

YOUNG and HOPF-WAGNER DRAINS

City of Port Colborne



**SPRIET
ASSOCIATES**

ENGINEERS & ARCHITECTS

155 York Street
London, Ontario N6A 1A8
Tel. (519) 672-4100
Fax (519) 433-9351
E-mail MAIL@SPRIET.ON.CA

Our Job No. 90070

July 27, 2017

YOUNG and HOPF-WAGNER DRAINS City of Port Colborne

This report is prepared pursuant to Section 78 of the Drainage Act, RSO 1990 in accordance with the City of Port Colborne resolution made at the May 11, 1998 council meeting. The original resolution identified the need for updated drainage report to address concerns raised by several affected landowners.

The objective of this report is provide for repair and improvement of the Young and Hopf-Wagner Drains commencing at the Tea Creek Drain North of Koabel Road upstream to it's head at the corner of White and Forks Road.

This objective will be achieved by:

- Excavating the existing low flow channel of the Young Drain from Tea Creek to the Hopf-Wagner Drain
- Excavating the existing low flow channel of the Hopf-Wagner Drain from its outlet in the Young Drain up to Forks Road
- Relocating a portion if the Hopf-Wagner Drain from Forks Road to the South side of the Canadian National Railway right-of-way
- Removal of any brush or obstructions located in the channel
- Installation of new road culverts, farms crossings as well as low flow rail culverts
- Seeding of ditch banks and buffer strips along the length of the channel as well as rearing and nursery planting

A summary of the proposed Young and Hopf-Wagner Drains is as follows:

- Approximately 10,138 lineal meters of low flow channel cleanout and reconstruction including sediment pools
- Approximately 9.3 Ha. of seeding of buffer strips, ditch bank and excavated material
- Approximately 76 lineal meters of 600mm sewer pipe parallel to White Road
- Construction of new road culverts under Willodell, Schneider, and Sherk Roads
- Installation of 4 new low flow rail culverts by boring

The Total Estimated cost is work is \$790,600.00

Total Watershed area affected is 1421 Hectares (3510 Acres)

- 821 Ha. in the City of Port Colborne
- 21 Ha. in the Town of Fort Erie
- 579 Ha. in the City of Niagara Falls

Four Schedules are attached: Allowances, Cost Estimate, Assessment for Construction, and Assessment for Maintenance

TABLE OF CONTENTS

1.0 AUTHORIZATION.....	1
2.0 HISTORY.....	2
2.1 YOUNG DRAIN.....	2
2.2 HOPF-WAGNER DRAIN.....	3
3.0 ON SITE MEETING – YOUNG DRAIN.....	4
4.0 FINDINGS AND EXISTING CONDITIONS – YOUNG DRAIN.....	5
5.0 INITIAL PRELIMINARY REPORT - YOUNG DRAIN.....	5
6.0 APPOINTMENT OF ENGINEER – HOPF-WAGNER DRAIN.....	6
7.0 JOINT PUBLIC MEETING - YOUNG DRAIN & HOPF-WAGNER DRAIN.....	6
8.0 FINAL PRELIMINARY REPORT – YOUNG DRAIN.....	6
9.0 ADDITIONAL FINDINGS AND EXISTING CONDITIONS – YOUNG DRAIN.....	7
10.0 FINDINGS AND EXISITNG CONDITIONS - HOPF-WAGNER DRAIN.....	7
11.0 DESIGN CRITEREA.....	8
12.0 DESIGN CONSIDERATIONS AND ALTERNATIVES – YOUNG DRAIN.....	9
12.1 CHANNEL REPAIR AND IMPROVEMENT.....	9
12.2 RAILWAY CULVERTS.....	9
12.3 WILLODELL ROAD BRIDGE REPLACEMENT.....	9
12.4 POTENTIAL FARM CULVERT ON THE SAUER PROPERTY.....	9
12.5 SCHNEIDER ROAD CULVERT REPLACEMENT.....	10
12.6 DRAIN RELOCATION ON NORTH SIDE OF C.N.R. TRACKS.....	10
13.0 DESIGN CONSIDERATIONS AND ALTERNATIVES – HOPF-WAGNER DRAIN.....	10
13.1 CHANNEL REPAIR AND IMPROVEMENT.....	10
13.2 BROOKFIELD ROAD AND SHERK ROAD CULVERTS.....	10
13.3 FORKES ROAD NORTH RELOCATRION ALTERNATIVE.....	11
13.4 SOUTH C.N.R. RELOCATION ALTERNATIVE.....	11
13.5 RAILWAY CULVERTS.....	11
14.0 ENVIRONMENTAL CONSIDERATIONS.....	12
15.0 FURTHER PUBLIC PARTICIPATION AND FOLLOW UP.....	12
16.0 REVISIONS AND FINALIZATION.....	13
17.0 RECOMMENDATIONS.....	14
17.1 YOUNG DRAIN.....	14
17.2 HOPF-WAGNER DRAIN.....	15
17.3 HOPF-WAGNER DRAIN –NEASE BRANCH.....	16

