms of erosion prevention and coastal habitat restoration with probable construction costs, constructability and regulatory permit considerations for each alternative proposed.

- KS will assist the City of Mentor with the preparation of the reports required for the Lake Erie Protection Fund (LEPF) Grant program.

- KS will attend meetings with the City of Mentor, as required, to assist with the preparation of the LEPF final report.

For the purpose of this proposal 'Nature based / green infrastructure', is defined as some combination of natural materials, such as trees and wood debris, and some recommendation of the introduction of post-project landscape elements (trees, plants) that can serve in tandem with inorganic materials, as a means to both manage and control shoreline erosion, be responsive to the existing natural conditions, and offer solutions that are site specific and appropriate in terms of being responsive to seasonal cycles.

Timetable

If written authorization is received by January 21, 2019, we will endeavor to prepare the preliminary design sketches, cost opinions and the alternative comparison matrix by February 18, 2019 for inclusion in the LEPF final report due February 28, 2019.

Professional Services Fee

Our fee for the cited scope of services will be based on hourly rates not to exceed the total project grant cost of **$10,000**. The following hourly rates will be used for the project:

Director of Coastal Engineering	$160/HR
Senior Coastal Engineer	$160/HR
Coastal Engineer	$100/HR
CAD Draftsman	$ 96/HR
Ed Herdendorf (Consultant)	$150/HR
Travel Expenses	$0.545/Mile

We will bill monthly for services rendered.

Exclusions

The preliminary design sketches prepared for inclusion in the LEPF report are not final construction drawings and will be clearly marked "Not for Construction". The Owner is cautioned and advised not to use preliminary plans for construction.

The preliminary design sketches will be prepared based on field observations and scaled measurements of the proximity of coastal features from aerial photographs. The proposal does not include professional surveying services.

This proposal does not include preparation of detailed design drawings or permit applications for the proposed alternatives.

Terms of the Agreement

By accepting this proposal, you agree to the Standard Conditions which is an integral part of this Agreement.

In order to initiate services, please have a properly authorized person sign this page, sign the Standard Conditions, and return the entire Agreement including attachments to KS.

If you have any questions or comments, please call me at (440) 365-4730 ext. 395 or email to cencerm@ksassociates.com

This professional services proposal is valid until January 31, 2019.

Sincerely,

KS ASSOCIATES, INC.

Mark Cencer, P.E.
Director of Coastal Engineering

Attachment: Standard Conditions

Cc: Lynn S. Miggins, P.E., President, KS Associates, Inc.
Mark B. Skellenger, P.E., Vice President, KS Associates, Inc.
Project File / Billing File

This Proposal is hereby accepted by:

City of Mentor
8500 Civic Center Blvd.
Mentor, OH 44060

Authorized Signature

Date

Printed Authorized Signature

STANDARD CONDITIONS

Fee

The total fee shall be understood to be an estimate, based upon Scope of Services, and shall not be exceeded without written approval of the Client. Where the fee arrangement is to be on an hourly basis, the rates shall be those that prevail at the time services are rendered. Reimbursable expenses will be invoiced at cost with no markup.

Billings/Payments

Invoices for services and reimbursable expenses shall be submitted, at KS's option, either upon completion of the services or on a monthly basis. Invoices shall be payable within 30 days after the invoice date. A service charge of 1.5% (or the maximum legal rate) per month will be applied to the unpaid balance after 30 days from the invoice date. KS shall have the right to suspend/terminate services if payment is not received within 60 days after the invoice date and KS shall have no liability for any resultant delays or damages incurred by the Client as a result of such suspension/termination. Retainers shall be credited on the final invoice. The Client agrees to pay all costs of collection, including but not limited to reasonable attorney's fees.

Standard of Care

In providing services under this Agreement, KS will endeavor to perform in a manner consistent with that degree of care and skill ordinarily exercised by members of the same profession currently practicing under similar circumstances. KS will perform its services as expeditiously as is consistent with professional skill and care and the orderly progress of KS's part of the Project. Regardless of any other term or condition of this Agreement, KS makes no express or implied warranty of any sort. All warranties, including warranty of merchantability or warranty of fitness for a particular purpose, are expressly disclaimed.

Consequential Damages

Notwithstanding any other provision to the contrary, and to the fullest extent permitted by law, neither the Client nor KS shall be liable to the other for any incidental, indirect or consequential damages arising out of or connected in any way to the Project or this Agreement. This mutual waiver of consequential damages shall include, but not be limited to, loss of use, loss of profit, loss of business or income or any other consequential damages that either party may have incurred from any cause of action whatsoever.

Unforeseeable Conditions

A condition is unforeseeable if concealed or is not capable of investigation by reasonable visual observation. If KS has reason to believe that such a condition may exist, the Client shall authorize and pay for all costs associated with the investigation of such a condition. If (1) the Client fails to authorize such investigation after such due cause of action in favor of a third party notification, or (2) KS has no reason to believe that such a condition exists, KS shall not be responsible for the existing conditions or any resulting damages or losses resulting therefrom.

Hazardous Materials/Mold

KS shall have no responsibility for the discovery, presence, handling, removal, disposal or exposure of persons to hazardous materials of any form including mold. The Client shall inform KS of any potentially hazardous condition prior to KS performing the services.

Indemnifications

~~The Client agrees, to the fullest extent permitted by law, to indemnify and hold KS and its subconsultants harmless from and against any and all damage, losses or cost (including reasonable attorneys' fees and defense costs) caused in whole or in part by its acts, errors or omissions and those of anyone for whom they are legally liable. KS further agrees to indemnify the Client for damages arising from its own negligent errors, acts or omissions.~~

Limitation of Liability

~~In recognition of the relative risks and benefits of the project to both the Client and KS, the Client agrees, to the fullest extent permitted by law, to limit KS's total liability to the Client or anyone making claims through the Client, for any and all damages or claim expenses (including attorney's fees) arising out of this Agreement, from any and all causes, to the amount of KS's actual fee charged to the client, or another amount agreed upon in writing and signed by both parties.~~

Termination of Services for Convenience

This Agreement may be terminated upon written notice by the Client for its convenience. In the event of termination, the Client shall pay KS for all services rendered to the date of termination, all reimbursable expenses, and reasonable termination expenses.

Termination of Services for Default

This Agreement may be terminated upon 10 days written notice by either party should the other fail to perform their obligations hereunder. In the event of termination, the Client shall pay KS for all services rendered to the date of termination, all reimbursable expenses, and reasonable termination expenses.

Ownership of Documents

~~All documents produced by KS under this Agreement, including electronic files, shall remain the property of KS and may not be used by this Client for any other purpose without the written consent of KS. Any such use or reuse shall be at the sole risk of the Client who shall defend, indemnify and hold KS and its subconsultants harmless from any~~

~~and all claims and/or damages arising therefrom. Electronic files are not contract documents and cannot be relied upon as identical to contract documents because of changes or errors induced by translation, transmission, or alterations while under the control of others. Use of information contained in the electronic files is at the user's sole risk and without liability to KS and its subconsultants.~~

KS's documents shall become the property of the Client upon payment in full of all monies due to the consultant under this agreement. KS grants a limited license to use portions of non-standard details in the documents that are unique to the project in connection with the Client's occupancy of the project only, conditioned on the Client's express understanding that the alteration of the documents without involvement of KS is at the Client's sole risk. The Client agrees that the documents will only be used for the intended project.

Defects in Service

The Client shall promptly report to KS any defects or suspected defects in KS's services. The Client further agrees to impose a similar notification requirement on all contractors in its Client/Contractor contract and shall require all subcontracts at any level to contain a like agreement. Failure by the Client and the Client's contractors or subcontractors to notify KS shall relieve KS of the costs of remedying the defects above the sum such remedy would have cost had prompt notification been given when such defects were first discovered.

Construction Activities

KS shall not be responsible for (1) the acts or omissions of any one performing any of the Work, (2) the instructions given by the Client or its representatives to any one performing any of the Work, (3) the means and methods of anyone performing any of the Work, (4) job-site safety.

Dispute Resolution

In the case of a claim or dispute between the Client and KS, at least one principal from each party shall enter into a negotiation to resolve the dispute. If the parties cannot reach resolution, the claim or dispute shall then be submitted to non-binding mediation, subject to the parties agreeing to a mediator(s). If the Parties cannot agree upon a mediator the claim or dispute shall be submitted to the American Arbitration Association (AAA) for mediation in accordance with the Construction Arbitration and Mediation Rules of the AAA then in effect. Unless otherwise specified, the laws of the State of Ohio shall govern this Agreement.

