ROAD 10 CROSSING OVER THE PATTERSON DRAIN

(Geographic Township of Gosfield North)

TOWN OF KINGSVILLE

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Project No. D-17-029

April 23rd, 2018

Mayor and Municipal Council
Corporation of the Town of Kingsville
2021 Division Road North
KINGSVILLE, Ontario
N9Y 2Y9

Mayor Santos and Members of Council:

SUBJECT: ROAD 10 CROSSING OVER THE PATTERSON DRAIN
(Geographic Township of Gosfield North)
Town of Kingsville, County of Essex
Project No. D-17-029

I. INTRODUCTION

In accordance with the instructions received by letter of April 18th, 2017, from the Drainage Superintendent, Mr. Ken Vegh, we have prepared the following report that provides for the replacement and improvements to the existing road crossing culvert across Road 10, within the Patterson Drain. These investigations were initiated by a resolution passed by Council for our firm to undertake the required works towards the preparation of an Engineer's Report for the replacement of said road crossing culvert, in accordance with the Drainage Act. A plan showing the general location, as well as the necessary details which pertain to the replacement of the above mentioned culvert, is included herein as part of this report.

The request to provide an Engineer's Report to address the replacement and improvements to said road crossing culvert within the Patterson Drain was submitted by Andrew Planke, Director of Municipal Services, for the Town of Kingsville.

Our appointment and the works relative to the improvements to the existing road crossing culvert within the Patterson Drain, proposed under this report, is in accordance with Section 78 of the "Drainage Act, R.S.O. 1990, Chapter D.17, as amended in 2017". We have performed all of the necessary survey, investigations, etc., for the Patterson Drain and we report thereon as follows.

II. BACKGROUND AND WATERSHED CHARACTERISTICS

The Patterson Drain is an existing open Municipal Drain which provides drainage to the lands primarily located within the northern portion of the Town of Kingsville and a small portion within the Town of Lakeshore. The upper end of the Patterson Drain commences at the south side of the Road 10 between Lot 22 and Lot 23, where it collects flows from the East and West Branch of the Patterson Drain. From the south side of Road 10, the open drain

extends downstream in a northerly direction through Concessions 10 and 11 and outlets into Lot 29, Concession 4, within the Town of Lakeshore, into the Ruscom River. The subject road crossing culvert conveys runoff from the lands south of Road 10, within the Town of Kingsville.

The Patterson Drain is predominantly located within the Brookston Clay soil type. This soil type is categorized as Hydrological Soil Group D and is described to have a low infiltration rate when thoroughly wetted and consists largely of soils with claypan or clay layer at or near the surface and shallow soils over nearly impervious material. The topography of the lands within the watershed are very flat, with the bottom of this drain having minimal gradient. As a result, these soils require effective artificial drainage to be productive.

III. DRAINAGE HISTORY

A review of the Town of Kingsville's drainage records indicate that the Patterson Drain is an existing open Municipal Drain that has been repaired and improved on a number of previous occasions under the provisions of the Drainage Act. The last major work of repair and improvement on this drainage system was completed under an Engineer's Report prepared by W.J. Setterington, P.Eng., dated December 12th, 1972. Under this report, the entire length of the 10th Concession Road Branch (East) as well as the entire length of the Patterson Drain, which are open drains, were cleaned of sediment and brushed throughout. This report did not provide for any improvements to any of the access bridges in the drain but identified the existence of two (2) private access bridges and three (3) municipal roadway bridges along its length. The report did not explicitly establish a mechanism or conceptual method of dealing with the future maintenance of all of said bridges.

From our review of the Town's records, we found that no further improvements have been performed on this drain. However, an Updated Maintenance Schedule Report was prepared by Nick J. Peralta, P.Eng., dated June 16th, 2004, for the reassessment of the "Patterson Drain and the 10th Concession Road Branch (East)", so that costs for future maintenance works on this drain may be fairly assessed. Furthermore, this report reviewed all existing access bridges within the subject drain and provided for future cost sharing provisions for each.

The Road 10 crossing within the Patterson Drain has been identified within the above mentioned By-Laws and is therefore, a legal entity with respect to this Municipal Drain. As identified within the 2004 Updated Maintenance Schedule Report, for all future maintenance works performed on the subject road crossing culvert under Road 10, the costs shall be entirely assessed to the Town of Kingsville.

Report - Road 10 Crossing Over the Patterson Drain
(Geographic Township of Gosfield North)
Town of Kingsville - D-17-029

III. PRELIMINARY INVESTIGATIONS AND ON-SITE MEETING

After reviewing all of the drainage information and documentation provided by the Drainage Superintendent, we arranged for an On-Site Meeting to be scheduled for May 29th, 2017. The following people were in attendance at said meeting: Kevin Girard (Town Manager of Municipal Services), Ken Vegh (Town Drainage Superintendent), and Tony Peralta (N.J. Peralta Engineering Ltd.).

Upon introductions, it was generally discussed that a written notice has been submitted by the Town of Kingsville, requesting the replacement of the existing road crossing culvert under Road 10 and within the Patterson Drain.

Mr. Girard outlined that this structure had been identified within the 2014 Kingsville Bridge and Culvert Needs Study, prepared by Dillon Consulting. From this report, we reviewed the details of the existing road crossing culvert and outlined the current condition, together with the various deficiencies with said structure. Based on the results of this report, the Town wishes to proceed with the replacement of said structure through the provisions of the Drainage Act. Mr. Girard further outlined that the Town had allocated costs within their budget for construction to commence in 2018.

Town staff was reminded that all costs associated to this road crossing culvert shall be entirely assessed to the Town of Kingsville under Section 26 of the Drainage Act, for the works caused by the existence of Road 10.

The Drainage Act processes were reviewed in great length and detail. The overall Engineer's Report and future maintenance processes and general timeframes were generally reviewed with the representatives. They were also advised that it was likely that the works in this drain were not to be undertaken between March 15th and June 30th, unless otherwise permitted by the Department of Fisheries and Oceans (D.F.O), Essex Conservation Authority (E.R.C.A), and the Ministry of Natural Resources and Forestry (M.N.R.F.).

The representatives were also advised that the work conducted under this project would be subject to further approvals and mitigation measures of the D.F.O, E.R.C.A. and the M.N.R.F.

As outlined within the 2014 Dillon Consulting report, the existing structure had various deficiencies, such as: broken railings, concrete delamination, spalling and scaling, together with very steep side slopes and ongoing embankment erosion at the wing walls. Further discussions ensued regarding the improvements required to the existing structure which directly affect the current roadway. With the existing structure having insufficient length, the existing roadway currently narrows at the bridge location with little to no shoulder. Therefore, the Town representatives had

requested a longer structure be considered to allow for a seamless transition across the new structure. It was further discussed that once the structure is surveyed and examined, a subsequent meetings shall be conducted to discuss available improvement options that may be considered as part of this project.

On this note, the On-Site Meeting had concluded.

IV. FIELD SURVEY AND INVESTIGATIONS

Following the On-Site Meeting and discussions with the Town, we arranged for our Survey Crew to attend the site and perform a topographic survey, including taking the necessary levels and details, to establish the design parameters for the installation of this replacement bridge. Benchmarks were looped from previous work carried out on the drain and were utilized in establishing a site benchmark near the location of the road crossing replacement. The survey work included picking up all of the details in the vicinity of the existing crossing. We also surveyed the drain for a considerable distance both upstream and downstream of the subject access bridge, in order to establish a design grade profile for the installation of same. We also took cross-sections of the Patterson Drain and it's Branches at the general location of the proposed bridge, as necessary, for us to complete our design calculations, estimates and specifications.

With respect to the Endangered Species Act 2007, the Ministry of Natural Recourses and Forestry (M.N.R.F.) Municipal Drain agreements, under Section 23 of the this Act, with the Municipality have expired as of June 30th, 2015. New regulation provisions have replaced these existing drain agreements under Ontario Regulation 242/08, Section 23.9 which allows the Municipality to conduct repairs, maintenance, and improvements, within existing Municipal Drains, under the Drainage Act to be exempt from Section 9 and 10 of the Endangered Species Act, so long as the rules in the regulation are followed. If eligible, the regulatory provision allows Municipalities to give notice to the Ministry by registering their drainage activities through an online registry system.

Once we had established a general scope of work on this project, our office had engaged in correspondence with the E.R.C.A. to provide general details of the project and to address any comments and/or concerns that they would have as it relates to the established scope of work. The E.R.C.A. had provided their initial comments outlining that the design proposal was to be submitted to them to demonstrate that the level of service for this structure would remain unchanged and/or not significantly lowered. In addition, consideration was to be given to the size of the current opening versus the proposed opening and potential ice/debris blockage issues. These details helped establish the extent of analysis and to determine the design requirements of the proposed replacement structure.

Report - Road 10 Crossing Over the Patterson Drain
(Geographic Township of Gosfield North)
Town of Kingsville - D-17-029

For the purpose of establishing the watershed area upstream of the subject access bridge location, and determining the culvert size required for same, we investigated and reviewed the Engineer's Report on the "Patterson Drain and the 10th Concession Road Branch (East)" prepared by W.J. Setterington, P.Eng., dated December 12th, 1972, along with the Updated Maintenance Schedule Report prepared by Nick J. Peralta, P.Eng., dated June 16th, 2004. All of the above investigations provided us with the correct watershed area affecting the size of the subject road crossing culvert replacement.

V. FINDINGS AND RECOMMENDATIONS

E.R.C.A., D.F.O. and M.N.R.F. Considerations

During the course of our investigations, this drainage project was discussed and reviewed in detail with Ms. Cynthia Casagrande, of the E.R.C.A., to deal with any E.R.C.A. issues and comments related to the "Conservation Authorities Act" and this Municipal Drain. The Patterson Drain is located within the regulated area and is under the jurisdiction of the E.R.C.A., and therefore an E.R.C.A. Permit is required for the improvements to this road crossing culvert within the Patterson Drain. Upon their request, a design proposal was submitted to the E.R.C.A. for their review and consideration. Further to the above, the E.R.C.A. provided us with their comments and concerns through email correspondence, and said email is included herein as **Appendix "A"**.

As it relates to the requirements of the "Fisheries Act", the proposed works in the Patterson Drain was "Self-Assessed" by the Engineer, through the Department of Fisheries and Oceans (D.F.O.) website to determine whether this project shall be reviewed by D.F.O. The Patterson Drain is considered a Class "F" drain through the Department of Fisheries and Oceans (D.F.O.), which means that the drain has intermittent flow and likely does not contain federally listed Aquatic Species at Risk. Based on the D.F.O. Self-Assessment website and their applicable guidance documents, we have determined that the project activities would not require a D.F.O. review for the works proposed under this project, so long as standard measures for fish habitat and migration are implemented. A copy of the D.F.O. "Best Management Practices – Culvert Replacements in Municipal Drains" document is included within **Appendix "A"**.

Under the Species at Risk Provincial Legislation, set in place with the Ministry of Natural Resources and Forestry (M.N.R.F.), Section 23.9 of the Endangered Species Act, 2007, allows the Municipality to conduct eligible repair, maintenance, and improvement work under the Drainage Act that exempts these works from Sections 9 and 10 of this Act, so long as they follow the rules within Ontario Regulation 242/08.

Report - Road 10 Crossing Over the Patterson Drain
(Geographic Township of Gosfield North)
Town of Kingsville - D-17-029

In recognition of impact that these species may experience as a result of the subject works, the Town of Kingsville has provided comprehensive mitigation measures as well as species identification guides for reference. These references shall be provided to the successful Tenderer and shall be available for viewing at the Municipal Office for those interested.

Through correspondence with the E.R.C.A. regarding the Conservation Authorities Act, the self-assessment under the Fisheries Act, and the mitigation measures related the Endangered Species Act, we have provided for all of the E.R.C.A., D.F.O., and M.N.R.F. concerns and issues in our design and recommend that this drainage works be constructed in total compliance with all of the above.

Road Crossing Improvements

Prior to the completion of our Engineer's Report on this project, we have various meetings and correspondence with Town Staff to review and discuss the particulars of the proposed road crossing replacement, in great length and detail. Furthermore, preliminary designs were presented and reviewed with Town Staff to ensure that they meet all of the required improvements necessary to address the proposed crossing.

The existing reinforced concrete span bridge consists of approximately 7.5m in length and varies in opening size from the upstream to the downstream, with the smallest cross-section at the downstream end consisting of approximately 3.04m Span x 2.3m Rise. The existing length of the structure provides for a narrow road width, with little to no gravel shoulder. As a result, the existing roadway crossing is perceived to be unsafe for the travelling public. We find the existing structure to be in poor physical condition, with various deficiencies. It shall be noted that this structure currently has an adequate opening size to convey the required 1:100 year storm event flows.

Through our correspondence and meetings with Town Staff, we presented various options related to the culvert length that would provide an unencumbered roadway platform over the crossing with wider shoulder widths, while providing the travelling public with a greater level of comfort when crossing the structure.

Currently, the existing structure is without any public safety features, such as guard rails. After conferring with the Ministry of Transportation (M.T.O.) Roadside Safety Manual, along with the Transportation Association of Canada (T.A.C.) Geometric Design Guide for Canadian Roads, we presented Town Staff with available options to consider as it relates to public safety and the potential for the installation of guard rails. This feature would be in addition to the proposed extended culvert length. In summary, these documents outlined the parameters in which warrants the necessity for additional public safety features. Ultimately, the determining factors are essentially evaluated by the level of

risk the situation presents. After investigating the daily traffic volumes, historical and potential accident occurrences, together with the public perception and current farming preferences, Town Staff determined that this crossing has a very low level of risk for potential traffic accidents. As a result, it was determined that guard rails would not be required for this application at this time. In accordance with the above noted safety manuals, other features have been adopted into our design in efforts to provide a safer crossing. These features include the exclusion of any roadside hazards or obstacles.

As part of our investigations, we had requested utility locates and found that various utilities could potentially be in conflict with the proposed culvert replacement. In light of the potential conflicts, we arrange for hydro-vacuum excavations to expose and establish depths for each potential conflicting utility. Based on the information provided by the Utility Companies, along with the findings from our hydro-vacuum excavations, we determined that Union Gas, Hydro One and Gosfield North Communications infrastructure will be in major conflict with the proposed road crossing culvert replacement. Based on our discussions with each affected utility, we arranged for coordination with each utility to initiate the relocation of their infrastructure.

After a considerable amount of correspondence with each utility company, we were able rectify all of the conflicts with the associated utilities. Each utility company have confirmed that all conflicts shall be addressed at the earliest, and shall not conflict with the timing of the proposed culvert replacement construction. Based on this information, we were able to finalize our design and report.

In addition to the road crossing culvert replacement, the Town of Kingsville has a road resurfacing program in place for all roads. When improving the road surface on Road 10 in recent years, a portion of the road over the subject road crossing culvert was unimproved with anticipation of the replacement of the subject road crossing culvert. With the existing road crossing culvert now being replaced, Town Staff has requested to include the placement of new asphalt pavement, as part of the road crossing culvert replacement project.

Based on our detailed survey, investigations, examinations, and discussions with Town Staff, we recommend that the existing road crossing culvert be replaced within the Patterson Drain. The new road crossing culvert shall consist of approximately 12.0 metres of 4200mm Span x 2400mm Rise Precast Concrete Box Culvert, together with Interlocking Concrete Block Headwall System and cable concrete erosion protection. This new road crossing culvert shall be installed at the location and to the general parameters as established in our design drawings attached herein.

Report - Road 10 Crossing Over the Patterson Drain
(Geographic Township of Gosfield North)
Town of Kingsville - D-17-029

With the replacement of the existing road crossing being provided entirely for the existence of Road 10, all of the costs associated with said crossing are to be entirely assessed to the Town of Kingsville. All of same has been provided for within the Construction Schedule of Assessment included within this report.

VI. ALLOWANCES AND COMPENSATION

All of the road crossing work under this project shall be carried out within the Road 10 road allowance. All areas disturbed by these works are specified for full restoration; therefore, these works shall not result in any loss of production of agricultural property, or any indirect damages to the non-agricultural areas. Therefore, no allowances or compensation has been provided for under this report, pursuant to Section 29 and/or Section 30 of the "Drainage Act, R.S.O. 1990, Chapter D.17, as amended 2017".

VI. ESTIMATE OF COST

Our estimate of the total cost of this work, including all incidental expenses, is the sum of **TWO HUNDRED AND SIXTY SEVEN THOUSAND TWO HUNDRED AND NINETY FOUR DOLLARS ($267,294.00)** made up as follows:

CONSTRUCTION

Item 1)	**Traffic Control**; Supply, install and maintain traffic control measures, including signs, flashers, and other traffic control devices to Ontario Traffic Manuals and MTO Roadside Safety Manual requirements. Remove all components at completion of project.	Lump Sum	$ 20,000.00
Item 2)	**Temporary Silt Barriers and Flow Conveyance Systems**; Supply, install and maintain temporary silt barrier, flow conveyance system and dewatering, including all additional equipment to ensure continuous conveyance of flow in drain during construction, including removal of all components at the completion of project.	Lump Sum	$ 5,000.00

Report - Road 10 Crossing Over the Patterson Drain
(Geographic Township of Gosfield North)
Town of Kingsville - D-17-029

Item 3)	**Removal of Existing Structure and Pavement**; Provide all labour and equipment to excavate, completely remove and dispose of the entire existing concrete bridge deck, bridge abutments, wingwalls, footings, quarried limestone, etc., together with the existing tar and chip pavement slated for removal within the entire project site, including all deleterious materials, complete.	Lump Sum	$ 5,500.00
Item 4)	**4.2m x 2.4m CHBDC CAN/CSA S6-14 Precast Box Culvert**; Supply and install approximately 12.0 lineal metres of new 4.2m x 2.4m precast box culvert across the Road 10 right-of-way to CHBDC CAN/CSA S6-14 complete including certified design and shop drawings, reinforcement and/or distribution slab, wall drains, geotextile at joints, apron wall at each end, excavation, bedding, cover, backfill and restoration as shown on drawings, complete at $8,000.00 per lineal metre.		$ 96,000.00
Item 5)	**Waterproofing**; Supply and install hot applied asphalt membrane deck waterproofing including reinforcing fabric at joints.	Lump Sum	$ 4,600.00
Item 6)	**Shear Plates**; Supply and install stainless steel plates, adhesive anchors and hardware at precast culvert section joint at driveway and road locations shown on the drawings, approximately 15 units at $800.00 each.		$ 12,000.00
Item 7)	**Cable Concrete Erosion Protection**; Supply and install approximately 155 square metres of CC-35 Cable Concrete Mats erosion protection system on geotextile where required at locations shown on contract drawing, including all necessary excavation, clamps, anchors, etc., at $95.00 per square metre.		$ 14,725.00
Item 8)	**Precast Interlocking Concrete Block Headwalls**; Supply and install precast interlocking concrete block headwalls at both ends of new culvert, including excavation, drainage material, geotextile filter cloth, dowels with concrete fill, bedding, backfill, restoration, etc., complete.	Lump Sum	$ 26,000.00

Report - Road 10 Crossing Over the Patterson Drain
(Geographic Township of Gosfield North)
Town of Kingsville - D-17-029

Item 9)	**Culvert Replacement and Re-alignment**; Provide all labour, equipment and materials to remove and dispose of approximately 7.0 metres of existing 450mm diameter CSP and replace same with 450mm diameter, smoothwall H.D.P.E. Boss 2000 plastic pipe with mortar joint connection, including excavation, granular bedding, backfill, compaction and restoration compaction, topsoil, seeding and mulching, cleanup and restoration, complete. Lump Sum	$	3,500.00
Item 10)	**Asphalt Pavement Restoration**; Replace removed tar and chip pavement with minimum 100mm thick, of HL-4 Asphaltic Concrete Pavement in minimum 2 equal lifts, supplied, laid, and compacted for the full width of the roadway and for a total distance of 50.0 metres (25.0 metres on both sides of new culvert), complete, approximately 82.0 tonnes, at $280.00 per tonne.	$	22,960.00
Item 11)	**Final Cleanup and Restoration**; Provide all labour, equipment and materials to clean up the project site on completion of the work, complete. Lump Sum	$	5,000.00
Item 12)	Net H.S.T. on Items above (1.76%)	$	3,789.00
	TOTAL FOR CONSTRUCTION		**$219,074.00**

INCIDENTALS

1)	Report, Estimate, and Specifications	$ 9,900.00
2)	Survey, Assistants, Expenses, and Drawings	$ 12,000.00
3)	Duplication Costs of Drawings and Report	$ 800.00
4)	Estimated Cost of Letting the Contract including Preparation of Tender Documents, Tender Review, and Tender Advertisement in The Windsor Star	$ 2,000.00
5)	Estimated Cost for Full-Time On-Site Inspections, and Periodic Supervision and Project Management during Construction (based on a 3.0 weeks duration)	$ 14,500.00
6)	Pre-Engineering Utility Locate Charges, including Hydro-Vacuum Excavation	$ 1,400.00

7)	Cost for third Party Geotechnical Investigations, and material testing	$ 6,000.00
8)	Net H.S.T. on Items above (1.76%)	$ 820.00
9)	Estimated Cost for E.R.C.A. Permit (if required)	$ 800.00
	TOTAL FOR INCIDENTALS	**$ 48,220.00**
	TOTAL FOR CONSTRUCTION (brought forward)	**$219,074.00**
	TOTAL ESTIMATE	**$267,294.00**

VII. DRAWINGS AND SPECIFICATIONS

As part of this report, we have attached design drawings for the Road 10 Crossing Over the Patterson Drain, consisting of Sheets 1 and Sheet 2. The design drawings show the subject road crossing location and the details of construction.

Furthermore, Bench Marks were established therein for the structure detail. The drawings attached herein have been reduced in size and the scale therefore varies; however, full scale drawings can be viewed at the Kingsville Municipal Office, if required.

Also attached, we have prepared Specifications which set out the required construction details for the various aspects of the works to be conducted under this report. We have also included Installation Guidelines for "Interlocking Block Headwalls" and "Cable Concrete Erosion Protection" related to the intended works, labelled herein as **Appendix "B"**.

A Geotechnical Exploration Report, provided by Golder Associates Ltd., has been included within this report which outlines geotechnical information and soil bearing capacities along with recommendations for backfilling and construction considerations. This document has been labeled herein as **Appendix "C"**

VIII. CONSTRUCTION SCHEDULE OF ASSESSMENT

We would recommend that all of the costs associated with the construction and improvements to the Road 10 Crossing Over the Patterson Drain shall be assessed to the Town of Kingsville Public Works Department for the works caused by the existence of their public roadway, in accordance with Section 26 of the Drainage Act.

Report - Road 10 Crossing Over the Patterson Drain
(Geographic Township of Gosfield North)
Town of Kingsville - D-17-029

This assessment is listed under Section 6 of the **Construction Schedule of Assessment** and shall be non-proratable.

IX. FUTURE MAINTENANCE

After the completion of all of the works associated with the roadway culvert replacement within the Patterson Drain, said installations shall be maintained in the future by the Town of Kingsville under the provisions of the Drainage Act. All of the costs for the maintenance and repair of said new road crossing and ancillary works shall be carried out at the sole expense of the Town of Kingsville Public Works Department. The future works of maintenance for which the Town of Lakeshore Public Works Department shall be solely responsible for shall be limited to and controlled by the lengths, dimensions, specifics, and appurtenances detailed within this report and the attached final design drawings and specifications.

All of the above provisions for future maintenance under this report, shall remain as aforesaid until otherwise determined under the provisions of the "Drainage Act, R.S.O. 1990, Chapter, D.17, as amended 2017".

All of which is respectfully submitted.

N. J. PERALTA ENGINEERING LTD.

Antonio B. Peralta, P.Eng.

ABP/amm
Att.

N. J. PERALTA ENGINEERING LTD.
Consulting Engineers
45 Division Street North
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N9Y 1E1

CONSTRUCTION SCHEDULE OF ASSESSMENT

ROAD 10 CROSSING OVER THE PATTERSON DRAIN

TOWN OF KINGSVILLE

6. SPECIAL NON PRO-RATEABLE ASSESSMENTS (non-agricultural (Sec.26)):

Tax Roll No.	Con. or Plan No.	Lot or Part of Lot	Acres Afft'd	Hectares Afft'd	Owner's Name	Value of Benefit	Value of Outlet	Value of Special Benefit	TOTAL VALUE
Kingsville Roads Department					Town of Kingsville	$ 267,294.00	$ -	$ -	$ 267,294.00
Total on Special Non Pro-Rateable Assessments (non-agricultural (Sec.26))						**$ 267,294.00**	**$ -**	**$ -**	**$ 267,294.00**
TOTAL ASSESSMENT						**$ 267,294.00**	**$ -**	**$ -**	**$ 267,294.00**

1 Hectare = 2.471 Acres

D-17-029

April 23rd, 2018

SPECIFICATIONS

ROAD 10 CROSSING OVER THE PATTERSON DRAIN

(Geographic Township of Gosfield North)

TOWN OF KINGSVILLE

I. GENERAL SCOPE OF WORK

The Patterson Drain is an existing open Municipal Drain which provides drainage to the lands primarily located within the northern portion of the Town of Kingsville and a small portion within the Town of Lakeshore. The upper end of the Patterson Drain commences at the south side of the Road 10 between Lot 22 and Lot 23, where it collects flows from the East and West Branch of the Patterson Drain. From the south side of Road 10, the open drain extends downstream in a northerly direction through Concessions 10 and 11 and outlets into Lot 29, Concession 4, within the Town of Lakeshore, into the Ruscom River. The subject road crossing culvert is located across Road 10 and conveys runoff from the lands south of the roadway. The work under this project generally comprises of the removal and replacement of the existing road culvert crossing Road 10. These works include the removal of existing bridge structure, headwalls, tar and chip pavement, the installation of new concrete structure, new interlocking precast concrete block headwalls, cable concrete erosion protection, granular bedding, granular approach and backfill, transition areas, roadway pavement placement and all ancillary work related thereto including cleanup and restoration. The proposed work is intended to address the replacement of deteriorated structure in accordance with the current standards.

All work shall be carried out in accordance with these specifications, and shall comply in all regards with **Appendix "A"**, as well as the "Interlocking Concrete Block Headwall" and "Cable Concrete Erosion Protection" installation guidelines included in **Appendix "B"**. The works shall also be carried out in accordance with the Geotechnical Exploration Report labelled **Appendix "C"**, together with the plans labelled herein as **Appendix "D"**. The open drain and structure shall be of the size, type, depth, etc., as is shown in the accompanying drawings, as determined from the **Bench Mark**, and as may be further laid out at the site at the time of construction. All work carried out under this project shall be completed to the full satisfaction of the Town Drainage Superintendent and/or the Consulting Engineer.

II. E.R.C.A. AND D.F.O. CONSIDERATIONS

The Contractor will be required to implement stringent erosion and sedimentation controls during the course of the work to minimize the amount of silt and sediment being carried downstream into the Ruscom River. It is intended that work on this project be carried out during relatively dry weather to ensure proper site and drain conditions and to avoid conflicts with sediment being deposited into the Ruscom River. All disturbed areas shall be restored as quickly as possible with grass seeding and mulching installed to

ensure a protective cover and to minimize any erosion from the work sites subsequent to construction. The Contractor may be required to provide temporary silt fencing and straw bales as outlined further in these specifications.

All of the work shall be carried out in accordance with any permits or authorizations issued by the Essex Region Conservation Authority (E.R.C.A.) or the Department of Fisheries and Oceans (D.F.O.), copies of which will be provided, if available. The Contractor is advised that no work shall be carried out in the existing drain from March 15th to June 30th, of any given year, because the drain is directly connected to a downstream drain that is classified as sensitive to impacts on aquatic life and habitat by the E.R.C.A. and D.F.O.

As part of its work, the Contractor will implement the following measures that will ensure that any potential adverse effects on fish and fish habitat will be mitigated:

a) As per standard requirements, work will not be conducted at times when flows in the drain are elevated due to local rain events, storms, or seasonal floods. Work will be done in the dry.

b) All disturbed soils on the drain banks and within the channel, including spoil, must be stabilized immediately upon completion of work. The restoration of the site must be completed to a like or better condition to what existed prior to the works. The spoil material must be hauled away and disposed of at a suitable site, or spread an appropriate distance from the top of the drain bank to ensure that it is not washed back into the drain.

c) To prevent sediment entry into the Drain, in the event of an unexpected rainfall, silt barriers and/or traps must be placed in the channel during the works and until the site has been stabilized. All sediment and erosion control measures are to be in accordance with related Ontario Provincial Standards. It is incumbent on the proponent and their Contractors to ensure that sediment and erosion control measures are functioning properly and are maintained and upgraded as required.

d) Silt or sand accumulated in the barrier traps must be removed and stabilized on land once the site is stabilized.

e) All activities including maintenance procedures should be controlled to prevent the entry of petroleum products, debris, rubble, concrete, or other deleterious substances into the water. Vehicular refuelling and maintenance should be conducted away from the water.

Specifications - Road 10 Crossing Over the Patterson Drain
(Geographic Township of Gosfield North)
Town of Kingsville - D-17-029

Not only shall the Contractor comply with all of the above, it shall also be required to further comply with the notes included within the email from Cynthia Casagrande, of the E.R.C.A. Furthermore, the Contractor shall also review and comply with the "Best Management Practices – Culvert Replacements in Municipal Drains" document prepared by the D.F.O. Both of which have been included within **Appendix "A"**.

III. M.N.R.F. CONSIDERATIONS

Under the Species at Risk Provincial Legislation, set in place with the Ministry of Natural Resources and Forestry (M.N.R.F.), Section 23.9 of the Endangered Species Act, 2007, allows the Municipality to conduct eligible repair, maintenance, and improvement work under the Drainage Act that exempts these works from Sections 9 and 10 of this Act, so long as they follow the rules within Ontario Regulation 242/08.

Prior to commencing work, the Town of Kingsville will complete an "Endangered Species Act Review" for the Patterson Drain and will provide the Contractor with the results of said review, including Town documents for the purpose of identification of known species at risk within the project area and mitigation measures for species and habitat protection. It is the responsibility of the Contractor to make certain that necessary provisions are undertaken to ensure the protection of all species at risk and their habitats throughout the course of construction.

The Contractor will be responsible for providing the necessary equipment and materials required by the mitigation plans and shall contact the Town of Kingsville Drainage Superintendent immediately if any endangered species are encountered during construction.

IV. ACCESS TO WORK AND TRAFFIC CONTROL

The Contractor is advised that the majority of the work to be carried out on this project extends across the Road 10. The Contractor shall have access for the full width of the roadway abutting the proposed drainage works. The Contractor may use the entire width of the Road 10 right-of-way as necessary to permit the completion of the work required to be carried out for this project. The Contractor shall avoid the use of private lands to perform the required works.

The Contractor shall ensure that the travelling public is protected at all times while utilizing the roadway for its access. The Contractor shall provide traffic control, including flag persons when required. The Contractor shall be required to submit a Traffic Control Plan to the Consulting Engineer for approval from the governing Road Authorities. The Traffic Control Plan shall be carried out in accordance with the requirements of the Ontario

Traffic Manual's Book 7 for Temporary Conditions. The Contractor may arrange to close Road 10, from the Graham Sideroad to County Road 31 (Albuna Townline) for the proposed works. The road closure must be requested and subsequently authorized by the Town of Kingsville and in consultation with the County of Essex. The Contractor shall also ensure that all emergency services, school bus companies, etc. are contacted about any disruption at least 48 hours in advance of same. Any and all detour routes shall be established in consultation with the Town of Kingsville and County of Essex Roads Departments.

Throughout the course of the work it is imperative that the Contractor protect as much landscaping and vegetation as possible when accessing along the drain. This will be of particular concern along the lawn areas of residential properties. Due to the extent of the work and the area for carrying out the work, the Contractor will be required to carry out all of the necessary steps to direct traffic and provide temporary diversion of traffic around work sites, including provision of all lights, signs, flag persons, and barricades required to protect the safety of the travelling public. Any accesses or areas used in carrying out the works are to be fully restored to their original conditions by the Contractor, including topsoil placement and lawn restoration as directed by the Town Drainage Superintendent and/or the Consulting Engineer. Restoration shall include but not be limited to all necessary levelling, grading, shaping, topsoil, seeding and mulching, and granular placement required to make good any damage caused.

