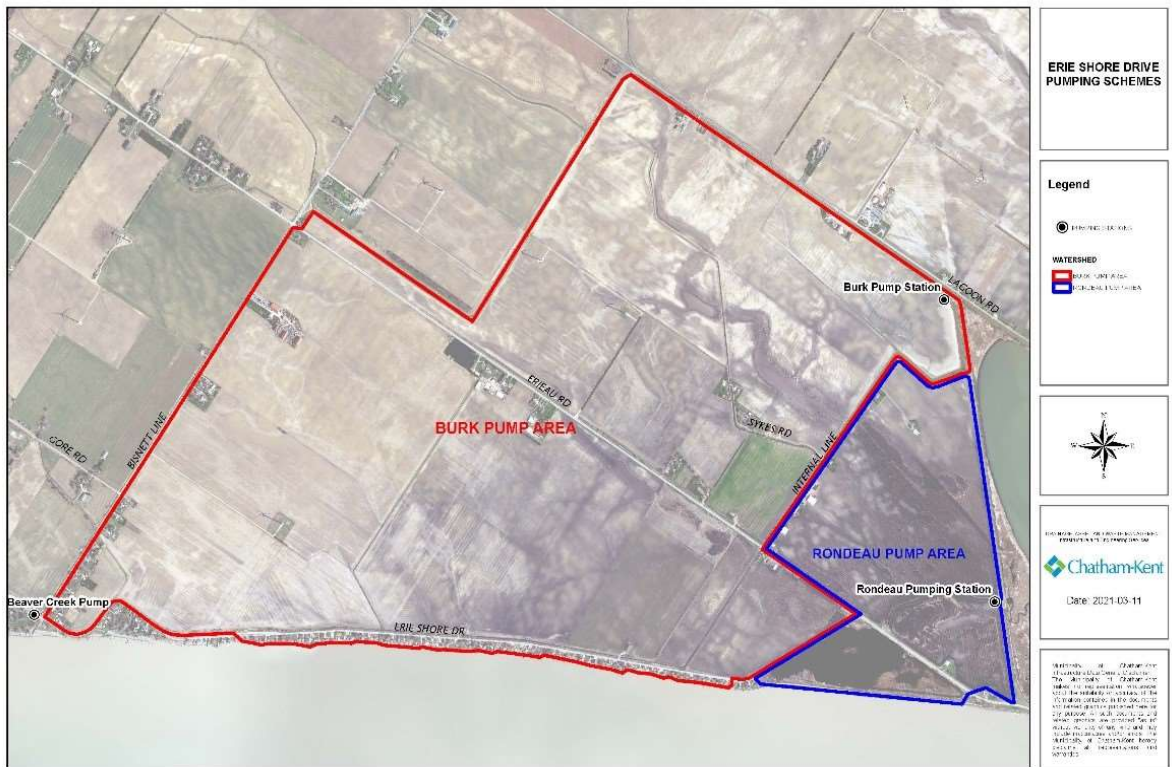


**PRELIMINARY REPORT FOR THE  
BURK DRAINAGE WORKS  
COMMUNITY OF HARWICH  
MUNICIPALITY OF CHATHAM-KENT**



**RC SPENCER ASSOCIATES INC.**  
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<b>DRAWING SHEETS</b>	
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June 18, 2023

Drainage Board  
Municipality of Chatham-Kent

Re: **Preliminary Report for the  
BURK DRAINAGE WORKS  
Community of Harwich  
Municipality of Chatham-Kent**

Board Members:

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## **1.0 OVERVIEW OF THE SITUATION**

The area known as the Burk Drainage Works is located in the Community of Harwich between the Communities of Erie Beach and Erieau. There are approximately 726 hectares of land comprised of 75 agricultural properties, roads and McGeachy's Pond located within this drainage. The area is served by a series of dykes and a number of internal gravity drainage systems with a mechanically pumped outlet into Lake Erie. Immediately south of the area of the Burk Drainage Works are approximately 153 year-round and seasonal residential properties located along the shore of Lake Erie.

The attached Drawing Sheet No. 1 shows the watershed of the Burk Drainage Area outlined with a heavy dashed line. Stations (distances) measured in metres are shown along the shoreline of Lake Erie for reference purposes.

A critical part of the Burk Drainage Works is a system of dykes and other protective works. The most critical dyke section that provides protection to the Burk Drainage Area is currently the most vulnerable and is the Erie Shore Drive (ESD) section between McGeachy's Pond (Station 1+000) and the Community of Erie Beach at Bisnett Line (Station 4+150). The current prolonged high lake level cycle has placed added pressure on this reach of shoreline and dyke resulting in higher frequency of erosion and flooding.

The rise in the static water level in Lake Erie in 2019, 1997, 1986 and prior years brought flood and wave attack impacts to the lakefront properties on Erie Shore Drive in the Community of Harwich. Flooding and wave attack is a recurring situation. The rising lake levels and wave attack also posed a real flood threat to the Burk Drainage Works as lake water has overtopped Erie Shore Drive in several locations, on many occasions.

The degree of this flooding is directly affected by the water levels in Lake Erie combined with the lake setup (or tilting) and wave runoff on the shoreline. The amount of lake setup and wave runoff depends upon the direction, duration and velocity of the wind.

The Council of the Municipality of Chatham-Kent recognizes the potential danger and on 30 June 2021, RC Spencer Associates Inc. was instructed to prepare a preliminary report under Section 10 of the Drainage Act for the Burk Drainage Works. The purpose of the preliminary report is to examine alternatives and courses of action for consideration by Council. Since no petition under Section 4 of the Drainage Act has been received, the scope of the proposed work is limited to that which can be carried out under Section 78 of the Drainage Act for potential repairs and improvements to the Burk Drainage Works for the better use, maintenance and repair of the existing drainage works.

## **2.0 AUTHORIZATION AND SCOPE OF REPORT**

This report is a preliminary report under Section 10 of the Drainage Act. It is for information and planning only and does not commit the Municipality or the property owners to any particular course of action. This report provides the following:

- History of the Burk Drainage Works;
- Background information;
- Evaluation of existing features and their conditions;
- Examination of design alternatives;
- Estimates of potential project costs;
- Preliminary estimates for distribution of project cost;
- Recommendations for a preferred option; and,
- Establish redundant features and the need for upgrades beyond the scope of Section 78 of the Drainage Act.

Accordingly, the firm of RC Spencer Associates Inc. has performed all the necessary studies, investigations, etc., and we report thereon as follows.

After public review, the Council of the Municipality of Chatham-Kent may take several courses of action such as:

- Take no further action;
- Instruct an Engineer that a final report be prepared which includes any portion or all of the recommended works in this preliminary report; or,
- Instruct the Engineer to consider additional options not previously considered.

## **3.0 STUDY AREA**

The study area extends along Erieau Shore Drive from the westerly end of McGeachy Pond to Bisnett Sideroad (Station 1+00 to Station 4+150). There are approximately 153 properties located south of Erie Shore Drive which abut Lake Erie. Approximately 21 properties are located in a triangular shaped area located near the westerly end of the study area from Station 3+575 to Station 3+900. There are approximately 75 properties within the Burk Drainage Works which lie north of Erie Shore Drive. These are largely agricultural in nature.

#### **4.0 PURPOSE OF THE BURK DRAINAGE WORKS**

Enclosed with this report is Drawing Sheet No. 1 which illustrates the area of the Burk Drainage Works. The plan also shows the extent of the previously constructed shore protection works, the extent of the shoreline exposed to Lake Erie and the approximate limits of the flooding which may be expected in the event of failure of the dyking system based on current lake levels.

The “Burk Drainage Works” generally refers to those lands in Registered Plan 420 and 421 in the Community of Harwich. Today, they are provided drainage by an extensive internal gravity and mechanically pumped drainage system and are provided protection from Lake Erie and Rondeau Bay by an extensive system of dykes, groynes, and other protective works. The total area within the Burk Drainage Works is in excess of 726 hectares (1,794 acres) and much of it lies below the current still water elevation of Lake Erie.

Approximately 542 hectares (1340 acres) of the agricultural area within the Burk Drainage Works is considered floodable. Drawing Sheet No. 1 illustrates contour lines which define the limits to which lake flooding would extend if the dyke was to be breached. The lands to the east of those contour lines are the low-lying areas.

Before the Burk Drainage Works was constructed, runoff from the upper lands entered the area of low-lying lands within the limits of the Burk Drainage Works and could not drain into Lake Erie or Rondeau Bay by means of gravity.

#### **5.0 DESCRIPTION OF THE BURK DRAINAGE WORKS**

When the Burk Drainage Works was constructed, the runoff from the areas outside of the limits of the Burk Drainage Works was re-directed by means of large open channels and dyke systems in a manner which would prevent these flows from being discharged into the area of the Burk Drainage Works.

Three external drains known as the Third Concession Drain, the Burk Drain, and the Beaver Creek Drain were constructed to cut off the upstream flows and discharge them by gravity into Lake Erie or Rondeau Bay. Earth embankments contained the flow within these channels and provided protection to the low-lying lands within the Burk Drainage Works.

The Burk Drainage Works consists of two separate pumped areas, the Burk Pump Area and the Rondeau Pump Area. Drawing Sheet No. 2 shows the two separate pump areas that make up the Burk Drainage Works. The size of each pump area is as follows:

Burk Pump Area	- Lands and roads	600 Hectares	1,483 Acres
Rondeau Pump Area	- Land and Roads	111 Hectares	274 Acres
	- McGeachy’s Pond	15 Hectares	37 Acres
		-----	-----
Total for Burk Drainage Works -		726 Hectares	1,794 Acres

A system of internal open drains was constructed within the low-lying lands of the Burk Drainage Works to collect run-off from these lands and convey them to a pumping station. These pumping stations provide outlet by means of mechanical pumps. In this manner, all low-lying lands within the Burk Drainage Works could be provided effective drainage. Over the years, several works of repair and improvement of the internal drainage system and pumping facilities have been undertaken under the provisions of The Drainage Act.

The internal drainage systems within the pump areas include the following Municipal Drains constructed under the Provisions of the Drainage Act:

Burk Pump Area

- Lakeshore Drain;
- Internal Drain;
- Verstraete Drain;
- Galloway Drain (Tile);
- Bisnett Drain; and,
- Bell and Bisnett Drain.

Rondeau Pump Area

- Big Creek Drain;
- Pike Creek Drain; and,
- Travnick Outlet Drain.

Virtually all of the major drainage systems within the Burk Drainage Works are municipal drains constructed under The Drainage Act. Further, with the exception of portions of Erie Shore Drive from the west end of McGeachy Pond to Bisnett Sideroad, the dyking system which protects the Burk Drainage Works from Lake Erie and Rondeau Bay was constructed under the provisions of The Drainage Act. The Council of the Municipality of Chatham-Kent is responsible to administer the continued repair and improvement of these drainage systems and protective works under The Drainage Act.

## **6.0 INVITATION FOR PROPERTY OWNERS TO PETITION FOR SHORELINE IMPROVEMENTS**

After R.C. Spencer was appointed to prepare a preliminary report under Section 10 of the Drainage Act pursuant to a Section 78 instruction for the repair and improvement of the Burk Drainage Works, the Municipality sent a notice to the lakefront owners of its intention to proceed with a preliminary report examining alternatives for the repair and improvement of the Burk Drainage Works under Section 78 of the Drainage Act. Past studies had determined that the lakefront property owners would like to have a high degree of shoreline protection provided for their benefit but were generally of the opinion that they should not bear any significant costs for such an endeavor.

Historically, the lakefront lands were not assessed for flood protection of the Burk Drainage Area as they are located outside of the dyking system. With one minor exception, the lakefront lands



did not contribute to the cost of any shoreline groynes or walls as the purpose of that work was to protect the natural beachfront from erosion and thereby protect the Burk Drainage Works from flooding.

In our opinion, the Engineer has no authority to construct shoreline protection to the high standard needed to protect the lakefront property as the costs would far exceed the costs required to provide protection to the Burk Drainage Works. Under Section 78 of the Drainage Act, the Engineer can recommend improvements for the better use and maintenance of the Burk Drainage Works. To provide shore protection beyond the level of protection required by the Burk Drainage Area for the betterment of lakefront lands would be beyond the authority provided by Section 78 of the Drainage Act. The Engineer has no authority to go beyond the limits of a Section 78 instruction unless a valid petition under Section 4 of the Drainage Act is filed with the Municipality. This would require a large number of lakefront landowners to sign a petition under Section 4 of the Drainage Act.