18.0 ENVIRONMENTAL MITIGATION MEASURES	17
19.0 SUMMARY OF PROPOSED WORK	18
19.1 YOUNG DRAIN	18
19.1 YOUNG DRAIN (cont'd)	19
19.2 HOPF-WAGNER DRAIN	24
19.3 NEASE BRANCH	27
20.0 SCHEDULES	27
21.0 ALLOWANCES	28
20.1 DAMAGES:	28
20.2 RIGHT-OF-WAY:	28
22.0 ASSESSMENT DEFINITIONS	28
23.0 ASSESSMENT	29
24.0 SPECIAL ASSESSMENT	30
25.0 GRANTS	32
26.0 MAINTENANCE	32

SCHEDULE "A" ALLOWANCES

SCHEDULE "B" ESTIMATE

SCHEDULE "C" ASSESSMENT FOR CONSTRUCTION

SCHEDULE "D" ASSESSMENT FOR MAINTENANCE

APPENDIX A - PHOTOS

APPENDIX B - GOLDERS GEOTECHNICAL INVESTIGATION (CN RAIL CROSSINGS)

SPECIFICATIONS FOR CONSTRUCTION OF MUNICIPAL DRAIN WORKS

London, Ontario
July 27, 2017

YOUNG and HOPF-WAGNER DRAINS

City of Port Colborne

To the Mayor and Council
of the City of Port Colborne

Mayor and Council:

We are pleased to present our report for the reconstruction of the Young and Hopf-Wagner Municipal Drains serving parts of Lots 1-15, Concessions 4 and 5 Colborne (part of the former Township of Humberstone) in the City of Port Colborne, part of Lots 29 and 30, Second Cross Concession (part of the former Township of Willoughby), and part of Lot in Rear of Lot 16 Concession 16NR (part of the former Township of Bertie) in the Town of Fort Erie, and part of Lots 1-4, Concessions 7 & Gore (part of the former Township of Crowland), and Lots 12-15, First Cross Concession and Lots 1-4, Concession 5-7(part of the former Township of Willoughby), and Lots 1-6, 8-9, Concession 5 (part of the former Township of Humberstone) in the City of Niagara Falls.

1.0 AUTHORIZATION

Spriet Associates London Ltd. was appointed on February 12, 1990 to prepare a preliminary report for the Young Drain pursuant to Section 10 of the Drainage Act R.S.O. 1990 in accordance with the recommendations laid out in the City Engineer's report No.90-13 and requisite instructions received from City Administration with respect to a motion of City Council. This preliminary report was finalized on July 31, 1998 and subsequently adopted by Council at a Report Consideration Meeting held on September 14, 1998. However, prior to the Meeting to Consider the Young Drain Preliminary Report, Spriet Associates London Ltd. was appointed on May 11, 1998 to prepare a final report for the Young & Hopf-Wagner Drains pursuant to Section 78 of the Drainage Act, in accordance with the recommendations laid out in Director's Report No. 98-33 and subsequent instructions received from City Administration, with respect to a motion by City Council.

The appointment of an engineer to prepare a new report for these drains was also an effort to address several affected landowners having filed written notice requesting cleanout and repair of the Young Drain and Hopf-Wagner Municipal Drain.