Any damages caused, resulting from non-compliance of the above noted provisions, shall be restored by the Contractor to its original condition, at the Contractor's expense.

V. REMOVAL OF BRUSH, TREES AND RUBBISH

Where there is any brush, trees or rubbish along the course of the drainage works, including the full width of the work access, all such brush, trees or rubbish shall be close cut and grubbed out, and the whole shall be chipped up for recycling, burned or otherwise satisfactorily disposed of by the Contractor. The brush and trees removed along the course of the work are to be put into piles by the Contractor in locations where they can be safely chipped and disposed of, or burned by it, or hauled away and disposed of by the Contractor to a site to be obtained by it at its expense. Prior to and during the course of any burning operations, the Contractor shall comply with the guidelines prepared by the Air Quality Branch of the Ontario Ministry of the Environment, and shall ensure that the Environmental Protection Act is not violated. The Contractor shall be required to notify the local Fire Authorities and co-operate with them in the carrying out of any work. The removal of brush and trees shall be carried out in close consultation with the Town Drainage Superintendent and/or Consulting Engineer to ensure that no decorative trees or

shrubs are disturbed by the operations of the Contractor that can be saved. It is the intent of this project to save as many trees and bushes as practical within the roadway allowances and on private lands.

The Contractor shall protect all other trees, bushes, and shrubs located along the length of the drainage works except for those trees that are established, in consultation with the Town Drainage Superintendent, the Consulting Engineer, and the Owners, to be removed as part of the works. The Contractor shall note that protecting and saving the trees may require the Contractor to carry out hand work around the trees, bushes, and shrubs to complete the necessary final site grading and restoration.

Following the completion of the work, the Contractor is to trim up any broken or damaged limbs on trees which are to remain standing, and it shall dispose of said branches along with other brush, thus leaving the trees in a neat and tidy condition.

The Contractor shall remove all deleterious materials and rubbish along the course of the open drain and any such materials located in the bridge culverts while carrying out its cleaning of same. All such deleterious materials and rubbish shall be loaded up and hauled away by the Contractor to a site to be obtained by it at its cost.

VI. FENCING AND ROAD SIGNS

Where it is necessary to take down any fence and road signs to proceed with the work, same shall be done by the Contractor across or along that portion of the work where such feature is located. The Contractor will be required to exercise extreme care in the removal of any these features so as to cause a minimum of damage to same. The Contractor will be required to replace any feature that is taken down in order to proceed with the work, and the feature shall be replaced in a neat and workmanlike manner. The Contractor will not be required to procure any new materials for reinstalling the feature provided that it has used reasonable care in the removal and replacing of same. When any feature is removed by the Contractor, and the Owner thereof deems it advisable and procures new material for replacing the feature so removed, the Contractor shall replace the feature using the new materials and the materials from the present feature shall remain the property of the Owner.

VII. DETAILS OF ROAD CROSSING WORK

The Contractor shall provide all material, labour and equipment to replace the existing road crossing within the Patterson Drain, as outlined on the plans, the Schedule of items, and in these specifications.

Specifications - Road 10 Crossing Over the Patterson Drain
(Geographic Township of Gosfield North)
Town of Kingsville - D-17-029

The existing culvert slated to be removed from the existing access bridge along the Patterson Drain, shall be replaced with new culvert materials as shown. All culverts within this project shall be set to the grades as shown on the plans or as otherwise established herein and the Town Drainage Superintendent or the Consulting Engineer may make minor changes to the bridge alignment as they deem necessary to suit the site conditions.

VIII. REMOVALS

Where existing culvert is to be replaced, the Contractor shall completely remove and dispose of all tar and chip asphalt, existing backfill material, concrete bridge deck, abutments, wingwalls, sidewalls, footings and steel reinforcing, together with any broken concrete slab pieces, steel sheet pile, and concrete curbs, all quarried limestone, as well as any deteriorated pipe and any deleterious materials that may be encountered in removing same. Furthermore, all unsuitable or deleterious materials from the excavation and removal of existing culverts, the granular approaches to the bridge or installation of new headwalls shall be hauled away and disposed of by the Contractor to a site to be obtained by it at its own expense. Likewise, where indicated in the plans, or in the Schedule of Items, or in the Specifications, the Contractor shall remove the existing culvert pipe at the north end of the new road crossing and dispose of same at a site to be obtained by it at its own expense. In all cases, the disposal of any trucked material with be the responsibility of the Contractor and it shall ensure that any permits required for fill disposal are obtained from the appropriate authority. The Contractor will be responsible for keeping all private and public roadways free and clear of mud and debris resulting from its use of same for access and hauling purposes.

The Contractor shall divert existing swales, tiles or pipes where they are impacted by the new bridge structure. The Contractor shall remove and dispose of unsuitable existing tile and extend and divert the tile with the same size Big 'O' Boss 2000 or equal material in general conformance with the **"Lateral Tile Outlet Detail"** as outlined within the accompanying drawings.

IX. CONCRETE BRIDGE STRUCTURE

The new concrete bridge structure shall be of precast concrete box culvert type. The new concrete bridge structure shall conform to the latest version of the Canadian Highway Bridge Design Code (C.H.B.D.C.) for Truck Loading and be constructed in general conformance with O.P.S.S. 1821 and designed for the available minimum cover. The installation of the concrete structure shall comply with O.P.S.S. 422 and 904, together with any other applicable references identified within these Specifications. **The Fabricator shall note that the subject road crossing culvert will**

have less than 600mm of cover. Therefore, the Fabricator shall make provisions to include the appropriate reinforcement and/or appropriately sized concrete distribution slab within the structure design to carry all required loading based on the C.H.B.D.C. provisions. The Contractor shall note that Geotechnical Explorations have been conducted for the proposed culvert replacement and shall assist the fabricator to design the proposed structure and footings to the appropriate bearing capacities for each structure, in addition to providing the Contractor with recommendations for the structure installation. This Geotechnical Report is attached herein as **Appendix "C"**.

The proposed structure shall include all appropriate appurtenances including, but not limited to, protection board, waterproofing, shear plates, dowels, etc. or any additional appurtenances that may be deemed necessary by the structure fabricator. Generally speaking, the following materials shall be utilized for the installation of said bridge structure and the installation of same shall comply with the manufacturer's recommendations:

Reinforcing Bars: CSA G30.18M, Grade 400R new deformed bars of billet steel. Refer to O.P.S.S. 1440 for material specifications.

Waterproofing Membrane: MEL-ROL, rolled, self-adhering membrane. Protection board for waterproof membrane shall be PC-3 heavy duty asphalt board. Both of which as manufactured by W.R. Meadows Canada, or approved equal.

Shear Plates: Precast culvert sections joint connecting plate and hardware shall be type 304 stainless steel. All anchors shall be type 316 stainless steel, Hilti-Hit Adhesive Anchors, or approved equal.

Bonding Agent: Intralok as manufactured by W.R. Meadows Canada or Sikadur 32ES as manufactured by Sika Canada Inc.

Curing Compound: CS-309 acrylic curing and sealing compound as manufactured by W.R. Meadows Canada, or approved equal.

Dowel Adhesive: Meadows Rezi-Weld Gel-Paste Cartridge System, Hilti-Hit HY150 System, Sikadur Injection Gel, Powers Acrylic – 100 System or approved equal.

Penetrating Sealer: Sikagard SN40 silane sealer as manufactured by Sika Canada Inc. or approved equal. Application shall be two (2) coats at a coverage of 3.8 sq.m./L per coat.

Joint Sealant: Sikaflex 2C NS for horizontal and vertical surfaces as manufactured by Sika Canada Inc.

Specifications - Road 10 Crossing Over the Patterson Drain
(Geographic Township of Gosfield North)
Town of Kingsville - D-17-029

The Contractor shall arrange for the Supplier to provide full shop drawings outlining all details of the fabrication and assembly and installation of the proposed concrete box culvert to the Consulting Engineer for approval prior to proceeding with fabrication and assembly of same. **The shop drawings shall bear the seal and signature of an Engineer certifying that the design meets the minimum design standards and includes fabrication details, hardware, reinforcing schedules, etc.** The Contractor shall arrange with the Supplier for technical assistance with the assembly of the structure on-site in full accordance with the requirements of the Supplier. All assembly installation shall be carried out to avoid any damage to the structure and shall follow the Supplier's recommendation in every respect to ensure a proper and safe installation.

The Contractor will also be responsible for excavating the necessary trench for the installing a reinforced concrete apron wall at each end of the new structure. The apron walls shall be to the size, type, depth, etc., including the necessary reinforcement, as is shown and detailed within the accompanying drawings. The apron wall shall have the appropriate reinforcing steel with minimum 400 MPa yield strength and minimum 50mm of concrete cover. All concrete utilized for the apron wall, concrete structure and headwalls shall adhere to CSA type GU cement and comprise of a minimum 35 MPa concrete strength at 28 days with a water-cement ratio not to exceed 0.4 with 6%(±1%) air entrainment. Concrete compression strength tests shall conform to CSA-A23.1-M requirements and the results of said test shall be submitted to the Consulting Engineer for their records.

The Contractor is to note that when installing the new structure, it shall be required to excavate a trench having a width not less than outside span distance plus a minimum of 600mm working width on both sides of the structure.

The Contractor shall note that the placing of the new access bridge shall be performed totally in the dry, and they shall be prepared to take whatever steps are necessary to ensure same, all to the full satisfaction of the Town Drainage Superintendent and the Consulting Engineer. The Contractor shall also be required to supply a minimum of 300mm (12”) of Granular “A” pipe bedding compacted to a minimum of 98% Standard Proctor Density bedding underneath the culvert pipe. Alternatively, the Contractor may supply 20mm (3/4”) clear stone in lieu of Granular “A” material. All of which shall conform to O.P.S.D. 802.010 or 802.030 and shall be performed to the full satisfaction of the Town Drainage Superintendent or the Consulting Engineer. Furthermore, if an unsound base is encountered, it must be removed and replaced with 20mm (3/4”) clear stone satisfactorily compacted in place to the full satisfaction of the Town Drainage Superintendent or the Consulting Engineer.

Specifications - Road 10 Crossing Over the Patterson Drain
(Geographic Township of Gosfield North)
Town of Kingsville - D-17-029

The Contractor shall be responsible for the safe and proper handling of the box culvert and shall inspect all sections to ensure that no cracks, chips or defects exist in the sections prior to placement in the drain line. Should the Contractor permit damaged culvert sections or materials to be installed in the drain line, it shall be responsible for the removal and replacement of same at its own expense, should the Engineer require such removal and replacement.

The Contractor shall lay the concrete structure to the lines, levels, and grades as shown in the accompanying drawings or as may be laid out and established by the Engineer prior to the time of construction. Prior to installation, the Contractor shall notify the Engineer for field verification of the layout. The Contractor will be held responsible for said lines, levels and grades of the structure and should the Engineer determine that the Contractor has not satisfactorily adhered to such lines, levels and grades, it may direct the Contractor to take up and re-lay any portion of the drain which does not conform to such lines, levels and grades.

The Contractor shall note the backfilling requirements outlined within the "**Typical Roadway Crossing Backfill Detail**" shown within the accompanying drawings. The Contractor shall backfill the concrete structure with Granular "B" Type II backfill compacted in place to a minimum 100% of Standard Proctor Density with the exception of the top 450mm which shall be backfilled with Granular "A" material also compacted in place to a minimum Standard Proctor Density of 100%.

The Contractor shall note that the existing roadway narrows across the existing structure. As part of the crossing improvements, the Contractor shall provide the necessary compacted Granular "A" material to widen the existing shoulders on both sides of the travelled roadway to facilitate a consistent roadway width across the proposed structure, as outlined within the accompanying drawings.

All granular backfill for the culvert installation and shoulder widening shall be satisfactorily compacted in place to the minimum Standard Proctor Density by means of mechanical compaction equipment. All of the backfill material, equipment used, and method of compacting the backfill material shall be provided and performed to the full satisfaction of the Town Drainage Superintendent or Consulting Engineer.

As part of the work, the Contractor will be required to clean out the drain including removal of all topsoil and deleterious material, along the full length of the box culvert, and clean the drain bottom for a distance 3.0m upstream and downstream of the new culvert ends. The Contractor shall dispose of all excavated and deleterious materials to a site to be obtained by it at its expense. The Contractor shall note that the survey indicates slight sedimentation in the drain as it currently exists, and the Contractor will be required to provide any and all labour,

materials and equipment to remove and dispose of the sediment and to set the box culvert to the required design grades including any bedding materials. Upon completion the Contractor shall ensure that there is no ponding of water adjacent to the box culvert.

The Contractor, in all cases, shall comply with these specifications and shall be read in conjunction with the fabrication design drawings. In the event that a conflict with these specifications, the fabrication drawings and specifications shall govern.

X. PRECAST INTERLOCKING CONCRETE BLOCK HEADWALLS

Once the new structure has been set in place, the Contractor shall construct precast interlocking concrete block headwalls at both ends of the road crossing culvert, where identified within the accompanying plans. The precast interlocking concrete block headwalls are to be provided and laid out as is shown and detailed in the accompanying drawing.

Alternatively, the Contractor may construct cast-in-place concrete headwalls in lieu of precast interlocking concrete block headwalls at no additional costs to the project and upon the authorization of the Town of Kingsville and the Consulting Engineer. If the Contractor obtains the necessary approvals to proceed with the cast-in-place concrete headwall, they shall comply with the requirements of CSA A23.1. The Contractor shall arrange for full shop drawings outlining all details of all concrete mix design, reinforcement, forming, assembly and installation of the proposed cast-in-place concrete headwall to the Consulting Engineer for approval prior to proceeding with the installation of same. **The shop drawings shall bear the seal and signature of an Engineer certifying that the design meets the minimum design standards and include fabrication details, hardware, reinforcing schedules etc.**

The standard precast interlocking concrete blocks shall be rectangular in shape with square corners and be a minimum size of 600mm x 600mm x 1200mm (2' x 2' x 4'), as available from Underground Specialties Inc., or approved equal. Blocks with modified lengths may be utilized to fill in staggered sections of the block wall. All blocks shall be cast in one pour with no cold joints and shall have a minimum compression strength of 30 MPa at 28 days. All precast concrete blocks shall be formed with interlocking pockets and tenons and each block shall be assembled in a staggered formation to prevent sliding at the interface between blocks. All precast concrete blocks shall be uniform in size with relatively smooth and consistent joints. All precast concrete blocks shall have a relatively smooth and consistent exterior finish for all blocks above the footing of the culvert. Each block shall be fitted with a lifting ring that will not interfere with the assembly of the block wall once they are set in place. Cap blocks

shall be utilized on the top course of the wall with the top of the cap blocks having a smooth, uniform finish.

Precast interlocking blocks that abut the culvert pipe shall be cut and shaped to fit closely around the perimeter of the culvert. The face of the wall shall not extend beyond the end of the culvert. All minor gaps between the blocks and the pipe shall be sealed with no shrink grout for the full depth of the blocks. At the base of the wall, a base block shall be used at the bottom of the interlocking block wall. The base block shall be founded on a firm solid base. When necessary, the Contractor shall provide a minimum of 150mm thickness of level compacted granular bedding, or a lean concrete footing, as a firm foundation for the blocks. The base block shall be set level and shall convey a vertical projection throughout its full height and shall include filter cloth behind the wall for the full height of the blocks to prevent soil migration though any joints. Filter cloth fabric shall be non-woven geotextile material and be minimum GMN-160 meeting O.P.S.S. Class I, or as further outlined within the shop drawings.

The interlocking block headwall shall be dowelled into the concrete culvert structure, utilizing appropriately sized stainless steel anchor rods and non-shrink grout, as illustrated in the details on Sheet 2 of the accompanying drawings.

The precast interlocking concrete block headwall shall be installed parallel to the roadway and include the 45 degree inward daylight, as illustrated within the accompanying drawings. The blocks shall extend up from the structure footing, and cross the full width of the drain and be embedded a minimum of 500mm into the drain banks. The top of the block wall shall be installed to match the height of the completed gravel shoulder, as specified within the accompanying drawings. Under no circumstance shall the top of the new headwall exceed the elevation of the existing gravel shoulder elevation. The Contractor shall embed the bottom course of blocks into the drain bottom the appropriate depth to achieve the required top elevation of the wall. The alignment of these headwalls shall be performed to the full satisfaction of the Town Drainage Superintendent or the Consulting Engineer.

The Contractor shall arrange for the Supplier to provide full shop drawings outlining all appropriate details, including an interlocking block layout drawings outlining block assembly and any necessary tie-backs of the proposed headwall to the Consulting Engineer for approval prior to proceeding with fabrication and assembly of same. **The shop drawings shall bear the seal and signature of an Engineer certifying that the design meets the minimum design standards and tie-back requirements.** The Contractor shall arrange with the Supplier for technical assistance with the assembly of the structure on-site in full accordance with the requirements of the Supplier. All assembly installation shall be carried out to avoid any damage to the

culvert and shall follow the Supplier's recommendation in every respect to ensure a proper and safe installation.

The installation of the precast interlocking concrete block headwalls and the placement of the backfill shall be carried out at the same time and shall be provided in total compliance with the shop drawings issued by the Supplier. Furthermore, the installation of the precast interlocking concrete block headwalls shall also comply with the "Block Headwall Installation Instructions for Culverts" provided by Underground Specialties Inc., as outlined in **Appendix "B"**.

XI. H.D.P.E. PIPE INSTALLATION

The new 320 kPa Smooth Wall H.D.P.E. pipe to be installed on this project is required to be provided as one (1) continuous length; however, where it is absolutely necessary, and only with the approval of the Town Drainage Superintendent and/or the Consulting Engineer, the Contractor may be allowed to utilize two (2) equal lengths of pipe coupled together utilizing split couplers with filter cloth wrapped connections. The Contractor shall supply all material and labour in order to provide a non-woven filter cloth wrap around the full circumference of the split coupler joint connection for the covered drain installation. The filter cloth wrapped connection shall be a minimum of 250mm (10") wider than the width of the proposed coupler and shall overlap a minimum of 200mm (8"), as available from Underground Specialties Inc., of Windsor, Ontario, or equal. The specific type to be utilized shall be approved by the Town Drainage Superintendent and the Engineer prior to its' placement. The installation of all joints must be inspected and approved by the Town Drainage Superintendent or Consulting Engineer prior to any backfilling of same.

The Contractor shall note that the placement of any new culvert pipe shall be performed totally in the dry and it shall be prepared to take whatever steps are necessary to ensure same, all to the full satisfaction of the Town Drainage Superintendent or the Consulting Engineer.

The new culvert pipe for this installation shall be provided with a minimum depth of cover from the top of the pipe of 305mm (12"). If the culvert is placed at their proper elevations, same should be achieved. If the Contractor finds that the minimum cover is not being met, they shall notify the Drainage Superintendent and the Consulting Engineer immediately so that steps can be taken to rectify the condition prior to the placement of any backfill. The minimum cover requirement is **critical** and must be attained.

As a check, all of the above structure design grade elevations should be confirmed before commencing to the next stage of the culvert installation. The Contractor is also to check that the pipe invert grades are correct by referencing the Benchmark.

Specifications - Road 10 Crossing Over the Patterson Drain
(Geographic Township of Gosfield North)
Town of Kingsville - D-17-029

The installation of the complete length of the culvert pipe, including all appurtenances, shall be completely inspected by the Town Drainage Superintendent or the Consulting Engineer's Inspector prior to backfilling any portions of same. Under no circumstance shall the Contractor commence the construction or backfill of the new culvert pipe without the site presence of the Town Drainage Superintendent or the Consulting Engineer's Inspector to inspect and approve said installation. The Contractor shall provide a minimum of forty-eight (48) hour notice to the Town Drainage Superintendent or the Consulting Engineer prior to commencement of the work. The installation of the new culvert structures are to be performed during normal working hours of the Town Drainage Superintendent and the Consulting Engineer from Monday to Friday unless written authorization is provided by them to amend said working hours.

Where the new pipe is located under an existing driveway, the Contractor shall backfill the entire trench for the width of the driveway with Granular "B" Type II backfill compacted in place to a minimum 98% of Standard Proctor Density with the exception of the top 300mm which shall be backfilled with Granular "A" material also compacted in place to a minimum Standard Proctor Density of 100%. For the remaining portion of the culvert installation, the Contractor shall backfill with clean native fill materials excavated from the removal of the existing culvert pipe. The Contractor should also note that prior to commencing its excavation that all existing topsoil should be scavenged for reuse on the project. All backfill material shall be placed in compacted lifts not to exceed 300mm thick. The Contractor is required to provide whatever mechanical equipment necessary, such as jumping jack and/or plate tamper, in order to achieve the necessary compaction levels, especially along the haunches of the new pipe.

The bottom of the trenches must be carefully excavated and trimmed to the elevation and shape of the bottom of the pipe. The bottom of the trenches shall be recessed to receive the pipe in order to allow the pipe to be uniformly supported for its' entire length. Corrections in depth of excavation caused by the Contractor excavating to an extent greater than that required for the elevation of the pipe shall be made by bedding the pipe with compacted granular material placed at the time that the pipes are being installed, at the Contractor's expense and all to the full satisfaction of the Town Drainage Superintendent or the Consulting Engineer. Furthermore, if an unsound base is encountered, it must be removed and replaced with 20mm (3/4") clear stone satisfactorily compacted in place to the full satisfaction of the Town Drainage Superintendent or the Consulting Engineer. The Contractor is to note that when replacing the existing culvert, it shall be required to excavate a trench having a width not less than the new pipe span distance plus a 300mm working width on both sides of the new pipe.

The Contractor shall connect the replacement culvert to the existing concrete pipe with the use of a mortar joint connection. Said mortar joint shall be provided at exterior of the joint for the full circumference of the connection and be of a sufficient mass to produce a sealed joint, all to be performed to the full satisfaction of the Town Drainage Superintendent or the Consulting Engineer.

XII. CABLE CONCRETE EROSION PROTECTION

At the locations indicated on the plans, and adjacent to all new bridge headwalls, the Contractor shall protect the drain banks utilizing cable concrete erosion protection. Once the Contractor has cut and shaped the drain bank, the Contractor shall supply all material and labour to place CC-35 Cable Concrete erosion protection mats, or approved equivalent, on the banks of the drain as determined by the Town Drainage Superintendent or the Consulting Engineer during construction.

Prior to the installation of the erosion protection mats, the Contractor shall be required to grub out and close cut all of the vegetation which exists along the existing drain side slopes. The Contractor shall also denude the drain banks to create a smooth plane finish. In order to conserve topsoil to finish off the cable concrete installation, the Contractor shall strip all topsoil from the existing drain side slopes. Said topsoil is to be stockpiled on-site, a sufficient distance away to allow for general operations and installation of the erosion protection mats. Said topsoil shall be re-used and spread over the erosion protection mats once they have been successfully installed.

Once the drain has been successfully denuded, the erosion protection mats are to be placed on a graded smooth plane finish and same shall be underlain in all cases with a non-woven synthetic filter mat. The smooth plane bank surface shall be uniform and consistent to ensure that the erosion protection mats maintain broad contact between the proposed mats and the native soil. The mats shall be successive installed to allow maximum gap distance no greater than 50mm (2”), with a preferred distance of 25mm (1”). When completed, the mats shall be consistent, uniform, and tightly laid, and in no instance shall the mats protrude beyond the exterior contour of the unprotected drain side slopes.

The standard CC-35 Cable Concrete mat consists of concrete blocks having a trapezoidal prism shape with a minimum size of 394mm (15.5”) square bottom and 292mm (11.5”) square top, with a minimum height of 114mm (4.5”). These blocks are systematically interlaced with stainless steel cables poured within each block. Standard mats are typically made up of 2.44m wide x 4.88m long (8’ x 16’) mats placed side-by-side and clamped together to create a homogeneous erosion protection system.

All concrete blocks shall be cast in one pour with no cold joints and shall have a minimum compression strength of 25 MPa at 28 days, together with a minimum of 5-8% air entrainment, and shall conform to CSA A23.1/A23.2. The cables shall be made of type 302 / 304 stainless steel aircraft cable, 1 x 19 construction, and shall be integrated into the concrete blocks and bisect through each block in both longitudinal and lateral directions in order to provide a flexible interlocked system. The Contractor shall also ensure that the non-woven synthetic filter mat be attached to the underside of the mats with a sufficient amount of overlap on a minimum of three (3) sides of the mats. The Cable Concrete erosion protection mats to be used for this project shall comply with the above specification and are available from International Erosion Control Systems Inc., or equal.

The installation of the cable concrete block system shall include all necessary anchors and clamps. Each mat shall be keyed in to the top and toe of the slope, to ensure that each mat is securely in place. Furthermore, the installation of the Cable Concrete erosion protection mats shall comply with the "Cable Concrete Specifications and Installation Guide" provided by International Erosion Control Systems Inc., as outlined in **Appendix "B"**.

XIII. BENCHMARKS

Also, for use by the Contractor, we have established Benchmarks along the course of the work. Benchmarks have been indicated and the Elevations has been shown and shall be utilized by the Contractor in carrying out its work. The Contractor shall note that a specific design elevation grade has been provided for the invert at each end of the culvert in the accompanying profile. The profile also sets out the culvert size, materials, and other requirements relative to the installation of the road crossing structure. In all cases, the Contractor is to utilize the specified drain grade to set any new pipe installation. The Contractor shall ensure that it takes note of the direction of flow and sets all pipes to assure that all grades flow from upstream to downstream to match the direction of flow within the drain. The Contractor’s attention is drawn to the fact that the culvert invert grades established herein provide for the culvert to be set a minimum of 10% of their rise below the existing drain bottom or the design grade of the drain, whichever is lower.

XIV. ANCILLARY WORK

During the course of any repair or improvements to the structure, the Contractor will be required to protect or extend any existing tile ends and connect them to the drainage works to maintain the drainage from the adjacent lands. All existing tiles shall be extended utilizing solid standard duty High Density Polyethylene (H.D.P.E.) or equal plastic pipe of the same diameter as the

existing tile and shall be installed in accordance with the "**Standard Lateral Tile Detail**" included within the accompanying drawings, unless otherwise noted. Connections shall be made using a manufacturer's coupling wherever possible. For other connections, the Contractor shall utilize a grouted connection. Grouted mortar joints shall be composed of three (3) parts of clean, sharp sand to one (1) part of Portland cement with just sufficient water added to provide a stiff plastic mix, and the mortar connection shall be performed to the full satisfaction of the Town Drainage Superintendent or the Consulting Engineer. The mortar joint shall be of a sufficient mass around the full circumference of the joint on the exterior side to ensure a tight, solid seal. The Contractor is to note that any intercepted pipes along the length of the existing culverts are to be extended and diverted to the downstream end of the new culvert unless otherwise noted in the accompanying drawings. All cuts or nicks to steel structures shall be touched up with a thick coat of zinc rich paint (Galvicon or equal) in accordance with the manufacturer's recommendations.

The Contractor shall also be required as part of the structure replacement to excavate and widen the drain bottom where required to fit the new pipes in order to provide a smooth transition between the new bridge culvert installations and the existing drain.

The Contractor, when doing his excavation or any other portion of the work, shall be very careful not to interfere with, plug up or damage, any existing surface drains, swales and lateral or main tile ends. If it is found that said existing drains are interfered with in any way, the Contractor will be required to unplug or repair said drains immediately, at no extra cost to the project. If it is found that any existing lateral tiles or main tile drains or tile ends have been cut off or damaged in any way during the course of the work, the Contractor will be required to either repair or replace same, to the full satisfaction of the Town Drainage Superintendent and the Consulting Engineer.

Although it is anticipated that the bridge structure installation at each site shall be undertaken in the dry, the Contractor shall supply and install a temporary straw bale check dam or silt fences in the drain bottom immediately downstream of each culvert site during the time of construction. The straw bale check dam or silt fences shall conform to O.P.S.D. 219.130 or approved equivalent and shall be to the satisfaction of the Town Drainage Superintendent or Consulting Engineer these temporary sediment features must be removed upon completion of the construction. These features may be reused at each site subject to their condition. All costs associated with the supply and installation of this straw bale check dam shall be included in the cost bid for the structure replacements.

Specifications - Road 10 Crossing Over the Patterson Drain
(Geographic Township of Gosfield North)
Town of Kingsville - D-17-029

XV. GENERAL CONSTRUCTION PROVISIONS

The Contractor is to note that legal survey bars may be located within the work area and it is to take whatever steps necessary to protect all of same. If any iron bars are damaged or removed by the Contractor, it shall arrange for an Ontario Land Surveyor licensed in the Province of Ontario to restore same, all at its cost.

The alignment of road crossing culvert throughout shall be to the full satisfaction of the Town Drainage Superintendent. The whole of the work shall be done in a neat, thorough and workmanlike manner to the full satisfaction of the Town Drainage Superintendent.

The Contractor shall satisfy itself as to the exact location, nature and extent of any existing structure, utility or other object that it may encounter during the course of the work. The Contractor shall indemnify and save harmless, the Town and the Engineer for any damages which it may cause or sustain during the progress of the work. The Contractor shall not hold the Town or the Engineer liable for any legal action arising out of any claims brought about by such damage caused by it.

All of the work required towards the installation and improvements to the road crossing culvert shall be performed in a neat and workmanlike manner and the general site shall be restored to its' original condition, and all of same is to be performed to the full satisfaction of the Town Drainage Superintendent and the Consulting Engineer.

XVI. ASPHALT PAVEMENT

The Contractor shall note that in addition to the restoration of the existing roadway surface, the Contractor shall extend the road surface replacement work for a distance of 25.0 metres on both sides of the new culvert installation, for a total distance of 50.0 metres. The Contractor shall be required to neatly saw cut the tar and chip pavement and same shall be restored with fully compacted Granular "A" backfill and a minimum of 100mm thick hot mix asphalt, to be placed in a minimum two (2) equal lifts to match the existing roadway elevation.

The Contractor shall be required to dispose of all removed tar and chip pavement material, and shall compact the Granular "A" as well as the hot mix asphalt to 97% of Standard proctor Density, and complete all of the roadway restoration to the full satisfaction of the Town of Kingsville Public Works Departments, the Town Drainage Superintendent, and the Consulting Engineer.

The Contractor shall supply and place hot-mix asphaltic concrete pavement, conforming to O.P.S.S. Form 310, base course Type HL-4 and HL-3 surface course. The Contractor shall supply asphaltic

mix designs to the Engineer for approval prior to any asphalt being laid.

All equipment used for placing and compacting the asphalt shall be approved by the Engineer. A paver shall be used for spreading and initial compaction of the asphalt. It shall be equipped with a distributing screw in front, adjustable screeds and be capable of spreading the mixture without segregation, in thickness from 12.5mm to 75mm and in width from a minimum of 1.8m to a maximum width of 4.0m, in increments of 0.15m. It shall also be equipped with a 3.0m straight edge for detecting variations from horizontal of 3.8mm in 3.0 metres.

The Contractor shall spread and compact the course of asphaltic concrete on a dry and solid base. The asphaltic concrete pavement delivered shall have a minimum temperature of 118 degrees Celsius (245 degrees F) and a maximum temperature of 150 degrees Celsius (300 degrees F) after spreading and prior to initial rolling. The Engineer shall reject any material which does not meet temperature requirements.

The Contractor shall hand spread asphaltic concrete at base widening, deep or irregular sections, intersections, turnouts, etc.

The asphaltic concrete shall be rolled in accordance with O.P.S.S. Form 310. The Contractor shall compact the asphaltic concrete until 97% of the density achieved in the laboratory has been reached. Hand tampers shall be used to compact asphaltic concrete in areas where machines have no access.

All joints, curbs, gutters, manholes, catch water basins and other structures at the point of contact with the asphaltic concrete, shall be painted with SS-1 Emulsion, O.P.S.S. Form 1102 or approved equal. The Contractor shall repair any faulty work under the Engineer's supervision.