The Municipality gave the property owners months to circulate a petition but no such petition was filed with the Municipality. At that point in time, RC Spencer Associates was instructed to proceed with an on-site meeting under Section 78 of the Drainage Act.

## **7.0 SITE MEETING**

A virtual on-site meeting was held on 27 January 2022 with the landowners in the watershed. The history of the Burk Drainage Works was presented at the meeting. The meeting attendees were asked for their input.

In general, no one expressed any concerns with the Burk Pumping Station, the Rondeau Pump Station, the internal systems of drains, and the boundary drains external to the Burk Drainage Works, including the Beaver Creek Outlet Drain Pumping Station.

The sole concern expressed was Lake Erie water that floods over Erie Shore Drive and enters the Burk Drainage works. These flows endanger the stability of the dyke system and this is a major concern.

## **8.0 DRAINAGE HISTORY**

### **8.1 25 March 1914 Report by G.A. McCubbin**

A review of the records indicates that the Burk Drainage Works were originally constructed under the Municipal Drainage Act in accordance with a report prepared by the George A. McCubbin dated 25 March 1914. **The work was initiated under a petition of several agricultural landowners.** Under the 1914 report, the intention was to construct a drainage scheme which included the embanking and pumping of the greater portion of the lands in the Third and Fourth Concessions, W.C.R. lying east of Bisnett Sideroad and west of the Chesapeake and Ohio Railway.

The work included the excavation of several open drains within the area of the Burk Drainage Works, the construction of embankments, access culverts and a pumping station. The pumping station was to have a capacity of 48,000 US gallons per minute (3,028 litres per second) pumping against a relatively low static lift of 3 feet (0.91 m) (which was equivalent to the difference in water levels at the time). In comparison, the main pump station present today operates under a static lift 9.4 feet (2.87 metres). Under this condition, the 1914 pump would have only delivered approximately 15,300 US gallons per minute (965 litres per second).

In addition, numerous reports have been prepared which provided for strengthening, raising, and protecting the various embankments around the Burk Drainage Works and along the external and internal drains. Also, many improvements have been carried out along the shore of Lake Erie, as works of improvement under The Drainage Act, in order to protect the beach and thereby protect the embankment upon which Erie Shore Drive is located. This embankment forms a vital part of the Burk Drainage Works as it forms the southerly boundary of the protected area and serves as the only protection for the farmland against Lake Erie.

## **8.2 5 November 1930 report by W.G. McGeorge and G.A. McCubbin**

The work involved the construction of 914 metres (3000 feet) of wood sheet piling and groyne construction near the McGeachy's Pond area.

The cost of the work was paid for by the Federal Government, the Provincial Government, the Village of Erieau and the agricultural and other lands within the limits of the Burk Drainage Works. **No lakefront lots were assessed for any of this work.**

## **8.3 8 May 1947 Report by G.A. McCubbin and W.G. McGeorge 6 June 1947 Report by G.A. McCubbin and W.G. McGeorge & 12 March 1948 Report by G.A. McCubbin**

A total of 777 metres (2,550 feet) of seawall and 54 groynes were constructed opposite the location where the ARDA Area A-1 Dyke was constructed in 1973. This is located near the west end of the Burk Drainage Works area from approximately Station 2+798 to Station 3+575.

The cost of the work was paid for by the agricultural and other lands within the limits of the Burk Drainage Works area. **No lakefront lots were assessed for any of this work.**

## **8.4 6 January 1951 Report by G.A. McCubbin and W.G. McGeorge**

Under the 1951 report, 1,859 metres (6100 feet) of seawall and 111 groynes were constructed along the shoreline of Lake Erie from Station along the area between were the ARDA dykes were built in 1973 for Area A-1 and Area A-2. The costs were assessed to

the agricultural and other lands within the limits of the Burk Drainage Works area. **No lakefront lots were assessed for any of this work.**

#### **8.5 1 May 1968 Report of E.C. Brisco**

Under the 1968 report, 325 metres of seawall and groynes were constructed in one area located in Concession 4, W.C.R., Registered Plan 421, Part of Lots 455, 468 to 470, and 472 to 476. This is a triangular area of land bounded by the Erie Shore Drive and Lake Erie near the westerly limit of the study area between Station 3+575 and Station 3+900 as shown on Drawing No. 1.

**Under the 1968 report, 23 residential lots fronting on Lake Erie were assessed an estimated cost of \$11,500 (16.9%) of the cost of the seawall and groyne construction. The remaining \$56,500 (83.1%) of the estimated cost was levied against the lands within the Burk Drainage Area. This is the only assessment ever made against the shoreline residential properties for all of the shoreline work carried out under the provisions of the Drainage Act.**

#### **8.6 1 February 1972 Report by E.C. Brisco**

The 1972 report provided for work at the site of the Burk Drainage Area Pump Station. The drawings show the original pump station constructed in 1914, as well as a secondary pump station located to the east. We understand that this secondary pump station was constructed around 1930 to supplement the capacity of the original pump station constructed in 1914.

The report called for the removal of the original pump station constructed under the 1914 report. The report also provided for the construction of a new main pump station capable of housing two pumps. Only one pump having a design capacity of 25,000 U.S. gallons per minute (1,577 litres per second) was installed at that time. It was designed for a total dynamic head of 16 feet (4.9 metres). The second bay of the pump station was sized to accommodate a future pump having a capacity of 35,000 U.S. gallons per minute (2,208 litres per second).

#### **8.7 July 23, 1973 Reports by H.H. Todgham** **ARDA DYKES (AREA A-1, AREA A-2 & AREA A-3)**

Three dyke construction projects were carried out under the provisions of the Drainage Act in accordance with three reports all dated 23 July 1973, and prepared by H.H. Todgham.

The locations for the three projects are shown on Drawing Sheet No. 1. The dykes were designed to a high standard of flood protection and are protected with armour stone.

These three major projects were undertaken on the dyke systems which protect the Burk Drainage Works. Major dyke reconstruction was undertaken at two locations along the Lake Erie shoreline and the third involved dyke reconstruction along the eastern boundary of the protected area adjacent to Rondeau Bay. These areas are identified as Area A1, A2 and A3 on Drawing Sheet No. 1. The A1 and A2 sections along the Lake Erie shoreline involved the construction of approximately 1650 m of earth fill dyke with armour stone protection.

All dyke works constructed at that time were done so under the provisions of The Drainage Act and special funding was provided under the A.R.D.A. program which existed at that time. ARDA stands for the “Agricultural and Rural Development Act”. The projects were completed under the Drainage Act with funding of 90% provided under a special agreement between the Federal and Provincial Governments. The ARDA grant applied only to agricultural lands. The 10% of the project costs were assessed against the lands within the Burk Drainage Works with **no assessment being made against the residential lots along the shore of Lake Erie which lie between the Erie Shore Drive and the water’s edge.**

#### **8.8 1 October 1973 Report by W.D. Colby**

Improvements were made to the pump reservoir portion of the Internal Drain.

#### **8.9 15 October 1986 Report by E.P. Dries**

The report provided for an updated schedule of assessment to be used to assess future operation and maintenance costs for the pump station.

#### **8.10 12 June 2013 Report by N.W. Morris**

This was a report for the installation of a second pump in the existing pump station constructed in 1972 at the Burk Pump Station site. The report also included updated provisions for assessing future maintenance cost on the Internal Drain.

The second pump was sized to accommodate a flow of 35,000 U.S. gallons per minute (2,208 litres per second). This would supplement the capacity of the first pump which is 25,000 U.S. gallons per minute (1,577 litres per second).

Prior to 2013, the lakefront lands, south of Erie Shore Drive were not assessed for any of the costs involved with the previous pump station construction or operation costs nor for maintaining the Internal Drain in the past.

Under the 2013 report, the drawings show 153 residential lots on the south side of Erie Shore Drive. **The front yards of 57 residential properties were assessed for the cost of the pump station constructed under that report. Each of these properties was assessed an average of \$40 (0.016%) out of the \$248,500 for upgrading the pump station.**

**The 57 residential properties were also assessed for future maintenance of the Internal Drain at an amount equal to between 0.01% to 0.02% of the cost of maintaining the drain. Prior to this, no lakefront properties were assessed for any of the internal drainage systems within the boundaries of the Burk Drainage Works.**

**The 2013 report did not make these 57 residential lots responsible for any of the future maintenance for the dyke works or the shoreline protection works.**

This report also outlines maintenance provisions for the following other internal drainage systems:

- Third Concession Drain;
- Internal Drain;
- Lakeshore Drain;
- Bell & Bisnett Drain;
- Verstraete Drain; and,
- Galloway Drain.

## **9.0 OTHER MUNICIPAL DRAINAGE WORKS:**

### **9.1 Internal Drain**

Improvements were made to the Internal Drain of the Burk Drainage Works under a report of E.C. Brisco dated 28 October 1964. Sediment was cleaned from the open drain. The work commenced at the outlet of the drain and proceeded upstream to the line between Lot 446 and Lot 450.

### **9.2 Lakeshore Drain**

The Lakeshore Drain is the large open drain on the north side of Erie Shore Drive. It outlets into the Internal Drain. The last report was prepared by G.A. McCubbin in 1949.

### **9.3 Third Concession Drain and Embankment**

The Third Concession Drain is an open municipal drain which serves as an outlet for approximately 1,521 Ha (3,760 acres) of land in Lots A and B, and Lots 3 to 10 in Concession 2, W.C.R.; Lots C and D and Lots 3 to 10 in Concession 3, W.C.R.; and Pt Lots 3 to 5 in Concession 4, W.C.R. The southerly bank of this drain forms a dyke to provide flood protection for the Burk Drainage Works.

The Third Concession Drain and Embankment diverts runoff away from the Burk Drainage Works. It is a gravity drain (no pumped outlet) that outlets into Rondeau Bay. The Burk Pumping Station outlets into the Third Concession Drain.

There have been numerous reports prepared for this drain under the Drainage Act. The most recent report was prepared by E.P. Dries and dated 22 March 2002.

#### **9.4 Beaver Creek Outlet Drain**

The upper portion of the Beaver Creek Drain is a covered drainage works. The lower portion of the Beaver Creek Drain is an open drainage works located along the west side of the Burk Drainage Area. It diverts the runoff from approximately 445 hectares (1100 acres) of land away from the Burk Drainage Works. The majority of the flows outlet through twin 1520 mm diameter pipes equipped with flapgates. There is a small pump 10 HP pump that lowers the water in the drain further when lake levels close the flapgates. The pump handles 5 mm (0.2 inches) of runoff in 24 hours.

#### **10.0 COST RECOVERY FOR PAST WORK ON THE BURK DRAINAGE WORKS**

It is important to note that **the lakefront lands, south of Erie Shore Drive were not assessed for any of the costs involved with the embankment and dyke work and the external drainage systems.**

**The lakefront lands, south of Erie Shore Drive were not assessed for any of the costs involved with the pump station construction or operation costs with one minor exception.** Under the 2013 report the drawings show 153 residential lots on the south side of Erie Shore Drive. In the past, these properties were not assessed for any work on the Burk Drainage Works. Under the 2013 report the front yards of 57 residential properties were assessed for drainage. Each of these properties was assessed an average of \$40 (0.016%) out of the \$248,500 for upgrading the pump station.

