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Victoria Beach Field Observations and Recommendations Lake Winnipeg, Manitoba

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Victoria Beach Field Observations and Recommendations

Prepared for

Rural Municipality of Victoria Beach

Prepared by

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EXECUTIVE SUMMARY

To be written in next draft.

1.0 INTRODUCTION

The Rural Municipality of Victoria Beach (RMVB) is located on a small isthmus of land in the southern basin of Lake Winnipeg. Elk Island is located immediately north of the RMVB and separated by only a shallow water sand spit, as seen in Figure 1.1. During low lake levels, a dry land connect exists.

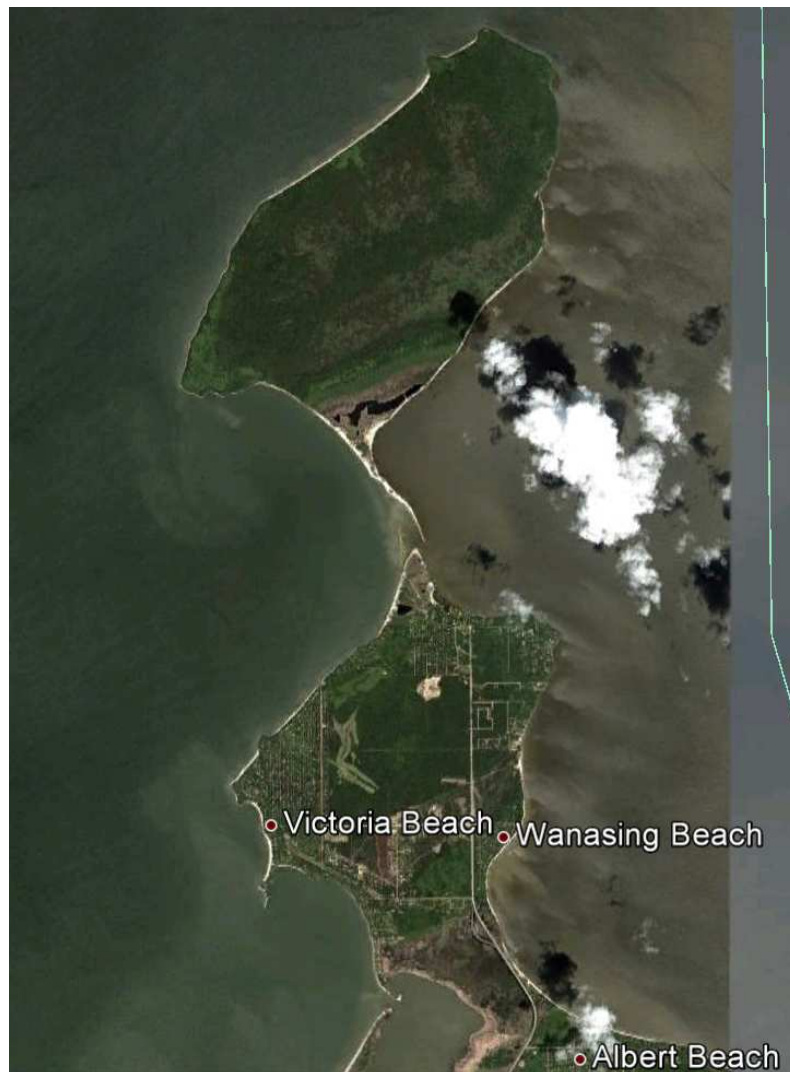


Figure 1.1 Rural Municipality of Victoria Beach (RMVB) and Elk Island

The Victoria Beach Company was created in 1910 to develop a summer resort community. Initially, the only access to Victoria Beach was via boat. In 1916 a rail connection was constructed from the mainland, which enhanced the flow of goods and services to the area. The area officially became a municipality in 1919. A road connection was established in 1952.

The development pattern in Victoria Beach is focused on one of its greatest assets, the shoreline, as seen in Figure 1.2. The interior of the municipality is largely undeveloped, with the exception of a golf course, which was built in the 1920s.



