



FEBRUARY 2011

TRANSPORTATION PLANNING STUDY

Foundation Assessment Wolfe Island Transportation Study C.A. No. 4006-E-0035

Submitted to:
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Markham, Ontario
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REPORT



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(BY URS CANADA INC.)

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by URS Canada Inc. (URS) on behalf of the Ministry of Transportation, Ontario (MTO) to carry out the foundation component of the transportation study for the proposed access improvement(s) between Wolfe Island and Kingston, Ontario. The Study area is shown on the Ontario Base Map (OBM) in Drawing B-1 and on the Air Photo in Drawing C-1 in Appendices B and C, respectively. The options being considered to improve the access and flow of traffic between the City of Kingston and Wolfe Island include:

- Replacement and/or upgrade(s) to the existing ferry vessel and terminal locations;
- Construction of new ferry terminal(s);
- Construction of a fixed-link connection (i.e. bridge); or,
- Combination of the above alternatives.

This report describes the methodology and resources employed to carry out the evaluation of the foundation component(s) for the various options and summarizes the results of the evaluation. The report includes drawings showing the crossing alternatives and terminal/bridge abutment locations (including field notes and photograph locations from the site reconnaissance) and provides recommendations on the requirements for additional investigation of the preferred crossing alternative at the preliminary and/or detail design stage(s).

The terms of reference for the scope of work are outlined in the MTO Request for Proposal (Consultant Assignment Number 4006-E-0035) dated December 23, 2008 and in our proposal P91-1017 dated January 2009. The work was carried out in accordance with our Quality Control Plan for Foundation Engineering Services dated July 29, 2009.

The work carried out for this study should be considered preliminary in nature and is intended only to highlight general foundation issues for use in comparing the crossing alternatives. No borehole drilling or laboratory testing to establish existing soil and/or bedrock conditions was undertaken as part of this assignment. Preliminary and/or detailed foundation investigations will be required at structure sites in order to obtain information to assess the subsurface conditions and to provide recommendations on the foundation aspects for design.

2.0 SITE DESCRIPTION

The project area for the foundation component of the transportation study generally encompasses the lands on the north shore of the St. Lawrence River within the City of Kingston and on the south shore of the St. Lawrence River on Wolfe Island, as shown on Drawing B-1 and Drawing C-1 in Appendices B and C, respectively.



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At the outset of the project, URS developed an initial “Long List of Potential Solutions” that included potential connection locations in the following areas:

- Kingston (6 locations)
- Howe Island (2 locations)
- Simcoe Island (2 locations)
- Wolfe Island (6 locations)

The details of all the initial connection location alternatives and the preliminary evaluation carried out by URS along with the decision to ‘Carry Forward’ the alternative or not, are described in the Draft “Screening of Long List Alternatives, Wolfe Island Transportation Study” Table by URS and dated January 13, 2010. A plan view of the Study area showing all of the initial connection locations is presented on the figure titled “Long List of Potential Solutions, Wolfe Island Transportation Study” dated January 14, 2010, prepared by URS, included in Appendix A

Following the screening by URS of the initial Long List connection locations, the project area was divided into a Short List consisting of five potential connection locations in Kingston and four potential connection locations on Wolfe Island. Each connection location has either an associated potential ferry route (with terminals) or an associated potential fixed link (with abutments) or both.

The initial potential connection locations to be considered in Kingston are:

- Portsmouth (Ontario Park and Kingston Psychiatric hospital);
- Downtown West (Kingston Yacht Club and Kingston Penitentiary);
- Barrack Street Terminal (existing ferry dock at Barrack Street);
- CFB East (Canadian Forces Base Kingston); and,
- Ravensview (Ravensview subdivision).

The initial potential connection locations to be considered on Wolfe Island are:

- Marysville West (Alston Moor Golf Links);
- Marysville (existing Marysville terminal);
- Dawson Point (existing Dawson Point terminal); and,
- Knapp Point (Knapp Point or Brophy Point).

A plan view of the Study area showing the above connection locations carried-forward after the initial screening is presented on the figure titled “Short List of Potential Solutions, Wolfe Island Transportation Study” dated January 18, 2010, prepared by URS, included in Appendix A.



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The Study area (including Kingston and Wolfe Island) is located within the physiographic region known as the Napanee Plain. This physiographic region is described as a flat-to-undulating plain of limestone from which glaciers have stripped most of the overburden. While the overburden soils may be less than 0.3 m deep over much of the region, some deeper glacial till occurs within stream valleys and towards the north of area while in the south, depressions often have shallow deposits of stratified clay (Chapman, L.J. and Putnam, D.F., 1984).

Details of the presence of exposed bedrock outcrops, existing vegetation, drainage and land use conditions and anticipated subsurface conditions for each of the connection locations are discussed in Section 4.

3.0 INVESTIGATION PROCEDURES

3.1 General Overview

The comparison and evaluation of the different crossing alternatives and associated potential connection locations is based on an evaluation of social, economic, natural environment and technical considerations. The foundation component is included as part of the technical considerations. The various alternatives considered for evaluation are shown in plan (along with our field notes and photograph locations), overlain on Ontario Base Maps and Air Photographs, on the drawings included in Appendix B and Appendix C, respectively. It should be noted that the plans in Appendices B and C which indicate the potential crossing alternatives selected for evaluation show ferry routes and/or fixed link (bridge alignment) alternatives that are conceptual and do not necessarily reflect the final alignment and locations in all areas and as such should only be used as a guide.

Foundation considerations for the connection locations and/or crossing alternatives include a quantitative and comparative assessment of topographic variability/terrain ruggedness; overall drainage ability and extent of open water; extent of swamp/soft ground areas; potential for approach embankment settlement and stability issues; and construction feasibility. In addition, a qualitative assessment of the expected foundation conditions at potential structure sites is also included.

A summary of the Foundation assessment factors, the indicators and the measures as utilized for the evaluation is shown in the following table:

Foundation Factors	Indicator	Measure
General Topography	Extent of Topographic/Terrain Variation	Quantitative Assessment / Estimate of Conditions: (Difficult/Very Rugged, Open) (% of Total Area)
Overall Drainage Pattern	Drainage Ability/Extent of Poned Water	Quantitative Assessment: (Rapid, Fair, Poor/Ponded Water Present) (% of Total Area)



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Foundation Factors	Indicator	Measure
Swamp and Soft Ground	Extent of Swamp and Soft Ground	Quantitative Assessment: (Major Deep Swamps/Difficult Conditions, Minor/Shallow Swamps) (% of Total Area)
Potential for embankment (or fill) stability/settlement issues	Presence of soft/loose soils	Quantitative Assessment: (Difficult embankment conditions or Favourable embankment conditions) (% of Total Area)
Foundation Types	Anticipated depth to Bedrock (Shallow or Deep)	Qualitative Assessment: (Exposed Bedrock/Shallow Foundations, Unknown/Possible Deep Foundations) (On-shore, Near-shore and Off-shore)
Construction Feasibility	Anticipated difficulty during construction / requirement for special construction techniques	Qualitative Assessment: (Difficult Construction Conditions, Favourable Construction Conditions)

Using the criteria listed above, each indicator has been assessed by assigning a numerical estimate (% of total area, number of each type of foundation unit, etc.) to each associated measure. A difficulty rating (1=Difficult, 2=Neutral, 3=Favourable) for each measure has then been assigned. The combination of the numerical estimate of the measure and the difficulty rating then provide a sub-total for each Foundation Factor which are then summed to provide an overall score (or total weighted ranking) for each potential terminal/bridge foundation location. It is noted that an equal weighting has been assigned to each of the Foundation Factors. Following the evaluation of each terminal/bridge foundation location, the crossing alternatives are assessed by summing the evaluation for each terminal/bridge foundation connection location associated with a particular crossing alternative.

Details of the procedures used for the evaluation of the terminal and bridge foundation locations, including sample calculations, are presented in Appendix D.

A discussion on the type of background information and methodology (i.e. desk study and field reconnaissance) utilized as the basis for the evaluation procedures for the terminal/bridge connection alternatives is presented in the following sections.

3.2 Terminal/Bridge Foundations Evaluation

The first stage of the evaluation process for the various crossing alternatives incorporated the collection, compilation, review and office analysis (i.e. desk-top study) of available existing information, to create site specific geologic maps onto which each of the Short-Listed potential connection locations/alignments could be superimposed. This facilitated the development of a general understanding of the anticipated foundation



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conditions at each of the proposed terminal/bridge foundation locations and identified areas of potential foundation concern (i.e. swamps, soft ground and structure locations).

The second stage involved a site reconnaissance (i.e. field study) to verify or update the information on the geological mapping, as required, and to fill in data gaps and create a photographic record of the conditions at each of the proposed terminal/bridge connection locations. Based on the results and data from these two stages of study, a qualitative and quantitative analysis was performed for the final comparison of the alternatives from a foundations perspective.

The available existing information reviewed at the first stage included subsurface, geologic and geographic information in the form of:

- Air photos;
- Topographical maps;
- Physiographical maps;
- Ontario Base Maps (OBMs);
- Existing terminal structure design and/or as-built drawings;
- Existing subsurface information from the MTO GEOCREs system;
- MOE water well records;
- City of Kingston construction drawings; and,
- Relevant information from internal Golder files.

A reference list of the available information reviewed from the MTO GEOCREs system, from the City of Kingston and from Golder's internal files, along with select borehole information and soil stratigraphy or foundation design drawings, are including in Appendix F.

These resources were used to identify regional trends with respect to: terrain ruggedness; drainage patterns; extent of bedrock outcropping; and swamp areas, and specifically to identify areas warranting further closer inspection during the site reconnaissance field study.

As noted previously, site specific maps were created utilizing the above information onto which the potential terminal/bridge connection location alternatives were superimposed for use during the field component of the study. The geological maps (with the OBM base) are included in Appendix B and the air photos are included in Appendix C.

The site reconnaissance work for the foundation assessment was carried out by members of our engineering staff between July 19 and 21, 2010. The field work included the following tasks:



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- Field mapping to identify the approximate areas of bedrock outcropping and swamp/soft ground areas within the various terminal/abutment connection location alternatives;
- Visual inspection of swamp/low-lying areas to estimate the potential severity/extent of soft ground and future foundation investigation requirements;
- Observations of existing structures/foundation performance;

Since survey layout/staking of the proposed connection locations was not included as part of this assignment, the site reconnaissance work relied heavily on the use of existing features (i.e. roadways, buildings and waterways) as landmarks as well as a handheld Global Positioning System (GPS) unit for orientation and location during the field work.

Field notes made during the site reconnaissance, as well as the locations of the photographs taken during the field work, are shown on the geological maps (along with the superimposed connection location alternatives) on Drawings B-1 to B-9 in Appendix B. It should be noted that the drawings included in Appendix B were produced for field use only and do not necessarily fully reflect the final alternatives carried forward for evaluation (although subsequent refinements by URS are relatively minor). The photographs of the various terminal/abutment locations are included in Appendix E.

Following the site reconnaissance, the available existing information together with the field notes and photos were reviewed to further compare each terminal/bridge foundation location from a foundations perspective. The results of the comparison, including the numerical estimates of each measure for the various indicators that comprise the foundation evaluation, were compiled and tabulated.

It should be noted that following completion of the field reconnaissance work, the nine (9) Short Listed areas identified by URS for evaluation were further refined to include four (4) potential ferry connections and two (2) potential bridge crossings. The results of the final proposed access connections by URS is included in the matrix table in Appendix A titled, "Wolfe Island Transportation Study, Summary of Alternative Solutions" dated October 4, 2010. The final proposed access connections are summarized below.

Route Alternative #	Type	Terminal/Abutment Location	
		Kingston	Wolfe Island
A1-1 and A1-2	Ferry Route	Barrack Street	Marysville
A2-1 and A2-2	Ferry Route	Barrack Street	Dawson Point
A8-1 and A8-2	Ferry Route	CFB East	Dawson Point
A10-1 and A10-2	Ferry Route	Ravensview	Dawson Point
B3	Fixed-Link Bridge	CFB East	Dawson Point
B5	Fixed-Link Bridge	Ravensview	Knapp Point



The completed foundation evaluation tables consisting of comparisons of the individual terminal/bridge foundation locations for the final alternative solutions are included in Table 1, and the summary comparisons of the various route/crossing alternatives (based on a combination of the individual terminal/foundation locations) are presented in Table 2 following the text of this report. The draft Foundation Evaluation Tables 1 and 2 were submitted to URS in October 2010.

4.0 DISCUSSION AND RECOMMENDATIONS FOR ALTERNATIVES

4.1 Terminal/Abutment Location Alternatives

As described in Section 2, prior to the start of the foundations field reconnaissance work, URS provided a Short List consisting of a total of nine (9) potential access connection locations (five (5) in Kingston and four (4) on Wolfe Island). It is our understanding that these access location alternatives are to be considered by the overall design team, in conjunction with other non-construction solutions such as using a larger, or faster ferry vessel(s), or multiple ferries. Each of the original nine (9) Short Listed potential access connection locations were investigated as part of the field reconnaissance work, as follows:

1. Portsmouth - Ontario Park, Kingston Psychiatric hospital and Kingston Penitentiary
2. Downtown West - Kingston Yacht Club
3. Barrack Street Terminal - Existing ferry dock at Barrack Street
4. CFB East - Canadian Forces Base Kingston
5. Ravensview - Ravensview subdivision
6. Marysville West - Alston Moor Golf Links
7. Marysville - Existing Marysville terminal
8. Dawson Point - Existing Dawson Point terminal
9. Knapp Point - Knapp Point and Brophy Point

As described in Section 3, subsequent to completion of the field reconnaissance work, based on other non-technical factors, URS further refined the alternatives to include only four (4) potential ferry connections and two (2) potential bridge crossings. As shown in the table in Section 3 and the matrix table in Appendix A, Marysville West, Portsmouth and Downtown West are no longer to be considered as potential connection locations in the access study. These locations were investigated by Golder's field staff and are discussed below, however evaluation and ranking for these locations has not been carried out as these alternatives have been suspended.



4.1.1 Portsmouth

The proposed Portsmouth terminal is located in the western portion of the City of Kingston in the vicinity of King Street West and Portsmouth Avenue and encompasses the land surrounding Ontario Park, the Kingston Psychiatric Hospital, Portsmouth Yacht Club and the Kingston Penitentiary. The area highlighted for evaluation stretches from Ontario Park to approximately 2.1 km east. The greater part of the evaluation area consists of gently rolling, open topography with occasional bedrock outcrops and light tree cover. The shore line within the study area consists of limestone bedrock outcrops (up to about 3 m high) or man made soil retaining structures (steel bulkhead or armour stone) with shallow bedrock ledges, cobbles or boulders visible on the lake bottom near the shore. The drainage pattern in the area trends to the south towards the St. Lawrence River with a few minor streams terminating at the shore line.

Based on the field observations and available existing subsurface information, foundations for on-shore structures are expected to be shallow foundations founded on the near surface bedrock. Approach fills for the ferry terminal point are not expected to experience any significant settlement or stability issues. Near shore foundations for a ferry terminal are expected to be founded on bedrock at or slightly below the river bed, however, the elevation of the river bed is unknown in the area of the proposed terminal location.

As a result of evaluation factors other than foundations, this location was not carried forward in the short list of alternative solutions, and as such, the evaluation for this location is not included in Table 1.

4.1.2 Downtown West

The proposed Downtown West terminal is located in the vicinity of the intersection of Ontario Street and West Street in the City of Kingston and encompasses the land surrounding the Kingston Yacht Club, the Pumphouse Steam Museum and the Marine Museum of the Great Lakes. The area highlighted for evaluation stretches from the Kingston Yacht Club to approximately 0.5 km east at the Marine Museum of the Great Lakes. The greater part of the evaluation area consists of mainly flat, open topography with light tree cover. The shore line within the study area consists mainly of man made soil retaining structures (armour stone or concrete rubble). Available existing subsurface information indicates that on-shore bedrock is found underlying less than about 2.7 m of sand and gravel overburden. The drainage pattern in the area trends to the south towards the St. Lawrence River with a few minor streams terminating at the shore line.

Based on the field observations and available existing subsurface information, foundations for on-shore structures are expected to be shallow foundations founded on the near surface bedrock. Approach fills for the ferry terminal point are not expected to experience any significant settlement or stability issues. Near shore foundations for a ferry terminal are expected to be deep foundations extending to bedrock at an unknown depth below the river bed.



As a result of evaluation factors other than foundations, this location was not carried forward in the short list of alternative solutions, and as such, the evaluation for this location is not included in Table 1.

4.1.3 Barrack Street

The proposed upgrade to the Barrack Street terminal is located in the vicinity of the intersection of Ontario Street and Barrack Street in the City of Kingston at the location of the existing Barrack Street Ferry Terminal. The evaluation area consists of mainly flat, open topography with light tree cover. The shore line within the study area consists mainly of man made soil retaining structures (steel bulkhead or armour stone). Available existing subsurface information indicates that on-shore bedrock is found underlying less than about 1.5 m of cohesionless overburden soils. Available existing near-shore subsurface information indicates that the soils below the river bed consist of about 3 m to 4 m of firm to very stiff silty clay to clay over about 1 m of glacial till overlying bedrock. The drainage pattern in the area trends to the east towards the Cataraqui River.

Based on the field observations and available existing subsurface information, foundations for any on-shore structures are expected to be shallow foundations founded on the near surface bedrock. Approach fills less than about 6 m in total height for a ferry terminal are not expected to experience any significant settlement or stability issues, however, the presence of the clay strata below the river bed could result in some time-dependent, post-construction settlements that may need to be taken into consideration. Near shore foundations for a ferry dock (or associated dolphin structures) are expected to be deep foundations extending to bedrock at approximately 3 m to 6 m below the river bed. Based on the available information (as included in Appendix F), it is estimated that the river bed is approximately at Elevation 69 m in the vicinity of the existing Barrack Street ferry dock.

The proposed Barrack Street terminal location is the Kingston connection point for Alternative Nos. A1-1, A1-2, A2-1 and A2-2.

4.1.4 CFB East

The proposed CFB East terminal/bridge abutment is located at the south east corner of the Canadian Forces Base (CFB) Kingston property, adjacent to the west end of Lasalle Boulevard. The evaluation area consists of gently sloping topography with heavy tree cover. The shore line within the study area consists of a steep bedrock outcrop approximately 2 m to 3 m above the river level. The visible river bed in the vicinity of the connection area is covered with limestone cobbles and boulders. Available existing subsurface information indicates that on-shore bedrock is found underlying less than about 1.5 m of sand or clay overburden. The drainage pattern in the area trends to the south towards the St. Lawrence River.

Based on the field observations and available existing subsurface information, foundations for on-shore structures are expected to be shallow foundations founded on the near surface bedrock. Approach fills for a ferry terminal or bridge are not expected to experience any significant settlement or stability issues. Near shore structures are expected to require deep foundations extending to bedrock at an unknown depth below the river



bed. No existing subsurface information is available for off-shore structure locations, however the foundations for bridge piers are expected to be deep foundations extending to bedrock.

The proposed CFB East terminal/bridge abutment location is the Kingston connection point for Alternative Nos. A8-1, A8-2 and B3.

4.1.5 Ravensview

The proposed Ravensview terminal/bridge abutment is located in the vicinity of the intersection of McKnight Road and Sibbitt Road on the east side of the City of Kingston and encompasses the land in and to the west of Ravensview subdivision. The evaluation area consists of gently sloping to rolling topography with light to heavy tree cover. The shore line within the study area consists of a steep bedrock outcrop approximately 2 m to 3 m above the river level. The visible river bed in the vicinity of the terminal/abutment area is covered with limestone cobbles and boulders. Available existing subsurface information indicates that on-shore bedrock is found underlying up to about 3 m of sand or clay overburden. The drainage pattern in the area trends to the south towards the St. Lawrence river.

Based on the field observations and available existing subsurface information, foundations for on-shore structures are expected to be shallow foundations founded on the near surface bedrock. Approach fills for a ferry terminal or bridge abutment are not expected to experience any significant settlement or stability issues. Near shore structures are expected to require deep foundations extending to bedrock at an unknown depth below the river bed. No existing subsoil information is available for off-shore structures, however the foundations for bridge piers are expected to be deep foundations extending to bedrock.

The proposed Ravensview terminal/bridge abutment location is the Kingston connection point for Alternative Nos. A10-1, A10-2 and B5.

4.1.6 Marysville West

The proposed Marysville West terminal is located in the vicinity of the intersection of County Road 96 and 5th Line Road on Wolfe Island and encompasses the shore line from approximately County Road 95 to 4th Line Road. The area identified for evaluation encompasses a point of land extending out from the shoreline of the island (across from 3rd Line Road) and contains a relatively large swamp area; however it is our understanding that the actual proposed terminal would be located to the west of the point adjacent to Alston Moore Golf Links. The evaluation area consists mainly of gently sloping to flat, open topography with light tree cover with the exception of the swamp area noted above. The shore line within the western portion of this study area consists of a limestone bedrock outcrop up to about 6 m high above the river level. The visible river bed in the vicinity of the connection/terminal area consists of shallow limestone shelves but the elevation of the river bed is unknown. Available existing subsurface information and field observations indicate that on-shore, the bedrock is located at



or within about 1 m of the ground surface. The drainage pattern in the area trends to the north towards the St. Lawrence River.

Based on the field observations and available existing subsurface information, on-shore structures are expected to be constructed on shallow foundations founded on the near surface bedrock. Approach fills for a ferry terminal are not expected to experience any significant settlement or stability issues. Near shore structures are expected to be founded on shallow foundations on or within the near river-bottom bedrock.

As a result of evaluation factors other than foundations, this location was not carried forward in the short list of alternative solutions, and as such, the evaluation for this location is not included in Table 1.

4.1.7 Marysville Terminal

The proposed upgrade to the Marysville terminal is located in the vicinity of the intersection of Main Street and Centre Street on Wolfe Island at the location of the existing Marysville Ferry Terminal. The evaluation area consists of mainly flat, open topography with light tree cover. The shoreline within the study area consists mainly of gently sloping overburden with man made soil retaining structures (armour stone) in places. Available existing subsurface information indicates that on-shore and near-shore bedrock is located underlying less than about 1 m of cohesionless overburden soils. The drainage pattern in the area trends to the north towards the St. Lawrence River.

Based on the field observations and available existing subsurface information, foundations for on-shore structures are expected to be shallow foundations founded on the near surface bedrock. Approach fills for a ferry terminal are not expected to experience any significant settlement or stability issues. Near shore foundations for a ferry dock could comprise cellular sheet pile cofferdams founded on the bedrock below the relatively thin overburden of the riverbed. Given the depth of water at this location, associated dolphin structures may require deep foundations extending into bedrock.

The proposed Marysville terminal location is the Wolfe Island connection point for Alternative Nos. A1-1 and A1-2.

4.1.8 Dawson Point

The proposed upgrade to the Dawson Point terminal/bridge abutment is located at the end of Dawson Point Road on Wolfe Island at the location of the existing Dawson Point Ferry Terminal. The evaluation area consists of mainly flat, open topography with light tree cover. The shore line within the study area consists mainly of man made soil retaining structures (armour stone) or gently sloping overburden. Available existing subsurface information indicates that on-shore bedrock is located underlying less than about 1 m of overburden. At some locations in the vicinity of the existing terminal, a bedrock shelf is visible at the river bottom. Available existing near-shore subsurface information indicates that the overburden soils consist of rockfill and/or dense sand up to



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about 8 m thick overlying limestone bedrock. The drainage pattern in the area trends to the north towards the St. Lawrence River.

Based on the field observations and available existing subsurface information, foundations for on-shore structures are expected to be shallow foundations founded on the near surface bedrock. Approach fills for a ferry terminal or bridge abutment are not expected to experience any significant settlement or stability issues. Near shore foundations are expected to be deep foundations extending to bedrock. No existing subsoil information is available for off-shore structures, however the foundations for bridge piers are expected to be deep foundations extending to bedrock.

The proposed Dawson Point terminal/bridge abutment location is the Wolfe Island connection point for Alternative Nos. A2-1, A2-2, A8-1, A8-2, A10-1, A10-2 and B3.

4.1.9 Knapp Point

The proposed Knapp Point terminal/bridge abutment is located at the end of East Point Lane on Wolfe Island and encompasses the shore line along Brophy's Point/Knapp Point. The evaluation area consists mainly of gently sloping to slightly rolling topography with heavy tree cover. The shore line within the study area consists of a limestone bedrock outcrop up to about 2 m high above the river level. The visible river bed in the vicinity of the terminal/abutment area consists of shallow limestone bedrock shelf which can be seen in the air photo of the area extending out into the river. Available existing subsurface information and field observations indicate that on-shore bedrock is located at or within about 3 m of the ground surface. The drainage pattern in the area trends to the north towards the St. Lawrence River.

Based on the field observations and available existing subsurface information, on-shore structures are expected to be constructed on shallow foundations founded on the near surface bedrock. Approach fills for a ferry terminal or bridge abutment are not expected to experience any significant settlement or stability issues. Near shore structures are expected to be deep foundations founded on/within the near river-bottom bedrock. No existing subsoil information is available for off-shore structures, however the foundations for bridge piers are expected to be deep foundations extending to bedrock.

The proposed Knapp Point abutment location is the Wolfe Island connection point for Alternative No. B5.

4.2 Crossing Alternatives

As noted in Section 3, following the field reconnaissance and assessment of each terminal/abutment location described in the preceding sections, the final proposed access connection alternatives by URS, have been assessed by summing the evaluation for each individual terminal/bridge foundation connection location associated with a particular crossing alternative.



Table 2 following the text of this report summarizes the foundation evaluation for the final crossing alternatives being considered. From a foundations perspective, Route Alternative A2 (a ferry crossing from Barrack Street, Kingston to Dawson Point, Wolfe Island) is considered to be the preferred alternative.

5.0 RECOMMENDED ADDITIONAL FOUNDATION INVESTIGATION

The crossing alternatives that were initially assessed (as described in this report and included in appendix A) were those presented at the Public Information Centres on March 29 and 30, 2010 by URS. It is our understanding that no selection of a preferred alternative has been made as of the submission date of this draft report.

As part of the review and assessment for the planning study, a recommendation of the additional foundation investigation requirements for the preliminary design stage is to be provided. Given that the preferred alternative is not known at present, the recommended additional foundation investigation described below is based on consideration of the potential requirements for both ferry terminal(s) as well as for a fixed-link bridge.

5.1 Ferry Terminal(s)

At the preliminary design stage, foundation investigation in the form of borehole drilling and rock coring is recommended at the proposed ferry terminal location(s). Given the available existing information at most of the alternative locations and considering that for the most part, the overburden in the on-shore locations of the study area is generally thin with limestone bedrock at shallow depth, only limited on-shore foundation investigation (1 or 2 boreholes) is deemed necessary at the preliminary design stage. However, in the near-shore areas, where the available existing subsurface information is more limited and where the depth of water, thickness of overburden and depth to bedrock can be more variable, additional foundation investigation will be required. At a minimum, 3 boreholes advanced through and fully penetrating the overburden with a minimum of 3 m of bedrock coring in each is recommended at the preliminary design stage at each ferry terminal location.

5.2 Fixed-Link Bridge

At the preliminary design stage, foundation investigation in the form of borehole drilling and rock coring is recommended at the approaches/abutment areas and along with over-water alignments of the proposed fixed-link bridge location(s). As noted above, given the available existing information at most of the alternative locations and considering that for the most part, the overburden in the on-shore locations of the study area is generally thin with limestone bedrock at shallow depth, only limited on-shore foundation investigation (2 to 4 boreholes) is deemed necessary at the preliminary design stage in the approach/abutment areas. However, in the off-shore areas, where there is no available existing subsurface information and where the depth of water, thickness of overburden and depth to bedrock is currently unknown, additional foundation investigation will be required. At a minimum, 5 to 7 boreholes (spaced at approximately 300 m centres along the over-water portion of the alignment) advanced through and fully penetrating the overburden with a minimum of 3 m of bedrock coring in each is recommended at the preliminary design stage along the fixed-link bridge location.



The details of the recommended preliminary foundation investigation program for the preferred crossing alternative should be developed in consultation with MTO Foundations and the designers following selection of a preferred alternative.

6.0 CLOSURE

This Foundation Planning Report was prepared by Mr. Matthew Kelly, P.Eng., and was reviewed by Mr. J. Paul Dittrich, Ph.D., P.Eng., a Principal and senior geotechnical engineer with Golder. Mr. Fin Heffernan, P.Eng., Golder's Designated MTO Contact for this project, conducted an independent quality review of this report.



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

Report Signature Page

GOLDER ASSOCIATES LTD.