No Third Party Beneficiaries

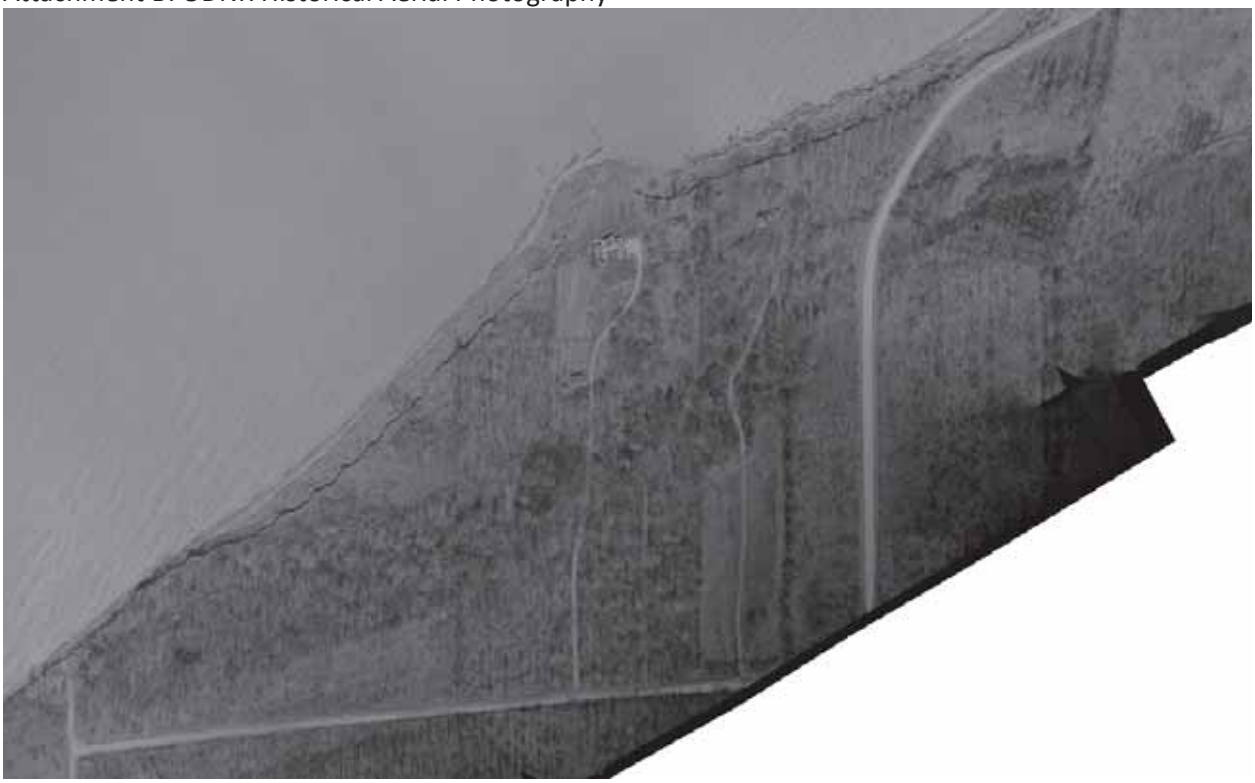
Nothing contained in this Agreement shall create a contractual relationship with or a cause of action in favor of a third party against either the Client or the Consultant. The Consultant's services under this Agreement are being performed solely for the Client's benefit, and no other party or entity shall have any claim against the Consultant because of this Agreement or the performance or nonperformance of services hereunder. The Client and Consultant agree to require a similar provision in all contracts with contractors, subcontractors, subconsultants, vendors and other entities involved in this Project to carry out the intent of this provision.

Standard Conditions Accepted by the Client:

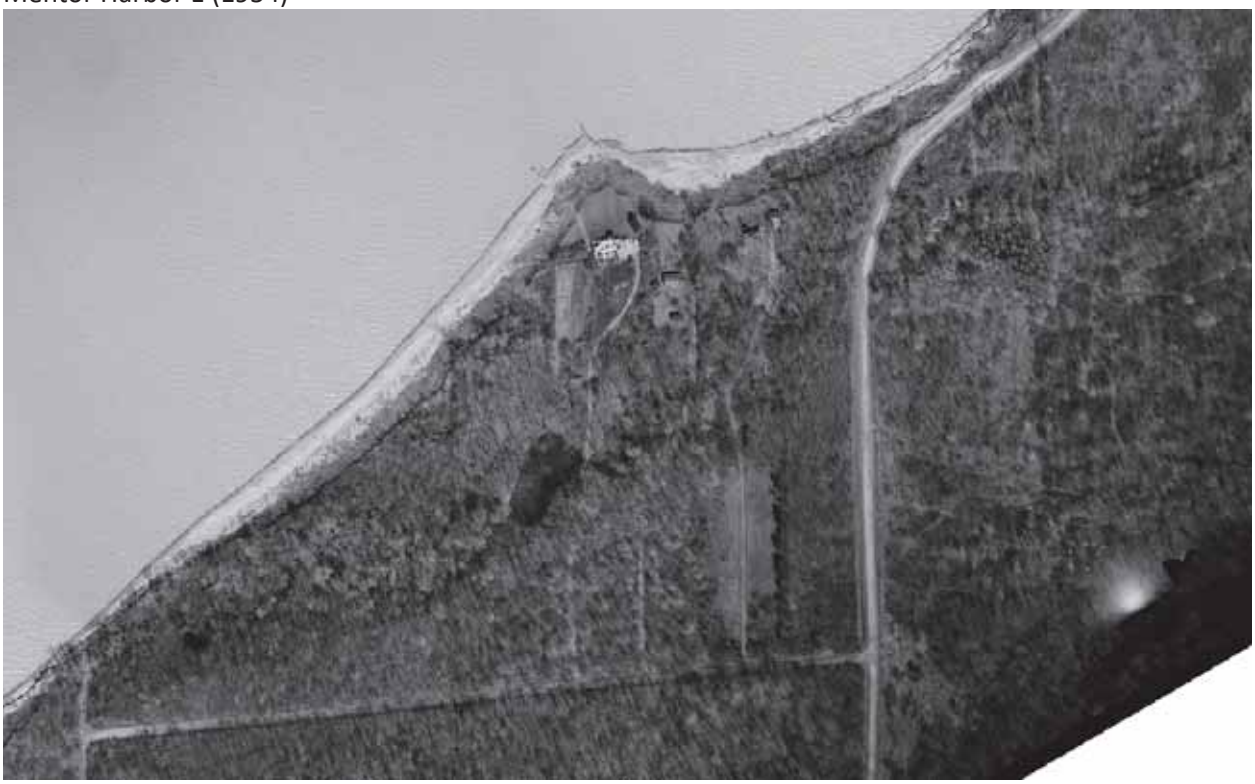
Authorized Signature	Title	Date

W:\Contracts\KS Standard Conditions\Signable KS Standard Conditions 9-19-17.doc

Attachment B: ODNR Historical Aerial Photography



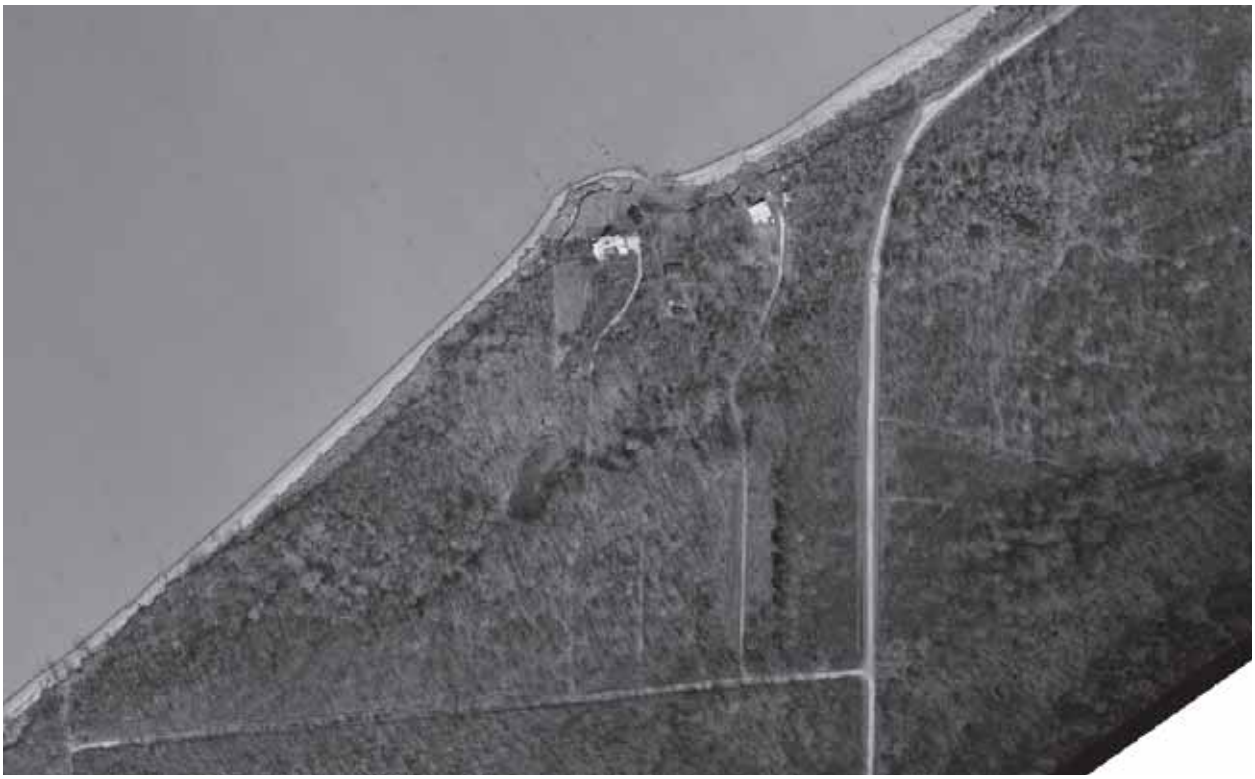
Mentor Harbor E (1954)



Mentor Harbor W (1954)

Mentor Harbor E (1968)

Mentor Harbor W (1968)



Mentor Harbor E (1973)

Mentor Harbor W (1973)

Mentor Harbor E (1980)

