Lake Erie Shore Erosion Management Plan

Erie County: Reach CV 05

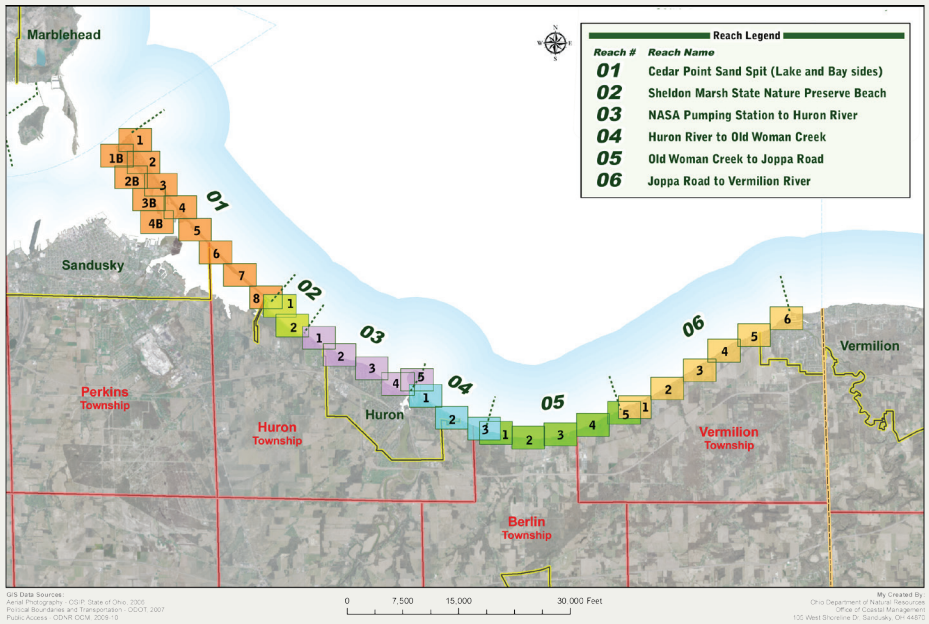
LESEMP

About the Program

In an on-going effort to assist property owners along Ohio's Lake Erie coast by providing free technical assistance, the *Lake Erie Shore Erosion Management Plan* (*LESEMP*) is being developed by the Ohio Department of Natural Resources through a partnership between the Office of Coastal Management, Division of Wildlife and Division of Geological Survey.

The *LESEMP* identifies the causes of erosion in specific areas called reaches which are stretches of shore with similar site conditions. The *LESEMP* then outlines the most likely means of successful erosion control based on reach-specific erosion issues, geology and habitat. The objective of the reach-based approach to erosion control is to simplify the decision process while enhancing the effectiveness of solutions to erosion related issues.

The *LESEMP* does not contain any regulatory oversight provisions.



The LESEMP is being developed by the project partners, Ohio Department of Natural Resources Office of Coastal Management, Division of Geological Survey and Division of Wildlife. Federal grant funding for this project is provided by the National Oceanic and Atmospheric Administration.

Description

Reach 5 of the Cedar Point to Vermilion Region extends from the mouth of Old Woman Creek to the northern terminus of Joppa Road at the lake shore. This reach is comprised entirely of private property with the exception of the small public access at the end of Joppa Road. This reach contains small areas of residential development separated by farms along the shores of Berlin Township and western Vermilion Township. From the west, this reach includes the Oberlin Beach, Ruggles Beach, Mitiwanga and Heidelberg Beach residential communities and contains approximately 20,000 feet of shore (3.79 miles) between the Old Woman Creek and Joppa Road.

The shore of this reach is curved northward near the center of the wide embayment spanning from Cedar Point to Vermilion and includes the southernmost point along the shore in the entire Great Lakes basin.

The shore is fairly uniform. The few small headlands and embayments are generally the result of localized erosion and accretion attributed to artificial structures. The most significant shore structures in this reach are the breakwaters enclosing a private marina near the east end of the reach. Littoral currents in this area are generally weak due to its location near the center of the wide embayment at the south end of Lake Erie. The net direction of littoral drift is typically from east to west, however cross currents and localized irregularities in the littoral current are common.

This reach is fronted by three to four well-defined sand bars extending up to 500 feet offshore. While sand bars are generally more prominent near the east end of the reach, the beaches and shallow nearshore demonstrate the amount of sand available throughout the reach. Nearshore slopes range from about 1 degree for the first 100 feet to about 0.3 degrees farther offshore. Due to the presence of sand bars, nearshore slopes are shallow at the west end of the reach and more variable to the east. The nearshore transitions from sand covering till to sand covering shale near the east end of the reach.

The shore in this reach is generally composed of 20- to 30-foot high till and glaciolacustrine clay bluffs. The relief of the upland quickly increases from the low lying delta at the mouth of Old Woman Creek to 20-foot banks near the Oberlin Beach community. The relief gradually increases to near 30 feet at the east end of the reach. The bluffs are disrupted with lower banks at the

Sand that accumulates along the barrier beach sometimes closes the mouth of the Old Woman Creek as shown in the July 30, 2009, large picture. The left inset picture taken November 8, 2011 shows a sand spit forms on the east side of the creek under low-flow rates. The right inset photo from May 3, 2011, shows high flow rates can eliminate a large portion of the barrier beach. The creek marks the western boundary of this Reach CV 05.