Matthew Kelly, P.Eng.
Geotechnical Engineer



J. Paul Dittrich, Ph.D., P.Eng.
Senior Geotechnical Engineer, Principal



Fin Heffernan, P.Eng.
Designated MTO Contact

MWK/JPD/FJH/mwk

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FOUNDATION PLANNING REPORT
WOLFE ISLAND TRANSPORTATION STUDY

TABLE 1 - DETAILS OF EVALUATION OF TERMINAL AND BRIDGE FOUNDATION LOCATIONS

FACTOR	INDICATOR	MEASURE	TERMINAL/BRIDGE LOCATIONS								
			KINGSTON					WOLFE ISLAND			
			Barrack Street	CFB East Terminal	CFB East Bridge	Ravensview Terminal	Ravensview Bridge	Knapp Point	Dawson Point Terminal	Dawson Point Bridge	Marysville
Foundations	a. Extent of topographic/terrain variation	(Difficult/Very Rugged, Neutral, Open) /(% of Total Area)	Difficult: 0% Neutral: 5% Open: 95% Weighted: 1x0.0+2x.05+3x.95 = 2.95	Difficult: 50% Neutral: 25% Open: 25% Weighted: 1x.50+2x.25+3x.25 = 1.75	Difficult: 50% Neutral: 25% Open: 25% Weighted: 1x.50+2x.25+3x.25 = 1.75	Difficult: 65% Neutral: 10% Open: 25% Weighted: 1x.65+2x.10+3x.25 = 1.6	Difficult: 65% Neutral: 10% Open: 25% Weighted: 1x.65+2x.10+3x.25 = 1.6	Difficult: 25% Neutral: 50% Open: 25% Weighted: 1x.25+2x.50+3x.25 = 2.0	Difficult: 0% Neutral: 5% Open: 95% Weighted: 1x0.0+2x.05+3x.95 = 2.95	Difficult: 0% Neutral: 5% Open: 95% Weighted: 1x0.0+2x.05+3x.95 = 2.95	Difficult: 0% Neutral: 5% Open: 95% Weighted: 1x0.0+2x.05+3x.95 = 2.95
	b.Drainage Ability / Extent of Poned Water	(Rapid, Fair, Poor/Ponded Water Present)/ (% of Total Area)	Poor: 0% Rapid-Fair: 100% Weighted: 1x0.0+2.5x1.0 = 2.5	Poor: 0% Rapid-Fair: 100% Weighted: 1x0.0+2.5x1.0 = 2.5	Poor: 0% Rapid-Fair: 100% Weighted: 1x0.0+2.5x1.0 = 2.5	Poor: 0% Rapid-Fair: 100% Weighted: 1x0.0+2.5x1.0 = 2.5	Poor: 0% Rapid-Fair: 100% Weighted: 1x0.0+2.5x1.0 = 2.5	Poor: 0% Rapid-Fair: 100% Weighted: 1x0.0+2.5x1.0 = 2.5	Poor: 0% Rapid-Fair: 100% Weighted: 1x0.0+2.5x1.0 = 2.5	Poor: 0% Rapid-Fair: 100% Weighted: 1x0.0+2.5x1.0 = 2.5	Poor: 0% Rapid-Fair: 100% Weighted: 1x0.0+2.5x1.0 = 2.5
	c.Extent of swamps and soft ground	(Major Deep Swamps/Difficult Conditions, Minor / Shallow Swamps) (% of Total Area)	Major: (0%) Minor: (50%) Favourable: (50%) Weighted: 1x.00+2x.50+3x.50 = 2.5	Major: (0%) Minor: (50%) Favourable: (50%) Weighted: 1x.00+2x.50+3x.50 = 2.5	Major: (0%) Minor: (75%) Favourable: (25%) Weighted: 1x.00+2x.75+3x.25 = 2.25	Major: (0%) Minor: (50%) Favourable: (50%) Weighted: 1x.00+2x.50+3x.50 = 2.5	Major: (0%) Minor: (75%) Favourable: (25%) Weighted: 1x.00+2x.75+3x.25 = 2.25	Major: (0%) Minor: (70%) Favourable: (30%) Weighted: 1x.00+2x.70+3x.30 = 2.3	Major: (0%) Minor: (10%) Favourable: (90%) Weighted: 1x.00+2x.10+3x.90 = 2.9	Major: (0%) Minor: (70%) Favourable: (30%) Weighted: 1x.00+2x.70+3x.30 = 2.3	Major: (0%) Minor: (15%) Favourable: (85%) Weighted: 1x.00+2x.15+3x.85 = 2.85
	d. Potential soft clay foundation / embankment stability issues	(Difficult embankment foundation conditions, favourable embankment foundation conditions) (% of total Area)	Difficult: 10% Favourable: 90% Weighted: 1x.1+2.5x.9 = 2.35	Difficult: 20% Favourable: 80% Weighted: 1x.20+2.5x.80 = 2.2	Difficult: 50% Favourable: 50% Weighted: 1x.5+2.5x.5 = 1.75	Difficult: 20% Favourable: 80% Weighted: 1x.20+2.5x.80 = 2.2	Difficult: 50% Favourable: 50% Weighted: 1x.5+2.5x.5 = 1.75	Difficult: 40% Favourable: 60% Weighted: 1x.40+2.5x.6 = 1.9	Difficult: 10% Favourable: 90% Weighted: 1x.1+2.5x.9 = 2.35	Difficult: 40% Favourable: 60% Weighted: 1x.40+2.5x.6 = 1.9	Difficult: 15% Favourable: 85% Weighted: 1x.15+2.5x.85 = 2.28
	e. Anticipated depth to Bedrock (Shallow or Deep)	(Exposed Bedrock/Shallow Foundations, Unknown/Possible Deep Foundations)	Structures Onshore = Shallow (0.75) Near Shore = Deep (0.25) Offshore = N/A (1.0) Weighted: 1x0.75+1x0.25+1x1.0 = 2.0	Structures Onshore = Shallow (0.75) Near Shore = Deep (0.25) Offshore = N/A (1.0) Weighted: 1x0.75+1x0.25+1x1.0 = 2.0	Structures Onshore = Shallow (0.75) Near Shore = Deep (0.25) Offshore = Deep (0.25) Weighted: 1x0.75+1x0.25+1x.25 = 1.25	Structures Onshore = Shallow (0.75) Near Shore = Deep (0.25) Offshore = N/A (1.0) Weighted: 1x0.75+1x0.25+1x1.0 = 2.0	Structures Onshore = Shallow (0.75) Near Shore = Deep (0.25) Offshore = Deep (0.25) Weighted: 1x0.75+1x0.25+1x.25 = 1.25	Structures Onshore = Shallow (0.75) Near Shore = Shallow (0.75) Offshore = Deep (0.25) Weighted: 1x0.75+1x0.75+1x.25 = 1.75	Structures Onshore = Shallow (0.75) Near Shore = Shallow (0.75) Offshore = N/A (1.0) Weighted: 1x0.75+1x0.75+1x1.0 = 2.5	Structures Onshore = Shallow (0.75) Near Shore = Deep (0.25) Offshore = Deep (0.25) Weighted: 1x0.75+1x0.25+1x.25 = 1.25	Structures Onshore = Shallow (0.75) Near Shore = Deep (0.25) Offshore = N/A (1.0) Weighted: 1x0.75+1x0.25+1x1.0 = 2.0
	f. Construction feasibility		Difficult: 25% Favourable: 75% Weighted: 1x.25+3x.75 = 2.5	Difficult: 30% Favourable: 70% Weighted: 1x.30+3x.70 = 2.4	Difficult: 70% Favourable: 30% Weighted: 1x.70+3x.30 = 1.6	Difficult: 30% Favourable: 70% Weighted: 1x.30+3x.70 = 2.4	Difficult: 70% Favourable: 30% Weighted: 1x.70+3x.30 = 1.6	Difficult: 65% Favourable: 35% Weighted: 1x.65+3x.35 = 1.7	Difficult: 10% Favourable: 90% Weighted: 1x.10+3x.90 = 2.8	Difficult: 65% Favourable: 35% Weighted: 1x.65+3x.35 = 1.7	Difficult: 15% Favourable: 85% Weighted: 1x.15+3x.85 = 2.7
Summary			14.8	13.35	11.1	13.2	10.95	12.15	16	12.6	15.28



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

TABLE 2 - FOUNDATION EVALUATION SUMMARY OF CROSSING ALTERNATIVES

ROUTE ALTERNATIVE	TERMINAL/ABUTMENT LOCATIONS	RANKING
A1-1 and A1-2	Barrack Street Marysville	30.1
A2-1 and A2-2	Barrack Street Dawson Point	30.8
A8-1 and A8-2	CFB East Dawson Point	29.4
A10-1 and A10-2	Ravensview Dawson Point	29.2
B3	CFB East Dawson Point	23.7
B5	Ravensview Knapp Point	23.1

Note: 'A'-series alternatives represent ferry crossings.

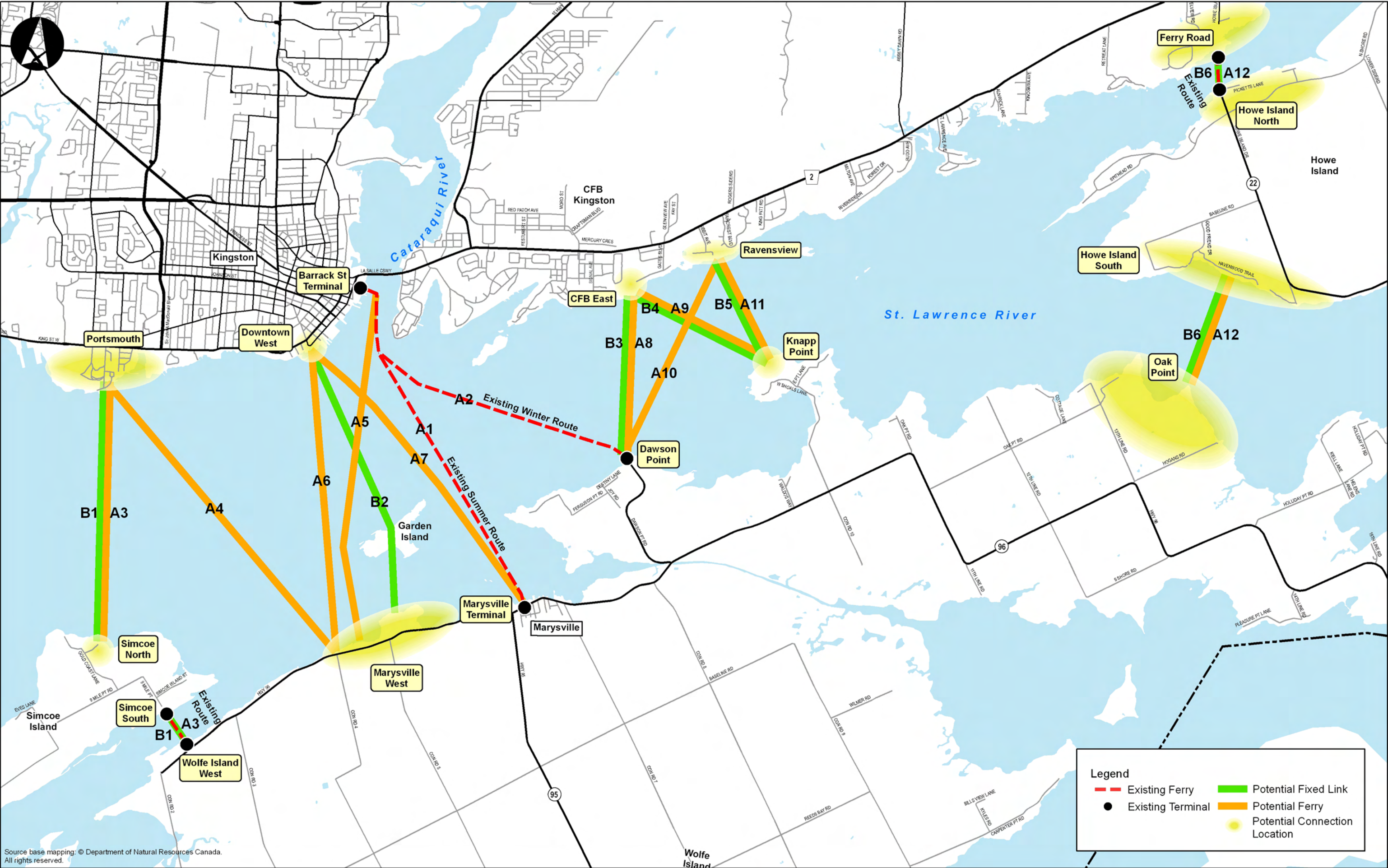
'B'-series alternatives represent bridge alignments.

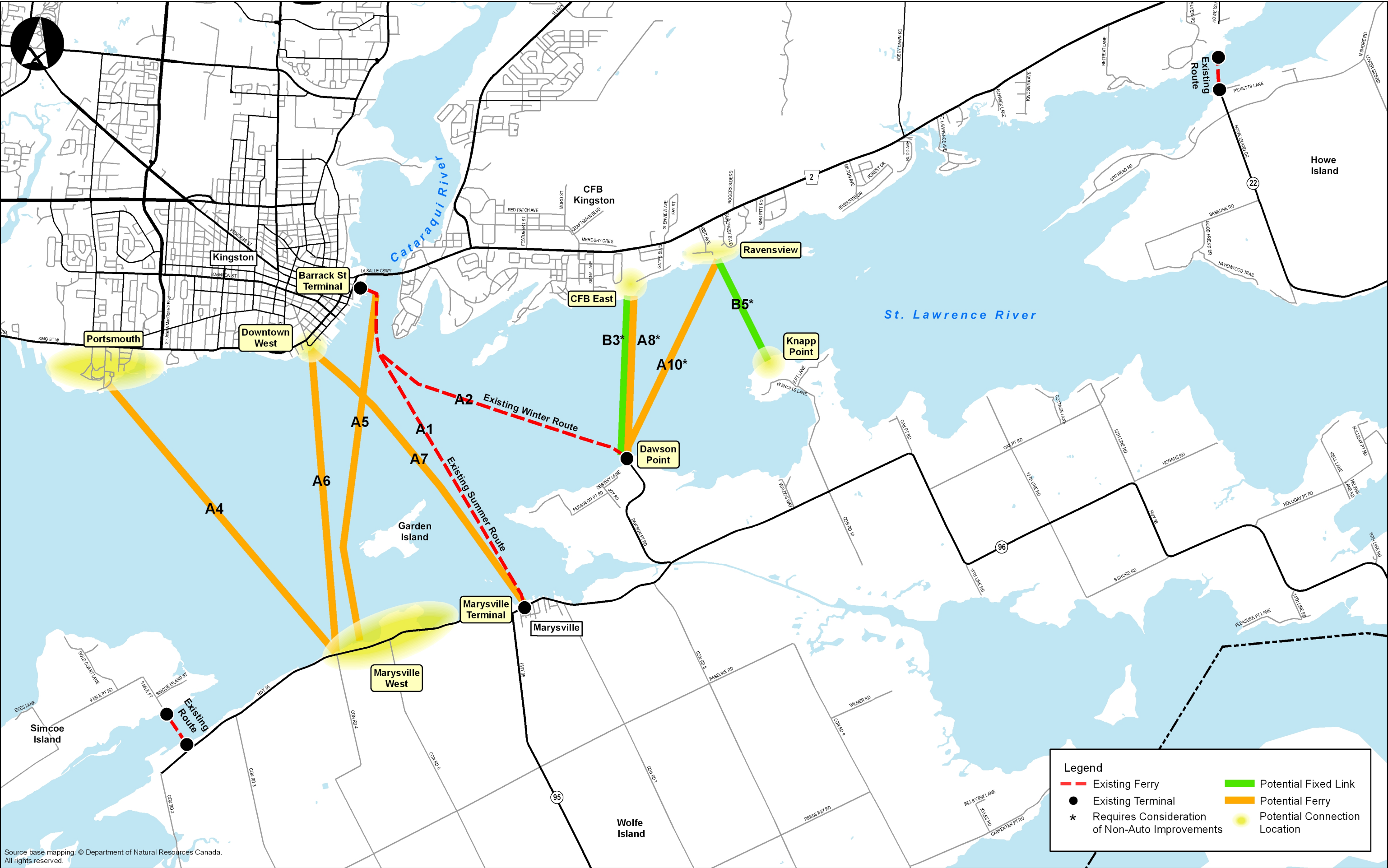
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APPENDIX A

DRAFT SCREENING OF CROSSING ALTERNATIVES (BY URS CANADA INC.)






Wolfe Island Transportation Study Summary of Alternative Solutions

ID	Description	Primary Alignment	Secondary Alignment
A1-1	Barrack Street to Marysville with high capacity vessel.	A1	-
A1-2	Barrack Street to Marysville with two vessels.	A1	-
A2-1	Barrack Street to Dawson Point with high capacity vessel and transit service.	A2	A1*
A2-2	Barrack Street to Dawson Pont with two vessels and transit service.	A2	A1*
A8-1	CFB East to Dawson Point with high capacity vessel and transit service.	A8	A1*
A8-2	CFB East to Dawson with two vessels and transit service.	A8	A1*
A10-1	Ravensview to Dawson Point with high capacity vessel and transit service.	A10	A1*
A10-2	Ravensview to Dawson Point with two vessels and transit service.	A10	A1*
B3	Fixed link from CFB East to Dawson Point with transit service.	B3	A1*
B5	Fixed link from Ravensview to Knapp Point with transit service.	B5	A1*

*Secondary alignment only applies if transit service consists of a pedestrian ferry.

Legend



Part of solution

Not part of solution

To be evaluated
Independently

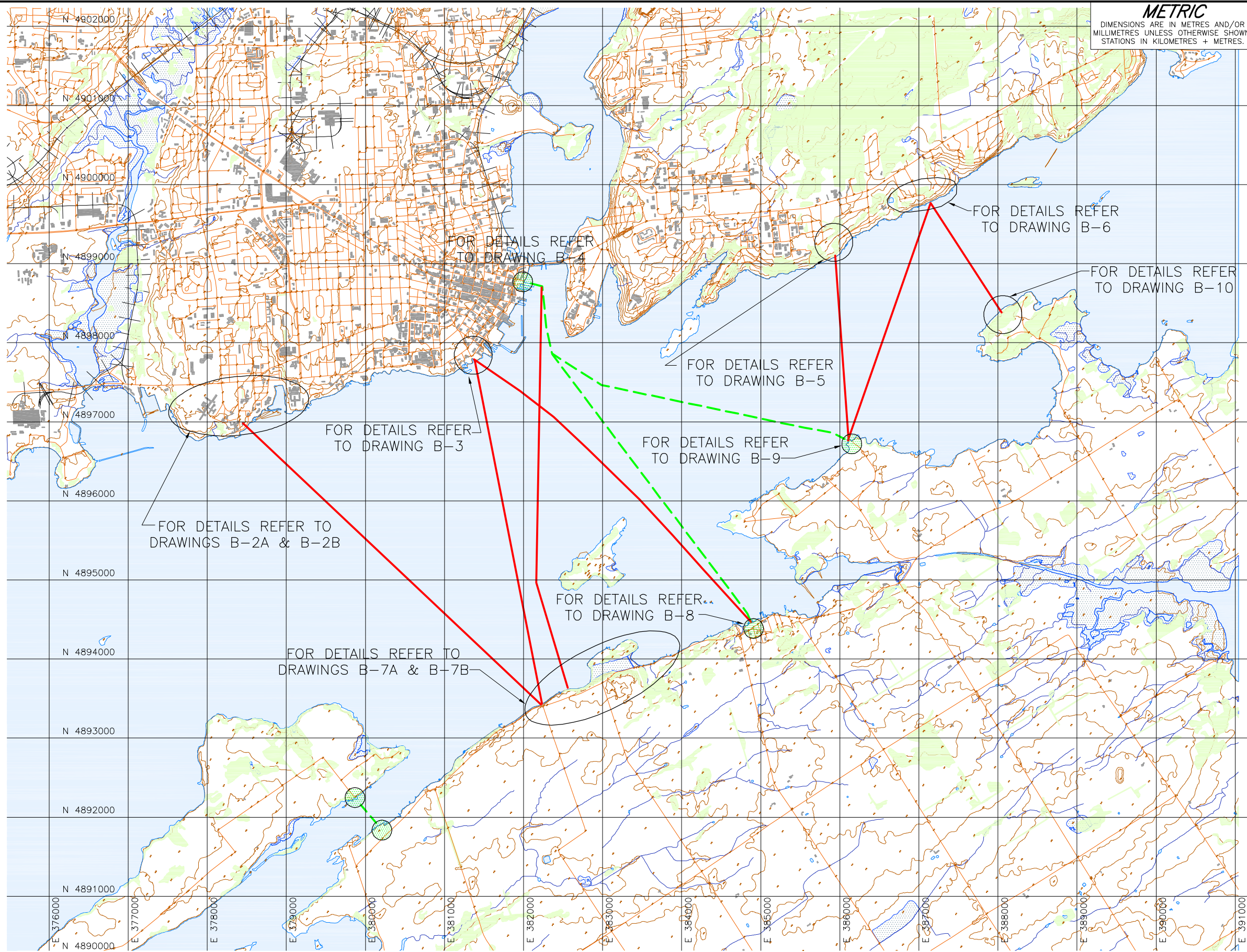
loading/unloading time = 9 minutes + 0.1 minutes/vehicle
mainland storage = .0085 ha/vehicle + .3 ha for building
island storage = .0085 ha/vehicle
Base DHV: 138

$$21.3 \text{ km/h} = 11.5 \text{ kn}$$
$$23.2 \text{ km/h} = 12.5 \text{ kn}$$



APPENDIX B

OBM DRAWINGS SHOWING SHORT-LISTED TERMINAL AND BRIDGE CROSSING LOCATIONS (WITH FIELD NOTES AND PHOTOGRAPH LOCATIONS)



PLAN



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.

WOLFE ISLAND
SITE LOCATION PLAN



SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

LEGEND:

- EXISTING FERRY ROUTES
- EXISTING FERRY TERMINALS
- POTENTIAL FERRY ROUTES
- POTENTIAL FERRY TERMINALS

NOTES

Projection is UTM83 ZONE 18

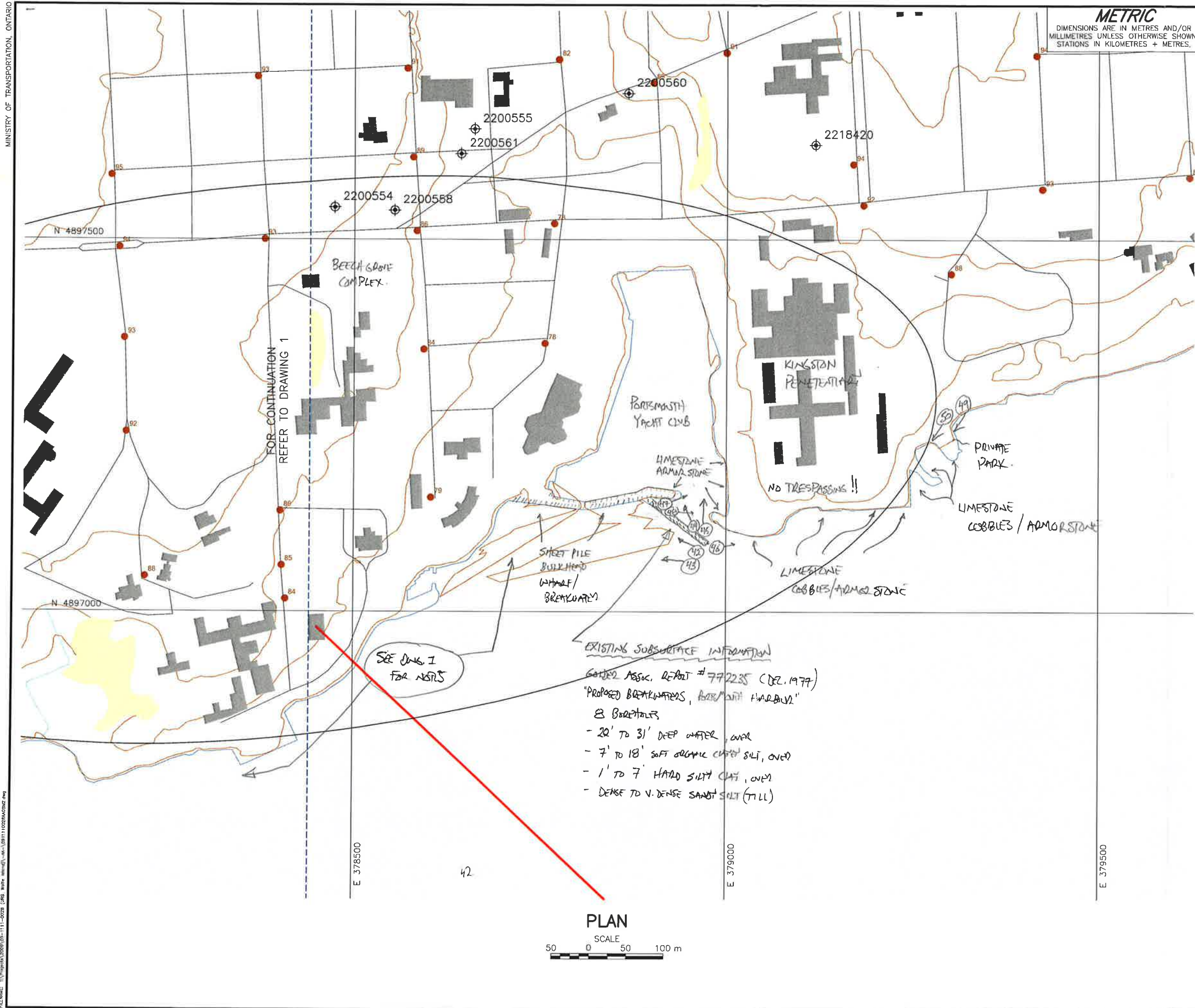
REFERENCE

Base Mapping obtained from Images and SHP Files provide by URS
received June 2010.

NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.		PROJECT NO. 09-1111-0028	DIST.
SUBM'D.	CHKD. JPD	DATE: 2/4/2011	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. B-1



NO.	DATE	BY	REVISION						
Geocres No. 31C-206									
HWY.			PROJECT NO. 09-1111-0028				DIST.		
SUBM'D.		CHKD. JPD		DATE: 7/15/2010			SITE:		
DRAWN: JFC/MG		CHKD. MWK		APPD. JPD			DWG B-2A		



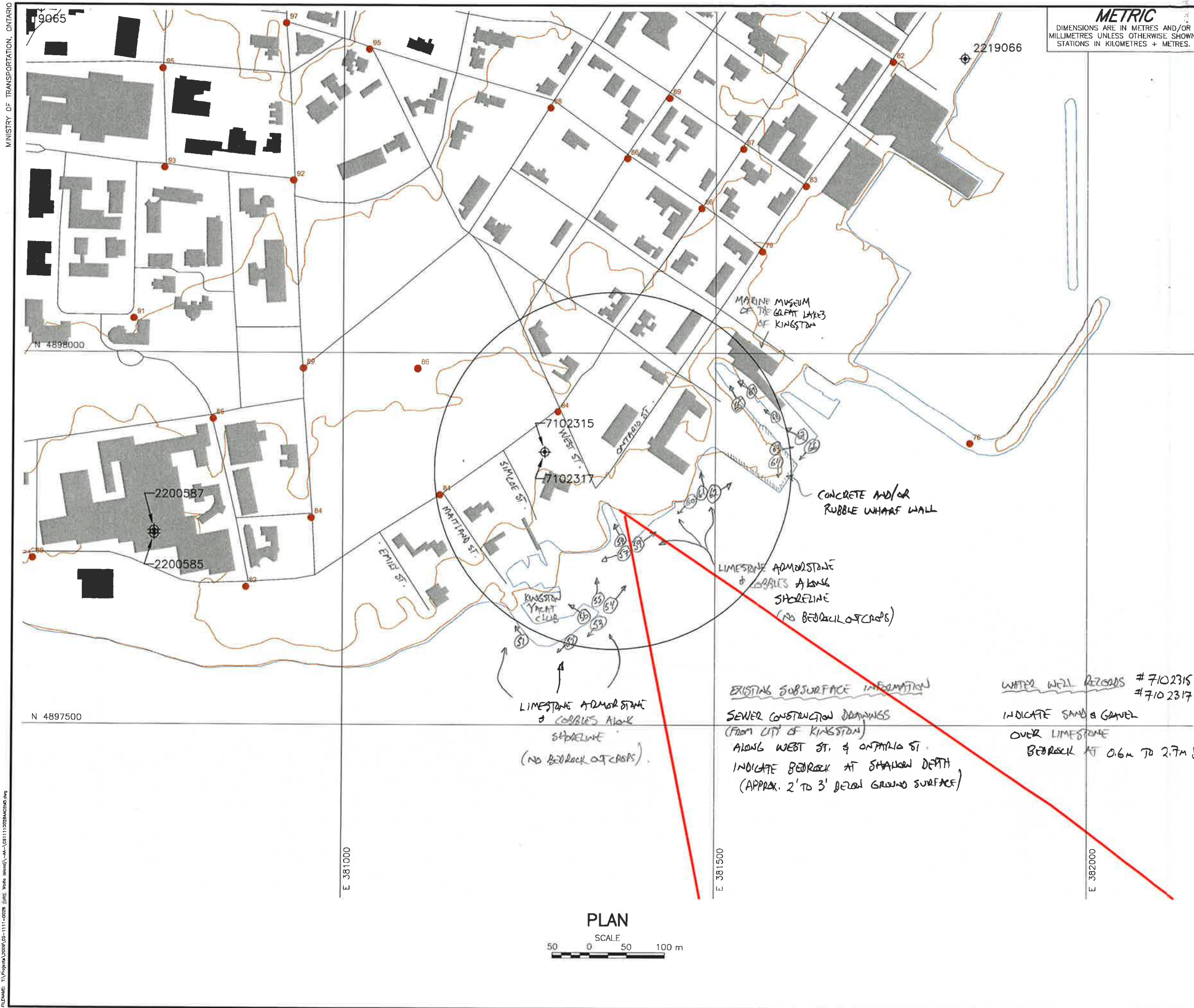
CONT No. WP No.		 SHEET
KINGSTON PORTSMOUTH (B)		
		Golder Associates Ltd. MISSISSAUGA, ONTARIO, CANADA

NOTE:
 For existing subsurface information, Golder Associates Ltd. Report #772235 was reviewed, but the information is not included herein as we do not have approval from our client (J. L. Richards & Associated Ltd.) or the owner (Department of Public Works, Canada).

LEGEND:

- POTENTIAL FERRY ROUTES
- POTENTIAL FERRY TERMINALS
- ⊕ WATER WELLS

NOTES			
Projection is UTM83 ZONE 18			
REFERENCE			
Base Mapping obtained from Images and SHP Files provide by URS received June 2010.			
NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.	PROJECT NO. 09-1111-0028		DIST.
SUBM'D.	CHKD. JPD	DATE: 7/15/2010	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. B-2B



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.

KINGSTON
DOWNTOWN WEST



SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

NOTE:

For existing subsurface information see
Golder Associates Ltd. Report 981-2465, City of Kingston
drawing 6151-West Street

LEGEND:

- POTENTIAL FERRY ROUTES
- POTENTIAL FERRY TERMINALS
- WATER WELLS

NOTES

Projection is UTM83 ZONE 18

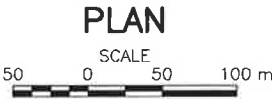
REFERENCE

Base Mapping obtained from Images and SHP Files provide by URS
received June 2010.

NO.	DATE	BY	REVISION
Geocres No.	31C-206		
HWY.		PROJECT NO.	09-1111-0028
SUBM'D.	CHKD. JPD	DATE:	7/15/2010
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. B-3

PLAN

SCALE
50 0 50 100 m



METRIC
 DIMENSIONS ARE IN METRES AND/OR
 MILLIMETRES UNLESS OTHERWISE SHOWN.
 STATIONS IN KILOMETRES + METRES.

CONT No. WP No.		 SHEET
KINGSTON BARRACK STREET TERMINAL		
		Golder Associates Ltd. MISSISSAUGA, ONTARIO, CANADA

NOTE:

For existing subsurface information see
 Geocres Reports 31C-118-2, 31C-118-3, 31C-132-1,
 31C-132-2, 31C-155 and Golder Associates Ltd. Reports
 871-2567, 901-2058, 961-2530 and City of Kingston
 drawing 7050-Barrack Street

EXISTING SUBSURFACE INFORMATION AT TERMINAL

- SEE BOREHOLE PROFILE DRAWINGS IN REF: 31C-118
31C-132
- TYPICAL CONDITIONS:
- GROUND SURFACE AT ELEV. 250.0'
- LAKE WATER SURFACE AT ELEV. 245.0'
- LAKE BED AT ELEV. 225.0' TO 227.0'
- SILT CLAY TO CLAY (10.0' TO 12.0' THICK)
- CLAYEY SILT (GLACIAL FILL) (2.0' THICK)
- LIMESTONE BED ROCK AT ELEV. 210.0'

**NOTE: ON SITE - BARRACK ST. SEWER
 DRAWINGS INDICATE BED ROCK
 WITHIN 2' TO 5' OF GROUND SURFACE**

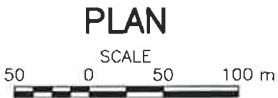
LEGEND:

- POTENTIAL FERRY ROUTES
- POTENTIAL FERRY TERMINALS
- EXISTING FERRY ROUTES
- WATER WELLS

NOTES			
Projection is UTM83 ZONE 18			
REFERENCE			
Base Mapping obtained from Images and SHP Files provide by URS received June 2010.			
NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.		PROJECT NO. 09-111-0028	DIST.
SUBM'D.	CHKD. JPD	DATE: 7/15/2010	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. B-4



No.	DATE	BY	REVISION		
Geocres No. 31C-206					
HWY.		PROJECT NO. 09-1111-0028		DIST.	
SUBM'D.	CHKD. JPD	DATE: 7/15/2010		SITE:	
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD		DWG. B-5	





NO.	DATE	BY	REVISION	
Geocres No. 31C-206				
HWY.		PROJECT NO. 09-1111-0028		DIST.
SUBM'D.	CHKD. JPD	DATE: 7/15/2010		SITE:
DRAWN: JFC/MG	CHKD. MWK	APP'D. JPD		DWG. B-6

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.

