

November 30, 2017

Mr. Paul Wicks,
Email: wicks1@live.ca

Dear Mr. Wicks,

**RE: 834 Lakeshore Road, Sarnia, Ontario
Shoreline Hazards Assessment
Our File 17-2577**

Development along the shoreline is subject to erosion, flooding and dynamic beach hazards associated with Lake Huron. This letter presents our assessment of the natural hazards at the above noted property and provides comments on how the hazard limits will affect development setbacks. It addresses Lake Huron shoreline hazards as defined by the Natural Hazards Policy 3.1 of the 2005 Provincial Policy Statement and the St Clair Region Conservation Authority (SCRCA) Ontario Regulation 171/06.

We visited the site on July 06, 2017. The water level recorded at the Goderich gauge by the Canadian Hydrographic Service at the time of the site visit was approximately 177.0 m, IGLD 1985. The photographs presented in this letter were taken during the site visit. Our assessment also uses a topographic survey by B. M. Ross and Associates Limited, file no. 16289, dated July, 2017. Figure 1 is a site plan based on that survey.

Existing Conditions

834 Lakeshore Road is located on the south shore of Lake Huron in Sarina. The site has approximately 40 m of shoreline facing north.

The property is fronted by a sand beach (Photo 1). The beach slope above the waterline is in the order of 14h:1v. The back of the beach is delineated by a steel sheet pile (SSP) wall. The top of the wall is approximately 178.3 m GSC. The sand beach material extends from approximately 0.5 to 0.8 m below the top of the wall to almost to the top of the wall (Photos 1 and 2).

We understand, based on your conversations with the original contractor, Shoreline Maintenance And Construction Limited, that the original wall was constructed prior to 1990 and the pipe support piles were installed in about 1990. The SSP piles are 3.6 m to 4.2 m long and pipe piles fronting the SSP are approximately 6 meters long. The wall is vertical and no sign of excessive corrosion or pitting on the wall was seen.

The backshore is near flat behind the SSP wall for zero to two meters and then slopes up for approximately four to six metres. The average height of the slope is in the order of 3.5 m with average slope approximately 1.5h:1v or marginally steeper. The slope and flat area at the back of the SSP wall are vegetated. No signs of instability or surface erosion were observed (Photos 2 and 3).

The table land beyond the top of the slope has a gentle gradient up to about the south side of the existing house and then slopes down very gently to a location approximately 70 meters from the top of bank before starting to rise very gently towards Lakeshore Road. The high land elevations reached near the south side of the house are in the order of 191.9 meters. The low elevations in the backshore about 70 meters from the top of bank are in the order of 180.6 m and elevations near Lakeshore Road are in the order of 180.8 metres.

A steel sheet pile groyne approximately 30 meters long extends out near the west limit of the site (see Photo 4) and is responsible for retaining the sand beach in front of this property. The groyne curves slightly to the east as it extends out into the water. The details of the groyne construction or the date of construction are not known. The groyne appears to function well and no significant damage to the structure was noted. This groyne is a part of a groyne system that exists along this part of Lake Huron shoreline (see Photo 5).

The shoreline to the east of 834 Lakeshore Road consists of a similar sand beach backed by wall structures at the back of the beach. A groyne, approximately fifty metres long extends out at the east side of the adjacent property (see Photo 6).

The shoreline of the property to the west is protected by a partly collapsed concrete block wall (see Photo 7). Another steel sheet pile wall is located on the west side of that property. We are aware that a new shore protection design was prepared for the owner recently. It consists of an armour stone revetment.

Natural Hazards

The Provincial Policy Statement identifies three natural hazards that must be considered along the shores of the Great Lakes: the dynamic beach hazard, the erosion hazard and the flooding hazard. Each of these hazards is discussed separately below.

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Flood Hazard

The Provincial Policy Statement defines the limit of the flood hazard limit as the 100-year instantaneous water level plus a wave uprush allowance. MNR determined the 100-year instantaneous water level along this section of Georgian Bay to be 178.0 m GSC. This represents the water level that has a 1% probability of occurrence in any year and considers both mean lake levels and wind setup. The wave uprush allowance was calculated for the 20 year return storm at the 178.0 m water level.