XVII. UTILITIES

All pipe shall be laid in trenches in the general location shown on the accompanying drawings or as may be specifically directed and laid out by the Engineer at the time of construction. The trench shall be located to clear all existing utilities and structures above, on, or below the ground level. The Contractor will be responsible at all times for complete investigation to determine the location of all such utilities or structures known or unknown, and it shall indemnify and save harmless the Engineer and the Municipality for any responsibility, injury, or liability arising from any damage to such utilities or structures by the Contractor.

The Contractor shall note that utility services in direct conflict with the existing and proposed structure have been relocated during the pre-engineering process. As a result, Bell Canada, Union Gas and Hydro One have made provisions to relocate various service lines and appurtenances in the vicinity of the replacement structure through the course of this project. Therefore, prior to any removal of residual abandoned infrastructure, it is the Contractor's responsibility to coordinate with each Utility Company for third party consultation, to confirm whether the utility service is "Dead or Alive". The Contractor shall note that when the abandoned line has been confirmed, the abandoned utility shall be removed within the trench width, pinched off and abandoned.

In the event that the existing utilities are still found to be in direct conflict with the new culvert, then the Contractor is to immediately notify the Town Drainage Superintendent and/or the Consulting Engineer, together with the affected Utility Company, so that the necessary arrangements can be made to avoid conflict with the new culvert pipe. The Contractor shall not in any way perform any work on the utility without explicit permission and supervision from the Utility Company.

The Contractor shall protect all other services located in the vicinity of the proposed drainage works including any sanitary sewers and connections, watermains and connections, telephone, hydro and gas services, along with any private systems and services. Any damaged components shall be replaced by the Contractor, totally at its own expense and it shall fully restore the functionality of same.

The Contractor shall further contact or notify such Utility Company or Commission of its intention to carry out work in the area and co-operate with such Utility Company or Commission in the location, maintenance and preservation of all such utilities. The location of the pipes and appurtenances as shown on the drawings is approximate and may be changed by the Engineer if deemed advantageous for the progress of the work.

Should the Contractor discover any conflicts with existing utilities during the course of the work, the Contractor shall give that utility the opportunity to make adjustments to their plant if required. This work shall be done at the expense of the utility pursuant to Section 26 of the Drainage Act.

XVIII. TOPSOIL, SEED AND MULCH

As part of the project, all disturbed and newly filled boulevard areas, together with all gaps in the newly installed cable concrete erosion mats, shall be covered with approximately 100mm of scavenged topsoil, fine graded and readied for the seeding and mulching process. If there is a shortage of scavenged topsoil material, the Contractor shall supply the balance of the topsoil needed, all at

its own expense. Along the frontage of residential properties, the lawn areas shall be restored by the placement of good quality OSECO Lawn Seed Mixture Canada No. 1 or equal. All existing roadway grass boulevard areas and open drain side slopes shall be restored utilizing a seed and mulch mixture which shall thoroughly restore same to their pre-construction conditions, or better. The placing and grading of all topsoil shall be carefully and meticulously carried out according to Ontario Provincial Standard Specifications, Form 570, dated November 2007, or as subsequently amended or as amended by these Specifications.

The Contractor is advised that control of erosion and sedimentation is a major requirement of this project. The Contractor will be expected to implement control measures including, but not limited to, utilizing silt fences and straw bales in the swale and drain bottoms to reduce the amount of sediment escaping downstream into the receiving water bodies. Said work shall be carried out in general conformance with Ontario Provincial Standard Specifications, Form 577, dated November 2006, or as subsequently amended or as amended by these Specifications. As an integral part of the sedimentation control, the Contractor will be required to carry out seeding and mulching on a timely basis so that no portion of the new swales or newly filled areas or open drain restored areas are left exposed for an extended period of time.

The seeding and mulching operations shall be carried out according to Ontario Provincial Standard Specifications, Form 572, dated November 2003, or as subsequently amended or as amended by these Specifications.

As part of the seeding and mulching operation, the Contractor will be required to provide either a hydraulic mulch mix or spread straw mulch with an adhesive binder in accordance with O.P.S.S. 1103.05.03, dated November 2007, or as subsequently amended, to ensure that the grass seed will be protected during germination and provide a thick uniform cover to protect against erosion, where necessary. The Contractor shall provide for the watering of newly seeded areas in accordance with O.P.S.S. requirements, and as part of the work, the Contractor must provide a full one (1) year guarantee on all seeding and mulching work, and will be required to repair all areas that erode or where the grass cover fails to catch. All work shall be meticulously done and completed in a good and workmanlike manner to the complete satisfaction of the Town Drainage Superintendent and the Consulting Engineer.

INDEX TO GENERAL CONDITIONS

PAGE GC -

GENERAL CONDITIONS

1. DEFINITIONS

Whenever used in these General Conditions, or in the Supplementary General Conditions, Special Provisions of Contract, Agreement, Plans, Form of Tender, Information for Tenderers, Specifications, Statutory Declaration or other documents forming part of this Contract: "authorized", "directed", "required", "requested", "approved", "ordered", "sanctioned", "considered", and "satisfactory", shall, unless some other meaning is obvious from the context, mean respectively authorized, directed, required, requested, approved, ordered, sanctioned or considered by or satisfactory to the Engineer.

"Owner" means the Municipality, Corporation, Company, Individual or Purchaser named in the Form of Tender, for whom the work is being performed.

"Corporation" shall mean the Municipality or Municipalities in or for which the work is being carried out.

"Contract" includes the Agreement to do the work entered into with the Owner, the Specifications, the General Conditions, Information to Tenderers, Special Provisions of Contract, the Plans, the Tender and all other documents referred to in or connected with the said Agreement.

"Contractor" or a pronoun in place thereof, means the person or persons or corporation who have undertaken to carry out the Contract.

"Engineer" shall refer to and mean N. J. PERALTA ENGINEERING LTD., 45 Division Street North, KINGSVILLE, Ontario N9Y 1E1 or any of their duly authorized representatives.

"Inspector" means an inspector for the Owner or Engineer acting under the direction of the Engineer.

"period of maintenance" means the period from the date of Substantial Performance of the Contract, as set out in the Certificate of Substantial Performance, to the date of issuance of the Final Certificate and shall be not less than 12 months.

"plans" means all plans, profiles, drawings, sketches, or copies thereof exhibited, used or prepared for or in connection with the work embraced under the Contract.

"plant" (unless the context requires a different meaning) means every temporary or accessory means necessary or required to carry on or complete the work and extra work, in the time and manner herein provided.

"shall", "may", "herein", "person", "writing", or "written", "surety", and "security", and works used in the singular number or the masculine gender, shall have the meaning and effect as given in the Interpretation Act of the Revised Statutes of Ontario.

"Solicitor" means the person for the time being acting as Solicitor for the Owner.

"Sub-Contractor" includes only a person, firm or corporation having a contract for the execution of a part or parts of the work included in the general contract or a person, firm or corporation furnishing material called for in the general contract and worked to a special design according to the plans or specifications, but does not include one who merely furnishes material not so worked.

"work" or "works" (unless the context requires a different meaning) means the whole works, materials, matters and things required to be done, supplied, or installed that are mentioned or referred to in the Contract, including all extra or additional work or material, matters or things which may be ordered by the Engineer, as herein provided.

2. TENDERS

All Tenders for the execution of the work herein set forth or referred to must be made on the printed forms supplied for that purpose. No others will be considered. Such Tenders must be made without any knowledge, comparisons of figures or arrangements with any other person making any Tender or estimate for the same purpose, and the Tenderers shall declare that such Tenders are in all respects fair and without collusion or fraud, and that no Owner or duly authorized representative is, shall be, or shall become interested, directly or indirectly as contracting party, partner, surety or otherwise in, or in the performance of, the Contract, or in the supplies, work or business to which it relates, or in any portion of the profits to be used therein or thereof, or in any of the monies to be derived therefrom. The Tender must be verified by the Statutory Declaration of the party or parties making the Tender that the several matters stated therein are in all respects true. Tenders must cover the cost of completion of the Contract in every respect, in accordance with the Contract, including all labour, plant, tools, etc.

2. TENDERS (CONT'D)

The Contractor agrees that it is fully informed regarding all of the conditions local or otherwise, affecting the work to be performed and that its information was secured by personal investigation and that it will make no claim against the Owner or Engineer based on any estimate or representation of the Owner or Engineer or of any representative of same.

3. SCOPE OF CONTRACT

Stated in general terms, and without in any way limiting the requirements and intent of the Contract, the work required to be done by the Contractor under the Contract comprises all excavations required for the proper carrying out of the works, the formation, construction, completion and maintenance of the works referred to in the Plans, Specifications, General Conditions or other Contract Documents relating thereto and includes the provision, except where otherwise specifically stated in the contract, of all labour, plant, material and equipment required for the complete and proper execution of the work. The Contract Documents are complementary and what is required by any part thereof shall be considered as being required by the whole thereof. Materials and work which are not specifically described or shown in the contract Documents but the necessity of which can reasonably be considered as inferable from the Contract Documents shall be supplied and performed by the Contractor at no additional cost to the Owner and the Contractor shall not claim extra payment therefore or an extension of the time of completion on account thereof.

In the case of discrepancies between drawings, those of larger scale, or if the scales are the same, those of later date shall govern. In the case of a discrepancy between the Drawings and the Specifications, the Specifications shall govern. Special Provisions of Contract shall govern over all other sections of the Contract Documents.

4. SCHEDULE OF CONSTRUCTION

The Contractor shall, within two weeks after the receipt by him of the Contract executed by the Owner and the Contractor, submit its proposed Schedule of Construction to the Engineer for approval. The Schedule of Construction shall show clearly in weekly stages the proposed progress on the main items, structures and Sub-trades of the Contract and shall indicate where applicable the labour, construction, crews, plant and equipment to be employed.

The Engineer may require the Contractor to revise its proposed schedule at any time as provided for in these General Conditions.

5. PLANT, LABOUR AND MATERIAL

The Contractor shall provide all necessary storage ground and storage sheds and shall furnish all required skilled and unskilled labour, materials, fuel or other energy, machinery, tools and all plant, so that the Contract, and all work required to be done under it, can and will be carried on continuously and expeditiously to completion, in all respects to the satisfaction of the Engineer.

All material, plant, machinery, tools and equipment acquired, possessed or provided by the Contractor for incorporation into the works shall be the property of the Owner, whether or not such material, plant, machinery, tools and equipment are brought to or upon the works or upon lands of the Owner and the Contractor is prohibited from removing or disposing of the same, or any part thereof, without the consent or instructions of the Engineer in writing.

No materials, plant, machinery or equipment reasonably required for the performance of the Contract and not for incorporation into the works, brought to or upon the works or upon lands of the Owner, shall be removed or disposed of during the progress of the works without the written consent or instruction of the Engineer or its authorized representative. In case of a difference of opinion between the Contractor and the Engineer or its authorized representative as to whether any of the aforesaid items is reasonably required on the works for the satisfactory progress of the work, the Contractor shall abide by the decision of the Engineer.

6. SAMPLES

Before any material of any kind is used on the work, the Contractor shall submit samples thereof for the approval of the Engineer and must obtain such approval. No material shall be used on the work which is in any way inferior to the approved samples. The giving of such approval shall not obligate the Owner to pay for any material other than in

accordance with the Contract, shall not prevent the rejection of any material which may be found, in the opinion of the Engineer, to be unsound or unfit for use on the work or not in accordance with the approved samples or the requirements of the Contract and shall not be deemed to be a waiver of objection to the work or any part thereof at any time on account of the materials used not being satisfactory or on any other account. The decision of the Engineer with respect to the approval or rejection of samples shall be final.

7. CONDEMNED AND SURPLUS MATERIALS

Should any plant, appliances or material which the Engineer may deem to be inferior or unfit for use in or on the works, be brought on the ground, or used, the same shall be wholly removed therefrom within twenty-four (24) hours after notification to that effect from the Engineer, and in case of failure or neglect on the part of the Contractor to

7. CONDEMNED AND SURPLUS MATERIALS (CONT'D)

remove the same, the Engineer may cause the same to be taken away at the Contractor's expense and deposited, wasted, or otherwise disposed of, in any locality, place or way it considers convenient or proper, and the Contractor shall forthwith pay to the Owner on demand, all expenses incurred, including storage, if any, or the same may be deducted or collected by the Owner as provided in the section hereof entitled "Monies Due Owner".

No surplus or other material of any kind, arising from any portion of the work, shall be sold, thrown away, dumped, wasted, or otherwise disposed of without the written sanction of the Engineer, and if so disposed of the Engineer may ascertain as nearly as it conveniently can the quantities and value, and deduct the same from the Contract's next Progress Payment Certificate.

All excavated material shall be disposed of in the manner set forth in the Plans and Specifications for the work or as directed by the Engineer.

All excavated material of value to, or required by the Owner including materials from existing structures, such as old lumber, concrete blocks, stone, rubble, crushed stone, sand or gravel, sewer or other pipe, sewer brick, manhole tops or other castings, valves, hydrants, and earth or any other materials, must be neatly piled, deposited or evenly spread by the Contractor in such place as may be directed by the Engineer, the whole expense, including that of hauling, unloading and spreading to be borne by the Contractor. The materials must be removed and deposited as above required, as soon as excavated, or as soon thereafter as the Engineer may direct.

Surplus excavated material not required by the Owner shall be disposed of by the Contractor off the line of the works, on sites obtained by him, in such a manner as not to cause a nuisance, injury or inconvenience to the Owner or to public or private parties; otherwise the Contractor will in all cases be held liable for, and must indemnify the Owner against, all claims in respect thereof.

8. EQUIVALENTS

Where pursuant to the Specifications the Contractor is required to supply an article or group of related articles designated by a trade or other name or an "approved equal", the Tender shall be based only upon supplying the articles or group of articles so designated, which shall be regarded as the standard quality required by the Specifications. After the acceptance of a Tender, the Contractor may apply to the Engineer to substitute as an approved equal another article or group of related articles identified by a different trade or other name for an article or group of related articles designated as aforesaid. The application shall be in writing and shall state the price for the proposed substitute articles or group of related articles, the price for the article or group of related articles, designated as aforesaid and such other information as the Engineer may require.

No ruling on a proposed substitution will be made prior to the acceptance of a Tender. No substitution shall be made without the prior approval of the Engineer. The approval or rejection of a proposed substitution shall be at the discretion of the Engineer and its decision shall be final. If the proposed substitution is approved by the Engineer, the Contractor shall be entitled to the first $100.00 of the aggregate saving in cost by reason of such substitution and to 50% of any additional saving in cost in excess of such $100.00. Each such approval shall be conveyed to the Contractor in writing by the Engineer and if any adjustment to the Contract Price is to be made by reason of such substitution, a Contract Change Order shall be issued to this effect.

9. MATERIALS AND EQUIPMENT SUPPLIED BY THE OWNER

All materials and equipment shall be supplied by the Contractor with the exception of such material or equipment as is specifically stated to be supplied by the Owner. In all cases where materials or equipment are supplied by the Owner every effort will be made to have a sufficient supply of such material or equipment tested, examined and approved and ready for use at such times as they may be required, but in case the Owner fails to furnish a sufficient supply at any time, the Contractor will not be entitled to any compensation for delay on that account (except as may be allowed in accordance with Section 14 hereof) other than an extension of the time for completion, the extent of which shall be determined by the Engineer and shall be as nearly as possible equivalent to the time delayed.

When the Contractor is required to make provisions for any conveyance of Owner supplied materials or equipment as above from railway cars, it shall do so as soon as the cars are delivered to the nearest siding. Any demurrage on account of its inattention will be borne by him.

Unless otherwise specified, all materials and equipment supplied by the Owner shall be transported to the work by the Contractor from the point for their supply, at the expense of the Contractor.

Once material or equipment has been supplied to the Contractor by the Owner, its storage prior to use is its responsibility. Any loss, theft, or damage occurring after the material is in the Contractor's custody, shall be at its expense.

Before taking delivery of Owner-supplied materials or equipment, whether they are being delivered by truck or by rail, the Contractor shall examine such materials or equipment and satisfy himself as to possible damage which they may have suffered in transit. Where damage has occurred the Contractor shall immediately notify the Engineer so

9. MATERIALS AND EQUIPMENT SUPPLIED BY THE OWNER (CONT'D)

that a claim may be made against the carrier. Should the Contractor fail to notify the Engineer of damage to materials or equipment, the Contractor will be liable for the cost of making good any damage subsequently found.

10. APPROVALS AND PERMITS

The construction of the works and all operations, connected therewith are subject to the approval, inspection, by-laws and regulations of all municipal, provincial, federal and other authorities having jurisdiction in respect to any matter embraced in this Contract.

The Owner will obtain and pay the fees, if any, for approvals and permits relating to the design and location of the permanent works required from the Ministries of Transportation, Labour, Environment, Public Works or Transport, from railway or pipeline companies or from hydro-electric, canal or seaway and conservation authorities. Unless otherwise specifically stated in the Tender Documents, the Contractor shall obtain and pay the fees for all other approvals and permits required for or in respect of the works.

11. ERRORS AND OMISSIONS BY CONTRACTOR

Errors, mistakes, omissions or unauthorized changes made by the Contractor or its agents, workmen or employees and all damage that may result therefrom shall be rectified by the Contractor at its own expense.

12. DELAYS

If, after the execution of the Contract, the Contractor suffers damage by reason of delay with respect to construction of the works arising from causes other than adverse weather or labour disputes and beyond its control, the Owner may in its discretion compensate the Contractor wholly or in part for such damage.

The Contractor shall take all steps necessary or advisable to reduce or eliminate all damage or loss by reason of delay with respect to construction of the works arising from any cause whatsoever.

13. ORAL ARRANGEMENTS

In all cases of misunderstanding or disputes, oral arrangements will not be considered, but the Contractor must produce written authority in support of its contentions, and shall advance no claim in the absence of such written authority, and shall not use, or attempt to use, against the Owner any conversation with any parties.

14. DECISIONS BY THE ENGINEER

Should any discrepancies appear or differences of opinion or misunderstanding arise as to the meaning of the Contract or as to any omissions therefrom or statement therein in any respect, or as to the quality or dimensions or sufficiency of the materials, plant or work or any part thereof or as to the due and proper execution of the works, or as to the measurement or quantity or valuation of any executed or to be executed works under this Contract, or as to the extras thereto or deductions therefrom, or as to any other questions or matter arising out of the Contract, the same shall, subject to the terms of the Contract, be determined by the Engineer, who shall have the right at all reasonable times to visit, enter and carry out inspections at any buildings, factories, workshops, works or sites of the Contractor or others wherever any materials are being prepared, manufactured or treated, or other work is being done in connection with this Contract and the right also to take such samples therefrom as it may deem necessary and the Contractor shall immediately when ordered by the Engineer, proceed with and execute the work or works, or any part thereof, forthwith in accordance with such order and with such additions to or deductions from the Contract price as are provided under the terms of the Contract, without making any claim for any extension of time in completing the work, unless arranged in writing with the Engineer as herein provided.

15. INSPECTOR AND INSPECTION

All work to be done under the Contract shall be done to the satisfaction of the Engineer or of an agent or inspector authorized to act for him. The Inspector is required by the Engineer to see that the provisions of the Contract are faithfully adhered to, especially as regards the quality of the workmanship and materials, and may stop the work entirely if there is not a sufficient quantity of suitable and approved material on the site to carry on the work properly or for any good and sufficient reason. In particular, but without limiting the powers of the Inspector, orders given by the Inspector relating to the quality of material or workmanship or in respect of safety or public convenience must at once be obeyed by the Contractor. The Inspector shall have the power to suspend any workman for incompetence, drunkenness, negligence or disregard of orders and the Contractor shall ensure that any workman so suspended is forthwith removed from the site.

Materials and equipment and the process of manufacture of materials or equipment shall at all times be subject to inspection, testing and rejection at any stage by the Engineer or its agent. The Engineer will give the Contractor reasonable notice of the materials and equipment in respect of which the Engineer proposes to have inspection or testing carried out during the process of preparation or manufacture, save that in the case of materials or equipment specifically stated in the Contract as required to be tested or inspected by or in the presence of the Engineer or its

15. INSPECTOR AND INSPECTION (CONT'D)

agent, the Engineer shall not be obliged to give such notice. The Contractor shall notify the Engineer in writing at least seven days previous to the commencement of preparation of manufacture of each item of such materials or equipment of the time and place at which such preparation of manufacture is to commence in order that the Engineer or its agent may be present.

Notwithstanding compliance by the Contractor with the foregoing paragraph hereof, if any materials or equipment prepared or manufactured away from the site of the works and required by the Contract or by the Engineer to be inspected or tested by or in the presence of the Engineer or its agent at the place of preparation or manufacture become ready for delivery to the site of the works but have not been inspected or tested as required, the Contractor shall so notify the Engineer in writing and shall not have such materials or equipment delivered to the site of the works until authorized to do so in writing by the Engineer.

In any event, no materials or equipment required by the Contract or by the Engineer to be inspected or tested by or in the presence of the Engineer or its agent shall be incorporated into the work until the required inspection or testing has been carried out to the satisfaction of the Engineer.

The Contractor shall provide, and shall ensure that all Sub-Contractors and those carrying out the process of preparation or manufacture shall provide, every reasonable facility and co-operation to assist the Engineer, Inspector, or others designated by the Contract or by the Engineer in carrying out inspection and testing.

The Contractor shall not backfill or otherwise cover up any work without either having it inspected and passed by the Inspector or first notifying the Inspector in a manner approved or as directed by the Engineer that the work is ready to be covered up and allowing the Inspector reasonable notice and opportunity for carrying out an inspection. Any work covered up other than in accordance with the foregoing shall, if ordered, by the Inspector or the Engineer, be uncovered or opened up for inspection and the Contractor shall, as directed by and to the satisfaction of the Inspector, or the Engineer, make good again all openings, excavations and disturbances of any property, real or personal, resulting therefrom, all at the Contractor's expense; but if the Contractor has backfilled or otherwise covered up any work in accordance with the foregoing, the cost of any uncovering or opening up and making good shall be borne as provided for in Section 29 (e) hereof.

No approval by an Inspector or by the Engineer or failure of an Inspector or the Engineer to carry out an inspection shall relieve the Contractor of any of its obligations under the Contract or shall be interpreted as being an acceptance of defective or improper work or material which must in every case be removed and replaced properly or otherwise rectified in a satisfactory manner whenever discovered at any time as provided for in Sections 29 and 49 hereof.

If, in addition to the inspection provided for above, the Contractor is required by the Contract, by law, by local by-law or by the Engineer to have any part of the works inspected by others, the Contractor shall give the Engineer and the others concerned reasonable notice of the time and date proposed for the additional inspection.

16. OCCUPANCY OF THE WORKS

The use or occupancy of the works or any part thereof by the Owner shall not be taken in any manner as an acceptance by the Owner of any work or material not in accordance with the Contract or to relieve the Contractor or its surety from liability, whether heretofore or hereafter incurred or arising, in respect of the observance or performance of any covenant or condition in the Contract not then performed, whether such covenant or condition be by way of indemnity to the Owner or by employees of the Owner for whom the Owner is responsible. In particular, without limiting the generality of the foregoing, the use or occupancy of the work or any part thereof by the Owner shall not release the Contractor from liability to pay to the Owner or waive or impair the right of the Owner to deduct and retain, liquidated damages and resident Engineers' and Inspectors' fees, in accordance with the Contract.

17. ABSENCE OF ENGINEER AND ITS AGENT

The Owner may appoint an Engineer or firm of Consulting Engineers for the purpose of inspecting the work performed under this Contract. In the absence of the Engineer or its duly authorized agent, any assistants who have been designated by the agent to superintend the work shall have full power to decide as to the manner of conducting and executing the work in every particular and the Contractor shall follow the instructions or orders of the person so designated.

18. CONTRACTOR'S ABSENCE

In the absence of the Contractor from the works (whether permanent or temporary) it must provide and leave a competent and reliable superintendent in charge of the entire works for him, and such person shall be considered as acting in its place, and all notices, communications orders and instructions given or sent to or served upon such person shall be taken as served upon and received by the Contractor.

19. CONVENIENCES

The Contractor must provide, and properly maintain in clean condition, suitable and convenient privy or water closet accommodation for its men and the Engineer.

The Contractor shall provide at its own expense, an adequate, warm, comfortable shelter, accessible during the noon hour and inclement weather to all men employed on the work, and its location shall be approved by the Engineer.

The Contractor shall provide for the sole use of the Engineer or its representatives, a field office in good condition, having a minimum area of 14 square metres, a wooden floor, a steel filing cabinet having four legal size drawers with lock and key, a drawing stand complete with six drawing hangers, a desk with a chair, a table 1.4 square metres in size, with a bench to accommodate at least four men, adequate lighting and a telephone which shall be maintained by the Contractor at its expense for the duration of the Contract. The office will be heated by the Contractor at its own expense. The office shall be erected and moved as, where, and when the Engineer directs. On completion of the works, or as otherwise directed by the Engineer, the field office shall be removed from the site by the Contractor and shall remain its property.

20. PUBLIC CONVENIENCE AND SAFETY

If at any time the Engineer or its authorized representative considers the works to be unsafe it may order the Contractor to take measures forthwith to ensure adequate safety. Should the Contractor fail to take adequate measures, the Engineer or its representative may order the work to cease until such measures have been taken. The Contractor shall not be entitled to additional payment for, or an extension of time for the performance of the Contract by reason of, such safety measures.

The fact that the Engineer or its representative has ordered or has failed to order additional safety measures shall not relieve the Contractor of responsibility for the adequacy of the safety measures taken.

The Contractor during the progress of the work shall keep the site and the work in as tidy a condition as practicable. it shall not deposit any material on any portion of street, sidewalk, boulevard, grass plot, or public property, without permission of the Engineer, and shall remove same without delay when and as directed by the Engineer. Upon completion of the work and subject to Section 8 it shall remove all false work, plant and surplus materials, as well as any rubbish accumulated on account of its operations and shall leave the site in a condition satisfactory to the Engineer.

Unless all surplus material, plant, rubbish, falsework, etc. are removed from time to time, when and as directed, the Engineer will proceed to do whatever is necessary to restore the site, street, sidewalk, boulevard, grass plot or public property to a tidy condition and will charge the cost thereof against the Contractor. Whenever and wherever any work is closed, suspended or stopped for the winter, all material of every description must be gathered up from the street, sidewalks, boulevards and grass plots, and removed therefrom and the site shall be left in a safe and tidy condition and shall be maintained in a safe condition until the work is resumed.

The method of use and the character of all explosives shall be subject to the approval of the Engineer. The Contractor shall ensure that the charges of explosives used by the Contractor and the time at which they are exploded shall be such as not to cause damage to person or property or to cause unreasonable inconvenience.

Explosives shall be properly housed and protected as provided by law, and no explosives known to have deteriorated shall be used. Approved methods of handling and thawing of frozen explosives shall be followed, and the greatest care shall be exercised at all times by the Contractor in blasting operations.

21. RESTORATION

Where the Contractor enters into the land or buildings of the Province or of any municipality or of any person or enters into any highway or road under the jurisdiction and control of any public authority for the purpose of making any survey examination, investigation, inspection or other arrangement or lays any pipes or appurtenances in, upon, through, over or under any highway or road under the jurisdiction and control of any public authority and in so doing disturbs any such lands, buildings, highways or roads, such lands, buildings, highways or roads shall be restored to their original condition without unnecessary delay.

22. DRAINAGE

The Contractor shall keep all portions of its work properly and efficiently drained during construction and until completion, and it will be held responsible for all damage which may be caused or result from water backing up or flowing over, through, from or along any part of the works.

23. BARRIERS, LIGHTS AND DETOURS

The Contractor must, at its own expense, and without further or other order, provide, erect and maintain all requisite barriers, fences or other proper protection; and must provide, keep and maintain watchmen and lights with red or

23. BARRIERS, LIGHTS AND DETOURS (CONT'D)

amber globes, as may be necessary or as may be ordered by the Engineer, in order to ensure safety to the public as well as to those engaged about the premises or works. Should the Contractor neglect to carry out the above requirement, the Engineer is hereby authorized to place such watchmen, lights, barriers, etc., as are required, and to charge the cost to the Contractor, without relieving the Contractor of any claims for damages or accident. The Contractor must (where it is practicable in the opinion of the Engineer) keep the roadway open for travel for the use of the public, for such width as the Engineer may direct. Where in the opinion of the Engineer, it is not practicable to keep a roadway open for the full flow of traffic, it may permit the Contractor to close or partially close such roadway to provide for a detour of the traffic or a part thereof. In each such case and before putting into effect the closure or detour, the Contractor shall present its proposal for closure or detour to the municipal or other authority or authorities having jurisdiction over any of the roadways which will be affected by the proposed closure or detour and shall obtain the written authorization to such proposal of the said authority or authorities. The Contractor must provide a sufficient number of "NO THOROUGHFARE", "DETOUR" or other proper notices, which it must cause to be placed and maintained in good order in conspicuous places wherever any roadway, sidewalk, or thoroughfare is torn up or dangerous, and so long as it remains unsafe and unfinished.

When any work is carried on at night, the Contractor must supply, at its own expense, a sufficient number of electric or other approved and efficient lights, to enable the same to be done in an efficient and satisfactory manner, and the Engineer shall have the power to order additional lights to be put on at the Contractor's expense if in the opinion of the Engineer, they are, or may be required.

24. LOSS OR DAMAGE

The Owner shall not in any manner be answerable or accountable for any loss or damage by fire or otherwise that shall or may happen to the work or any part or parts thereof; or for any of the materials or other things used and employed in finishing and completing the work, or for any injury to any person or persons, including workmen and the public, or for damage to adjoining property, against all of which injuries and damages to persons or property, the Contractor shall properly guard, and shall make good all damage of whatsoever nature or origin which may arise out of, or be occasioned by any cause connected with the Contract, or the work done by the Contractor, and shall indemnify and keep indemnified the Owner against same until the completion of all the work hereunder and the termination in accordance with the Contract of the insurance which the Contractor is required by the Contract to provide.

25. INSURANCE

(a) The Contractor shall insure and shall maintain insurance for, in the joint names of the Contractor and the Owner, and in an insurance company satisfactory to the Owner, the work and all materials, plant, fuel, machinery, tools and equipment acquired, possessed or provided by the Contractor for incorporation into the work, whether or not such material, plant, fuel, machinery, tools and equipment are brought to or upon the

(b) work or upon lands of the Owner or of the Corporation, in an mount of not less than 90% of the total value of such work and material, plant, fuel, machinery, tools and equipment and such additional amount, not exceeding the Contract price, as may be directed by the Owner against all risk, so that any loss under such insurance shall be payable to the Owner and the Contractor as their respective interests may appear. The Contractor shall deposit with the Owner a cover note of such insurance and the original policy of such insurance or a Certificate of Insurance, clearly stating that the policy of insurance provided as aforesaid complies with these provisions. The Contractor shall pay all insurance premiums as they become due; provided that the Owner may pay premiums and deduct the amount thereof from monies due the Contractor. Any loss or damage which may occur shall not affect the rights and obligations for the Contractor or of the Owner under this Contract except that in such event the Engineer may in writing extend the time for completion for such period as it thinks reasonable. If the Engineer does not extend the time for completion, then the work must be completed within the time fixed in the Contract. Monies paid to the Contractor under such insurance shall be used for the purpose of replacing, rebuilding, repairing and completing the work, and all such material, plant, fuel, machinery, tools and equipment which have been damaged or destroyed. Such replacing, rebuilding, repairing and completion shall be carried out in every way subject to the terms and conditions of the Contract.

(c) The Contractor shall maintain and pay for such insurance and shall pay such assessments as will protect him from claims under the Workplace Safety and Insurance Act and from any other claims for damages arising from bodily injury, including death, and from claims for property damage which may arise from its operations under this Contract. The Contractor shall deposit with the Owner a Certificate of such insurance, clearly stating that the policy of insurance so provided complies with these provisions.

(d) The insurance required under paragraphs (a) and (b) shall be maintained in full force until the Engineer has issued a Certificate of Completion or until the Owner has otherwise approved in writing save that if the Contractor continues to work at the site after the date of completion as established by the Certificate of Completion or returns to the site of work after such date, it shall maintain or renew for the duration of such work the Insurance required by the Contract.