Figure 1.2 Development Pattern for RMVB

1.1 Scope of Study

Baird was retained in the fall of 2011 to observe the shoreline conditions of the municipality over a two day period. Visual observations, digital photographs, sediment samples, beach profiles and lakebed depths were collected. The field data has been archived and will be processed in later phases of this study. The findings of this initial study are summarized in this report.

2.0 BACKGROUND INFORMATION

Section 2.0 of the report summarizes background information, recent trends in lake levels and our field methods for the site visit in October, 2011.

2.1 Previous Studies

Two previous studies provided valuable background information on coastal processes in Lake Winnipeg. They are summarized briefly in the following sections.

2.1.1 *Lake Winnipeg Shoreline Erosion Study (Baird, 2000)*

Baird completed a comprehensive coastal investigation for the Lake Winnipeg Shoreline Erosion Advisory Group in 2000. The study documented the geology and shore types found on the lake, reviewed water levels and wave conditions, documented historical recession rates and longshore sediment transport rates. Shoreline management options for a set of representative site conditions were evaluated, including non-structural and structural alternatives.

2.1.2 *Lake Winnipeg Shoreline Management Handbook (2001)*

The Lake Winnipeg Shoreline Management Handbook was published by Manitoba Conservation in 2001. It provides a readable summary of the 2000 Baird report.

2.2 Recent Lake Levels

Lake Winnipeg water levels are influenced by a range of factors, including upstream supply from the Lake of the Woods and Lake Manitoba, inflow from the local watershed, rainfall, evaporation and regulation of the outflow from the northern basin at the Jenpeg generating station, which is operated by Manitoba Hydro. The long-term water levels are summarized in Figure 2.1.

The last couple of years have been characterized by very high water level supplies and thus very high water levels on Lake Winnipeg. The desired operating range for the lake is 711 to 715 feet and yet the lake peaked at 716.90 ft on July 8, 2011. Refer to the levels summarized in Figure 2.2.

