Lake Erie Shore Erosion Management Plan

Cedar Point to Vermilion - Reach 06

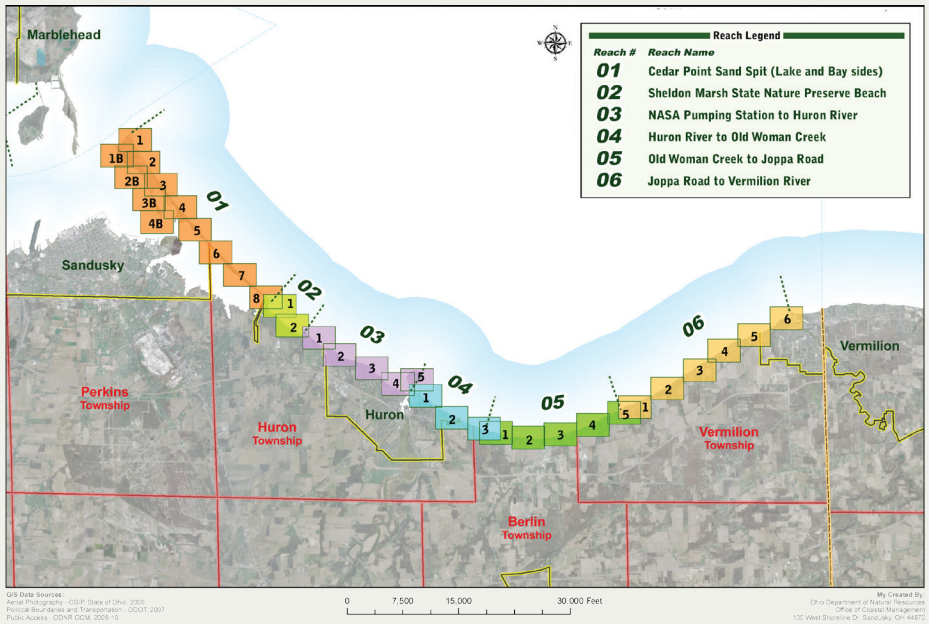
LESEMP

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 6 of the Cedar Point to Vermilion Region extends from the northern terminus of Joppa Road at the lake shore to the west bank of the Vermilion River. This reach includes the residential communities along the shore of Vermilion Township and the west side of the city of Vermilion. This reach contains approximately 26,000 feet (4.9 miles) of shore. Most of the reach is private property with the exception of Vermilion's Main Street Beach and Sherod Park and small public access areas at the northern terminuses of Joppa, Risden and Coen roads.

The shore of this reach makes up the eastern end of the wide embayment from Vermilion to Cedar Point. On a large scale, the shore is fairly uniform with few notable headlands and embayments. At a smaller scale, localized erosion and accretion due to artificial structures has resulted in nearly constant irregularities along the coast. The net direction of littoral drift is typically from east to west, however cross currents and periods of alternating littoral currents are common near the west end of the reach. The most significant shore structures in this reach are the jetties and breakwater at the mouth of the Vermilion River at the east end of the reach. A large amount of sand has been trapped up-drift of the structures, limiting sediment supply to the east end of the reach.

The shore is generally characterized by 20 to 30-foot high bluffs and narrow, transient beaches supported by groins along most of the reach. The bluffs along the shore are broken by lower relief in floodplains near the mouths of the Chappel Creek, Sugar Creek, Darby Creek and Vermilion River. The bluffs are generally composed of till overlain with glaciolacustrine deposits.

The nearshore in this reach is typically shale which is covered with sand deposits. The western portion of this reach is fronted by three to four sand bars extending up to 500 feet offshore. The sand bars are well defined in the western portion of the reach but generally disperse just west of Sherod Park due to the reduced sand supply downdrift of the jetties and breakwater at the Vermilion River. East of Sherod Park, sand deposits are typically limited to

The 0.16-acre Joppa Road public access site is at the west end of Reach CV 06. A steep, traversable grass-covered bluff (top inset photo) leads down to a revetment placed at the back of a narrow sand and shale beach. A small tributary, Bingham Ditch, enters Lake Erie at the east side of the access site. (bottom inset photo).

the first 100 feet from shore. Nearshore slopes generally 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 variable in the western portion of the reach.