2.0 HISTORY

2.1 YOUNG DRAIN

A detailed history of the Young and Hopf-Wagner Municipal Drains, based on a review of available records by Henri Bennemeer, Drainage Superintendent of the City of Port Colborne, is provided in the following summary. The earliest indication of the Young Drain is by way of a profile survey by John De Cew, dated May/June 1875, titled "Marsh Drain in Humberstone Township", which depicts its origin at the Airline (CN) Railway, being carried downstream to approximately 900' NE of the Crowland/Willoughby Township line. The description of the lots and concessions clearly indicates that this profile is the Young Drain

The earliest record of the Young Drain being brought under the Drainage Act and Predecessor Acts was through a petition by Jesse Young, A. McPhalen, and others for the repair of the Young Drain. This petition resulted in a report by George Ross, dated August 6, 1891, which describes the drain commencing at its head at the north side of the Air Line (now Canadian National) Railway in the N½ Lot 10, Concession 4 (Humberstone), now the City of Port Colborne, extending downstream in a north-easterly direction into the Townships of Crowland and Willoughby. The report also recommended that the drain should be extended 2 miles further than when first made, in order that all lands assessed may be benefited which indicates there may have been a previous award/report initiated and facilitated by one of the affected municipalities.

It should also be noted that many of the property owner names shown on the 1875 profile are also contained in the 1891 engineer's report. It is evident from the assessments to Willoughby Township that the Young Drain outlet was extended further downstream, as outlined in the 1891 report. The August 6, 1891 report was adopted through By-Law 322 on September 22, 1891. There is no copy of the original plan or profile. This information was obtained from the By-Law.

A subsequent petition by J. E. Young, Henry Cronmiller, and others for the repair of the Young Drain through Concessions 4 and 5 Humberstone to an outlet in Willoughby resulted in a report by E. Gardiner, dated April 22, 1905. This report recommended similar work to the 1891, report but extending only 200 feet into Willoughby. The report was adopted by By-Law 375 on July 22, 1905. There is no original copy of the report, plan or profile on file with the City of Port Colborne. This information was obtained from the By-law.

In the year 1915 Willoughby served notice on Humberstone with their intention to have the Young Drain outlet repaired. A report prepared by George Ross, dated September 14, 1915, recommended improvement of the Young Drain from Lot 1, Concession 6, Willoughby downstream into Tee Creek in Lot 9, Concession 7, Willoughby. There is a corresponding Humberstone By-Law 461 provisionally adopted March 16, 1916, with a confirmed (Council Meeting Minutes of May 1, 1916) third reading dated May 1, 1916, thereby adopting By-Law 461. There is no original copy of the report, plan or profile on file with the City of Port Colborne. This information was obtained from the By-Law.

On September 11, 1926 James E. Young, Jesse Young, and others petitioned to have the Young Drain repaired, improved or enlarged. This resulted in the last report which reconstructed and extended the Young Drain, dated April 17, 1928 by J. R. Scott. (first mention of the Hopf-Wagner Drain in Young Drain reports) It recommended the repair of the Young

2.0 HISTORY (cont'd)

2.1 YOUNG DRAIN (cont'd)

Drain from the CN railway in Lot 9, Concession 4 in Humberstone, downstream to Lot 9, Concession 7, Willoughby to an outlet in the existing Tee Creek. The report was adopted by By-Law 591 on August 6, 1928. This by-law was subsequently amended through By-Law 626 adopted on December 2, 1929 to levy the costs. By-Law 172, adopted June 26, 1928, was the corresponding Crowland By-Law. There is an original copy of the report but only printed copies of the plan and profile.

Correspondence July 20 and August 10, 1940 to the railways indicates that maintenance was carried out on the Young Drain between 1930 and 1940. It appears that this maintenance may have been levied under By-Law 908 which was adopted December 15, 1949.

A petition dated February 21, 1938 by J. E. Henry, Edward Fox, and others to have the Young Drain repaired from Lot 13, Concession 4 Humberstone to the junction of the Howie Drain in Lot 6, Concession 5 Humberstone, resulted in an inspection report by J.R. Scott, dated November 18, 1938. This inspection report recommended the maintenance of the Hopf-Wagner Drain without the report of an engineer.

Correspondence dated December 18, 1945 Willoughby/Humberstone and September 7, 1946 by Blake Erwin resulted in the maintenance of the Young Drain from the north limit of the CN right-of-way at Lot 10, Concession 4 Humberstone downstream to Lot 9, Concession 7 Willoughby as per the report of J.R. Scott dated April 17, 1928. The cost of this maintenance was levied under By-Law 908 Humberstone, dated December 15, 1949 and By-Law A-109 Willoughby, dated November 10, 1947. A report was not commissioned at this time, however correspondence indicated that there was an updated plan and current conditions profile provided at that time. This information was likely in the hands of Willoughby who initiated the maintenance.