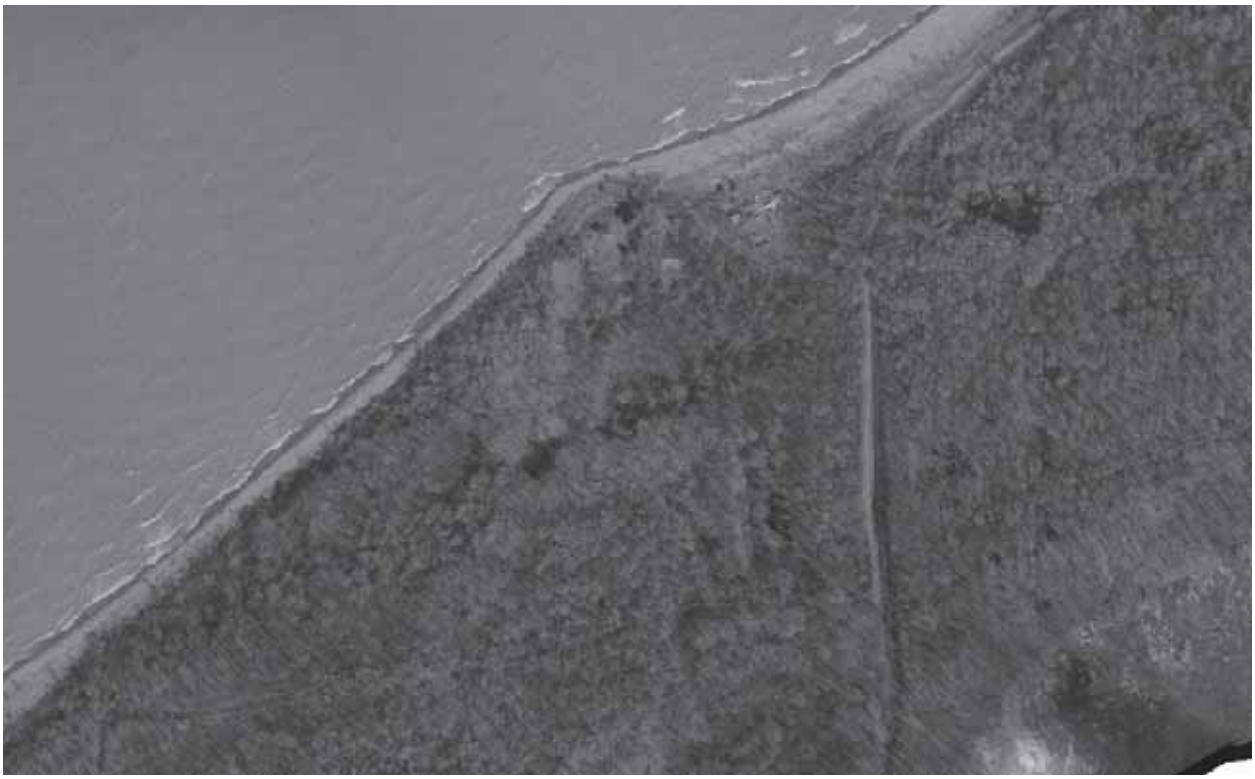
Mentor Harbor W (1980)

Mentor Harbor E (1986)

Mentor Harbor W (1986)

Mentor Harbor E (1989)

Mentor Harbor W (1989)

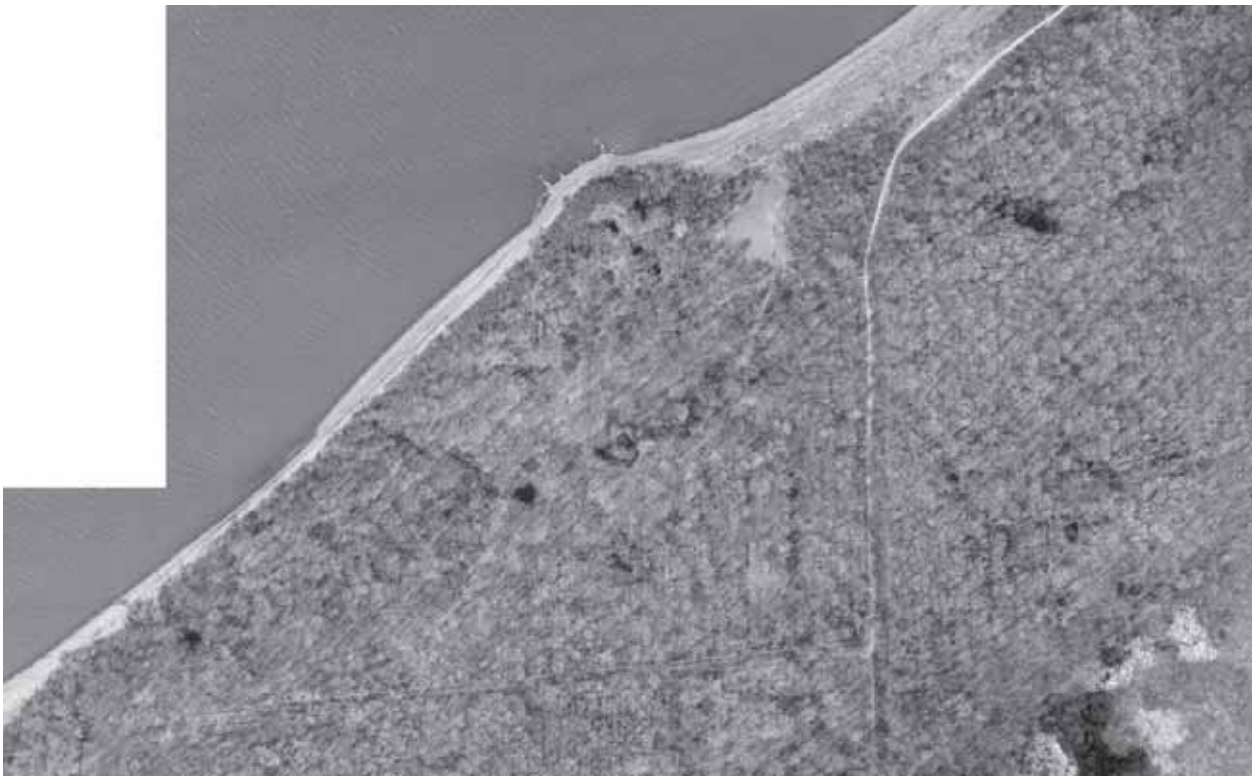


Mentor Harbor E (1993)

Mentor Harbor W (1993)

Mentor Harbor E (2003)

Mentor Harbor W (2003)



Mentor Harbor E (2004)

Mentor Harbor W (2004)

Mentor Harbor E (2006)

Mentor Harbor W (2006)

Mentor Harbor E (2011)

Mentor Harbor W (2011)

Mentor Harbor E (2014)

Mentor Harbor W (2014)

Attachment C: Site Photography (February 7, 2019)

Photo 1: At Wood's Trail Road looking east at the bluff

Photo 2: At Wood's Trail Road looking west at the bluff

Photo 3: Between Wood's Trail Road and the Marina looking west at the start of the revetment

Photo 4: Looking at the bluff to the east at Wood's Trail Road

Photo 5: At Sawyer's Point looking west

Photo 6: From the east end looking west at Sawyer's Point

LAKE ERIE COASTAL EROSION AREA
OHIO COASTAL MANAGEMENT PROGRAM

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
2010

Lake County

Frame: 351

FINAL COASTAL EROSION AREA MAPS

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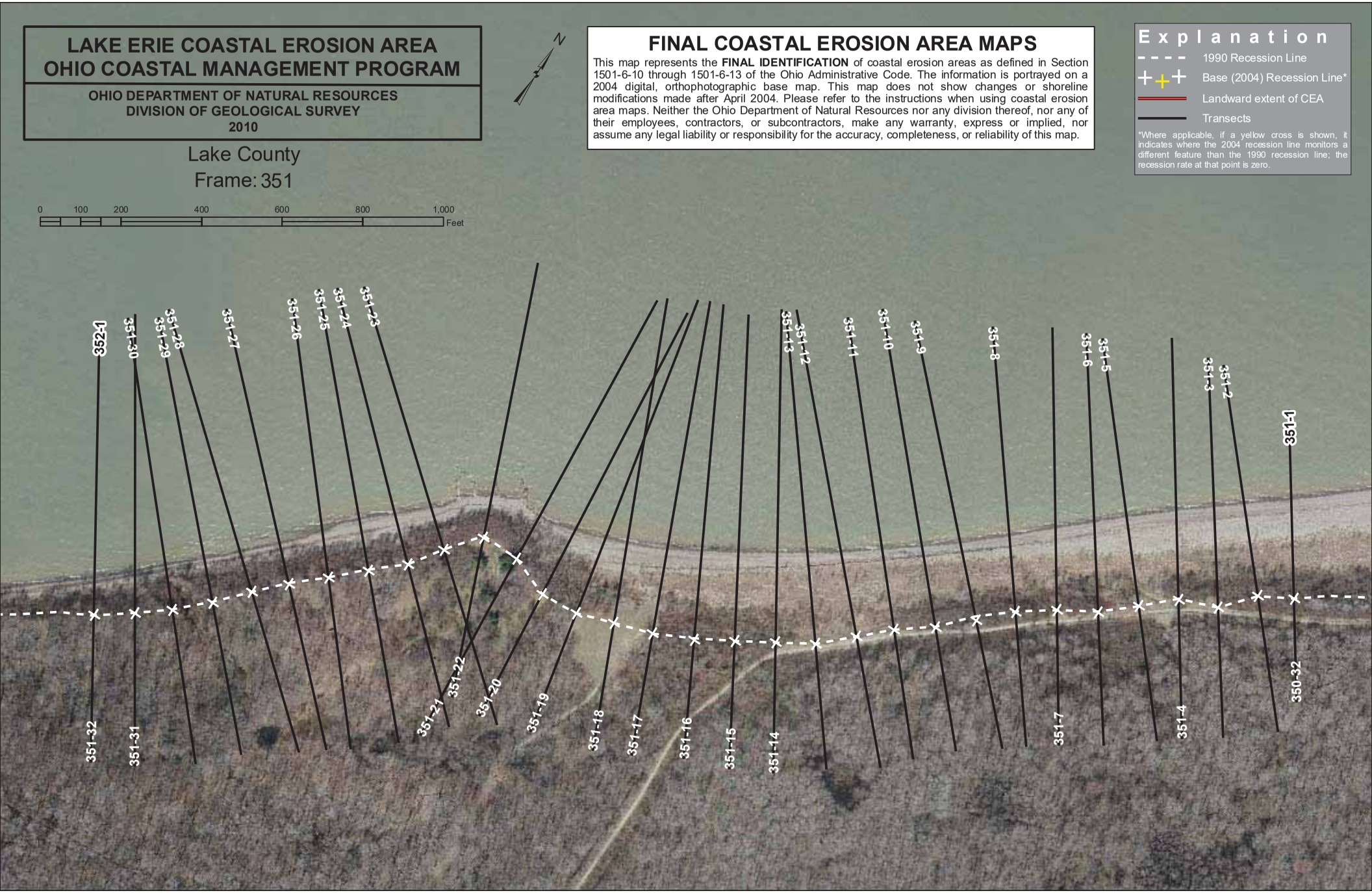
Explanation