Old Woman Creek and Cranberry Creek floodplains.

At the west end of the reach is a small lagoon between Cleveland Road (U.S. Route 6) and an approximately 750-foot long barrier beach at the east bank of Old Woman Creek. The connection between Lake Erie and Old Woman Creek is highly dynamic and is particularly sensitive to storms, lake levels and changes in creek flow. The nearshore often includes small sand formations due to both littoral processes and channel shoaling at the mouth of the creek. The barrier beach extends to a 450-foot long concrete seawall at the west end of Colony Lane in the Oberlin Beach community. The remaining residences in Oberlin Beach are protected by a variety of revetments and concrete seawalls. A few properties have small groins extending 30 to 50 feet into the lake; however sand accumulation in this area is minimal.

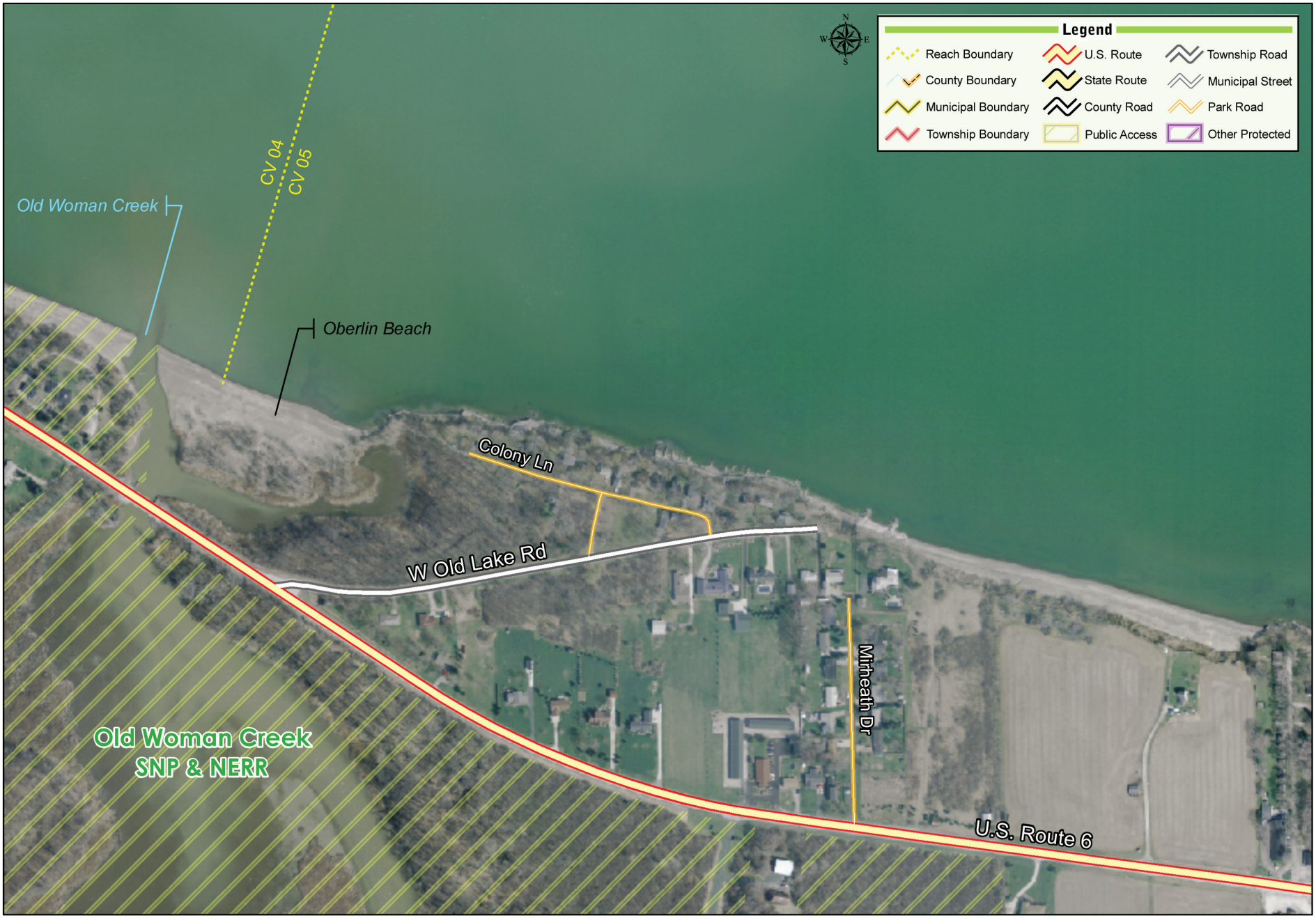
East of Mirheath Drive, the shore is unarmored beach fronting 1,200 feet of agricultural land. The next 1,200 feet is developed as both farmland and residential property along Freeman Lane and Kamm Farms Drive. The shore is protected with curved concrete block and armor stone revetments and groins segmenting the shore into six small beach cells ranging from 100 to 200 feet. The next 2,300 feet of shore is agricultural land fronted by a 20 to 30-foot high bank and a narrow beach. The beach is stabilized with 40 to 50-foot long concrete groins spaced fairly evenly at 50 to 100 feet. The beach is occasionally protected with concrete modules or rubble.