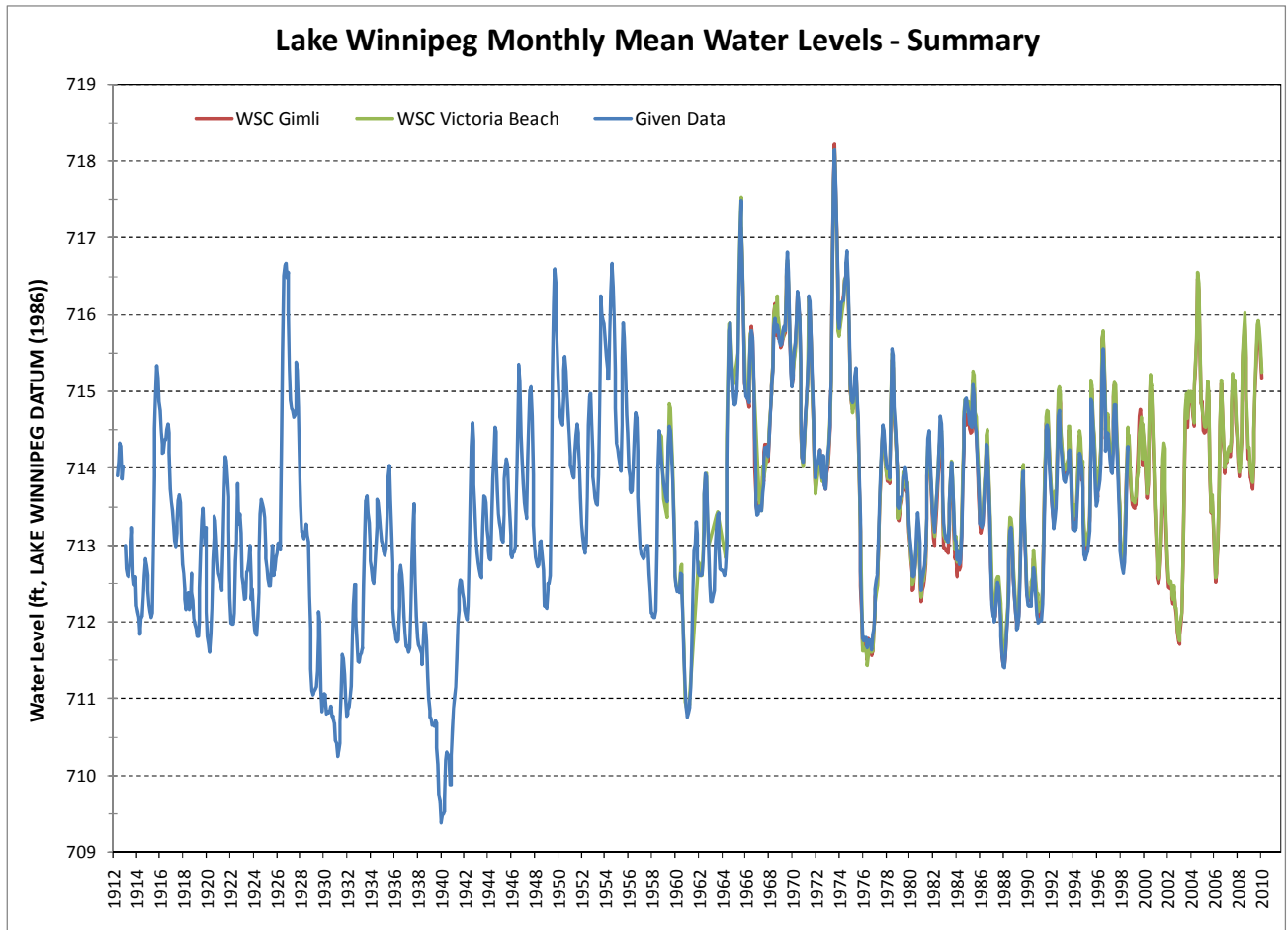


Figure 2.1 Long-term Lake Winnipeg Water Levels (wind setup removed)