- 1990 Recession Line
- Base (2004) Recession Line*
- Landward extent of CEA
- Transects

*Where applicable, if a yellow cross is shown, it indicates where the 2004 recession line monitors a different feature than the 1990 recession line; the recession rate at that point is zero.



LAKE COUNTY

Frame: 351
Number of Profiles: 32

TRANS	MEAS DIST	RECESS RATE	ANTICIPATED DIST	STATUS
351-1	0.9	0.1	5.3	NO CEA
351-2	0.0	0.0	2.5	NO CEA
351-3	0.3	0.0	1.6	NO CEA
351-4	2.4	0.2	2.4	NO CEA
351-5	0.0	0.0	2.1	NO CEA
351-6	1.8	0.1	2.1	NO CEA
351-7	0.0	0.0	3.3	NO CEA
351-8	1.5	0.1	6.7	NO CEA
351-9	9.9	0.7	9.8	NO CEA
351-10	1.7	0.1	6.6	NO CEA
351-11	0.0	0.0	2.5	NO CEA
351-12	0.0	0.0	0.3	NO CEA
351-13	0.1	0.0	0.2	NO CEA
351-14	0.0	0.0	1.0	NO CEA
351-15	0.6	0.0	2.6	NO CEA
351-16	4.2	0.3	3.8	NO CEA
351-17	0.0	0.0	2.2	NO CEA
351-18	0.1	0.0	0.7	NO CEA
351-19	0.0	0.0	0.1	NO CEA
351-20	0.0	0.0	0.9	NO CEA
351-21	0.3	0.0	2.6	NO CEA
351-22	4.7	0.3	4.1	NO CEA
351-23	0.3	0.0	3.1	NO CEA
351-24	0.0	0.0	2.5	NO CEA
351-25	3.2	0.2	3.2	NO CEA
351-26	0.0	0.0	3.1	NO CEA
351-27	3.0	0.2	3.4	NO CEA
351-28	0.0	0.0	2.9	NO CEA
351-29	2.5	0.2	3.3	NO CEA
351-30	1.1	0.1	2.7	NO CEA
351-31	1.2	0.1	1.9	NO CEA
351-32	0.0	0.0	1.0	NO CEA

FRAME:	Frame number of aerial photograph	**RECESS RATE:**	Recession rate (feet per year) between 1990 and 2004
TRANS:	Transect number	**ANTICPATED DIST:**	Recession (feet) anticipated during the next 30 years
MEAS DIST:	Recession distance (feet) between 1990 and 2004	**STATUS:**	Indicates presence or absence of Coastal Erosion Area

LAKE ERIE COASTAL EROSION AREA
OHIO COASTAL MANAGEMENT PROGRAM

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
2018

Lake County
Frame: 351

FINAL COASTAL EROSION AREA MAPS

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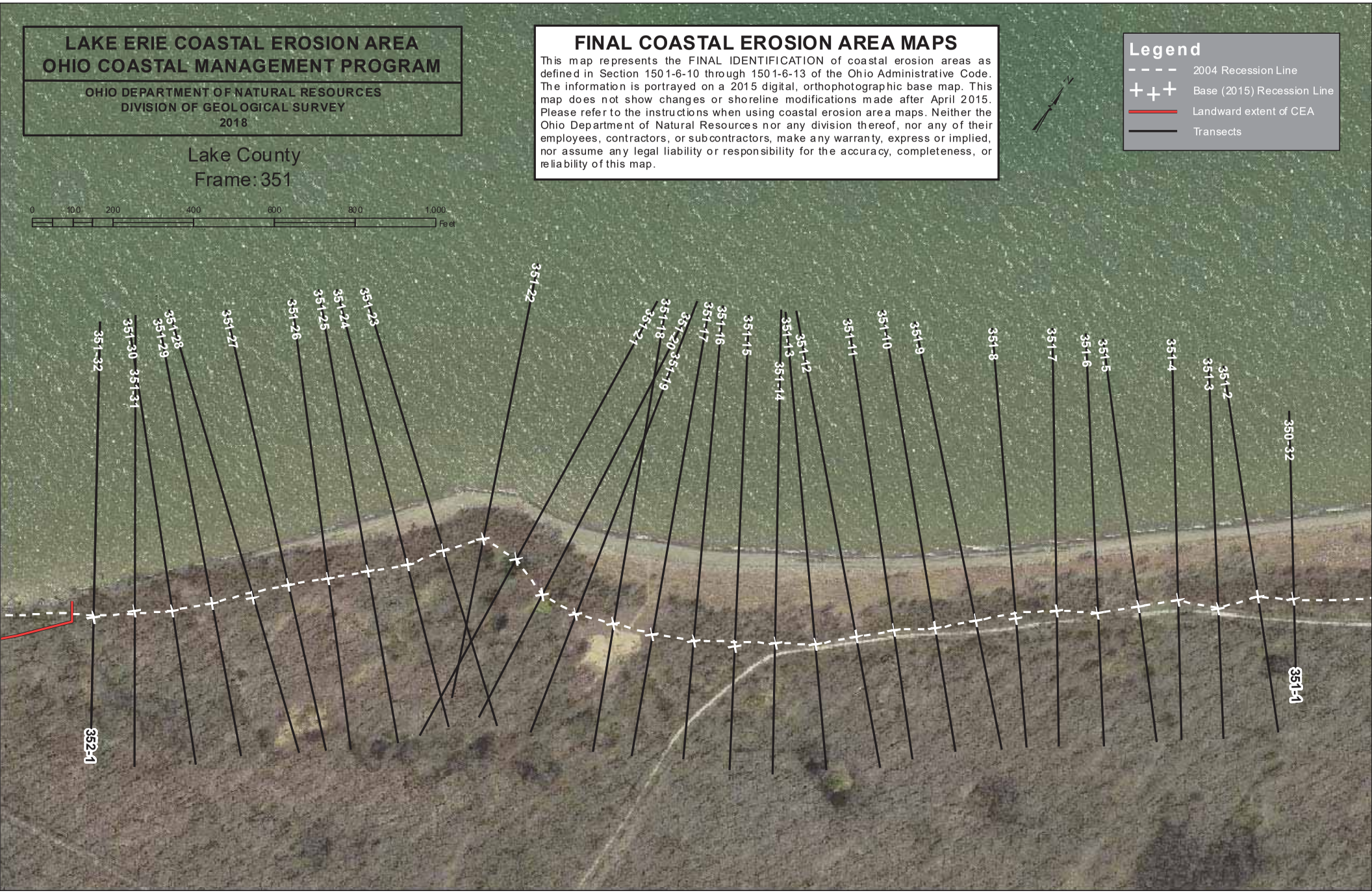

Final 2018 CEA Map Data Sheet

Frame: 351 **LAKE COUNTY**

Number of Profiles: 32

TRANS	MEAS DIST	RECESS RATE	ANTICIPATED DIST	STATUS
351-1	0.0	0.0	0.0	NO CEA
351-2	0.0	0.0	0.0	NO CEA
351-3	0.0	0.0	0.0	NO CEA
351-4	0.0	0.0	0.0	NO CEA
351-5	0.0	0.0	0.0	NO CEA
351-6	0.0	0.0	2.7	NO CEA
351-7	0.0	0.0	8.1	NO CEA
351-8	12.9	1.2	13.6	NO CEA
351-9	0.0	0.0	8.1	NO CEA
351-10	0.0	0.0	2.7	NO CEA
351-11	0.0	0.0	0.0	NO CEA
351-12	0.0	0.0	0.0	NO CEA
351-13	0.0	0.0	0.0	NO CEA
351-14	0.0	0.0	0.0	NO CEA
351-15	0.0	0.0	0.0	NO CEA
351-16	0.0	0.0	0.0	NO CEA
351-17	0.0	0.0	0.0	NO CEA
351-18	0.0	0.0	0.0	NO CEA
351-19	0.0	0.0	0.0	NO CEA
351-20	0.0	0.0	0.0	NO CEA
351-21	0.0	0.0	0.0	NO CEA
351-22	0.0	0.0	0.0	NO CEA
351-23	0.0	0.0	0.0	NO CEA
351-24	0.0	0.0	0.0	NO CEA
351-25	0.0	0.0	0.0	NO CEA
351-26	0.0	0.0	0.0	NO CEA
351-27	0.0	0.0	0.0	NO CEA
351-28	0.1	0.0	0.0	NO CEA
351-29	0.0	0.0	0.0	NO CEA
351-30	0.0	0.0	1.1	NO CEA
351-31	0.0	0.0	4.8	NO CEA
351-32	5.0	0.5	12.7	NO CEA

FRAME:	Frame number of aerial photograph	**RECESS RATE:**	Recession rate (feet per year) between 2004 and 2015
TRANS:	Transect number	**ANTICPATED DIST***	Recession (feet) anticipated during the next 30 years
MEAS DIST:	Recession distance (feet) between 2004 and 2015	**STATUS:**	Indicates presence or absence of Coastal Erosion Area

* Due to averaging, may not equal RECESS RATE times 30

LAKE ERIE COASTAL EROSION AREA
OHIO COASTAL MANAGEMENT PROGRAM

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
2010

Lake County

Frame: 352

FINAL COASTAL EROSION AREA MAPS

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Explanation

- 1990 Recession Line
- Base (2004) Recession Line*
- Landward extent of CEA
- Transects

*Where applicable, if a yellow cross is shown, it indicates where the 2004 recession line monitors a different feature than the 1990 recession line; the recession rate at that point is zero.