To the east, the shore is protected by a series of stepped, concrete seawalls approximately 550, 350 and 300 feet long. The second two seawalls are separated by a concrete pad supporting a small boat ramp and pier at The Queen of the Lakes Mobile Home Park. Two small concrete groins support a narrow beach up-drift of the concrete pier. The east 350 feet of shore at The Lakes Mobile Home Park is protected with a rip-rap revetment and three concrete groins. An approximately 500-foot long beach extends to the east. The beach is supported by several small concrete groins extending about 50 feet into the lake. The toe of the bluff is protected with a small concrete block seawall

East of The Queen of the Lakes Mobile Home Park, the shore steps about 150 feet lakeward along an armor stone revetment and concrete groin. The next 1,500 feet of shore is protected by low revetments or seawalls placed at the toe of the bluff. The structures were constructed landward of a narrow beach stabilized by a few concrete or rubble mound groins. The next 600 feet of shore lakeward of East Old Lake Road is protected with a series of L-shaped rubble mound groins extending about 75 feet into the lake before turning about 50 feet to the east. The groins are evenly spaced every 100 to 150 feet. Between the groins the shore is protected with low revetments.

A small beach leads up to the concrete jetties at the entrance to the Cranberry Creek Marina. The jetties extend about 100 feet into the lake

The 600 feet of shore lakeward of East Old Lake Road is protected with a series of L-shaped rubble mound groins. The groins are evenly spaced every 100 to 150 feet. Between the groins the shore is also protected with low revetments.



GIS Data Sources:
Aerial Photography - OSIP, State of Ohio, 2006
Political Boundaries - ODOT, 2007
Public Access - ODNR OCM, 2009-10
Transportation - LBRS, Erie County and State of Ohio, 2005-07

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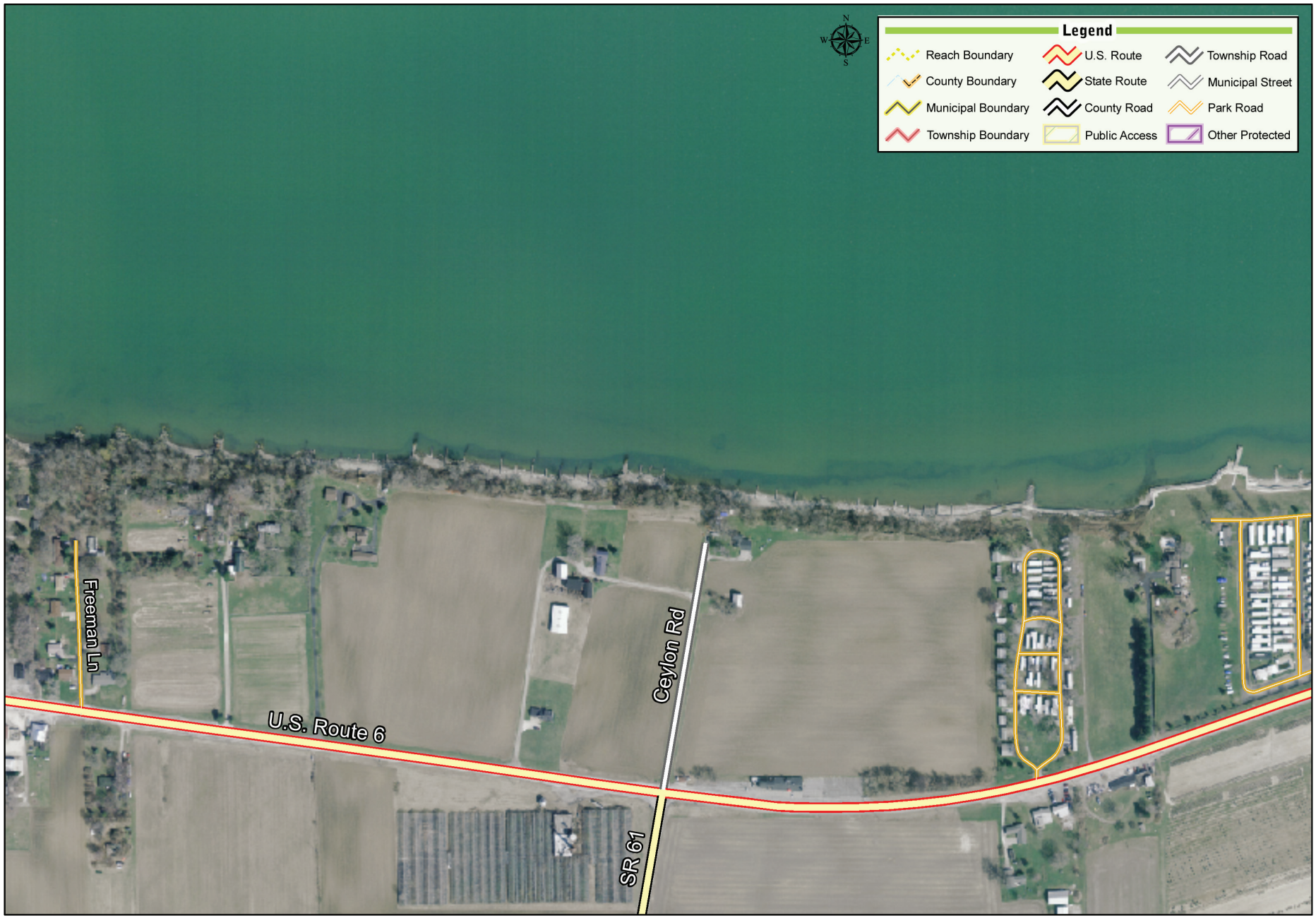