At the west end of the reach, approximately 900 feet of shore is protected with an armor stone and concrete block revetment along the shore of the Beulah Beach Camp and residential community. The concrete blocks step lakeward at a small concrete groin to protect about 300 feet of perched beach. The next 750 feet of shore is a beach area near the mouth of Chappel Creek.

The 4,700 feet of shore between Chappel Creek and Sugar Creek is highly armored. An 800-foot long stone and concrete block revetment begins at the east bank of Chappel Creek and extends lakeward of the Grand Harbor Condominiums. A narrow, transient beach supported by a variety of groins makes up the next 1,300 feet of shore. The shore in this area is highly irregular due to the lack of consistency in the spacing and length of the groin structures. A few properties near the center of this stretch are protected by a shore-parallel breakwater extending to the east from a groin. Sand has accumulated and filled in most of the space landward of the structure.

Near the end of Poorman Road, 900 feet of shore is protected with an armor stone revetment. Transient beaches occasionally form lakeward of the revetment and in small embayments in the revetment. Several rubble mound groins protect the next 750 feet of shore to the east before approximately 600 feet of shore is protected by armor stone revetments. Small gaps in the revetments provide access to the lake from a 60 to 80-foot wide beach trapped landward. Terminal groins stabilize the east and west ends of the structure. To the east, approximately 300 feet of unarmored beach leads to the mouth of Sugar Creek. Most properties in this area are also protected by a small revetment or seawall at the toe of the bluff.

The next 4,600 feet of shore shares fairly similar characteristics. The shore is protected by a variety of small groins extending 40 to 100 feet into the lake. Narrow beaches generally form updrift of the structures. Beach widths vary from transient beaches where shore-parallel structures are placed close to the shore to 70-foot wide beaches updrift of the long groins just east of Sugar Creek. A seawall at the Spanish War Veterans Association at Volunteer Bay creates an approximately 400-foot break in the beach and groins. In the Orchard Beach area, the 1,400 feet of shore lakeward of Center Road and Overlook Drive is protected by a nearly uniform series of 100-foot long groins spaced about 150 feet apart. This area has a consistent 30 to 50-foot wide beach during typical water levels. The toe of the 20 to 30-foot high bluffs is protected by low revetments and seawalls along most of this stretch.

The 5,400 feet of shore between Risden Road and Coen Road is typically protected with small groins and a narrow beach. The shore in this area generally steps incrementally to the north as sand accumulates to the west of each groin. Many properties have additional protection in the form of low revetments at the toe of the bluff. Just east of Menominee Trail is the only open agricultural space along the shore of this reach. The shore is protected by a low revetment and an approximately 350-foot long shore-parallel structure placed in the nearshore. Approximately 2,700 feet west of Sherod Park, the Morris Beach Club marina has been constructed at the mouth of Darby Creek. The mouth of the creek is stabilized with short concrete block jetties extending 50 to 80 feet into the lake. Aerial photos of this area show the remains of several submerged groins in the area just west of Coen Road.

East of Coen Road is approximately a 1,200-foot beach stabilized by 150-foot and 200-foot long groins at Sherod Park. Sherod Creek, a small tributary enters the lake alongside the eastern groin creating a recess in the unarmored bluff at the park. Approximately 1,800 feet east of Sherod Park is a small marina at the Compass Rose Condominiums. The marina entrance is protected by a northwest facing, L-shaped breakwater extending about 100 feet into the lake. Approximately 450 feet to the east the beach is stabilized by two detached breakwaters and a series of groins.

The shore from Sherod Park to Vermilion's Main Street Beach is more heavily armored than the western portion of the reach, because sand supply to the area is reduced by jetties at the mouth of the Vermilion River. Despite the reduced sand supply, groins and narrow transient beaches are common in this area. Most properties are also protected with a revetment or seawall at the toe of the bluff, although the relief of the upland is gradually reduced leading up to the Vermilion River.