**The lakefront lands, south of Erie Shore Drive were not assessed for any of the costs involved with internal drainage systems with one minor exception.** Under the 2013 report, 57 residential properties were assessed for future maintenance of the Internal Drain at an amount equal to between 0.01% to 0.02% of the cost of maintaining the drain. **Prior to this no lakefront properties were assessed for any of the internal drainage systems within the boundaries of the Burk Drainage Works.**

Under reports prepared under the provisions of The Drainage Act in 1930, 1946, 1947, 1948, 1951 and 1968, wooden seawalls and wooden groynes were constructed along the shoreline of Lake Erie opposite the length of the Lakeshore Drain abutting the Erie Shore Drive. The construction of the wooden seawalls and groynes was carried out primarily to protect the Burk Drainage Works and **except for the 1968 report, the entire cost of the seawall and groyne construction projects was assessed against the lands within the Burk Drainage Works with no assessment being made against the residential lots along the shore of Lake Erie which lie between the Erie Shore Drive and the water's edge.**

Under the 1968 report, seawall and groynes were constructed in one area where 23 residential lots were assessed an estimated cost of \$11,500 (16.9%) of the cost of 325 m of seawall and

groyne construction located in Concession 4, W.C.R., Registered Plan 421, Part of Lots 455, 468 to 470, and 472 to 476. This is a triangular area of land bounded by the Erie Shore Drive and Lake Erie near the westerly limit of the study area between Station 3+575 and Station 3+900 as shown on Drawing No. 1. The remaining \$56,500 (83.1%) of the estimated cost was levied against the lands within the Burk Drainage Area. **This is the only assessment ever made against the shoreline residential properties for all of the shoreline work carried out under the provisions of the Drainage Act.**

## **11.0 WATERSHED DESCRIPTION**

The “Burk Drainage Works” generally refers to those lands in Registered Plan 420 and 421 in the Community of Harwich. Today, they are provided drainage by an extensive internal gravity and artificially pumped drainage system and are provided protection from Lake Erie and Rondeau Bay by an extensive system of dykes, groynes, and other protective works. The total area within the Burk Drainage Works is in excess of 726 hectares (1,794 acres) and much of it lies below the current still water elevation of Lake Erie. Approximately 542 hectares (1340 acres) of the agricultural area within the Burk Drainage Works is considered floodable

There are three different soil types within the watershed. The proportions of different soil groups within the watershed are as follows:

- Muck (Organic Soils) – 66%
- Beverly Loam – 30%
- Haldimand Loam – 4%

The Muck soils occur in the lower lying lands in the Burk Drainage Works watershed. The Beverly Loam and the Haldimand Loam occur in the higher lands in the watershed. The lands in the Burk Drainage area are comprised largely of agricultural properties with several small residential properties. Erie Shore Drive acts as a dyke along the south limit of the Burk Drainage Works area. The lakefront properties south of Erie Shore Drive are outside of the embankments protecting the Burk Drainage Works.

## **12.0 LAKE LEVEL FLUCTUATIONS**

The changes in the water level of Lake Erie are affected by several natural factors and man-made influences. The levels of the lake depend on storage capacity, outflow characteristics of the outlet channel, operating procedures of the regulatory structures and the supply of water received by the lake. The primary natural factors affecting the lake levels include precipitation on the lakes, runoff from the drainage basin, evaporation from the lake surface, inflow from upper lakes, and outflow into the downstream lake. Man-made factors include diversions into and out of the Great Lakes Basin, consumptive uses, dredging of outlet channels and the regulation of outflow.

The influence of all of these factors produces long term fluctuations in lake levels that extend from very low levels in 1926, 1935 and 1965 to the high levels experienced in 1972, 1986, 1997 and 2019. More than a century of records in the Great Lakes Basin indicate no regular predictable

cycle. A plot of the average annual water level records on Lake Erie from 1918 to 2020 is attached as Drawing Sheet No. 3.

The seasonal fluctuations of Lake Erie are far less dramatic. The annual hydrologic cycle produces higher net basin supplies in the spring and early summer and low net supplies in the remainder of the year. The maximum lake level usually occurs in June and will be approximately 0.3 m above the season low which is experienced in December-January.

More significant water level fluctuations, lasting from several hours to several days, can be caused by wind effects and differences in barometric pressure over the surface of the lake. Storm surges of approximately 0.5 m are common through this reach of the lake.

Acting on all three categories of water level fluctuations are wind induced waves. Surface waves are the main cause of shore erosion. Localized flooding also occurs as a result of waves overtopping the existing shoreline protection system.

### **13.0 CURRENT CONDITIONS ALONG ERIE SHORE DRIVE**

In March 2020, Chatham-Kent completed enhanced maintenance works along Erie Shore Drive in an effort to stabilize the roadway and dyke in order to mitigate the risk of dyke failure identified in a Golder Associates geotechnical report. The work included the raising and relocation of a continuous row of concrete blocks to a location near the centerline of the travelled portion of the road. The row of blocks were reinforced in the rear with compacted clay over the north lane of the roadway. Spillways were created and reinforced to control flows over the south bank of the Lakeshore Drain in order to minimize the effects of erosion, undermining and degradation of the dyke. To date this action has held up well as a short-term measure to minimize the risk and damages to the dyke and road infrastructure.

### **14.0 EXISTING CONDITIONS FOR THE BURK DRAINAGE WORKS**

#### **14.1 Wooden Seawall and Groynes**

Wooden seawalls and wooden groynes have been constructed along the lakeshore under the provisions of The Drainage Act under reports of 1930, 1943, 1946, 1947, 1948, 1951, and 1968. Generally speaking, these walls have not been maintained by the Municipality nor the property owners. In fact, the majority of these wooden groynes have been destroyed by natural lake processes or have been replaced by privately installed systems.

The existing seawall and groynes systems were not designed to provide effective protection from the high lake levels experienced in 1973, 1986 and 1997. It does not appear that they have been effective in the development of any substantial sand beach at the current lake levels. It does not appear practical on the part of the Municipality to undertake a program to attempt to maintain or repair these wooden groyne systems.



#### **14.2 1973 A.R.D.A. Dyke Works**

The extent of the two sections of dyking and lakeshore protection installed in 1973 under the A.R.D.A. program is shown in Drawing No. 1. An inspection of these dykes confirm that they have performed to their intended design standard. They have provided effective flood protection to the lands they were intended to serve. There has been virtually no requirement for maintenance on these dykes since their construction.

#### **14.3 Lake Shore Drive**

The high lake levels in 1986 and 2018, in conjunction with several storm events during that period resulted in significant flooding over Erie Shore Drive. The overtopping of Erie Shore Drive caused serious erosion and loss of the north shoulder and portions of the north travelled lane of the road. All of the material was eroded into the Lake Shore Drain which abuts the north edge of the travelled portion of Erie Shore Drive for much of its length. Remedial measures were taken at the time by the Township of Harwich to protect the structural integrity of the road.

As no long-term shore or flood protection program was implemented as a result of the 1986 experience, the Township of Harwich simply rebuilt Erie Shore Drive after the lake levels subsided. The reconstruction took place in 1991. Although every effort was made to raise the centreline profile of the road where possible, this was extremely constrained by the very narrow platform width. The works did raise the road as much as 300 mm in places. However, this was never intended as a long-term flood protection measure for the lands in the Burk Drainage Works.

Storm events, coupled with the high lake levels experienced in 1997 once again generated flood events over Erie Shore Drive. Again, the Township of Harwich undertook emergency remedial action to protect the structural integrity of the road. While these actions served to protect the Burk Drainage Works against catastrophic failure of Erie Shore Drive, it remains susceptible to isolated flood events caused by the large volume of water discharged into the Burk Drainage Area from the lake. Further, it must bear the cost of the additional pumping required to remove these flows.

Again in 2018, the high lake levels experienced once again generated flood events over Erie Shore Drive. Again, the Municipality undertook emergency remedial action to protect the structural integrity of the road. Erie Shore Drive remains susceptible to isolated flood events caused by the large volume of water discharged into the Burk Drainage Area from the lake.

**Clearly, any long-term solution should be aimed at providing additional flood protection to Erie Shore Drive and the Burk Drainage Works.**

#### **14.4 Lakeshore Properties**

During the 1986 event and in the subsequent years, many property owners have constructed private shore protection systems along the lake frontage of their property. However, wind generated wave events on the high lake levels experienced in 1997 and 2018 once again resulted in flood and wave damage to many of the permanent homes, cottages and residential lots along this reach of the shoreline. The degree of damage varied to some extent by the effectiveness of the private shore protection systems. There is little doubt that the beach area, the beach dune, and the residential structures between the lake and Erie Shore Drive absorb a great deal of the energy from wave attack and in fact, provide some considerable degree of protection to Erie Shore Drive and lands to the north. However, since there is no consistency in the design of the private protection systems along the lakeshore, effective, long-term protection against wave damage or flooding is not provided to the residential properties, Erie Shore Drive, or the lands in the Burk Drainage Works.

Private shore protection systems along the lakeshore cover a broad range of design standards and materials used. Some property owners have no protection at all while others have reasonably substantial steel sheet pile seawall and groyne systems. As there is no consistent design standard applied, there are several instances of private structures failing as a result of the activities, or lack thereof, on neighbouring properties.

The construction of private shore protection systems at various locations along this reach of the lakeshore continue on a near constant basis. Any long-term shore protection option should provide a consistent level of protection to the properties along this reach of the lakeshore.

#### **14.5 Utilities**

The utilities which exist within the road allowance of Erie Shore Drive include Ontario One, Bell Canada and a municipal watermain which serves the Erie Shore Drive residents as well as the Community of Eriean. Catastrophic failure of Erie Shore Drive will result in significant damage to these services. **Continuing erosion of the lakeshore at various locations along this reach have significantly reduced the relative proximity of the watermain to the lakeshore. The Municipality must give consideration to the circumstance.**

#### **14.6 Access to Eriean**

The Community of Eriean is accessible only by Eriean Road which passes through the centre of the Burk Drainage Works. This roadway has been constructed to an elevation which is significantly above that of the adjacent lands. However, various portions of the road are still below the potential flood elevations that would occur should catastrophic failure of Erie Shore Drive occur. In that case, the Community of Eriean would, in all probability, be cut off from public access, potable water and electrical services. This would pose a significant threat to life and property.

## **15.0 CAPACITY OF THE INTERNAL AND EXTERNAL PUMP STATIONS**

Drainage pump stations and drainage pumping equipment are described in terms of the flows that they can convey in terms of U.S. gallons per minute (USgpm) or litres per second (L/s) against a specific head of water expressed as either:

1. a static head or lift of water in feet or metres.
- or 2. A dynamic head of water in feet or metres. Dynamic head includes the static lift of water plus any hydraulic losses due to friction in the pump column and discharge pipe, head losses at bends, losses of energy at flap gates, discharges, etc.

We have examined the capacity of the pump stations in and near the Burk Drainage Works. We find that none of them have any reserve capacity that could be used to pump any additional lake water that may outlet into the Burk Drainage Works.

Publication 29 of the Ministry of Agriculture, Food and Rural Affairs recommends design standards for covered drains. Where surface and subsurface runoff is collected by a covered drain, the following drainage coefficient or removal rates are recommended:

- For cash crops, a drainage coefficient of 37 mm (1.5 inches) per day.
- For high valued specialized crops, a drainage coefficient of 45 mm (1.75 inches) per day.

The Burk Pump Station should be designed to convey a minimum of 45 mm (1 to 1.75 inches) of runoff per day. The capacity of the three pump stations in this area are as follows:

### **15.1 Burk Pump Station (Internal)**

The main Burk Pump Station consists of two pumps with a combined total removal rate of approximately 55 mm (2.15 inches) per day from the watershed. This is reasonable given that there is no effective gravity overflow outlet for Burk Pump Area.

The combined pump capacity is 60,000 USgpm which is 3,825 L/s. This does not include the capacity of the secondary pump station that was built around 1930.

### **15.2 Rondeau Pump Station (Internal)**

The Rondeau Pump Station consists of two pumps with a combined total removal rate of approximately 37 mm (1.5 inches) per day from the watershed.

### **15.3 Beaver Creek Pump Station (External)**

The Beaver Creek Pump Station consists of one pump with a removal rate of approximately 5 mm (0.20 inches) per day from the watershed.

## **16.0 PREVIOUS ENGINEERING STUDIES**

### **16.1 1986 Study by Todgham and Case Associates**

Todgham and Case Associates was commissioned by the Lower Thames Valley Conservation Authority to prepare an engineering study of this same area in 1986. The main purpose of the study was to determine the extent of the damage caused by the recent storm events, examine the reasons for flooding and examine the feasibility and cost of several alternatives for providing an improved degree of protection to the Burk Drainage Works, as well as, the potential benefits to be derived by providing this improved protection. That study was supported by a Coastal Engineering Study done by Keith Philpot Consulting Limited.

Although the focus of the study was the protection of the Burk Drainage Works, some of the options considered involved construction activities along the lakeshore which would consequently provide protection to the lakefront properties as well as Erie Shore Drive and the Burk Drainage Works. For all of the lakeshore protection systems considered in that report, the most cost-effective option for shore protection consisted of a steel sheet pile wall parallel to the shore near the water's edge in conjunction with a steel sheet pile groyne field. However, this alternative was not supported by the Coastal Engineering Consultant on the basis that there was insufficient literal material to effectively fill the groynes. Further, it was anticipated that the vertical wall at the head of the beach could potentially accelerate the erosion of the near shore lakebed.