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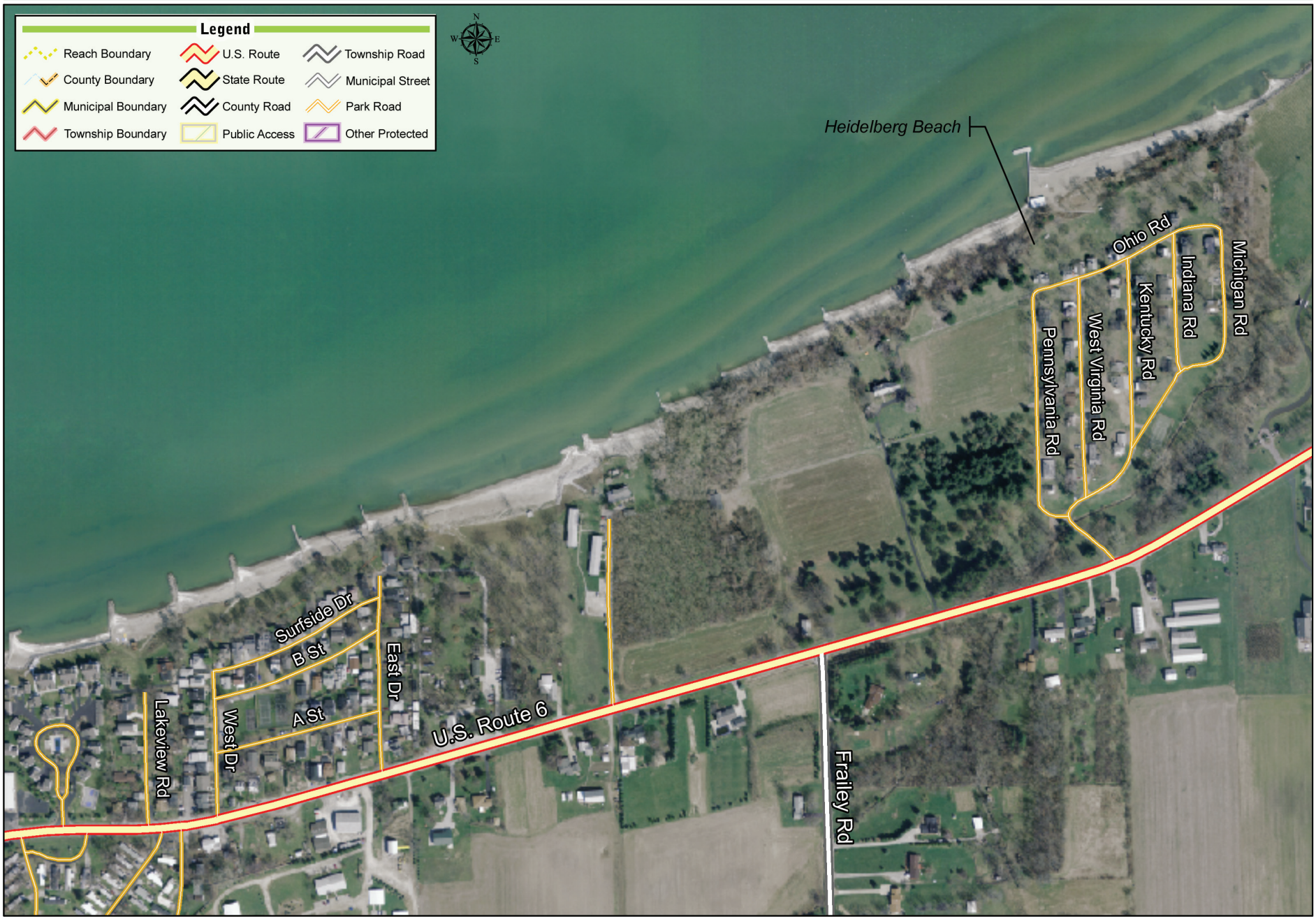