Lake Winnipeg Observed Water Levels in Feet 2010-2011

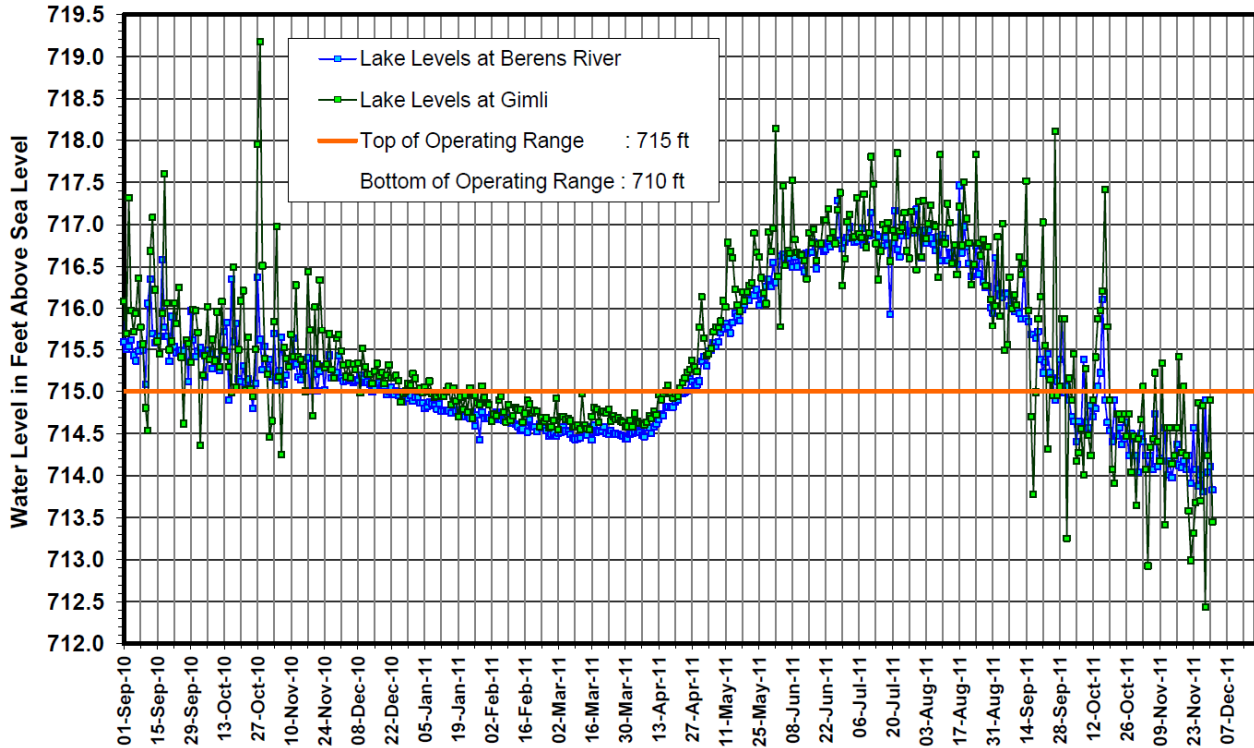


Figure 2.2 Lake Winnipeg Measured Water Levels from 2010 to 2011

2.3 Field Observation Methods

Baird completed the site visit on October 5 and 6, 2011. The entire peninsula was traversed by boat and at select locations on land. In total, data and observations were collected at 19 sites. The lake work was done with the assistance of Captain XX. A picture of the crew and boat is provided in Figure 2.3. In addition to observations, GPS coordinates and digital photographs, the beach profiles were extended into deep water a distance of approximately 500 m. The soundings were collected as the boat proceeded onshore. Depths were collected with a portable hand-held depth sounder and horizontal positioning was noted with a hand-held GPS. Refer to Figure 2.4.

On the beach, distance and depth measurements were extended from the waterline to the back of the beach (base of the bank). Refer to Figure 2.5. This beach profile data will be further augmented with the topographic LIDAR that was recently collected for the municipality. Sediment samples were also collected from the beach and bank at the sites around the peninsula. See Figure 2.6.