26. CONTRACTOR'S LIABILITY

The Contractor shall assume the defense of and indemnify and save harmless the Owner and its officers and agents from all claims relating to labour and materials furnished for the work, and to inventions, copyrights, trademarks, royalties or patents, and rights thereto, relating to or used in doing the work, or the subsequent use and operation of the work or any part thereof upon completion. In carrying out the works from the inception, and until the final acceptance of the same, the Contractor must be careful to cause as little injury or damage as possible to any adjacent property, public or private, or to any sidewalks, roadways, curbs, gutters, drains, hydrants, manholes, frames, covers or street gullies, boulevards, grass plots, sodding, trees, shrubs, or structures, utilities and all municipal services, works or things on or near the line or in the vicinity of the works or elsewhere, and, except as in the Contract is otherwise provided, if injury or damage is done, it must make good the same, at its own expense, in the manner directed by, and to the satisfaction of, the Engineer. The Contractor shall be responsible for any and all damages, or claims for damages for injury or accidents done or caused by him or its employees or agents, or resulting from the prosecution of the works, or any of its operations, or caused by reason of the existence or location or condition of the works, or of any materials, plant or machinery used thereon or therein, or which may happen by reason thereof, or arising from any act of commission or omission on its part, or on the part of any of its agents or employees, in connection with the Contract, and covenants and agrees to hold the Owner harmless and indemnified from all such damages; and in case of the Contractor's failure, neglect or omission to observe and perform faithfully and strictly, all the provisions of the Contract, the Engineer may, either with or without notice (except where in this Contract, notice is specially provided for, and then upon giving the notice therein provided for), take such steps, procure such material, plant, trucks and men, and do such work or things as it may deem advisable toward carrying out and enforcing the same, and any and all expenses so incurred may be deducted or collected by the Owner under the provisions of Section 45 hereof, entitled "Monies Due Owner", and any such action by the Engineer as it is herein empowered to take, shall not in any way relieve the Contractor or its surety from any liability under the Contract.

Without limiting the generality of the foregoing provisions of this section and notwithstanding any consent or order which the Engineer may give to the Contractor to prosecute the works under this Contract for a longer period than eight hours a day or forty-eight hours a week, the Contractor may, by order of the Engineer be prohibited from carrying on operations during any hour or hours of the day in which the Engineer in its judgment deems such operations to be a disturbance or nuisance to the residents of the municipality or municipalities wherein the work is being executed in whole or in part, and irrespective of any permission or order which the Engineer may have given to the Contractor, the Contractor shall indemnify and save harmless the Owner or such municipality or municipalities as aforesaid, from any claim, action, loss or damage whatsoever which may be made, brought or recovered against it to them as a result of any of its operations. In the event of the Contractor being enjoined by court process in connection with any of its operations, it shall not have recourse against the Owner or municipality or municipalities as aforesaid on account thereof.

The Contractor shall at all times pay, or cause to be paid, any assessment or compensation required to be paid pursuant to the Workplace Safety and Insurance Act, and the Owner may pay the same and deduct or collect such expenses under the provision of Section 45 hereof, entitled "Monies Due Owner". The Contractor shall, at the time of entering into any Contract with the Owner, make a statutory declaration or furnish a satisfactory clearance letter from the Workplace Safety and Insurance Board stating that all assessment or compensation payable to the Workplace Safety and Insurance Board have been paid, and the Owner may, at any time during the performance or upon the completion of such Contract, require further proof that such assessments or compensation have been paid.

The Contractor shall at all times be subject to and will be required to observe all rules and regulations which are or may from time to time be imposed by law, as related to all branches of the work under the Contract. The Contractor shall from time to time adopt such approved construction or operating methods in carrying out the work as may be called for due to changing conditions which may be encountered during the progress thereof.

27. NIGHT, SUNDAY AND HOLIDAY WORK

The Engineer may order the work to proceed on a two or three eight-hours shift basis if it deems this necessary to speed up the work, or it may order any work to be carried out in whole or in part at night, and the Contractor shall have no claim for extra compensation in respect thereof. No work, however, shall be undertaken at night without the consent in writing of the Engineer.

Whenever, in the judgment of the Engineer, it may be necessary or expedient, in order to preserve and maintain traffic over or on any street or road, to do work at night or after or before the regular time of ending or beginning labour, such night or overtime work shall be performed by the Contractor without additional or extra cost to the Owner beyond the price bid for the work.

No Sunday work will be permitted, except in the case of emergency and then only with the written permission of the Engineer and to such extent as it may judge to be necessary.

The Contractor shall, as far as possible refrain from working on days which are legal holidays. In case it desires to work on any such holiday it shall notify the Engineer in writing to that effect at least four (4) days in advance of such holiday, stating those places where the said work will be conducted. If the Contractor fails to give such notice In

27. NIGHT, SUNDAY AND HOLIDAY WORK (CONT'D)

advance of any holiday, such failure shall be considered as an indication that no work requiring the presence of an Engineer or Inspector is to be done by the Contractor on such a holiday.

28. NOTICE TO CONTRACTOR

Any notice or communication to the Contractor shall be deemed to be well and sufficiently given and served if handed to the Contractor or any of its clerk or agents, or if posted or sent to the address given in the Agreement, or to its domicile or usual place of business, or to the place where the work is to be or is being carried on, or if posted to or left at its last known address, and any papers so left, sent or addressed shall be considered to be, and to have been legally served upon the Contractor. In any written or printed notice to the Contractor in respect of general, special, or other repairs, or of any work of any nature required to be done under any of the provisions of the Contract, or of any other after, it shall not be obligatory upon the Engineer to specify minutely or in detail everything required, nor to specify by measurement the exact extent thereof or the precise spot or spots where the work or material may be defective or faulty or where any of the requirements of the Specifications have not been observed; but a reference in such notice to the clause or clauses bearing upon the matter, and a description of the locality in general terms, and sufficiently clear, in the opinion of the Engineer, to indicate where the defect or trouble exists, shall be deemed to be, and shall be, ample notice.

29. RECTIFICATION AND MAINTENANCE

(a) The Contractor guarantees and warrants that with ordinary wear and tear the work shall, until the end of the period of maintenance, remain in such condition as will meet with the approval of the Engineer, and that it will be responsible for rectification in a manner satisfactory to the Engineer, and for the cost thereof, of any imperfect work due to or arising from materials, equipment or plant incorporated into or used in the construction thereof, or due to or arising from workmanship or methods of construction, that is discovered by any means at any time prior to the issuance of the Final Certificate. The Engineer shall decide as to the nature, extent, cause of, and responsibility for imperfect work and the necessity for and the method of rectification thereof.

(b) Prior to the expiration of the period of 12 months from the date of Substantial Performance, as set out in the Certificate of Substantial Performance, the Engineer or its agent shall carry out an inspection of the work and shall notify the Contractor of any imperfections therein disclosed by such inspection provided that the failure of the Engineer or its agent to carry out such an inspection or to give such notification shall not relieve the Contractor or its surety from any responsibility or obligation under, or any term or provision of, the Contract.

(c) If, as a result of imperfect work for which the Contractor s responsible, the Owner incurs any costs, and without limiting the generality of the foregoing, including cost of Engineering and investigation and all costs of administration, or sustains damage or loss of any kind, the Contractor and its surety or sureties shall be liable to the Owner for such costs, damage and loss. The amount of such costs, damage or loss shall be determined or estimated by the Engineer and, upon such determination or estimation, shall be deemed to be "Monies payable to the Owner" under Section 45 of the General Conditions and may be deducted or collected by the Owner as therein provided for.

(d) No payment, certificate, document, act, failure to act, statement or representation of, by or on behalf of the Owner or its employees or agents, no dealing, transaction, forbearance or forgiveness which may take place between the Contractor or its surety or sureties and the Owner or its employees or agents and no exercise or forbearance to exercise any of the rights or powers of the Owner or of the Engineer under the Contract, other than the Final Certificate, or a release duly executed by the Owner, shall release the Contractor or its surety or sureties from any term or provision of or any responsibility, obligation or liability under the Contract, or otherwise, or shall waive or impair any of the rights and powers of the Owner or of the Engineer.

(e) The Contractor shall, at any time or times prior to the issuance of the Final Certificate and when required to do so by the Engineer, make such openings, tests, inspections, excavations, examinations, or other investigations in, through, of or in the vicinity of the work as the Engineer may direct and shall, if required, make good again, to the satisfaction of the Engineer, any openings, excavations or disturbances of any property, real or personal, resulting therefrom. If, in the opinion of the Engineer, any imperfect work for which the Contractor is responsible is found in the work by such investigations, the cost of such investigations and such making good shall be borne by the Contractor; but if, in the opinion of the Engineer, no such imperfect work is found by such investigations, the said cost shall be borne by the Owner, except as otherwise provided in Section 15 of the General Conditions.

30. CONTRACT BONDS

The Contractor shall, unless otherwise directed by the Owner, furnish to the Owner contract bonds in accordance with the requirements of the Information to Tenderers.

31. CONTRACTOR'S DISCHARGE OF LIABILITIES

The Contractor shall discharge all liabilities incurred by him for labour, materials or services, used or reasonably required for use in the performance of this Contract on the date upon which each becomes due.

The Construction Lien Act, any amendments thereto and any regulations made thereunder apply to the performance of this Contract, but do not limit the provisions of this Contract, and the Owner has all the rights and powers set out therein and in the Contract.

The Contractor shall cause every Sub-Contractor engaged in the performance of this Contract to discharge all liabilities incurred by such Sub-contractor for labour, materials or services used or reasonably required for use in the performance of this Contract. Workmen employed by a Sub-Contractor shall be paid in full at intervals not less frequently than semi-monthly and other liabilities of the Sub-Contractor, as aforesaid, shall be discharged on the date upon which each becomes due. At the request of the Owner, the Contractor shall furnish the Owner with evidence satisfactory to it that its liabilities and those of the Sub-contractors, as aforesaid have been discharged.

The Owner may, in writing, require the Contractor to send to it, by registered mail, within fifteen days from the date of the mailing of the demand, a list of the names and addresses of and the amounts owing to its creditors in a form satisfactory to the Engineer.

No payment to which the Contractor is otherwise entitled under this Contract shall in the discretion of the Owner be due and payable to him so long as it or any of such Sub-Contractors are in default under this Section, and upon such default occurring, the Engineer may notify the Contractor to discontinue all work under the Contract and the Owner shall have the same rights and privileges as are provided in Section 49 of these General Conditions. The Owner may after notice in writing to the Contractor and its Surety, if any, (a) pay any such liability of the Contractor and of the Sub-Contractors, as aforesaid or (b) make a direct payment at any time, with or without default, to a creditor of the Contractor or of a Sub-Contractor arising out of these works, and in each such case deduct the amount so paid from any monies due or that may become due to the Contractor on any account, and, if there are insufficient monies due or to become due to the Contractor to permit of such deduction, the Contractor shall pay to the Owner upon demand an amount sufficient to make up the deficiency. In making payments under this Section, the Owner may act upon any evidence that it deems sufficient and may compromise any disputed liability.

The Contractor shall submit to the Engineer in duplicate, together with each monthly statement, except the first one, required by Section 38 (a) of the General Conditions, a "Statutory Declaration re Payment on Accounts" in the form bound herein (or in such other form as may be required by the Owner) signed by an authorized signing officer of the Contractor stating that all workmen employed by the Contractor in the performance of the Contract have been paid in full and in accordance with the requirements of the Contract not less frequently than semi-monthly and up to and including the payday immediately preceding the date of the declaration and that all other liabilities incurred by the Contractor arising out of work performed or materials supplied as set forth in the Monthly Estimate relating to the last monthly statement previously submitted have been discharged. The Owner may withhold approval of a Monthly Payment Certificate if the Contractor fails to submit such a declaration or if the Contractor submits an improperly completed declaration.

Before any holdback will be released to the Contractor the statutory declaration required by Section 33 (c) of the General Conditions must have been submitted to the Owner by the Contractor.

The Owner may in its discretion require the Contractor to submit such additional statutory declaration relating to discharge of liabilities as the Owner may require before the Owner will release to the Contractor any remaining holdback.

32. COMMENCEMENT AND COMPLETION

The work shall not be commenced, nor shall any material be procured, until the Contractor has signed the Contract and obtained or received a written order, or orders, to commence the same, signed by the Engineer, and it shall thereupon be at once begun and continuously carried on to completion, (subject as herein provided) and shall be completed and full possession thereof given the Owner within the period provided in the Contract, unless an extension of time, in writing, shall be allowed by the Engineer in which case, it shall be carried on to completion and possession given to the Owner within the additional period so allowed.

If ordered by the Engineer, the Contractor and its agents and employees shall be required to work continuously throughout the twenty-four (24) hours of the day for six days per week in the performance of the work under the Contract.

In case the Contractor shall fail to complete the work in accordance with the Contract and to the satisfaction of the Engineer, within the time or times specified, the Contractor shall pay to the Owner (in addition to amounts payable by the Owner in respect of site supervision of the work) the sum specified in the Contract for each and everyday that the work or works shall remain unfinished after the time so specified; which said sum or sums in view of the difficulty of ascertaining the losses which the Owner may suffer by reason of delay in the performance of the said works, is hereby agreed upon, fixed and determined by the parties hereto as the liquidated damages that the Owner will suffer by reason of said delay and default, and not as a penalty; and the Owner may deduct and retain the amounts of such

32. COMMENCEMENT AND COMPLETION (CONT'D)

liquidated damages out of the monies which may be due or become due to the Contractor under the Contract, as provided in Section 45 hereof, entitled, "Monies Due Owner."

In the event of delay caused by strikes or combinations on the part of the workmen employed, or by any act of the Owner, or from such other cause as, in the opinion of the Engineer, the Contractor cannot reasonably be held responsible for, or in the event of extra or additional work being ordered by the Engineer, the Engineer may allow such additional time for completion as it may deem fair and reasonable, provided the Contractor applies in writing for an extension of time at the time such delay occurs or such extra or additional work is ordered and satisfies the Engineer that it is justly entitled to a further time allowance.

Notwithstanding the time allowed for completion of the work, if in the opinion of the Engineer the rate of progress of any part or parts of the work or during any period or periods during which work is being carried on or is required to be carried on is unsatisfactory and if amounts are payable by the Owner in respect of site supervision of the work, traffic control, compensation or damages by reason, in the opinion of the Engineer, of such unsatisfactory rate of progress, the Contractor shall be liable to the Owner for the payment of such amounts and such amounts may be deducted by the Owner from any money due or that may become due to the Contractor under the Contract.

No progress or interim estimate or certificate shall release the Contractor or its surety from any responsibility, or be taken as evidence of any such release, or as acceptance of any work or material, or as a waiver of any condition herein. The whole work and every portion and detail thereof shall, during construction, be protected by the Contractor from damage from any cause whatsoever, and shall at the time of completion, be put and left by the Contractor in good and satisfactory condition, finished in all respects, and, at that time, must be fully up to the requirements of the Contract in every particular; all surplus and refuse material and rubbish removed from the vicinity of the works; the premises left in a neat and tidy condition; all damage to adjacent property, pavements, foot-walks, beaches, boulevards and sodding, or other things, injured or interfered with by the Contractor or its agents or employees, made good, and, every other requirements of the Contract complied with.

In case of the Contractor's failure to furnish the work properly and fully, and as required, or in case of the work, or any part thereof, being taken out of its hands, as provided in these General Conditions, the Engineer may proceed to finish the work for him, as its agent in this respect, and at its expense, as provided in Section 49 hereof, entitled, "Non-fulfillment of Contract".

33. CERTIFICATES OF SUBSTANTIAL PERFORMANCE AND COMPLETION

(a) The Contract shall be considered as substantially performed when:

(1) the works have satisfactorily passed the required inspection and testing and are ready for use or are being used for the purposes intended, and

(2) the works are capable of being completed or, where there is a known defect, corrected at a cost of not more than,

(i) 3 percent of the first $500,000.00 of the Contract price plus

(ii) 2 percent of the next $500,000.00 of the Contract price plus

(iii) 1 percent of the balance of the Contract price.

(b) Where the works or a substantial part thereof are ready for use or are being used for the purpose intended but part of the works cannot be completed expeditiously for reasons beyond the control of the Contractor or where the Owner and the Contractor agree to delay completion of the works, the cost, as determined by the Engineer, of completing the outstanding work shall be deducted from the Contract price in determining Substantial Performance and the value of the work completed.

(c) As soon as, in the opinion of the Engineer, the Contract has been substantially performed in accordance with the foregoing, the Engineer will issue a Certificate of Substantial Performance on submission by the Contractor of the following documents:

(1) A written undertaking by the Contractor to complete expeditiously any outstanding work and to discharge all unfulfilled obligations under the Contract.

(2) The Contractor's final claim (except in respect of outstanding work).

(3) A release by the Contractor in a form satisfactory to the Engineer releasing the Owner from all further claims relating to the Contract (except in respect of outstanding work).

(4) A Statutory Declaration in a form satisfactory to the Engineer that all liabilities incurred by the Contractor and its Sub-Contractors in carrying out the Contract have been discharged and that all

33. CERTIFICATES OF SUBSTANTIAL PERFORMANCE AND COMPLETION (CONT'D)

liens in respect of the Contract and Sub-Contracts thereunder have expired or have been satisfied, discharged or provided for by payment into Court.

(5) A satisfactory clearance certificate from the Workplace Safety and Insurance Board.

(d) The Engineer shall set out in the Certificate of Substantial Performance the date on which the Contract was substantially performed and within seven days after signing the said Certificate it shall provide a copy to the Contractor.

(e) Upon receipt of a copy of the Certificate of Substantial Performance, the Contractor shall forthwith, as required by Section 32 (1) Paragraph 5 of The Construction Lien Act, publish a copy of the said Certificate in a construction trade newspaper. Such publication shall include placement in the Daily Commercial News.

(f) Where the Contractor fails to publish a copy of the Certificate of Substantial Performance as required above within seven days after receiving a copy of the said Certificate signed by the Engineer, the Owner may publish a copy of the Certificate at the Contractor's expense.

(g) Except as otherwise provided in Section 31 of The Construction Lien Act, the 45-day period prior to the release of holdback as referred to in Section 38 (f) (3) hereof, shall commence from the date of publication of the Certificate of Substantial Performance as provided for in (e) and (f) above.

(h) The works shall be deemed to be completed when:

(1) the works have satisfactorily passed the required inspection and testing, and

(2) the cost of completion of all outstanding work and known defects is not more than the lesser of

(i) one percent of the contract price, and,

(ii) $1,000.00

(i) As soon as, in the opinion of the Engineer, the works have been completed in accordance with paragraph (h) above, the Engineer will issue a Certificate of Completion on submission by the Contractor of the following documents:

(1) The Contractor's final claim (including the value of work completed since the date of the claim referred to in paragraph (c) (2) above).

(2) An up-to-date release by the Contractor in a form satisfactory to the Engineer releasing the Owner from all further claims relating to the Contract.

(3) An up-to-date Statutory Declaration in a form satisfactory to the Engineer that all liabilities incurred by the Contractor and its Sub-Contractors in carrying out the Contract have been discharged and that all liens in respect of the Contract and Sub-Contractors thereunder have expired or have been satisfied, discharged or provided for by payment into Court.

(j) The Engineer shall set out in the Certificate of Completion the date on which the works were completed and within seven days of signing the said Certificate it shall provide a copy to the Contractor.

(k) Payment due to the Contractor following issuance of the Certificate of Completion shall be as provided for in Section 38 hereof.

(l) On the expiration of a period of 12 months from the date of Substantial Performance, as set out in the Certificate of Substantial Performance, and after all known imperfect work has been rectified in accordance with the Contract and to the satisfaction of the Engineer and the Engineer is satisfied to the best of its obligations under the Contract, the Engineer will issue the Final Certificate approving the release to the Contractor of the maintenance security (see Section 38 (h) hereof), less any deduction as provided for in the Contract.

(m) On the expiration of a period of 12 months from the date of Substantial Performance, as set out in the Certificate of Substantial Performance, the Engineer may approve the release to the Contractor of a part of the maintenance security on such terms and conditions as the Engineer deems advisable notwithstanding that the Final Certificate has not been issued and that all imperfect work has not been rectified in accordance with the Contract.

(n) The Engineer may in its discretion direct or approve that the works covered by the Contract be divided into two or more parts for the purpose of issuing Certificates of Completion and Releasing Holdback monies. In that event the Contractor shall submit documentation as set out above in respect of each such part.

33A. RELEASE OF HOLDBACK TO SUB-CONTRACTORS

Notwithstanding that the Contract as a whole has not yet been substantially performed, the Engineer may, if requested in writing by the Contractor, approve the completion of a Sub-Contract and the release to a Sub-Contractor through the Contractor of the 10% holdback retained by the Owner in respect of the work covered by the said Sub-Contract provided that

(a) The Contractor certifies

(1) that the said Sub-Contract has been completed satisfactorily, or

(2) that the said Sub-Contract has been completed satisfactorily except for work not exceeding in value the lesser of

(i) one percent of the Sub-Contract price, and

(ii) $1,000.00

and gives reasons why the uncompleted work is still outstanding.

(b) the Engineer is satisfied

(1) that the said Sub-Contract has been completed satisfactorily, or

(2) that the said Sub-Contract has been completed satisfactorily to the fullest extent reasonably possible at that date and that the work remaining to be completed does not exceed in value the sum derived from (a) (2) above.

(3) that all required or necessary inspection and testing of the works covered by the said Sub-Contract have been carried out and that the results are satisfactory.

(c) the Contractor has furnished to the Engineer

(1) a release by the Contractor in a form satisfactory to the Engineer releasing the Owner from all further claims (excepting holdback monies) relating to the said Sub-Contract.

(2) evidence satisfactory to the Engineer that the said Sub-Contractor has discharged all liabilities incurred by him in carrying out the said Sub-Contract and that all liens in respect of the completed Sub-Contract have expired or have been satisfied, discharged or provided for by payment into Court.

(3) a satisfactory clearance certificate or letter from the Workplace Safety and Insurance Board relating to the said Sub-Contractor.

(4) the required maintenance security in respect of the said Sub-Contract as provided for in Section 38A hereof.

(d) The Engineer retains sufficient money to cover the cost of completing any work which remains uncompleted under the said Sub-Contract.

(e) if it so requests, the Engineer is furnished with a photostat copy of the Contract between the Contractor and the said Sub-Contractor and with a satisfactory statement showing the total amount due from the Contractor to the said Sub-Contractor.

The Engineer shall, within seven days after it approves a certificate wherein it is certified that the Sub-Contract has been completed, give a copy of the said certificate to the Contractor and to the Sub-Contractor concerned.

On receipt of the holdback monies from the Owner, the Contractor shall forthwith pass to the Sub-Contractor concerned the payment due under the said Sub-Contract and shall pass to the Engineer a copy of the transmittal letter showing the amount of the said payment.

The period of maintenance for the work carried out under the said Sub-Contract shall continue until the issuance of the Final Certificate for the Contract.

Release of Holdback monies by the Owner in respect of a Sub-Contract in accordance with the foregoing shall not relieve the Contractor or its surety of any of their responsibilities and shall not be made until a period of 45 days has elapsed from the date of approval of the certificate certifying the said Sub-Contract to be completed.

34. MEASUREMENTS

(a) Approximate monthly measurements of the works completed under the Contract shall be made by the Engineer at the end of each calendar month except where the work has been delayed or suspended. An authorized representative of the Contractor shall assist the Engineer in taking such measurements and shall furnish all particulars required by the Engineer. The Engineer shall notify the Contractor when such a measurement will be made.

(b) The said monthly measurements shall not bind the Engineer in any manner in the preparation of its final measurement of the works constructed by the Contractor under this Contract, but shall be construed and held to be approximate only.

(c) The final measurement shall be prepared in detail as soon as the whole of the works have been completed, and this final measurement shall be approved and accepted in writing by the Engineer. Thereafter the Completion Payment Certificate shall be issued and payment shall be made in accordance with Section 38 hereof.

35. ALTERATIONS, EXTRAS, DEDUCTIONS AND CLAIMS

The Engineer shall have the right to make or order any alterations and changes as it may deem advisable at any time before or during the prosecution of the works, in any line, grade, plan or detail thereof, or to suspend or omit any portion of the work or to increase or decrease the dimensions of any part of the work or works, or to vary in any way the work herein contracted for, or to order any additional or extra work to be done, or additional or extra materials to be furnished; and the Contractor shall, in pursuance of written orders of the Engineer to that effect, proceed with, carry out and execute the works as directed, and shall supply such additional materials, and do such additional extra work as the Engineer requires in pursuance of such orders, without being entitled to any extension of time for completion or any additional payment on account thereof, except only as herein provided. In each and every case where additional or extra work or materials of any kind is ordered to be done or supplied, or where the Contractor does or supplies, or contemplates doing or supplying any work or material which it considers extra or beyond the requirements of the Contract, or upon which it intends claiming any extra or additional payment, it is required, before commencing any such work, or procuring any such material, to obtain from the Engineer a written order therefore, stating that the same is an extra and will be paid for as such, and also clearly defining the nature of such extra work or material, and the amount the Contractor is to receive therefore, or the terms under which the same is to be paid for; and the work or commencing to deliver any such additional material, notify the Engineer in writing of its intention to commence work thereon or delivery thereof, so that a proper account or record of the same may be kept by the Engineer.

In case of the Contractor's neglect or failure to observe fully and faithfully the above conditions in this section contained, it shall forfeit all right to payment therefore which it otherwise might have had, and shall not make any claim in respect thereof, and if made, the Engineer may reject the same as invalid.

36. VALUATION OF VARIATIONS

(a) The Engineer shall determine the amount, if any to be added to, or deduced from, the sum named in the Tender, in respect of any extra or additional work done, or work omitted by its order. All such work shall be valued at the price as set out in the Schedule of Items and Prices and the Schedule of Additional Unit Prices if, in the opinion of the Engineer, the same shall be applicable.

(b) If the Contract does not contain any prices applicable to the extra, additional, or omitted work, then the Contractor and the Engineer may agree on a price for such work, in which case the price shall be comparable to prices quoted on work of a similar nature.

(c) If the methods of evaluating extras described in (a) or (b) herein are clearly inapplicable, then the Engineer may direct that extra work shall be done by the Contractor on a cost-plus basis providing for payment as follows:

(1) The actual cost of all labour, including allowance for holiday pay, unemployment insurance, levy by the Workplace Safety and Insurance Board, and other contributions made by the employer to any employee as required by law or a contract, required directly for the performance of extra work plus 15% of the same.

(2) The actual cost of materials including transportation charges required directly in the extra work, plus 15% of the same.

(3) A reasonable rental to be agreed upon before the work is begun for machinery and heavy equipment, such as tractors, bulldozers, ditching machines, air compressors, concrete mixers and graders, for the actual time required in operation for the performance of the extra work, to which no percentage shall be added.

If the Contractor is directed to carry out extra or additional work on a cost-plus basis and it proposes to have such work or a part thereof carried out by a Sub-Contractor or a Sub-Sub-Contractor, it shall notify the Engineer to that

36. VALUATION OF VARIATIONS (CONT'D)

effect before commencing the said work. Provided that the Contractor's proposal and all Sub-Contractors involved have first been approved by the Engineer, the Contractor may claim payment from the Owner for such work as follows:

(i) In respect of work carried out by the Contractor's own forces, an amount equal to the sum of the amounts provided for under (1), (2) and (3) above.

(ii) In respect of work carried out by a Sub-Contractor's forces, an amount equal to the sum of the amounts provided for under (1), (2) and (3) above plus 5% of such sum.

(iii) In respect of work carried out by a sub-Sub-Contractor's forces, an amount equal to the sum of the amount provided for under (1), (2) and (3) above plus 5% of such sum plus a further 5% of the total so obtained.

(d) The compensation provided for above shall be payment in full for all charges including superintendence, overhead, the use of small tools and profit.

No compensation for extra work or material shall be allowed unless such work or material is ordered in writing by the Engineer. Whenever any extra work is being performed in accordance with (c) herein the Contractor shall, each working day, report to the Engineer, in writing, in full detail, the amount and cost of the labour and materials supplied and used in carrying out each order for extra work on the preceding working day, and no claim for compensation for extra work or materials will be considered or allowed unless such report shall have been made. The Engineer will not allow any compensation for the cost of repairs to equipment of any kind or for damage to anything used in performing any such work or making any such alterations.

37. BOOKS AND RECORDS OF THE CONTRACTOR

(a) The Contractor shall keep proper books and records showing names, trades, and addresses of all workmen in its employ and wages paid to, and the time worked by, such workmen; also records, books, and invoices showing all costs, expenditures, payments, settlements, receipts and balances in connection with the construction of the works.

(b) All records of the Contractor relevant to the valuation of the works including payrolls, time books of account, invoices, and statements, shall be maintained on the site or at some other place approved by the Engineer and shall be open at all reasonable times for inspection by the Engineer. The Contractor shall in every way assist such inspection for the purpose of establishing and determining labour costs, the cost of extra work, and progress payments to be made.

38. PAYMENT

(a) The Contractor shall submit to the Engineer at the end of each calendar month a fully itemized statement showing the estimated value of the permanent work executed up to the end of the month based on the unit prices shown in the Contract and the section covering Valuation of Variations, together with a fully itemized statement of the value of major items of material and equipment on site for incorporation into the permanent works.

(b) From each monthly statement including the statement based on the final measurement, the Engineer will prepare a Monthly Payment Certificate and will include therein so much as it considers fair and reasonable in respect of the value of the work executed and of the major items of material and equipment on site.

(c) Ten percent (10%) of all monies due the Contractor in accordance with the Monthly Payment Certificate up to a limit of 10% of the Contract price, shall be retained by the Owner except as may be otherwise noted and shall be termed the holdback.

(d) The Monthly Payment Certificate will show the Engineer's gross valuation of the work performed and materials supplied, the deduction of the appropriate amount of holdback, the previous payments to the Contractor and the amount due him.

(e) No progress estimate or payment shall be held to bind the Engineer in its valuation of the work on its completion and the Engineer may on any Monthly Payment Certificate make correction or modification to any previous certificate it has made.

(f) At the time of issuance by the Engineer of the Certificate of Substantial Performance in accordance with Section 33(c) of the General Conditions, the Engineer shall:

(1) notify the Contractor of the value of the maintenance security required by Section 38A.

(2) Prepare a Substantial Performance Payment Certificate showing:

38. PAYMENT (CONT'D)

- the value of work complete to date.
- the value of outstanding or uncompleted work.
- the value of the required maintenance security.
- the amount of the 10% holdback (allowing for any previous releases of holdback to the Contractor in respect of completed Sub-Contractors and deliveries of pre-selected equipment).
- the amount due the Contractor.

(3) Prepare a Payment Certificate releasing to the Contractor the 10% holdback due in respect of work performed up to the date of substantial performance. Subject to the provisions of The Construction Lien Act and the submission by the Contractor of the documents required by Section 33(c) hereof, such holdback shall become payable after 45 days from the date of publication of the Certificate of Substantial Performance.

(g) At the time of issuance by the Engineer of the Certificate of Completion in accordance with Section 33(i) of the General Conditions, the Engineer shall:

(1) prepare a Completion Payment Certificate showing

- the Final Contract Price.
- the amount of the further 10% holdback (based on the value of the further work completed over and above the value of work completed shown in the Substantial Performance Payment Certificate referred to in (f) above).
- the amount due the Contractor.

(2) Prepare a payment certificate releasing to the Contractor the further 10% holdback. Subject to the provisions of The Construction Lien Act and the submission by the Contractor of the documents required by Section 33(i) hereof, such further 10% holdback shall become payable after 45 days from the date of completion of the works as established by the Certificate of Completion.

(h) If, when the Engineer issues the Final Certificate at the end of the period of maintenance (see Section 33(1) hereof), any monies that are still being retained by the Owner as maintenance security or for other reasons, the Engineer will issue a Final Payment Certificate releasing the monies due the Contractor.