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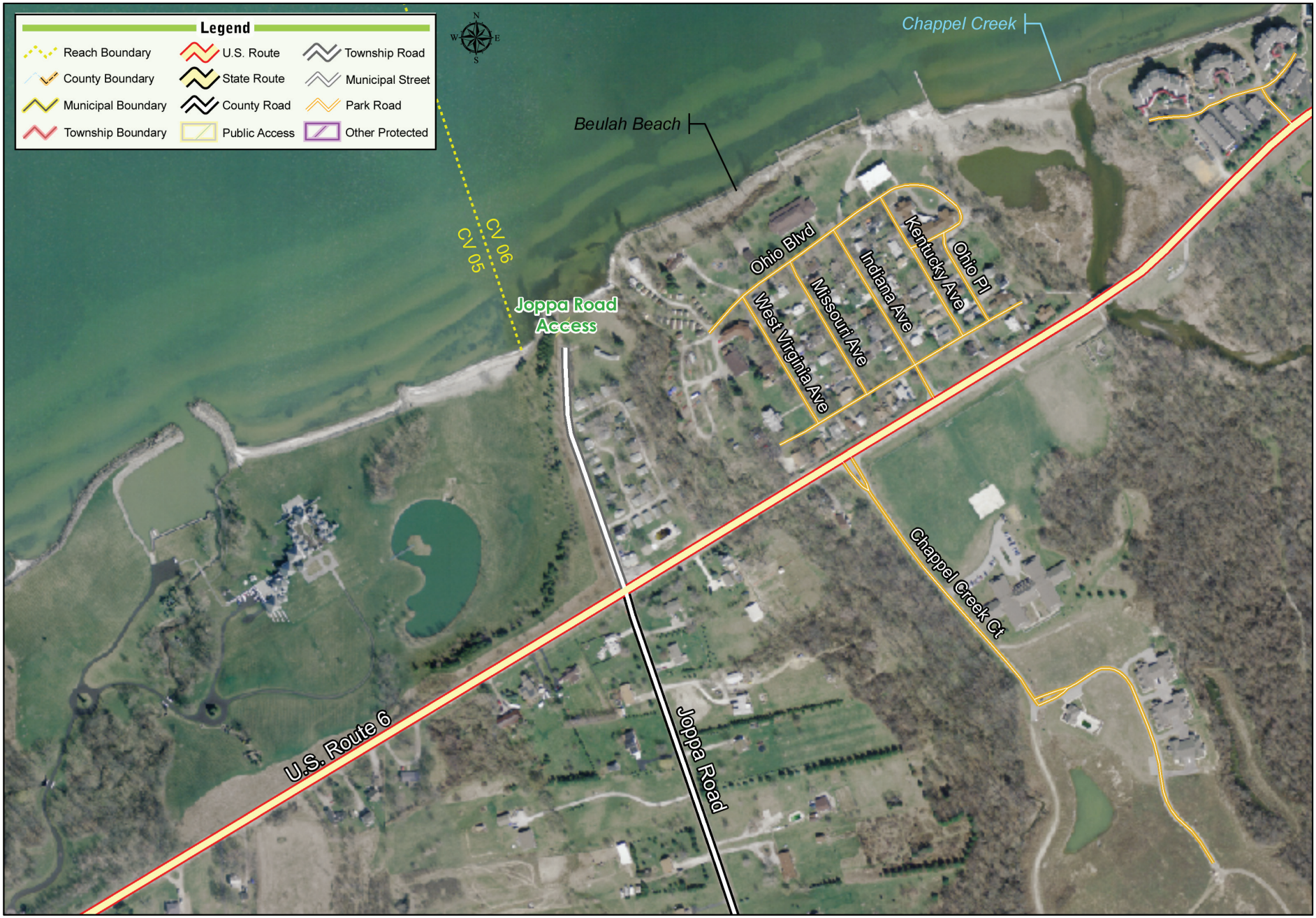

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and have helped stabilize about 200 feet of beach to the east and west. East of Cranberry Creek are the Ruggles Beach and Mitiwanga communities. The shore in this area is fronted by a narrow beach stabilized by concrete groins spaced fairly evenly apart at about 250 feet. To the east, an L-shaped groin extends about 100 feet into the lake before turning 50 feet east at the Bay Breeze Condominiums. The shore lakeward of the residences along Lakeview Road and Surfside Drive has a similar beach stabilized by rubble mound and concrete groins spaced about every 250 feet. The toe of the bluff along Ruggles Beach, the Bay Breeze Condominiums and Surfside Drive in Mitiwanga is protected with a variety of concrete seawalls and revetments.

The next 2,300 feet of shore is primarily agricultural with few homes or cottages. The shore is fronted by a discontinuous sand beach supported up-drift of small concrete groins. A few properties include an armor stone or rip-rap revetment at the toe of the bluff but this area is generally unarmored. To the east a concrete groin extends about 225 feet into the lake to a 70-foot long shore-parallel concrete caisson. The groin supports about 800 feet of wide beach at the Heidelberg Beach residential community. The beach is widest directly up-drift of the groin and tapers back near the east end.

The next 650 feet of shore is armored with an armor stone revetment leading up to a 275-foot long armor stone breakwater extending east along the shore, creating a private marina. The east end of the marina is protected with an armor stone breakwater extending about 250 feet into the lake, creating an approximately 60-foot long channel at the entrance. An approximately 1,000-foot long sand beach is present up-drift of the marina.

Mitiwanga is at the left of the photo. Bay Breeze is to the right.

The beach is also stabilized by an armor stone groin extending about 70 feet into the lake near the center of the beach. The beach is backed by an armor stone revetment for most of its length; although a small unprotected gap exists east of the groin.

Recession/Erosion

The ODNR Division of Geological Survey has evaluated the recession of Ohio's Lake Erie shore over three time periods: 1877 to 1973, 1973 to 1990 and 1990 to 2004. Changes in the rates measured during each of the time periods are generally attributed to development along the coast and natural factors such as lake level changes.

During the time period from 1877 to 1973 this reach generally experienced slow recession with small areas downdrift of shore-perpendicular structures experiencing localized moderate recession. The unprotected agricultural areas often experienced greater recession as various residential communities constructed groins to stabilize beaches. The localized accretion and erosion near these structures have caused small irregularities in the shape of the shoreline. Recession rates during this time period were generally 1 to 3 feet per year with moderate 3 to 5 feet per year recession occurring downdrift of larger shore-perpendicular structures. Aerial photography shows that Cleveland Road (U.S. Route 6) was relocated in the late 1930s due to the threat of imminent erosion. Parts of the old road still in existence, now known as West Old Lake and East Old Lake roads, help give an idea of the amount of erosion that occurred.