The downstream portion of the Young Drain from lot 3 to 9, Concession 7, Willoughby, was reconstructed as the Tee Creek Municipal Drain pursuant to a report by J.B. Weibe, P.Eng., dated February 26, 1998. This report was adopted by City of Niagara Falls Council under By-Law 93-230, on October 6, 1997. A corresponding levy by-law, By-Law 3568/149/97 was passed by City of Port Colborne Council on December 15, 1997.

2.2 HOPF-WAGNER DRAIN

A petition dated June 29, 1916 by Melvina Hopf and John Wagner, under the Ditches and Watercourses Act, was initially signed for the construction of a new ditch or the deepening, widening, covering or improving of an existing ditch. Subsequently, a petition under the Municipal Drainage Act by Mrs. J. Hopf, John Wagner and others was filed on November 27, 1916. This resulted in a report dated August 13, 1917 by George Ross which provided for a ditch commencing at the easterly limit of Lot 15, Concession 4 Humberstone and extending downstream easterly along various road allowances and railway lands to an outlet into the Young Drain. This report was adopted by BY-Law 480, on October 29, 1917. As well, an agreement dated September 13, 1916 was entered into between Humberstone and the Grand Trunk Railway for the use of railway lands for the open drain location south of the track from

2.0 HISTORY (cont'd)

2.2 HOPF-WAGNER DRAIN

Lots 10 to 12, Concession 4. By-Law 501 was adopted November 1, 1920 to amend By-Laws 480 and 498 and to levy the cost of the drainage works.

As previously mentioned, a petition dated February 21, 1938 by Jacob E. Henry, Edward Fox, and others for the repair of the Young Drain resulted in a letter report dated November 18, 1938 from J.R. Scott to maintain the Hopf-Wagner Drain as per the 1917 report. As well, J.R. Scott recommends an investigation into redirecting the Hopf-Wagner into the Indian Creek or Lyons Creek Drains. Details of this investigation could not be found. A corresponding levy By-Law for this maintenance has also not been located.

An award report prepared by George Ross dated April 9, 1906 for the Barnhart Award Drains 1 and 2. Drain No. 1 was located along the east side of the road bed on the side road between Lots 10 & 11 in the Fourth Concession Humberstone. The length of this drain was to be 1,723 feet, extending from the south side of the ditch on the south side of Airline (CN) Railway to the south limit of Mr. Barnhart's lands in Lot 10 Concession 4. Drain No.2 was located along the west side of the line between Lots 9 & 10 and was to be 833 feet from the south limit of the Air Line (CN) Railway right-of-way to the north limit of Mr. Barnhart's lands in Lot 10 Concession 4. There is a copy of the plan and profile including the Award on file with the City. Both drains are shown on Drawing. No. 1 which forms a part of this report. Drain No. 1 is shown along the east ditch of the Brookfield Road. Drain No. 2 is in Concession 4 on the Lot 9/10 lot line.

3.0 ON SITE MEETING – YOUNG DRAIN

Notices, dated March 26, 1990 to attend an on-site meeting at 10:00 AM on April 17, 1990 regarding the Young Drain, were issued through the Clerk's Department of the City of Port Colborne. This on-site meeting was facilitated by René Landry, C.E.T., Drainage Superintendent for the City of Port Colborne, to field review the condition of the Young Drain, open ditch, from Koabel Road, on the north side of the CN Track, east of Brookfield Road, for a distance of 7.69 kilometres. Several landowners, in whose property the Young Drain is located in both Niagara Falls and Port Colborne, were invited to attend. Several of these landowners reported that the existing ditch had silted in and grown in with vegetation so that it no longer provided a proper drainage outlet. They requested an investigation be conducted into cleaning out the Young Drain including clearing and brushing.

At the time of the on-site meeting it was indicated that a new report was being prepared to be submitted to the City of Niagara Falls to reconstruct the portion of the Young drain downstream of Koabel Road which in essence renamed this portion the Tee Creek Municipal Drain. Subsequent to that meeting, design grade information was provided by the engineer, which showed that additional depth would be provided for the future repair and improvement to the Young Drain being investigated under this report.

4.0 FINDINGS AND EXISTING CONDITIONS – YOUNG DRAIN

A survey of the entire Young Drain was completed using level, rod, and chain commencing at the Tee Creek Drain north of Koabel Road upstream to the Hopf-Wagner Drain for approximately 7,764 meters for cleanout and reconstruction purposes.