WOLFE ISLAND
MARYSVILLE WEST (A)

**Golder Associates Ltd.**
MISSISSAUGA, ONTARIO, CANADA


SHEET

N 4894000

N 4893500

E 382000




E 382500

E 383000

PLAN



LEGEND:

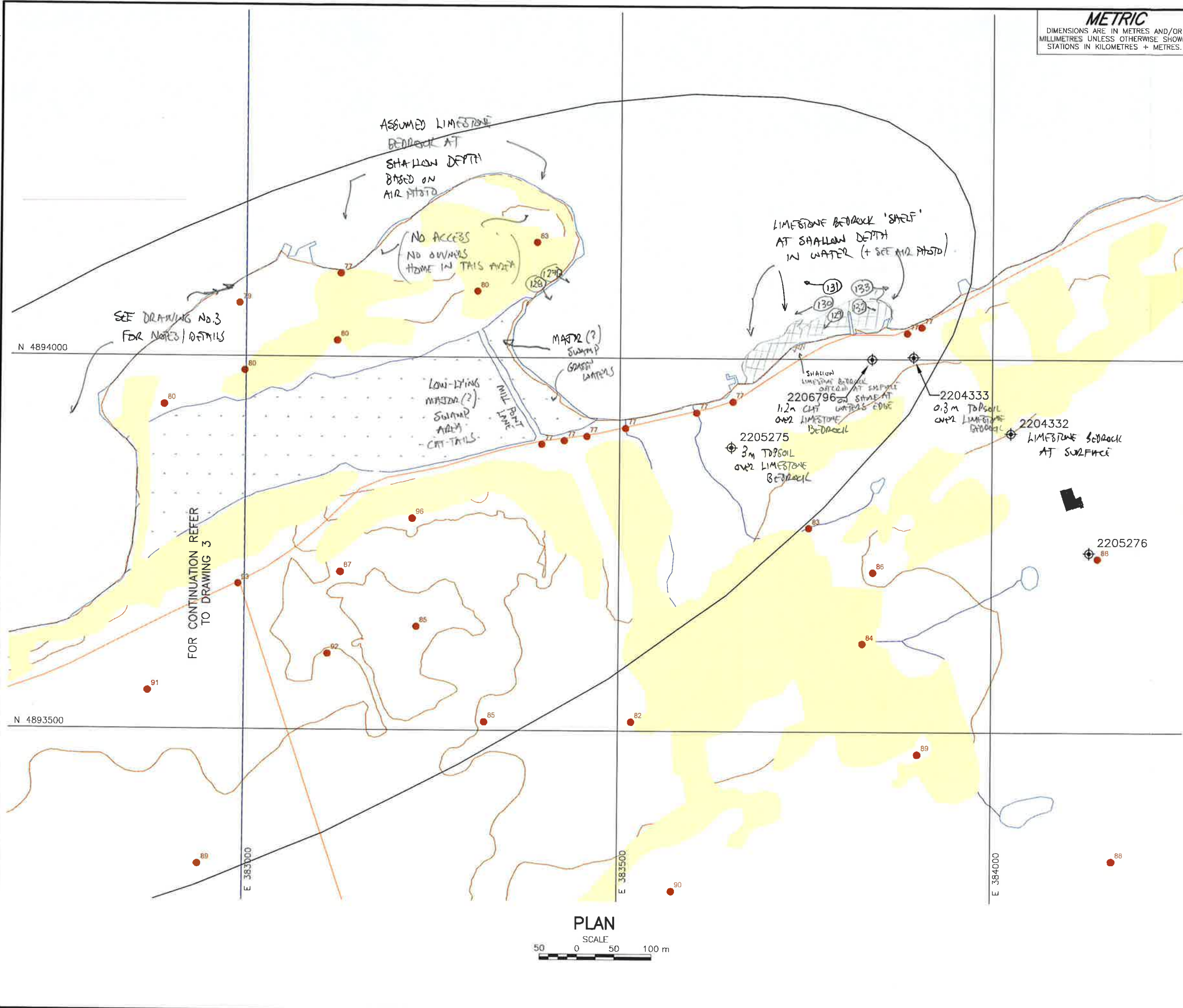
-  POTENTIAL FERRY ROUTES
-  POTENTIAL FERRY TERMINALS
-  WATER WELLS

NOTES
Projection is UTM83 ZONE 18



REFERENCE
Base Mapping obtained from Images and SHP Files provide by URS
received June 2010.

NO.				REVISION			
Geocres No. 31C-206				PROJECT NO. 09-1111-0028			
HWY.		CHKD. JPD		DATE: 7/15/2010		SITE:	
SUBM'D.		CHKD. MWK		APPD. JPD		DWG. B-7A	



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DRAWN BY: JFC/MG



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No. WP No.		 SHEET
WOLFE ISLAND MARYSVILLE WEST (B)		
 Golder Associates Ltd. MISSISSAUGA, ONTARIO, CANADA		

LEGEND:

	POTENTIAL FERRY TERMINALS
	WATER WELLS

NOTES Projection is UTM83 ZONE 18			
REFERENCE Base Mapping obtained from Images and SHP Files provide by URS received June 2010.			
Geocres No. 31C-206			
NO.	DATE	BY	REVISION
HWY. PROJECT NO. 09-1111-0028 DIST.			
SUBM'D.	CHKD. JPD	DATE: 7/15/2010	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. B-7B

EXISTING SUBSURFACE INFORMATION AT TERMINAL

- SEE BOREHOLE PROFILE DRAWINGS IN REPORT: 31C-118
- TYPICAL CONDITIONS:
- GROUND SURFACE AT ELEV. 250.0'
- LAKE WATER SURFACE AT ELEV. 245.0'
- LAKE BED AT ELEV. 228.0' TO 230.0'
- LOOSE TO COMPACT SILT, SAND & GRAVEL (1.0' THK)
- OVER LIMESTONE BEDROCK

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.

WOLFE ISLAND
MARYSVILLE TERMINAL



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



SHEET

NOTE:

For existing subsurface information see
Geocres Report 31C-118-3

NO EVIDENCE OF
BEDROCK OUTCROPPING
ON SHORE / NEAR SHORE

- LIMESTONE ARMOURSTONE
IN PLACES
- LIMESTONE BEDROCK EXPECTED
AT SHALLOW DEPTH
BASED ON EXISTING BH INFO
- WATER WELL
REDAOS

N 4894500

N 4894000

E 384500

E 385000

E 385500

PLAN

SCALE
50 0 50 100 m

LEGEND:

— POTENTIAL FERRY ROUTES

--- EXISTING FERRY ROUTES

○ EXISTING FERRY TERMINALS

⊕ WATER WELLS

NOTES

Projection is UTM83 ZONE 18

REFERENCE

Base Mapping obtained from Images and SHP Files provide by URS
received June 2010.

NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.	PROJECT NO. 09-1111-0028		DIST.
SUBM'D.	CHKD. JPD	DATE: 7/15/2010	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. B-8

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.

WOLFE ISLAND
DAWSON POINT



SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

NOTE:

For existing subsurface information see
Geocres Reports 31C-118-2 and 31C-118-3

EXISTING SUBSURFACE INFORMATION AT TERMINAL

- SEE BOREHOLE PROFILE DRAWINGS IN REPORT: 31C-118
- TYPICAL CONDITIONS:
- GROUND SURFACE AT ELEV. 250.0'
- LAKE WATER SURFACE AT ELEV. 245.0'
- LAKE BED AT ELEV. 222.0' (OFF-SHORE) TO 232.0' (NEAR SHORE)
- ROCKFILL (COARSE & BOUNDED) OR DENSE SAND (5.0'-NEAR SHORE TO 25.0'-OFF-SHORE) (OVER THIN HARD TILL IN PLACES)
- LIMESTONE BEDROCK AT ELEV. 245.0' (ON-SHORE / NEAR SHORE) TO 205.0' (OFF-SHORE)

LIMESTONE ARMOUR STONE
AROUND EXISTING TERMINAL
DOCKING POINTS

LIMESTONE BEDROCK SHELF
AT SHALLOW DEPTH NEAR
SHORE AND AT SHORE EDGE

EXPOSED
LOW LIMESTONE BEDROCK
OUTCROP ON SHORE EDGE
(SMALL AREA)

"DAWSON POINT"
WINTER TERMINAL

7114137
0.7m CLAY
OVER LIMESTONE BEDROCK

2219273
0.6m CLAY
OVER 0.6m SHALE
OVER LIMESTONE BEDROCK

2216597
1.8m CLAY
OVER LIMESTONE BEDROCK

2208602
2208603
2208604

7040343

PLAN

SCALE
50 0 50 100 m

LEGEND:

- POTENTIAL FERRY ROUTES
- POTENTIAL FERRY TERMINALS
- EXISTING FERRY ROUTES
- WATER WELLS

NOTES

Projection is UTM83 ZONE 18

REFERENCE

Base Mapping obtained from Images and SHP Files provide by URS
received June 2010.

NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.	PROJECT NO. 09-1111-0028		DIST.
SUBM'D.	CHKD. JPD	DATE: 7/15/2010	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. B-9

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.

WOLFE ISLAND
KNAPP POINT



SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

NOTE:

For existing subsurface information see
Geocres Report 31C-105-1

DIAMOND DRILLING INVESTIGATION (1 CORE HOLE)
AT KNAPP'S POINT (POSSIBLY NEAR LIGHTHOUSE
→ DRAWING NOT CLEAR).
↳ INDICATES BEDROCK AT GROUND SURFACE

N 4898500

EXPOSED LIMESTONE BEDROCK OUTCROP
ON SHORE & AT SHALLOW
DEPTH IN NEAR OFF-SHORE
(+ SEE AIR PHOTO FOR OUTLINE
OF LIMESTONE SHELF).

EXPOSED LIMESTONE BEDROCK OUTCROP
ON SHORE & AT SHALLOW
DEPTH IN NEAR SHORE
(+ SEE AIR PHOTO FOR
OUTLINE OF
LIMESTONE SHELF)

NO STRUCTURES
OR RESIDENTS
- UNABLE TO
OBTAIN PERMISSION
FOR ACCESS

2218576
CLAY SHALE TO 27m
OVER LIMESTONE BEDROCK

TABLE ROCK
LANE

WEST SHOALS LANE

EAST POINT LANE

2217314

"ENVIRONMENTALLY
SENSITIVE"
WETLAND
ACCORDING TO
LOCAL RESIDENT

N 4898000

E 387500

E 388000

E 388500

PLAN

SCALE
50 0 50 100 m

LEGEND:

- POTENTIAL FERRY ROUTES
- POTENTIAL FERRY TERMINALS
- WATER WELLS

NOTES

Projection is UTM83 ZONE 18

REFERENCE

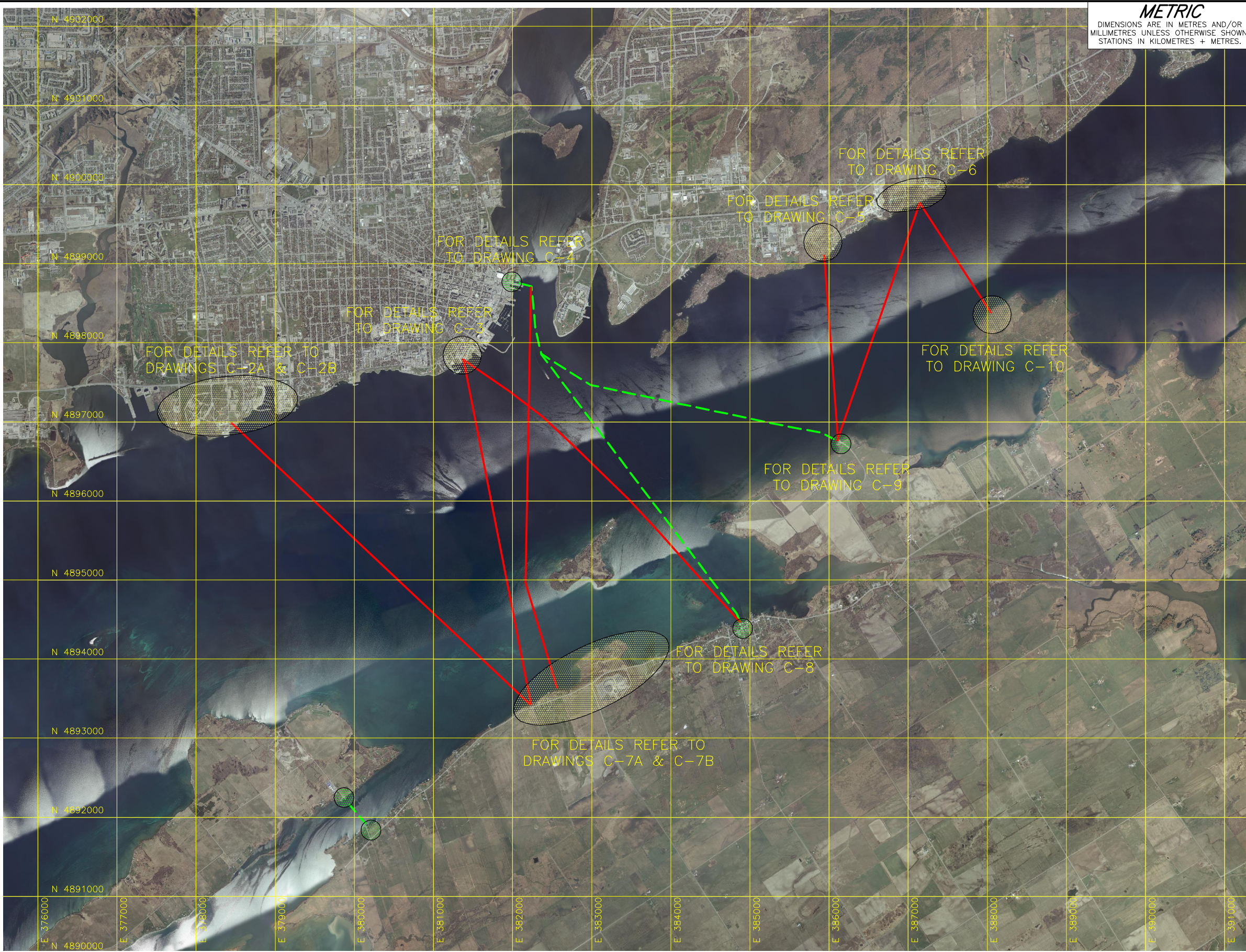
Base Mapping obtained from Images and SHP Files provide by URS
received June 2010.

NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.		PROJECT NO. 09-1111-0028	DIST.
SUBM'D.	CHKD. JPD	DATE: 7/15/2010	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. B-10



APPENDIX C


AIR PHOTOS SHOWING SHORT-LISTED TERMINAL AND BRIDGE CROSSING LOCATIONS








METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.

KINGSTON AND WOLFE ISLAND
SITE LOCATION PLAN

**Golder Associates Ltd.**
MISSISSAUGA, ONTARIO, CANADA


SHEET

- LEGEND:**
-  EXISTING FERRY ROUTES
 -  EXISTING FERRY TERMINALS
 -  POTENTIAL FERRY ROUTES
 -  POTENTIAL FERRY TERMINALS

NOTES

Projection is UTM83 ZONE 18

REFERENCE

Base Mapping obtained from Images and SHP Files provide by URS
received June 2010.

NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.	PROJECT NO. 09-1111-0028		DIST.
SUBM'D.	CHKD. JPD	DATE: 1/31/2011	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. C-1



PLAN



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.

KINGSTON
PORTSMOUTH (A)

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

SHEET

NOTE:

For existing subsurface information Golder Associates Ltd. Report #772235 was reviewed, but the information is not included herein as we do not have approval from our client (J.L. Richards & Associated Ltd.) or the owner (Department of Public Works, Canada)

LEGEND:

POTENTIAL FERRY ROUTES

POTENTIAL FERRY TERMINALS

NOTES

Projection is UTM83 ZONE 18

REFERENCE

Base Mapping obtained from Images and SHP Files provide by URS received June 2010.

NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.	PROJECT NO. 09-1111-0028		DIST.
SUBM'D.	CHKD. JPD	DATE: 2/1/2011	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. C-2A



PLAN



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.

KINGSTON
PORTSMOUTH (B)

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

SHEET

NOTE:

For existing subsurface information Golder Associates Ltd. Report #772235 was reviewed, but the information is not included herein as we do not have approval from our client (J.L. Richards & Associated Ltd.) or the owner (Department of Public Works, Canada)

LEGEND:

POTENTIAL FERRY ROUTES

POTENTIAL FERRY TERMINALS

NOTES

Projection is UTM83 ZONE 18

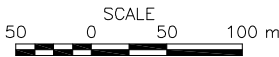
REFERENCE

Base Mapping obtained from Images and SHP Files provide by URS received June 2010.

NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.	PROJECT NO. 09-1111-0028		DIST.
SUBM'D.	CHKD. JPD	DATE: 2/1/2011	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. C-2B



PLAN




METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.

KINGSTON
RAVENSVIEW

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

NOTE:

For existing subsurface information see
Geocres Report 31C-105-1

LEGEND:

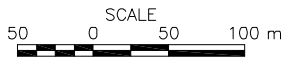
POTENTIAL FERRY ROUTES

POTENTIAL FERRY TERMINALS

NOTES				
Projection is UTM83 ZONE 18				
REFERENCE				
Base Mapping obtained from Images and SHP Files provide by URS received June 2010.				
NO.	DATE	BY	REVISION	
Geocres No. 31C-206				
HWY.		PROJECT NO. 09-1111-0028		DIST.
SUBM'D.		CHKD. JPD	DATE: 1/31/2011	SITE:
DRAWN: JFC/MG		CHKD. MWK	APPD. JPD	DWG. C-6



PLAN



CONT No.
WP No.

KINGSTON
DOWNTOWN WEST



SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

NOTE:

For existing subsurface information see
Golder Associates Ltd. Report 981-2465, City of Kingston
drawing 6151-West Street

LEGEND:

POTENTIAL FERRY ROUTES

POTENTIAL FERRY TERMINALS

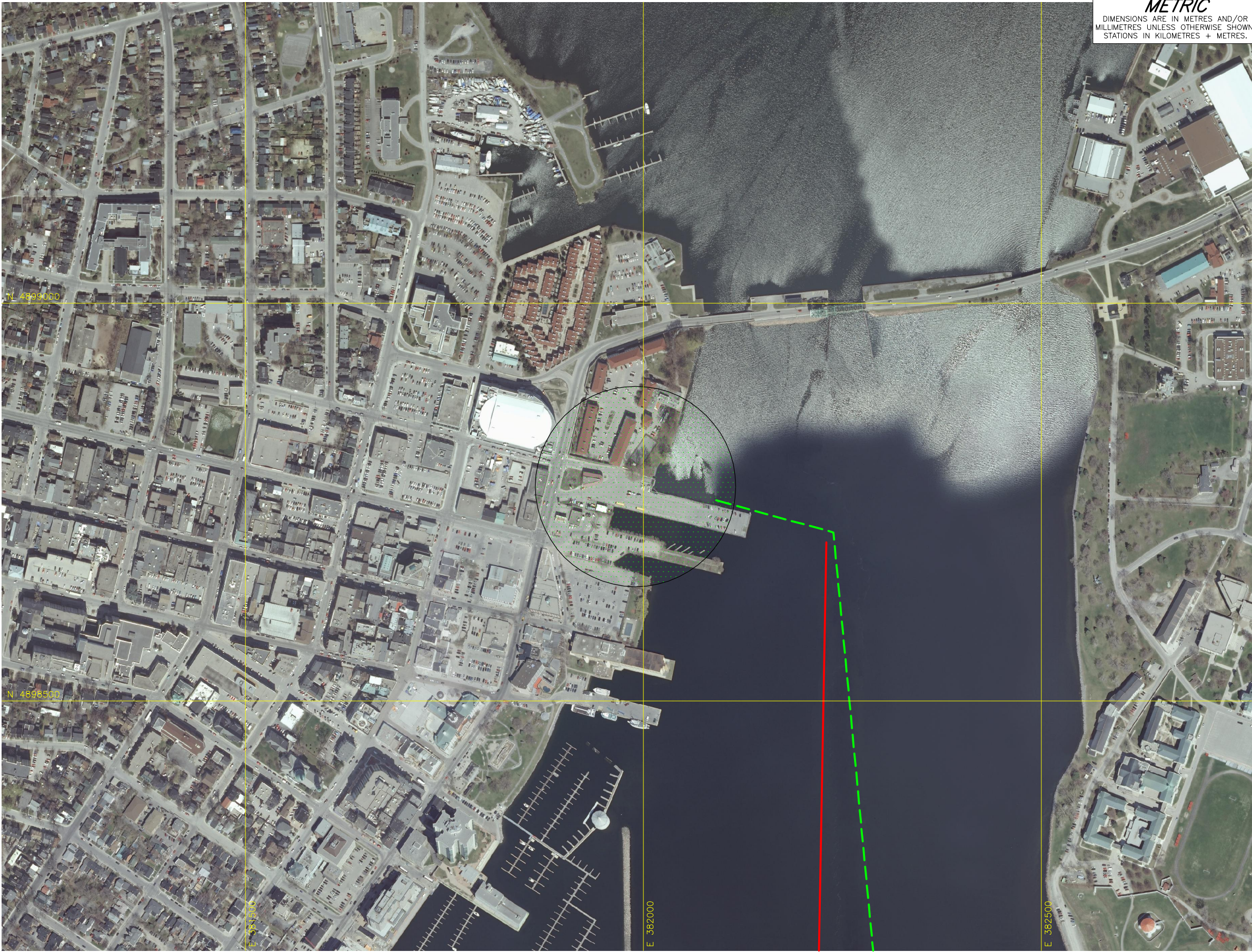
NOTES

Projection is UTM83 ZONE 18

REFERENCE

Base Mapping obtained from Images and SHP Files provide by URS
received June 2010.

NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.	PROJECT NO. 09-1111-0028		DIST.
SUBM'D.	CHKD. JPD	DATE: 1/31/2011	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. C-3



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No. WP No.		
KINGSTON BARRACK STREET TERMINAL		SHEET
		Golder Associates Ltd. MISSISSAUGA, ONTARIO, CANADA

NOTE:

For existing subsurface information see
Geocres Reports 31C-118-2, 31C-118-3, 31C-132-1,
31C-132-2, 31C-155 and Golder Associates Ltd. Reports
871-2567, 901-2058, 961-2530 and City of Kingston
drawing 7050-Barrack Street

- LEGEND:**
- EXISTING FERRY ROUTES
 - EXISTING FERRY TERMINALS
 - POTENTIAL FERRY ROUTES

NOTES

Projection is UTM83 ZONE 18

REFERENCE

Base Mapping obtained from Images and SHP Files provide by URS
received June 2010.

PLAN



NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.	PROJECT NO. 09-1111-0028		DIST.
SUBM'D.	CHKD. JPD	DATE: 1/31/2011	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. C-4



PLAN



CONT No.
WP No.

KINGSTON
CFB EAST



SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

LEGEND:

 POTENTIAL FERRY ROUTES

 POTENTIAL FERRY TERMINALS

NOTES

Projection is UTM83 ZONE 18

REFERENCE

Base Mapping obtained from Images and SHP Files provide by URS received June 2010.


NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.	PROJECT NO. 09-1111-0028		DIST.
SUBM'D.	CHKD. JPD	DATE: 1/31/2011	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. C-5




METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.


WOLFE ISLAND
MARYSVILLE WEST (A)

**Golder Associates Ltd.**
MISSISSAUGA, ONTARIO, CANADA


SHEET

LEGEND:

POTENTIAL FERRY ROUTES



POTENTIAL FERRY TERMINALS

NOTES			
Projection is UTM83 ZONE 18			
REFERENCE			
Base Mapping obtained from Images and SHP Files provide by URS received June 2010.			
NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.		PROJECT NO. 09-1111-0028	DIST.
SUBM'D.	CHKD. JPD	DATE: 1/31/2011	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. C-7A



PLAN



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No. WP No.		
WOLFE ISLAND MARYSVILLE WEST (B)		SHEET
		Golder Associates Ltd. MISSISSAUGA, ONTARIO, CANADA

LEGEND:

	POTENTIAL FERRY TERMINALS
--	---------------------------

NOTES
Projection is UTM83 ZONE 18

REFERENCE
Base Mapping obtained from Images and SHP Files provide by URS
received June 2010.

NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.	PROJECT NO. 09-1111-0028		DIST.
SUBM'D.	CHKD. JPD	DATE: 1/31/2011	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. C-7B



PLAN



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.

WOLFE ISLAND
MARYSVILLE TERMINAL



SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

NOTE:

For existing subsurface information see
Geocres Report 31C-118-3

LEGEND:

- EXISTING FERRY ROUTES
- EXISTING FERRY TERMINALS
- POTENTIAL FERRY ROUTES

NOTES

Projection is UTM83 ZONE 18

REFERENCE

Base Mapping obtained from Images and SHP Files provide by URS
received June 2010.

NO.	DATE	BY	REVISION
Geocres No. 31C-206			
HWY.	PROJECT NO. 09-1111-0028		DIST.
SUBM'D.	CHKD. JPD	DATE: 1/31/2011	SITE:
DRAWN: JFC/MG	CHKD. MWK	APPD. JPD	DWG. C-8

N 4897000

N 4896500

E 385500

E 386000

E 386500

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.

WOLFE ISLAND
DAWSON POINT



SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

NOTE:

For existing subsurface information see
Geocres Reports 31C-118-2 and 31C-118-3

LEGEND:

--- EXISTING FERRY ROUTES

○ EXISTING FERRY TERMINALS

— POTENTIAL FERRY ROUTES

NOTES

Projection is UTM83 ZONE 18

REFERENCE

Base Mapping obtained from Images and SHP Files provide by URS
received June 2010.

PLAN



NO.	DATE	BY	REVISION	
Geocres No. 31C-206				
HWY.			PROJECT NO. 09-1111-0028	DIST.
SUBM'D.		CHKD. JPD	DATE: 1/31/2011	SITE:
DRAWN: JFC/MG		CHKD. MWK	APPD. JPD	DWG. C-9




PLAN




METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No.

WOLFE ISLAND
KNAPP POINT

**Golder Associates Ltd.**
MISSISSAUGA, ONTARIO, CANADA


SHEET

NOTE:

For existing subsurface information see
Geocres Report 31C-105-1

LEGEND:

POTENTIAL FERRY ROUTES



POTENTIAL FERRY TERMINALS

NOTES				
Projection is UTM83 ZONE 18				
REFERENCE				
Base Mapping obtained from Images and SHP Files provide by URS received June 2010.				
NO.	DATE	BY	REVISION	
Geocres No. 31C-206				
HWY.		PROJECT NO. 09-1111-0028		DIST.
SUBM'D.		CHKD. JPD	DATE: 1/31/2011	SITE:
DRAWN: JFC/MG		CHKD. MWK	APPD. JPD	DWG. C-10



APPENDIX D

SAMPLE CALCULATIONS OF FOUNDATION EVALUATION OF ALTERNATIVES



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

CRITERIA FOR EVALUATION TABLE CALCULATIONS - FOUNDATIONS

Connection Location Alternatives

For each of the alternatives, an overall score (or total weighted ranking) was calculated based on expected topographic variability/terrain ruggedness within the area proposed for a ferry terminal or bridge connection location, overall drainage ability and extent of swamp and/or soft ground areas that may be present at the location of any structures or fills associated with the proposed connection locations. Included as part of this assessment, numerical estimates were compiled for expected foundation types of on-shore, near shore and off-shore structures at each connection location. The foundation factors are summarized below following which an example is provided of the method of assigning a numerical estimate and difficulty rating to each associated measure along with the resulting calculated score.

Foundation Factors	Indicator	Measure
General Topography	Extent of Topographic/Terrain Variation	Quantitative Assessment / Estimate of Conditions: (Difficult/Very Rugged, Open) (% of Total Area)
Overall Drainage Pattern	Drainage Ability/Extent of Ponded Water	Quantitative Assessment: (Rapid, Fair, Poor/Ponded Water Present) (% of Total Area)
Swamp and Soft Ground	Extent of Swamp and Soft Ground	Quantitative Assessment: (Major Deep Swamps/Difficult Conditions, Minor / Shallow Swamps) (% of Total Area)
Potential for embankment (or fill) stability/settlement issues	Presence of soft/loose soils	Quantitative Assessment: (Difficult embankment conditions or Favourable embankment conditions) (% of Total Area)
Foundation Types	Anticipated depth to Bedrock (Shallow or Deep)	Qualitative Assessment: (Exposed Bedrock/Shallow Foundations, Unknown/Possible Deep Foundations) (On-shore, Near-shore and Off-shore)
Construction Feasibility	Anticipated difficulty during construction / requirement for special construction techniques	Qualitative Assessment: (Difficult Construction Conditions, Favourable Construction Conditions)

1. *Extent of topographic/terrain variation:*

Calculated score based on percentage of difficult terrain versus open area were calculated. Difficult terrain was considered to refer to rolling, undulating and rugged topography, or low-lying swamp, soft ground and/or ponded water areas. Difficult terrain was assigned a value of 1, treed areas were assigned a value of 2 and open areas were assigned a value of 3. These numbers were multiplied by



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

5. *Anticipated depth to bedrock for structures (shallow or deep foundations)*

A site specific comparative number was assigned to all potential structure foundation locations. Each connection location was assigned a foundation type for on-shore (ancillary buildings, bridge abutments, etc.), near- shore (warf or dolphin) and off-shore (bridge pier). Exposed bedrock or existing subsurface information indicating shallow foundations was typically assigned a value of 0.75 and areas likely requiring deep foundations were assigned a value of 0.25. Where no foundations are required (i.e. off-shore for a ferry terminal) a value of 1.0 was assigned.

6. Construction Feasibility:

Calculated score based on the percentage of area where construction feasibility issues are present. Areas where construction activities are anticipated to be difficult were assigned a value of 1.0 and areas where construction activities are expected to be favourable were assigned a value of 3. For a connection location containing 20% difficult construction areas and 80% favourable construction areas, the calculation would be as follows:

$$\begin{aligned}\text{Indicator score} &= 1 \times 0.20 + 2.5 \times 0.80 \\ &= 2.2\end{aligned}$$

The overall score used for comparing the connection locations was calculated as the sum of the indicator scores numbers from the six criteria listed above.