The mouth of the Vermilion River is stabilized by 850-foot long jetties extending north into the lake. To prevent excessive wave energy in the river channel the entrance is protected by an 850-foot long breakwater constructed about 300 feet lakeward of the jetties. The harbor structures have a large impact on the east end of the reach by both limiting sand supply and providing protection to the Main Street Beach from northwest waves.

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 experiencing localized moderate recession downdrift of shore-perpendicular structures. Recession was typically greatest immediately after the structures were constructed then reduced as the shore stabilized over time. The accretion and erosion near these structures has caused small irregularities in the shape of the coast. Recession rates during this time period ranged from less than 1 foot to 5 feet per year but were generally between 1 and 3 feet per year. Moderate recession from 3 to 5 feet per year only occurred downdrift of larger shore-perpendicular structures, such as the groins east of Orchard Beach and Chappel Creek.

From 1973 to 1990 the recession rates ranged from 0 feet per year to 7.8 feet per year. Recession was greatest at the west end of the reach just east of Joppa Road and near the mouth of Chappel Creek. Recession also reached 3.3 feet per year along the unarmored bluff at Sherod Park. Most of the reach experienced slow recession with rates rarely greater than 1 foot per year,

The shore west of Risden Road has 20 to 30 foot bluffs fronted by narrow beaches that have formed between small groins that extend 40 to 100 feet into the lake.

The shore from Sherod Park to Vermilion's Main Street Beach is more heavily armored than the western portion of the reach, because sand supply to the area is reduced by jetties at the mouth of the Vermilion River.

although localized recession continued to occur downdrift of the larger groins throughout the reach.

From 1990 to 2004 this reach experienced little to no recession. Recession rates ranged from 0 feet per year to 0.4 feet per year throughout the reach. The one exception was the unarmored bluff at Sherod Park with recession rates reaching 2.7 feet per year at the mouth of the Sherod Creek just west of the groin near the center of the park.

Flooding

Due to the 20 to 30-foot banks and bluffs in this reach, flooding is less of a concern. Flooding in this reach is generally limited to low areas at the mouth of the Vermilion River or near the mouths of Chappel or Sugar creeks. Flooding can generally be attributed to a combination of high lake levels and flooding of the river or creeks due to upland runoff.

Beaches/Sand Supply

The presence of beaches at the toe of the bluff and sand bars extending up to 500 feet into the nearshore demonstrates the availability of sand in the western portion of this reach. Although beach widths have 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.

Sand supply to the eastern portion of this reach is limited by the harbor structures at the mouth of the Vermilion River. Still, narrow beaches stabilized by groins are common in the eastern portion of this reach. Sand deposits generally extend less than 100 feet offshore from just west of Sherod Park to the near the mouth of the Vermilion River.

Use of Shore Structures

The largest shore structures in this reach are the jetties and breakwater at the mouth of the Vermilion River. The structures were originally constructed in 1836 and immediately began trapping sand to the east. The structures have limited the supply of sand to the eastern portion of this reach resulting in the significant transition of sand deposits in the area of Sherod Park and the lack of nearshore sand bars in the eastern portion of the reach.

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. Groin construction has gradually progressed since the 1860s as the shore was steadily developed. 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 shore. 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 concrete seawalls are also common throughout the reach. On most properties revetments and seawalls were constructed at the toe of the bluff allowing narrow beaches to persist lakeward of the structures.

A variety of shore protection methods in the area west of the Vermilion River are shown above.

Summary

The reach from Joppa Road to the Vermilion River primarily consists of residential development with 20 to 30-foot high bluffs along the shore. Most of the reach is fronted by narrow beaches typically stabilized by groin structures. Many properties also include revetments or seawalls placed upland of beaches to protect the toe of the bluff. Several well defined sand bars extend approximately 500 feet into the nearshore in the western portion of the reach. Sand supply is limited to the eastern portion of the reach by the jetties and breakwater at the mouth of the Vermilion River. This reach has historically experienced slow recession rates although moderate recession often occurs downdrift of shore-perpendicular structures. Future erosion will likely be localized to areas downdrift of shore-perpendicular structures or properties relying on beaches for shore protection without additional structures at the toe of the bluff.