Ruggles Beach, shown above, is immediately west of Bay Breeze.

From 1973 to 1990 the recession rates ranged from 0 feet per year to 7.3 feet per year. Recession was greatest at the east end of the reach where the shore was dramatically changed with the construction of a private marina. Otherwise recession was greatest along the unarmored agricultural land east of Oberlin Beach. Most of the shore experienced slow recession with rates less than 2 feet per year although localized recession continued downdrift of the larger groins throughout the reach.

In the time period from 1990 to 2004 recession rates ranged from 0 feet per year to 1.5 feet per year. Most of the shore experienced little to no recession. Recession was greatest along the unprotected agricultural land east of Oberlin Beach.

Flooding

Flooding is not a significant concern for most of the reach due to the 20 to 30-foot high banks and bluffs along the shore. Flooding in this reach is generally limited to low areas at the mouths of Old Woman Creek and Cranberry Creek. Flooding can generally be attributed to a combination of high lake levels and increased creek discharge due to upland runoff.

Beaches/Sand Supply

The presence of beaches at the toe of the bluff and sand bars in the nearshore demonstrates the availability of sand throughout the reach. Although beach width has decreased over the past century, this reach has consistently contained narrow to moderate sized beaches and has often been fronted by sand bars. Decreases in beach width are generally attributed to the overall reduction of sand supply to the area due to the large scale hardening of Lake Erie's shore.

On a localized scale, beach widths have been influenced by the construction of groins along the shore of this reach. Groins have generally been constructed to support beaches lakeward of the residential communities along the shore. This has increased beach widths at the Ruggles Beach and Heidelberg Beach residential communities but has resulted in narrower beaches downdrift.

Use of Shore Structures

Groins are the most common shore structure in this reach. Much of the shore is fronted by narrow beaches stabilized with concrete or rubble mound groins. The remnants of several submerged/ruined groins are also present in the nearshore throughout the reach. The groins show the location of past beaches. As the shore receded many of the structures have been replaced or supplemented with new structures along the current shoreline. The remnant groins still impact littoral processes and often divert littoral currents and sand resources farther offshore, playing a role in the formation of the nearshore sand bars in this reach.

Armor stone revetments and cast concrete seawalls are also common near the residential communities. In many areas, such as Ruggles Beach and Mitiwanga just east of Cranberry Creek, revetments and seawalls were constructed at the toe of the bluff. Constructing the shore-parallel structures

Ruggles Beach starts at the left of the above photo. A beach is present east of the east jetty that marks the channel of Cranberry Creek Marina.

The west jetty Cranberry Creek Marina is shown at the left. The beach present west of the jetty is bounded by a groin seen at the above photo's far right.

landward of existing beaches has allowed narrow beaches to persist in the area.

The largest shore structures in this reach are the revetment and breakwater forming a private marina at the east end of the reach. While these structures have dramatically changed the shore in this area the protective structures have reduced recession and resulted in a stable shoreline.

Summary

The reach from Old Woman Creek to Joppa Road contains both small residential communities and agricultural land. The shore of this reach is generally narrow beaches fronting 20 to 30-foot high bluffs. Beaches in the area are typically stabilized by concrete or rubble mound groins. Many properties also include revetments or seawalls placed upland of beaches to protect the toe of the bluff. These structures are most common near residential development. This reach is fronted by several sand bars beginning just east of Old Woman Creek and becoming more defined near the east end of the reach. This reach has historically experienced gradual recession due to erosion of beach sand and wave attacks at the toe of the bluff. Future erosion will likely be localized in areas without shore protection or downdrift of shore-perpendicular structures.

Recommendations

The recommendations included below are options that may be applicable within this reach and should only be used for planning purposes. Based upon the above physical characteristics the following recommendations are suggested for the reach between Old Woman Creek and Joppa Road. Each recommendation includes a brief overview of the solution prior to addressing areas within the reach where the recommendation is best suited. For more information on any of the items listed below, please refer to the Glossary and Appendix A: Erosion Control Solutions.

In addition to the recommendations listed below a “do nothing” alternative should also be considered. This may be a viable, and even favorable, alternative for much of Ohio’s Lake Erie shore. The Old Woman Creek to Joppa Road reach generally has a relatively stable shore with low erosion rates in recent years. In areas where the shore is protected with effective structures additional protection might not be necessary. In these areas attention should be focused on monitoring and maintaining the structures. In other areas, particularly those with a natural shoreline and low erosion rates, the best option may be to hold development back from the shore and allow natural erosion/accretion processes to occur. This option should be considered in the unarmored beaches along the undeveloped agricultural areas in this reach.

East of Mitiwanga, a 2,300-foot stretch of shore is primarly agircultural upland with a few homes or cottages. The eastern portoin is shown in the above photo.

Firefly Beach Resort is to the east of the Mitiwanga community’s East Drive. This beach is west of the photo on the left.

Sand Management:

1. <u>Conserve Sand Resources</u>: Conserve sand resources within the shore and nearshore areas. Sand is a limited resource in constant fluctuation. Avoid removing sand from the system; sand moved or excavated during construction along the shore should be placed in the nearshore, not on the upland and should not be incorporated into the construction project.