38A. MAINTENANCE SECURITY

The Contractor shall provide to the Owner for the duration of the period of maintenance a maintenance security the value of which shall be derived from the following table:

CONTRACT PRICE		VALUE OF MAINTENANCE SECURITY
FROM $	TO $	
Less than 0.1M	4% of Final Contract Price	
0.1M	0.5M	4,000 on first 0.1M + 3.0% on next 0.4M
0.5M	1.0M	16,000 on first 0.5M + 2.4% on next 0.5M
1.0M	2.0M	28,000 on first 1.0M + 2.2% on next 1.0M
2.0M	4.0M	50,000 on first 2.0M + 2.0% on next 2.0M
4.0M	6.0M	90,000 on first 4.0M + 1.8% on next 2.0M
6.0M	10.0M	126,000 on first 6.0M + 1.5% on next 4.0M
over 10.0M	186,000 on first 10.0M + 1.0% on balance	

The maintenance security, which is at no time a part of the statutory holdback, shall be retained by the Owner in increments from monies that would otherwise be payable to the Contractor, commencing during the latter part of the period of construction, so that by the date of substantial performance of the contract the full value of the required maintenance security has been retained.

38A. MAINTENANCE SECURITY (CONT'D)

Except as otherwise provided hereunder, the maintenance security, less any deductions made therefrom as provided for in the Contract shall be paid to the Contractor following the issuance by the Engineer of the Final Certificate at the end of the period of maintenance.

Where the Engineer proposes to release the statutory holdback to a Sub-Contractor through the Contractor as provided for in Section 33A hereof, the Engineer shall arrange for "the required maintenance security in respect of the said Sub-Contract", as referred to in Section 33A(c) (4) hereof, to be provided by a retention from monies that would otherwise be payable to the Contractor. The value of the required maintenance security shall be determined by applying to the value of the Sub-Contract work the same effective percentage retention, derived from the foregoing table, as applies to the Contract as a whole.

39. SUSPENSION OF WORK

The Engineer may, by an order in writing, at any time stop or suspend any part of the work, or direct any portion to be commenced or completed in priority to any other part or portion, or may cancel the order to proceed with the work, or with any part thereof, and the Contractor shall not thereby be entitled to any additional payment, or to claim for loss of profit or anticipated profit, or for damages otherwise howsoever, by reason of such order except as may be allowed in accordance with Section 14 hereof. When in the opinion of the Engineer, it is deemed advisable, for any reason to discontinue the work, or any part thereof, for the winter, the Contractor must, on notice from the Engineer of the required discontinuation, forthwith place the work in proper and satisfactory condition for the accommodation and safety of the public and for the effectual protection of the work against damage from rain, snow, frost, ice, wind or other causes, and must so maintain the work.

When work is ordered or permitted by the Engineer to be done during freezing weather, the Contractor shall provide the necessary means for heating, and all the material required in the work shall be heated. Unless otherwise directed in writing by the Engineer, all masonry, concrete, painting, roadway and other work liable to be injuriously affected by frost, or which cannot, in the opinion of the Engineer, be satisfactorily proceeded with because of the condition of the weather, must be put in proper and satisfactory condition and be carefully and well protected from damage by frost at all times, all at the cost and expense of the Contractor.

40. SUB-LETTING

The Contractor shall keep the work under its personal control, and shall not assign, transfer, or sub-let any portion without first obtaining the written consent of the Engineer. The consent of the Engineer to any such assignment, transfer, or sub-letting, shall not, however, relieve the Contractor of any responsibility for the proper commencement, execution, and completion of the work according to the terms of the Contract. If the Engineer consents to any such assignment, transfer or sub-letting the Contractor shall, either in person or through an accredited agent, receive all notices, communications, orders, instructions, or legal service, as if it were performing the work with its own plant and its own men.

41. USE OF HYDRANTS AND WATER

The Contractor shall make its own arrangements for a supply of water to be used in carrying out the Contract, and shall bear all costs for water and temporary connections unless otherwise specifically provided for in the Contract.

The Contractor shall comply with the regulations of the authority supplying the water regarding the use and care of hydrants. Any damage to hydrants caused by the Contractor's operations shall be its responsibility. In the event the Contractor fails to make good such damage the Engineer will have the necessary repairs made and will retain the cost from monies due the Contractor.

The Contractor shall bear the cost of all water used in testing and chlorinating of all installations.

42. SETTING OUT

The Engineer will provide the Contractor in writing with Bench Marks and point of reference to be used by him in setting out the works. The Owner will be responsible only for the correctness of the information so supplied. From these Bench Marks and points of reference the Contractor will do its own setting out. The setting by the Contractor shall include but shall not be limited to the preparation of grade sheets, the installation of centre line stakes, grade stakes, offsets, site rails and screeds.

The Contractor shall be responsible for the true and proper setting of the works and for the correctness of the position, levels, dimensions and alignment of all parts of the works, and for the provision of all necessary instruments and labour
in connections therewith. The Contractor shall not be responsible for the correctness of the information supplied by the Engineer as herein provided for. If at any time during the progress of the works any error shall appear or arise in the position, levels, dimensions or alignment of any part of the works, the Contractor shall, at its own expense, rectify such error to the satisfaction of the Engineer, unless such error is based on incorrect data supplied in writing by the Engineer. The checking of the setting out of any line or level by the Engineer shall not in any way relieve the

42. SETTING OUT (CONT'D)

Contractor of its responsibility for the correctness thereof and the Contractor shall carefully protect and preserve all Bench Marks, stakes and other things used in setting out the works.

43. ASSISTANCE

The Contractor is to furnish the Engineer or any of its assistants, with any reasonable help which it or they may require at any time in checking the work. it shall also furnish the said parties, or any of the Inspectors, at all times, with convenient means of access to all parts of the works, and also with all required assistance to facilitate thorough examination of the same, and inspection, culling and removal of doubtful or defective materials, and for any other purpose required in connection with the said works or in the discharge of their respective duties, for which services no additional allowance will be made.

44. OTHER'S RIGHTS

The Contractor must afford all necessary and reasonable facilities to the Owner, or any of its employees or workmen, as well as to any company, corporation or person owning or operating any railway, tramway, wires, pipes or conduits or work or property, on, or along, or near the line of the works, or in their vicinity; it shall notify all such parties before interfering with any of their property, rights or privileges and must work in harmony with them; otherwise it shall notify the Engineer in writing of its failure to do so, or of any difficulty that may at any time arise which it may be unable to overcome, in which case the Engineer shall deal with the matter as in its judgment may seem right or proper, and the Contractor shall abide by the decision and the direction of the Engineer. Any property of such parties which the Engineer orders to be moved by the Contractor must be handled with care, and must be neatly piled up and preserved free from injury or loss, and must be properly and satisfactorily replaced, all of which must be done by the Contractor without extra charge (unless specifically provided for in the Contract) and to the satisfaction of the Engineer. The Engineer shall have the right, at any time before or during the construction, or after the completion of the work, to open up any portion of the work or works, or the ground or roadway, or to grant permission for such opening to be made or left by the Contractor, as it, the Engineer, may deem advisable, for the purpose of examining, repairing or laying any water, gas or other pipe, sewer, drain, track or other underground or surface construction or to cause any such work as it may deem necessary or advisable to be done, and such permission, or the exercise of such rights, either by the Engineer or by any other person or corporation having the requisite authority (either statutory or otherwise), shall not relieve the Contractor from any of its responsibilities or obligations, nor shall the opening up of any portion of the work for these or any other purpose, or by any other parties, relieve the Contractor of such responsibilities or obligations, except only for the portion of the work actually torn up and destroyed and then only in case the Contractor applies in writing for such relief at the time the work is being done, or within ten days afterwards, and can furnish sufficient cause, in the opinion of the Engineer, why such relief should be granted.

45. MONIES DUE OWNER

All monies payable to the Owner by the Contractor under any stipulation herein or to the Workplace Safety and Insurance Board, may be retained out of any monies then due, or which may become due, from the Owner to the Contractor under this or any other Contract with the Owner, or otherwise howsoever, or may be recovered in any Court of competent jurisdiction, as a debt to the Owner, and the Owner shall have full power to withhold any estimate or certificate if circumstances arise which may indicate to it the advisability of so doing, though the sum to be retained may be unascertained.

46. HOURS OF WORK

Except in cases of emergency or other special circumstances as may be approved by the Engineer, the working hours of all persons in the employ of the Contractor or of any Sub-Contractor or other person doing or contracting to do the whole or any part of the work contemplated by the Contract shall not exceed:

- eight (8) hours per day and forty-four (44) hours per week for general construction trades;
- ten (10) hours per day and fifty (50) hours per week for sewer and watermain construction;
- eleven (11) hours per day and fifty-five (55) hours per week for road building.

47. LIENS

The Contractor and its surety, executors, administrators, successors and assigns (if assignment is approved as herein provided), and any and all other parties in any way concerned, shall fully relieve and indemnify the Owner and all its officers, servants and employees from any and all liability or expenses in respect to any claim which may be made for a lien or charge at law or in equity or to any claim or liability or to any attempted attachment for debt, garnishee, process or otherwise. The Owner shall not in any case be liable to any greater extent than the amount owing by it to the Contractor, its executors, administrators, successors and assigns, pursuant to this Contract.

48. REMOVAL OF PERSONNEL

Should any superintendent, foreman, mechanic or workman employed on or about the work or in connection therewith, give any just cause for complaint (of which the Engineer shall be the sole judge), the Engineer may instruct the Contractor to remove such person from the works forthwith.

49. NON-FULFILLMENT OF THE CONTRACT

If in the opinion of the Engineer and at any time or times prior to the issuance of the Final Certificate, the Contractor neglects or fails to commence work with seven days after the date of the Engineer's written order to commence work, or becomes bankrupt or insolvent, or compounds with its creditors, or commits any act of insolvency, or transfers, assigns or sub-lets the Contract or any part thereof without the written consent of the Engineer, or has not executed or is not executing the work or any part thereof in a sound and workmanlike manner and in accordance with the Contract, or is not performing the work so as to ensure its completion within the time stipulated in the Contract or has failed to complete the works within the said time, or fails or refuses to take down, rebuild, repair or rectify any imperfect works for which the Contractor is responsible, or fails to remove any condemned material, or fails to comply with any reasonable order given to him by the Engineer, or abandons the work, or fails to observe or perform any of the provisions of the Contract then in each and any such case the Engineer shall, after giving the Contractor 48 hours written notice, have the right and power, at its discretion without process or action at law, to take possession and control of the whole work, or any part or parts thereof specified in the said notice, from the Contractor, and the Contractor upon receiving the said notice, shall give possession and control of the said work, or the part or parts thereof specified in the said notice, peaceably to the Engineer, and the Engineer may employ such means as it may deem necessary or advisable to complete the work to its satisfaction with such changes therein as in the Engineer's opinion are necessary or advisable by reason of the Contractor's non-fulfillment of the Contract as set out herein. In the event of any emergency in any manner due to the Contractor's non-fulfillment of the Contract as set out above or in Section 29(a) hereof, the Engineer shall have the right and power at its discretion without process or action at law or any notice to the Contractor to take possession and control of the works, or any part thereof, from the Contractor and the Engineer may take such measures as it may deem necessary or advisable to deal with the emergency and the decision of the Engineer as to the existence of such an emergency and as to the measures to be taken in regards thereto as provided for above, it shall notify the Contractor as is practicable. The Contractor and its surety in every case provided for above shall be liable for all loss, damage, expense, expenditures and cost which may be incurred by reason of the Engineer's exercise of the rights and powers provided for herein. If the said sum exceeds that which would have been payable under the Contract if the same had been completed by the Contractor, the Contractor or its surety shall pay the amount of such excess to the Owner together with the amount of liquidated damages from the date fixed for the completion of the work, and the same may be deducted or collected by the Owner as provided for in Section 45 entitled "Monies Due Owner". All the powers of the Engineer with respect to the determination of any doubts, disputes and differences, and the determination of the sum or sums, or balance of money to be paid to or received from the Contractor or its surety in respect of the Contract, shall nevertheless continue in force. The fulfillment by the Contractor of any stipulation in the Contract may be enforced by legal proceedings and judgment, or order of court, without prejudice to any other remedy herein contained.

In case possession and control of the work, or any part thereof, is taken from the Contractor as herein provided the relative obligations of the Owner and the Contractor and its surety in respect of the Contract shall not be affected nor shall the completion of the work be delayed; all property, materials, articles and things whatsoever including all machinery, tools, plant and equipment, and all rights, proprietary or otherwise, licenses, powers and privileges, whether relating to or affecting real or personal property, acquired, possessed or provided by the Contractor for the purpose of the work, or by the Engineer under the provisions of this Contract, shall be the property of the Owner and may be used, exercised and employed by the Owner as fully as they might have been used, exercised and employed by the Contractor, and the Owner may sell or otherwise dispose of, at public auction or private sale or otherwise, the whole or any portion or number of such property, materials, articles and things, at such price or prices as it may deem fit and retain the proceeds of any sale or disposition and all other amounts then or thereafter due the Owner to the Contractor, on account of or in part satisfaction of any loss, damage, expense or cost which the Owner may sustain or has sustained by reason aforesaid. If any balance of the Contract price, or any other money payable by the Owner hereunder, shall remain in the hands of the Owner upon the completion of the measures taken by the Engineer and the fulfillment of the Contract, the same shall be payable to the Contractor or the person legally representing him, but neither the Owner nor any officer employee or agent thereof shall be liable or accountable to the Contractor or its surety in any way for the manner in which, or the price at which, the said work or any portion thereof, may have been or may be done or completed by the Engineer.

Neither an extension of time for any reason beyond the date fixed herein for the completion of the Contract, nor the payment for any portion of the work shall be deemed to be a waiver by the Engineer or the Owner of their rights under the Contract.

50. BRIBERY

Should the Contractor or any of its agents give or offer any gratuity to, or attempt to bribe, any member of the Council of the Corporation, or any officer or servant of the Owner or any agent of the Engineer, the Owner shall be at liberty to cancel the Contract forthwith, or to direct the Engineer to take the whole or any part of the works out of the hands of the Contractor, under the same provisions as those specified in the preceding section hereof.

51. DISPUTES

(a) Contractor's Claims

Any claim which the Contractor may have against the Owner based on any dispute or difference of any kind whatsoever arising out of the Contract or work shall not be grounds for delay in the work but shall be referred by the Contractor in writing to the Engineer not later than fifteen days after the Contractor becomes aware of the circumstances giving rise to such dispute or difference. Such reference to the Engineer shall contain a concise statement of the relevant facts. The Engineer may require any additional information.

The claim shall be settled by the Engineer who shall communicate its decision in writing to the parties within sixty days of the reference and such decision shall forthwith be given effect by the parties, and the Contractor shall proceed with the works with all due diligence in accordance therewith whether or not such claim shall be referred to arbitration as hereinafter provided.

Except in those circumstances where it is provided in the Contract that the decision of the Engineer shall be final, any dispute or difference persisting after the delivery of the Engineer's decision or after the expiry of the period of sixty days aforementioned, whichever shall first occur, shall, within thirty days, be referred to arbitration in accordance with the Provincial Arbitration Act as herein provided.

The arbitration shall be by a board of three members except as provided for in the following paragraph hereof.* Either party shall notify the other party in writing of its desire to submit the dispute or difference to arbitration and the notice shall contain the name of the first party's appointee to the arbitration board. The recipient of the notice shall within fourteen days, inform the other party of the name of its appointee to the arbitration board. The two members, so selected, shall within fourteen days of the appointment of the second of them appoint a third person who shall be the chairman.

* Alternatively, the arbitration board may consist of a sole arbitrator provided that;

(i) The Owner and the Contractor so agree and

(ii) The Owner and the Contractor agree upon the person to be appointed as sole arbitrator.

Either party may appeal from the arbitration award.

Reference to arbitration by the Contractor as herein provided shall be a condition precedent to any legal action by him with respect to any dispute or difference of any kind whatsoever which the Contractor may have with the Owner arising out of the Contract or work.

(b) Owner's Claims

Any claim which the Owner may have against the Contractor based on any dispute or difference of any kind whatsoever arising out of the Contract or work may, at the option of the Owner, and after notification in writing to the Contractor, be settled in accordance with the procedure set out in sub-section (a) hereof and the provisions thereof shall apply, the necessary changes having been made.

52. SPECIFICATION EXPLANATION

(a) The specifications may be of the simplified abbreviated type and include incomplete sentences. "The Contractor shall", "in conformity therewith", "as noted on the Drawings", "according to the plans", "a", "an", "the", and "all" are intended. Omitted words or phrases shall be supplied by inference in the same manner as they are when a "note" occurs on the Drawings.

(b) Whenever the words, "approved", "satisfactory", "reviewed", "directed", "submitted", "inspected", or similar words and phrases are used, it shall be assumed that the words "Engineer or its representative" follow the verb as the object of the clause such as "approved by the Engineer or its representative".

(c) All reference to standard specifications or manufacturer's installation directions shall mean the latest edition thereof.

53. SHOP DRAWINGS

The Contractor shall submit to the Engineer for review shop drawings for all equipment, fabricated items and materials and shall not incorporate any equipment, fabricated items or materials into the work prior to the Engineer's review of shop drawings.

Shop drawings shall illustrate appropriate portions of the work showing fabrication, layout, setting and erection details. Where manufacturers' standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data are submitted they must be clearly marked to show the

53. SHOP DRAWINGS (CONT'D)

information that applies to this project including dimensions and clearances required, performance characteristics and wiring diagrams and controls.

All submissions shall be identified by project name and location, section of specifications where specified, location where equipment or materials to be installed, name of the Sub-Contractor and supplier and any other relevant information.

The Contractor shall review all shop drawings prior to submission to verify the data and dimensions thereon and shall sign and stamp the drawings, "Checked and Certified Correct for Construction". Drawings not stamped and signed by the Contractor will not be reviewed by the Engineer. The Contractor shall notify the Engineer in writing of all aspects where the shop drawings deviate from the requirements of the Contract Drawings and Specifications. The Engineer's review of shop drawings shall not relieve the Contractor from responsibility for results arising from any errors, deviations or omissions.

Unless directed otherwise six (6) copies of shop drawings shall be submitted by the Contractor. Two (2) copies of reviewed drawings will be returned to the Contractor. The Contractor shall make all corrections and changes required by the Engineer and re-submit six (6) copies of final revised drawings.

54. FOSSILS, ETC.

All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the site, shall as between the Owner and the Contractor, be deemed to be the absolute property of the Owner; and the Contractor shall take reasonable precautions to prevent its workmen or any other persons, from removing or damaging any such article or thing, and shall immediately upon discovery thereof, and before removal, acquaint the Engineer of such discovery and carry out at the expense of the Owner, the Engineer's orders as to the disposal of same.

APPENDIX “A”

E.R.C.A.
CORRESPONDENCE

Subject: Re: Road 10 Crossing Over the Patterson Drain - Town of Kingsville - D17-029
From: Tony Peralta <tony@peraltaengineering.com>
Date: 4/6/2018 3:29 PM
To: Cynthia Casagrande <CCasagrande@erca.org>
CC: Dan Jenner <DJenner@erca.org>, Ken Vegh <kvegh@kingsville.ca>, "russell@peraltaengineering.com" <russell@peraltaengineering.com>, Diane Broda <dbroda@kingsville.ca>, Shaun Martinho <smartinho@kingsville.ca>

Good morning Cynthia;

In accordance with your request for a preliminary design proposal for this project, attached you will find the preliminary design drawings for your review.

As previously noted, the existing road crossing structure is a concrete span bridge which varies in size. The upstream section consists of approximately 3.83 span x 2.3m rise and the downstream section has a smaller cross-section of approximately 3.04m span x 2.3m rise. Both sections have an obvert elevation of 190.548m.

The proposed replacement structure consisting of a 4.2m span x 2.4m rise concrete box culvert with an obvert elevation of 190.151. Although, the obvert elevation has been lowered to accommodate for adequate cover over the proposed structure, the proposed cross-sectional area is considerably more than the existing structure. This, in turn, provides for increased carrying capacity and conveys the 1:100 year storm event flows at a lower elevation than the existing structure. In fact, based on our calculations, the 1:100 year storm event water surface elevation will be lowered by approximately 0.320m through the proposed structure with approximately 1.0m of free-board to the obvert of the structure. Furthermore, with the proposed structure having a wider and uniform span, the risk of ice/debris blockage will be significantly reduced.

We have also reviewed the DFO website as it relates to the Fisheries Act and have performed a "Self Assessment" for this project. Also, as it relates the the Endangered Species Act, we have contacted the Town of Kingsville to ensure that this project is covered under the new ESA Regulation 242/08.

As this project is being conducted under Section 78 of the Drainage Act, we are looking to complete the Engineer's Report in the near future. Please feel free to provide any comments or concerns that you may have. If further explanation of the hydraulic analysis is required, please feel free to contact us to discuss.

We trust that this information is satisfactory. However, if you have any concerns or require additional information, please feel free to contact us.

Regards,

Tony Peralta, P.Eng.

N.J. Peralta Engineering Ltd.

45 Division Street North
Kingsville, ON
N9Y 1E1
(519)733-6587 office
(519)733-6588 fax

-------- Original Message --------
Subject: Re: Road 10 Crossing Over the Patterson Drain - Town of Kingsville - D17-029
From: Cynthia Casagrande <CCasagrande@erca.org>
To: Tony Peralta <tony@peraltaengineering.com>
Cc: Dan Jenner <DJenner@erca.org>, Ken Vegh <kvegh@kingsville.ca>, "russell@peraltaengineering.com" <russell@peraltaengineering.com>, "Diane Broda" <dbroda@kingsville.ca>
Date: Tue Sep 05 2017 13:26:30 GMT-0400 (Eastern Standard Time)

Dear Tony:

We acknowledge your inquiry regarding the proposed repair and improvements to the Patterson Drain for the Road 10 Crossing.

A review of our floodplain mapping for the Patterson Drain indicates that this drain is located within an area that is under the jurisdiction of the Essex Region Conservation Authority (ERCA) (Section 28 of the *Conservation Authorities Act*). Prior to undertaking works, a permit is required from this office.

At this time, we do not expect that there will be any extraneous comments or concerns with respect to this project. We will require confirmation that the level of service for the new bridge remains unchanged and/or not significantly lowered. In addition, consideration will need to be given to size of current opening versus proposed opening and potential for ice/debris blockage issues. However, we cannot be more specific in this regard without an actual proposal to review.

If further information or clarification is required, please do not hesitate to contact this office.

Yours truly,

Cynthia Casagrande
Regulations Coordinator
Essex Region Conservation Authority
360 Fairview Avenue West, Suite 311
Essex ON N8M 1Y6
(519) 776-5209, Ext. 349

From: Tony Peralta [mailto:tony@peraltaengineering.com]
Sent: Thursday, August 31, 2017 10:33 AM
To: Cynthia Casagrande <CCasagrande@erca.org>
Cc: Dan Jenner <DJenner@erca.org>; Ken Vegh <kvegh@kingsville.ca>; russell@peraltaengineering.com
Subject: Road 10 Crossing Over the Patterson Drain - Town of Kingsville - D17-029

Good morning Cynthia;

We have been appointed by the Town of Kingsville, under Section 78 of the Drainage Act, to provide an Engineer's Report for the replacement of an existing road crossing culvert over the Patterson Drain, located approximately 1.8km west of County Road 31 (Albuna Townline).

Based on their bridge and culvert needs study, the Town of Kingsville has requested that the subject road crossing be replaced through the provisions of the Drainage Act. This structure varies in size and on average consists of a 3.78m span x 2.40m rise concrete span bridge. Upstream of this crossing is where the East and West Branches of the Patterson Drain converge. The most downstream culvert on the West Branch was recently installed under the February 8th, 2016 Engineer's Report prepared by myself under Project# D15-004. This culvert consists of an embedded 2200mm diameter CSP that is located approximately 150m from the subject crossing. The most downstream culvert on the East Branch consists of a 2200mm diameter CSP located approximately 100m from the subject crossing. Approximately 1500m downstream of the subject bridge, at the Road 11 crossing, consists of 5.33m span x 3.0m+/- concrete bridge.

At this time, we would kindly request any comments or concerns from the ERCA. Attached is a map showing the general drain and crossing location.

As part of our investigations, we have reviewed the DFO website as it relates to the Fisheries Act and have performed a "Self Assessment" for this project. Also, as it relates the the Endangered Species Act, we have contacted the Town of Kingsville to ensure that this project is covered under the new ESA Regulation 242/08.

Thank you for your time and attention to this matter. We look forward to your response.
--

Regards,

Tony Peralta, P.Eng.

N.J. Peralta Engineering Ltd.
45 Division Street North
Kingsville, ON
N9Y 1E1
(519)733-6587 office
(519)733-6588 fax

Attachments:

180406 PRELIMINARY DESIGN SHEET 1 AND 2.pdf 1.1 MB

D.F.O.
BEST MANAGEMENT PRACTICES – CULVERT REPLACEMENTS IN MUNICIPAL DRAINS

Best Management Practices – Culvert Replacements in Municipal Drains

This document describes the conditions on which one may proceed with a culvert replacement in a municipal drain without DFO approval/notification. All municipal, provincial, or federal legislation that applies to the work being proposed must be respected. If the conditions/requirements below cannot be met, please complete the drain notification form and submit it to the Fisheries Protection Program form review at: FisheriesProtection@dfo-mpo.gc.ca.

Potential Impacts to Fish Habitat

- Infilling fish habitat by encroachment of the water crossing footprint or channel realignment to accommodate culvert
- Harmful substrate alteration of fish habitat (e.g. blockage of groundwater upwellings, critical SAR habitat, spawning areas)
- Removal of riparian vegetation and cover along the banks of the municipal drain
- Removal of edge habitat (e.g. undercut bank, shallower areas with lower velocity, aquatic vegetation) creation of barriers to fish movement (e.g. perched crossings, velocity barriers, alteration of the natural stream gradient)
- Alteration of channel flow velocity and/or depth (e.g. oversized culvert resulting in insufficient depth for fish passage at low flow or undersized culvert resulting in a flow velocity barrier at high flow)
- Alteration of channel morphology and sediment transport processes caused by the physical structure of the crossing resulting in upstream and downstream sediment aggradation/erosion
- Re-entry of sediment that was removed/stockpiled into the watercourse
- Erosion downstream from sudden release of water due to the failure of site isolation
- Stranding of fish in isolated ponds following de-watering of the site
- Impingement or entrainment of fish when de-watering pumps are used
- Short term or chronic transport of deleterious substances, including sediment, into fish habitat from construction or road drainage

Requirements

The following requirements must be met:

- There are no aquatic Species at Risk present in the work zone or impact zone. To confirm there are no aquatic Species at Risk present, refer to the document, A Guide for Interpreting Fish and Mussel Species at Risk Maps in Ontario which can be found at: http://www.dfo-mpo.gc.ca/Library/356763.pdf. Links for Ontario Conservation Area specific fish and mussel maps that include critical habitat extents and a list of aquatic Species at Risk found within the conversation authority boundary can be found on Page 5 of A Guide for Interpreting Fish and Mussel Species at Risk Maps in Ontario.
- The culvert is embedded into the streambed and must allow for the free passage of fish.
- The work involves like-for-like replacements of existing road or private access culverts on all drain types without SAR.
- On C and F Drains only, this can also include replacements with extensions and end walls for the purposes of providing the property or road with safe access, but the project permanent footprint will not increase more than 250 m^2 below the high water mark.
- The project does not involve replacing a bridge or arch with one or more culverts installed in parallel or a larger-diameter culvert with more than one culvert installed in parallel.

- The project does not involve building more than one culvert installed in parallel on a single watercourse crossing site (e.g. twin culvert).
- The project does not involve temporarily narrowing the watercourse to an extent or for a duration that is likely to cause erosion, structural instability or fish passage problems.
- The municipal drain has no flow/low flow or is frozen to the bottom at the time of the replacement.
- In-water work is scheduled to respect timing windows (Tables 1 and 2) to protect fish, including their eggs, juveniles, spawning adults, and/or the organisms upon which they feed.
- The work can be conducted using the Culvert Removal Method described below and Standard Measures to Avoid Causing *Serious Harm to Fish* will be implemented when required.

Note: If your project must be conducted without delay in response to an emergency (e.g. the project is required to address an emergency that poses a risk to public health or safety or to the environment or property), you may apply for an Emergency Authorization (http://www.dfo-mpo.gc.ca/asp/forceDownload.asp?FilePath=/pnw-ppe/reviews-revues/Emergency-Authorizations-Autorisations-Urgences-eng.pdf).

Culvert Removal Methodology

- Plan/manage the work site in a manner that prevents sediment from entering the municipal drain by installing sediment and erosion control materials where required. Ensure that a sediment and erosion control plan is developed and modified as necessary for the site.
- Where required, install effective erosion and sediment control measures before starting work to prevent sediment from entering the municipal drain.
- Implement site isolation measures when in-water work is required.
    - Install an impervious barrier upstream of the work area (Figure 1). If possible, install a secondary barrier upstream of the work area for added protection.
    - Attempt to drive out the fish from the work area and then install the impervious barrier downstream of the work area. This may reduce or eliminate the need for a fish salvage.
    - When the drain is flowing, maintain downstream flows (e.g. bypass water around the work site using pumps or flume pipes; Figure 2). Provide temporary energy dissipation measures (e.g. rip-rap) at discharge point of the hose or temporary outlet pipe when required. Routinely inspect bypass pump and hose or pipe to ensure proper operation. Inspect discharge point for erosion and reposition hose/pipe or install additional temporary energy dissipation material as needed.
    - Dewater the isolated work area. The hose for a pump may discharge along the top of the bank into existing vegetation; however, the area should be monitored for signs of erosion. Reposition the hose or install additional temporary energy dissipation material as needed.
    - A fish screen with openings no larger than 2.54 mm (0.10 inches) should be equipped on any pump used during the operation. Note: Additional information regarding fish screens can be found in the DFO Freshwater Intake End-of-Pipe Fish Screen Guideline document (http://www.dfo-mpo.gc.ca/Library/223669.pdf).
    - Collect any fish present in the isolated work area and relocate them downstream.
    - Fish salvage operations must be conducted under a license issued by the Ontario Ministry of Natural Resources and Forestry (MNRF). The MNRF should be contacted well in advance of any work to obtain the required fish collection license.
- Install the culvert so that it is embedded into the streambed; ensure the culvert remains passable (e.g. does not become perched) by fish and wildlife.

- Decommission the site isolation in a manner that minimizes the introduction of sediment. The downstream isolation barrier shall gradually be removed first, to equalize water levels inside and outside of the isolated area and to allow suspended sediments to settle.
- Stabilize and remove waste from the site.
- Where required, maintain effective erosion and sediment control measures until complete re-vegetation of disturbed areas is achieved.