The preferred alternative recommended in the 1986 report included the relocation of the Lakeshore Drain north of Erie Shore Drive and the construction of an earth dyke immediately north of Erie Shore Drive. This option would provide maximum flood protection to the lands within the Burk Drainage Works. This option offered no protection whatsoever to the lakeshore properties south of Erie Shore Drive. However, it did include a program of municipal acquisition of properties along the lakeshore.

The total estimated cost of those works inflated to 1998 values was in the order of \$10.8 million dollars. As these works would only provide protection to lands and roads within the Burk Drainage Area, we would anticipate that any cost recovery program would be focused on the Municipality and the agricultural lands in the Burk Drainage Works.

### **16.2 May 1998 - Baird Report**

The Baird report provided technical background and development of the alternative long term shore protection options. The study reach was divided into four distinct sections. See Drawing Sheet No. 7. Each section had unique features or conditions which distinguished it from neighbouring sections. The works proposed in each section and the comments made in the Baird report are summarized as follows:

### **16.2.1 Reach 1 (Station 3+900 to Station 4+150)**

The recommended works include the reconstruction of the existing shore protection works as an armour stone revetment. The existing concrete rubble and armour stone materials would be salvaged from this reach for reuse. The underlying earth berm would be raised, widened and reshaped to produce a consistent cross-section with a finished elevation of at least 176.50 m. This would be very similar to the existing dyke system which exists along McGeachy's Pond. An appropriate geotextile would be placed on the reshaped earth berm and it would be covered with the salvaged material as well as additional armour stone. All of the works would take place on privately-owned lands. Appropriate allowances for the right of access onto the property to perform the works as well as the use of the land on which to construct the works will be required.

These works would provide effective long-term erosion and flood protection to the lands and roads lying north of the revetment. However, this system would not enhance beach development through this reach.

### **16.2.2 Reach 2 (Station 3+575 to Station 3+900)**

The recommended works through Reach 2 includes the installation of three armour stone hard points with beach. The armour stone hard points shall consist of a rock core extending from the shore lakeward approximately 30 m. The rock core would be covered with layers of filter rock and armour stone. The armour stone hard point would encourage beach development which in turn would provide flood protection during storm events. It may be necessary to initially pre-nourish the beach unless it can be clearly determined that sufficient natural material is available.

This option would not significantly reduce the access to the water through this reach. However, access through specific properties to permit construction would be required. The vast majority of construction would occur on the lake bed.

### **16.2.3 Reach 3 (Station 3+080 to Station 3+575)**

The physical limitations through this reach severely limit the shore protection options available. The existing lots have so little depth that any shore protection system along water's edge would severely limit their development. The probability of regenerating a beach sufficient to allow redevelopment of these lots as well as provide some degree of flood protection to them is remote. Erie Shore Drive and the Burk Drainage Works are already adequately protected by the previous works completed in 1973 under the ARDA A-1 project. Therefore, it is recommended that the Municipality consider municipal ownership of the lots through this reach. Acquisition at fair market value with life lease provisions could be considered.

### **16.2.4 Reach 4 (Station 1+000 to Station 3+080)**

The recommended works include the construction of offshore breakwaters and steel sheet pile wall with beach. This design consists of a large offshore breakwater

constructed parallel to the shore and connected to the shoreline by a steel sheet pile wall. The offshore breakwater would be constructed approximately 60 m lakeward. These structures would create semi sheltered embayments which would contain sediment and extend the beach and beach profile. It may be necessary to initially pre-nourish the beach unless it can be clearly demonstrated that sufficient natural material is available.

This option would not significantly reduce access to the water through this reach. It would also enhance the effectiveness of all existing private shore protection systems. The vast majority of the construction activities would occur on the lakebed although access through specific properties to permit construction would be required.

### **16.3 1998 Study by Todgham and Case Associates Inc.**

The “Flood Protection Study for Erie Shore Drive” dated May 15, 1998 was prepared for the Municipality of Chatham-Kent by Todgham and Case Associates Inc. It incorporated the recommendations from the Baird report of May 1998. The costs of the work for each reach was estimated and approximate assessments were determined for the Lakefront Lots, Erie Shore Drive, Lands in the Burk Drainage Area, Municipality of Chatham-Kent, Utilities and Access to Erieau.

### **16.4 April 2020 – Zuzek Report**

Chatham-Kent commissioned the “Lake Erie Shoreline Study” prepared by Zuzek Inc. which examined the entire length of the shoreline of Lake Erie in the Municipality of Chatham-Kent. Council endorsed the six recommendations within that report with the underlying goal to be the prioritization of the most vulnerable areas of shoreline along Lake Erie.

The section of shoreline adjacent to the Burk Drainage Works, between Erie Beach and Erieau is one of the identified key focal points. Various options were examined including:

- Protection of the shoreline with various levels of armour stone revetment.
- Relocation of the dyke towards the north so that it can be raised. This would require the relocation of the Lakeshore Drain towards the north. A covered drain could be added to enhance drainage along the road. These flows would be discharged into a storm water detention pond that would be discharged back into Lake Erie by means of a mechanical pump.
- Options that would involve an Erie Shore Drive land buyout.

## **16.5 March 2020 – Golder Associates Study**

A study dated 31 March 2020 by Golder Associates Limited made recommendations to improve the short-term stability of Erie Shore Drive due to lake water overtopping Erie Shore Drive. Those measures included concrete barriers, clay fill and spillway construction. Those measures were implemented.

## **17.0 ALTERNATIVES**

There are two types of projects considered in this report for comparison. They are:

1. A new capital works designed only for the protection of Erie Shore Drive and the agricultural lands north of the road in the Burk Drainage Works. This type of improvement is permitted under Section 78 of the Drainage Act.
2. A new capital works along the lakeshore which would provide protection to the lakefront properties, Erie Shore Drive and the lands in the Burk Drainage Works. This type of improvement would require a valid petition from the lakefront landowners under Section 4 of the Drainage Act. Otherwise, the Municipality will have no authority to spend the additional money and assess the lakefront landowners.

### **17.1 Do Nothing Alternative**

The “Do nothing” option assumes that the Municipality will undertake no further works of maintenance, repair, or protection of Erie Shore Drive or the protection works associated with the Burk Drainage Works. This does not appear to be practical as Council is obliged under The Drainage Act to maintain and repair all existing municipal drainage systems. However, they are not necessarily compelled to improve the existing systems or construct new works. It would not appear practical in the long term to jeopardize the municipal and private investment in the existing road and drainage systems. Therefore, it would appear prudent for the Municipality to consider a more effective long-term solution for the protection of Erie Shore Drive and the lands and roads within the Burk Drainage Works.

All of the short-term protective works undertaken by the Municipality in the past have focused on short term relief measures to prevent significant damage to Erie Shore Drive and the lands in the Burk Drainage Works. These works offer no direct protection to the properties along the lakeshore. It is also important to recognize that the Municipality has borne all costs of these short-term protective works. There does not appear to be any legislative base which allows the Municipality to recover these particular protective/maintenance costs from the properties affected by these works.

While these protective/maintenance works have provided reasonably effective protection to Erie Shore Drive and the Burk Drainage Works, they resulted in inconvenience to the travelling public on Erie Shore Drive. The following “Major

Improvements” options would seek a more permanent long-term solution for the lands and roads currently affected by the flood events in this area.

### **17.2 Option 1 - Relocate Lakeshore Drain and Construct New Dyke**

Option 1 involves the relocation of the Lakeshore Drain and the construction of a new dyke on the north side of Erie Shore Drive from Station 1+000 to Station 3+075. Drawing Sheet No. 4 shows a typical cross-section for Option 1. Drawing Sheet No. 5 shows is a plan view showing the location of the work proposed with Option 1.

In general terms, the work involves backfilling of the existing Lakeshore Drain and excavating a new open drain further to the north. Erie Shore Drive presently serves as a dyke and a new dyke would be constructed along the north side of Erie Shore Drive at a higher elevation.

The height of the dyke will be substantially higher than Erie Shore Drive and access to the farm properties from Erie Shore Drive will not be feasible. We recommend that a new gravel access road be constructed across private lands to provide access to all properties.

Allowances for land, buildings and crop damages would be provided to the affected properties.

A storm sewer would be constructed on the north side of Erie Shore Drive with catch basins on both sides of the road. The storm sewer would require a pumping station to lift the water and discharge it into Lake Erie.

Drawing Sheet No. 5 shows a proposed “Burk Relief Drain and Reservoir”. Initially, we considered discharging the storm sewer along Erie Shore Drive into the reservoir and having one pump to handle the flows from the storm sewer and provide additional pump capacity for the Burk Drainage Area during large storm events when an overflow pipe would allow runoff to enter the “Burk Relief Drain” and the reservoir. We decided against this concept. Under extreme conditions of rainfall and high lake levels flooding the road, the capacity of the storm sewer would be exceeded. The storm sewer would become surcharged and pressurized flows would exceed the capacity of the pumping station. If these flows are allowed to enter the reservoir then extra rain and lake water would enter the Burk Drainage Area from outside sources and adversely affect drainage and flooding in this pumped drainage area.

We recommend that the proposed storm sewer along Erie Shore Drive be connected to a dedicated pumping station that will discharge directly into Lake Erie.

Drawing Sheet 5 shows the location where a “Burk Relief Drain” and Reservoir could be constructed near the east end of the project. Also shown is a second pumping station that would lift water from the reservoir and discharge the flows into Lake Erie. This would provide additional pumping capacity for the Burk Drainage Area. The property owners



can consider this and give input into the need for additional pumping capacity and the economics of this.

We have separated the cost of Option 1 into two parts described in the following sections.

#### **17.2.1 Option 1A – Excluding Burk Relief Drain, Pond & Second Pump**

Option 1A includes all of the work described above for Option 1 excluding the proposed “Burk Relief Drain”, the reservoir and the second pumping station.

#### **17.2.2 Option 1B – Burk Relief Drain, Reservoir & Second Pump**

Option 1B includes the proposed “Burk Relief Drain”, the reservoir and the second pumping station.

### **17.3 Option 2 - Work Recommended in Baird Report**

Drawing Sheets Nos. 6 and 7 show the work recommend in the Baird Report as previously described. The work would include armour stone shore protection, armour stone hard points and offshore breakwaters with steel sheet pile walls.

### **17.4 Option 3 - Work Recommended in Zuzek Report**

Drawing Sheet No. 8 shows the work proposed as an option in the Zuzek report. It involves Armour stone revetment along the shoreline.

## **18.0 ALLOWANCES**

Allowances would be provided to the agricultural properties within the Burk Drainage Area under Section 29 of the Drainage Act for any additional land required to relocate the Lakeshore Drain and construct the new dyke. This would also include any land required for permanent access corridors, a 3 m wide buffer strip along the north side of the new Lakeshore Drain, the new pumping station and the relief drain and reservoir. Two barns may have to be removed and the land allowances would compensate the property owners for that loss. A land appraisal study would be performed to assist in setting a fair land value.

Also, allowances under Section 30 of the Drainage Act would be provided for damages to lands and crops (if any) caused by the construction and repair and improvement drainage works and for the operation of equipment and disposal of excess excavated material.

**19.0 COST ESTIMATES**

**19.1 OPTION 1 - Relocate Lakeshore Drain and Construct New Dyke  
- Storm Sewer and Dedicated Pumping Station**

**19.1.1 OPTION 1A - Excluding Burk Relief Drain, Reservoir & Second  
Pumping Station**

The preliminary estimate of cost for **Option 1A** including the potential engineering and contingency costs is as follows:

<b>TOTAL CONSTRUCTION COST</b> . . . . .	<b>\$ 5,950,500</b>
Engineering (12%)	1,072,700
Construction Supervision (7%)	626,300
Contingencies (15%)	1,297,500
<b>TOTAL PROJECT COST - OPTION 1A</b> . . . . .	<b>\$ 8,947,000</b>

A detailed breakdown of the estimate is included in “Appendix A”.

**19.1.2 OPTION 1B - Burk Relief Drain, Reservoir & Second  
Pumping Station**

The preliminary estimate of cost for **Option 1B** including the potential engineering and contingency costs is as follows:

<b>TOTAL CONSTRUCTION COST</b> . . . . .	<b>\$ 665,000</b>
Engineering (12%)	92,300
Construction Supervision (7%)	55,400
Contingencies (15%)	110,800
<b>TOTAL PROJECT COST - OPTION 1B</b> . . . . .	<b>\$ 923,500</b>

A detailed breakdown of the estimate is included in “Appendix A”.