LAKE COUNTY

Frame: 352
Number of Profiles: 34

TRANS	MEAS DIST	RECESS RATE	ANTICIPATED DIST	STATUS
352-1	0.0	0.0	1.0	NO CEA
352-2	0.0	0.0	0.9	NO CEA
352-3	1.5	0.1	1.2	NO CEA
352-4	0.0	0.0	0.7	NO CEA
352-5	0.0	0.0	0.5	NO CEA
352-6	0.0	0.0	1.0	NO CEA
352-7	1.3	0.1	2.2	NO CEA
352-8	2.3	0.2	3.0	NO CEA
352-9	0.0	0.0	3.9	NO CEA
352-10	2.4	0.2	6.4	NO CEA
352-11	7.8	0.6	9.2	NO CEA
352-12	1.0	0.1	8.3	NO CEA
352-13	6.1	0.4	8.6	NO CEA
352-14	1.0	0.1	7.9	NO CEA
352-15	7.9	0.6	8.0	NO CEA
352-16	0.0	0.0	4.3	NO CEA
352-17	0.0	0.0	2.3	NO CEA
352-18	1.3	0.1	2.2	NO CEA
352-19	2.4	0.2	2.6	NO CEA
352-20	0.0	0.0	1.8	NO CEA
352-21	0.0	0.0	2.6	NO CEA
352-22	2.3	0.2	6.2	NO CEA
352-23	6.2	0.4	12.2	CEA
352-24	7.4	0.5	20.3	CEA
352-25	13.8	1.0	32.7	CEA
352-26	24.0	1.7	46.0	CEA
352-27	29.2	2.1	49.3	CEA
352-28	22.5	1.6	36.9	CEA
352-29	0.0	0.0	15.9	CEA
352-30	0.0	0.0	3.7	NO CEA
352-31	0.0	0.0	0.0	NO CEA
352-32	0.0	0.0	0.0	NO CEA
352-33	0.0	0.0	0.0	NO CEA
352-34	0.0	0.0	0.0	NO CEA

FRAME:	Frame number of aerial photograph	**RECESS RATE:**	Recession rate (feet per year) between 1990 and 2004
TRANS:	Transect number	**ANTICPATED DIST:**	Recession (feet) anticipated during the next 30 years
MEAS DIST:	Recession distance (feet) between 1990 and 2004	**STATUS:**	Indicates presence or absence of Coastal Erosion Area

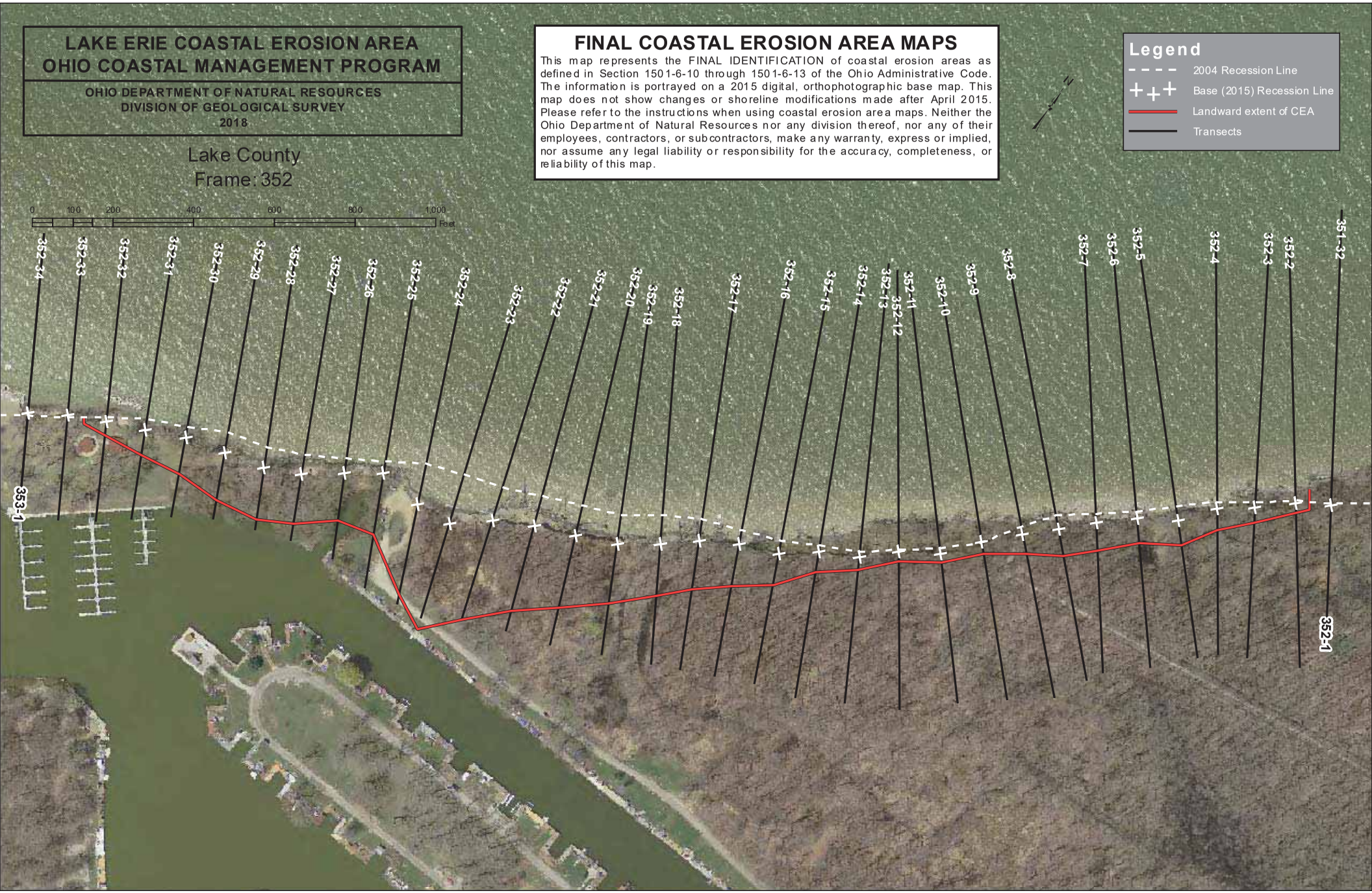
LAKE ERIE COASTAL EROSION AREA
OHIO COASTAL MANAGEMENT PROGRAM

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
2018

Lake County
Frame: 352

FINAL COASTAL EROSION AREA MAPS

This map represents the FINAL IDENTIFICATION of coastal erosion areas as defined in Section 1501-6-10 through 1501-6-13 of the Ohio Administrative Code. The information is portrayed on a 2015 digital, orthophotographic base map. This map does not show changes or shoreline modifications made after April 2015. Please refer to the instructions when using coastal erosion area maps. Neither the Ohio Department of Natural Resources nor any division thereof, nor any of their employees, contractors, or subcontractors, make any warranty, express or implied, nor assume any legal liability or responsibility for the accuracy, completeness, or reliability of this map.