Figure 2. Isolation of Site

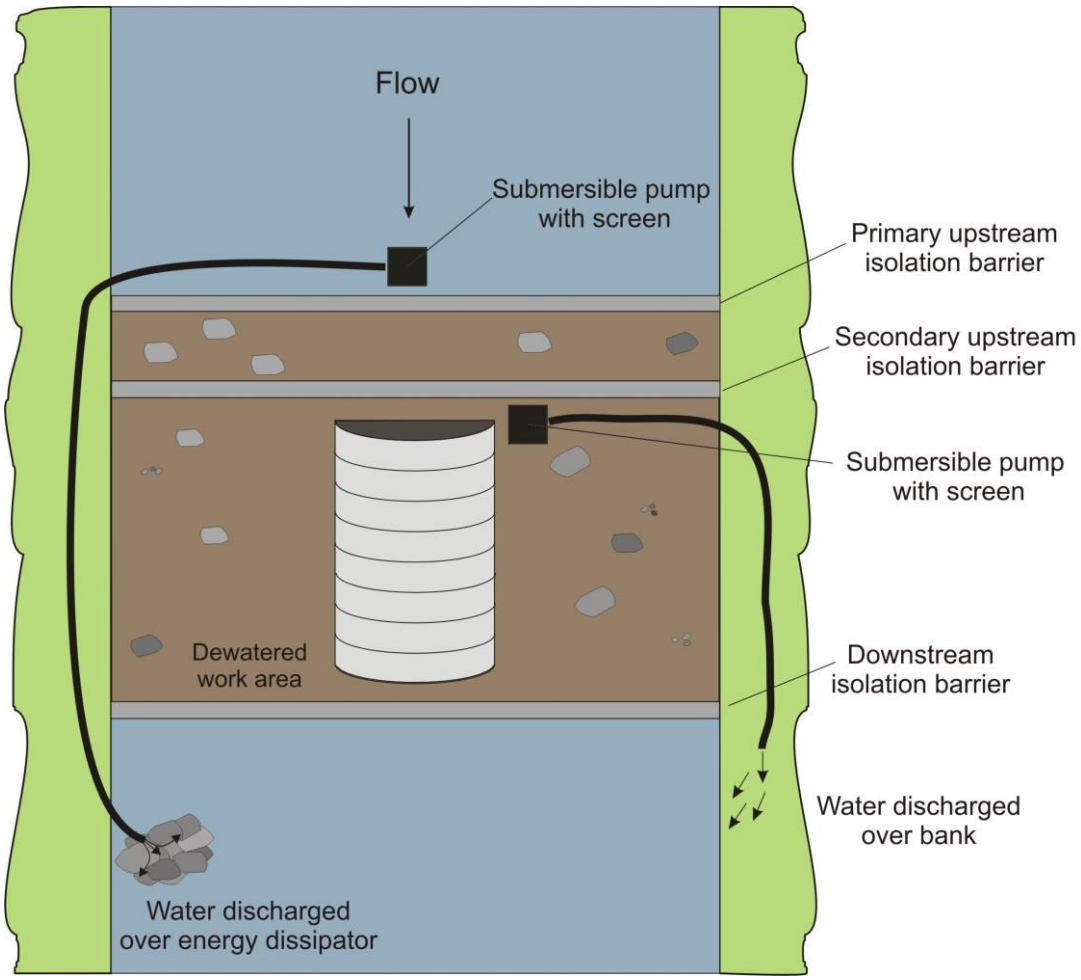


Figure 3. Isolation and Bypass Diversion when Working In-Water

Timing Windows

Figure 1 and Tables 1 and 2 can be used to determine the Restricted Activity period for the drain based on its classification. Note: Timing windows identified on Conservation Authority permits or Ministry of Natural Resources (Government of Ontario) work permits may differ and take precedence.

Figure 1. Ontario's Northern and Southern Region boundaries for determining application of restricted activity timing windows.

Table 1. Restricted Activity timing windows for the protection of spawning fish and developing eggs and fry in the Northern Region. Dates represent when work should be avoided.

Drain Type	Restricted Activity Period
A	September 1 to July 15
B	September 1 to July 15
C	April 1 to July 15
D	September 1 to July 15
E	April 1 to July 15

Table 2. Restricted Activity timing windows for the protection of spawning fish and developing eggs and fry in the Southern Region. Dates represent when work should be avoided.

Drain Type	Restricted Activity Period
A	September 15 to July 15
B	March 15 to July 15
C	March 15 to July 15
D	October 1 to July 15
E	March 15 to July 15

Standard Measures to Avoid Causing *Serious Harm to Fish*

When implementing a culvert removal project in a municipal drain, the *Fisheries Act* still requires an individual/company to ensure they avoid causing *serious harm to fish* during any activities in or near water. The following advice will help one avoid causing harm and comply with the *Act* (for additional information see http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/measures-mesures-eng.html).

1. Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
2. Whenever possible, operate machinery on land above the high water mark or on ice and in a manner that minimizes disturbance to the banks and bed of the municipal drain.
    - Ensure that machinery arrives on site in a clean condition and is maintained free of fluid leaks.
    - Limit machinery fording of the municipal drain to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the municipal drain are required, construct a temporary crossing structure.
    - Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water.
    - Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.
3. Install effective sediment and erosion control measures before starting work to prevent sediment from entering the municipal drain. Inspect them regularly during the course of construction and make all necessary repairs if any damage occurs.
4. Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the municipal drain and runoff water is clear.
5. Undertake all in-water activities in isolation of open or flowing water while maintaining the natural flow of water downstream and avoid introducing sediment into the municipal drain.
6. Ensure applicable permits for relocating fish are obtained and relocate any fish that become trapped in isolated pools or stranded in newly flooded areas to the main channel of the watercourse.
7. Ensure that the water that is being pumped/diverted from the site is filtered (sediment remove) prior to being released (e.g. pumping/diversion of water to a vegetated area).
8. Implement measures for containing and stabilizing waste material (e.g. dredging spoils, construction waste and materials, commercial logging waste, uprooted or cut aquatic plants, accumulated debris) above the high water mark of nearby waterbodies to prevent re-entry.
9. Stabilize shoreline or banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through re-vegetation with native species suitable for the site.
10. If replacement rock reinforcement/armouring is required to stabilize eroding or exposed areas, then ensure that appropriately-sized, clean rock is used; and that rock is installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment.
11. Remove all construction materials from site upon project completion.

APPENDIX “B”

UNDERGROUND SPECIALTIES
BLOCK INSTALLATION GUIDE

Block Headwall Installation Instructions for Culverts

1. A swift lift device will be required to place the blocks. A 75mm eye bolt will be required to place the caps.
2. The bottom course of blocks shall be founded on a firm solid base. The contractor shall provide a minimum levelling course of 150mm of compacted 3/4" Clear Stone, or a 100% compacted granular A, or lean concrete as a foundation base.
3. Ensure that the base is level and flat as this will greatly improve speed of installation.
4. On new culverts a minimum of 150mm of block wall will extend below the culvert to prevent scouring under the culvert.
5. The bottom course of blocks shall be embedded into the drain bottom to achieve the desired top elevation of the wall.
6. Blocks shall extend from the pipe invert across the full height and width of the drain and be imbedded a minimum of 300mm into the drain banks. Where possible the top of the block wall will match the height of the completed driveway.
7. Blocks shall be placed such that all joints are staggered.
8. Any excavation voids on the ends of block walls below subsequent block layers shall be filled with ¾" Clear Stone.
9. Where block walls extend beyond three blocks in height, they should be battered a minimum of 1 unit horizontal for every 10 units vertical throughout the wall's full height and width. This can be achieved using pre-battered base blocks, or by careful preparation of the base.
10. Filter cloth (270R or equivalent) should be placed behind the wall to prevent the migration of fill material through the joints.
11. The walls should be backfilled with a free draining granular fill.
12. A uni-axial geogrid (SG350 or equivalent) should be used to tie back the headwalls where walls extend beyond 1.8m in height.
13. The face of the block wall shall not extend beyond the end of the pipe culvert.
14. Any gaps between the blocks and culvert shall be sealed with non-shrink grout for the full depth of the block.

IECS CABLE CONCRETE GUIDE

International Erosion Control Systems Inc.
22295 Hoskins Line, Rodney, ON N0L 2C0
Phone: 1-800-821-7462 Fax: 1-866-496-1990
www.iecs.com

Specifications

A. DESCRIPTION

Cable Concrete® is an articulated concrete block revetment system, developed by International Erosion Control Systems, to control various types of erosion due to water, wind, or vehicular traffic.
This system is made up of 2.44m x 4.88m long (8'x16') mats placed side by side and clamped together to provide one homogeneous erosion protection system. Smaller mats are available as required.
The mats consist of concrete blocks interlocked by integrally woven stainless steel cables, which are poured within each block. Geotextile fabric is attached to the base of each concrete mat. The blocks typically have 292.10mm (11.5") square top faces and 393.70mm (15.5") square bottoms. Variations between the mat systems are the block heights and weights.

SYSTEM	Minimum BLOCK WEIGHT		Minimum BLOCK HEIGHT		Open Area %
	kg/sm	***lbs/sf***	***mm***	***inches***	
CC 35	180.65-195.30	37-40	114.3-127.0	4 1/2-5	20
CC 45	229.47-253.88	47-52	139.7-152.4	5 1/2-6	20
CC 70	351.53-380.83	72-78	215.9-228.6	8 1/2-9	20

B. CONCRETE

The concrete shall meet the requirements of CSA A23.1/A23.2 for materials, testing, and methods of construction. The concrete mix Exposed Class F-2 25 MPA .55 w/c with a minimum of 5-8% air entrainment throughout at 28 days.

C. CABLES

The cables shall be made of type 302/304 stainless steel aircraft cable, 1x19 construction.
Cables shall be integral (poured into) to the concrete block and shall traverse through each block in both longitudinal and lateral directions, providing a flexible interlocked system.

STAINLESS STEEL CABLE				
System	Lengthwise mm	inches	Widthwise mm	inches
CC35	4	5/32"	4	5/32"
CC45	4	5/32"	4	5/32"
CC70	4.8	3/16"	4.8	3/16"

D. GEOTEXTILE

The standard geotextile material used is a needle punched non-woven fabric which is attached to the underside of the mats. An overlap shall be incorporated on three sides. The overlap provides area for the adjoining mats to be placed upon and prevent undermining of the erosion control system.
It should be noted that when different geotextile weights are used and or when additional overlap area is added to the mat, additional cost adjustments shall be made.

E. CLAMPS

Sufficient malleable or stainless steel cable clamps may be used to connect adjoining Cable Concrete® mats. The standard placement of clamps shall be placed on 1.22m (4') centres connecting adjoining mats together. Clamps are recommended in applications exceeding 3.05m (10') per second.
When placing clamps under existing water, the manufacture will specify a clamp for the condition.

F. ANCHORING

Cable Concrete® mats are designed to take certain velocities in certain slope and bedding situations. This information is founded on engineered flume testing. The data shows maximum limits of the mat system, based on unanchored mats.
Anchoring Cable Concrete® mats offer additional safety to the erosion protection system. If a situation arises where velocities may exceed maximum limits of a system, or if slopes of 1.5:1 or greater are encountered, then anchoring becomes an item to be specified by the governing project engineer.

G. INSTALLATION

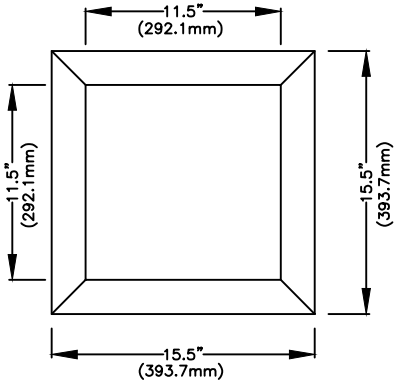
Installation equipment shall have a lifting capacity, capable of completely lifting the concrete mat and the lifting bar during unloading, stockpiling and installing etc.
Prepared areas shall be graded to a smooth plane finish. Any roots, debris and stones must be removed and regraded. Specified geotextile to be placed according to manufacturing recommendations. There shall not be any dragging, tearing or damaging of the geotextile. The mats shall be laid on the geotextile in such a manner to produce a smooth plane surface. Intimate contact with the subsurface is critical to the systems performance in the field.
The gap between each mat shall not be greater than 2", preferably 1" or it must be closed using a cement mixture.

It is recommended that after the installation of the mat system, that it be covered with desired backfill. If vegetation is required, the mat system shall be backfilled and seeded. This will allow moisture to traverse back and forth from sub grade to vegetation. Vegetation will lend support and an even grade for maintenance vehicles (mowers) to traverse over it. Any surface application should not be placed prior to the inspection of the systems clamping and anchoring.

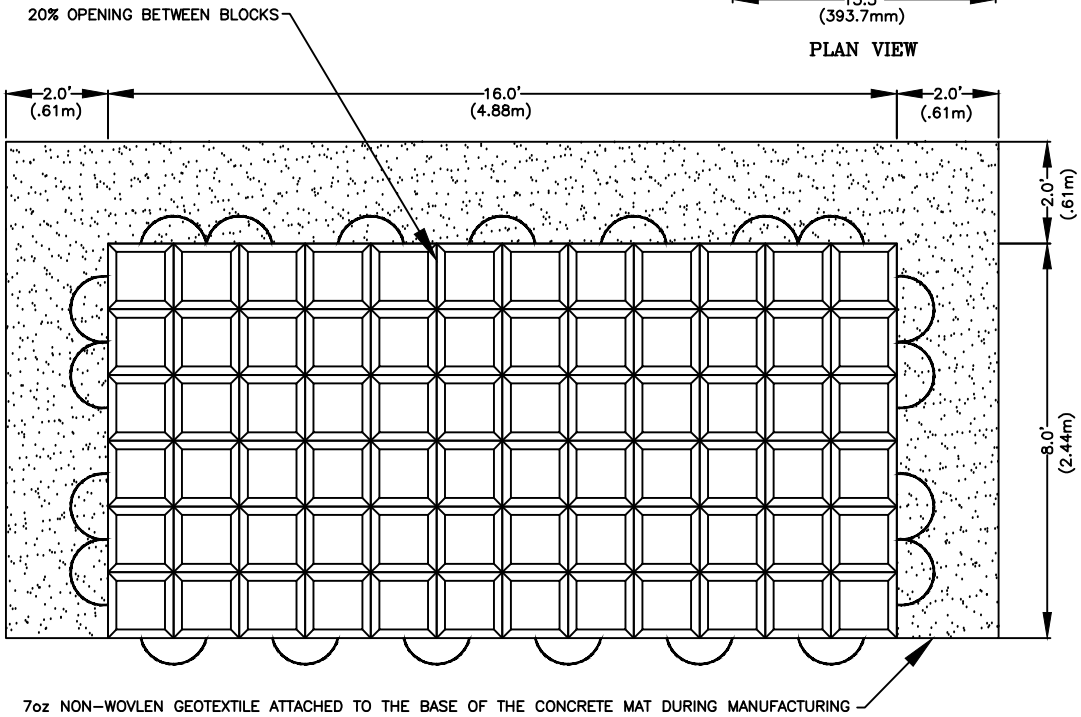
H. PAYMENT

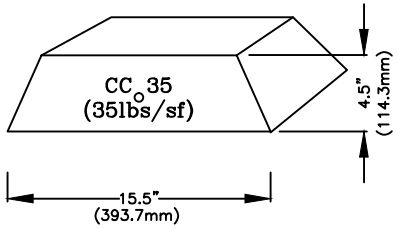
Payment shall be by the square metre and shall include Cable Concrete® mats and manufacturer's recommended geotextile.
Stainless Steel cable clamps, anchors, lifting bar rental and delivery are separate cost items.
Upgrades or additional items shall be considered additional costs.

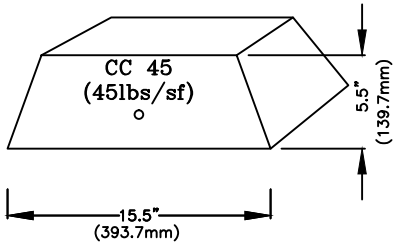
CABLE CONCRETE ®
TYPICAL UNIT DEPTHS

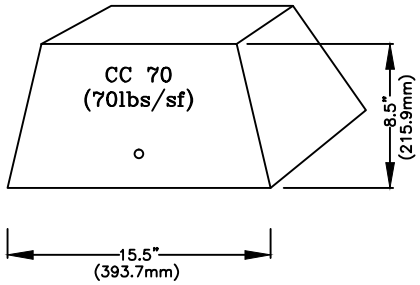


PLAN VIEW









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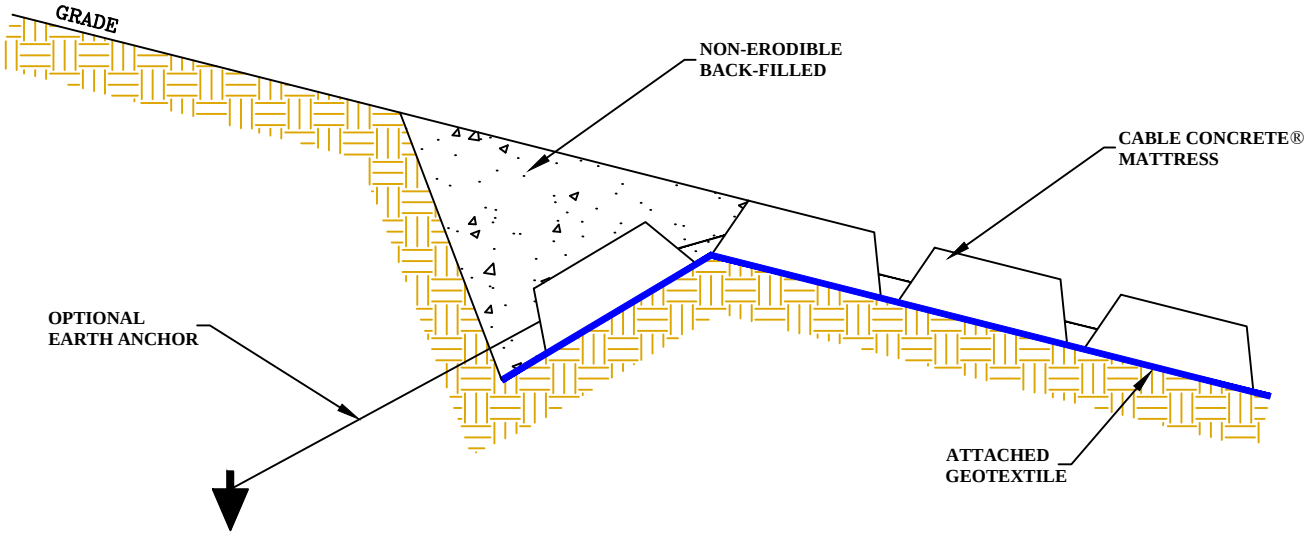
www.iecs.com

CABLE CONCRETE ®
TYPICAL UNIT DEPTHS

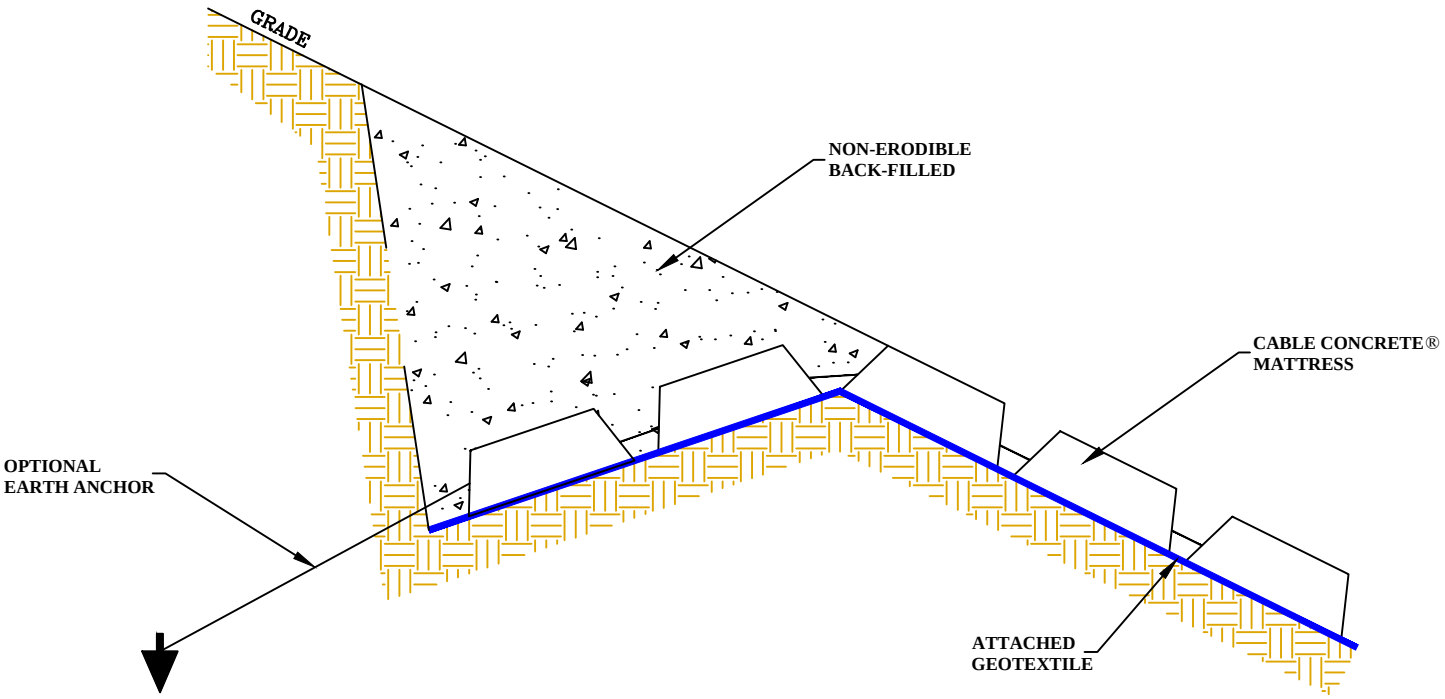
DRAWN BY:	CHECKED BY:
D. J	L.A

SCALE: N.T.S	DATE: 10/21/13	SHEET 1 OF 1

TOP OF SLOPE
OPTION 1



TOP OF SLOPE
OPTION 2



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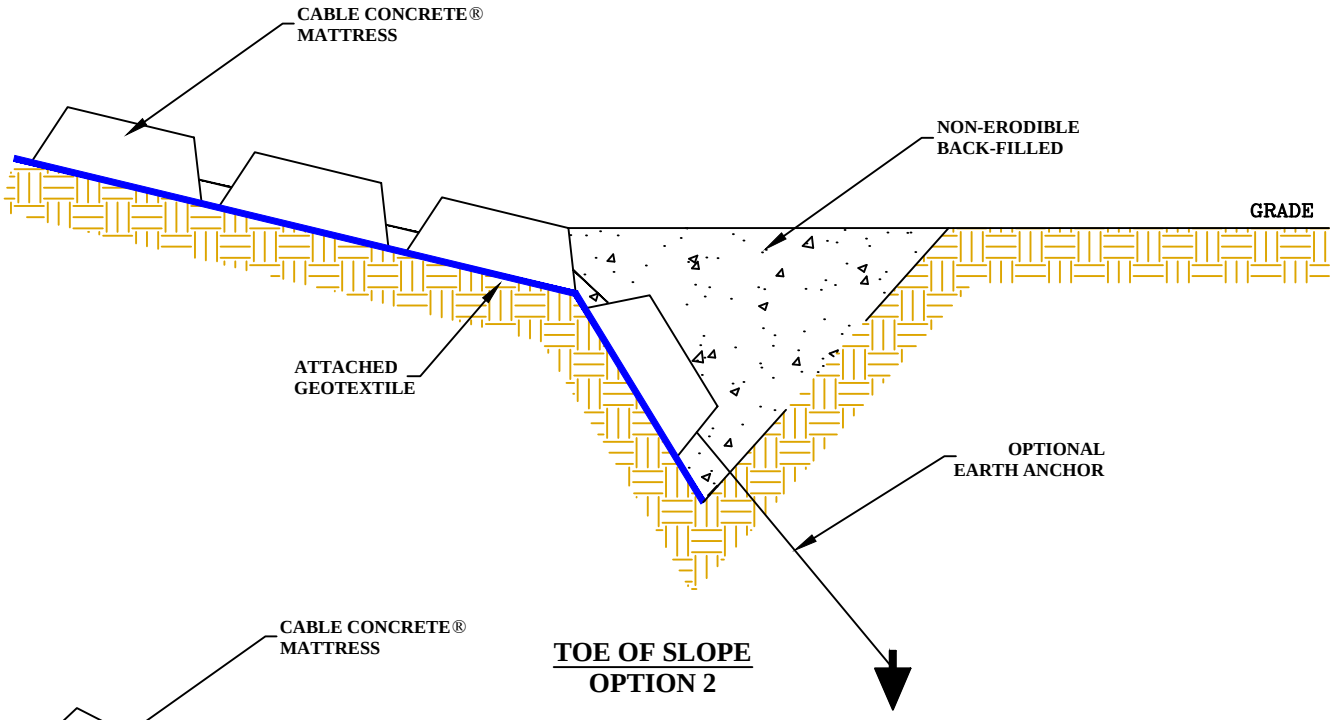
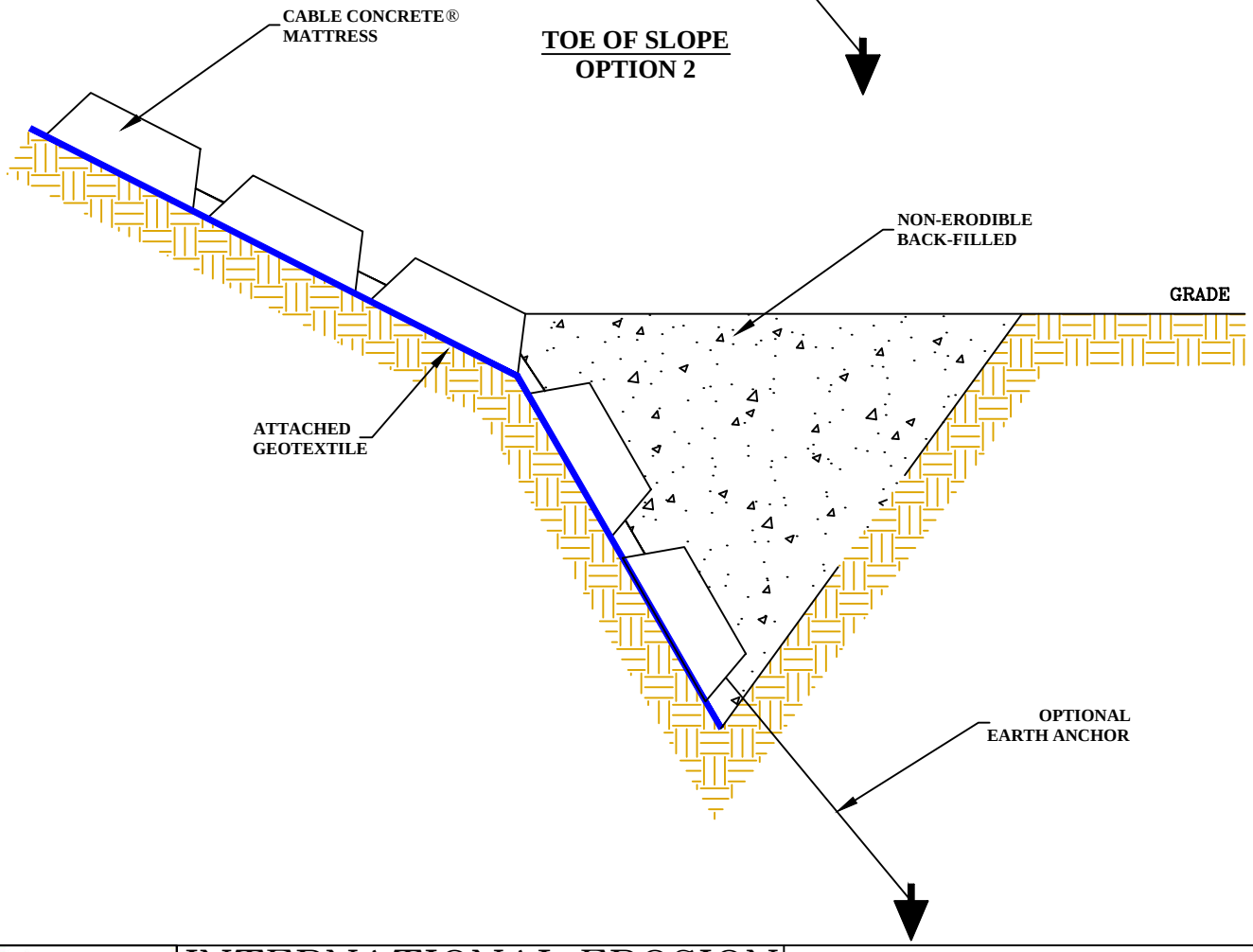
KEY IN DETAIL

DRAWN BY: D. J	CHECKED BY: L. A
SCALE: N.T.S	DATE: 09/02/14	SHEET 1 OF 2

TOE OF SLOPE
OPTION 1



TOE OF SLOPE
OPTION 2



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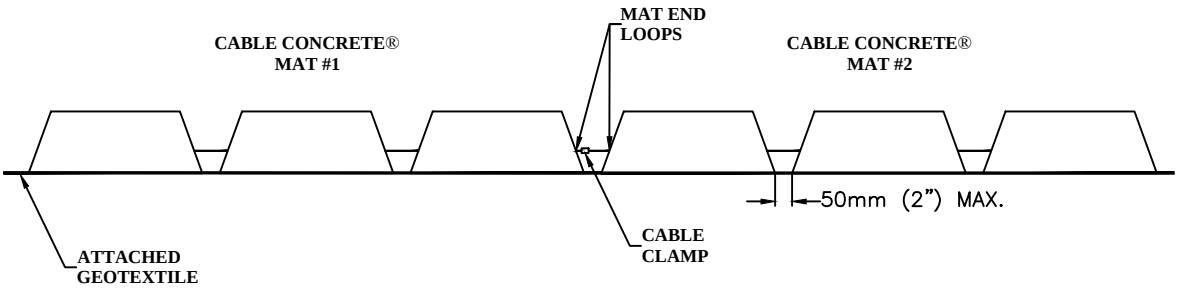
TOE IN DETAIL

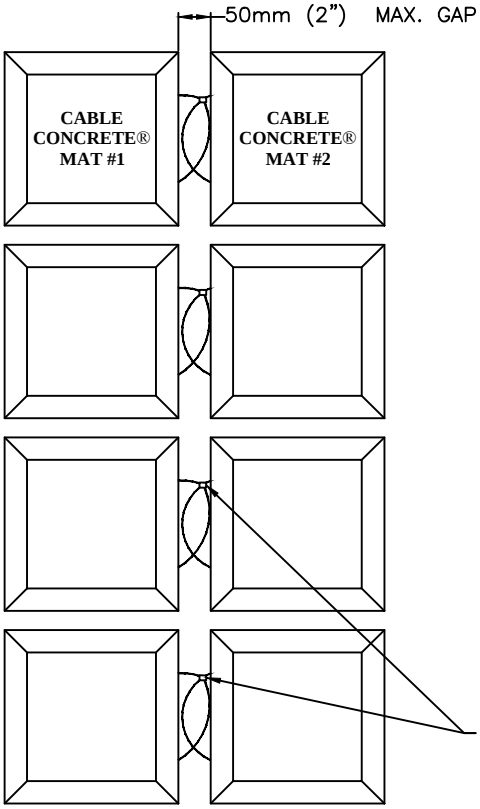
DRAWN BY: D. J	CHECKED BY: L. A
SCALE: N.T.S	DATE: 09/02/14

PROFILE VIEW



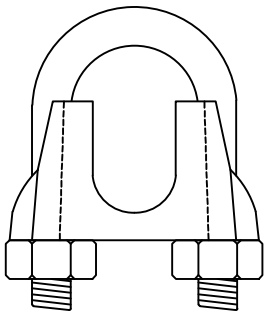
WHEN PLACING THE MATS, THE GAP BETWEEN THE MATS SHOULD NOT BE ANY LARGER THAN A 50mm (2") MAXIMUM. IF THE MATS ARE PLACED WITH A LARGER SPACE THAN 50mm (2"), IT IS RECOMMENDED TO GROUT THE SEAM BETWEEN THE MATS.

PLAN VIEW



POSITION CABLE CLAMP AS SNUG TO THE BASE OF THE CONCRETE BLOCK BY SLIDING CABLE CLAMP DOWN TO THE ADJACENT LOOPS, THEN TIGHTEN CLAMP SECURELY.