Crossing Alternatives

The various crossing alternatives were ultimately assessed by summing the overall score calculated for each connection location associated with a particular crossing.

n:\active\2009\1111\09-1111-0028 urs - wolfe island planning - kingston\reporting\final\appendix d\appendix d - evaluation.docx



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

5. *Anticipated depth to bedrock for structures (shallow or deep foundations)*

A site specific comparative number was assigned to all potential structure foundation locations. Each connection location was assigned a foundation type for on-shore (ancillary buildings, bridge abutments, etc.), near-shore (wharf or dolphin) and off-shore (bridge pier). Exposed bedrock or existing subsurface information indicating shallow foundations was typically assigned a value of 0.75 and areas likely requiring deep foundations were assigned a value of 0.25. Where no foundations are required (i.e. off-shore for a ferry terminal) a value of 1.0 was assigned.

6. Construction Feasibility:

Calculated score based on the percentage of area where construction feasibility issues are present. Areas where construction activities are anticipated to be difficult were assigned a value of 1.0 and areas where construction activities are expected to be favourable were assigned a value of 3. For a connection location containing 20% difficult construction areas and 80% favourable construction areas, the calculation would be as follows:

$$\begin{aligned}\text{Indicator score} &= 1 \times 0.20 + 2.5 \times 0.80 \\ &= 2.2\end{aligned}$$

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Crossing Alternatives

The various crossing alternatives were ultimately assessed by summing the overall score calculated for each connection location associated with a particular crossing.

n:\active\2009\1111\09-1111-0028 urs - wolfe island planning - kingston\reporting\final\appendix d\appendix d - evaluation.docx



APPENDIX E

SITE PHOTOGRAPHS



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

Portsmouth



Photo 1- Shoreline in Ontario Park facing north.jpg



Photo 2 - Shoreline in Ontario Park facing east.jpg



Photo 3 - Ontario Park facing northeast.jpg



Photo 4 - Ontario Park facing east.jpg



Photo 5 - Ontario Park shoreline facing east.jpg



Photo 6 - Shoreline in Ontario Park facing east.jpg



Photo 7 - Shoreline in Ontario Park facing north.jpg



Photo 8 - Concrete shore protection in Ontario Park.jpg



Photo 9 - Shoreline in Ontario Park facing north.jpg



Photo 10 - Concrete shore protection in Ontario Park.jpg



Photo 11 - Bedrock at river bottom in Ontario Park.jpg



Photo 12 - Cobbles, exposed bedrock in Ontario Park.jpg



Photo 13 - Bedrock along shoreline in Ontario Park.jpg



Photo 14 - Bedrock along shoreline in Ontario Park.jpg



Photo 15 - Bedrock along shoreline in Ontario Park.jpg



Photo 16 - Cobbles and boulders Ontario Park shoreline.jpg



Photo 17 - Cobbles and boulders in Ontario Park.jpg



Photo 18 - Cobbles and boulders Ontario Park shoreline.jpg



Photo 19 - Cobbles and boulders in Ontario Park.jpg



Photo 20 - Exposed Bedrock along shoreline facing east.jpg



Photo 21 - Exposed bedrock along shoreline facing west.jpg



Photo 22 - Cobbles and boulders shoreline facing west.jpg



Photo 23 - Bedrock along shoreline facing east.jpg



Photo 24 - Boulders along shoreline facing east.jpg



Photo 25 - Shoreline facing west.jpg



Photo 26 - Shoreline facing east.jpg



Photo 27 - Shoreline facing northwest.jpg



Photo 28 - Shoreline facing northwest.jpg



Photo 29 - Bedrock along shoreline facing east.jpg



Photo 30 - Concrete shoreline protection.jpg



Photo 31 - Concrete docking structure at shoreline.jpg



Photo 32 - Concrete shore protection at Heakes Ln.jpg



Photo 33 - Shore protection at Lakewatch Ln.jpg



Photo 34 - Shore protection at end of Heakes Ln.jpg



Photo 35 - Facing east to Kingston Penitentiary.jpg



Photo 36 - Armourstone shore protection at Lakew...



Photo 37 -Shoreline protection facing north.jpg



Photo 38 - Armour stone at Mowat Ave facing north.jpg



Photo 39 - Break wall infront of Portsmouth Yacht Club.j...



Photo 40 - Shoreline protection at end of Mowat...



Photo 41 - Break wall at Portsmouth Yacht Club.jpg



Photo 42 - Break wall at of Portsmouth Yacht Club.jpg



Photo 43 - Facing west from Portsmouth Yacht Club.jpg



Photo 44 - Portsmouth Yacht Club facing north.jpg



Photo 45 - Portsmouth Yacht Club facing north.jpg



Photo 46 - Shore infront of Kingston Pen facing east.jpg



Photo 47 - Breakwall in Yacht Club facing east.jpg



Photo 48 - Shore infront of Kingston Pen facing east.jpg



Photo 49 -East side of Kingston Pen facing south....



Photo 50 - East side of Kingston Pen facing south....



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

Downtown West



Photo 51 - West of Kingston YC facing northwest.jpg



Photo 52 - Breakwall at Kingston YC facing south...



Photo 53 - Breakwall at Kingston YC facing south...



Photo 54 - Shoreline at Ontario St facing northeast...



Photo 55 - Shoreline at end of West St facing north.jpg



Photo 56 - Kingston Yacht Club facing north.jpg



Photo 57 - Shoreline at end of West St facing west.jpg



Photo 58 - Shoreline at end of West St facing north.jpg



Photo 59 - Shoreline at end of West St facing east.jpg



Photo 60 - Shoreline at Ontario St facing southwe...



Photo 61 - Shoreline along Ontario St facing north.jpg



Photo 62 - Shoreline along Onario Street facing east.jpg



Photo 63 - Structure at Marine Museum facing ea...



Photo 64 - Wall at Marine Museum facing south.jpg



Photo 65 - Marine Museum harbour facing northwest.jpg



Photo 66 - Marine Museum harbour facing southwest.jpg



Photo 67 - Marine Museum harbour facing northwest.jpg



Photo 68 - Marine Museum harbour facing northwest.jpg



Photo 69 - Marine Museum harbour facing northwest.jpg



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

Barrack Street



Photo 70 - Barrack Street terminal facing west.jpg



Photo 71 - Barrack Street terminal facing northwest.jpg



Photo 72 - West of Barrack St dock facing west.jpg



Photo 73 - Shoreline west of Barrack St dock.jpg



Photo 74 - From dock west of Barrack St facing east.jpg



Photo 75 - From west of Barrack St dock facing north.jpg



Photo 76 - From west of Barrack St dock facing west.jpg



Photo 77 - Shoreline west of Barrack St dock.jpg



Photo 78 - Dock west of Barrack St dock.jpg



Photo 79 - Dock west of Barrack Street dock.jpg



Photo 80 - Existing Barrack Street terminal.jpg



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

CFB East



Photo 81 - Shore at Lasalle Blvd facing southwest.jpg



Photo 82 - Shore at Lasalle Blvd facing southwest.jpg



Photo 83 - Shore at Lasalle Blvd facing northeast.jpg



Photo 84 - Shore at Lasalle Blvd facing northeast.jpg



Photo 85 - View of Wolfe Island from CFB east.jpg



Photo 86 - Sign on CFB Kingston property.jpg



Photo 87 - Shore at CFB east facing southwest .jpg



Photo 88 - Shore at CFB east facing northeast.jpg



Photo 89 - View of Wolfe Island from CFB east.jpg



Photo 90 - Shore at CFB east facing northeast.jpg



Photo 91 - Shore at CFB east facing southwest.jpg



Photo 92 - Submarine cable crossing sign at CFB east.j...



Photo 93 - Shore at CFB east facing northeast.jpg



Photo 94 - Training grounds at CFB east.jpg



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

Ravensview



Photo 95 - Shore at
Mcknight Road facing wes...



Photo 96 - Shore at
Mcknight Road facing wes...



Photo 97 - Shore at
Mcknight Road facing nort...



Photo 98 - Shore at
Mcknight Road facing nort...



Photo 99 - Shore at
Mcknight Road facing nort...



Photo 100 - Shore at
Mcknight Road facing nort...



Photo 101 - Wolfe Island
from Mcknight Road.jpg



Photo 102 - Wolfe Island
from Mcknight Road.jpg



Photo 103 - Shore at
Mcknight Road facing wes...



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

Marysville West



Photo 104 - Shoreline along hwy 96 facing east.jpg



Photo 105 - Shoreline along hwy 96 facing south.jpg



Photo 106 - Shoreline along hwy 96 facing south.jpg



Photo 107 - Shoreline along hwy 96 facing south.jpg



Photo 108 - Shoreline along hwy 96 facing southwest.jpg



Photo 109 - Shoreline along hwy 96 facing southwest.jpg



Photo 110 - Shoreline along hwy 96 facing northwest.jpg



Photo 111 - Shoreline along hwy 96 facing northeast.jpg



Photo 112 - Shoreline along hwy 96 facing west.jpg



Photo 113 - Shoreline along hwy 96 facing north.jpg



Photo 114 - Shoreline along hwy 96 facing southwest.jpg



Photo 115 - Shoreline along hwy 96 facing southwest.jpg



Photo 116 - Shoreline along hwy 96 facing south.jpg



Photo 117 - Shoreline along hwy 96 facing east.jpg



Photo 118 - Shore at Mill Point Ln facing southwest.jpg



Photo 119 - Shore at Mill Point Ln facing south.jpg



Photo 120 - Shore at Mill Point Ln facing southeast.jpg



Photo 121 - Shoreline along Mill Point facing north.jpg



Photo 122 - Swamp area on Mill Point facing east.jpg



Photo 123 - Shore at Mill Point Ln facing west.jpg



Photo 124 - Shore at Mill Point Ln facing northeast.jpg



Photo 125 - Shore at Mill Point facing southwest.jpg



Photo 126 - Shore at Mill Point facing northeast.jpg



Photo 127 - Swamp area on Mill Point facing south.jpg



Photo 127B - Shore from Mill Point facing southeast.jpg



Photo 128 - Shoreline from Mill Point facing south.jpg



Photo 129 - Shoreline along hwy 96 facing southwest.jpg



Photo 130 - Shoreline along hwy 96 facing west.jpg



Photo 131 - Shoreline along hwy 96 facing west.jpg



Photo 132 - Shoreline along hwy 96 facing east.jpg



Photo 133 - Shoreline along hwy 96 facing east.jpg



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

Marysville



Photo 153 - Marysville terminal facing west.jpg



Photo 154 - Marysville terminal facing west.jpg



Photo 155 - Marysville terminal facing south.jpg



Photo 156 - Marysville terminal facing south.jpg



Photo 157 - Marysville terminal dolphins.jpg



Photo 158 - Dock east of Marysville terminal.jpg



Photo 159 - Marysville terminal from Hwy 96.jpg



Photo 160 - Shore west of Marysville terminal.jpg



Photo 161 - Shore west of Marysville terminal.jpg



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

Dawson Point



Photo 144 - Shore west of Dawson Point facing east.jpg



Photo 145 - Shore west of Dawson Point facing SE.jpg



Photo 146 - Shore west of Dawson Point facing south...



Photo 147 - Existing Dawson Point terminal.jpg



Photo 148 - Staging area for Dawson Point terminal.jpg



Photo 149 - Shore east of Dawson Point facing SE.jpg



Photo 150 - Shore east of Dawson Point facing east.jpg



Photo 151 - Dawson Point staging area.jpg



Photo 152 - Dawson Point terminal.jpg



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

Knapp Point



Photo 134 - Shore at Knapp Point facing NE.jpg



Photo 135 - shore at Knapp Point facing east.jpg



Photo 136 - Shore at Knapp Point facing SE.jpg



Photo 137 - Shore at Knapp Point facing SW.jpg



Photo 138 - Shore at Knapp Point facing SW.jpg



Photo 139 - Shore at Knapp Point facing SW.jpg



Photo 140 - Shore at Knapp Point facing NE.jpg



Photo 141 - Shore at Knapp Point facing SW.jpg



Photo 142 - Shore at Knapp Point facing SW.jpg



Photo 143 - Shore at Knapp Point facing SW.jpg



APPENDIX F

REFERENCE LIST AND SELECT SUBSURFACE INFORMATION

- MTO GEOCRES
- CITY OF KINGSTON
- GOLDER ASSOCIATES LTD.



REFERENCE LIST

City of Kingston Engineering Department. Construction drawing nos. 7050 (Barrack Street, 1956 and 2008), 6151 (West Street, 1973 and 1995), and B-861 (Ontario Street, 1980)

Devata, M., Kazmierowski, T. 1982. Foundation Investigation Report - For Proposed Ferry Terminals, Kingston - Wolfe Island Ferry Service, City of Kingston and Township of Wolfe Island, County of Frontenac, District No. 8 (Kingston). MTO W.P. 25-73-01, Geocres Report No. 31C-118-3.

Devata, M., Ly, B. 1976. Foundation Investigation and Design Report - Wolfe Island Ferry Service, Barrack Street Fender Replacement. MTO W.O. 76-16003, Geocres Report No. 31C-132.

Devata, M., Poon, C. S. 1973. Foundation Investigation Report - Dawson Point Terminal Dolphin No. 3. MTO W.P. 181-81-01, Geocres Report No. 31C-118.

Dundas, D. H. 1989. Memorandum - Wolfe Island Ferry Terminal Building, Barrack Street Dock at Ontario Street. MTO Contract 89-404, W.P. 222-86-00, Geocres Report No. 31C-155.

Glassford, B. K. 1954. Memorandum - For Diamond Drill Investigation, Ferry Dock Sites, Kingston and Wolfe Island. MTO W.P. 316-64-1 and 316-64-2, Geocres Report No. 31C-105.

Heffernan, F. J. 1977. Soil Investigation, Proposed Breakwaters, Portsmouth Harbour, Kingston. Golder Associates Report No. 772235. [Property of J. L. Richards & Associates Ltd. and/or Department of Public Works, Canada and not included herein]

Kingsland, T. C. 1976. Memorandum - Wolfe Island Ferry Service, Barrack Street Fender Replacement. MTO W.O. 76-16-003, Geocres Report No. 31C-132-1.

Kingsland, T. C. 1981. Memorandum - Dawsons Point Terminal Dolphins, Wolfe Island Ferry. MTO W.O. 81-46014, Geocres Report No. 31C-118-1.



FOUNDATION PLANNING REPORT WOLFE ISLAND TRANSPORTATION STUDY

SELECT SUBSURFACE INFORMATION

- MTO GEOCREST
- City of Kingston



RECORD OF BOREHOLE No /

METRIC

W P 222-86-00 LOCATION CO-OPDS N 4898 958.8; E 306 487.7 ORIGINATED BY P.M.
DIST 8 HWY N/A BOREHOLE TYPE CONTINUOUS FLIGHT AUGER (S.S.) COMPILED BY P.M.
DATUM GEODETIC DATE 89-03-07 TO 89-03-09 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
77.6	GROUND LEVEL												
0.0	CLAYEY SILT		1	AS									
	TRACE ORGANICS, SAND		2	SS									
	SOFT TO STIFF		3	SS									
	BOULDERS		4	SS									
	FILL		5	AS									
75.1	WEATHERED												
73.5	Unweathered		5	RC 100%									
	LIMESTONE			BQ									
	BEDROCK												
4.1	END OF BOREHOLE												
	*WATER LEVEL NOT ESTABLISHED												

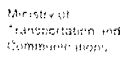


RECORD OF BOREHOLE No 3

METRIC

W P 222-86-00 LOCATION Co-ords N 4 898 971.3; E 306 485.5 ORIGINATED BY P.M.
DIST 8 HWY N/A BOREHOLE TYPE CONTINUOUS FLIGHT AUGER (S.S.) COMPILED BY P.M.
DATUM GEODETIC DATE 89-03-07 to 89-03-09 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT <u>2</u>		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N' VALUES			20 40 60 80 100	20 40 60 80 100					
77.8	GROUND LEVEL													
0.0	SILTY SAND		1	SS	60	8.9cm								
	TRACE OF GRAVEL, ORGANICS HARD		2	SS	47									
	Boulders		3	SS	60	2.5cm								
	FILL		4	SS	60	7.5cm								
74.0			5	SS	60	5.0cm								
3.8	Weathered - Unweathered Limestone Bedrock		6	RC	100%									
72.4				BQ										
5.4	END OF BOREHOLE													
	* WATER LEVEL NOT ESTABLISHED													



METRIC

WP 222-86-00 LOCATION CO-ORDS. N 4 898 964.3; E 306 509.6 ORIGINATED BY P.M.
DIST 8 HWY N/A BOREHOLE TYPE CONTINUOUS FLIGHT AUGER (C.S.) COMPILED BY P.M.
DATUM GEODETIC DATE 89-03-07 to 89-03-08 CHECKED BY _____

[illegible]

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 5

METRIC

W P 222-86-00

LOCATION CO-ORDS. N 4 898 966.3; E 306 500.5

ORIGINATED BY P.H.

DIST 8 HWY N/A

BOREHOLE TYPE CONTINUOUS FLIGHT AUGER (C.S.)

COMPILED BY P.H.

DATUM GEODETIC

DATE 89-03-08

CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT <u>2</u> 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
77.3	GROUND LEVEL												
5.0	BOULDERS												
	SILTY SAND, TRACE ORGANICS		1	SS	32								
	CLAYEY SILT, SOME GRAVEL		2	SS	14								
			3	SS	36								
3.0	BOULDERS		4	SS	62	2.5 cm							
73.6	FILL												
3.8	WEATHERED BEDROCK												
33.5	END OF BOREHOLE												
15	PRESUMED BEDROCK												
20	*WATER LEVEL NOT ESTABLISHED												
25													
30													
35													
40													
45													
50													
55													
60													
65													
70													
75													
80													
85													
90													
95													
96													

OFFICE REPORT ON SOIL EXPLORATION



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

WO 76-16003 LOCATION Sta. 2+11.5 ; 6.5' Rt. of Edge of Dock ORIGINATED BY SM
DIST 8 HWY N/A BORING DATE August 4, 1976 COMPILED BY SM
DATUM Geodetic BOREHOLE TYPE Washboring BX Rock Coring CHECKED BY *OP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W $W_P \quad W \quad W_L$ WATER CONTENT %	UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100			
250.1	Dock Surface					250								
0.0	6" Asphalt		1	SS	7									
	Fill - gravel & sand, some silty clay.		2	SS	7									
	Firm to Very Stiff		3	SS	26									
243.1			4	SS	8									
7.0	Timbers, some gravel, sand & silty clay. Cavities throughout.		5	SS	10									
			6	SS	9	240								
237.6	Loose		7	SS	6	10"								
12.5	Rock Fill													
	some silt		8	SS	54									
233.3			9	BX-RC	-									
16.8	Organic clay													
231.3	Very Soft		10	SS	3	26"								
18.8	Silty Clay		11	SS	16	230								
	Very Stiff to Hard		12	SS	37									
227.1														
23.0	End of Borehole													

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2

WO 76-16003 LOCATION Sta. 1 + 73.5, 5' Rt. of Edge of Dock ORIGINATED BY SM
DIST 8 HWY N/A BORING DATE August 5, 1976 COMPILED BY SM
DATUM Geodetic BOREHOLE TYPE Washboring, BX Rock Coring CHECKED BY *JP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W_P	W	W_L		
250.1	Dock Surface					250										GR SA SI CL
0.0	6" Asphalt															
	Fill - gravel & sand, some silty clay.		1	SS	5											
	Firm to Very Stiff		2	SS	29											
243.1			3	SS	11											
7.0	Sand, silt, silt and some burnt wood chips				1											
	Cavities throughout		4	SS	5	240										
	Loose		5	SS	7											
235.3			6	SS	8	4"										
14.8	Rock Fill		7	RC	-											
234.0	Organic Clay															
16.1	Very Soft															
230.1	Silty clay		8	SS	13	230										
20.0	Stiff to Very Stiff		9	SS	21											
226.6																
23.5	End of Borehole															

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 3

WO 76-16003 LOCATION Sta. 1 + 36.5 ; 5' Rt. of Edge of Dock ORIGINATED BY SM
DIST 8 HWY n/a BORING DATE August 5 & 6, 1976 COMPILED BY SM
DATUM Geodetic BOREHOLE TYPE Washboring CHECKED BY CP

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
250.1	Dock Surface					250										
0.0	6" Asphalt															
	Fill - gravel & sand, some silty clay.		1	SS	6											
			2	SS	3											
			3	SS	13											
241.4	Soft to Hard		4	SS	33	3"										
8.7	Rock fill some sand & gravel		5	SS	40	4"										
232.6	some timber		6	SS	6											
17.5	Organic clay				1											
230.1	Very Soft		7	SS	1											
20.0	Silty Clay					230										
	Stiff to Hard		8	SS	31											
224.7			9	SS	14											
25.4	End of Borehole															

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 4

WO 76-16003 LOCATION Sta. 1 + 00.5; 5' Rt. of Edge of Dock ORIGINATED BY SM
 DIST 8 HWY N/A BORING DATE August 6 & 9, 1976 COMPILED BY SM
 DATUM Geodetic BOREHOLE TYPE Washboring CHECKED BY SP

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W_P	W	W_L		
250.1	Dock Surface					250										
0.0	6" Asphalt															
	Fill - gravel & sand, some silty clay.		1	SS	6											
			2	SS	20											
			3	SS	12											
	Firm to Stiff		4	SS	13											
240.1						240										
10.0	Rock Fill - some gravel and sand.		5	SS	8											
	Timber at bottom.		6	SS	33											
235.4																
14.7	Organic Clay															
	Very Soft															
231.3			7	SS	1											
18.8					25											
	Silty Clay		8	SS	39											
	Very Stiff to Hard		9	SS	17											
220.1			10	SS	17											
30.0	End of Borehole															

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 5

W/O 76-16003 LOCATION Sta. 0 + 68.5; 6.5' Rt. of Edge of Dock ORIGINATED BY SM
 DIST 8 HWY N/A BORING DATE August 9, 1976 COMPILED BY SM
 DATUM Geodetic BOREHOLE TYPE Washboring CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
							SHEAR STRENGTH									
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
WATER CONTENT %																
250.1	Dock Surface					250										
0.0	6" Asphalt															
	Fill - gravel & sand, some silty clay.															
	Firm to Stiff		1	SS	8											
			2	SS	15											
			3	SS	9	240										
238.1																
12.0	Rock Fill - some sand trace of gravel.															
236.1	Timber at bottom		4	SS	53											
14.0	Organic Clay															
	Very Soft		5	SS	1											
232.1																
18.0	Silty Clay		6	SS	22	230										
	Very Stiff															
227.1			7	SS	19											
23.0	End of Borehole															

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 4 A (Formerly BH#4 W.O.72-11164)

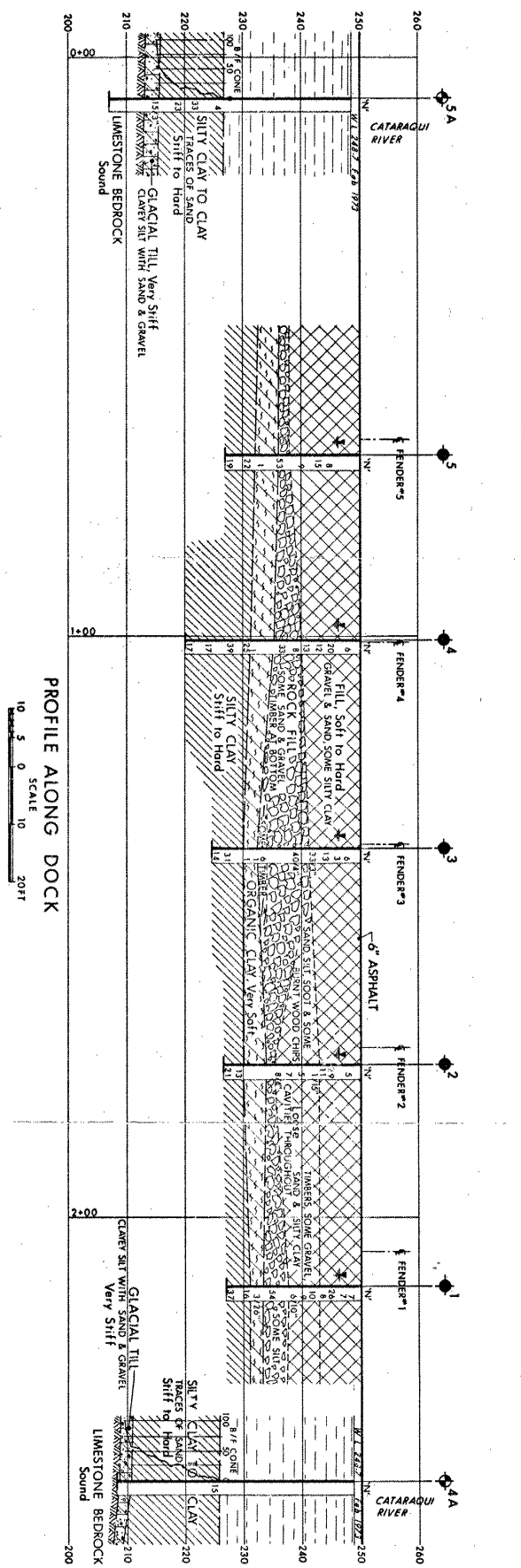
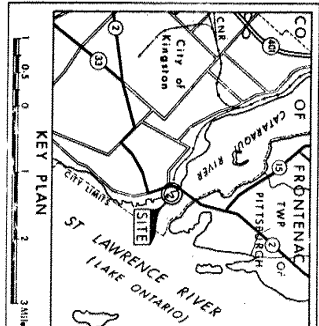
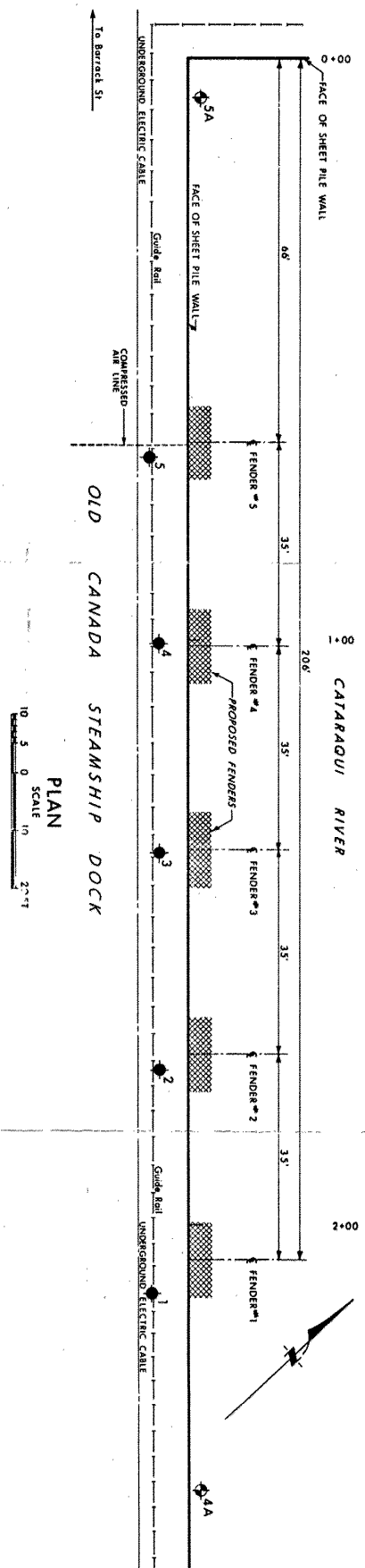
WO 76-16003 LOCATION Sta. 2 + 45 o/s 2.0' Lt. of Edge of Dock ORIGINATED BY CP
DIST 8 HWY N/A BORING DATE February 15 & 16, 1973 COMPILED BY JB
DATUM Geodetic BOREHOLE TYPE Washboring and Cone Test CHECKED BY *[Signature]*






SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			UNIT WEIGHT γ PCF	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W_P	W	W_L		
248.7	River Level															
0.0																
	WATER					240										
						230										
225.7																
23.0	Silty clay to clay with traces of sand.		1	SS	15											
	Grey		2	TW	PH	220										
	Stiff to Hard		3	TW	PH											
210.7																
38.0	Clayey silt with traces of sand & gravel (Glacial Fill)		4	TW	PH	210										
208.2	Limestone Bedrock															
40.5	End of Borehole															

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

WO 76-16003	LOCATION Sta. 0+07.0 o/s 2.0' Lt. of Edge of Dock	ORIGINATED BY CP
DIST 8 HWY N/A	BORING DATE February 13-14 & 16, 1973	COMPILED BY JB
DATUM Geodetic	BOREHOLE TYPE Washboring, Cone Test and BXL Rock Core	CHECKED BY <i>[Signature]</i>

15 ϕ 5 % STRAIN AT FAILURE



LEGEND			
	Bore Hole		
	Dynamic Cone Penetration Test (Cone)		
	Bore Hole & Cone		
	Blows/f (Std Pen Test 350ft lbs energy)		
	CONE Blows/f (60" Cone, 350ft lbs energy)		
<p>Wt at time of investigation Aug 1976</p> <p>Bore Holes AA & SA were done Feb 1973 (WO 72-11164)</p>			
No	ELEVATION	STATION	OFFSET EDGE OR DOCK
1	250.1	2+11.5	6.5' RT
2	250.1	1-73.5	5.0' RT
3	250.1	1+36.5	5.0' RT
4	250.1	1+00.5	5.0' RT
5	255.1	0+68.5	5.5' RT
4A	248.7	2+45.0	2.0' LT
5A	248.7	0+07.0	2.0' LT

-NOTE-

The boundaries between soil ¹ to have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

[illegible]

HWY No	DIST 8
SLIP/D BL	SITE
CHECKED BL	DWG 7616C03-A
DATE OCT 29, 1976	
DRAWN BY	
CHECKED BY	
APPROVED	

RECORD OF BOREHOLE No 2

METRIC

W P 181-81-01 LOCATION 1.75 Metres South of Cell #3 S. Face o/s 0.6 M. East ORIGINATED BY R.Z.
 DIST 8 HWY Ferry Terminal BOREHOLE TYPE Washboring, BXC Rock Core COMPILED BY R.Z.
 DATUM Geodetic DATE 82 06 22 CHECKED BY so

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
74.7	Lake Surface																
0.0																	
	Water																
68.2	Lake Bottom																
6.5	Grey Occ. Cobbles and Boulders																
	Silty Sand to Sandy Silt Some Shells		2	SS	23												
	Silty Clay with Gravel Trace Sand Boulder		4	SS	41												25 5 47 23
	Brown																
	Silty Sand with Pockets of Clay and Gravel Loose to Very Dense		6	SS	94												2 65 29 4
59.3			7	SS	87												15 42 21 22
15.4	Grey (Glacial Till)																
58.1	Silty Clay and Sand Some Gravel Hard		8	RC	-												
16.6	Gravel and - Boulder Sand																
57.0	With Cobbles & Boulders		9	BX RC	REC 88%												RQD = 24%
17.7	Slightly Weathered - Sand Seam		10	BX RC	REC 92%												RQD = 85%
	Dark Grey Limestone Bedrock Very Fine to Fine Crystalline Dense High Strength		11	BX RC	REC 99%												RQD = 66%
			12	BX RC	REC 82%												RQD = 75%
51.8																	
22.9	End of Borehole																
	Note: Drive N Casing to Elevation 63.7 Drill B Casing to Elevation 56.7																

+³, x⁵: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 1

METRIC

W P 181-81-01 LOCATION 1.75 Metres North of Cell #3 N. Face o/s 1.2 M. East ORIGINATED BY R.Z.
 DIST 8 HWY Ferry Terminal BOREHOLE TYPE Washboring, BXL Rock Core COMPILED BY R.Z.
 DATUM Geodetic DATE 82 06 17 CHECKED BY So

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
74.7	Lake Surface																
0.0																	
	Water																
68.3	Lake Bottom																
6.4	Occ. Cobbles and Boulders																
	Sandy Silt to Silty Sand Some Shells Pockets of Clay and Gravel Loose to Dense		2	SS	26												7 23 64 6
	Grey		4	SS	40												
	Brown		6	SS	36												1 61 33 5
60.9																	
13.8	Grey (Glacial Till) Silty Clay and Sand		8	SS	100	23 cm											18 43 25 14
59.5	Some Gravel Hard																
15.2	Gravel and Sand with Cobbles and Boulders		10	SS	120												
57.6			11	BX RC	REC 63%												RQD = 0%
17.1	Dark Grey Slightly Weathered		12	BX RC	REC 93%												RQD = 67%
	Limestone Bedrock Very Fine to Fine Crystalline Dense High Strength		13	BX RC	REC 100%												RQD = 96%
			14	BX RC	REC 96%												RQD = 94%
52.7																	
22.0	End of Borehole																
	Note: Drive N Casing to Elevation 59.3 Drill B Casing to Elevation 57.9																

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

20
15 ϕ 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY C.S.P.