Final 2018 CEA Map Data Sheet

Frame: 352 **LAKE COUNTY**

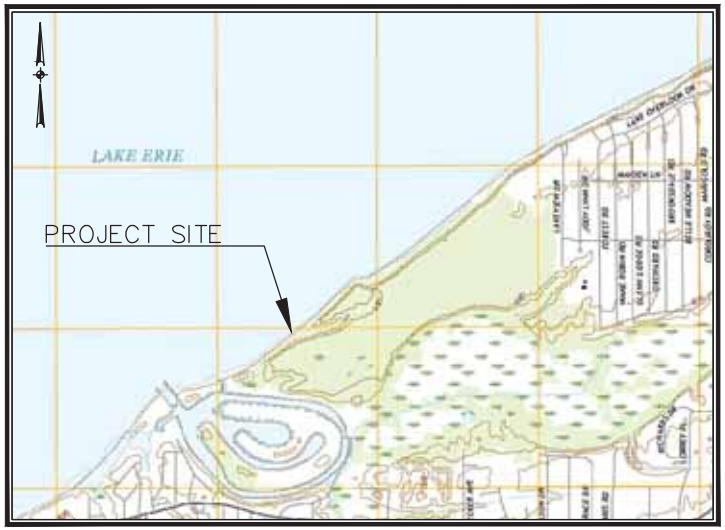
Number of Profiles: 34

TRANS	MEAS DIST	RECESS RATE	ANTICIPATED DIST	STATUS
352-1	5.0	0.5	12.7	NO CEA
352-2	7.8	0.7	22.6	CEA
352-3	12.0	1.1	36.8	CEA
352-4	17.5	1.6	52.4	CEA
352-5	34.3	3.1	64.0	CEA
352-6	15.3	1.4	63.3	CEA
352-7	23.4	2.1	67.4	CEA
352-8	35.1	3.2	66.7	CEA
352-9	19.1	1.7	49.7	CEA
352-10	0.0	0.0	28.3	CEA
352-11	12.5	1.1	22.7	CEA
352-12	5.0	0.5	23.5	CEA
352-13	11.2	1.0	34.2	CEA
352-14	15.7	1.4	52.4	CEA
352-15	32.5	3.0	80.2	CEA
352-16	35.1	3.2	103.8	CEA
352-17	55.8	5.1	121.1	CEA
352-18	47.9	4.4	127.3	CEA
352-19	52.5	4.8	147.4	CEA
352-20	76.3	6.9	182.8	CEA
352-21	76.7	7.0	218.5	CEA
352-22	85.7	7.8	255.2	CEA
352-23	126.6	11.5	273.0	CEA
352-24	101.6	9.2	230.2	CEA
352-25	29.3	2.7	154.3	CEA
352-26	35.8	3.3	119.5	CEA
352-27	50.1	4.6	124.0	CEA
352-28	50.9	4.6	130.4	CEA
352-29	50.9	4.6	119.3	CEA
352-30	28.0	2.5	91.4	CEA
352-31	27.2	2.5	63.3	CEA
352-32	10.3	0.9	33.8	CEA
352-33	0.0	0.0	12.2	NO CEA
352-34	0.0	0.0	2.2	NO CEA

FRAME:	Frame number of aerial photograph	**RECESS RATE:**	Recession rate (feet per year) between 2004 and 2015
TRANS:	Transect number	**ANTICPATED DIST***	Recession (feet) anticipated during the next 30 years
MEAS DIST:	Recession distance (feet) between 2004 and 2015	**STATUS:**	Indicates presence or absence of Coastal Erosion Area

* Due to averaging, may not equal RECESS RATE times 30

MENTOR COASTAL HABITAT
AT 8365 HARBOR DRIVE
MENTOR, OHIO 44060



VICINITY MAP, USGS MENTOR QUAD, NO SCALE

DRAWING TITLE	SHEET No.
TITLE SHEET	1
SITE PLAN	2
WEST END ALTERNATIVES	3
TRAIL ALTERNATIVES	4
SAWYER'S POINT ALTERNATIVES	5
GROIN CONSTRUCTION ALTERNATIVES	6

MARK P. CENCER, P.E. OHIO REG. NO. 74234 DATE

OHIO Utilities Protection SERVICE
Call Before You Dig
1-800-362-2764
CALL TWO WORKING DAYS BEFORE YOU DIG
(NON MEMBERS MUST BE CALLED DIRECTLY)

1. UNDERGROUND UTILITIES ARE SHOWN FROM RECORDS AND FIELD MARKINGS PROVIDED BY UTILITY COMPANIES AND AGENCIES. ACTUAL LOCATIONS MAY VARY. CONTACT OHIO UTILITIES PROTECTION SERVICE (OUPS) AT 1-800-362-2764 AT LEAST 48 HOURS PRIOR TO EXCAVATION.

2. VISIBLE SURFACE UTILITIES HAVE BEEN FIELD LOCATED UNLESS OTHERWISE NOTED.

CONCEPTUAL DRAWINGS
NOT FOR CONSTRUCTION

ADJACENT PROPERTY OWNERS
MENTOR HARBOR YACHT CLUB
5330 CORONADA DRIVE, MENTOR, OHIO 44060
DAVID J. & KATHLEEN A. VAVRO
8715 HEADLANDS ROAD, MENTOR, OHIO 44060

DATUM: 0.0 LWD = 569.2 FEET IGLD 1985

REVISIONS	DATE	BY
	–	

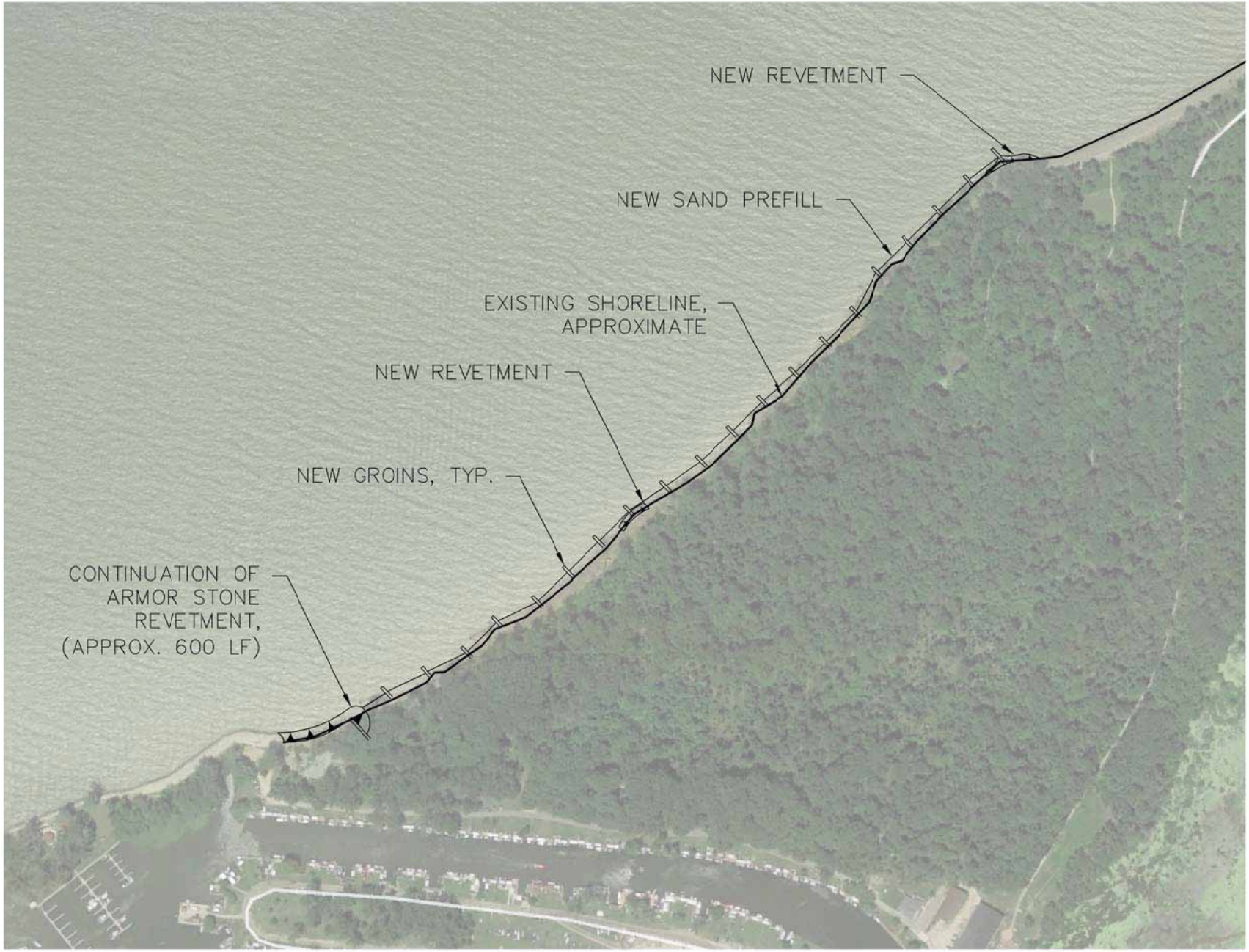
DATE:
DRAWN BY:
CKD BY:
DWG. NAME:
PATH:
F.B.

KS ASSOCIATES
KS Associates, Inc.
260 Burns Road, Suite 100
Elyria, OH 44035
P 440 965 4790
F 440 965 4790
www.ksassociates.com

TITLE SHEET
MENTOR COASTAL HABITAT
LAKE COUNTY
8365 HARBOR DRIVE
MENTOR, OHIO 44060

SHEET 1 OF 6

JOB NO.
17304



SITE PLAN

500 0 500

SCALE IN FEET

CONCEPTUAL DRAWINGS
NOT FOR CONSTRUCTION

ADJACENT PROPERTY OWNERS
MENTOR HARBOR YACHT CLUB 5330 CORONADA DRIVE, MENTOR, OHIO 44060
DAVID J. & KATHLEEN A. VAVRO 8715 HEADLANDS ROAD, MENTOR, OHIO 44060

DATUM: 0.0 LWD = 569.2 FEET IGLD 1985

DATE	BY
–	

REVISIONS

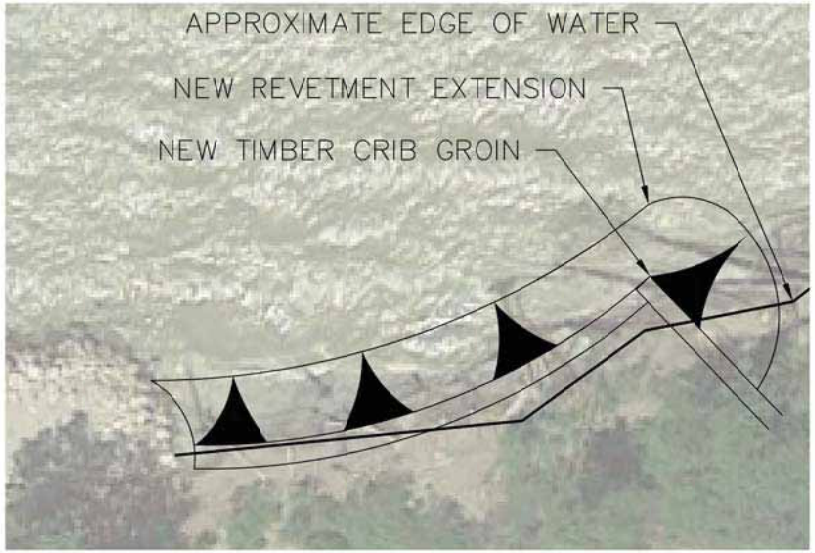
DATE:
DRAWN BY:
CKD BY:
DWG. NAME:
PATH:
F.B.