**19.2 Option 2 - Work Recommended in Baird Report**

The preliminary estimate of cost on a reach-by-reach basis including the potential engineering and contingency costs is as follows:

Reach 1 – Station 3+900 to Station 4+150	\$ 3,380,000
Reach 2 – Station 3+575 to Station 3+900	3,900,000
Reach 3 – Station 3+080 to Station 3+575	2,850,000
Reach 4 – Station 1+000 to Station 3+080	37,925,000
<b>TOTAL CONSTRUCTION COST . . . . .</b>	<b>\$ 48,055,000</b>
Engineering (12%)	7,392,000
Construction Supervision (5%)	3,080,000
Contingencies (5%)	3,073,000
<b>TOTAL PROJECT COST . . . . .</b>	<b>\$ 61,600,000</b>

**19.3 Option 3 - Work Recommended in Zuzek Report**

The preliminary estimate of cost including the potential engineering and contingency costs is as follows:

<b>TOTAL CONSTRUCTION COST . . . . .</b>	<b>\$ 65,000,000</b>
Engineering (12%)	9,999,000
Construction Supervision (5%)	4,166,000
Contingencies (5%)	4,160,000
<b>TOTAL PROJECT COST . . . . .</b>	<b>\$ 83,325,000</b>

**20.0 ASSESSMENT RATIONALE FOR OPTIONS**

Under the Drainage Act, assessments against individual properties can be made for three (3) assessment components:

- i. *Benefit (advantages relating to the betterment of lands, roads, buildings, or other structures resulting from the improvement to the drain).*
- ii. *Outlet Liability (part of cost required to provide outlet for lands and roads).*
- iii. *Special Benefit (additional work or feature that may not affect function of the drain).*

The suggested distribution of project costs contained herein is **not** on a property-by-property basis. Generally, preliminary reports of this nature set out the total assessment that would be levied against the lands and roads affected by the work. This is intended to provide a general order of magnitude of potential assessments. For the purposes of this preliminary assessment,

we have assumed that all costs associated with providing protection to utilities will be the responsibility of the Municipality.

We have provided assessment breakdowns for Option 1 and Option 2 only. Option 3 is more expensive than Option 2.

## **20.1 Option 1 - Relocate Lakeshore Drain and Construct New Dyke**

Option 1A includes all of the work described for Option 1 excluding the proposed “Burk Relief Drain”, the reservoir and the second pumping station.

Option 1B includes the proposed “Burk Relief Drain”, the reservoir and the second pumping station.

### **20.1.1 OPTION 1A - Excluding Burk Relief Drain, Reservoir & Second Pumping Station**

Lakefront Lots	6%	\$ 536,880
Erie Shore Drive	15%	\$ 1,342,200
Utilities	6%	\$ 536,880
Access to Erieau	4%	\$ 357,920
Lands in Burk Drainage Works	69%	\$ 6,174,120
<b>Total . . . . .</b>		<b>\$ 8,948,000</b>

We would recommend that all assessments levied against the agricultural lands in the Burk Drainage Works be developed on an equalized rate per acre basis. There is a total of approximately 1666 acres of farm and other lands within the Burk Drainage Works. Therefore, the potential gross assessment against the agricultural lands would be in the order of \$3,706 per acre. Therefore, on this basis, a 100 acre parcel could anticipate a gross assessment of approximately \$370,600.

From Station 1+000 to Station 3+075, there are 105 lakefront properties along the south side of Erie Shore Drive. This is the area between ARDA Dyke A-1 and ARDA Dyke A-2. Approximately \$536,880 of the estimated cost would be levied against the 105 lakefront lots. We would recommend that the cost be recovered on an equalized rate per metre frontage along the lakeshore. This would result in an assessable rate of approximately \$ 259 per metre. The average lot has a lake frontage of approximately 20 m. The gross assessment against an average lot would be in the order of \$5,180.

**20.1.2 OPTION 1B - Burk Relief Drain, Reservoir & Second Pumping Station**

Lands in Burk Drainage Works	100%	\$ 923,500
<b>Total . . . . .</b>		<b>\$ 923,500</b>

We would recommend that all assessments levied against the agricultural lands in the Burk Drainage Works be developed on an equalized rate per acre basis. There is a total of approximately 1666 acres of farm and other lands within the Burk Drainage Works. Therefore, the potential gross assessment against the agricultural lands would be in the order of \$554 per acre. Therefore, on this basis, a 100 acre parcel could anticipate a gross assessment of approximately \$55,400.

**20.2 Option 2 - Work Recommended in Baird Report**

The works recommended in each of the defined reaches along the lakeshore affect different properties or groups of properties in different ways. We have developed a preliminary distribution of project cost for each of the four reaches.

a) **Reach 1** – Station 3+900 to Station 4+150

- Direct wave damage and flood protection provided to one vacant lot on the lakeshore.
- Direct wave damage and flood protection provided to Erie Shore Drive.
- Flood protection provided to lands in Burk Drainage Works.
- Municipal services not severely threatened.
- Access to Erieau not severely threatened.

Lakefront Lots	5%	\$ 216,635
Erie Shore Drive	60%	\$ 2,599,620
Lands in Burk Drainage Works	35%	\$ 1,516,445
<b>Total . . . . .</b>		<b>\$ 4,332,700</b>

b) **Reach 2** – Station 3+575 to Station 3+900

- Direct wave damage and flood protection provided to approximately 21 lots south of Erie Shore Drive.
- Minor amount of flood protection provided to Erie Shore Drive.
- Minor amount of flood protection provided to lands in Burk Drainage Works.
- Municipal services not severely threatened.
- Access to Erieau not severely threatened.

Lakefront Lots	80%	\$ 3,999,440
Erie Shore Drive	10%	\$ 499,930
Lands in Burk Drainage Works	10%	\$ 499,930
<b>Total . . . . .</b>		<b>\$ 4,999,300</b>

c) **Reach 3** – Station 3+080 to Station 3+575

- No private lots to remain in this reach.
- No threat to Erie Shore Drive.
- No threat to lands in Burk Drainage Works.
- Long term benefit as Municipal parkland.

Municipality of Chatham-Kent	100%	\$ 3,653,300
<b>Total . . . .</b>	<b>100%</b>	<b>\$ 3,653,300</b>

d) **Reach 4** – Station 1+000 to Station 3+080

- Direct wave damage and flood protection provided to all lakefront lots.
- Direct wave damage and flood protection provided to Erie Shore Drive.
- Flood protection provided to lands in Burk Drainage Works.
- Municipal services threatened.
- Access to Erieau threatened.

Lakefront Lots	50%	\$ 24,307,350
Erie Shore Drive	20%	\$ 9,722,940
Utilities	6%	\$ 2,916,882
Access to Erieau	4%	\$ 1,944,588
Lands in Burk Drainage Works	20%	\$ 9,722,940
<b>Total . . . . .</b>		<b>\$ 48,614,700</b>

A summary of the assessments levied on a reach-by-reach basis against the three primary assessable groups of properties is as follows:

**SUMMARY**

	Reach 1	Reach 2	Reach 3	Reach 4	Total	% of Total
Lakefront Lots	\$216,635	\$3,999,440		\$24,307,350	\$28,523,425	46%
Burk Drainage Works	\$2,599,620	\$499,930		\$9,722,940	\$12,822,490	21%
Municipal	\$1,516,445	\$499,930	\$3,653,300	\$14,584,410	\$20,254,085	33%
<b>Totals</b>	<b>\$4,332,700</b>	<b>\$4,999,300</b>	<b>\$3,653,300</b>	<b>\$48,614,700</b>	<b>\$61,600,000</b>	<b>100%</b>

We would recommend that all assessments levied against the agricultural lands in the Burk Drainage Works be developed on an equalized rate per acre basis. There is a total of approximately 1666 acres within the Burk Drainage Works. Therefore, the potential gross assessment against the agricultural lands, assuming that all four reaches are constructed as recommended, would be in the order of \$7,733 per acre. Therefore, on this basis, a 100 acre parcel could anticipate a gross assessment of approximately \$773,300.

For Reach 2, we recommend that only the 21 properties in the triangular area bounded by Erie Shore Drive and the Lake Erie Shoreline be levied the costs apportioned to the “lakefront lots”. We would recommend the cost be recovered on an equalized rate per acre from these lots. This would result in an assessable rate of approximately \$525,550 per acre. There are several very small parcels of land in this area which are in the order of .10 acres. The gross assessment against these lands, in that case, would be in the order of \$52,555.

For Reach 4, we recommend that only the 105 properties, which exist along the lakeshore, be levied the costs apportioned to the “lakefront lots”. We would recommend that the cost be recovered on an equalized rate per metre frontage along the lakeshore. This would result in an assessable rate of approximately \$11,905 per metre. The average lot has a lake frontage of approximately 20 m. The gross assessment against an average lot would be in the order of \$238,100.

**21.0 PREFERRED ALTERNATIVE**

Option 1A is the preferred option that we are recommending for the following reasons:

- The estimated cost of Option 1 is \$9,114,000 which is much lower than Option 2 (\$61,600,000) and Option 3 (\$83,325,000).
- Option 1 provides increased flood protection for the lands within the limits of the Burk Drainage Works to a level similar to that provided by the ARDA Dyke Systems A-1 and A-2.

- While water may pond in certain areas along Erie Shore Drive for short periods of time, the storm sewer system and catch basins along both sides of Erie Shore Drive will minimize the duration of flooding. The storm sewer will discharge into a new pump station located near Station 1+000 and a pump station will mechanically discharge this collected water back into Lake Erie. This will provide front yard drainage for the residential lands south of Erie Shore Drive.
- Options 2 and 3 would benefit the lakefront properties by providing flood protection to those properties whereas the existing Burk Drainage Works was never intended to protect the shoreline properties. To expand the scope of the Burk Drainage Works to include flood protection to the lakefront properties would require a petition under Section 4 of the Drainage Act. Otherwise, the Engineer would have no authority to expand the drainage area of the Burk Drain to protect additional lands.
- The “Do Nothing” option is not recommended as the integrity of the Burk Drainage Works is threatened.

Option 1B is not required for improved protection from Lake Erie but can be considered by the ratepayers if additional pumped drainage capacity is desired. The detention pond will provide additional storage and pumping capacity for the Burk Drainage Works during time of high-water levels in the Lakeshore Drain and Internal Drain by means of an overflow pipe connecting the detention pond to the Internal Drain. The new pump station would have a capacity of approximately 10% of that provided by the Burk Pumping Station. The economics of Option 1B can be discussed by the ratepayers.

## **22.0 ADDITIONAL RECOMMENDATIONS**

The existing groynes and seawalls have greatly deteriorated and serve no useful purpose. Given the increase in lake levels, repairing the groynes and seawalls to the standard set out in the current bylaws for the drain would not provide the degree of flood protection desired by the lakefront owners. We recommend that these groynes and seawalls be abandoned and no longer be considered a part of the Burk Drainage Works when the next report is prepared under Section 78 of the Drainage Act.

We also recommend that Reach 1 described in Option 2 be monitored to determine if improvements are required along the length of Shoreline at this time.

## **23.0 DRAINAGE ACT GRANTS**

Should the works be completed under the provisions of The Drainage Act, those agricultural properties which are levied assessments may be eligible for a 33-1/3 percent grant from the Ministry of Agriculture, Food and Rural Affairs. No Drainage Act grants are available under this program for non-agricultural or municipally owned properties.



## 24.0 CONCLUSIONS

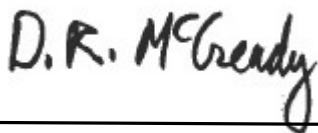
We are satisfied that the application of The Drainage Act is an appropriate mechanism to proceed with any portion of the recommended works. The significant costs to all parties involved in this project deserve careful consideration.

We recommend that all issues be thoroughly discussed and the views of the public be clearly brought to the Council of the Municipality of Chatham-Kent in order that they may be in a better position to decide the fate of this project.

All of which is respectfully submitted.

### RC SPENCER ASSOCIATES INC.

#### PREPARED BY:



Dennis R. McCready, B.A.Sc., P. Eng.

Appointed Engineer

18 June 2023



#### REVIEWED BY:



Stephen E. Jahns, P. Eng.