CABLE CLAMP



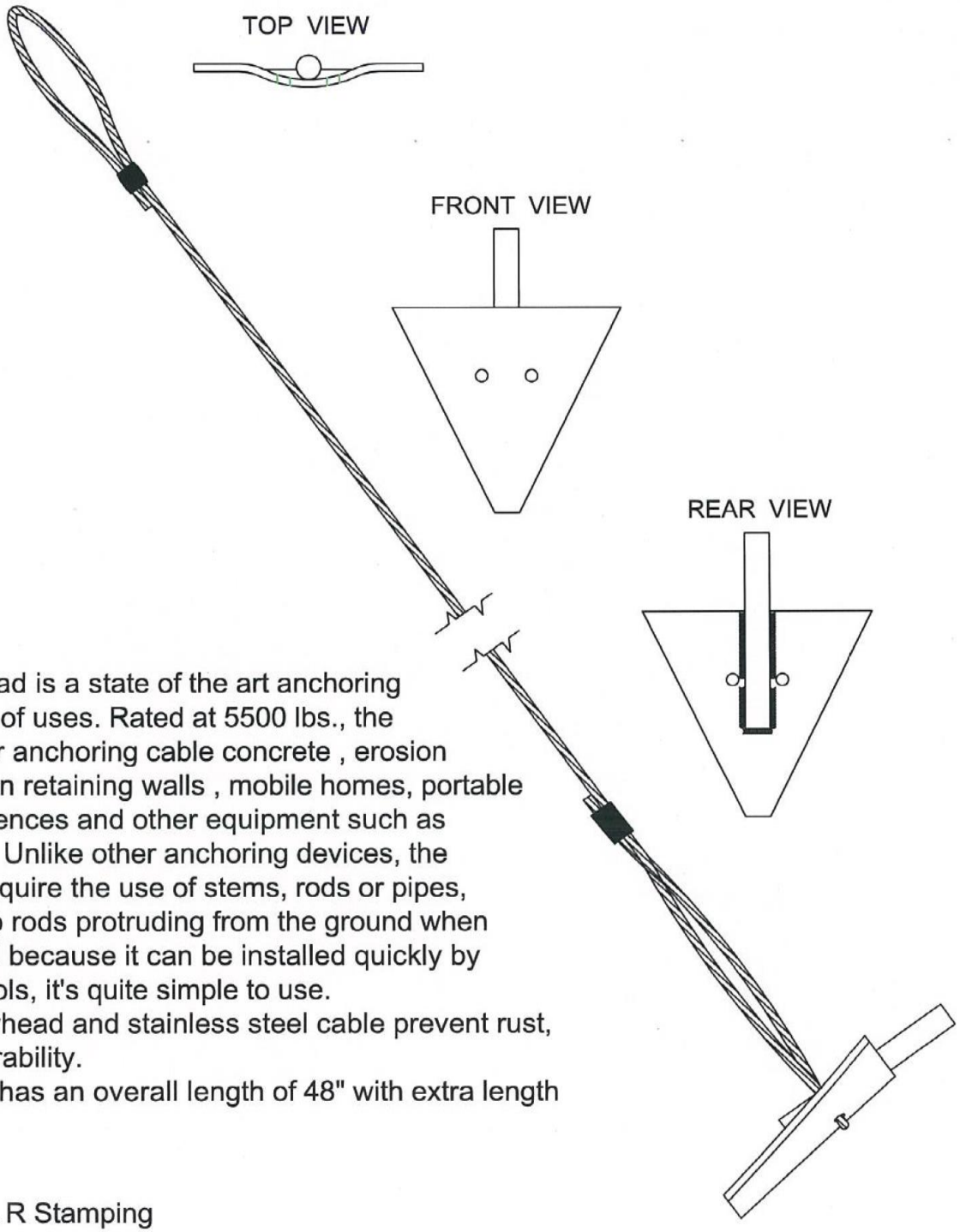
NOTE:
CABLE CLAMPS ARE MADE OF A U-BOLT, A COVER SADDLE, AND TWO NUTS.

IECS
INTERNATIONAL EROSION CONTROL SYSTEMS
22295 Hoskins Line
Rodney, ON, N0L 2C0
Phone: 800-821-7462
Fax: 866-496-1990
www.iecs.com

CABLE CLAMP DETAIL

DRAWN BY:	CHECKED BY:	
D. JOHNSTON	L. ARVAI	
SCALE: N.T.S	DATE: 03/18/13	SHEET 1/1

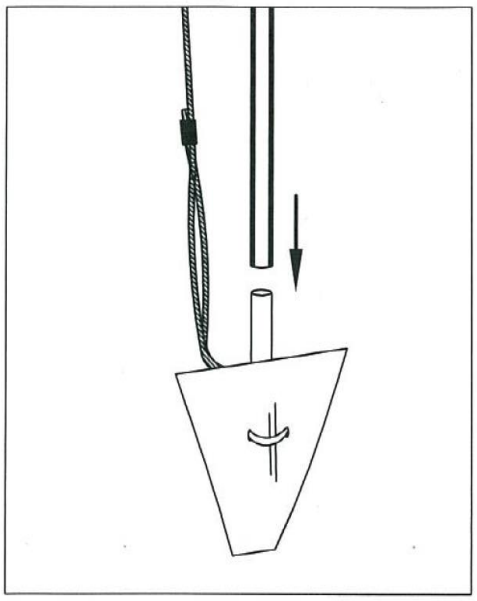
ARROWHEAD
EARTH ANCHORS



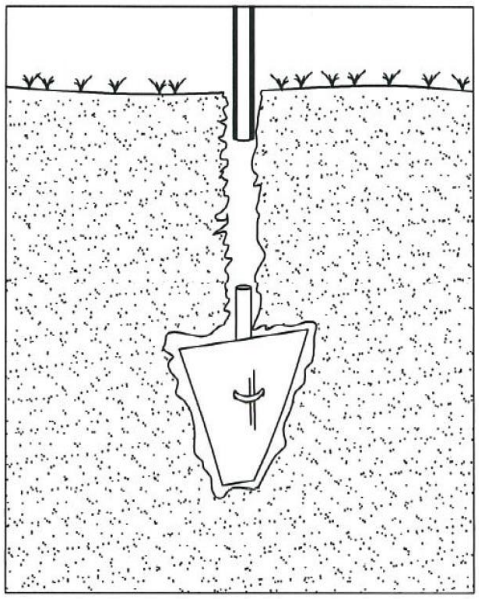
The Chasco Arrowhead is a state of the art anchoring system with a variety of uses. Rated at 5500 lbs., the Arrowhead is ideal for anchoring cable concrete , erosion mats , concrete gabion retaining walls , mobile homes, portable classrooms, sheds , fences and other equipment such as oil tanks and towers. Unlike other anchoring devices, the Arrowhead doesn't require the use of stems, rods or pipes, therefore there are no rods protruding from the ground when the anchor is set. And because it can be installed quickly by means of common tools, it's quite simple to use.
The galvanized Arrowhead and stainless steel cable prevent rust, giving it increased durability.
The standard anchor has an overall length of 48" with extra length supplied as required.

Manufactured by B & R Stamping
Oakville , Ontario
905-847-5294

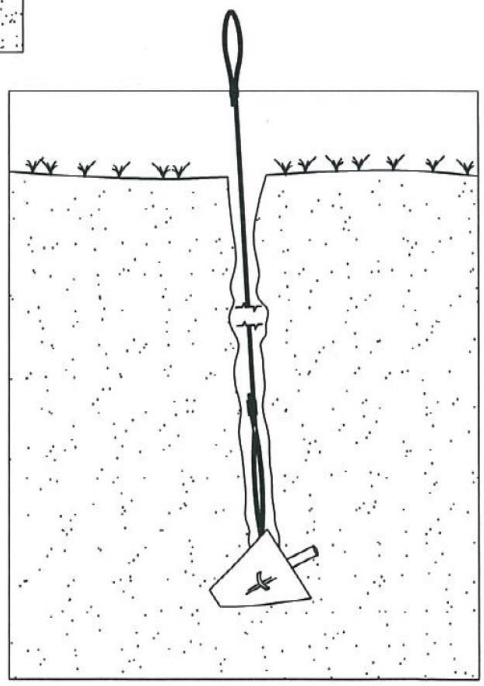
NOT TO SCALE



CABLE IS ATTACHED AND CRIMPED.
DRIVE ROD IS HALF INCH BLACK
IRON PIPE - 4 FEET LONG



DRIVE ANCHOR MINIMUM OF 1 METER INTO UNDISTURBED SOILS CAPABLE OF HOLDING SPECIFIED ANCHOR STRENGTH



ANCHOR MUST BE PULLED UP INTO PLANED / LOCKED POSITION

NOT TO SCALE

APPENDIX “C”

December 2017

GEOTECHNICAL EXPLORATION

Culvert Replacement
Road 10 East - Patterson Drain
Kingsville, Ontario

Submitted to:
Mr. Tony Peralta, P.Eng.
N.J. Peralta Engineering
45 Division Street North
Kingsville, Ontario N9Y 1E1

REPORT

Report Number: 1790503-R01

Distribution:

1 E-Copy: N.J. Peralta Engineering
1 E-Copy: Golder Associates Ltd.

Golder Associates

Table of Contents

1.0 INTRODUCTION

This report presents the results of the geotechnical exploration and testing program carried out for the proposed replacement of the culvert over the Patterson drain, located on Road 10 approximately 1,800 metres (m) west of County Road 31 in the Town of Kingsville, Ontario. The location of the site is shown on the Key Plan, Figure 1.

Based on the preliminary information provided to Golder Associates Ltd. (Golder), it is understood that it is proposed to replace the existing culvert on Road 10 over the Patterson drain with a new box culvert structure. From the review of available mapping data, the existing culvert has an approximate height of 4.0 m and a width of about 7.0 m. Currently, the culvert carries two lanes of traffic over the Patterson drain.

Confirmation of authorization to proceed with the exploration in accordance with our November 01, 2017 proposal (P1790503) was provided by Mr. Tony Peralta, P.Eng. of N.J. Peralta Engineering (Peralta) on November 02, 2017.

This report should be read in conjunction with the attached document "Important Information and Limitations of This Report", which comprises an integral component hereof. The reader's attention is specifically drawn to this material, as it is essential for the proper use and interpretation of the information presented and discussed herein.

2.0 SITE DESCRIPTION AND GEOLOGY

The project area is located in the physiographic region of Southwestern Ontario known as the St. Clair Clay Plains. Within this region, Essex County and the southwestern part of Kent County are normally discussed as a sub-region known as the Essex Clay Plain. The clay plain was deposited during the retreat of ice sheets (late Pleistocene Era) when a series of glacial lakes inundated the area. In general, the ice sheets deposited materials with a glacial-till-like gradation in the Essex County area. Depending on the locations of the glacial ice sheets and depths of water in the ice-contact glacial lakes, the materials may have been directly deposited at the contact between the ice sheet and the bedrock or, as the lake levels rose, and the ice sheets retreated and floated, the soil and rock debris within and at the base of the ice were deposited through the lake water (glaciolacustrine depositional environment). The term "glacial till", in its common usage, often indicates a very dense or hard composition resulting from consolidation and densification under the weight of the ice sheet and the mineral soil particles typically have a distribution of grain sizes ranging from cobbles to clay. In many areas of Essex County, however, the majority of the soils described as "glacial till" were deposited through water and have a soft to firm consistency below an upper "crust" that has since become stiff to hard through weathering and desiccation.

3.0 PROCEDURE

The field work for this exploration was conducted on November 23, 2017 at which time two boreholes, designated as boreholes (BH)-101 and BH-102, were each advanced to a depth of approximately 8.0 m below the existing ground surface. The borehole locations are shown on the Plan, Figure 1.

Standard penetration testing and sampling was carried out in the boreholes using 35-millimetre (mm) inside diameter split spoon sampling equipment and an automatic hammer, in accordance with ASTM D 1586 "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils". According to ASTM D1586,

the SPT resistance, or 'N' value, is defined as the number of blows required by a 63.5-kilogram (kg) hammer dropped from a height of 760 mm to drive a split-spoon sampler a distance of 300 mm, after an initial 150 mm of penetration. The soil stratigraphy encountered in the boreholes is shown in detail on the Record of Borehole sheets following the text of this report.

Groundwater seepage levels were observed in the boreholes during drilling as detailed on the Record of Borehole sheets. Upon completion of sampling and in situ testing, the boreholes were backfilled in accordance with Ontario Regulation 903, as amended.

All of the samples obtained during the exploration were brought to our laboratory for further examination and representative classification testing. The results of the field and laboratory testing are shown on the Record of Borehole sheets and on Figures 2 and 3.

The borehole locations were designated in the field by members of our engineering staff who also arranged for underground utility clearances, supervised the drilling, sampling and standard penetration testing, logged the boreholes, and cared for the samples obtained.

The ground surface elevations at the borehole locations were surveyed by Golder staff at the time of borehole advancement. The top nut of the existing fire hydrant located on the north side of Road 10, approximately 10.0 m west of Municipal No. 493 was utilized as a benchmark, with a reported elevation of 191.093 m. It is understood that the bench mark is referenced to geodetic datum. The ground surface elevations at the borehole locations were found to range between approximately 191.030 m and 191.058 m.

4.0 SUBSURFACE CONDITIONS

4.1 General

The subsurface conditions encountered in the boreholes advanced at the site are shown on the attached Record of Borehole sheets. The following paragraphs have been simplified in terms of major soil strata for the purposes of geotechnical design. The soil boundaries indicated have been inferred from non-continuous samples and observations of sampling and drilling resistance and typically represent transitions from one soil type to another rather than exact planes of geological change. Further, the subsurface conditions will vary between and beyond the borehole locations.

4.2 Soil Conditions

4.2.1 Pavement Structure and Granular Fill

A bituminous surface treatment (tar and chip) was encountered at the ground surface in both of the boreholes. The thickness of the surface treatment ranged from about 25 to 150 mm at the borehole locations. Approximately 140 mm of granular fill was encountered between two layers of surface treatment in BH-101.

Gravelly sand fill, interpreted to be granular road base materials based on visual examination, was encountered beneath the surface treatment in both of the boreholes, and ranged in thickness from about 100 to 150 mm.

The noted pavement component thicknesses are specific to the borehole locations and variations in surface treatment thickness should be anticipated in other areas of the site.

A layer of sandy silty clay fill with a thickness of approximately 320 mm was encountered underlying the gravelly sand fill in BH-101.

4.2.2 Buried Topsoil

A layer of dark brown to dark grey sandy silty clay topsoil was encountered beneath the silty clay fill material in BH-101; and underlying the gravelly sand fill in BH-102. The topsoil layer ranged from about 310 to 610 mm in thickness. Materials designated as topsoil in this report were classified based solely on visual and textural evidence. Testing of organic content or for other soil nutrients was not carried out. Accordingly, materials classified as topsoil herein cannot necessarily be relied upon for support and growth of landscaping vegetation without supplemental soil nutrient analyses.

4.2.3 Sand

A layer of sand, with some silt and clay pockets, was encountered underlying the topsoil in BH-102. The sand layer had a thickness of about 0.4 m and had measured 'N' values ranging from 4 to 5 blows per 0.3 m. The water content of the sand varied from about 12 to 20 per cent.

4.2.4 Silty Clay Till

Sandy silty clay till soils were encountered underlying the buried topsoil in BH-101 and underlying the sand in BH-102, extending to the termination depth of the boreholes. The upper portion of the silty clay till was observed to have a mottled brown and grey colour. The mottled colour indicates weathering and periodic wetting and drying of the soils. The mottled brown and grey silty clay was classified as soft to firm, with measured 'N' values ranging from 4 to 5 blows per 0.3 m. The water content of the mottled silty clay till varied from about 22 to 27 per cent.

Very stiff brown sandy silty clay till was encountered underlying the mottled silty clay till. Oxidized fissures, along with sand pockets, were noted in several of the samples within the brown silty clay till. Measured 'N' values obtained in the brown silty clay till ranged from 16 to 17 blows per 0.3 m. The water content of the brown silty clay till was about 18 per cent.

Underlying the brown silty clay till, firm to very stiff grey sandy silty clay till was encountered, which extended to the termination depth of each borehole. Measured 'N' values obtained in the grey silty clay till ranged from 6 to 15 blows per 0.3 m. Field vane shear tests conducted in the grey silty clay till yielded undrained shear strengths in excess of 96 kilopascals (kPa) at a depth of about 7.0 m below ground surface. The water content of the grey silty clay till varied from about 17 to 22 per cent. Atterberg limits testing conducted on a sample of the grey silty clay till recovered from BH-101 yielded a liquid limit of about 33 per cent and a plasticity index of about 16 per cent, indicating an inorganic silty clay of intermediate plasticity. The results of the Atterberg limits testing are shown on Figure 3 and grain size distribution results for the grey silty clay till are shown on Figure 2.

4.3 Groundwater

Groundwater seepage conditions were observed in the boreholes during drilling as shown on the Record of Borehole sheets. Both boreholes were dry upon completion of drilling, and no seepage into the boreholes was encountered.

It should be noted that groundwater conditions are generally dependent on the amount of recent precipitation, site grading and other measures in place to control surface water drainage, as well as the time of year, and can fluctuate significantly in elevation over time.

5.0 DISCUSSION

The purpose of the exploration was to evaluate the subsurface soil and groundwater conditions at the site and to provide geotechnical engineering recommendations for the proposed culvert reconstruction.

This section of the report provides our interpretation of the factual geotechnical data obtained during the exploration and testing program and is intended for the guidance of the design engineer. Where comments are made on construction, they are provided only to highlight those aspects which could affect the design of the project. Contractors bidding on or undertaking the work should make their own independent interpretation of the factual subsurface information provided as it affects their proposed construction means and methods, equipment selection, scheduling and the like.

Our professional services for this assignment address only the geotechnical (physical) aspects of the subsurface conditions at this site. The geo-environmental (chemical) aspects, including the consequences of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this report and have not been addressed.

5.1 Culvert Foundation

Based on the conditions encountered in the boreholes, a factored geotechnical resistance at the Ultimate Limit State (ULS) of 250 kPa and a geotechnical reaction at the Serviceability Limit State (SLS) of 165 kPa may be used, provided that the founding elevation of the culvert is between 2.3 m and 4.3 m below the existing ground surface, or between approximate elevations of 188.8 m and 186.8 m. Should the founding elevation of the culvert be below an elevation of 186.8 m, a factored geotechnical resistance at the ULS of 150 kPa and a geotechnical reaction at the SLS of 100 kPa may be used. The foundation excavations should be inspected by the geotechnical engineer prior to placing the clear stone bedding or footing concrete.

To reduce potential damage due to frost action, all exterior footings should be provided with at least 1.2 m of soil cover after final grading. If the top of the box is above a depth of 1.2 m, Ontario Provincial Standards Specifications (OPSS) Granular 'C' backfill with appropriate frost tapers should be provided above the frost penetration depth in accordance with Ontario Provincial Standard Drawing (OPSD) 205.060. Should the construction be carried out in the winter months, care should be taken to prevent the penetration of frost beneath the partially completed structure.

The culvert bedding or footing concrete should be placed as soon as practical following the excavation, inspection and approval of the founding soils. If it is expected that the founding soils will be left open to exposure for an extended period of time, it is recommended that a 75 mm thick lean concrete working mat be placed to protect the structural integrity of the founding soils.

5.1.1 Sliding Resistance

The resistance to lateral forces/sliding resistance between the culvert base/footings and founding soil should be calculated in accordance with Section 6.7.5 of the Canadian Highway Bridge Design Code. The angle of friction, ϕ, and the unfactored coefficient of friction, tan ϕ, may be taken as 28 degrees and 0.53, respectively.

5.2 Seismic Site Classification

Site Class D is considered appropriate for seismic design purposes for structures founded as noted above, based on the results of the geotechnical exploration and our geotechnical experience in the area. The site classification for seismic response presented in Table 4.1.8.4 of the 2012 Ontario Building Code relates to the average properties of the upper 30 m of supporting strata. The information obtained in the geotechnical field exploration was gathered from the upper 8.0 m.

Mean seismic hazard values were determined for the 2 per cent in 50-year (0.000404 per annum) probability of exceedance for the standard base condition assuming "firm ground" (NBCC 2015 Soil Class C, average Vs30 shear wave velocity 450 m/s). The 5 per cent damped spectral acceleration (S_a) values for the location of the site (as multiples of gravitational acceleration, 9.81 m/s^2) are: $S_a(0.2)$ = 0.109; $S_a(0.5)$ = 0.068; $S_a(1.0)$ = 0.038; and $S_a(2)$ = 0.018. The peak ground acceleration (PGA) value for the site is 0.65 m/s^2 with a peak ground velocity (PGV) of 0.052 m/s. Acceleration-based (F_a) and velocity-based (F_v) site coefficients of 1.3 and 1.4, respectively, should be applied to account for the Site Class D designation.

5.3 Excavations

All excavations should be conducted in accordance with current Occupational Health and Safety Act (OHSA) provisions, and in particular, OHSA Regulation 213/91, which specifically addresses Construction Projects.

The sand and sandy silty clay till soils encountered in the boreholes would be classified as Type 3 soils, provided they are not saturated. For OHSA compliance, all unsupported excavations in Type 3 soils should be cut with side slopes inclined not steeper than a gradient of 1 horizontal to 1 vertical, extending outward from the base of the excavation. All wet or saturated soils would be classified as Type 4 soils and unsupported excavations in those materials must be sloped from the bottom of the excavation at a minimum gradient of 3 horizontal to 1 vertical for OHSA compliance.

5.3.1 Construction Considerations

Adequate support should be provided for any existing utilities which may be located within the zone of influence of the excavations as defined by a line drawn upwards and outwards from the base of the excavation at an inclination of 1 horizontal to 1 vertical.

Care should be taken during construction to avoid disturbance of the founding soils. All existing fill, topsoil, organics, and any soft, excessively wet, or loose soils should be stripped from the proposed founding areas prior to placement of concrete or bedding materials. For pre-cast box culverts, the bedding should be placed on a properly prepared subgrade and uniformly compacted to at least 95 per cent of the standard Proctor maximum dry density (SPMDD). Subexcavated material below the design founding elevation should be replaced with compacted OPSS Granular 'A' or Granular 'B', Type II placed in loose lifts not exceeding 300 mm in thickness and uniformly compacted to at least 98 percent of SPMDD. The excavation base should be inspected by the geotechnical engineer prior to placing concrete or bedding.

5.4 General Backfill

Any existing topsoil, organic, and deleterious fill materials excavated from the site are not considered suitable as general backfill.

Approved native soils excavated at the site during construction are generally considered to be suitable for reuse as backfill above the culvert bedding and below the depth of frost penetration. As noted previously, if the top of the box is above a depth of 1.2 m, OPSS Granular 'C' backfill with appropriate frost tapers should be provided above the frost penetration depth to the subgrade level in accordance with OPSD 205.060.

All backfill material should be at suitable moisture contents to achieve the specified degree of field compaction. Materials should not be considered acceptable as backfill when the placement water content exceeds the optimum water content (as determined by the standard Proctor compaction test ASTM D698) by more than about 2 to 3 per cent. Further, material that is more than 3 per cent dry of the optimum water content should be wetted during compaction to minimize post construction settlement, or should not be used.

The native silty clay till soils are cohesive in nature. When these cohesive soils are utilized for backfill, it is essential that these types of materials be broken down and compacted thoroughly to reduce voids and the potential for settlement. Should very moist to wet soils be encountered during excavation, these soils will require extensive air-drying to achieve the specified field compaction. If time constraints do not permit for air-drying of soils, they will have to be wasted and replaced with a suitable approved alternative.

Backfill material should be placed in loose lifts not exceeding a maximum thickness of 300 mm for granular soils and 200 mm for the native silty clay till, and compacted to a minimum of 95 per cent of SPMDD. The upper one metre of backfill which comprises the roadway subgrade should be uniformly compacted to at least 98 per cent of SPMDD. If lesser degrees of compaction are achieved, increased settlements will result. In general, some settlement of trench backfill should be expected and where pavements or other settlement-sensitive surface treatments will be constructed, these should be delayed as long as possible in the contract or, preferably, finished with surface asphalt during the following construction season.

Care will be required to ensure that the height of the backfill on either side of the culvert does not differ by more than 600 mm at any given time.

5.5 Pavement Restoration

Prior to replacing the pavement structure, the subgrade should be proofrolled and any soft unstable areas should be subexcavated and replaced with approved soils and compacted to a minimum of 98 per cent of SPMDD. Any soft areas or areas with deleterious fill or other materials must be subexcavated and restored with approved material. The subgrade should be free of depressions and sloped appropriately. Rapid drainage of the pavement structure is critical to ensure long-term performance of the pavement.

The roadway pavement structure should be restored using 300 mm of Granular 'A' base followed by bituminous surface treatment to match the existing pavement structure. The granular base should be uniformly compacted to 98 per cent of SPMDD.

5.6 Geotechnical Inspections and Testing

After final design and once construction commences, a regular program of geotechnical inspections and testing should be carried out during construction to confirm that the conditions encountered are consistent with the results of the boreholes, to ensure that the intent of the design recommendations provided is being met, and that the various project and material specifications are being consistently achieved.

The factual data, interpretation, and recommendations in this report pertain to a specific project as described in this report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, deviates from the assumption stated herein, or if the project is not initiated within twelve months of the date of the report, Golder Associates Ltd. should be given an opportunity to confirm that the recommendations are still valid. The subject geotechnical exploration and this report address only the geotechnical aspects of the proposed project; potential environmental impacts or related issues are beyond the defined scope of this work and have not been addressed.

We trust that this report provides all of the geotechnical information presently required. Should any point require clarification, or should you have any comments on this report, please contact this office.

GOLDER ASSOCIATES LTD.

LICENSED PROFESSIONAL ENGINEER
N. J. CHORTOS
100210851
PROVINCE OF ONTARIO

Nathan Chortos, P.Eng.
Geotechnical Engineer

Mark A. Swallow, PE, P.Eng.
Principal and Senior Practice Leader

NC/MAS/nc/sjo

https://golderassociates.sharepoint.com/sites/20579g/deliverables/r01-geo expl/1790503-dec0717-draft-geo exploratory.docx

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

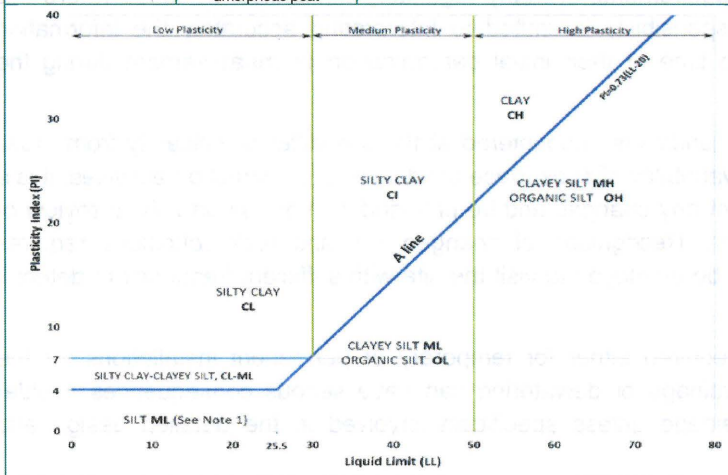
Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
				Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% (see Note 2)	CL	SILTY CLAY
			Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat							75% to 100%		PEAT



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.
For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.
A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.*, SAND and GRAVEL, SAND and CLAY)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.).

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
FS	Foil sample
GS	Grab Sample
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size
TP	Thin-walled, piston – note size
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 - 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects.
2. Definition of compactness descriptions based on SPT 'N' ranges from Terzaghi and Peck (1967) and correspond to typical average N_{60} values.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1,2] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

PROJECT: 1790503

RECORD OF BOREHOLE BH-101

SHEET 1 OF 1

LOCATION: REFER TO LOCATION PLAN

BORING DATE: November 23, 2017
DRILLING CONTRACTOR: Henderson Drilling Inc.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl, 10 20 30 40)	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
0	POWER AUGER 83mm ID HOLLOW STEM	SURFACE TREATMENT		191.03				192				
		FILL, gravelly sand, some silt; grey		0.00				191				
		SURFACE TREATMENT		0.18								
		FILL, gravelly sand, some silt; brown		0.28								
		FILL, sandy silty clay; dark brown		190.42								
1		**TOPSOIL**, sandy silty clay; dark brown to dark grey; firm		0.61	1	SS	7	190				Borehole dry during drilling on November 23, 2017.
				189.81								
2		(CI-CL) sandy **SILTY CLAY**, trace gravel; mottled brown and grey, **TILL**; firm		1.22	2	SS	5	189				
				188.90								
3		(CI-CL) sandy **SILTY CLAY**, trace gravel, with oxidized fissures and sand partings and pockets; brown, **TILL**; very stiff to stiff		2.13	3	SS	16	188				
					4	SS	14				MH	
				187.37								
4		(CI-CL) sandy **SILTY CLAY**, trace gravel; grey, **TILL**; stiff to very stiff		3.66	5	SS	14	187				
5					6	SS	9	186				
6					7	SS	8	185				
7							>96	184				
8					8	SS	11	183				
		END OF BOREHOLE		182.95 8.08								
9												

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: SM
CHECKED:

LDN_BHS_07 1790503.GPJ GLDR_LON.GDT 06/12/17 09:35 DATA INPUT: ZJB

PROJECT: 1790503

RECORD OF BOREHOLE BH-102

SHEET 1 OF 1

LOCATION: REFER TO LOCATION PLAN

BORING DATE: November 23, 2017
DRILLING CONTRACTOR: Henderson Drilling Inc.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
0	POWER AUGER 83mm ID HOLLOW STEM	SURFACE TREATMENT		191.06				192				
		SURFACE TREATMENT		0.00								
		FILL, gravelly sand, some silt; brown		0.15								
		TOPSOIL, clayey sandy silt; dark brown		0.30 / 190.45								
1		**FILL**, clayey sandy silt; brown; firm		0.61	1	SS	5	191				Borehole dry during drilling on November 23, 2017.
				189.69								
		(SW) **SAND**, some silt, with clay pockets; brown; very loose		1.37 / 189.31	2	SS	4	190				
2		(CI-CL) sandy **SILTY CLAY**, trace gravel; mottled brown and grey, **TILL**; soft to firm		1.75 / 188.93								
		(CI-CL) sandy **SILTY CLAY**, trace gravel; brown, **TILL**; very stiff		2.13	3	SS	17	189				
				188.16								
3				2.90	4	SS	15	188				
4					5	SS	13	187				
					6	SS	10					
5		(CI-CL) sandy **SILTY CLAY**, trace gravel; grey, **TILL**; very stiff to firm						186				
6					7	SS	6	185	>96 +			
7								184				
8				182.98	8	SS	7					
		END OF BOREHOLE		8.08				183				
9												

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: SM
CHECKED: MC

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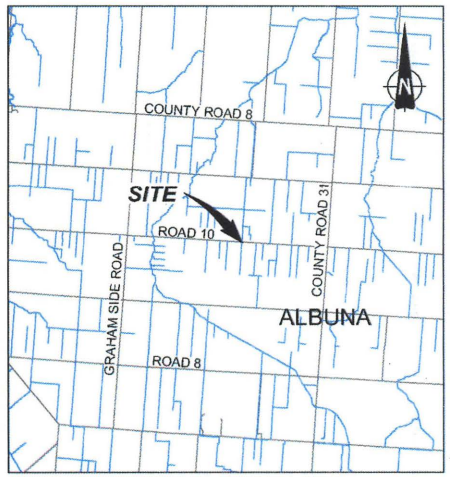


KEY PLAN

LEGEND

BOREHOLE

REFERENCE

DRAWING BASED ON 2017 AERIAL IMAGERY FROM THE COUNTY OF ESSEX WEB MAPPING SITE, BY PERMISSION; AND CANMAP STREETFILES V2008.4.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