Under the 178.0 m water level, the water line will reach the base of the SSP wall. The wave uprush of the design wave is expected to overtop the SSP wall and extend onto the bank landward of the SSP wall. We estimate this elevation to be approximately 179.72 m. It means there would be overtopping that needs to be controlled. Details of this are described later in this letter. Flood hazard is not the governing hazard at this site.

Dynamic Beach Hazard

SCRCA's Lake Huron Shoreline Management Plan (SMP) update does not apply a dynamic beach designation in this reach. It indicates that the erosion hazard governs. We therefore have not applied a Dynamic Beach Allowance here.

Erosion Hazard

The erosion hazard limit is the sum of two components: an erosion allowance plus a stable slope allowance. The erosion allowance is calculated as 100 times the average annual erosion rate for unprotected shoreline. The erosion allowance is applied first so that the stable slope allowance can be considered to apply at the point where the shoreline would be expected to be in 100 years. The erosion hazard is measured horizontally from the toe and perpendicular to the shoreline.

The subject property is located within Reach 3 in the Shoreline Management Plan (SMP) (Baird, 2011). The annual average recession rate (AARR) for this

reach listed in the SMP is not available. So we have used the 0.3 m/year default erosion rate in this assessment. Applied over 100 years, the erosion allowance is 30 m (0.3 m/yr x 100 years).

The survey identifies the toe of the vegetated slope behind the SSP wall as the bottom of slope. In our opinion, this is not the appropriate toe of slope of shoreline hazard analysis. Taking the toe of the shore protection structure as the “toe of bank” is a common practice. We consider taking the beach elevation at the structure as the toe of bank to be an appropriate and a reasonable approximation of toe of bank. For the toe elevation we have used an average elevation of the beach directly in front of the wall. The toe elevation used in this assessment is 177.8 m.

The stable slope allowance is calculated as the slope height multiplied by the stable slope. The Technical Guidelines specify a 3h:1v stable slope to be used in the absence of a site specific geotechnical report. The 2010 SMP and the 1996 SMP both used a stable slope of 3h:1v. We have used a stable slope of 3h:1v in the present assessment. The average elevation along the toe of the steel sheet pile wall is 177.8 m and the average elevation of the tablelands in the vicinity of the stable slope is 181.9 m. The stable slope allowance is therefore 12.3 m ((181.9-177.8) m x 3.0).

The erosion hazard is the sum of the erosion allowance and the stable slope allowance and is 42.3 m (30.0 m + 12.3 m). The erosion allowance is applied from the toe of the slope at the steel sheet pile wall and is shown on Figure 1.

We note that review of other erosion data, such as the Coastal Zone Atlas, suggests that the erosion rate in this area is lower than the provincial default value of 0.3 m/year. We further note that, in our professional opinion, the stable slope of the soils in the area is likely steeper than 3h:1v. We would expect it to be closer to 2h:1v than 3h:1v. Therefore, the delineation of the shoreline hazard noted above is very conservative. We recommend that you reserve the right to complete a site specific analysis of historical aerial photography and a site specific geotechnical investigation and adjust the extent of erosion hazard.

Development Setbacks

The Technical Guide prepared in support of the Provincial Policy Statement allows for development to encroach into the erosion hazard under certain conditions. The Technical Guide indicates that when a suitable erosion protection structure has been constructed, development can encroach into the erosion hazard. The permissible encroachment is calculated as L times

the recession rate, where L is the estimated remaining life of the shore protection structure.

The remaining design life of a shore protection structure is difficult to estimate, particularly if the exact details of the construction are not known. In our professional opinion the existing seawall has a remaining life of at least fifteen years. Further, it is our opinion that if minor shore protection improvements are carried out and maintenance access is provided then the remaining useful life of the structure would be in the order of 40 years and development would be consistent with the 60 year erosion allowance that may be accepted by SCRCA. The proposed improvements are described in the following section.