Since there is sand available in the littoral system conserving sand should be considered throughout this reach. Many properties rely on narrow transient beaches stabilized by groins for shore protection. Sand bars in the nearshore often cause waves to break before reaching the shore, particularly near the east end of the reach. A decrease in sand in the littoral system would decrease the effectiveness of many protective structures, leaving residential properties in the area more susceptible to erosion.

2. <u>Beach Nourishment</u>: Supplement the current sand supply with beach nourishment, also known as beach fill or pre-fill. Beaches protected by groins and detached breakwaters will benefit from initial nourishment (pre-fill during or directly after construction) and periodic re-nourishment. The sand used in these projects should be acquired from an upland source.

This recommendation is applicable throughout the reach. A large portion of this reach is fronted by narrow beaches that would benefit from nourishment. The addition of beach nourishment would be especially beneficial at sites with existing structures to stabilize the shore or as part of the construction for new groins or detached breakwaters.

3. <u>Vegetation</u>: Encourage growth of native vegetation on the back beach. Beach vegetation encourages the formation of a dune system by holding sand in place and providing protection from wind. It is also possible to simply allow the natural succession of native plant species to grow along the beach.

Native vegetation on the beaches would help encourage sand accumulation at the toe of the low bluffs throughout this reach. Sand accumulation and dune formation would be beneficial in many areas of this reach where the beach is relied on for shore protection *(see photo page 12)*.

The groin marking the west boundary of the Heidelberg Beach community, shown above, extends about 225 feet into Lake Erie to a 70-foot long shore parallel concrete caission. On the east side of the groin, sand has accumulated about half the length of the structure as shown below. The third photo is taken north of northern reaches of the shore-parallel portion of the structure looking east at the shore along Heidelberg Beach.

Native vegetation on the beaches helps encourage sand accumulation at the toe of the low bluffs. The beach shown above is east of Mirheath Drive.

Cranberry Creek Marina, near the middle of Reach CV 05, is above. A white bench sits on top of the west jetty of the private residence's marina entrance near the eastern portion of reach in the photos below. If either marina is dredged, nearshore placement of the dredged material should be considered.

4. <u>Sand Bypassing</u>: Move sand from areas of excess accretion, usually up-drift of a shore perpendicular structure, to areas downdrift. By redistributing sand within the nearshore system, the littoral drift in the area will be more evenly dispersed.

Sand bypassing would be beneficial at many of the small shore-perpendicular structures along the shore of this reach. The widespread use of groins in this reach has resulted in localized erosion downdrift of the structures. This is the cause of the small headlands, embayments and irregularities along the shore. Bypassing any excessive accretion would help redistribute sand in the littoral system and prevent localized erosion to downdrift properties.

5. <u>Dredging</u>: Dredge marinas and harbors on as frequent a basis as possible to add sand into the littoral system. Dredging of navigation channels at harbors and marinas enhances navigation for boaters and provides sand for downdrift areas when placed along the shore. When dredged material is disposed of on the upland or in offshore areas, the material is no longer a benefit to the littoral system. In-lake placement is preferred as long as the sand meets the grain size and total organic carbon criteria. Uncontaminated dredge material that is composed of sand and gravel should be placed in the nearshore through sidecasting or placing downdrift. Placing sand in shallow water keeps the sand in the nearshore environment and the littoral system. Sand placed into deeper waters will likely be lost to the system and will not nourish downdrift beaches.

If the mouths of the Cranberry Creek Marina or the private marina just west of Joppa Road need to be dredged, nearshore placement of the dredge materials should be considered. Dredge materials suitable for the nearshore environment may be used to nourish the narrow beaches throughout the reach.

Toe Protection:

6. <u>Revetments</u>: Revetments along the toe of a bank will aid in protecting against wave-based erosion. In areas without beaches, a structural measure may be necessary to protect the toe of the bank. The low-relief banks within this reach have relatively gradual slopes, which are ideal for revetment development. In essence the revetments form a stable bank slope, providing protection to the soil underneath while breaking up wave attacks. Since material eroded off the bank is one source of beach-building sand, some regulatory agencies may require that one of the design components for a revetment be the inclusion of sand pre-filling in the amount equal to that which would have been added to the system over the life of the structure.

Most properties in this reach rely on narrow beaches supported by groins as shore protection. If the beach is eroded or submerges during times of high water the unarmored bluffs are subjected to wave action. To protect the toe of the bluff revetments have been constructed along many properties. Most revetments are constructed upland of existing beaches and are only subject to wave action during high lake levels. This design provides protection from severe storms without interfering with littoral processes during normal lake conditions. Revetments along the toe of the bluff have been constructed at the Bay Breeze Condominiums and along several properties near the east end of the reach. This recommendation would also be effective to stabilize the unarmored agricultural areas with the highest recent erosion rates.

A revetment is at landward of the beach along the toe of the regarded bluff.

Bluff/Bank Modifications:

7. <u>Re-grading/ Terracing</u>: Re-grade or terrace less stable bluffs/banks to a more gradual slope. By creating a lower (flatter) slope angle or terracing the slope to a series of steps, instability caused by gravity's forces on the upper bluff/bank is decreased. Re-grading is a non-structural approach to stabilize the bluff that leaves the shore relatively unaltered. When re-grading, also review the toe of the bluff/bank to determine if a structural (revetment) or non-structural (beach nourishment) solution would be preferable.