GEOTECHNICAL EXPLORATION
CULVERT REPLACEMENT, ROAD 10 (PATTERSON DRAIN)
KINGSVILLE, ONTARIO

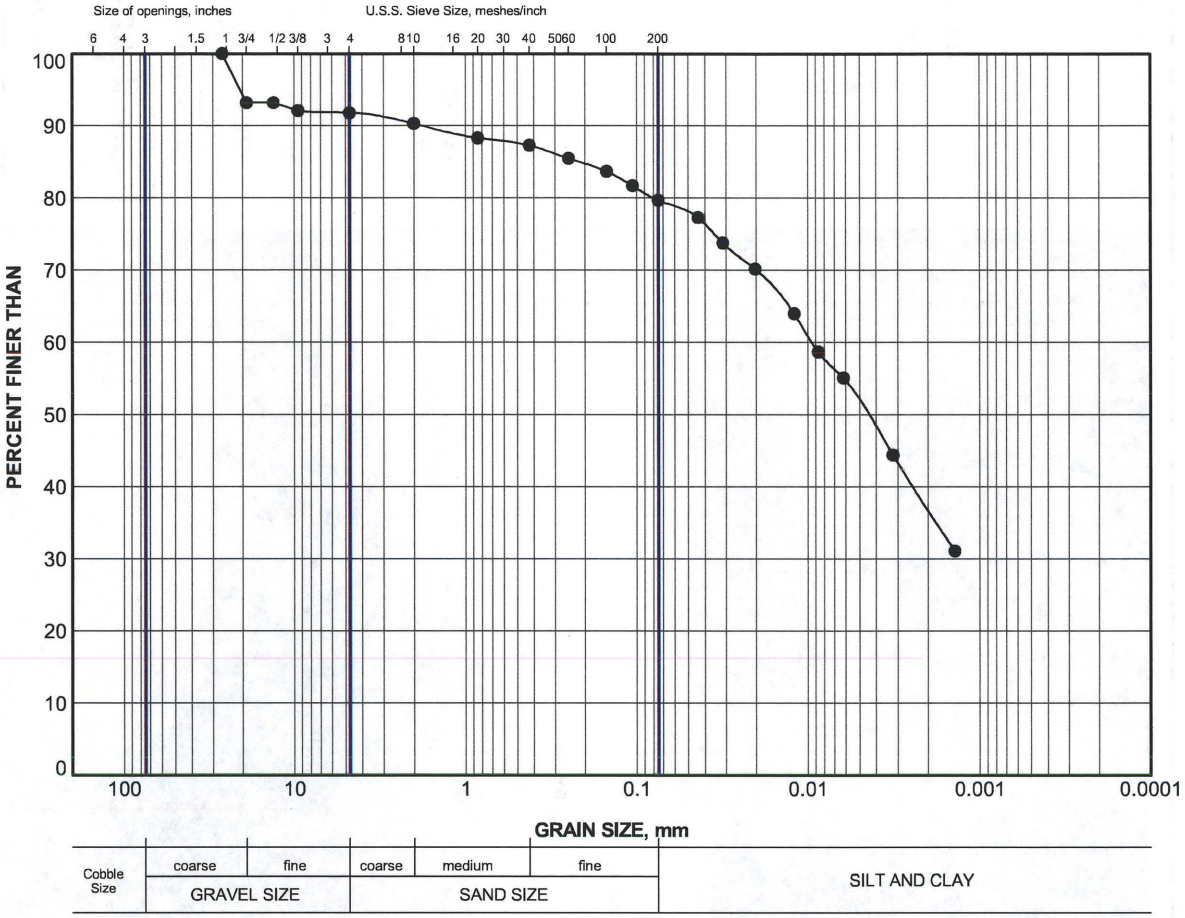
TITLE

LOCATION PLAN

Golder Associates

PROJECT No.		1790503	FILE No.	1790503-R01001
			SCALE	AS SHOWN
CADD	ZJB	Dec. 6/17		
CHECK	MC			

FIGURE 1



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH-101	4	187.8

PROJECT

GEOTECHNICAL EXPLORATION
CULVERT REPLACEMENT, ROAD 10 (PATTERSON DRAIN)
KINGSVILLE, ONTARIO

TITLE

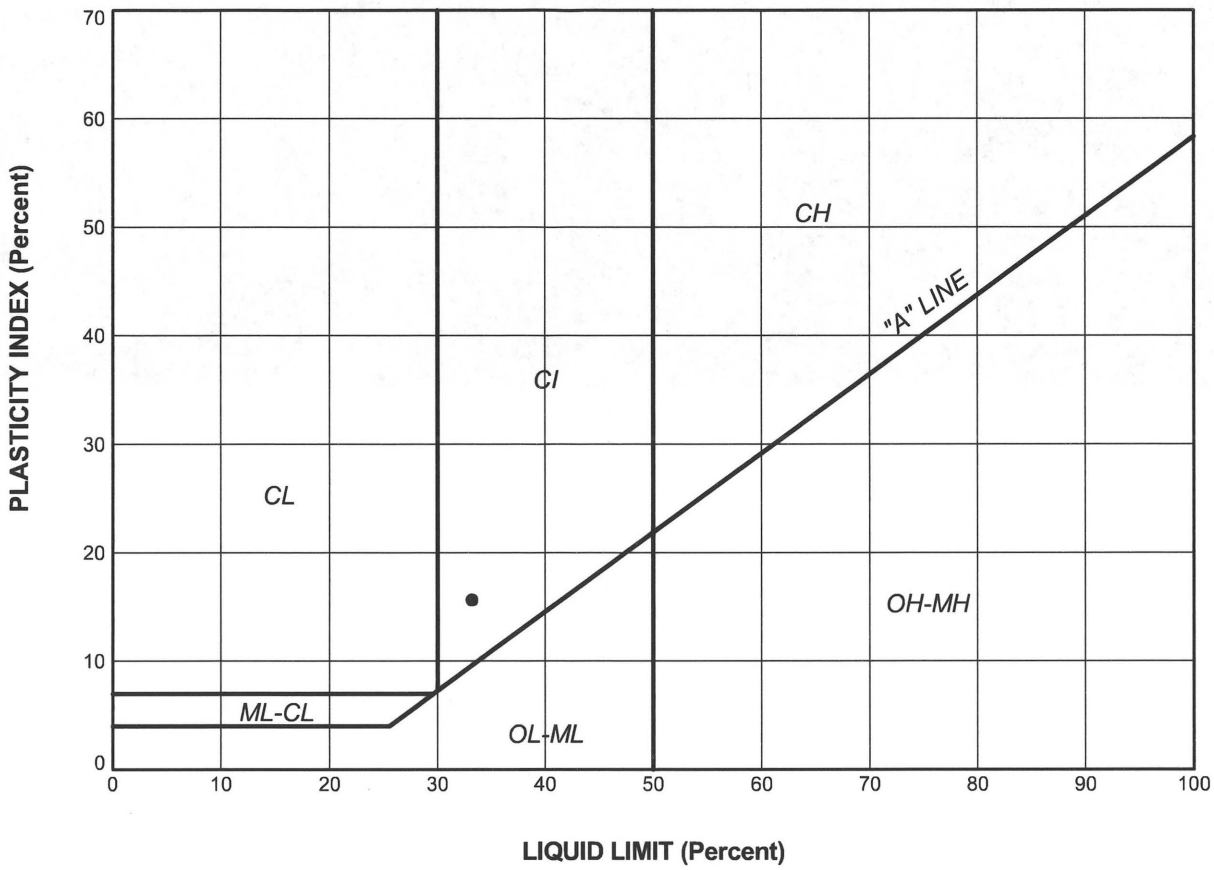
GRAIN SIZE DISTRIBUTION

sandy SILTY CLAY TILL

Golder Associates

PROJECT No.		1790503	FILE No.	1790503-R01002
			SCALE N/A	REV.
DRAWN	ZJB	Dec 06/17		
CHECK			FIGURE 2	

LDN_GSD GLDR_LDN.GDT 06/12/17 09:27



SOIL TYPE	PLASTICITY
C = Clay	L = Low
M = Silt	I = Intermediate
O = Organic	H = High

LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
●	BH-101	4	33.2	17.6	15.7

PROJECT

GEOTECHNICAL EXPLORATION
CULVERT REPLACEMENT, ROAD 10 (PATTERSON DRAIN)
KINGSVILLE, ONTARIO

TITLE

PLASTICITY CHART

Golder Associates

PROJECT No.		1790503	FILE No.	1790503-R01003
			SCALE N/A	REV.
DRAWN	ZJB	Dec 06/17	FIGURE	3
CHECK				

LDN_PI GLDR_LON.GDT 06/12/17 09:27

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Golder Associates

APPENDIX “D”

PLAN, PROFILE, SECTIONS, & DETAILS

OF THE

ROAD 10 CROSSING OVER THE PATTERSON DRAIN

IN THE

TOWN OF KINGSVILLE (Geographic Township of Gosfield North)

IN THE

COUNTY OF ESSEX • ONTARIO

ANTONIO B. PERALTA, P.ENG.

N. J. PERALTA ENGINEERING LTD.

45 DIVISION STREET NORTH
KINGSVILLE, ONTARIO
N9Y 1E1

LICENSED PROFESSIONAL ENGINEER
A. B. PERALTA
100138683
2018-04-23
PROVINCE OF ONTARIO

DATE: APRIL 23rd, 2018

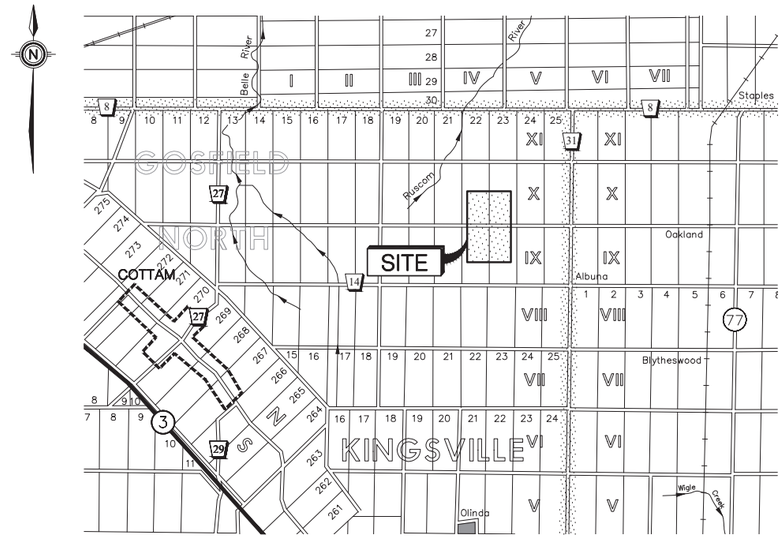
TOWN OF KINGSVILLE

MAYOR: NELSON SANTOS
CLERK: JENNIFER ASTROLOGO
DRAINAGE SUPERINTENDENT: KEN VEGH

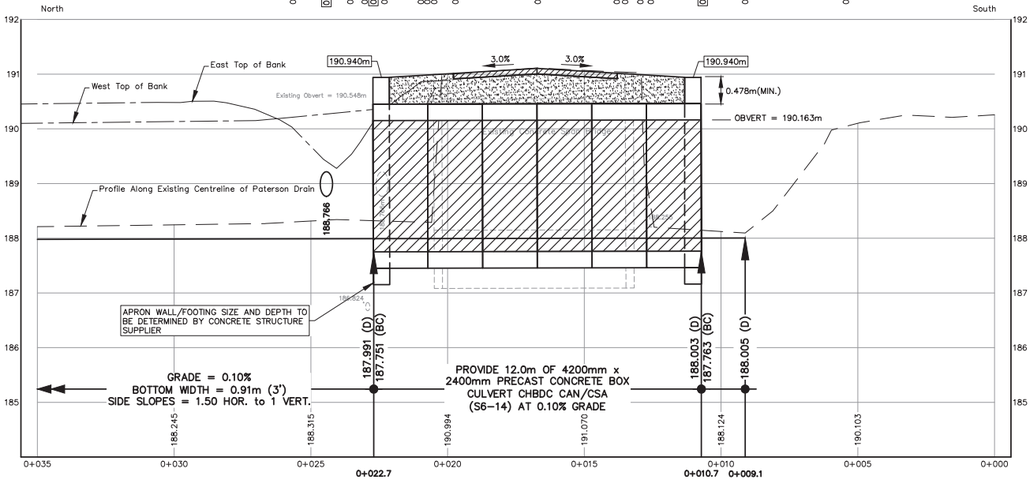
BENCHMARKS:

1) TOP NUT OF EXISTING FIRE HYDRANT LOCATED ON THE NORTH SIDE OF ROAD 10, APPROXIMATELY 57.0m WEST OF SUBJECT ROAD CROSSING.
ELEV. = 191.093m

2) TOP OF NAIL SET IN SOUTH FACE OF EXISTING HYDRO POLE LOCATED ON THE NORTH SIDE OF ROAD 10, APPROXIMATELY 152.0m WEST OF SUBJECT ROAD CROSSING.
ELEV. = 190.963m



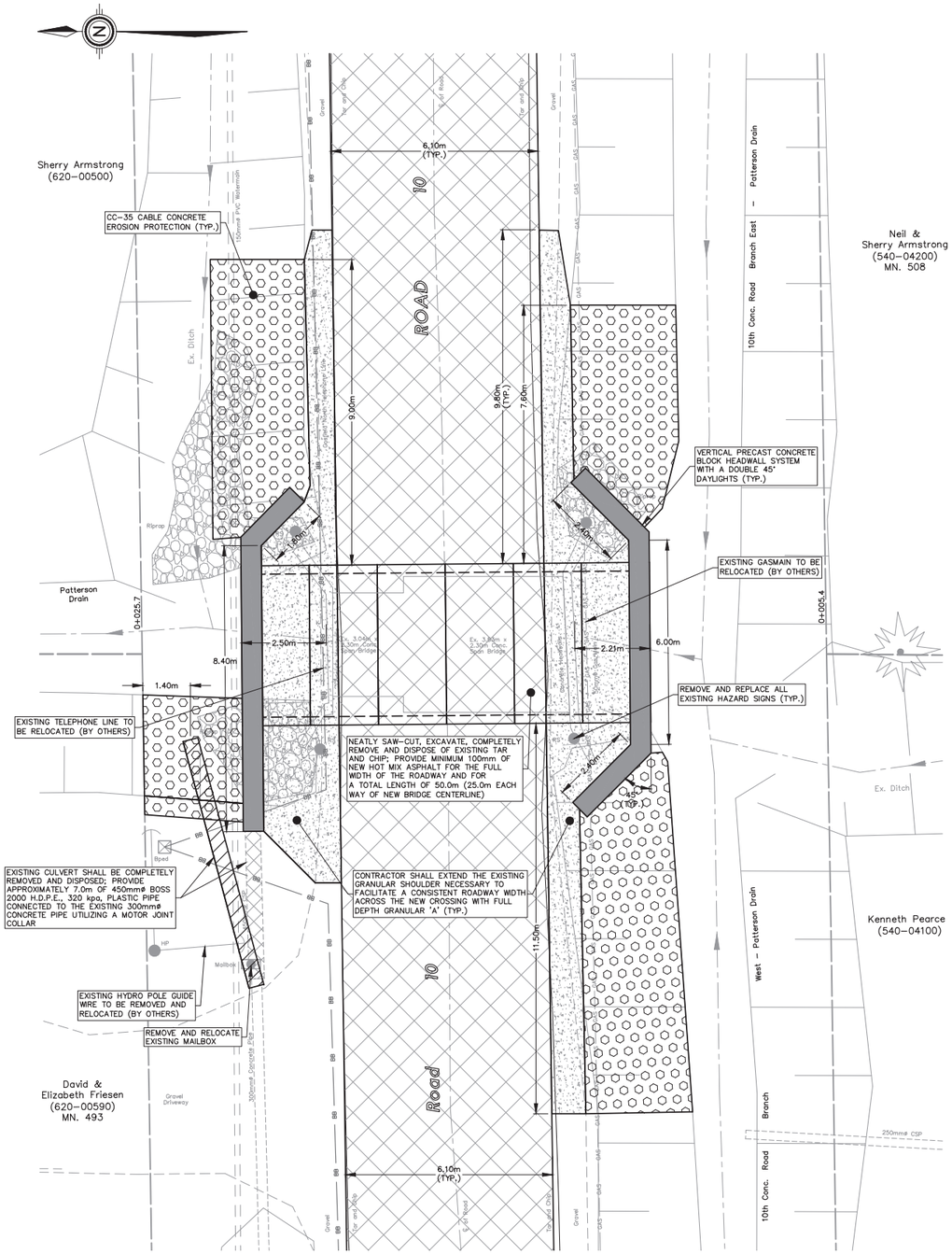
KEY PLAN
N.T.S.



0+025.7 North R.O.W. Limit
0+024.4 PROPOSED 450mmø H.D.P.E. PIPE
0+023.6 Road Side Ditch Enters From East
0+022.7 NORTH LIMIT OF PROPOSED BOX CULVERT
0+022.3 Existing 450mmø CSP From West
0+020.4 Fiber Optic Cable
0+020.4 Edge of Gravel
0+020.4 Existing Concrete Bridge
0+019.8 Edge of Tar and Chip
0+016.7 ℄ of Road 10
0+013.8 Edge of Tar and Chip
0+013.6 Edge of Gravel
0+012.9 Existing Concrete Bridge
0+012.6 50mmø Gas Main
0+010.7 SOUTH LIMIT OF PROPOSED BOX CULVERT
0+009.1 ℄ of Drain
0+005.4 South R.O.W. Limit

SECTION THROUGH ROAD CULVERT
Scale = 1:100 (Hor.)
= 1:50 (Ver.)

LEGEND:
(D) – DENOTES DRAIN BOTTOM
(BC) – DENOTES BOX CULVERT INVERT



PLAN
Scale = 1:75

NOTE TO FABRICATOR:

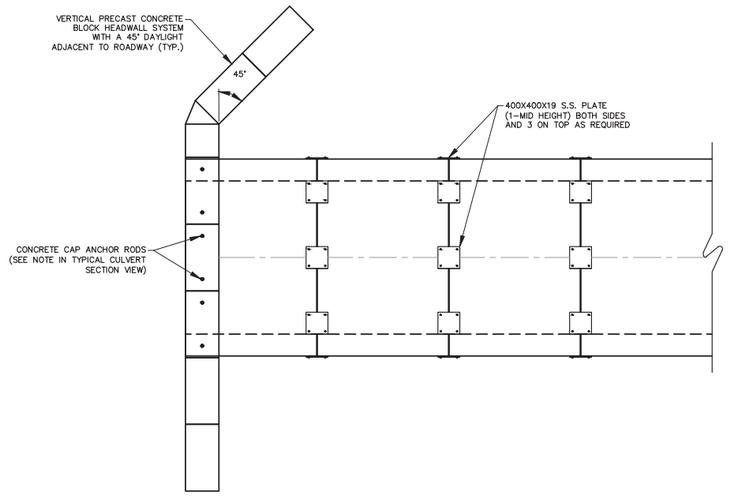
FABRICATOR SHALL NOTE THAT THIS BRIDGE WILL HAVE LESS THAN 600mm OF COVER AND THEREFORE, SHALL MAKE PROVISIONS TO INCLUDE THE APPROPRIATE REINFORCEMENT WITHIN THE STRUCTURE DESIGN OR A DISTRIBUTION SLAB TO CARRY ALL REQUIRED LOADING BASED ON THE C.H.B.D.C. PROVISIONS.

THESE DRAWINGS HAVE BEEN REDUCED IN SIZE AND THE SCALE THEREFORE VARIES.
FULL SCALE DRAWINGS CAN BE VIEWED AT THE MUNICIPAL OFFICES IF REQUIRED.

DRAWN BY: R.A.L.
PLOT CODE: 1:1
COMPUTER FILE: D17029S1.dwg

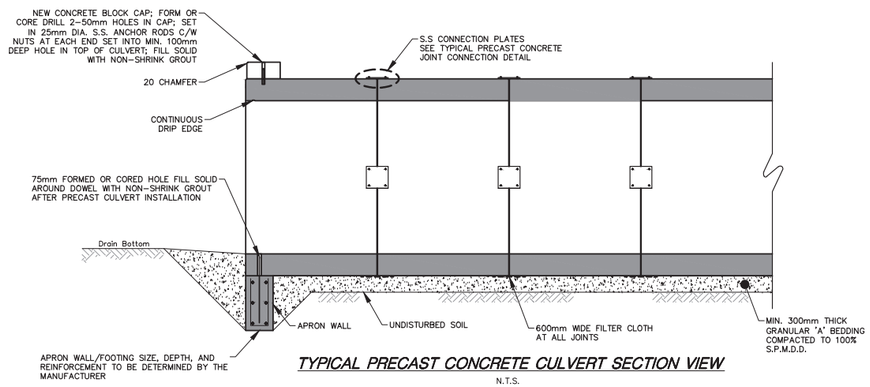
FILE No.: D17-029
SHEET No.: 1 OF 2

Z:\PROJECTS\DRAINAGE\2017\D17029\CAD\DWG\D17029S1.dwg 2018/04/23, 3:25:59 PM



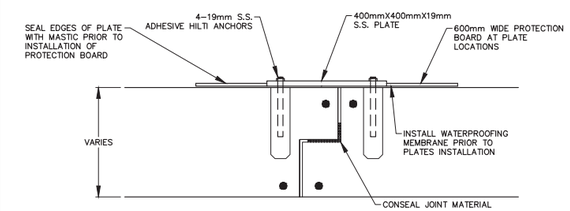
TYPICAL PRECAST CONCRETE CULVERT PLAN VIEW

N.T.S.



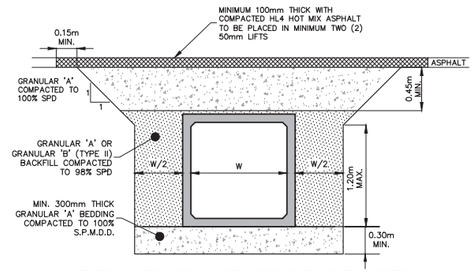
TYPICAL PRECAST CONCRETE CULVERT SECTION VIEW

N.T.S.



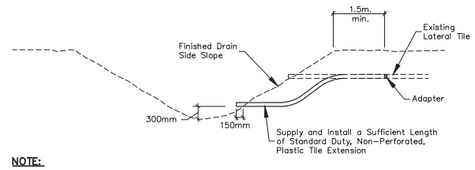
TYPICAL PRECAST CONCRETE JOINT CONNECTION DETAIL

N.T.S.



TYPICAL ROADWAY CROSSING BACKFILL DETAIL

Scale = N.T.S.



NOTE:

If Existing Lateral Tile Is Plastic, Utilize a Plastic Coupler in Place of Adapter

STANDARD LATERAL TILE DETAIL

Scale = N.T.S.

CONCRETE STRUCTURES AND HEADWALL NOTES:

GENERAL NOTES:

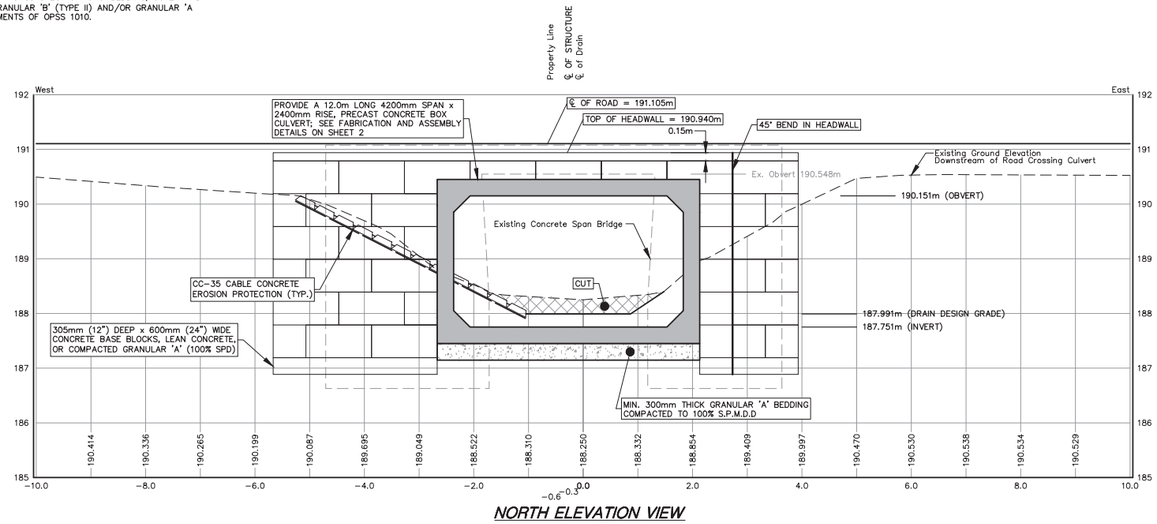
1. THE ACCURACY OF THE UTILITIES SHOWN ON THESE DRAWINGS ARE NOT GUARANTEED BY THE OWNER OR N. J. PERALTA ENGINEERING LTD.; OTHER UTILITIES MAY BE PRESENT OR THE UTILITIES SHOWN MAY DIFFER IN SIZE AND/OR LOCATION SHOWN.
2. ALL DIMENSIONS SHOWN IN METRIC UNLESS NOTED OTHERWISE. PROPERTY LINES ARE APPROXIMATE AND ARE BASED ON THE TOWN OF LAKESHORE GIS AND FIELD SURVEY INFORMATION.
3. CONTRACTOR SHALL VERIFY ALL BURIED SERVICES WITHIN CONSTRUCTION ZONE AND SHALL REMAIN RESPONSIBLE FOR THEIR PROTECTION DURING CONSTRUCTION.
4. THE CONTRACTOR SHALL ENTIRELY REMOVE THE EXISTING ROAD CROSSING STRUCTURE AND DISPOSE OF SAME; RESTORE THE EXISTING DRAIN BANKS TO ITS ORIGINAL DRAIN CONFIGURATION.
5. THE CONTRACTOR MUST SUBMIT THE FOLLOWING PLANS PRIOR TO CONSTRUCTION; DEMOLITION PLAN (DEBRIS MANAGEMENT PLAN), SEDIMENT AND EROSION CONTROL PLAN, WATER CONTROL PLAN (FLOW CONVEYANCE) AND FISH SALVAGE PLAN TO ERCA (ESSEX REGION CONSERVATION AUTHORITY) AND CONSULTING ENGINEER FOR REVIEW AND APPROVAL.
6. CONTRACTOR MUST COMPLY WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS LATEST EDITION FOR CONSTRUCTION PROJECTS. NO WORK TO BE COMMENCED UNTIL ALL APPROVALS ARE IN PLACE.
7. CONTRACTOR SHALL RESTORE ALL AREAS DISTURBED BY NEW CONSTRUCTION TO THEIR ORIGINAL CONDITION OR BETTER AND TO THE SATISFACTION OF THE OWNER.
8. APPROPRIATELY DISPOSE OF ALL SURPLUS MATERIALS AND DEBRIS OFF-SITE.
9. BACKFILL BEHIND THE ABUTMENTS AND WING WALLS WITH GRANULAR MATERIALS AS INDICATED ON DRAWING. COMPACT GRANULAR 'A' MATERIALS TO A MINIMUM OF 98% STANDARD PROCTOR MAXIMUM DRY DENSITY RESPECTIVELY. PLACE FILL AT BOTH SIDES OF THE CULVERT SIMULTANEOUSLY.
10. THE CONTRACTOR MUST PROVIDE THE TOWN AND ENGINEER WITH A MINIMUM OF 48 HOUR NOTICE PRIOR TO COMMENCING ANY WORKS ON THIS PROJECT.
11. RUBBISH AND DEBRIS SHALL BE REMOVED FROM SITE ON A DAILY BASIS AND DISPOSED OF APPROPRIATELY.
12. CONTRACTOR SHALL INSTALL TEMPORARY SILT FENCE AS PER OPSD 219.130.
13. THE CONTRACTOR SHALL FIELD CHECK AND VERIFY ALL CONDITIONS AND MEASUREMENTS AT THE SITE AND REPORT ANY DISCREPANCIES TO THE DESIGN ENGINEER BEFORE PROCEEDING WITH THE WORK.
14. CONTRACTOR SHALL PROVIDE ALL NECESSARY TEMPORARY BRACING AS REQUIRED FOR ALIGNMENT, WIND, DEAD LOAD AND EROSION STRESSES.
15. DO NOT EXCEED DEAD LOADS DURING CONSTRUCTION UNLESS SHORING IS PROVIDED BY THE STRUCTURAL DESIGN ENGINEER.

MATERIALS:

1. ONLY PRECAST PLANT CERTIFIED BY CSA STANDARD A23.4 FOR STRUCTURAL PRECAST OR MEETING OPSS 1821 REQUIREMENTS SHALL DESIGN AND SUPPLY THE PRECAST CONCRETE BOX CULVERT.
2. PRECAST CULVERT SUPPLIER SHALL BE CERTIFIED BY THE CANADIAN STANDARDS ASSOCIATION IN STRUCTURAL CATEGORY ACCORDING TO CSA A23.4, SUBMIT STAMPED SHOP DRAWINGS FOR THE CONSULTING ENGINEER'S REVIEW AND APPROVAL.
3. DESIGN CULVERT TO CHBDC REQUIREMENTS. PROVIDE ADDITIONAL REINFORCING AROUND PIPE OPENINGS. SUBMIT CERTIFIED DRAWINGS FOR REVIEW AND APPROVAL.
4. FABRICATOR SHALL NOTE THAT THIS BRIDGE WILL HAVE LESS THAN 600mm OF COVER AND THEREFORE, SHALL MAKE PROVISIONS TO INCLUDE THE APPROPRIATE REINFORCEMENT WITHIN THE STRUCTURE DESIGN OR A DISTRIBUTION SLAB TO CARRY ALL REQUIRED LOADING BASED ON THE C.H.B.D.C. PROVISIONS.
5. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE FABRICATION DESIGN DRAWINGS. IN THE EVENT OF A CONFLICT WITH THESE DRAWINGS, THE FABRICATION DRAWINGS SHALL GOVERN.
6. CONCRETE – 35 MPA AT 28 DAYS FOR WALLS, CUT OFF WALLS AND SLABS (5 TO 8% AIR ENTRAINED), <0.40 WATER/CEMENT RATIO AND 15MPA MUD MAT.
7. JOINT WATERPROOFING – 'MEL-ROL' ROLLED, SELF-ADHESIVE WATERPROOFING MEMBRANE BY W.R. MEADOWS OR APPROVED EQUIVALENT.
8. PROTECTION BOARD ON WATERPROOFING MEMBRANE – PC-3 HEAVY DUTY ASPHALT BOARD BY W.R. MEADOWS OR APPROVED EQUIVALENT.
9. ANCHORS – HILTI FASTENING SYSTEMS OR APPROVED EQUIVALENT
10. CONCRETE BLOCK GRAVITY WALL/RETAINING WALL SYSTEM – SHALL CONFORM TO OBC, CHBDC DESIGN CODE & CSA STANDARD. SUBMIT CERTIFIED DRAWINGS TO THE CONSULTING ENGINEERS FOR REVIEW.
11. REINFORCEMENT – GRADE 400R CSA G30.18.
12. GRANULAR MATERIALS – OPSS SPECIFICATIONS BEDDING, COVER AND BACKFILL SHALL BE GRANULAR 'B' (TYPE II) AND/OR GRANULAR 'A MEETING THE REQUIREMENTS OF OPSS 1010.

FOUNDATIONS/FOOTINGS

1. FOOTINGS SHALL BE INSTALLED ON NATURAL UNDISTURBED SOIL CAPABLE OF SUSTAINING BEARING CAPACITIES ESTABLISHED IN THE GEOTECHNICAL EXPLORATIONS FOR THE STRUCTURE PROVIDED BY GOLDERS ASSOCIATES AND INCLUDED WITHIN THE CONTRACT DOCUMENTS.
2. EXCAVATION TO BE INSPECTED BY A SOIL ENGINEER BEFORE PROCEEDING WITH INSTALLATION OF CONCRETE STRUCTURES AND CONSTRUCTION OF WALL SYSTEM.
3. TEMPORARY FLOW CONVEYANCE PIPE SHALL BE INSTALLED DURING CULVERT INSTALLATION, AND SHALL BE REMOVED JUST PRIOR TO FINAL BACKFILL AND SUBSTRATE INSTALLATION (SIZE OF PIPE AS DIRECTED BY ENGINEER OR OWNER). CONTRACTOR TO REMAIN RESPONSIBLE FOR MAINTENANCE OF PIPE OPERATION DURING CONSTRUCTION PERIOD.



NORTH ELEVATION VIEW

Scale: 1:50

THESE DRAWINGS HAVE BEEN REDUCED IN SIZE AND THE SCALE THEREFORE VARIES.
FULL SCALE DRAWINGS CAN BE VIEWED AT THE MUNICIPAL OFFICES IF REQUIRED.

LICENSED PROFESSIONAL ENGINEER
A. B. PERALTA
100138883
2018-04-25
PROVINCE OF ONTARIO

DRAWN BY: R.A.L.
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