Recommendations

The recommendations included below are options that may be applicable within this reach and should only be used for planning purposes. Based on the above physical characteristics, the following recommendations are suggested for the reach between Joppa Road and the mouth of the Vermilion River. 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: Erosion Control Methods.

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 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 shore and low erosion rates, the best option may be to hold development back from the coast and allow natural erosion/accretion processes to occur. This option should be considered on the unarmored beaches in natural areas such as Sherod Park.

The shore near and to the east of Risden Road is shown in the above three photos.

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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Ohio Department of Natural Resources
Office of Coastal Management
105 West Shoreline Dr, Sandusky, OH 44870

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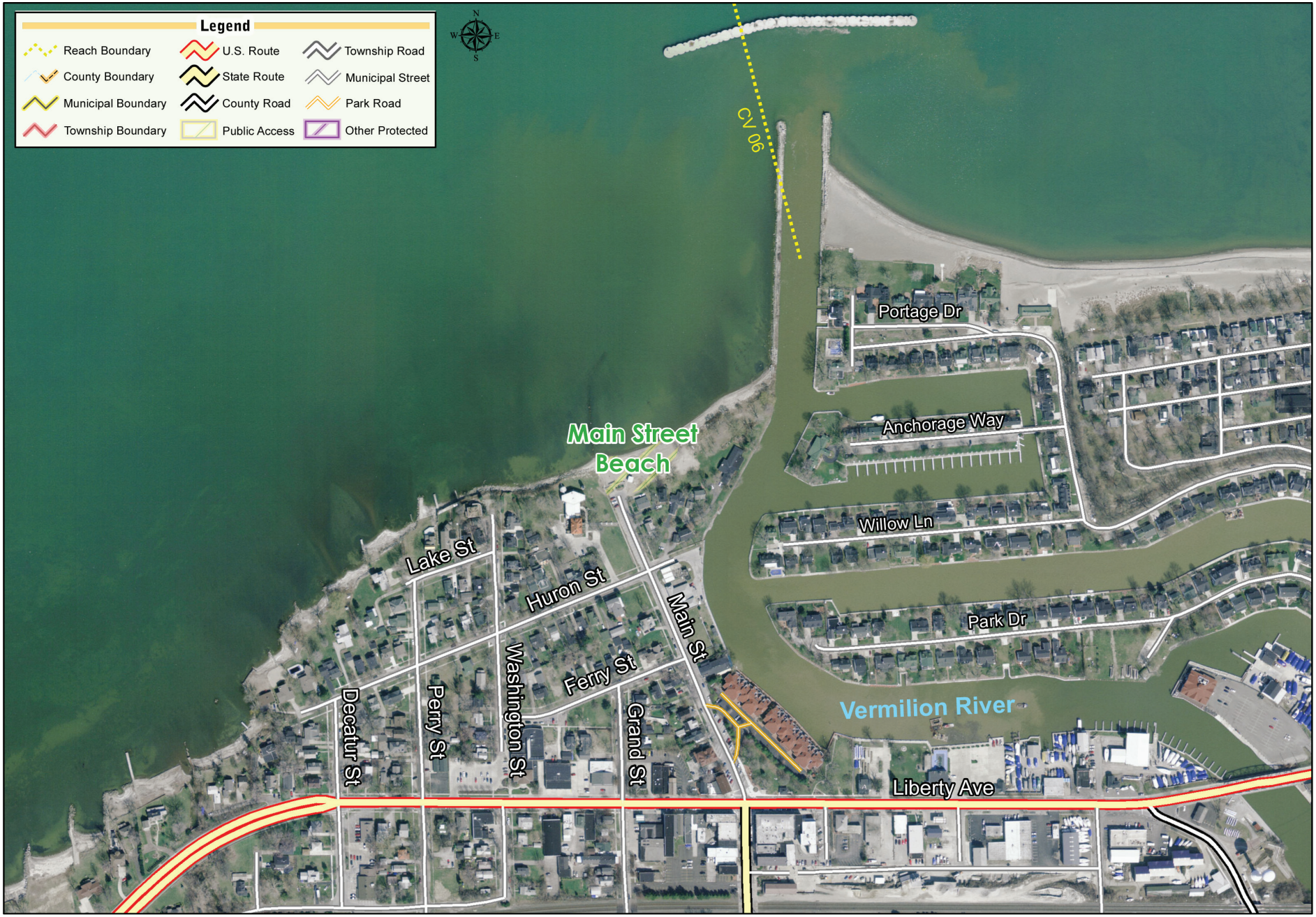