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The maintenance access should be a minimum of 5 metres wide from the municipal roadway to and along the shoreline. Based on a 40 year structure life, development can encroach 12.0 m (0.3 m/year x 40 years) into the erosion hazard. The position of the development setback is shown on the site plan on Figure 1. The development setback is in line with existing development along the shoreline.

Proposed Shore Protection Improvements

A conceptual cross-section, showing the proposed improvements is shown on Figure 2. The proposed improvements consist of constructing a buried boulder berm along the steel sheet pile wall to minimize wave reflection and toe scour and a layer of boulders along the back of the SSP wall to protect against scour in the event of heavy wave spray over the wall and/or wave overtopping. A single cap armour stone is proposed on top of the splash pad for additional protection. The improvements address the two weak points typically associated with steel sheet pile walls.

The buried toe boulder berm is proposed to be constructed with a 2 m wide crest and slope of 1.5h:1v. The berm has a proposed crest elevation of 177.0 m and is founded at 175.5 m. The berm will be buried under the existing beach profile. It is likely to become exposed during severe storms at high water levels, but is expected to be covered with sand again during calm periods at average or low water levels. The berm will provide additional protection, increase stability of the SSP and will substantially reduce wave reflection off the SSP wall.

A splash pad proposed along the back of the SSP wall will consist of layers of boulders and can be buried and vegetation allowed re-establish along the back of the wall. The rocks will provide scour protection during overtopping

events during severe storms at high water levels. A single cap armour stone along the back of the scour protection is proposed, to increase the shore protection height to 179.0 m.

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Closing Comments

We trust that these comments will assist you in your dealings with SCRCA. Do not hesitate to call should you have any questions regarding this letter report.

Yours truly,

Shoreplan Engineering Limited



M. Sturm, P. Eng.



Photos 1 – 7 and Figures 1 – 2 follow

References

Baird (W.F. Baird and Associates Coastal Engineers Ltd.) (2011) *Lake Huron Shoreline Management Plan Update – 2011*, prepared for St. Clair Region Conservation Authority, December 5, 2011

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Ministry of Natural Resources (MNR) (1975) *Canada/Ontario Great Lakes Shore Damage Survey*, Technical Report, October 1975

Ministry of Natural Resources (MNR) (February, 1989) *Great Lakes Flood Levels and Water Related Hazards, Provincial Shoreline Management Program, Conservation Authorities and Water Management Branch, Ontario.*

Ministry of Natural Resources (MNR) (2001) *Great Lakes St. Lawrence River System and Large Inland Lakes: Technical Guides for Flooding, Erosion and Dynamic Beaches in Support of Natural Hazards Policies 3.1 of the Provincial Policy Statement*, Ontario Ministry of Natural Resources, 2001.

Photo 1: 834 Lakeshore Rd Sarnia as seen from the east



SHOREPLAN

Photo 2: SSP wall and slope at back of the beach



Photo 3: Top of the slope above the beach



SHOREPLAN

Photo 4: Steel sheet pile groyne to west of subject property



Photo 5: Steel sheet pile groyne system to west of subject property



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Photo 6: Steel sheet pile groyne to east of subject property