W.P. 25-73-01

BORING DATE September 20 - 21, 1973

COMPILED BY C.S.P.

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Rock Core

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L WATER CONTENT %				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
245.8 0.0	Lake Level					240									GR. SA. SI. CL.	
	Water															
237.5 8.3	Rock fill and/or cobbles, boulders.															
232.5 13.3	fractured		1	BX RC	98% Rec	230										
	Bedrock - Limestone		2	BX RC	95% Rec											
228.4 17.4	Grey sound		3	BX RC	90% Rec											
	End of Borehole.					220										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3

JOB 73-11071

LOCATION As Shown on drawing

ORIGINATED BY C.S.P.

W.P. 25-71-01

BORING DATE September 17 - 20, 1973

COMPILED BY C.S.P.

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Rock Core

 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT % W_P W W_L					
245.8 0.0	Lake Level														GR.SA.SI.C
	Water														
233.3 12.5	Rock fill and/or cobbles, boulders (with sand, seams below elevation 223)		1	BX RC	30% Rec										
			2	BX RC	50% Rec										
			3	BX RC	42% Rec										
			4	BX RC	10% Rec										
			5	BX RC	90% Rec										
			6	BX RC	44% Rec										
207.3 37.9	Bedrock - limestone		7	BX RC	97% Rec										
201.5 44.8	Grey sand End of Borehole														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 4 (72-11164)

JOB 73-11071

LOCATION As shown on Drawing

ORIGINATED BY C.P.

W.P. 25-71-01

BORING DATE February 15, 1973

COMPILED BY S.O.

DATUM Geodetic

BOREHOLE TYPE Washboring & Cone Test

CHECKED BY [Signature]

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE	LIQUID LIMIT		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT	BLOWS / FOOT	PLASTIC LIMIT		
248.7	Lake Level					20 40 60 80 100	W _L	W _P		
0.0							W _P — W — W _L	W		
							WATER CONTENT %			
							15 30 45			
							WATER CONTENT %			
							15 30 45			
					</					

 20
15 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 5

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY C.S.P.

W.P. 25-73-01



BORING DATE September 13, 1973

COMPILED BY C.S.P.

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Rock Core

 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				w_p — w — w_L WATER CONTENT %					
249.6	Ground Level														GR.SA.SI.CL.	
0.0	Fill material sand & gravel (with silt, cobbles and chunks of asphalt)															
243.7																
5.9	Bedrock - Limestone		1	BX RC	93% Rec	240										
239.0	Grey sand															
10.6	End of Borehole					230										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 4

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY C.S.P.

W.P. 25-73-01

BORING DATE September 17, 1973

COMPILED BY C.S.P.

DATUM Geodetic

BOREHOLE TYPE Wash Boring, BX Rock Core

CHECKED BY *VR*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W $W_P \quad W \quad W_L$				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT %					
245.8 0.0	Lake Level															
	Water					240										
233.8 12.0	Limestone rock fill with concrete pieces.		1	BX RC	33% Rec	230										
228.2 17.6	Bedrock - limestone		2	BX RC	90% Rec											
223.5 22.3	Grey sand		3	BX RC	100% Rec											
	End of Borehole.					220										

OFFICE REPORT SOIL EXPLORATION

FOUNDATIONS OFFICE

JOB 72-11071 LOCATION As Shown on Drawing ORIGINATED BY C.D.
W.P. 25-71-01 BORING DATE February 13 - 14, 1973 COMPILED BY S.O.
DATUM Geodetic BOREHOLE TYPE Washboring, Cone Test & BXL Rock Core CHECKED BY SKL

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w w_p ——— w ——— w_L WATER CONTENT % 15 30 45	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE					
248.7 0.0	Lake Level								
	Water								
226.7 22.0	Silty clay to clay with traces of sand. Grey. Stiff to very stiff.		1	SS	4				
			2	SS	33				
			3	SS	23				
215.7 33.0	Clayey si. with traces of sa. & gr. (Glacial till)		4	SS	15/1				
213.1 35.6	Bedrock - Limestone		5	RC BXL	80%				
207.1 41.6	Grey sand		6	RC BXL	95%				
	End of Borehole.								

20
15 ϕ 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 6

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY C.S.P.

W.P. 25-73-01

BORING DATE September 21, 1973

COMPILED BY C.S.P.

DATUM Geodetic

BOREHOLE TYPE Washboring and BX Rock Core

 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT — w w_p — w — w_L			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT %				
245.8	Lake Level														
0.0	Water														
239.6						240									
6.2	Cobbles														
7.0	Bedrock - Limestone		1	BX RC	93% Rec										
233.6	Grey sand														
12.2	End of Borehole					230									

 20
15 ϕ 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 7

JOB 73-11071 LOCATION As Shown on Drawing ORIGINATED BY J.B.
 W.P. 25-73-01 BORING DATE September 24, 1973 COMPILED BY C.S.P.
 DATUM Geodetic BOREHOLE TYPE Washboring and BX Rock Core CHECKED BY CK




SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT			PLASTIC LIMIT — w_p				
							SHEAR STRENGTH P.S.F.			WATER CONTENT — w				
249.2	Ground Level													
0.0	Fill material - sand and gravel													
245.5	Gray													
3.7	Bedrock - Limestone		1	BX RC	100% Rec									
			2	BX RC	100% Rec									
240.5	Grey sand													
8.7	End of Borehole.					240								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 8

JOB 73-11071 LOCATION As Shown on Drawing ORIGINATED BY J.B.
 W.P. 25-73-01 BORING DATE September 24, 1973 COMPILED BY C.S.P.
 DATUM Geodetic BOREHOLE TYPE Washboring and BX Rock Core CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		W_P W W_L WATER CONTENT %			
250.2	Ground Level											GR.SA.SI.CL.
0.0	Fill material - sand, gravel, and cobbles											248.2
244.6	Brown sand											
5.6	Bedrock - Limestone		1	BX RC	90% Rec							
239.6	Grey sand		2	BX RC	100% Rec							
10.6	End of Borehole.					240						


20
15 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 9

JOB 73-11071 LOCATION As Shown on Drawing ORIGINATED BY J.B.
 W.P. 25-73-01 BORING DATE September 24, 1973 COMPILED BY C.S.P.
 DATUM Geodetic BOREHOLE TYPE Washboring and BX Rock Core CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L WATER CONTENT %				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
250.7	Ground Level															
0.0	Topsoil		1	BX RC	50% Rec	250										
0.6	Bedrock - fract. & weath. sound Limestone		2	BX RC	100% Rec											
242.7	Grey															
8.0	End of Borehole.					240										

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 10

FOUNDATIONS OFFICE

JOB. 73-11071

LOCATION AS Shown on Drawing

ORIGINATED BY J.B.

W.P. 25-73-01

BORING DATE September 25, 1973

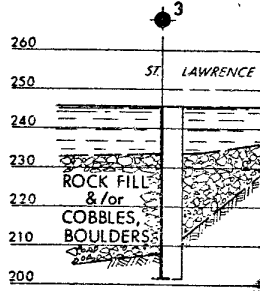
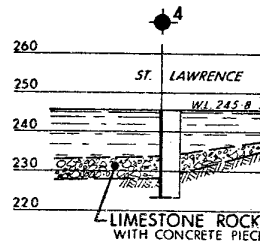
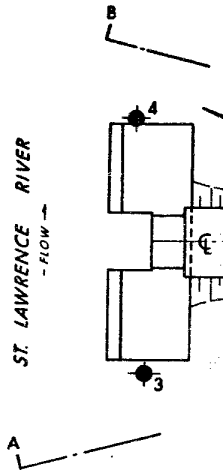
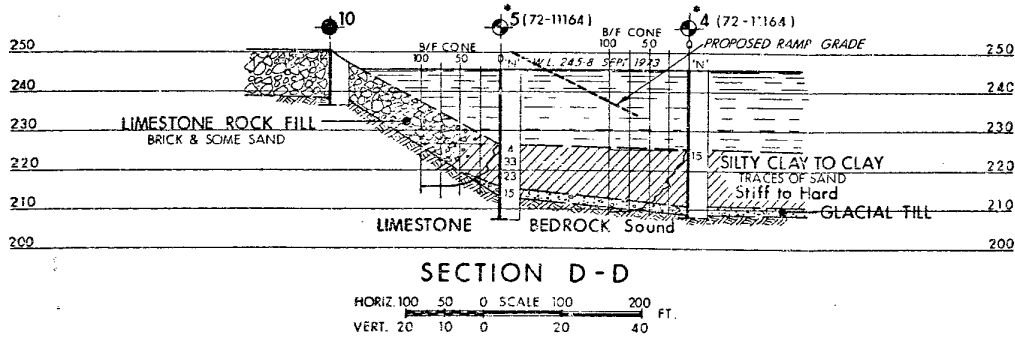
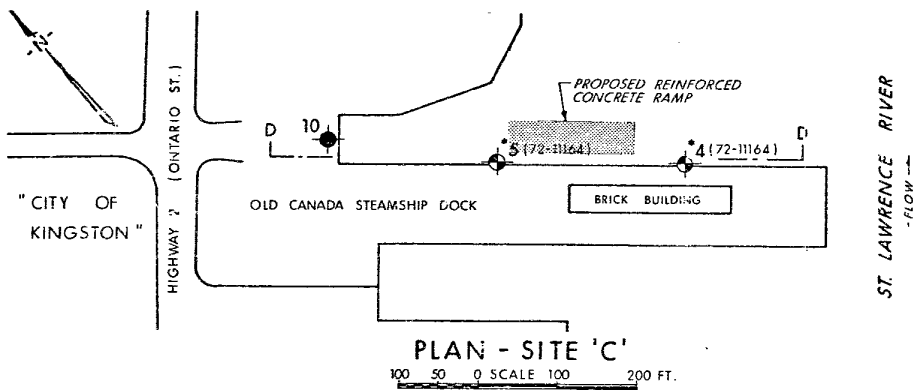
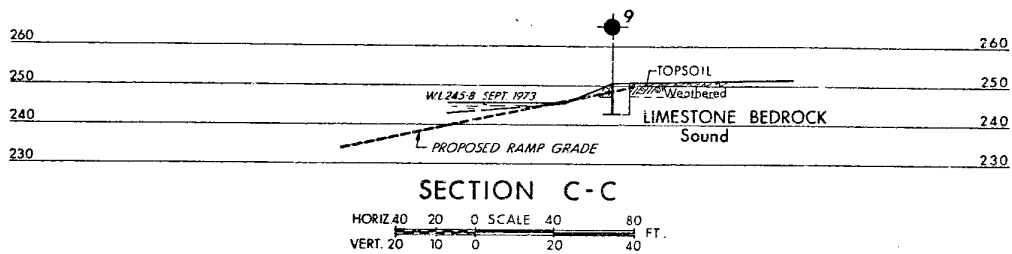
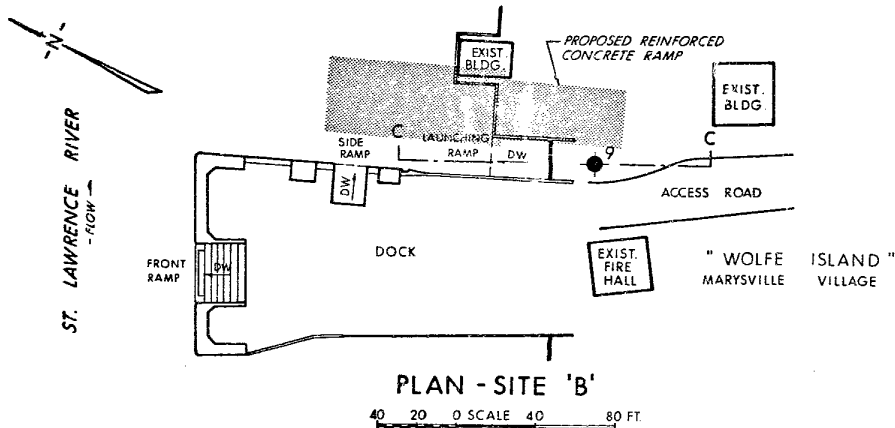
COMPILED BY C.S.D.

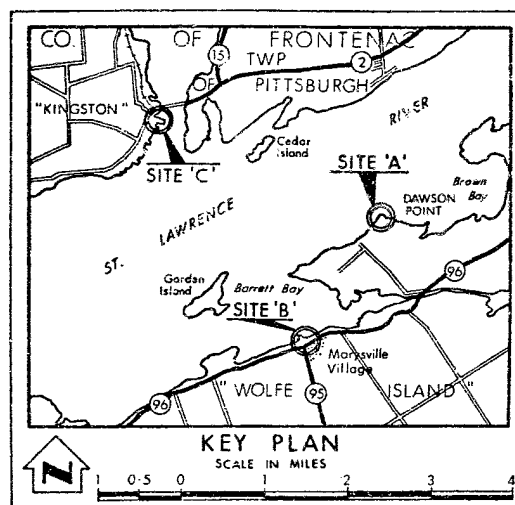
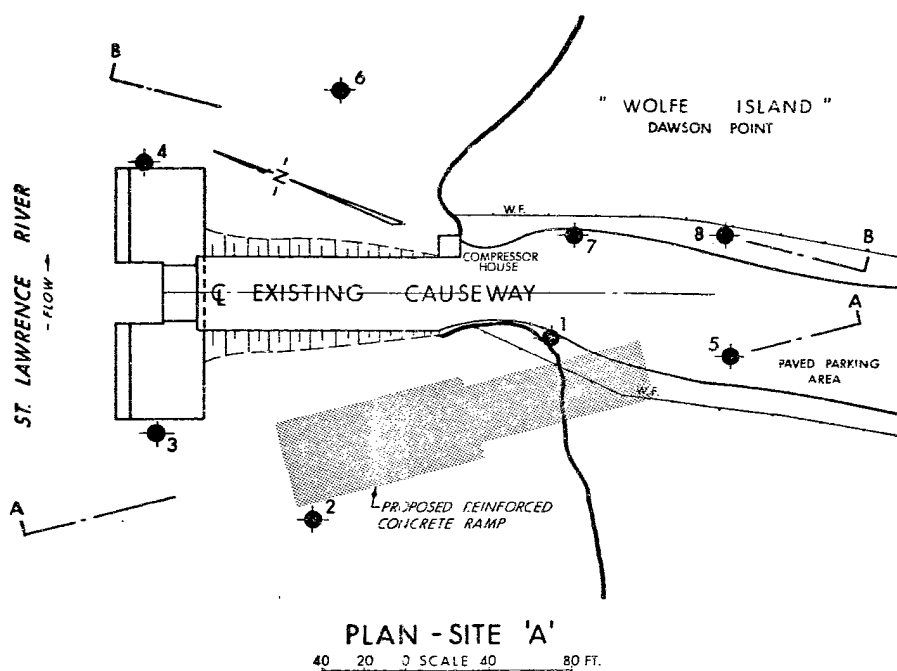
DATUM

BOREHOLE TYPE Washboring and BX Rock Core

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w w_p ——— w ——— w_L			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT %				
250.6	Ground Level					250									
0.0	Topsoil														
0.5	Fill material -														
	Limestone rock fill, bricks and some sand.														
			1	BX RC	43% Rec	240									
			2	BX RC	10% Rec										
238.2	Bedrock -		3	BX RC	70% Rec										
12.4	limestone														
236.4	Gray fractured		4	BX RC	100% Rec										
14.2	End of Borehole.					230									





LEGEND			
	Bore Hole		
	Cone Penetration Test		
	Bore Hole & Cone Test		
	Water Levels established at time of field investigation, SEPT. 1973		
NO.	ELEVATION	LOCATIONS AS SHOWN ON DWG.	
1	248.6		
2	245.8		
3	245.8		
4	245.8		
4*	248.7		
5	249.6		
5*	248.7		
6	245.8		
7	249.2		
8	250.2		
9	250.7		
10	250.6		

* BORE HOLES FROM PREVIOUS REPORT 72-11164

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE

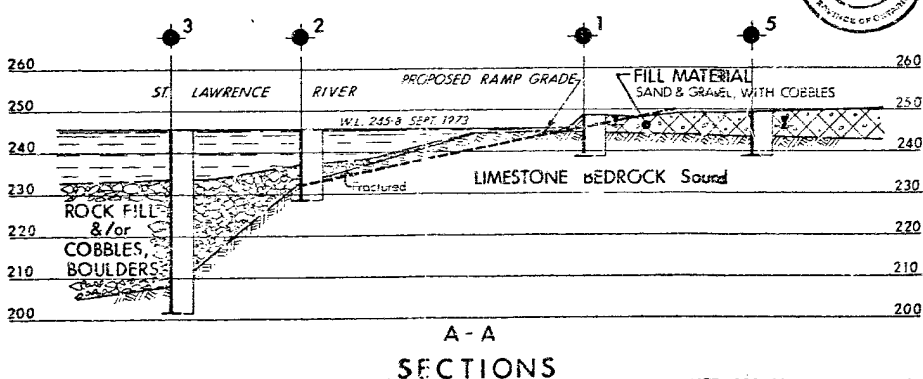
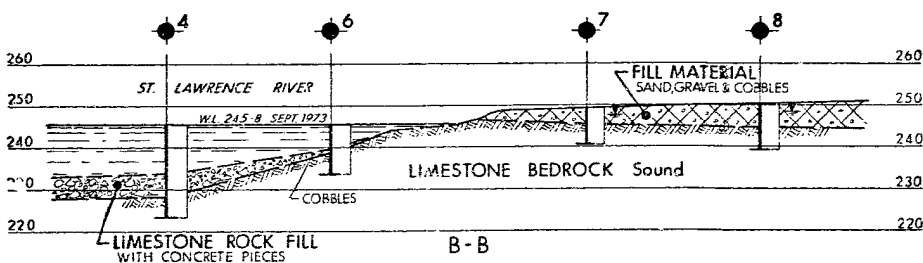
PROPOSED TERMINALS KINGSTON-WOLFE ISL. FERRY SERVICE

HIGHWAY NO. _____ DIST. NO. 5
CO. FRONTENAC
TWP. WOLFE ISLAND CITY OF KINGSTON

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD. C.P. CHECKED <input checked="" type="checkbox"/>	WP. NO. 25-73-01	DRAWING NO.
DRAWN S.O. CHECKED <input checked="" type="checkbox"/>	WO. NO. 73-11071	73-11071A
DATE 17 OCT 1973	SITE NO.	BRIDGE DRAWING NO.
APPROVED <i>W. J. M. J.</i>	CONF. NO.	
PRINCIPAL FOUNDATION ENGINEER		

890-TRAC-100-0-72



HORIZ. 40 20 0 SCALE 40 80 FT.
VERT. 20 10 0 20 40

NOTE FOR CONTRACT DOCUMENTS

The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the KINGSTON District Office.

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 20

FOUNDATIONS OFFICE

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY J.B.

W.P. 25-73-01

BORING DATE October 4 - 9, 1973

COMPILED BY C.S.P.

DATUM Geodetic

BOREHOLE TYPE Wash Boring and BX Rock Core

CHECKED BY *JK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT W_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT			PLASTIC LIMIT W_P				
						SHEAR STRENGTH P.S.F.			W_P — W — W_L					
						○ UNCONFINED + FIELD VANE			WATER CONTENT %					
						* QUICK TRIAXIAL x LAB VANE			10 20 30					
245.8	Lake Level													
0.0														
	Water													
228.8														
17.0	Gravel, some sand (with boulders below elevation 226)		1	SS	7									
224.4	Grey Loose													
21.4	Bedrock - limestone		2	BX RC	45% Rec									
221.6	Grey sound		3	BX RC	100% Rec									
24.2	End of Borehole													

20
15 ϕ 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 21

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY J.B.

W.P. 25-73-01

BORING DATE October 9 - 10, 1973

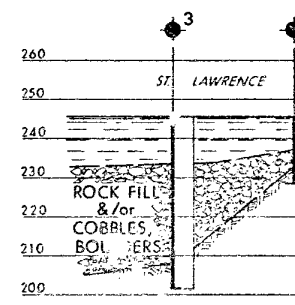
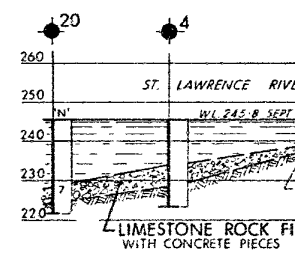
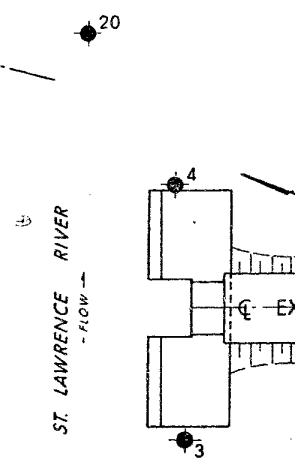
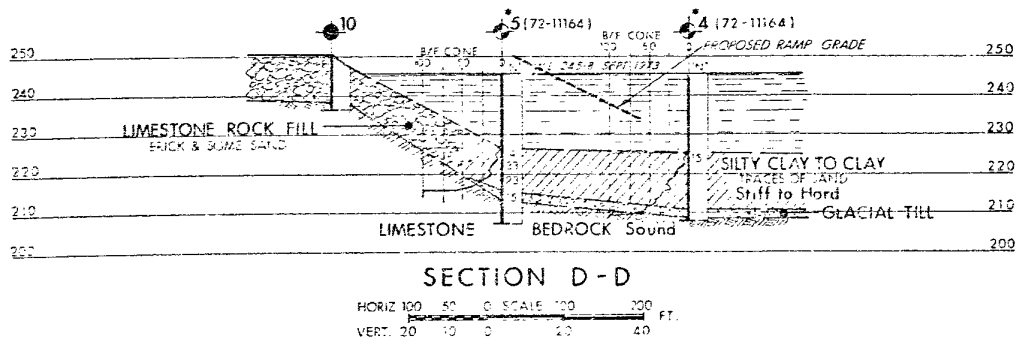
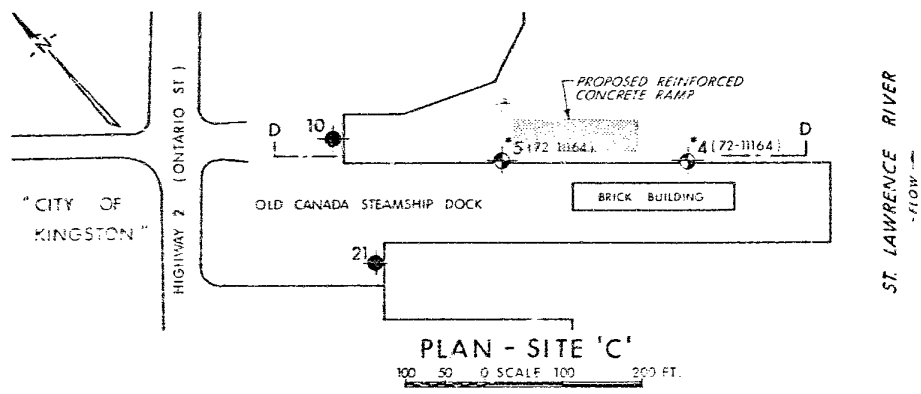
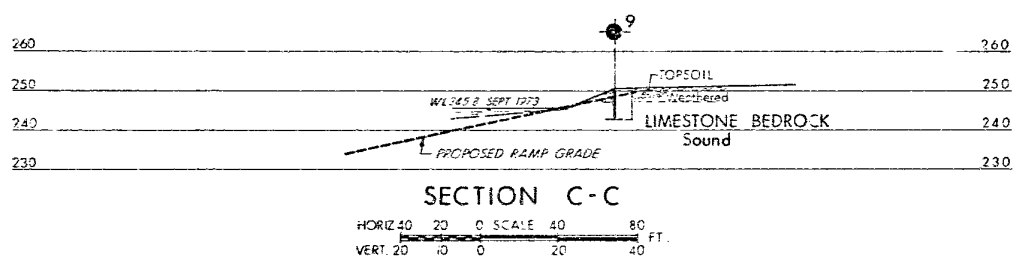
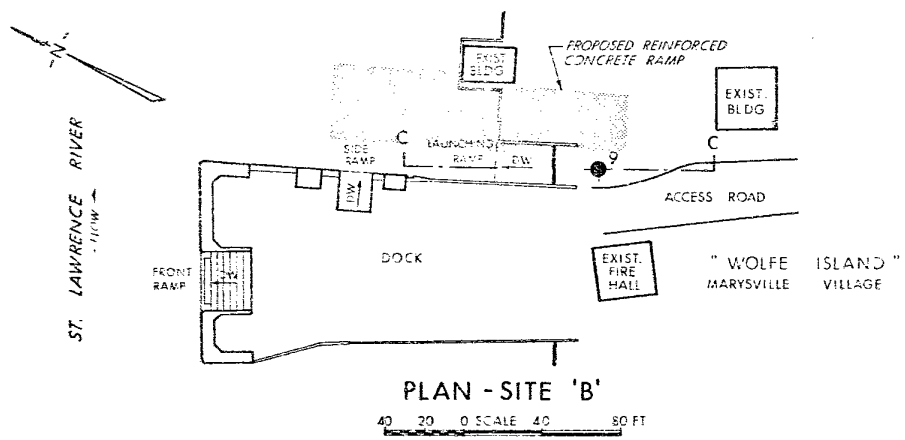
COMPILED BY C.S.P.

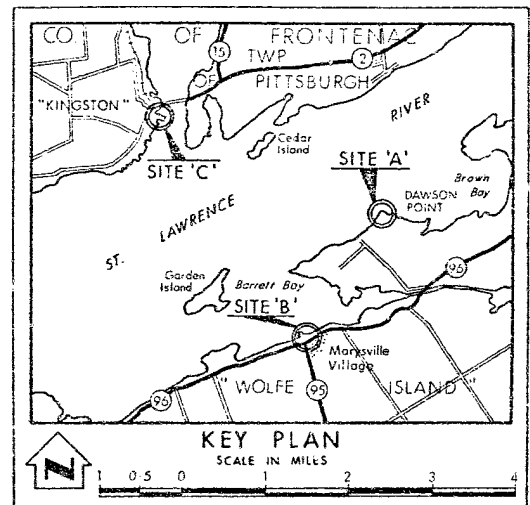
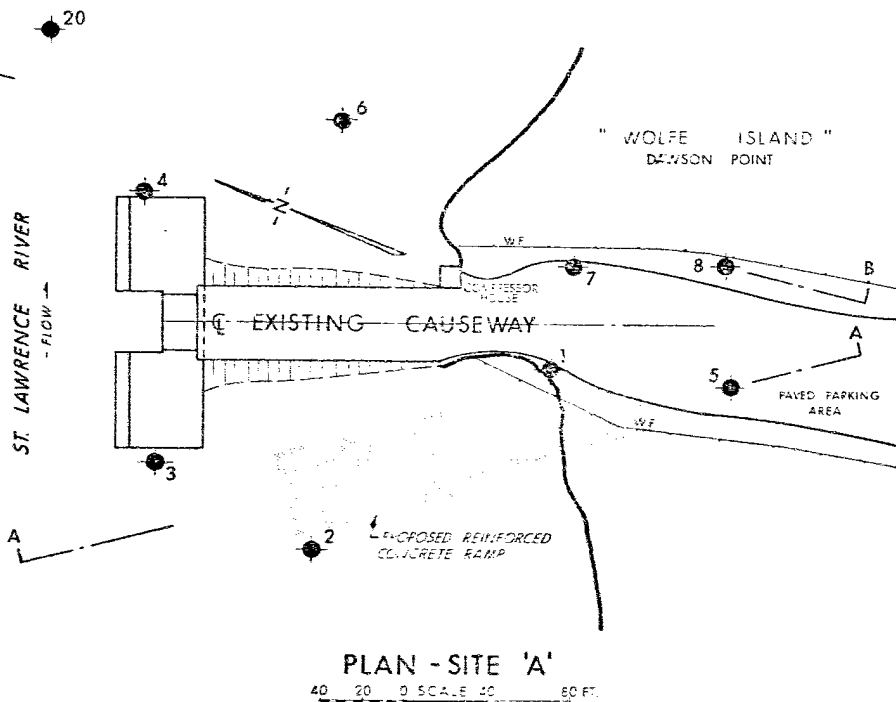
DATUM Geodetic

BOREHOLE TYPE Wash Borings and BX Rock Core

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.		W_P — W — W_L 10 20 30			
250.6	Ground Level											
0.0	Fill Material					250						
	Gravel, sand, silt and trace of organics		1	SS	13							
243.1			2	SS	15							
7.5			3	SS	95bouncing	240						
	Wood and Sand		4	SS	2							
			5	SS	3							
234.1												
16.5	Clayey silt, some sand and gravel		6	SS	19							
	Grey											
230.4	Very stiff to hard		7	SS	64bouncing	230						
20.2	End of Borehole.											
	Probably bedrock											

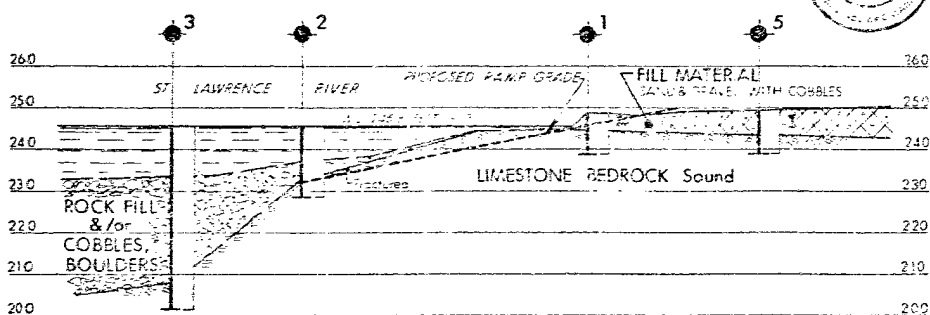
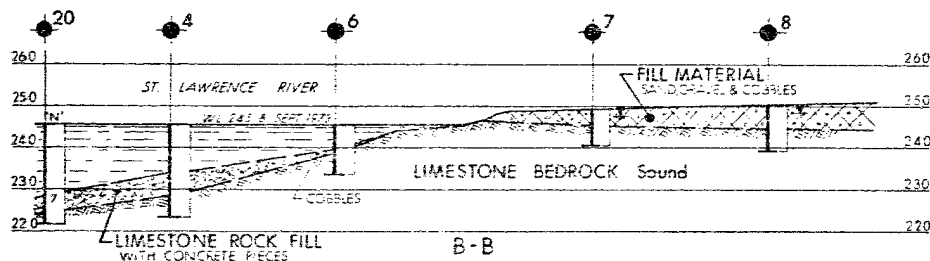




LEGEND		
	Bore Hole	
	Cone Penetration Test	
	Bore Hole & Cone Test	
	Water Levels established at time of field investigation, SEPT. 1973	
NO.	ELEVATION	
1	248.6	LOCATIONS AS SHOWN ON DWG.
2	245.8	
3	245.8	
4	245.8	
4*	245.8	
5*	248.7	
6	249.6	
7	248.7	
8	245.8	
9	249.2	
10	250.2	
20	250.7	
21	250.6	

* BORE HOLES FROM PREVIOUS REPORT 72-11164

NOTE
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.