The lower 4,900 meters of the Young Drain are in the City of Niagara Falls. The upper 2,900 meters of the drain are in the City of Port Colborne. At the drain outlet into Tee Creek, just north of Koabel Road (Niagara Falls) water levels in the drain were near the underside of the road bridge and 1.8 meters (6 feet) above original design at elevation 175.4. This water level carries upstream, almost flat, for a distance of 2,000 meters to Schneider Road, where the ditch was bank full at the time of inspection. From Schneider Road to Montrose Road the ditch water level rose 1 meter, at which point, ditch water levels appeared normal. From Montrose Road upstream to the drain end point, which is the outlet point of the Hopf-Wagner Drain, the water level rose a further 2.5 meters (8.2 feet). Between Netherby Road and Green Road considerable water was found standing in the ditch at an average depth of 0.5 meters. At the junction of the Howie Drain outlet, the Young Drain water level stood relatively flat for a distance of 990 meters to Forkes Road at depths of up to 0.4 meters.

A review of the 1928 profile shows that the slope of the ditch bottom varied from a minimum of 0.04% to a maximum of 0.11%. Large sections were found to be shallow with flooding over the banks on adjacent farmlands.

We found that two CN railway culverts, on either side of Forkes Road have concrete floors with invert at the existing ditch bottom elevation which is well above the original design grade of the previous 1928 report. These culverts were constructed in 1970 in conjunction with the new road and rail tunnels under the Welland Canal By-Pass project, undertaken by Transport Canada. The C.N. and C.P. rail lines were interconnected at that time requiring two new bridge structures crossing of the Young Drain. It appears that at the time of construction, the Seaway Authority / Railway Engineers did not allow for the design grade, but rather the existing conditions of the Young Drain.

5.0 INITIAL PRELIMINARY REPORT - YOUNG DRAIN

A draft preliminary report dated November 29, 1993 with respect to the condition of the Young Drain as specified in the 1928 report was prepared and submitted to the City of Port Colborne. This preliminary report recommended a complete reconstruction, including ditch bottom cleanout, culvert replacements, clearing, excavation, levelling, slope seeding and erosion and rip-rap protection where required, with allowances for right-of-way and damages by way of a new engineer's report under the Drainage Act. This report also included a plan drawing and cost estimate for the recommended work. Port Colborne's instruction at that time was to wait until the Tee Creek report was completed and built before proceeding further.

Then upon, instruction by the City of Port Colborne, the above draft preliminary report for the Young Drain was updated and re-submitted, dated June 11, 1998 in anticipation for a public meeting.

6.0 APPOINTMENT OF ENGINEER – HOPF-WAGNER DRAIN

Subsequent to written requests submitted by landowners, the City of Port Colborne appointed Spriet Associates under section 78 of the Drainage Act on May 11 1998 to prepare a report for repair and improvement to the Hopf-Wagner Municipal Drain.

7.0 JOINT PUBLIC MEETING - YOUNG DRAIN & HOPF-WAGNER DRAIN

A public meeting was held at City Hall on July 15, 1998 to review the draft preliminary report, dated November 29, 1993 for the Young Drain with the affected landowners. This meeting also served as an 'On-Site' meeting for the Hopf-Wagner pursuant to councils 'Notice of Appointment' for examination by an engineer on the Hopf-Wagner Drain, dated June 30, 1998.

Several landowners attended and provided verbal and written comments on both municipal drains. W. Sauer noted that the Tee Creek Drain excavation work was completed in 1998 and that the Young Drain now has an adequate outlet on the north side of Koabel Road in the City of Niagara Falls. Seasonal high water flood levels have been lowered somewhat upstream at Willodell and Schneider Roads but still required significant excavation of sediment and deepening to provide a sufficient outlet.

Several ratepayers on both drains indicated that drainage runoff was slow, resulting in significant flooding of lands and that both drains needed a channel cleanout/improvement through flood prone areas.

Based on comments from properties abutting the Hopf-Wagner Drain, as well as the City Road Authority for Forkes, White, Brookfield, and Sherk Roads, reconstruction of the entire Hopf-Wagner Drain was requested from its outlet into the Young Drain to the west side of White Road.