18 June 2023



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## **APPENDIX A**

### **COST ESTIMATE FOR OPTIONS 1A & 1B**

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**OPTION 1A**  
**Estimate of Cost**  
**Relocate Lakeshore Drain and Construct New Dyke**  
**Storm Sewer along Lakeshore Drive with**  
**Dedicated Pumping Station**  
**Station 1+000 to Station 3+075**

100,700 m <sup>3</sup> Dyke Construction .....	\$ 1,007,000
25,200 m <sup>3</sup> Excavate New Ditch .....	\$ 126,000
75,500 m <sup>3</sup> Imported Clay Backfill .....	\$ 1,132,500
72,000,m <sup>2</sup> Seeding and Mulching .....	\$ 360,000
2300 m of perforated HDPE Storm Sewer (300 mm to 750 mm in diameter) .....	\$ 130,000
20 Manholes .....	\$ 100,000
30 Catch Basins and Leads .....	\$ 108,000
Pumping Station - 400 liters/second (6,320 USgpm) .....	\$ 700,000
2200 m of 3 m wide Gravel Shoulder .....	\$ 230,000
Remove 4 Access Crossings .....	\$ 50,000
2,000 m of Gravel Access Road .....	\$ 403,000
Remove 2 barns .....	\$ 50,000
Reroute Private Drains .....	\$ 500,000
Miscellaneous Items .....	\$ 154,000
Allowances for Land, Buildings and Crop Damages .....	<u>\$ 900,000</u>
<b>TOTAL FOR CONSTRUCTION -</b>	<b>\$ 5,950,500</b>
Engineering (12%) .....	\$ 1,073,700
Contract Administration (7%) .....	\$ 626,300
Contingencies (14.5%) .....	<u>\$ 1,297,500</u>
<b>TOTAL FOR OPTION 1A -</b>	<b>\$ 8,948,000</b>

**OPTION 1B**  
**Estimate of Cost**  
**“Burk Relief Drain, Reservoir and Second Pump Station**  
**Station 1+000 to Station 1+250**

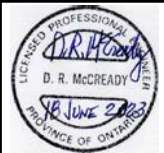
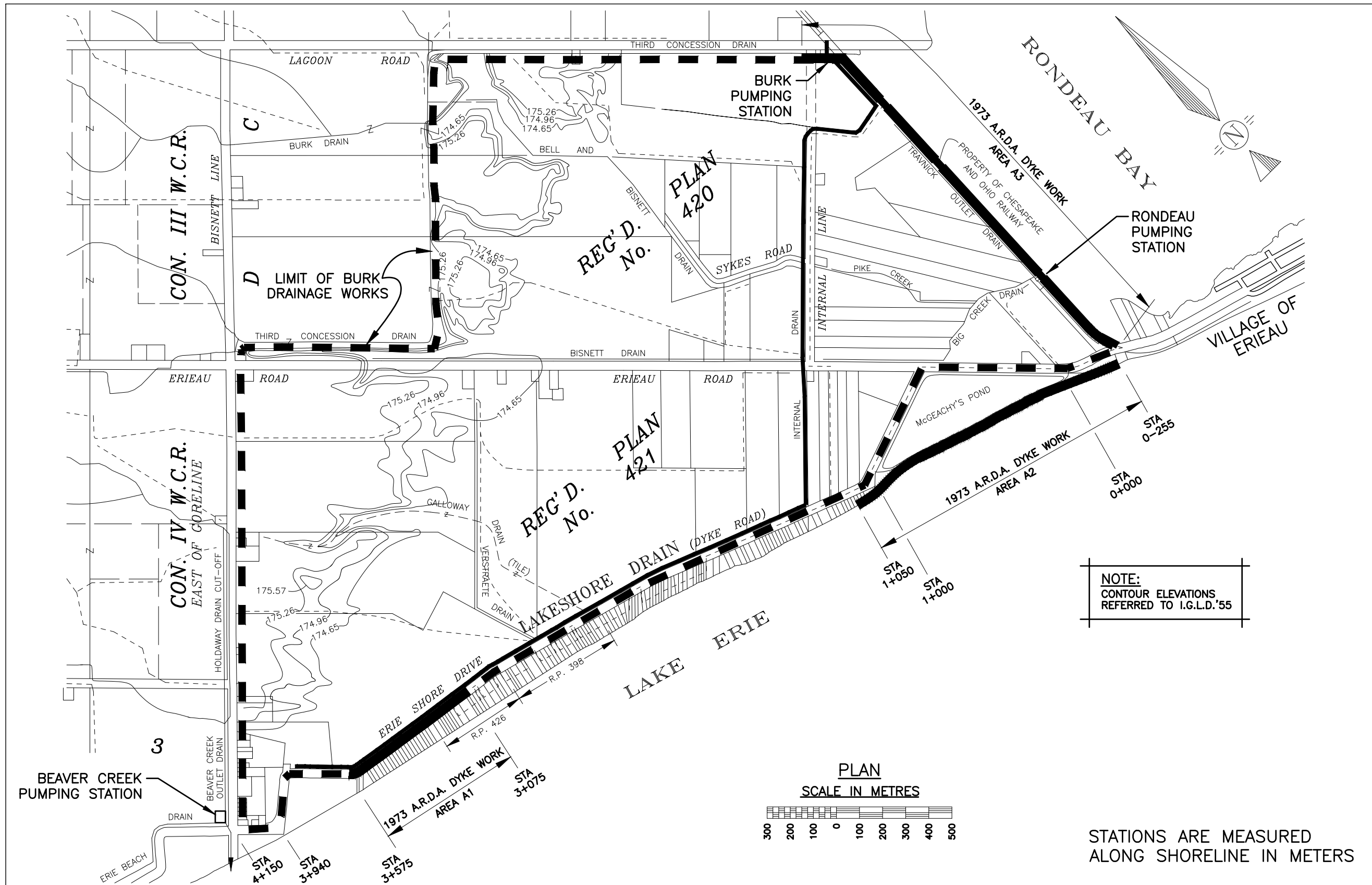
Burk Relief Drain, Reservoir and Overflow Pipe .....	\$ 50,000
3,800,m <sup>2</sup> Seeding and Mulching .....	\$ 19,000
Second Pumping Station - 400 liters/second (6,320 USgpm) .....	\$ 550,000
Miscellaneous Items .....	\$ 16,000
Allowances for Land and Crop Damages .....	<u>\$ 30,000</u>
<b>TOTAL FOR CONSTRUCTION -</b>	<b>\$ 665,000</b>
Engineering (10%) .....	\$ 92,300
Contract Administration (6%) .....	\$ 55,400
Contingencies (12%) .....	<u>\$ 110,800</u>
<b>TOTAL FOR OPTION 1B -</b>	<b>\$ 923,500</b>

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APPENDIX B

**DRAWINGS**

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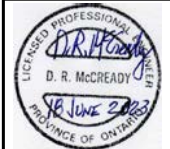
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CHECKED	S.E.J.
DRAWN	M.R.B.
CHECKED	D.R.M.
DATE	18 JUNE 2023
SCALE	N.T.S.

COMMUNITY OF HARWICH  
BURK DRAINAGE WORKS  
**PLAN OF THE BURK  
DRAINAGE AREA**

PROJECT NO.	21-1150
SHEET NO.	1
OF	8



- PUMPING STATIONS
- ▭ BURK PUMP AREA
- - - RONDEAU PUMP AREA



**RC SPENCER ASSOCIATES INC.**  
 Consulting Engineers  
 Windsor: 800 University Ave. W. - Windsor, ON N9A 5B9  
 Leamington: 18 Talbot St. W. - Leamington, ON N8B 1M4  
 Chatham-Kent: 49 Raleigh St. - Chatham, ON N7M 2M6

Professional Engineers  
 Ontario

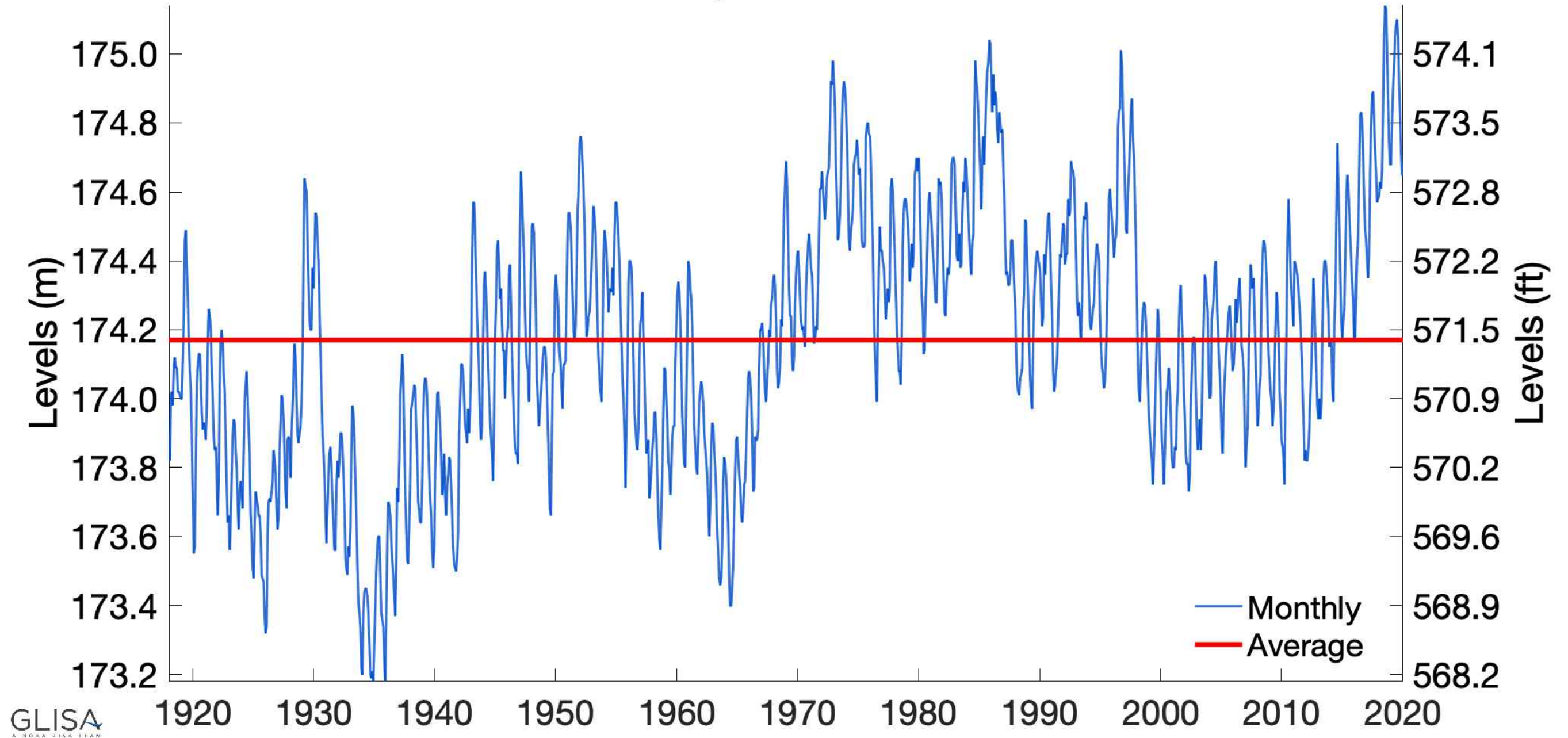


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CHECKED	S.E.J.
DRAWN	M.R.B.
CHECKED	D.R.M.
DATE	18 JUNE 2023
SCALE	N.T.S.