A-A SECTIONS

HORIZ. 40 20 0 SCALE 40 80 FT.
VERT. 20 10 0

NOTE FOR CONTRACT DOCUMENTS

The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the Kingston District Office.

REVISED	DATE	DESCRIPTION
73-11071A	8/1	BORE HOLES 20 & 21 ADDED

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE			
PROPOSED TERMINALS KINGSTON-WOLFE ISL. FERRY SERVICE			
HIGHWAY NO. _____	DIST. NO. 8		
CO. FRONTENAC			
TWP. WOLFE ISLAND	CITY OF KINGSTON		
BORE HOLE LOCATIONS & SOIL STRATA			
SUBWD. C.P. _____	CHECKED: _____	W.P. NO. 73-73-01	DRAWING NO. _____
DRAWN S.P. _____	CHECKED: _____	A.D. NO. 73-11071	73-11071A
DATE OF FIELD INVESTIGATION: 7/73	SITE NO. _____		BRIDGE DRAWING NO. _____
APPROVED: _____	CONT. NO. _____		

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N^o 101

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY C.S.P.

W.P. 25-73-01

BORING DATE Jan. 8 - 9, 1974

COMPILED BY C.S.P.

DATUM I.G.L.D.

BOREHOLE TYPE Washboring and BX Rock Core

CHECKED BY

SOIL PROFILE				SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w		BULK DENSITY γ P.C.F.	REMARKS
ELEV. Ft.	DEPTH Ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (100 mm)	ELEV. SCALE Ft.	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT %		
74.7	245.0	Water Level										
0.0	0.0	Water					240 73					
70.2	230.2						230					
4.5	14.7	Silt, sand some gravel		1A	SS	wt.	of 70					
69.4	227.5	Grey loose to compact		1	SS	12	rods					
5.3	17.5	Bedrock - Limestone			BX	95%						
67.9	222.5	Grey Sound		2	RC	Rec						
6.8	22.5	End of Borehole					220 67					

OFFICE REPORT ON OIL EXPLORATION

20
15 ϕ 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 102

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY C.S.P.

W.P. 25-73-01

BORING DATE Jan. 9 - 10, 1974

COMPILED BY C.S.P.

DATUM I.G.L.D.

BOREHOLE TYPE Washboring and BX Rock Core

CHECKED BY [Signature]

SOIL PROFILE				SAMPLES			ELEV. SCALE ft. m	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w $w_p \quad w \quad w_L$				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH ft. m	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0-3m)	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT %							
74.7	245.0	Water Level														GR.SA.SI.CL.	
0.0	0.0	Water				240 73											
70.4	230.8					230 70											
4.3	14.2	Sand and gravel, comp.		1	SS	13											
4.7	15.5	Bedrock - Limestone		2	BX	97%											
68.6	225.0	Grey Sound			RC	Rec.											
6.1	20.0	End of Borehole				220 67											

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 103

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY CSP

W.P. 25-73-01

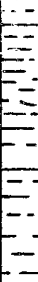



BORING DATE January 17 - 18, 1974

COMPILED BY CSP

DATUM I.C.L.D.

BOREHOLE TYPE Wash Boring

CHECKED BY SR

SOIL PROFILE				SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L WATER CONTENT %				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PICT	NUMBER	TYPE	BLOWS/FOOT 10.3 m.	ELEV. SCALE ft. / m.	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
m. 74.7	245.0	Water Level														
	0.0	Water					240									
							73									
							230									
							70									
68.3	224.0															
6.4	21.0	sand-some gravel		1	SS	1/2	ft.									
67.4	221.0	black-very loose					220									
7.3	24.0	Silty clay with trace of sand		2	SS	20	67									
64.9	213.0	Grey-Stiff to very stiff		3	TW	PM										
9.8	32.0	End of Borehole Probably Bedrock					210									
							64									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 104

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY CSP

W.P. 25-73-01

BORING DATE January 22, 1974

COMPILED BY CSP

DATUM I.G.L.D.

BOREHOLE TYPE Dynamic Cone Penetration Test

CHECKED BY SR

SOIL PROFILE				SAMPLES			DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT —w _L			BULK DENSITY γ	REMARKS	
m.	ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0-3m)	BLOWS / FOOT (0-3m)				PLASTIC LIMIT —w _p					WATER CONTENT % w _p — w — w _L
							20	40	60	80	100	SHEAR STRENGTH P.S.F.				
							○ UNCONFINED + FIELD VANE									
							● QUICK TRIAXIAL x LAB VANE									
74.7	245.0	Water Level												P.C.F.	GR.SA.SI.CL.	
0.0	0.0	Water														
69.1	226.5															
5.6	18.5	probably sand, some silt, trace of gravel														
65.8	215.7	very loose to compact														
8.9	29.3	End of Cone Test														

20
15 5 % STRAIN AT FAILURE
10

OFFICE REPORT OF SOIL EXPLORATION

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 105

FOUNDATIONS OFFICE

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY CSP

W.P. 25-73-01

BORING DATE January 22, 1974

COMPILED BY CSP

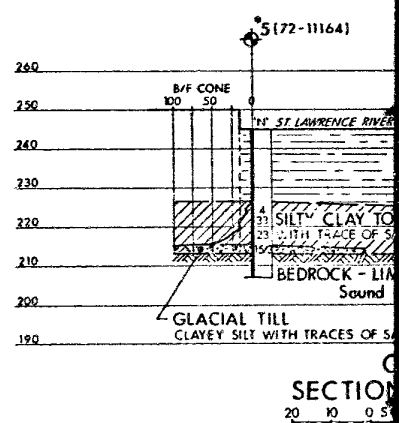
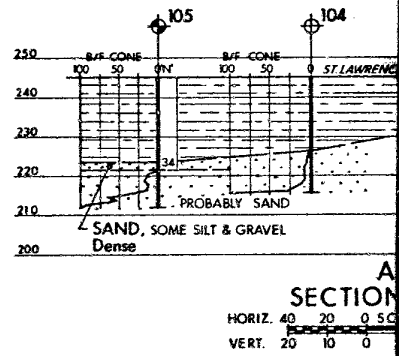
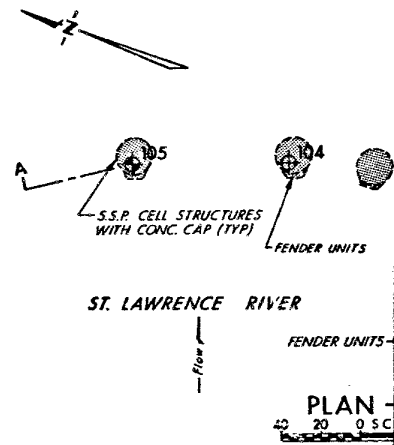
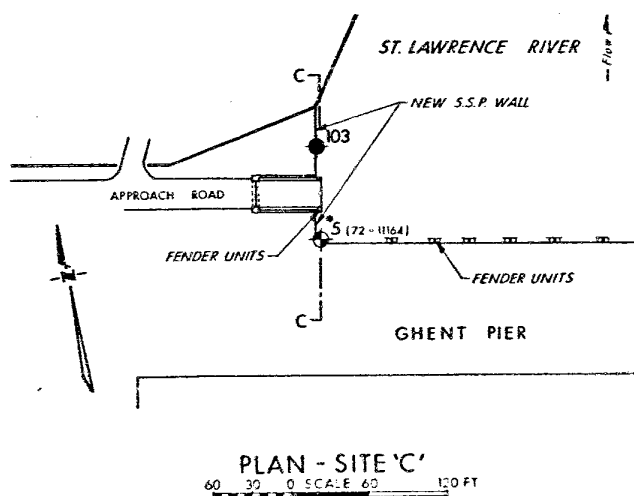
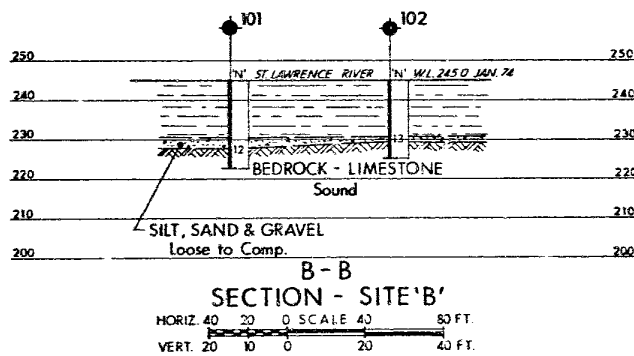
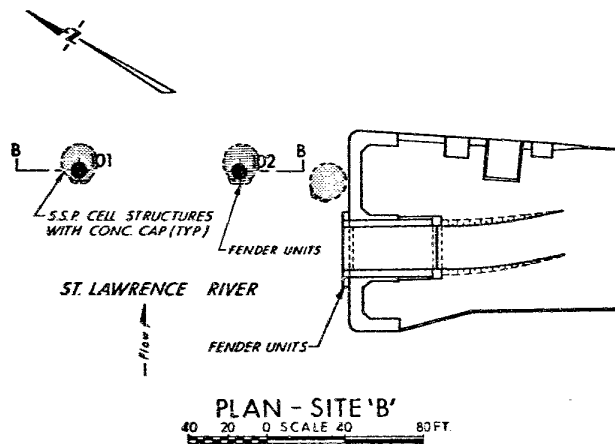
DATUM I.G.T.D.

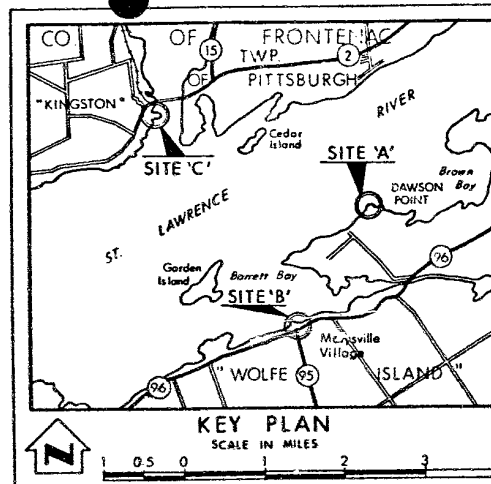
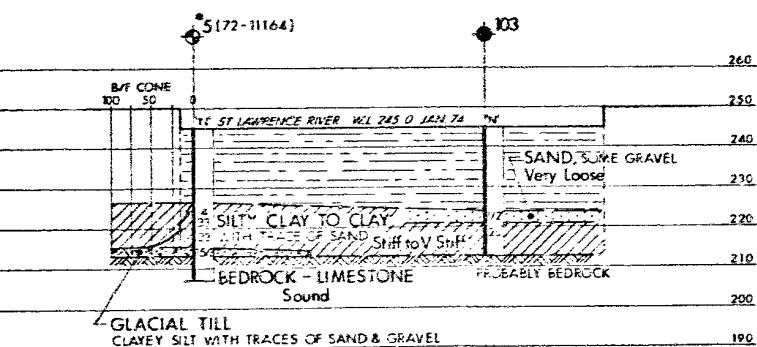
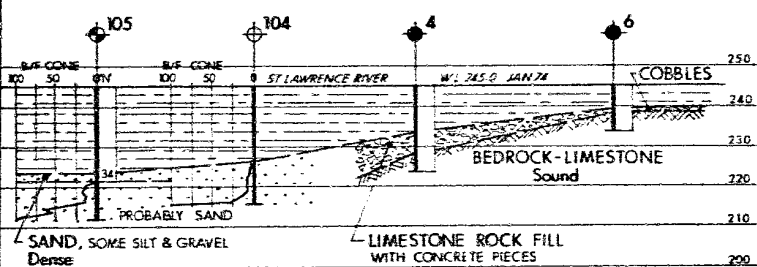
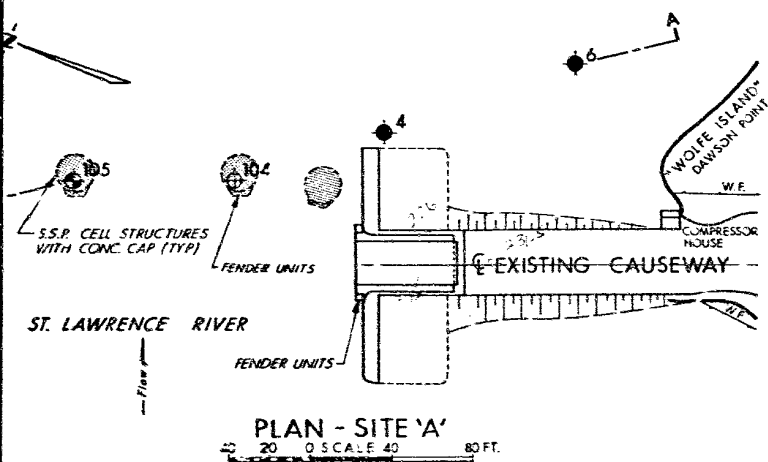
BOREHOLE TYPE Wash boring and dynamic cone penetration test

CHECKED BY SR

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3m)				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w				BULK DENSITY γ	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0.3m)	ELEV. SCALE ft.	20	40	60	80	100	w_p	w	w_L	
m. 74.7	245.0	Water Level													
0.0	0.0	Water				240									
						73									
						230									
						70									
68.1	223.5														
67.5	221.5	sand, some silt, gravel	1	SS	34										
7.2	23.5	End of Borehole				220									
		Probably sand, some silt and gravel				67									
64.6	212.0	compact-v. dense													
10.1	33.0	End of Cone Test				210									
						64									

20
15 ϕ 5 % STRAIN AT FAILURE
10





LEGEND		
	Bore Hole	
	Cone Penetration Test	
	Bore Hole & Cone Test	
	Water Levels established at time of field investigation, Sept. 73 & Jan. 74	
NO.	ELEVATION	
4*	245.8	LOCATIONS AS SHOWN ON DWG.
5*	246.7	
6*	245.8	
101	245.0	
102	245.0	
103	245.0	
104	245.0	
105	245.0	

* BORE HOLE FROM PREVIOUS REPORT 72-11164
* BORE HOLES CARRIED OUT IN SEPT. 1973

NOTE FOR CONTRACT DOCUMENT:

The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the KINGSTON District Office.

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE

PROPOSED TERMINALS KINGSTON - WOLFE ISL. FERRY SERVICE

HIGHWAY NO. _____ DIST. NO. 8
CO. FRONTENAC
TWP. WOLFE ISLAND CITY OF KINGSTON

BORE HOLE LOCATIONS & SOIL STRATA

SUBNO. C.P.	CHECKED <input checked="" type="checkbox"/>	W.P. NO. 25-73-01	DRAWING NO.
DRAWN S.R.	CHECKED <input checked="" type="checkbox"/>	W.O. NO. 73-11071	73-11071B
DATE	6 FEB 1974	SITE NO.	BRIDGE DRAWING NO.
APPROVED		CONT. NO.	



DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 33

FOUNDATIONS OFFICE

JOB 73-11071

LOCATION As Shown on Drawing 73-11071A

ORIGINATED BY JB

W.P. 25-73-01

BORING DATE April 17, 1974

COMPILED BY CSP

DATUM I.G.L.D.

BOREHOLE TYPE Hollow Stem Auger, BX Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ft/m ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P W W_L WATER CONTENT %		BULK DENSITY γ	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (60 lb. 30 in.)		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					
75.3 0.0	247.1 0.0	Ground Level										P.C.F. GB SA SI CL
		Fill Material										
		Rock fill										
73.0 2.3	239.6 7.5	Silt, sand and decayed wood pieces.		1	SS	54						
				2	SS	3876	bouncing					
69.2 6.1	227.1 20.0	Gravel, traces of sand with occ. cobbles.		3	RC BX	-						
67.7 7.6	222.1 25.0	Bedrock Limestone		4	RC BX	100% Rec	220 67.1					
65.2 9.1	217.1 30.0	Grey Sound										
		End of Borehole										
							210 64.0					

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 31

JOB 73-11071

LOCATION As shown on Drawing 73-11071A

ORIGINATED BY JB

W.P. 25-73-01

BORING DATE April 16, 1974

COMPILED BY CP

DATUM I.G.L.D.

BOREHOLE TYPE Hollow Stem Auger, BX Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT			BULK DENSITY	REMARKS
ELEV.	DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				W _L	W _P	W		
75.9	249.0	Ground Level					SHEAR STRENGTH P.S.F.				WATER CONTENT %				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				W _P	W	W _L		
0.0	0.0	Fill Material rock fill with occ. lenses of grey silty clay	1	SS	100/9"										GR SA. SI. CL.
73.8	242.0		2	SS	bouncing										▼ 247.0
2.1	7.0	Sand, silt and gravel with pockets of organics	3	SS	12	240									75.3
			4	SS	42	73.2									4,88, (8)
21.0	233.0														23,63,12, 2
4.9	16.0	Silty sand with some gravel. Compact	5	SS	12	230									9,55,32, 4
70.3	230.5		6	PC	80"	70.1									
5.6	18.5	Bedrock Limestone													
68.6	225.1	Grey Sound	7	BX	91"										
7.3	23.9	End of Borehole													
						220									
						67.1									

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 32

FOUNDATIONS OFFICE

JOB 73-11071

LOCATION As shown on drawing 73-11071A

ORIGINATED BY JB

W.P. 25-73-01

BORING DATE April 18, 1974

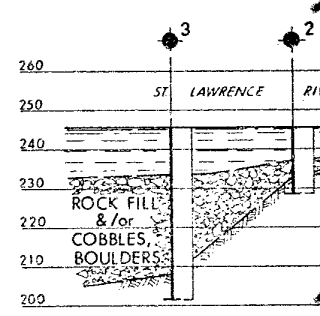
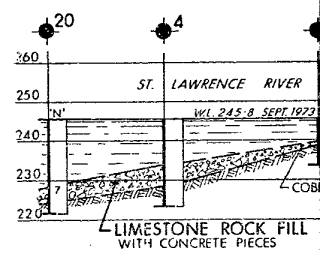
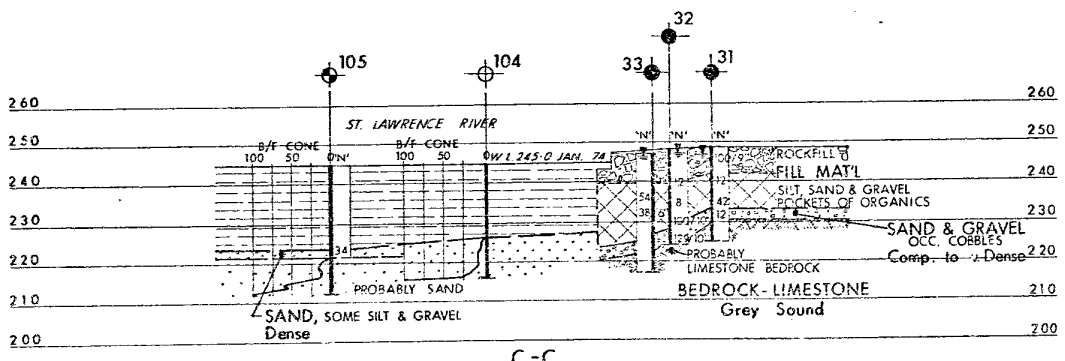
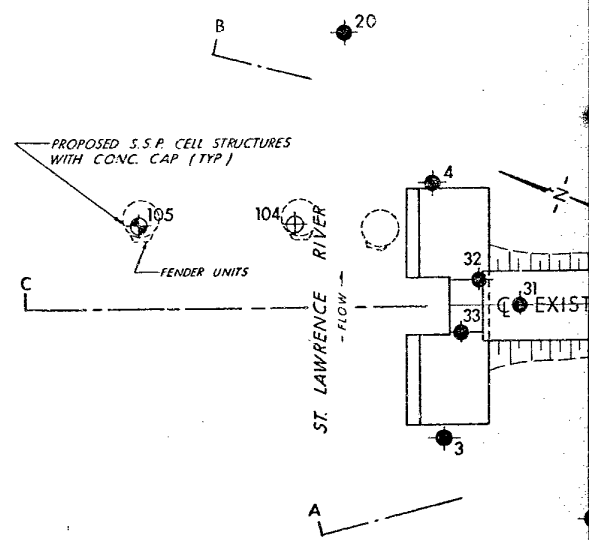
COMPILED BY Cp

DATUM I.G.L.D.

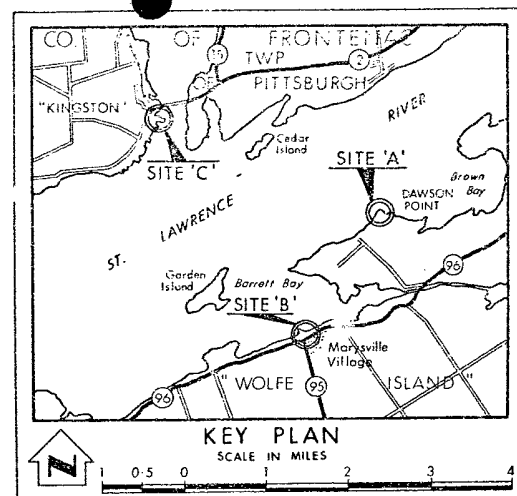
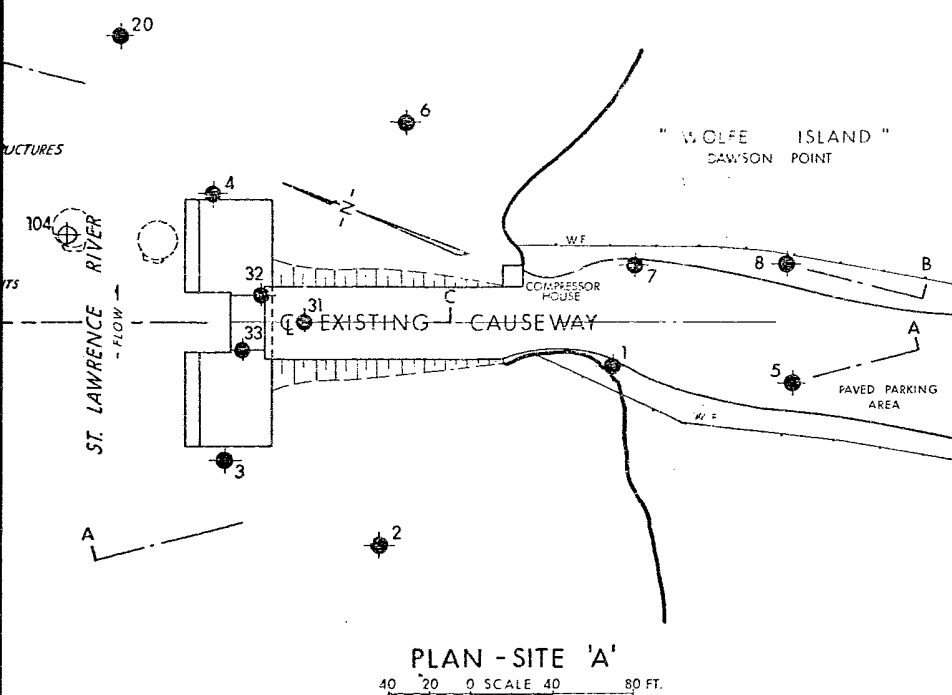
BOREHOLE TYPE Hollow Stem Auger, BX Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			ft./m	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L		BULK DENSITY	REMARKS
ELEV. DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (60.3m)		BLOWS / FOOT	PLASTIC LIMIT — w_p	WATER CONTENT — w	WATER CONTENT %		
m						ELEV. SCALE	SHEAR STRENGTH P.S.F.		w_p — w — w_L			
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE		10 20 30		P.C.F.	GR. SA. SI. CL.
75.8	248.7	Ground Level										
0.0	0.0	Fill Material										247.2
		Rock Fill										75.4
73.1	239.7		1	SS	12	240						
2.7	9.0	Sand, gravel, traces of silt & clay with occ. inclusion of organics.	2	SS	8	73.2						
			3	SS	1007	0" 230						19, 63, (18)
69.7	228.7					70.1						
6.1	20.0	Sand & gravel with fragments of limestone	4	SS	1297	0"						21, 52, 24, 3
68.4	224.3	Very Dense	5	SS								
7.4	24.4	End of Borehole Probably limestone bedrock										
						220						
						67.1						



HORIZ
VERT.



LEGEND		
	Bore Hole	
	Cone Penetration Test	
	Bore Hole & Cone Test	
	Water Levels established at time of field investigation, SEPT. 1973	

NO.	ELEVATION	
1	248.6	
2	245.8	
3	245.8	
4	245.8	
5	249.6	
6	245.8	
7	249.2	
8	250.2	
20	245.8	
104	245.0	
105	245.0	
31	249.0	
32	248.7	
33	247.1	

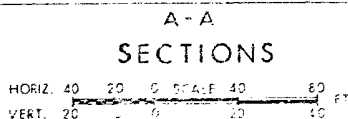
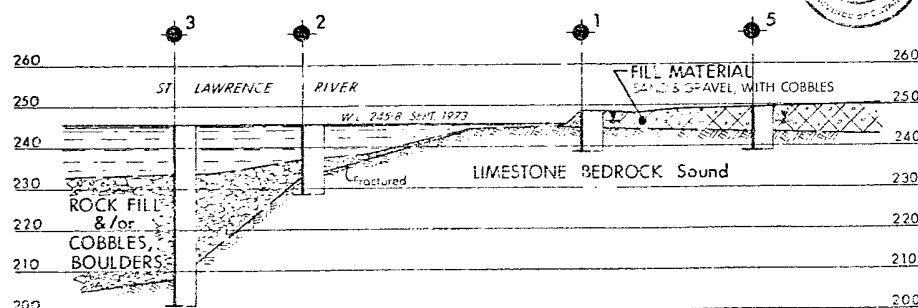
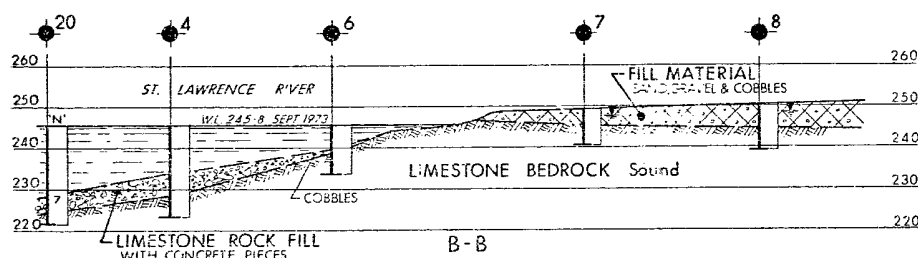
LOCATIONS AS SHOWN ON DWG.

JAN. 1974

APR. 1974

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

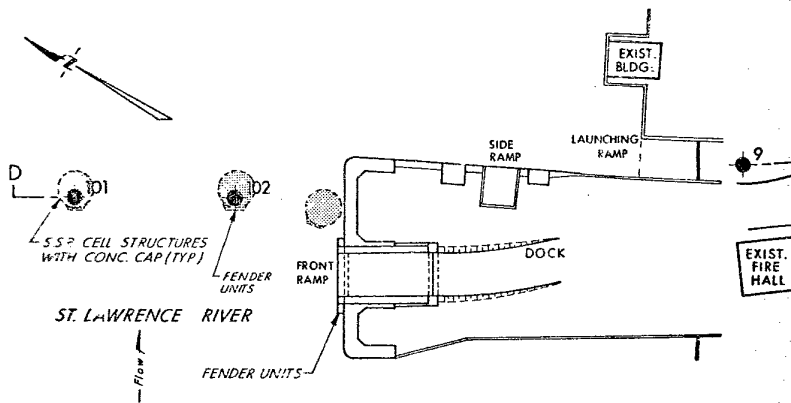


NOTE FOR CONTRACT DOCUMENTS

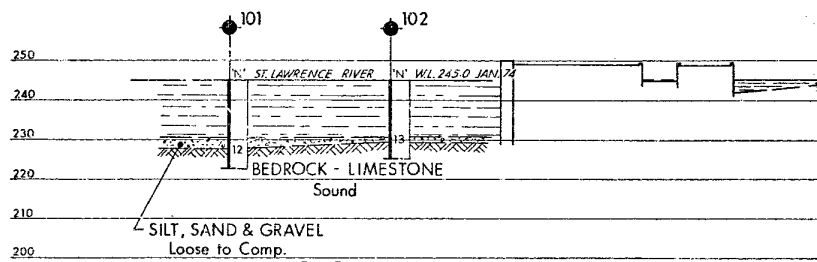
The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the Kingston District Office.