KS Associates, Inc.
260 Burns Road, Suite 100
Elyria, OH 44035
P 440 365 4730
F 440 365 4790
www.ksassociates.com
KS ASSOCIATES

SITE PLAN
MENTOR COASTAL HABITAT
LAKE COUNTY
8365 HARBOR DRIVE
MENTOR, OHIO 44060

SHEET 2 OF 6

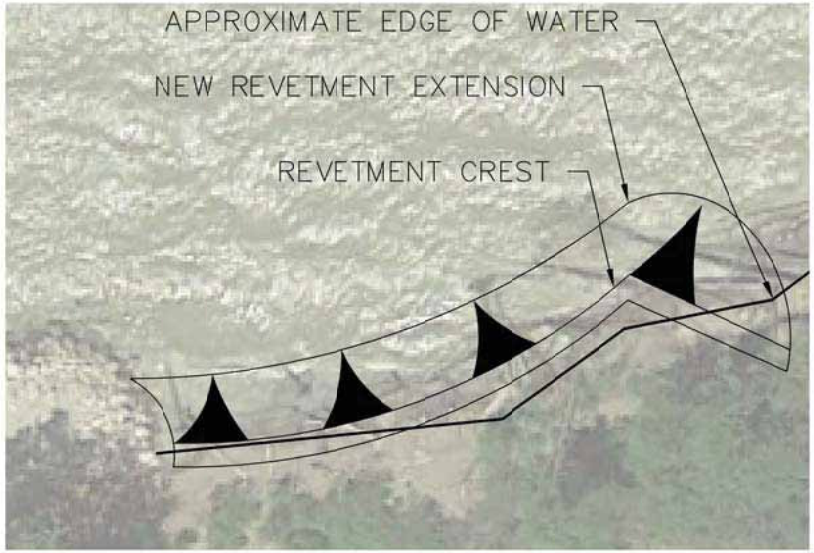
JOB NO.
17304



WEST END ALTERNATIVE 1

100 0 100

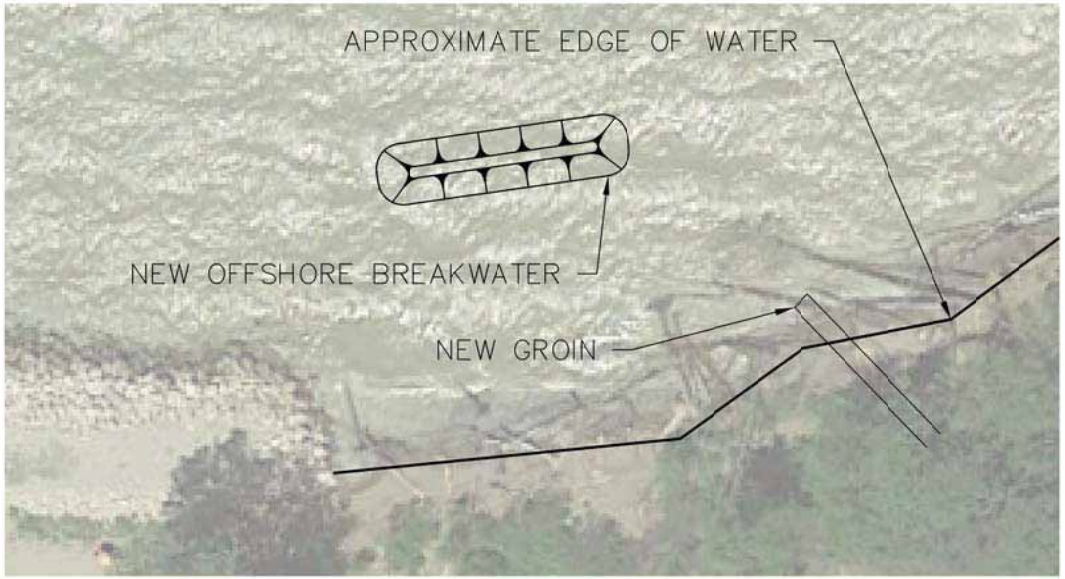
SCALE IN FEET



WEST END ALTERNATIVE 2

100 0 100

SCALE IN FEET



WEST END ALTERNATIVE 3

100 0 100

SCALE IN FEET

CONCEPTUAL DRAWINGS
NOT FOR CONSTRUCTION

DATE	BY	ADJACENT PROPERTY OWNERS
–		MENTOR HARBOR YACHT CLUB 5330 CORONADA DRIVE, MENTOR, OHIO 44060
		DAVID J. & KATHLEEN A. VAVRO 8715 HEADLANDS ROAD, MENTOR, OHIO 44060

REVISIONS

DATUM: 0.0 LWD = 569.2 FEET IGLD 1985

DATE:
DRAWN BY:
CKD BY:
DWG. NAME:
PATH:
F.B.

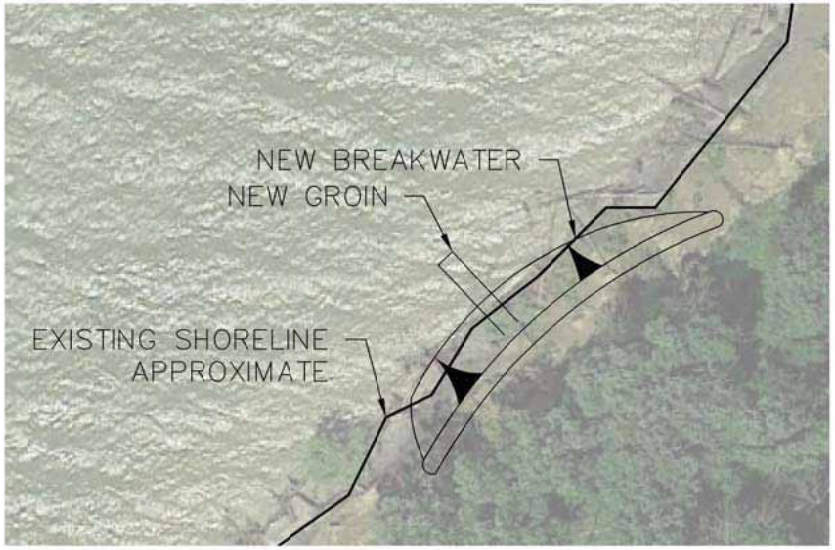
KS Associates, Inc.
260 Burns Road, Suite 100
Elyria, OH 44035
P 440 365 4730
F 440 365 4790
www.ksassociates.com
KS ASSOCIATES

WEST END ALTERNATIVES
MENTOR COASTAL HABITAT

LAKE COUNTY
8365 HARBOR DRIVE
MENTOR, OHIO 44060

SHEET 3 OF 6

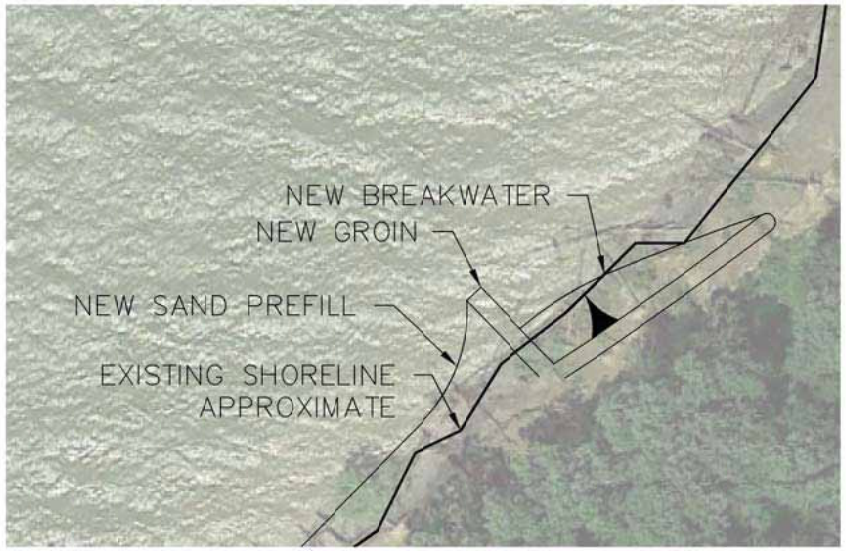
JOB NO.
17304



WOODS TRAIL ROAD ALTERNATIVE 1

100 0 100

SCALE IN FEET



WOODS TRAIL ROAD ATERNATIVE 2

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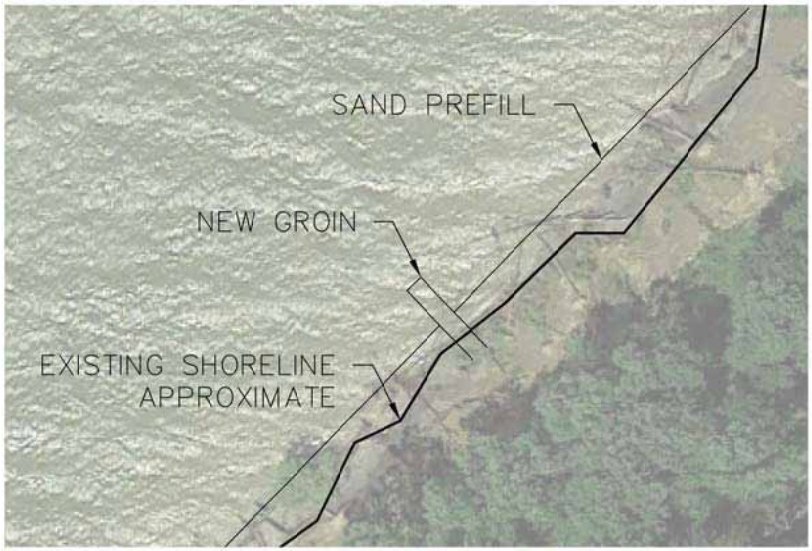
SCALE IN FEET



WOODS TRAIL ROAD ALTERNATIVE 3

100 0 100

SCALE IN FEET

CONCEPTUAL DRAWINGS
NOT FOR CONSTRUCTION

DATE	BY	ADJACENT PROPERTY OWNERS
–		MENTOR HARBOR YACHT CLUB 5330 CORONADA DRIVE, MENTOR, OHIO 44060
		DAVID J. & KATHLEEN A. VAVRO 8715 HEADLANDS ROAD, MENTOR, OHIO 44060

DATUM: 0.0 LWD = 569.2 FEET IGLD 1985

REVISIONS

DATE:
DRAWN BY:
CKD BY:
DWG. NAME:
PATH:
F.B.