COMMUNITY OF HARWICH BURK DRAINAGE WORKS	
<b>PUMPING SCHEMES</b>	

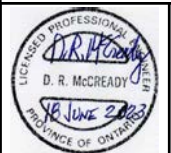
PROJECT NO.	21-1150
SHEET NO.	2
OF	8

# Lake Erie Monthly Historical Water Levels



GLISA  
A NOAA FISA TEAM

ALL ELEVATIONS RELATE TO I.G.L.D.'85  
(INTERNATIONAL GREAT LAKE DATUM)

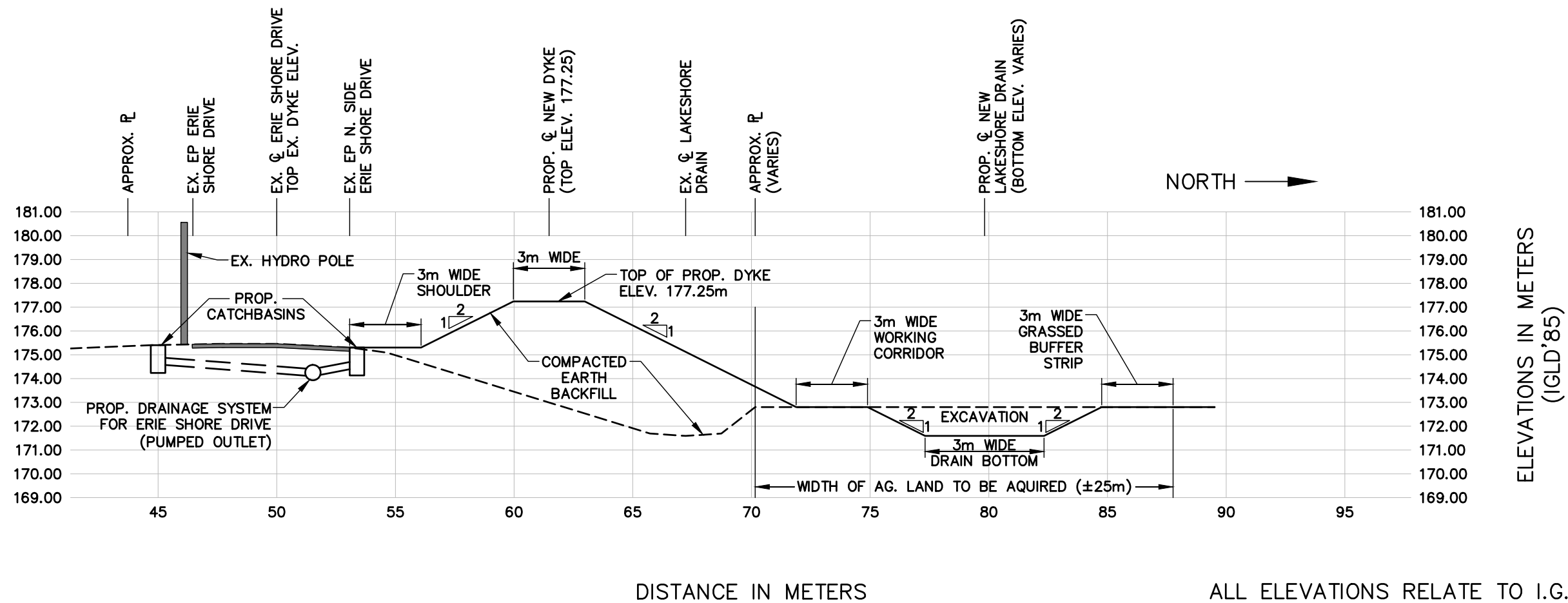
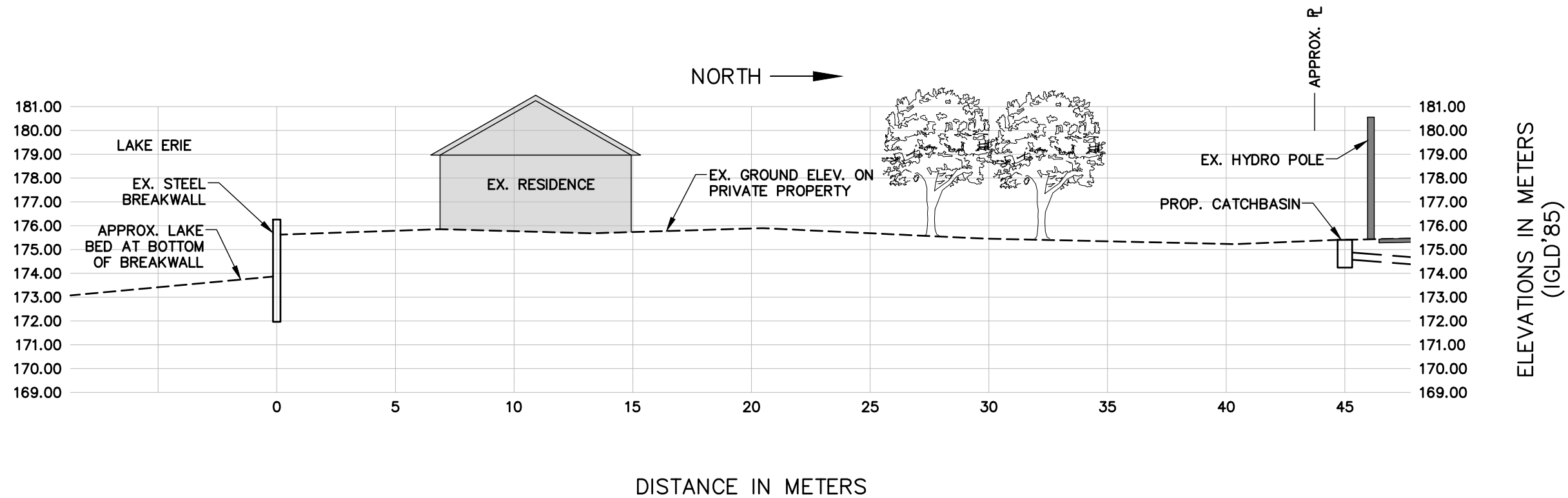


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CHECKED	S.E.J.
DRAWN	M.R.B.
CHECKED	D.R.M.
DATE	18 JUNE 2023
SCALE	N.T.S.

COMMUNITY OF HARWICH BURK DRAINAGE WORKS	
<b>LAKE ERIE MONTHLY HISTORIC WATER LEVELS</b>	

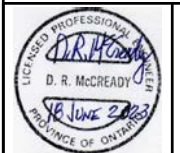
PROJECT NO.	21-1150
SHEET NO.	3
OF	8





ALL ELEVATIONS RELATE TO I.G.L.D.'85 (INTERNATIONAL GREAT LAKE DATUM)

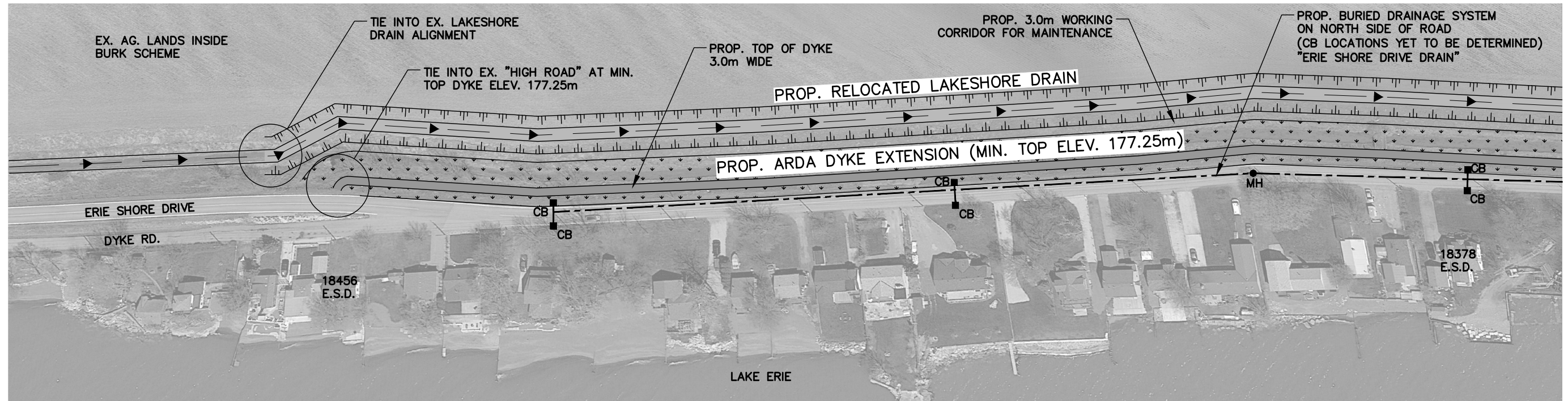
NOT TO SCALE



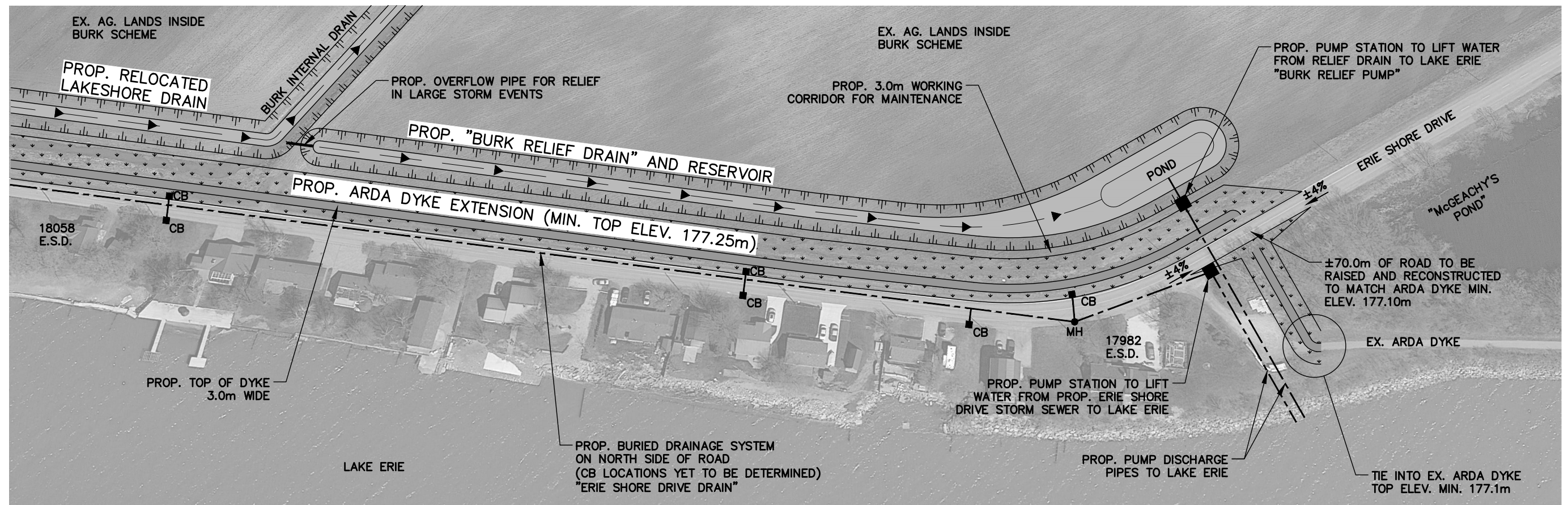
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DRAWN	M.R.B.
CHECKED	D.R.M.
DATE	18 JUNE 2023
SCALE	N.T.S.