Figure 2.3 Boat Captain and Survey Crew with Boat



Figure 2.4 Collection of Lakebed Depths from Boat



Figure 2.5 Beach Profile Measurements



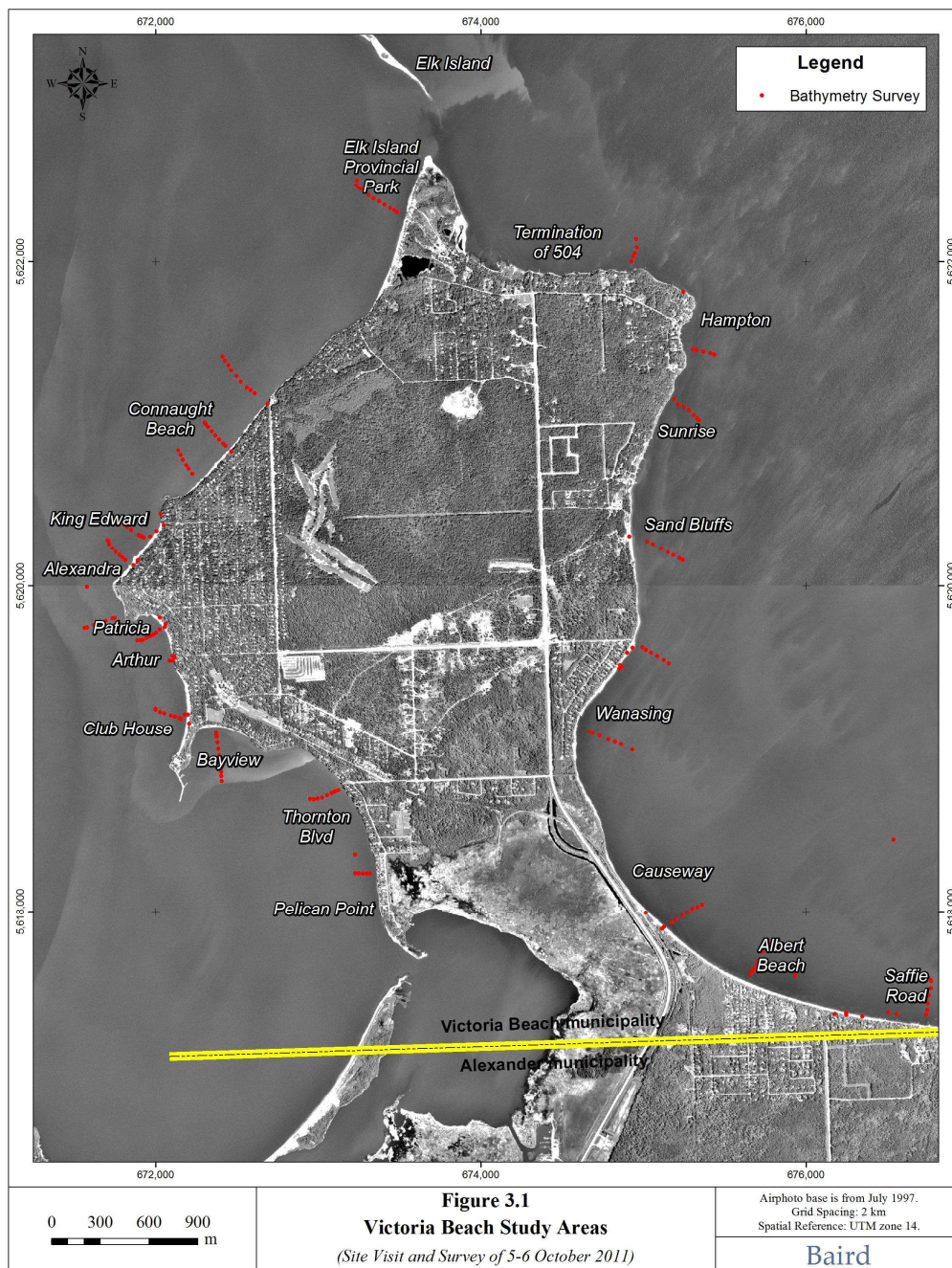
Figure 2.6 Sediment Sampling Shovel

3.0 FIELD OBSERVATIONS

The field observations are summarized in Section 3.0. The post-processing of the bathymetric data and recent LIDAR land elevations will occur in future phases of the study.

3.1 Summary of Observations by Shoreline Reach

The 19 sites visited around the perimeter of the RMVB are noted in Figure 3.1.



3.1.1 Connaught Beach

Connaught Beach is located along the north-west shoreline of the peninsula and actively eroding. The angle of the beach appears to be in alignment with the incident waves from the north-west, suggesting it is a wave cut shore (i.e. an erosional feature). Some revetment protection has been installed in the northern end (see Figure 3.2), near the water intake facility. Historically, large cobbles and boulders were piled into shore perpendicular groynes (Figure 3.3).



Figure 3.2 North Section of Connaught Beach Protected with a Revetment



Figure 3.3 South Section of Connaught Beach Featuring Eroding Sandy Bank

3.1.2 *King Edward Beach*

King Edward Beach is located along the west shore of the RMVB and the beach is accessed from a wooden stairwell. See Figure 3.4. The headland to the north of the staircase was armoured in the past and was just recently upgraded with additional stone. Along the toe of the eroding sand bank at King Edward, geo-textile sand bags were placed to provide temporary protection from bank erosion during high lake levels.



Figure 3.4 Staircase to King Edward Beach



Figure 3.5 Geo-textile Sand Bags Placed at the Toe of the Bank

3.1.3 *Alexandra Beach*

Alexandra Beach is adjacent to King Edward and access to the beach from the high sand bank is provided by a wooden staircase (Figure 3.6). The base of the staircase was also protected with the geo-textile sand bags. In several locations large boulders have been rearranged to form ad hoc shore perpendicular shore protection, such as the groyne in Figure 3.7.



Figure 3.6 Stairwell to Alexandra Beach



Figure 3.7 Eroding Sand Bank at Alexandra Beach

3.1.4 Patricia Beach

Patricia Beach is located at the base of a high eroding sand bank. The northern limits of the beach are seen in Figure 3.8. A groyne type structure was installed in the past and it appears some ad hoc shore protection is located at the back of the beach. The beach features a very gentle slope and a wide swath of the nearshore was exposed in Figure 3.9 on October 5, 2011 due to the offshore winds and setdown of the lake surface.



Figure 3.8 Patricia Looking to the North-west



Figure 3.9 Eroding Sand Banks at Patricia Looking to the South

3.1.5 Arthur Beach

A revetment was recently constructed at the toe of the eroding bank at Arthur Beach, as seen in Figure 3.10. The transition from the revetment to the natural sand bank is seen from the water in Figure 3.11. Remnants of former shore protection was observed further south.