REVISIONS		DATE		BY	DESCRIPTION
APR. 74	2	REVISED DWG., SUPERCEDES DWG. 73-11071A, OCT. 11, 1973			

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO			
ENGINEERING SERVICES BRANCH—GEOTECHNICAL OFFICE			
KINGSTON—WOLFE ISL. FERRY SERVICE			
PROPOSED TERMINAL AT DAWSON POINT			
HIGHWAY NO.	SITE 'A'	DIST. NO.	8
CO.	FRONTENAC		
TWP.	WOLFE ISLAND		
BORE HOLE LOCATIONS & SOIL STRATA			
SUBMD. C.P.	CHECKED	WF. NO.	25-73-01
DRAWN	S.O.	CHECKED	WF. NO. 73-11071
DATE	7 MAY 1974	SITE NO.	
APPROVED		CONT. NO.	
		DRAWING NO. 73-11071A	
		BRIDGE DRAWING NO.	



20 20 0 SCALE 40 80 FT.



HORIZ. 40 20 0 SCALE 40 80 FT.
VERT. 20 10 0 20 40 FT.

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 101

FOUNDATIONS OFFICE

JOB 73-1101

LOCATION As Shown on Drawing

ORIGINATED BY G.S.L.

W.P. 26-73-03

BORING DATE Jan. 8 - 9, 1974

COMPILED BY G.S.L.

DATUM T.T.T.D.

BOREHOLE TYPE Washboring and BX Rock Core

CHECKED BY *[Signature]*

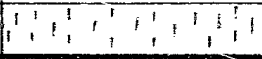
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ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F. O UNCONFINED ● QUICK TRIAXIAL + FIELD VANE X LAB VANE	PLASTIC LIMIT W_p	WATER CONTENT % W W_L		
70.0	154.5			210 73						
69.0	153.5			230 0770 nodes						
68.5	Silt, sand some gravel very loose to compact		1A SS 1 SS							
67.5	bedrock - limestone		RX 95% RC							
67.0	very sound		2							
66.0	end of borehole			220 67						

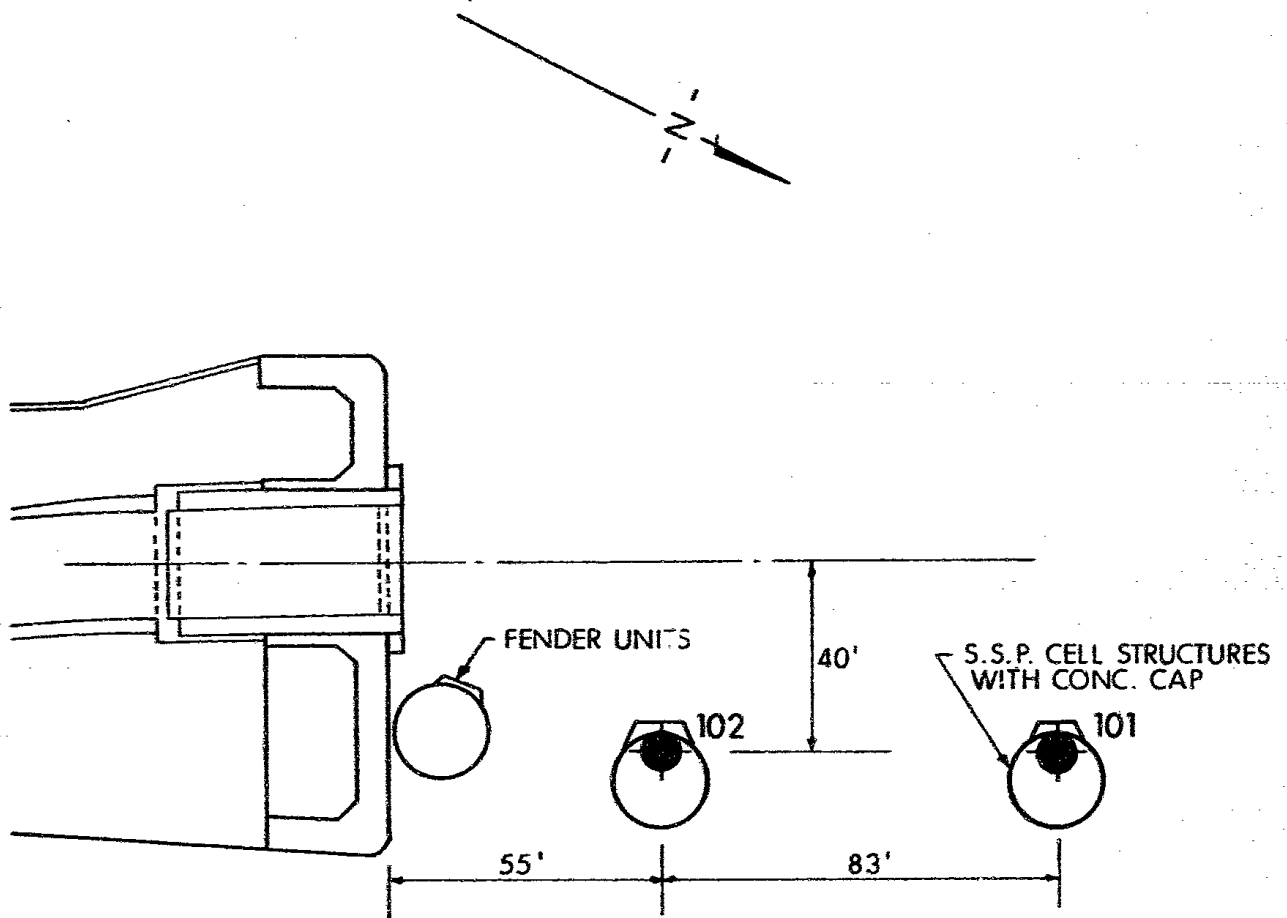
DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 102

FOUNDATIONS OFFICE

JOB NO. 1001 LOCATION As Shown on Drawing
 W.P. 00-73-01 BORING DATE Jan. 9 - 10, 1976
 DATUM T.M.D. BOREHOLE TYPE Washpiling and BX Rock Core
 ORIGINATED BY G.L.P.
 COMPILED BY G.L.P.
 CHECKED BY G.L.P.

SOIL PROFILE				SAMPLES		ELEV. SCALE		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		BULK DENSITY		REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT	WATER CONTENT %	WATER CONTENT %	P.C.F.	GR. S.A. SCL.	
	Bottom Level													
230.8	Gravel and gravel, compacted		1	SS	13	210								
225.0			2	BK	97%	70								
220.0			Top of Sound	RC	Rec.	220								
	End of Borehole					67								



ST. LAWRENCE RIVER (BARRETT BAY)

FLOW

BORE HOLE LOCATION PLAN

SCALE 1"=40'

WOLFE ISLAND FERRY
(MARYSVILLE TERMINAL)

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 101

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY C.S.P.

W.P. 25-73-01

BORING DATE Jan. 8 - 9, 1974

COMPILED BY C.S.P.

DATUM I.G.L.D.

BOREHOLE TYPE Washboring and BX Rock Core

CHECKED BY

SOIL PROFILE				SAMPLES			DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT				BULK DENSITY	REMARKS
ELEV. DEPTH		DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0-3m)	BLOWS / FOOT				PLASTIC LIMIT					
ELEV. DEPTH							SHEAR STRENGTH P.S.F.				WATER CONTENT %					
ELEV. DEPTH							O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE				Wp — W — Wl					
ELEV. DEPTH		WATER CONTENT %				Wp — W — Wl										
71.7	215.0	Water Level														
70.2	230.2	Water														
69.4	227.5	Silt, sand some gravel		1A	SS	wt.										
68.4	227.5	Grey loose to compact		1	SS	12										
5.3	17.5	Bedrock - Limestone			BX	95%										
67.9	222.5	Grey Sound		2	RC	Rec										
6.8	22.5	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 102

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY C.S.P.


W.P. 25-72-01

BORING DATE Jan. 9 - 10, 1974

COMPILED BY C.S.P.

DATUM I.L.L.D.

BOREHOLE TYPE Washboring and BX Rock Core

CHECKED BY 

SOIL PROFILE			SAMPLES			ELEV. SCALE ft m	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L WATER CONTENT %				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0-3m)		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
21.7	215.0	Water Level														
0.0	0.0	Water				240 73										
70.4	230.8					230 70										
11.2	11.2	Sand and gravel, compact		1	SS	13										
11.2	15.5	Bedrock - Limestone														
68.6	225.0	Grey Sand		2	BX RC	97% Rec.										
6.0	20.0	End of Borehole				220 67										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 103

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY CSP

W.P. 25-73-01

BORING DATE January 17 - 18, 1974

COMPILED BY CSP

DATUM I.C.L.D.

BOREHOLE TYPE Wash Boring

CHECKED BY SR

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT W_L			BULK DENSITY	REMARKS
ELEV. m.	DEPTH ft.	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT (0.3 m.)	ELEV. SCALE ft. / m.	BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT W_P	WATER CONTENT W		
74.7	245.0	Water Level							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	W_P — W — W_L WATER CONTENT %			
	0.0	Water											
68.3	224.0						240						
6.4	21.0	sand-some gravel		1	SS	1/2	73						
67.4	221.0	black-very loose											
7.3	24.0	Silty clay with trace of sand		2	SS	20	67						
64.9	213.0	Grey-Stiff to very stiff		3	TW	PM							
9.8	32.0	End of Borehole Probably Bedrock					210						
							64						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 104

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY CSP

W.P. 25-73-01

BORING DATE January 22, 1974

COMPILED BY CSP

DATUM I.G.L.D.

BOREHOLE TYPE Dynamic Core Penetration Test

CHECKED BY SR

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT W_L			BULK DENSITY	REMARKS
ELEV.	DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	20	40	60	80	100	PLASTIC LIMIT W_P	WATER CONTENT W		
m.	ft.														
74.7	245.0	Water Level													
0.0	0.0	Water													
69.1	226.5														
5.6	18.5	probably sand, some silt, trace of gravel													
65.8	215.7	very loose to compact													
8.9	29.3	End of Cone Test													

 20
15 \div 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE N° 105

JOB 73-11071

LOCATION As Shown on Drawing

ORIGINATED BY CSP

W.P. 25-73-01

BORING DATE January 22, 1974

COMPILED BY CSP

DATUM I.G.L.D.

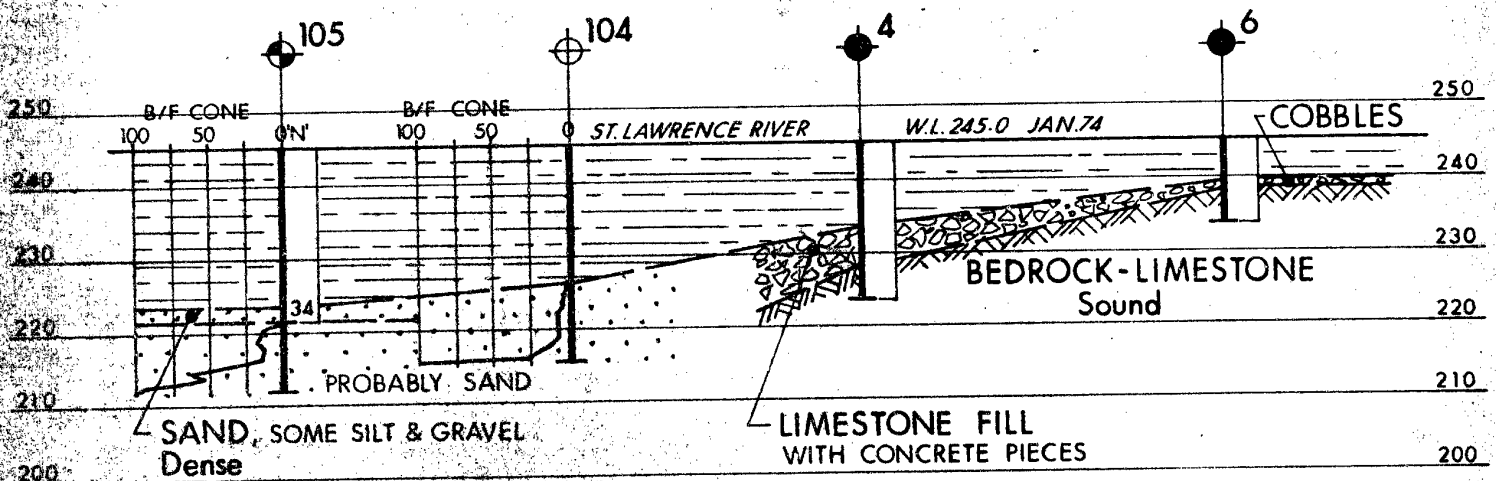
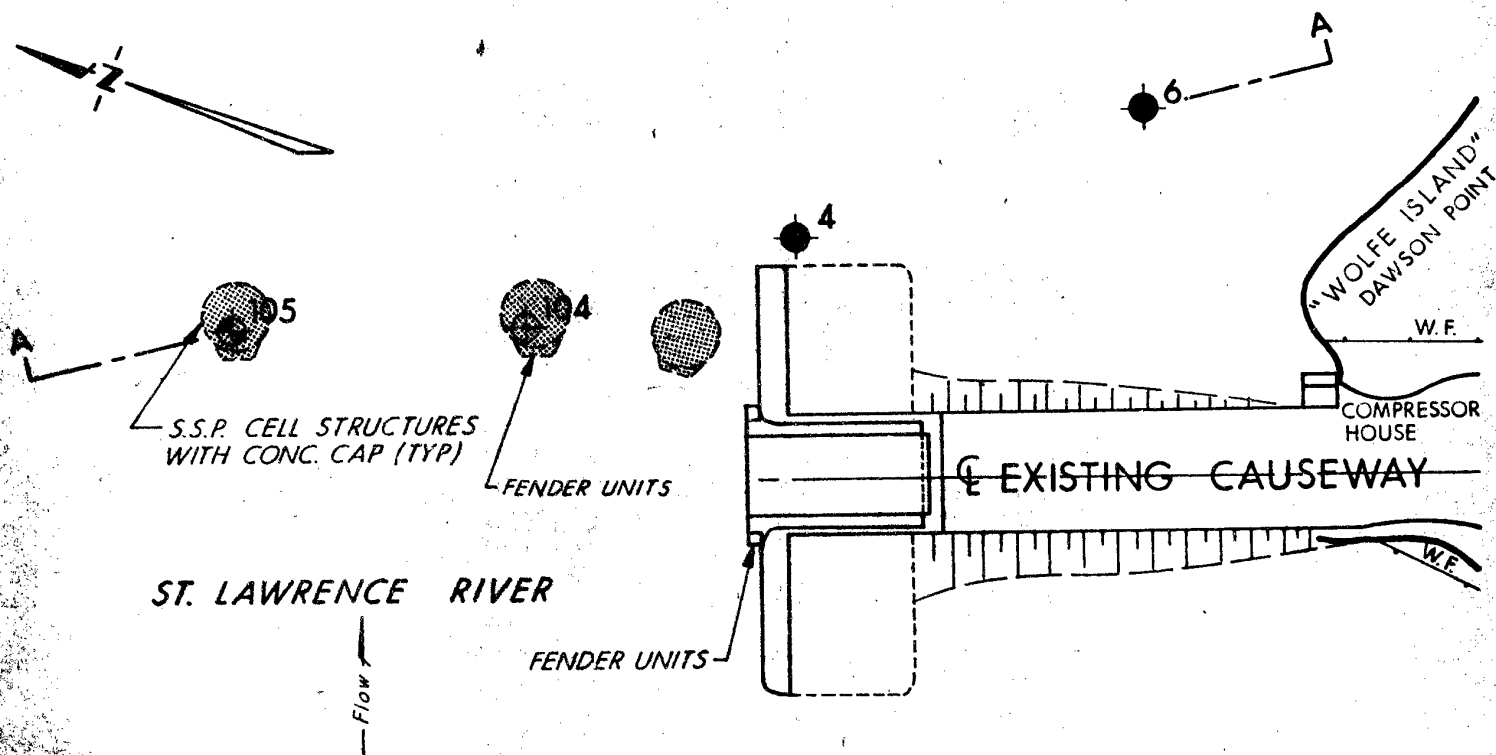
BOREHOLE TYPE Wash boring and dynamic cone penetration CHECKED BY SR

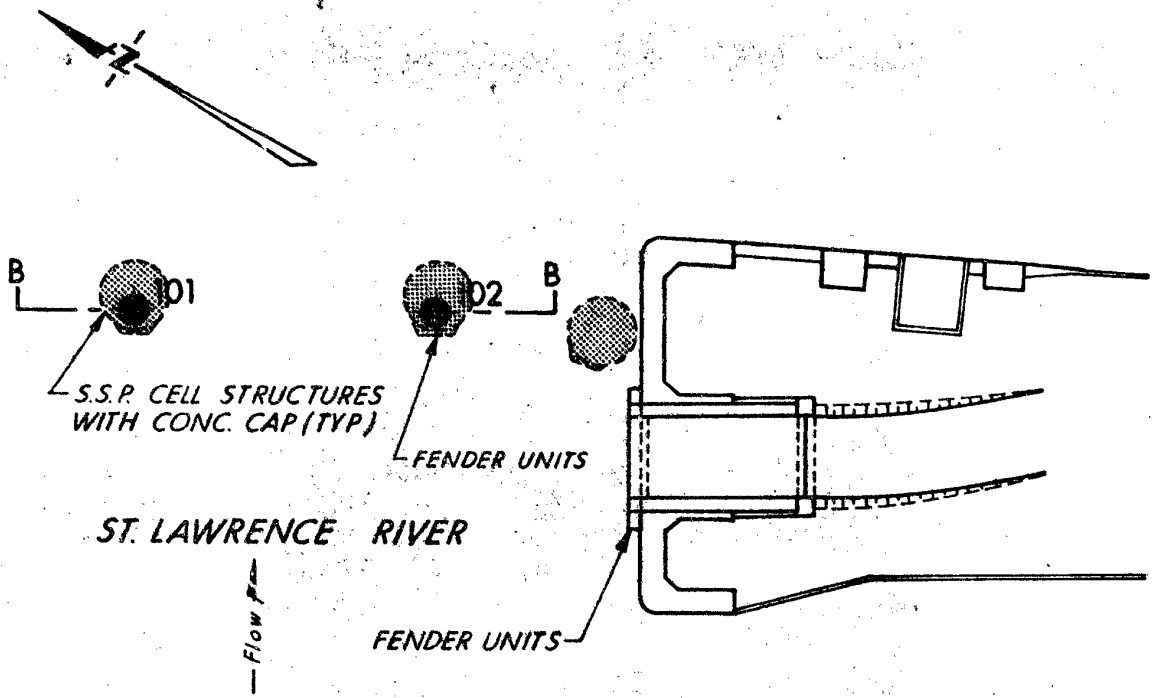
RECHECKED BY SR

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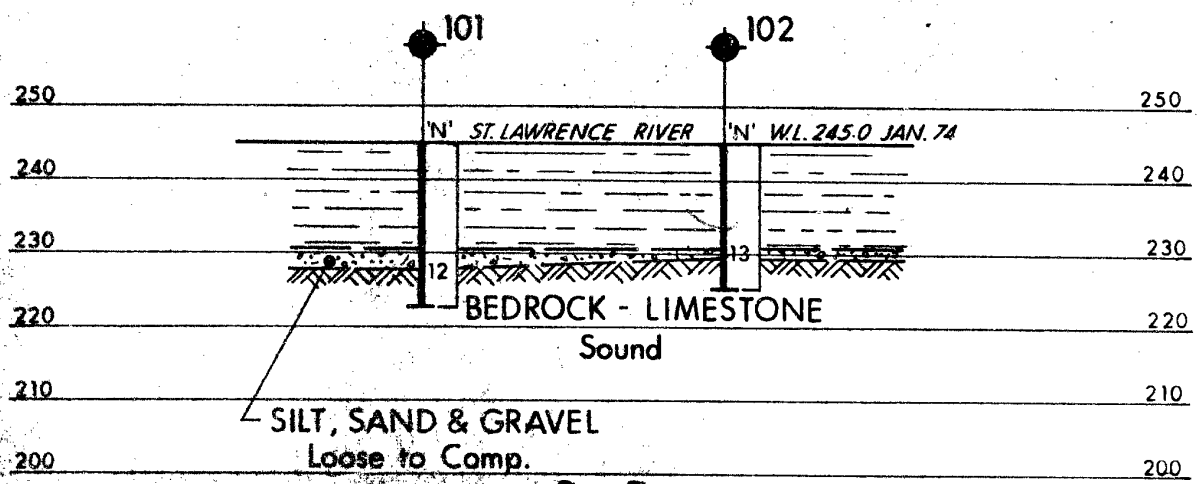
20
15 ϕ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

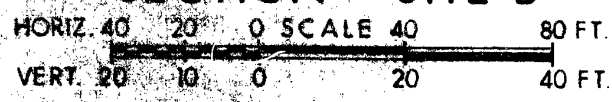


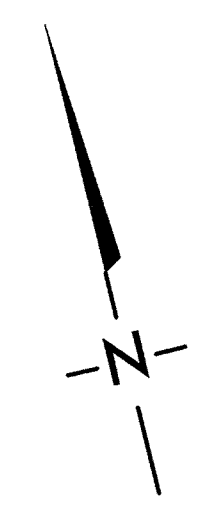


PLAN - SITE 'B'



B - B
SECTION - SITE 'B'