KS Associates, Inc.
260 Burns Road, Suite 100
Elyria, OH 44035
P 440 365 4730
F 440 365 4790
www.ksassociates.com
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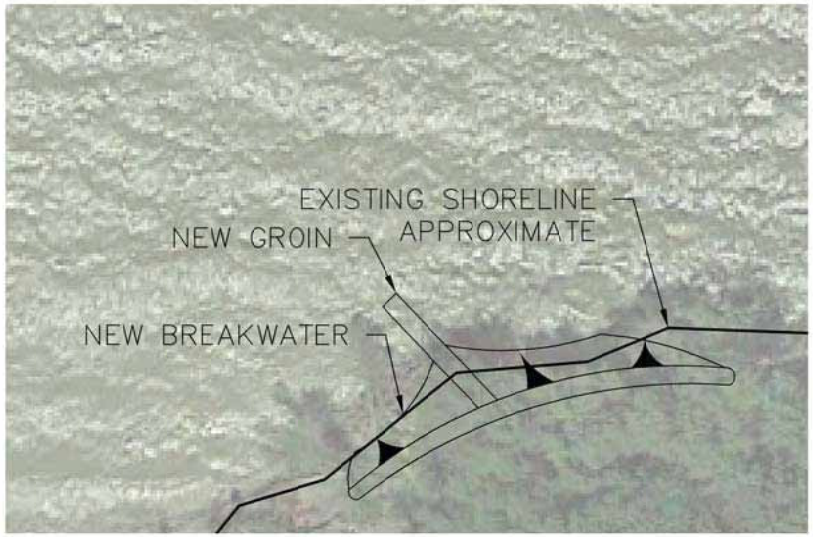
WOODS TRAIL ROAD ALTERNATIVES
MENTOR COASTAL HABITAT

LAKE COUNTY
8365 HARBOR DRIVE
MENTOR, OHIO 44060

SHEET 4 OF 6

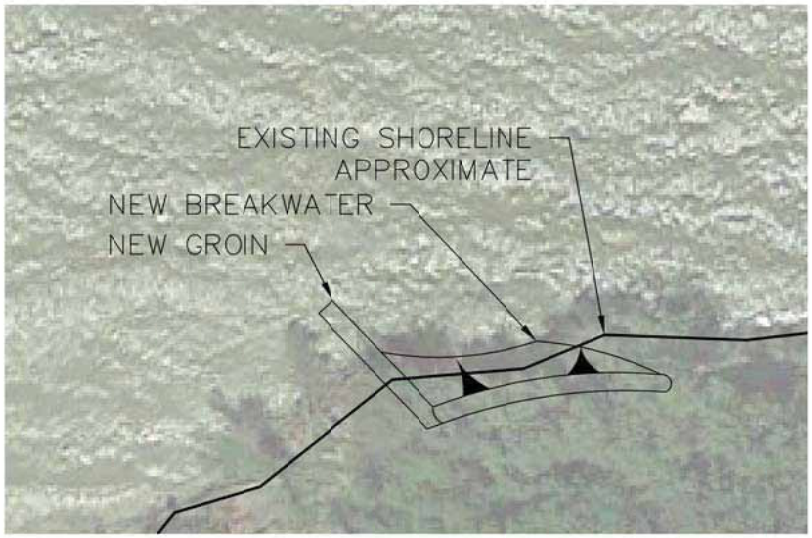
JOB NO.
17304



SAWYER'S POINT ALTERNATIVE 1

100 0 100

SCALE IN FEET



SAWYER'S POINT ALTERNATIVE 2

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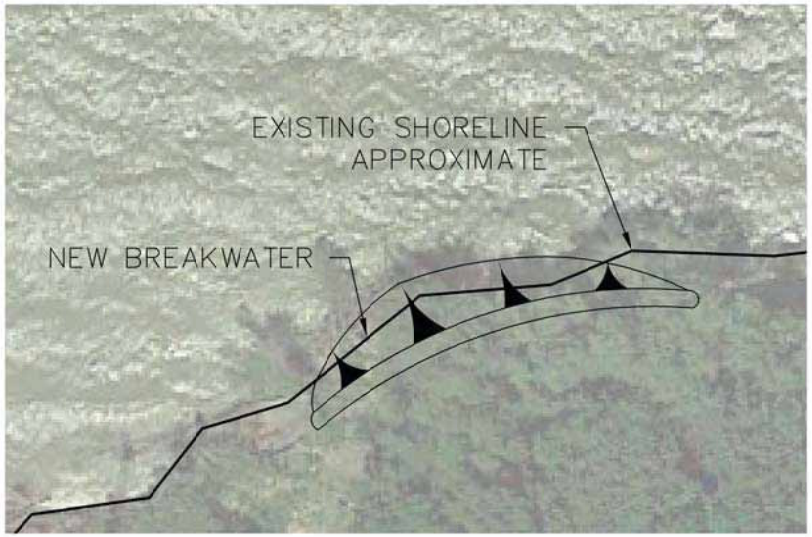

SAWYER'S POINT ALTERNATIVE 3

100 0 100

SCALE IN FEET

CONCEPTUAL DRAWINGS
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DATE	BY	REVISIONS
–		

ADJACENT PROPERTY OWNERS
MENTOR HARBOR YACHT CLUB
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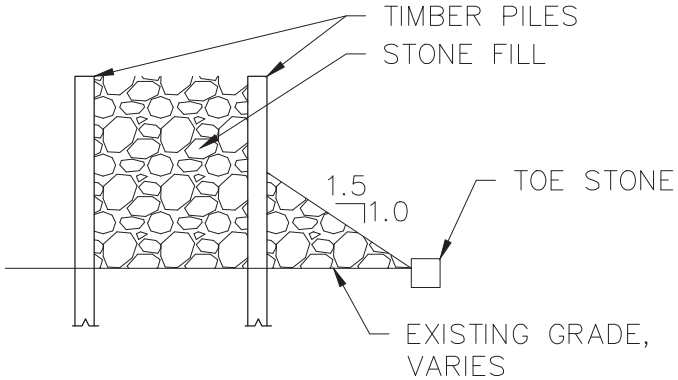
SHEET 5 OF 6

JOB NO.
17304



TIMBER PILES GROIN ALTERNATIVE 1

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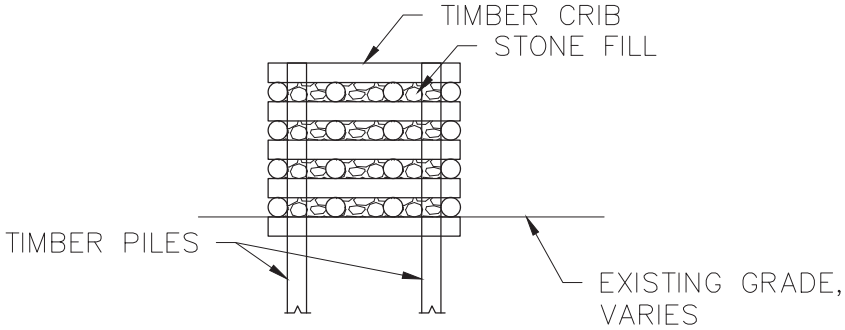
SCALE IN FEET



TIMBER CRIB GROIN ALTERNATIVE 2

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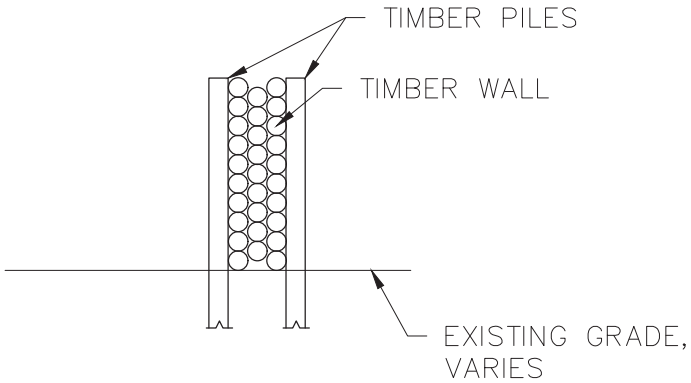
SCALE IN FEET



TIMBER GROIN ALTERNATIVE 3

10 0 10

SCALE IN FEET

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MENTOR HARBOR YACHT CLUB 5330 CORONADA DRIVE, MENTOR, OHIO 44060
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SHEET 6 OF 6

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