Figure 3.10 Recent Revetment Constructed at the Back of the Beach (Arthur)



Figure 3.11 Transition from Natural Eroding Bank to Recent Revetment Shore Protection

3.1.6 Club House Beach

Club House Beach is bounded by Arthur to the north and the municipal pier to the south. The beach is aligned in a north-south direction and possibly backed by relic sand dunes. Due to the gentle slope of the upland, pedestrian traffic is contributing to slope instability. The municipal pier likely helps anchor the southern portion of the beach.



Figure 3.12 Eroding Sand Banks and Beach at Club House



Figure 3.13 View of Eroding Relic Sand Dunes at Club House

3.1.7 Bayview

Bayview is located in the lee of the municipal pier and features a narrow sand beach. A boating club is located on the beach, as seen in Figure 3.14. The sand beach transitions to shore protect towards the pier, as noted in Figure 3.15. Although the beach is somewhat sheltered from wave attack on the main lake, sediment supply is also limited due to the presence of the pier.



Figure 3.14 Boat Club at Bayview



Figure 3.15 Transition from Sand Beach to Shore Protection on Bayview

3.1.8 Thornton Boulevard

The Thornton Boulevard reach features a combination of natural shoreline conditions with dense backshore vegetation and engineered shore protection and buildings within close proximity to the shoreline. Beaches were generally absent in this reach with the early October, 2011 lake levels.



Figure 3.16 Natural Shoreline Along Thornton Boulevard



Figure 3.17 Shore Protection Along Thornton Beach

3.1.9 Pelican Point

Pelican Point is a relatively recent development that was constructed on top of a former barrier beach. The homes are all located in very close proximity to the shoreline and heavily protected. The first generation of protection appears to be large boulders, which were followed recently by gabion baskets in select locations. Refer to Figure 3.18 and 3.19.



Figure 3.18 Gabion Basket Shore Protection at Pelican Point



Figure 3.19 Rock and Gabion Protection at Pelican Point

3.1.10 Saffie Road

The south-east boundary of the municipality is defined by Saffie Road. The eroding bluffs appear to cut in a glacial till with a high cobble/boulder content and low percentage of sand. Refer to Figure 3.20. The backshore is protected by a combination of dumped boulders and gabion baskets. Given the general shoreline orientation of this area and lack of sand in the bank, it is unlikely sand beaches exist here, even during low lake levels.



Figure 3.20 Eroding Glacial Till (?) Bluff along Saffie Road



Figure 3.21 Dumped Boulders and Gabion Basket Protection

3.1.11 *Albert Beach*

Albert Beach is located north-west of Saffie Road and is generally unprotected. The bank height decreases as you move towards the causeway. Since the back of the beach has remained unprotected, a wide beach remains. Refer to Figure 3.22. Due to the low elevation of the backshore, a sand bank dyke was constructed at the back of the beach to protect the residential/cottage development.



Figure 3.22 Transition from Armoured Saffie Road to Unprotected Albert Beach



Figure 3.23 Flood Susceptible Development behind Albert Beach

3.1.12 Causeway

The Causeway is a narrow strip of beach that separates Lake Winnipeg from Highway 59. Although this area features a sand beach, the shoreline has been heavily modified by structures in the past. Refer to the former piles in Figure 3.24 from a former Lumber Mill. Exposed tree roots in the backshore, as seen in Figure 3.25, suggest the beach is eroding.



Figure 3.24 Piles from a former Lumber Mill



Figure 3.25 Exposed Tree Roots in the Backshore Indicate the Beach is Eroding

3.1.13 *Wanasing*

Wanasing features a combination of sand and cobble/pebble beaches. See Figure 3.26. Due to the low elevations of the backshore, a sand bag dyke was recently constructed to provide additional flood protection (Figure 3.27). The beach features a wide variety of structures, from boulder groynes, gabion groynes and boat docks.