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A look at shore structures between Coen Road (not shown to the east/left) and Morris Beach Club (not shown to the west/right).

Coen Road Access is where the small lighthouse structure is visible along the shore. To the immediate east/left is Sherod Park which has a public swimming beach to the east/left of the groin in this picture.

Numerous types and sizes of groins run perpendicular to the shore in the area east of Sherod Park and west of Vermilion's Main Street Beach.

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.

This recommendation is applicable throughout the reach. While there is sand is available in the western portion of the reach, sand supply is limited east of Sherod Park. Many properties throughout the reach 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 west 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.

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 it or as part of new construction for 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 narrow beaches would help encourage sand accumulation at the toe of the low bluffs throughout this reach. This would be beneficial in many areas of this reach where the beach is relied on for shore protection. This recommendation would be particularly beneficial along wider natural beaches such as small barrier beach at the mouth of Chappel Creek, the beaches at Sherod Park and the east end of Vermilion's Main Street Beach.

*4. **Sand Bypassing:** 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 the mouth of the Vermilion River. The jetties and breakwater at the mouth of the river have impeded the flow of littoral material, trapping sand on up-drift beaches. This has limited the amount of sand available to sustain beaches in the eastern portion of this reach. Bypassing future accretion would reduce erosion at downdrift properties and likely help extend the nearshore sandbars in the western portion of the reach.

Sand bypassing would also 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. **Dredging**: 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 mouth of the Vermilion River needs maintenance dredging, the nearshore placement of dredge materials should be considered. If the dredge materials are suitable for the nearshore environment, nearshore placement would be beneficial to nourish the narrow beaches throughout the reach. This recommendation should also be considered if the marinas at the mouth of Darby Creek or the Compass Condominiums need dredged.

Toe Protection:

*6. **Groins and Groin Fields:** Groins are intended to stabilize a beach by interrupting the transport of sand along the shore. As a result sand accumulates up-drift of the structures, widening the beach. Due to the lack of sand and disruption of littoral currents beaches are typically eroded immediately downdrift of the structures. By appropriately spacing multiple structures a groin field can effectively balance the erosion and accretion caused by the structures, resulting in stable beach. This may be advantageous to longer properties or projects coordinated across several lakefront properties. An initial beach nourishment (pre-fill) and periodic re-nourishment will often be advantageous to creating and retaining the beach while limiting impacts to neighboring shorelines. Some regulatory agencies may require pre-fill and periodic nourishment as one of the design components for a project that includes shore-perpendicular structures.*

Groins are the most common erosion management structure in this reach and have generally been effective at stabilizing the shore. Long term average recession rates have steadily decreased as the reach has been developed and groins constructed. The availability of sand in the nearshore and the weak, variable littoral currents make groins an effective choice, particularly in the western part of this reach. The availability of sand and the presence of defined sand bars in the nearshore help sustain the area's narrow beaches by providing sand up-drift of the structures and limiting erosion downdrift.

Groins are intended to stabilize a beach by interrupting the transport of sand along the shore. By appropriately spacing multiple structures a groin field can effectively balance the erosion and accretion caused by the structures, resulting in stable beach.