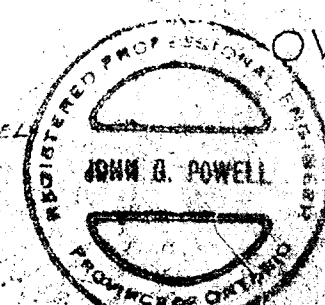
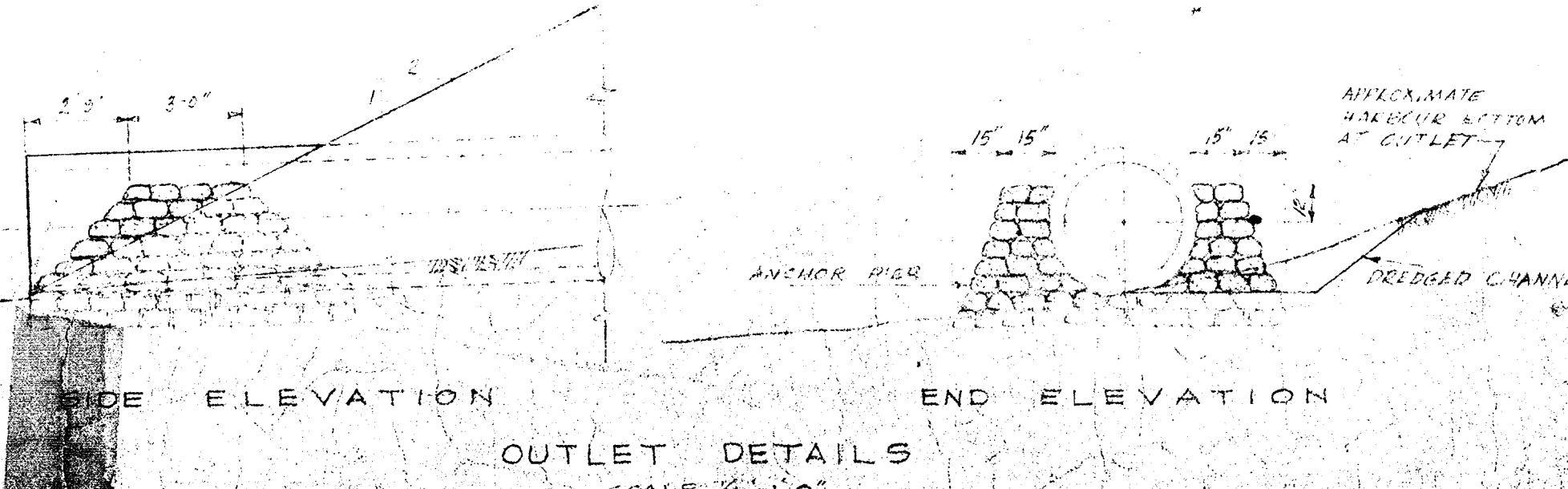
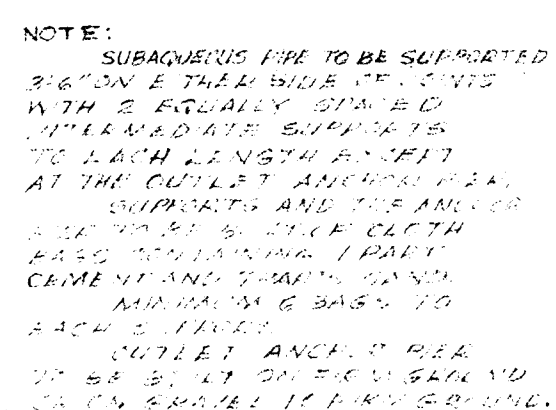
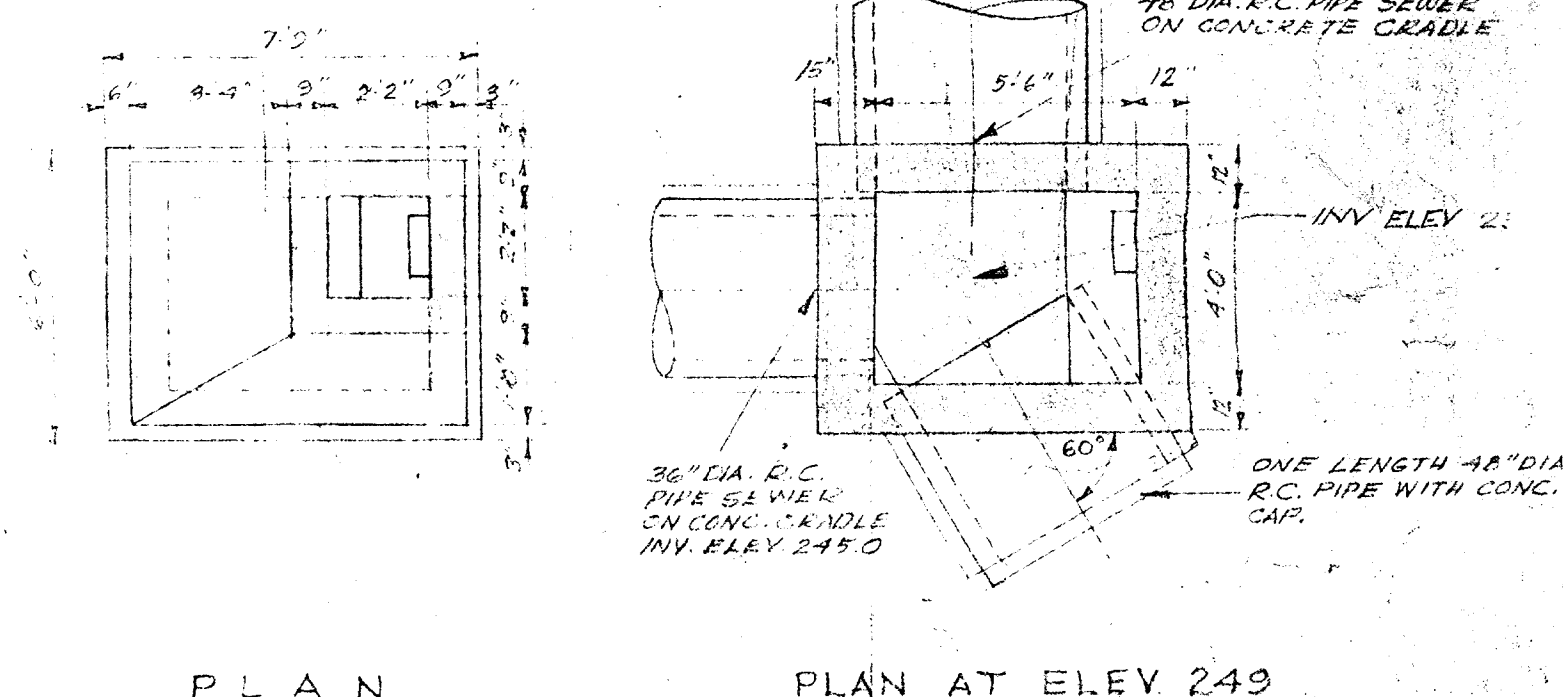
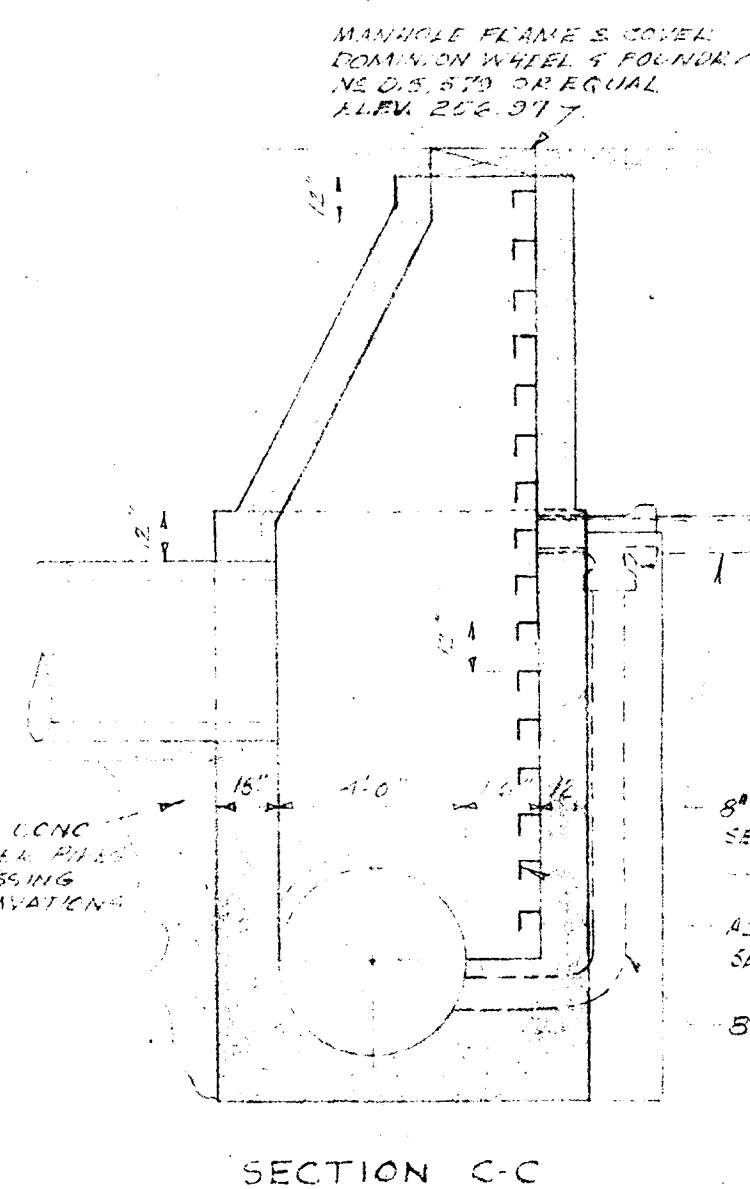
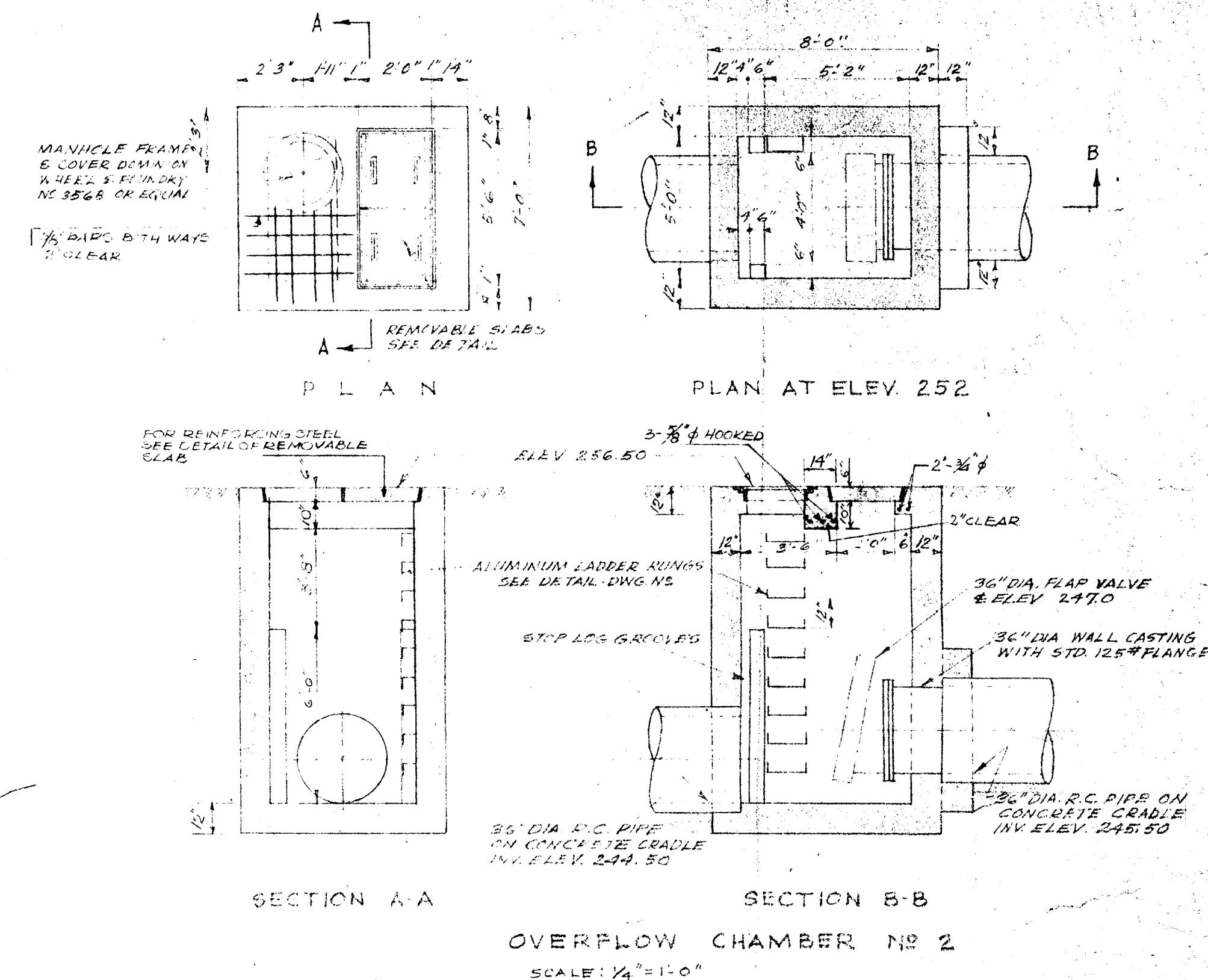
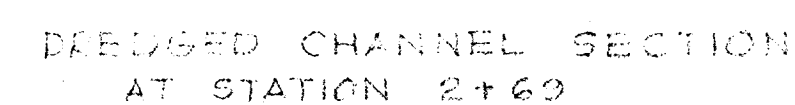
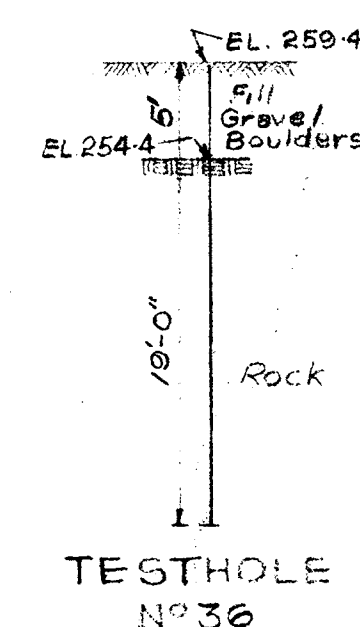
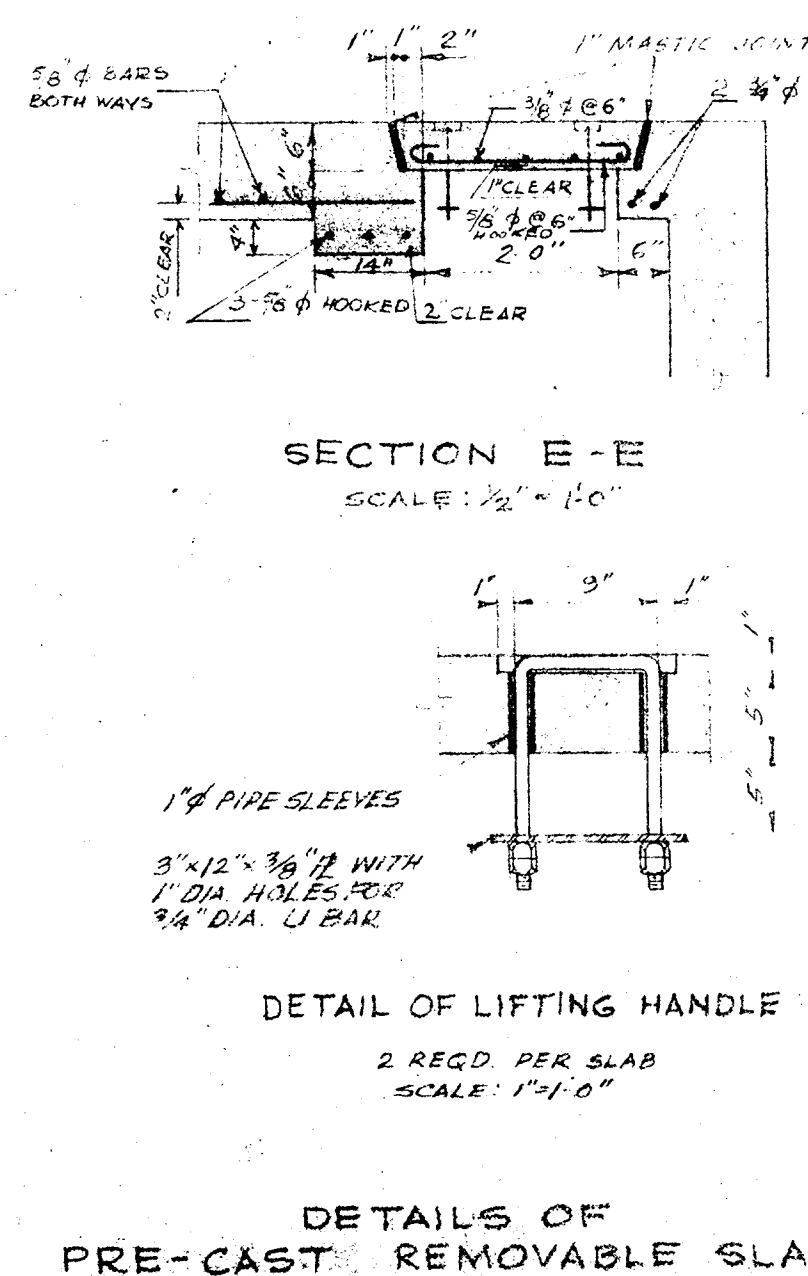
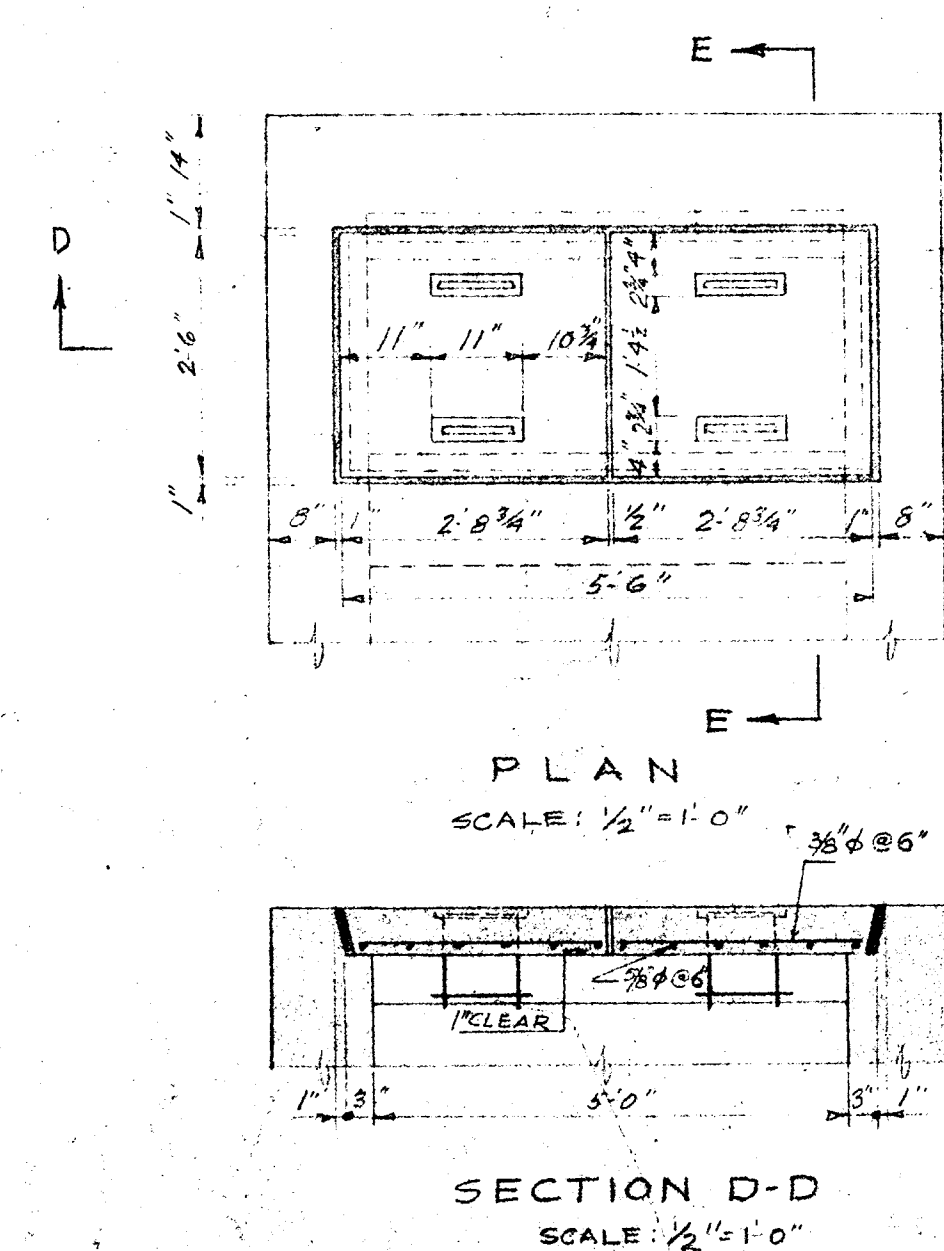
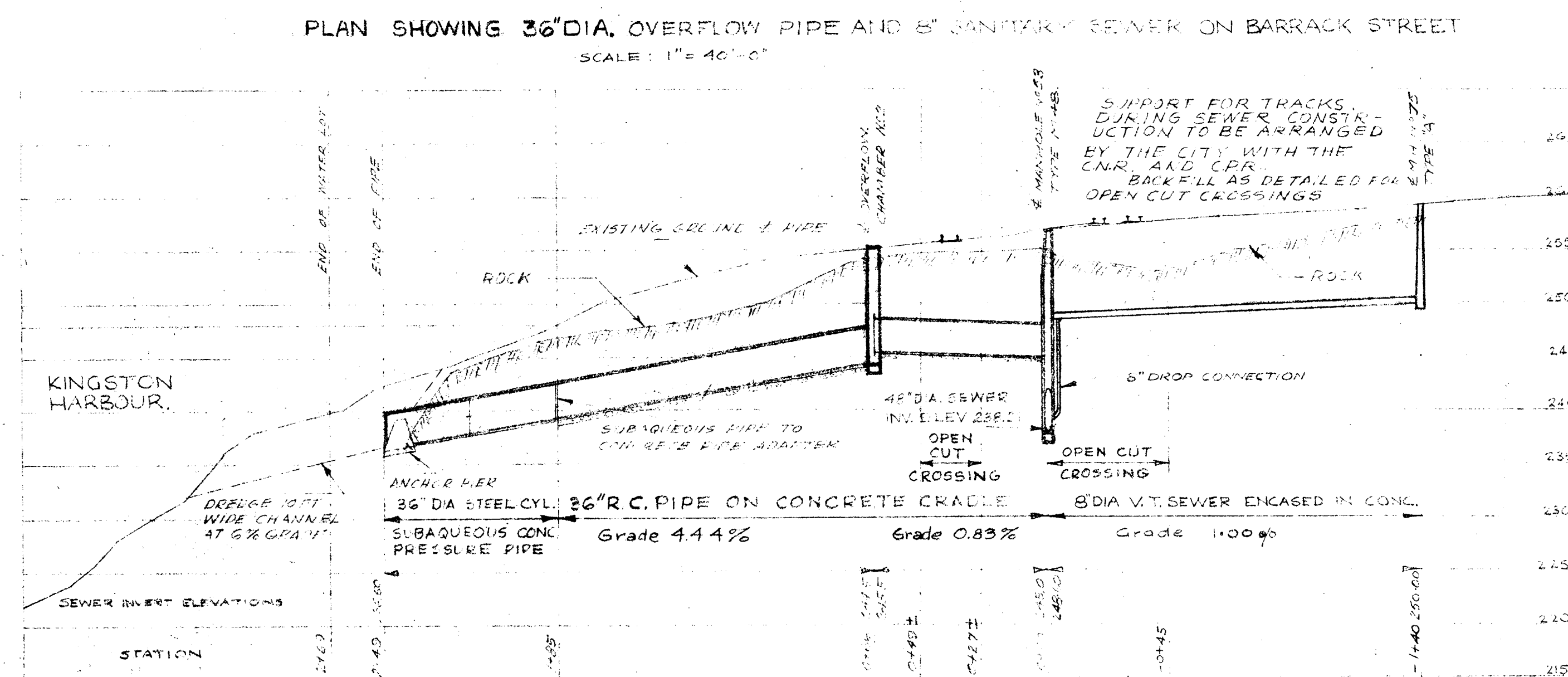
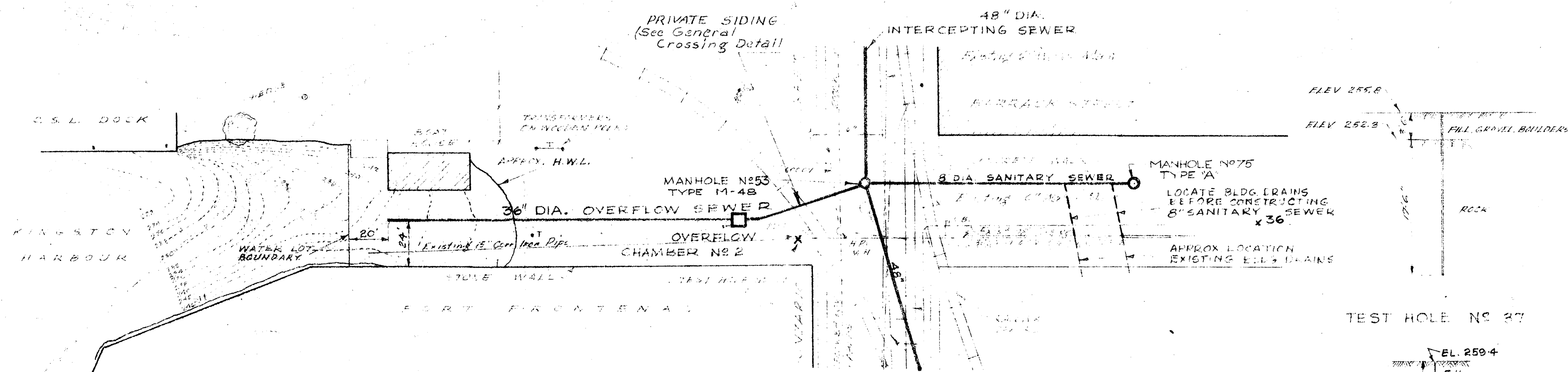
As Built			
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No. 2 ELEVATION

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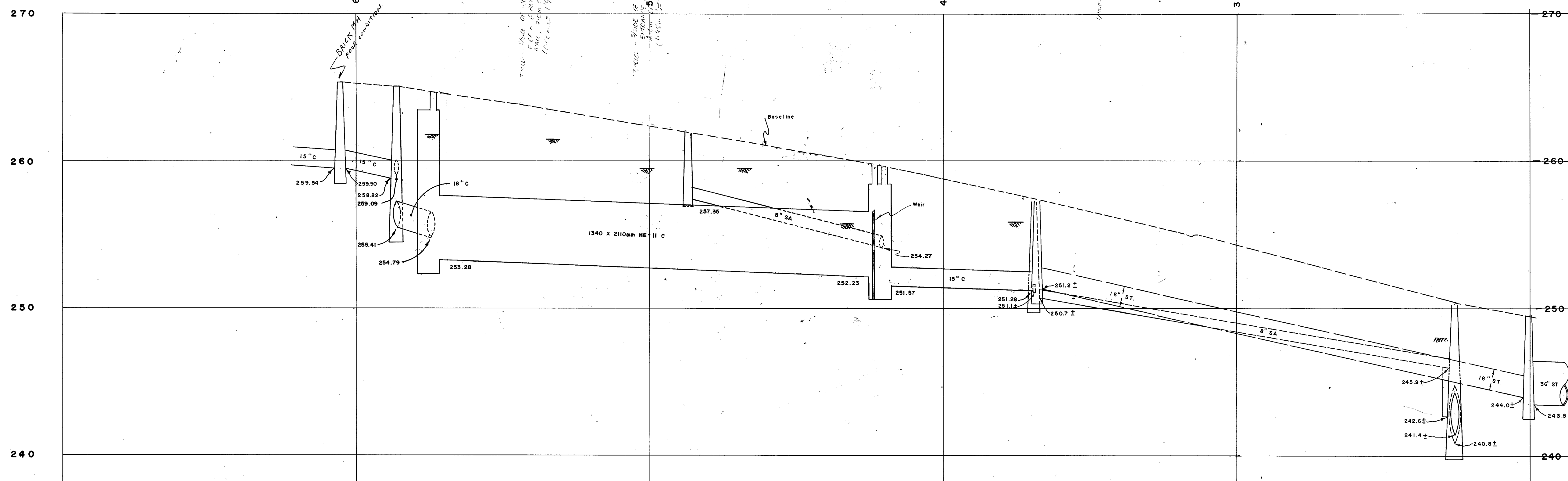
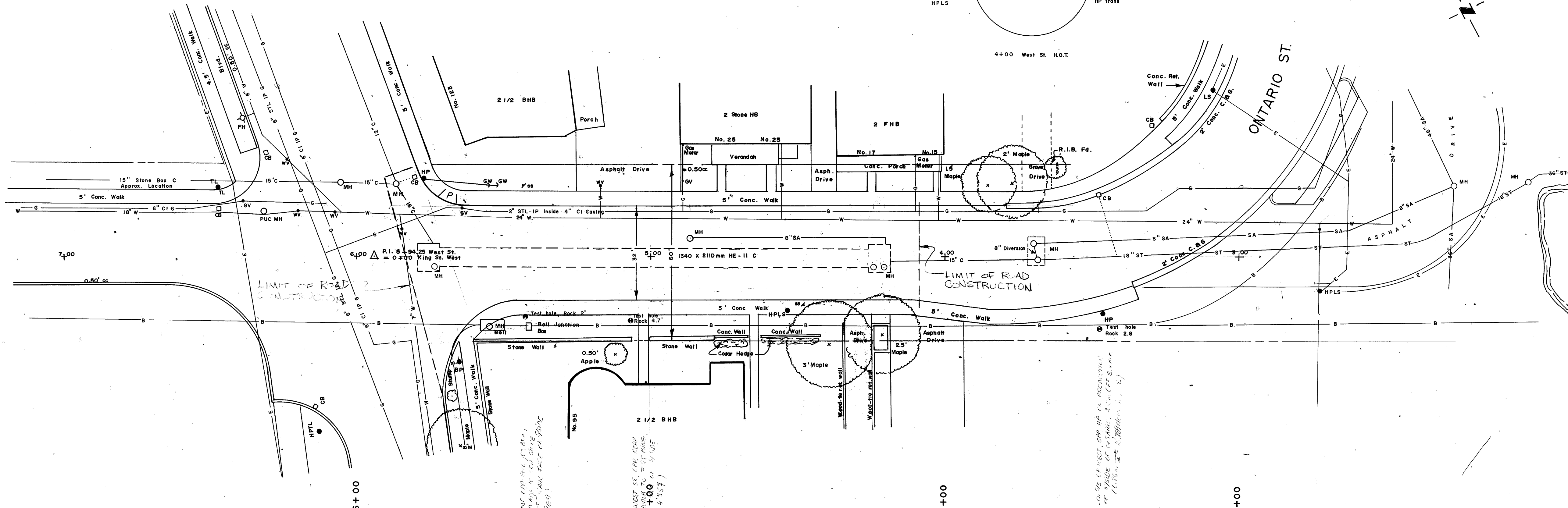
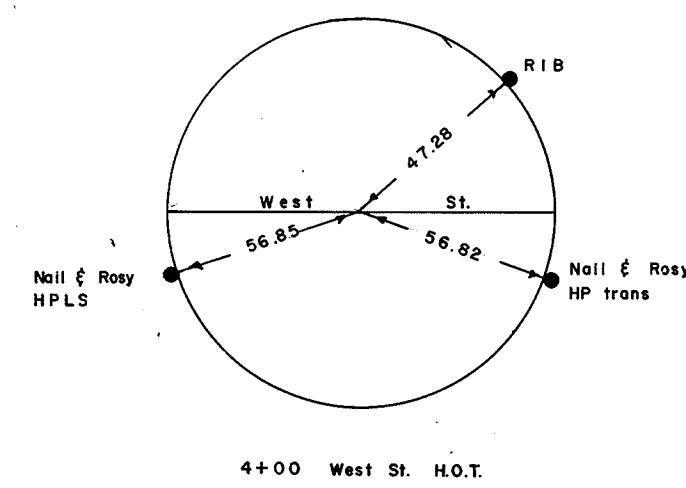
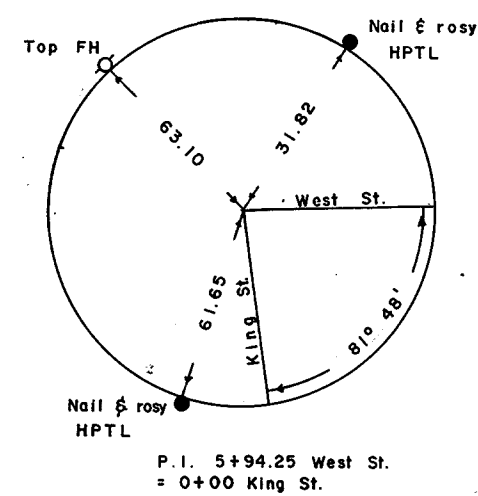
Const.			
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APPROVED FOR RELEASE



CITY OF KINGSTON
WORKS DEPARTMENT
SEWER DISPOSAL SYSTEM
FRONT INTERCEPTING SEWER
PART II
FLOW CHAMBER No 2 & OUTLET
BARRACK STREET
GORE & STORRIE LIMITED
CONSULTING ENGINEERS

SCALES AS NOTED DATE OCT 10TH 36
REVISED AS CONSTRUCTED



Water	10 Aug 92	C.C.	Info from print
Gas	10 Aug 92	C.C.	" " " "
Ball	10 Sept 92	C.C.	" " " "
Sewers			
Detail			
As Built	28 Feb. 95	N. Bean	92 - 13W

APPROVED

APPROVED

WARNING

Contractor to check, verify and be responsible for all services, structures, and utilities.
Soundings are shown for information only; Refusal or assumption of same is not guaranteed.

BENCH MARKS

No.1 ELEVATION
No.2 ELEVATION

REVISION DATA

BY	DATE	APPRO'D	DRAWING	BY	DATE	CHK'D
			Topo	K. Filer	08-01-22	
			U/G	C. Couture	4 Mar 91	
			AS BUILT INFORMATION			
			Roads			
			Sewers			
			Other			

CITY OF KINGSTON
ENGINEERING DEPARTMENT

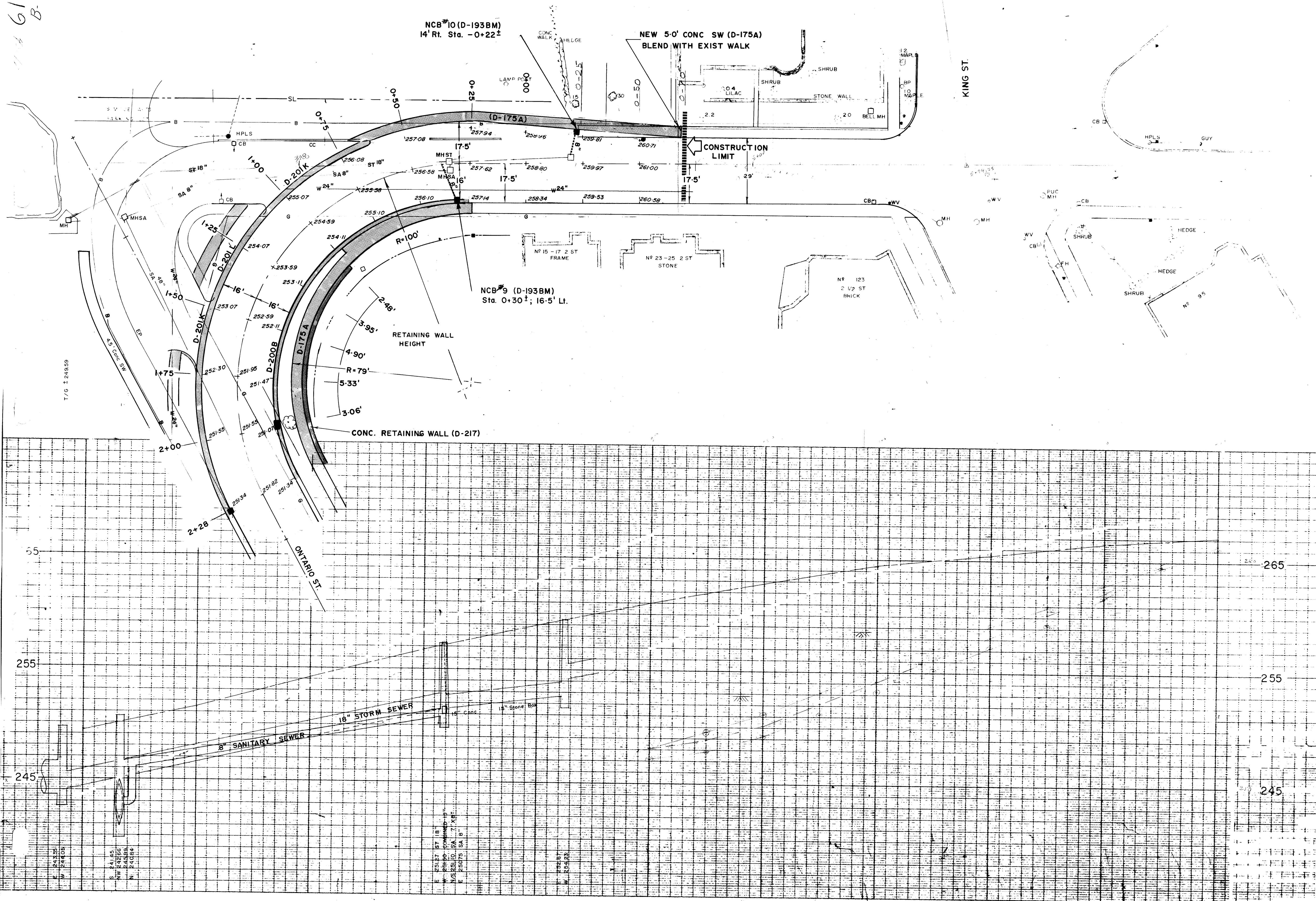
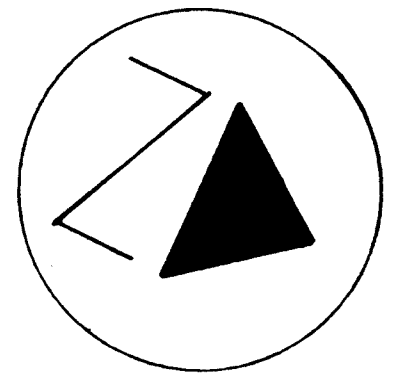
TITLE
WEST STREET
ONTARIO ST. - KING ST. WEST

SCALE
Horiz. 1" = 20'
Vert. 1" = 4'

DATE OF ISSUE
COMMISSIONER OF WORKS

CONTRACT No.
DRAWING No. 6151-
SHEET 1 of 1
REV

WEST ST.



BENCH MARK ()	BENCH MARK ()
ELEVATION 253-15	ELEVATION
RR Spike in HP, South West corner of West St. at Ontario St.	

LEGEND (Exist Services)	
Sanitary Sewer	SA
Sanitary Manhole	MHSA
Storm Sewer	ST
Storm Manhole	MHST
Combined Sewer	C
Combined Manhole	MHC
Catch Basin	CB
Watermain	W
Gasmain	G
Gas Valve	sv
Water Valve	wv
Fire Hydrant	FH
UTILITY POLES, Hydro	HP
Telegraph	TP
Traffic Light	TL
Light Standard	LS
Sign	S
UNDERGROUND CABLE	
Hydro	H
Bell	B
TV	TV
Bell Junction Box	JB
Conc Curb	CC
Asph Curb	AC
Curb & Gutter	CG
Edge of Pavement	EP
Street Line	SL
FENCE	
Chain Link	CL
Wire	W
Wooden	WO
Removals	RM

WARNING
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6					
5					
4					
3					
2					
1					
CITY OF KINGSTON ENGINEERING DEPARTMENT					
TITLE ONTARIO ST AT WEST ST.					
DATE 06/73	BY R.S.	SCALE HORIZ = 20' VERT = 4'	ROADS ENGINEER	SEWER ENGINEER	
CHECKED <i>Ch. R.</i>	DATE	APPROVED <i>R. D. van Wyngaarden</i>	DRAWING NO. B-861 (A)	SHEET 1	REVISION
FINAL DRAWING DATE CHD APPROVED					

5-2818 6151



At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

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South America	+ 55 21 3095 9500

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