Figure 3.26 Sand and Cobble Beach at Wanasing



Figure 3.27 Sand Bag Dyke Protecting Flood Susceptible Homes

3.1.14 Sand Bluffs

The Sand Bluffs are actively eroding and evidence of massive slope failures was observed in the field. Refer to Figure 3.28, where a portion of the tablelands was displaced following a large rotational failure. Although the majority of the bluffs are sandy, clay lenses were observed at higher elevations and on the beach, as seen in Figure 3.29. The clay lenses can create perched water tables in the bluff, creating ideal conditions for a rotational failure.



Figure 3.28 Large Rotational Failure in Sand Bluff



Figure 3.29 Exposed Clay on the Beach at Sand Bluffs

3.1.15 Sunrise

Sunrise features similar geologic conditions (very high sandy bluffs) to Sand Bluffs. It was distinguished as a separate study area due to the presence of the residential development as seen in Figure 3.30. It appears a large rotational failure also impacted this stretch of shore and future slope failures might have serious consequences for the existing development. A bluff stability assessment should be performed to evaluate the risks of future failures. Some areas are protected (Figure 3.31).



Figure 3.30 High Sand Bank with (potential) Rotational Failure



Figure 3.31 Shore Protection at Sunrise

3.1.16 Hampton

The Hampton peninsula is located in the north-east corner of the municipality. Development densities are not as dense as most other shoreline segments. Although the shoreline orientation is not conducive to beach building, the natural sections of shore are stable (see Figure 3.32). Conversely, when the forest vegetation has been removed for development, a steep eroding bank is present at the back of the beach, as seen in Figure 3.33.



Figure 3.32 Natural Shoreline with Stable Backshore



Figure 3.33 Eroding Sand Bank Where Vegetation Cleared for a Residential Lot

3.1.17 Termination of 504

Highway 504 terminates along the north shore of the municipality. Recently, a large volume of stone was placed at the back of the beach. Refer to Figure 3.34. A cut down the bank provides access to the beach for launching boats. For example, our survey vessel was launched from the tractor seen in Figure 3.35.



Figure 3.34 Recent Bank Protection at the Termination of Highway 504



Figure 3.35 Close Up of Recent Bank Protection

3.1.18 Elk Island Provincial Park (mainland)

Elk Island Provincial Park is located north of the RMVB. A small portion is located on the mainland at the northern tip of the municipality. The vegetated tip of the park is seen in Figure 3.36. A sand spit extends further to the north and the degree of exposure for this dynamic sand feature will be determined by lake levels, storm surges and sediment supply. The eastern and western shores of the park feature sandy beaches backed by sand dunes (Figure 3.37).



Figure 3.36 North Facing Tip of Elk Island Provincial Park (connected to mainland)



Figure 3.37 Beach and Dunes along the Western Shore of the Provincial Park (connected to mainland)

3.1.19 *Elk Island Provincial Park (island)*

The southern shoreline of Elk Island Provincial Park and the sand spit were observed from the boat. A view of the south-west shoreline is seen in Figure 3.38 and it looks very similar to the Sand Bluffs site. This eroding sand bluff is a potential source of beach sand for the western shore of the RMVB. The sand spit at the southern tip of the island is a popular locations for shore birds (see Figure 3.39).



Figure 3.38 Eroding South-western Shore of Elk Island



Figure 3.39 Sand Spit Extending Southward from Elk Island

4.0 CONCLUSIONS

Section 4.0 summarizes our key findings from the site visit and recommendations for additional studies.

4.1 Summary of Key Findings

Key findings are summarized below based on the site observations, our previous technical work for the Lake Winnipeg Shoreline Erosion Study and experience with similar glacial lakes across North America:

- The residents and stakeholders in Victoria Beach are knowledgeable and passionate about their shoreline. The high quality of the stakeholder consultation to date has set a solid foundation for this community based planning exercise;
- The sand beaches within the Rural Municipality are a very important asset to the community;
- The natural long-term trend for the entire shoreline is erosion. In other words, even prior to European settlement, the majority of the shorelines in the Rural Municipality were eroding;
- Due to the long settlement history, there is now infrastructure (buildings, utilities and roads) that are at risk to ongoing shoreline erosion. Active management is required to protect capital investments, maximize the recreational value of local beaches and ensure their sustainability in perpetuity while enhancing ecology integrity of the coastal zone;
- Shoreline management is a challenge for this small rural municipality and local bylaws/legislation are not adequate to deal with the combination of dense shoreline development and severe coastal hazards (e.g. eroding shoreline and flood risk); and
- A science based planning framework is required for the coastal zone of the Municipality to make informed decisions and trade-offs on erosion mitigation alternatives.