Photo 7: Shore protection works on property to the east



SHOREPLAN

LAKE HURON

EDGE OF WATER JULY 12 2017
ELEVATION 177.000±

LAKE HURON
DETAILED SITE PLAN

EXISTING TOE OF BANK

EROSION ALLOWANCE

TUDOR CLOSE W

LAKESHORE ROAD

EROSION ALLOWANCE
30.0m

STABLE SLOPE ALLOWANCE
12.3m

DEVELOPMENT ENCROACHMENT
12.0m

DEVELOPMENT SETBACK

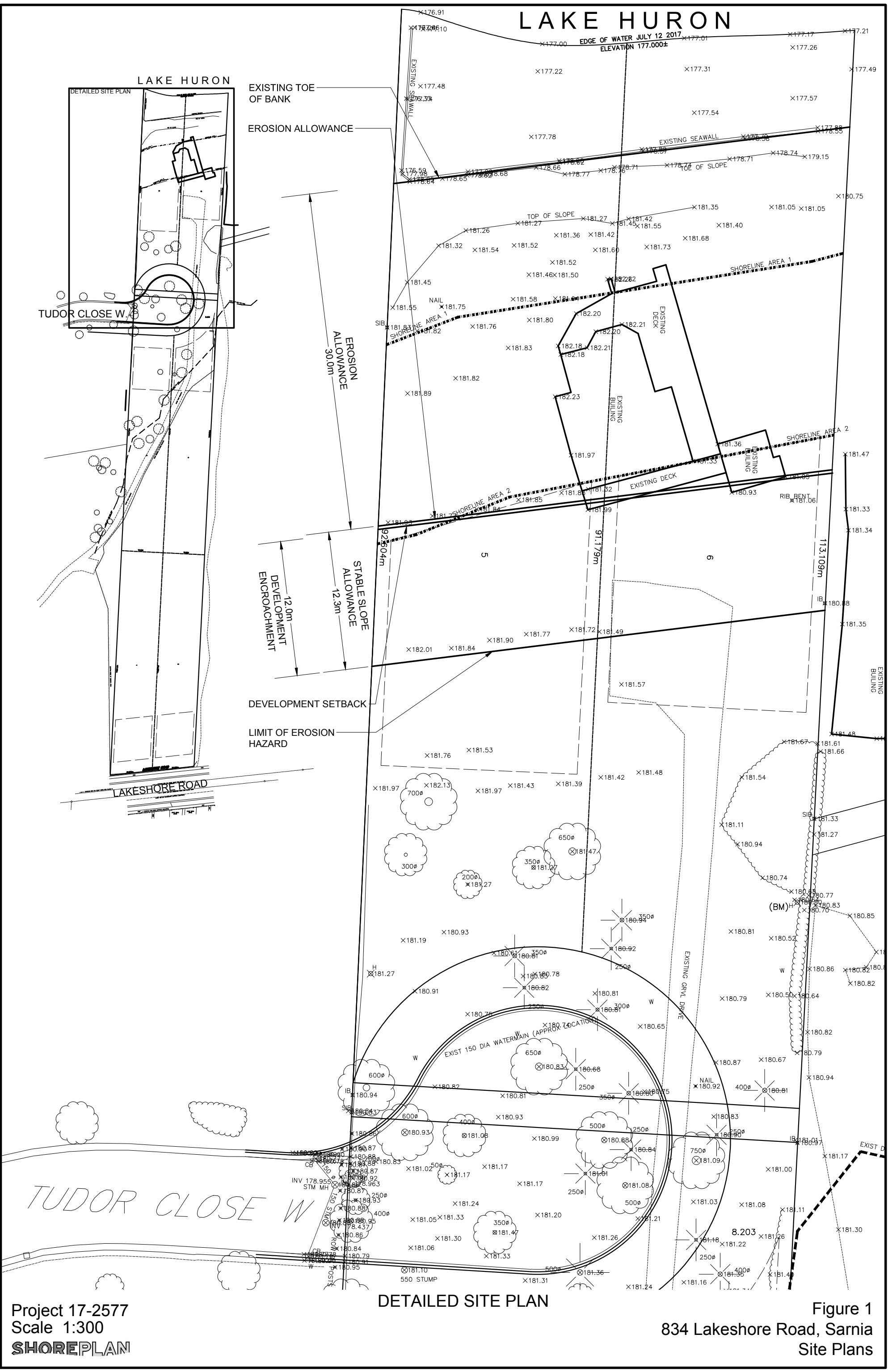
LIMIT OF EROSION HAZARD

DETAILED SITE PLAN

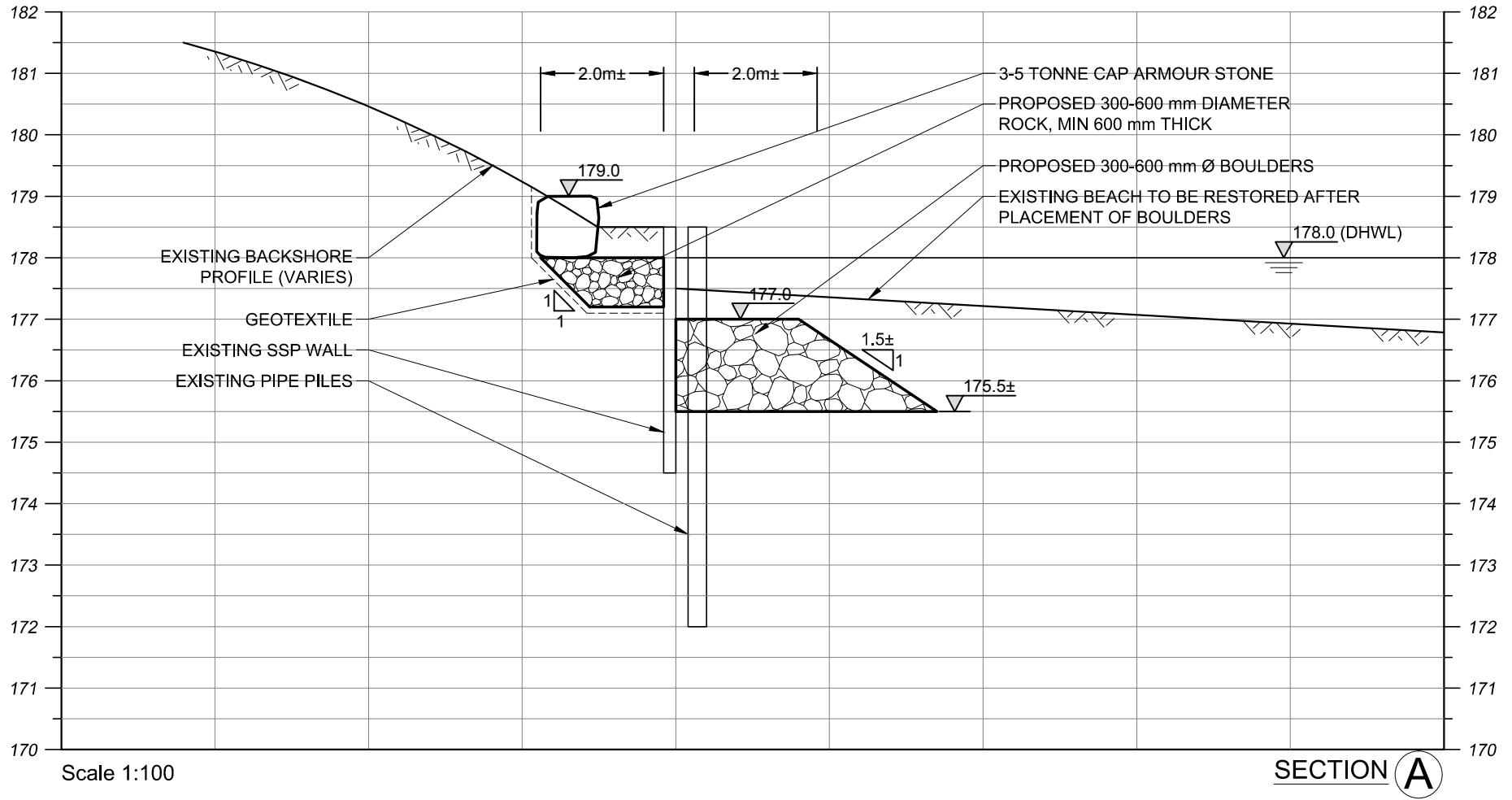
Figure 1
834 Lakeshore Road, Sarnia
Site Plans

Project 17-2577
Scale 1:300
SHOREPLAN

Drawing Location: S:\Shoreplan Project Files\17-2577 834 Lakeshore Rd Sarnia (Wicks)\DRAWINGS\17-2577_rdb.dwg



Drawing Location: S:\Shoreplan Project Files\Files 2500-2599\17-2577 834 Lakeshore Rd Sarnia (Wicks)\DRAWINGS\17-2577 rob.dwg



Scale 1:100

SECTION A

Project 17-2577
Scale 1:100
SHOREPLAN

Figure 2
834 Lakeshore Road, Sarnia
Typical Cross Section