The groins have also contributed to the development of the sand bar system by routing the littoral drift farther offshore, causing a balanced and relatively stable nearshore system. The weak and variable littoral currents in the area have contributed to the effectiveness of groins in this reach by limiting and often balancing the erosion and accretion on each side of the structure.

A disadvantage of groins alone, as shore protection is that they rely on the presence of beaches for shore protection and are heavily dependent on the continued availability of sand resources. Although groins have effectively supported consistent beaches in the area with reduced sand deposits east of Sherod Park, the effectiveness of groins as erosion protection is decreased during times of high water or severe storms. These factors must be considered in the design of effective groin structures.

*7. **Detached Breakwaters**: Detached breakwaters may be useful in areas where beaches are present or likely to form. Detached breakwaters aid in retaining a beach by limiting the wave energy reaching the shore causing sediment to settle out and be deposited. As opposed to groins which trap sand moving along the shore, properly designed and constructed detached breakwaters are intended to allow alongshore movement of sand. An initial beach nourishment (pre-fill) and periodic re-nourishment will often be advantageous to creating and retaining the beach landward of the breakwater while limiting impacts to neighboring shorelines. Some regulatory agencies may require pre-fill and periodic nourishment as one of the design components for a project that includes detached breakwaters.*

The reach from Joppa Road to the Vermilion River is characterized by narrow beaches supported by shore-perpendicular structures. Many of the groins in this area are more than 30 years old and may be in need of maintenance or replacement. If existing structures need to be replaced, detached breakwaters should also be considered. Detached breakwaters can help stabilize a beach without obstructing littoral currents. Detached breakwaters also have the advantage of limiting the wave energy reaching the shore, reducing the need for structural protection at the toe of the bluff.

Detached breakwaters would be most effective in the western portion of the reach due to the availability of sand and gentle slopes in the nearshore. The effectiveness of detached breakwaters is also increased when multiple breakwaters are constructed over a long stretch of shore, making them a suitable design alternative for the larger lakefront properties, condominiums or homeowners associations.

Beach nourishment or sand pre-fill should be included in the design of a detached breakwater to prevent the structure from trapping littoral material and increasing the risk of erosion on adjacent properties.

*8. **Revetments**: 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.*

This recommendation is applicable throughout the reach. In general, most properties in this reach rely on narrow beaches supported by groins as

Looking east at structures at the mouth of the Vermilion River as seen from the water.

shore protection. If the beach is eroded or submerged during times of high water, 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.

Bluff/Bank Modifications:

9. <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 20 to 30-foot high bluffs is common throughout this reach. 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.

10. <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 Joppa Road to Vermilion River reach. The till and glaciolacustrine deposits that make up the bluff face in this reach area are highly erodible by surface water. Attention to the signs of surface water will allow for early action on limiting the affects of runoff.

11. <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 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 bluffs and 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.

From Vermilion's Main Street Beach, looking east along the shore (bottom) and from slightly farther east, looking north at the jetties and offshore breakwaters at the mouth of the Vermilion River (top).

Management and Monitoring:

*12. **Bank-Top Management:** 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.

*13. **Coordination of Projects**: 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.*

This recommendation is applicable throughout this reach. In residential areas, littoral property is often divided into parcels as small as 50 feet wide with each property owner responsible for their own shore protection. In the Joppa Road to Vermilion River Reach this has led to the construction of many groins competing for sand resources. The interaction between structures often causes excessive erosion or accretion on adjacent properties. This is best avoided by coordinating projects over a length of shore. Groins are most effective when designed as part of a groin field with consistent length, spacing and construction. Groin fields are typically tapered with shorter groins near the ends to reduce effects to the surrounding shores. In addition to creating more effective shore protection, coordinating projects 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.

*14. **Shore Structure Management-Monitoring**: 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 well spaced groins in the nearshore and sand pre-fill 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

Learn More:

LESEMP Webpages: ***ohiodnr.com/tabid/20501.default.aspx***

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