4.2 Recommendations

Based on the key findings, discussions with council and our review of the preliminary report from the shoreline advisory committee, we have several recommendations:

- **Step #1 - Additional Technical Studies:** There are several fundamental questions that must be answered at Victoria Beach prior to developing options to mitigate coastal hazards, such as erosion and flooding. First, what are the long-term rates of shoreline erosion for the

RMVB and have these rates changed substantially from the pre- and post-regulation era. And second, sediment budget calculations are required to look at sediment sources (fine sand to pebbles and cobbles), sediment pathways (where sediment moves) and long-term sediment sinks (where eroded sediment is ultimately deposited). The sediment budget findings will be used to evaluate future shoreline conditions with and without remedial alternatives. Collectively, these two pieces of technical information are needed in conjunction with information on the shoreline/lake ecosystem to evaluate the effectiveness of hazard mitigation alternatives, the long-term future of the beaches and impacts on the environment;

- **Step #2 - Review of Shoreline Governance:** The current municipal and provincial legislation that is relevant to the management of the shoreline should be reviewed in light of the ongoing challenges along the coast and a collective community desire to improve long-term planning, management, and the decision making framework. This would include a review of the draft Development Plan for the RMVB, Zoning Bylaws, other relevant Municipal regulations, the Provincial Planning Act, other Provincial/Federal policy and land ownership along the lake;
- **Step #3 - Update and Enhancement of Shoreline Regulations:** The findings from the governance review will be used to update the shoreline regulations for the RMVB. The preferred location for these updated regulations is not clear but would be determined following the activities in Step #2. Moving forward, it is important the community stakeholders, councillors and staff at the RMVB recognize the need for active and continuous shoreline management using an improved set of rules. The hazards that threaten the beaches and homes of this community will not go away and will require continuous management in the future.

Some coastal communities develop “Shoreline Management Plans (SMP)” that serves as a customized planning document which outlines long-term goals for the protection and management of the shoreline resources of a community. Beach resources, access objectives, critical ecological resources, and recommendations for hard and soft coastal engineering structures are provided. The SMP provides a logical framework for decision making based on community values and other pertinent legislation (e.g. Provincial and Federal policy). The level of detail in a SMP can range from general recommendations or guiding principles to deal with such issues as selecting shoreline erosion mitigation alternatives to the development of a range of specific alternatives for specific shoreline reaches. The guiding principles in the SMP facilitate decision making and the trade-off analysis;

- **Step #4 - Evaluation of Shoreline Management Alternatives for the RMVB:** Regardless of whether the updated shoreline regulations are embedded in the draft Development Plan, a SMP or some other policy document, these principles and values should be used to evaluate a range of shoreline management alternatives for the various beach units that represent the

perimeter of the Municipality. These alternatives will range from do nothing, to relocating infrastructure, to constructing shoreline erosion protection, and enhancing the existing beaches with structures and beach nourishment. A long-term perspective is required to compare the various alternatives, along with a detailed benefit-cost analysis that includes initial capital costs, ongoing maintenance, ecological considerations, anticipated future damages for the status quo scenario and avoided damages for the planning and engineering alternatives. The decision making process should continue to be transparent and involve community feedback to reach a consensus on the path forward;

- **Interim Development Restrictions:** Until updated shoreline regulations have been developed, new construction or home additions along the shoreline should not be permitted. Further, for the areas featuring a high eroding coastal bluff (such as east shore), a geo-technical slope stability analysis is recommended to evaluate the risk of future rotational slope failures; and
- **Ongoing - Continued Stakeholder Participation:** The local shoreline stakeholder committee provides a critical liaison role between the residents of Victoria Beach and the Municipality. Their continued involvement will ensure all the views of the local stakeholders are heard and considered when developing long-term management options for the shoreline.