COMMUNITY OF HARWICH BURK DRAINAGE WORKS	
TYPICAL CROSS-SECTIONS FOR OPTION 1	

PROJECT NO.	21-1150
SHEET NO.	4
OF	8



WEST END



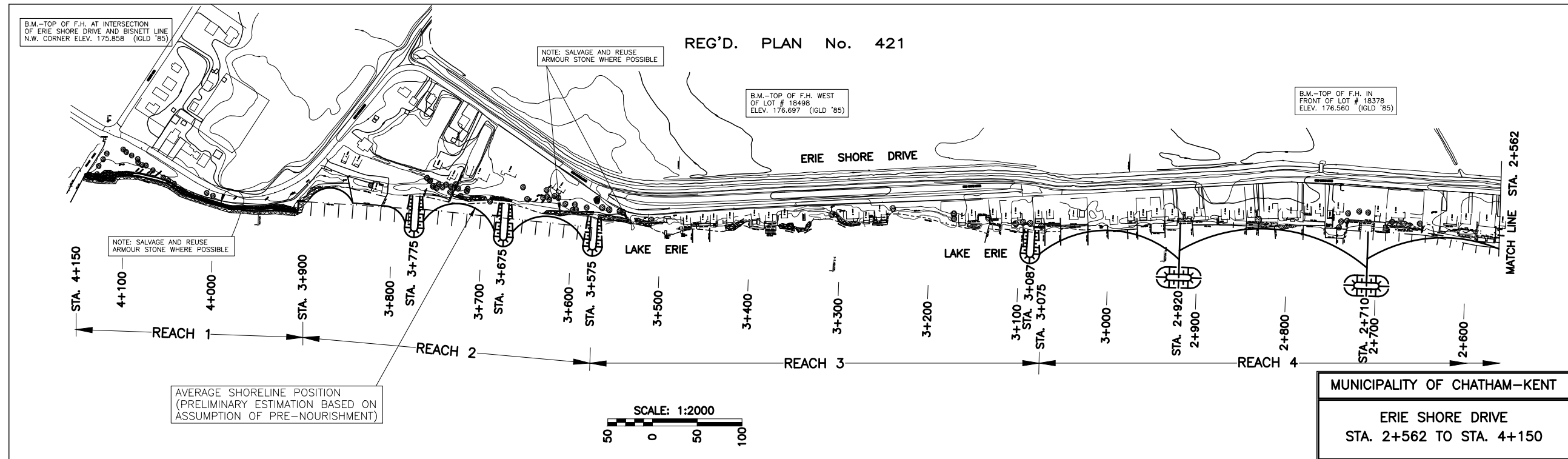
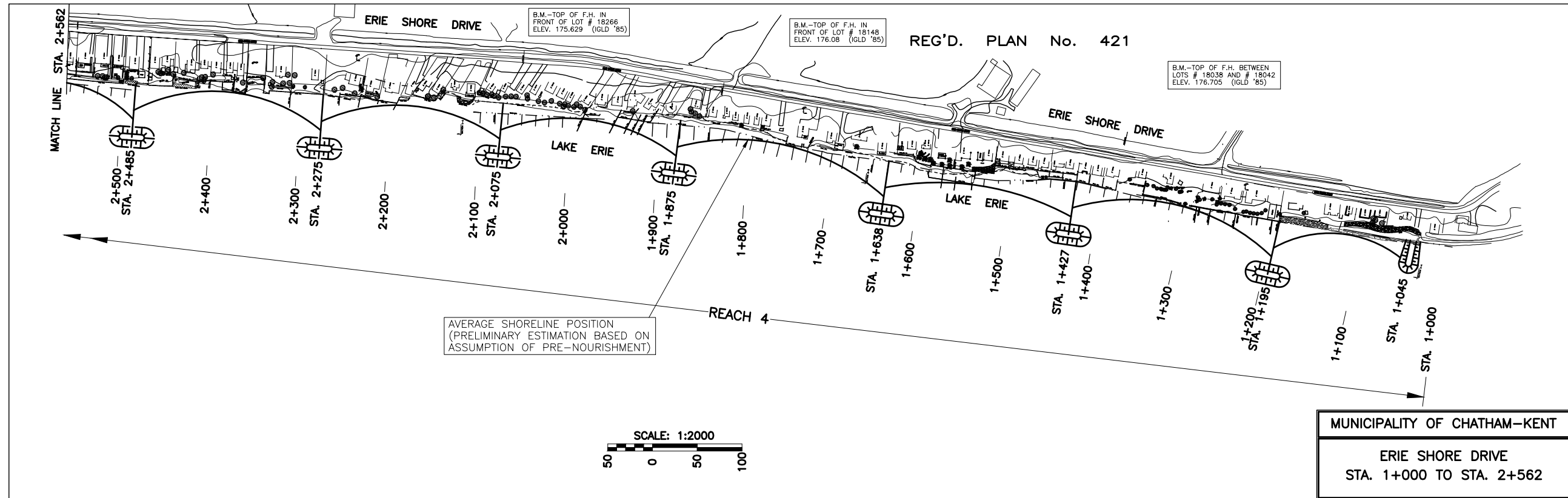
EAST END

ALL ELEVATIONS RELATE TO I.G.L.D.'85  
(INTERNATIONAL GREAT LAKE DATUM)



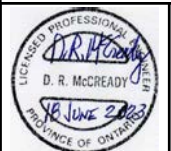
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DRAWN	M.R.B.
CHECKED	D.R.M.
DATE	18 JUNE 2023
SCALE	N.T.S.

COMMUNITY OF HARWICH BURK DRAINAGE WORKS		PROJECT NO. 21-1150
PLAN VIEW OF OPTION 1		SHEET NO. 5
		OF 8



NOTE: DRAWINGS OBTAINED FROM 1998 SHORELINE PROTECTION STUDY BY W.F. BAIRD & ASSOCIATES AND TODGHAM & CASE ASSOCIATES INC.

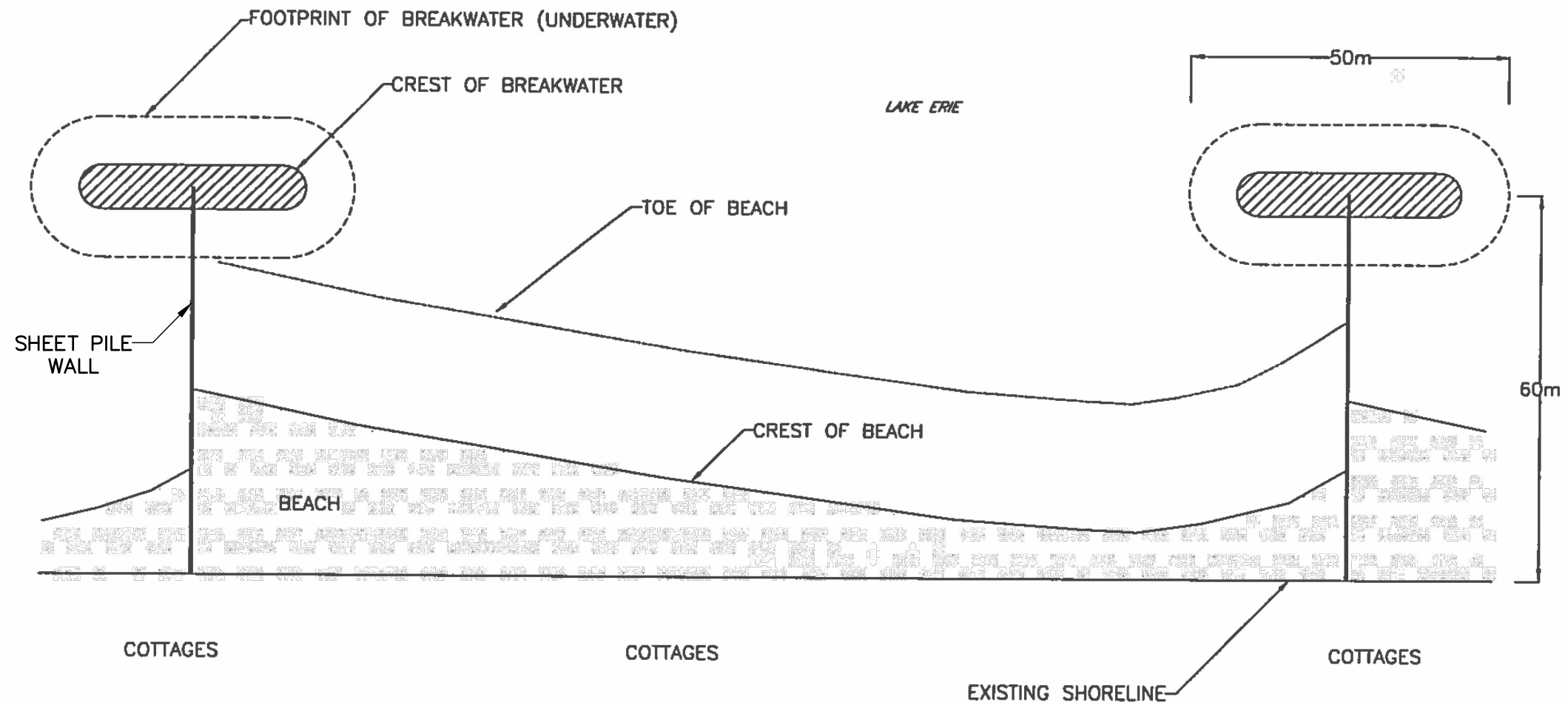
ALL ELEVATIONS RELATE TO I.G.L.D.'85 (INTERNATIONAL GREAT LAKE DATUM)



DESIGN	D.R.M.	COMMUNITY OF HARWICH BURK DRAINAGE WORKS	PROJECT NO.	21-1150
CHECKED	S.E.J.		SHEET NO.	6
DRAWN	M.R.B.	PLAN VIEW OF OPTION 2	OF	8
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DATE	18 JUNE 2023			
SCALE	N.T.S.			



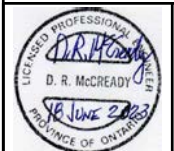
## OFFSHORE BREAKWATER WITH STEEL SHEET PILE WALL AND BEACH (TYPICAL)



*NOT FOR CONSTRUCTION*

NOTE: SKETCH OBTAINED FROM 1998 SHORELINE PROTECTION STUDY BY  
W.F. BAIRD & ASSOCIATES AND TODGHAM & CASE ASSOCIATES INC.

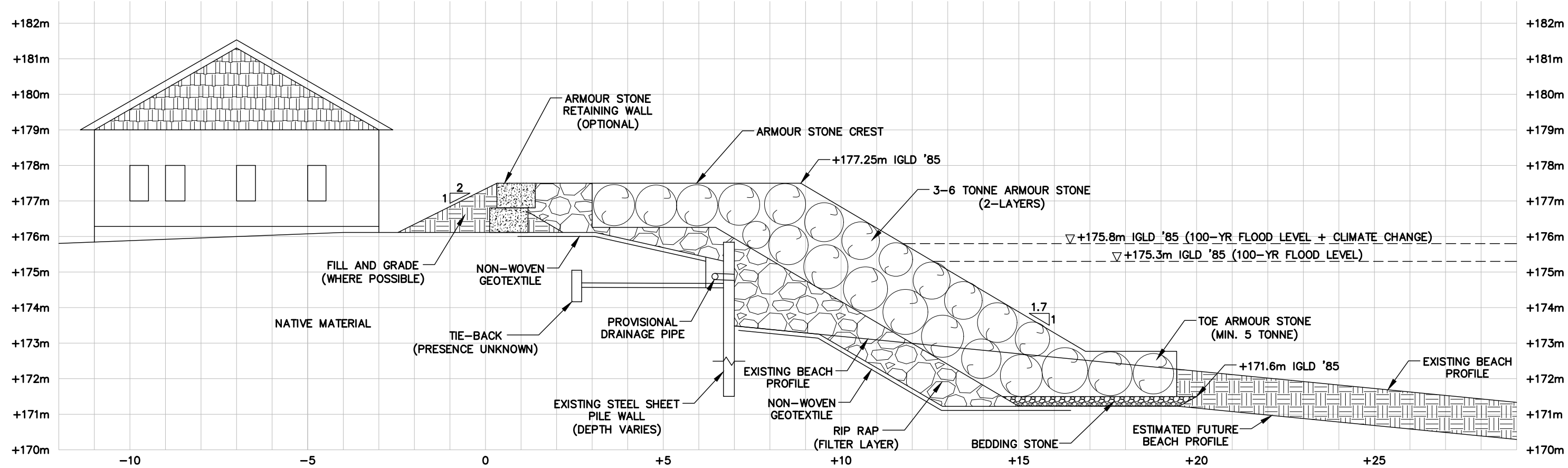
ALL ELEVATIONS RELATE TO I.G.L.D.'85  
(INTERNATIONAL GREAT LAKE DATUM)



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DRAWN	M.R.B.
CHECKED	D.R.M.
DATE	18 JUNE 2023
SCALE	N.T.S.

COMMUNITY OF HARWICH BURK DRAINAGE WORKS	
<b>OPTION 2 – TYPICAL OFFSHORE BREAKWATERS &amp; SHEET PILE WALLS</b>	

PROJECT NO.	21-1150
SHEET NO.	7
OF	8



NOTE: 100-YEAR FLOOD LEVELS ARE STILLWATER LEVELS AND DO NOT INCLUDE LAKE SETUP AND WAVE RUNUP CAUSED BY WIND ACTION.

ALL ELEVATIONS RELATE TO I.G.L.D.'85 (INTERNATIONAL GREAT LAKE DATUM)

				DESIGN D.R.M.	COMMUNITY OF HARWICH BURK DRAINAGE WORKS	PROJECT NO. 21-1150
				CHECKED S.E.J.		<b>OPTION 3 – CROSS-SECTION OF ARMOUR STONE REVETMENT</b>
DRAWN M.R.B.	DATE 18 JUNE 2023	OF 8				
CHECKED D.R.M.	SCALE N.T.S.					