Re-grading of the bluff face is common in this reach, particularly along the residential beach communities east of Cranberry Creek. The bluff is consistently re-graded from just east of Cranberry Creek to the agricultural area east of Surfside Drive. The bluff is also cut back to a stable grade from Heidelberg Beach to Joppa Road. Because the bluffs in this reach are composed of till and glaciolacustrine deposits they area highly susceptible to slumping if the toe of the bluff is eroded by wave action. Except for those areas where a building is too close to the bluff/bank edge, re-grading could be applied to any property within this reach that is experiencing active slumping or upper bluff/bank erosion. Re-grading or terracing is typically done in conjunction with the construction of a revetment to provide a stable slope above the structure *(see example photos on page 15)*.

8. <u>Surface Water Management</u>: Route surface water away from the face of the bluff/bank. In areas where gullies or rills are forming, surface water is slowly eroding the face of the bluff/bank. Where possible, re-route water away from the bluff/bank. Sometimes this may involve changing gutter or driveway drainage. Terracing of the bluff/bank can also be used as a means of intercepting and diverting seeped ground water. Sources of surface water include, but are not limited to roof gutter downspouts, runoff from driveways and sidewalks, precipitation, and sprinkler systems.

The re-routing of surface water should occur throughout the Old Woman Creek to Joppa Road reach. Attention to the signs of surface water will allow for early action on limiting the affects of runoff.
Surface water management is of particular importance along the agricultural areas of this reach to prevent untreated runoff of excessive nutrients, fertilizers or pesticides directly into the lake. On agricultural properties collection areas and drainage swales should be considered as part of an active surface water management plan.

Colonial Villa has a terraced bluff.

The Queen of the Lakes Mobile Home Park has a regarded bluff.

Ruggles Beach's bluff has been regarded with a slight terrace.

10. <u>Vegetation</u>: Encourage growth of vegetation along the bank slope. Where possible plant vegetation, preferably native species, along the bank to remove excess ground water while retaining soil strength. It is also possible to simply allow the natural succession of native plant species to grow along the bank.

This recommendation is applicable throughout the Old Woman Creek to Joppa Road Reach. Allowing native vegetation to grow on the natural bluff face or on the re-graded slope above the seawalls, revetments and other shore structures in this reach would reduce excess ground water and help stabilize the low banks. Vegetation should be closely monitored on the actual structures. For example, vegetation growing on a rip-rap or armor stone revetment could damage the structure by causing stones to be broken or displaced.

Surface water management in the form of routing surface water away from the face of the bluff/bank is being practiced in the above photo.

Management and Monitoring:

11. <u>Bank-top Management</u>: Keep heavy materials, equipment or structures well back from the edge of the bank-top. Any structure (concrete decks, stone walls) or heavy object (vehicles or construction equipment) placed near the bank edge will increase the stress within the soil and can lead to slope failure.

This recommendation applies to the low banks and structure crests throughout this reach. Care should be taken when accessing the top of the bluff with heavy materials or machinery while maintaining shore structures to prevent sliding failures. This recommendation should also be carefully considered when planning new structures on the upland or along the shore.

12. <u>Coordination of Projects</u>: Continuation of similar erosion control measures along a stretch of shore will often yield more effective protection than the installation of multiple types of structures adjacent to one another. Most erosion control measures function better when utilized over large areas of the shore.

The reach from Old Woman Creek to Joppa Road contains several good examples of similar shore structures constructed continuously over large areas. The agricultural areas, homeowners associations, condominiums and mobile home parks in this reach result in long, continuous stretches of shore with a single owner or ownership group. The shore from Freedom Lane to just west of the Colonial Villas Mobile Home Park is protected with a nearly continuous groin field. In this area groins of differing ages and construction materials have been used to create a fairly continuous shoreline. The shore from Cranberry Creek to East Drive in Mitiwanga is another example of well planned, continuous protection across several properties. Coordination of projects creates more effective protection, limits the amount of time the littoral system is disturbed and can also allow some engineering and construction expenses to be spread over several properties.

When structures can not be continued across multiple properties, conditions at the ends of the structure should be carefully considered in the design. The structures should be designed to prevent intersections causing increased wave energy or gaps between structures where erosion is likely.

13. <u>Shore Structure Management/Monitoring</u>: Monitor and maintain shore structures. Routine monitoring of shore structures will allow for early detection of any potential failures. Smaller repairs performed more frequently will be less costly and can often increase how long the structure will be effective at controlling erosion. Should removal of an aged or deteriorating structure be necessary, consider the above recommended items as potential future solutions.

Many of the structures in this reach were constructed more than 30 years ago. The condition of the structures should be closely monitored and repairs should be made when necessary. If new erosion control measures are installed, the recommendations listed above should be considered. A combination of recommendations may be the most effective solution. For example, to protect a bluff and upland structures fronted by an existing beach, a revetment landward of the beach along with beach nourishment may be considered.

References:

- Carter, Charles H. and Donald E. Guy. Report of Investigations No. 122, Lake Erie Shore Erosion, Ashtabula County, Ohio: Setting, Processes, and Recession Rates from 1876 to 1973. State of Ohio, Department of Natural Resources, Division of Geological Survey, Columbus, 1983.
- Ohio Department of Natural Resources, 1998 Final Coastal Erosion Area (CEA) Mapping
- Ohio Department of Natural Resources, 2010 Final Coastal Erosion Area (CEA) Mapping

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