8.0 FINAL PRELIMINARY REPORT – YOUNG DRAIN

A Final Preliminary Report, dated July 31, 1998 was submitted to the City of Port Colborne for consideration. This preliminary report recommended a complete reconstruction, including ditch bottom cleanout, culvert replacements, clearing, excavation, levelling, slope seeding and erosion and rip-rap protection where required, with allowances for right-of-way and damages by way of a new engineer's report under the Drainage Act for both the Young Drain and Hopf-Wagner Drain. This report included a plan drawing and cost estimates.

This report was considered by Council on September 14th 1998 and instruction was provided to proceed to prepare and submit a final report for both drains. It would also need to address some of the issues created by particular utilities, railways, and roads. The final report would also include distribution of the costs through assessment schedules and net schedules (showing grant and allowances).

9.0 ADDITIONAL FINDINGS AND EXISTING CONDITIONS – YOUNG DRAIN

Additional surveys of the Young Drain were completed using level, rod, and chain as follows:

- The lower 2017 meters of the drain were resurveyed now that the water levels had been lowered and more/proper information could be obtained within the ditch bottom
- 206 meters of open drain relocation along the north C.N. fence in property Roll No's' 6-101 and 6-102 (Sta. 7+558 – Sta. 7+764) between Sherk and White Roads in the City of Port Colborne

Detailed surveys were also completed using EDM and GPS equipment including the following:

- A survey for a new farm crossing on property Roll No. 130-040-181-00 (W. & C. Sauer)
- A detailed field investigation and survey of the existing Schneider Road bridge site in the City of Niagara Falls
- A detailed field investigation and survey of the existing Willodell Road bridge site in the City of Niagara Falls
- Two detailed field investigations and surveys of the existing culverts under the CN Track at Station 7+085.6 and 7+542.0

The inspection and survey of the concrete culvert under Schneider Road revealed extensive deterioration of the concrete elements of the old structure, including barrier walls, abutments, underside of concrete deck and footings, including steel embedded deck support beams. (See appendix for photos). The load limit capacity of this structure is indeterminate.

The inspection and survey of the Willodell Road Bridge revealed it is no longer open to vehicular traffic, in poor condition and unsafe for modern vehicles or farm equipment. Niagara Falls indicated it was considering replacing this structure due to its age and condition.

Culvert sizing, hydrology, and grade information with regard to the Howie Municipal Drain and how it relates to the Young Drain was investigated and reviewed with the municipality.

10.0 FINDINGS AND EXISTING CONDITIONS - HOPF-WAGNER DRAIN

A survey of the entire Hopf-Wagner Drain was completed using level, rod, and chain commencing at the head of the Young Drain upstream along its original route for 2,038 meters to its head on the east side of White Road. Further surveys completed using EDM and GPS equipment to investigate design alternatives. This included a survey of the Hopf-Wagner Drain along the north side of Forkes Road for 637 meters from Sta.9+313 to Sta.9+950 for relocation to the north side. It also included a survey from Sherk Road to White Road for 950 meters to investigate the potential relocation of the ditch to south of the CN railway and 89 meters north along the east side of White Road back to Forkes Road.

Hopf-Wagner Drain profile revealed large sections requiring improvement. Large sections of both drains were found to be shallow with flooding over the banks on adjacent farmlands. We also found that similar to the Young Drain one municipal road and one railway

10.0 FINDINGS AND EXISTING CONDITIONS - HOPF-WAGNER DRAIN (cont'd)

Culverts have inverts that are higher than the original design grade restricting the depth of the drain.

The existing open ditch which is along the south side of Forkes Road is very shallow and runs parallel to a high pressure gas main for a distance of approximately 625 meters. The design slope of this 1917 open drain was 0.02%, which is almost flat.

The existing concrete culvert under Sherk Road was found to be in poor condition.

At the time of the original survey, it was not possible to determine the exact elevations of the inverts of the existing culvert under Brookfield Road.

Based on the Canadian Niagara Power criteria it was determined that there were hydro poles that would potentially be in conflict with any proposed ditch excavation along both White Road and the north side of Forkes Road.

Buried utilities in the areas of potential proposed drain work were also located and exposed to determine their exact location and elevation, and then plotted on the profile drawings. This included hydro, telephone and gas.

11.0 DESIGN CRITERIA

The capacity of both the Young Drain and Hopf-Wagner Drain were reviewed in accordance with the rational method and compared to a return frequency of a 1 in 2 year storm. Storm frequency is the frequency with which a given storm event is equalled on the average, once in a number of years. The capacity of the channel has been designed to accommodate 1/3 of a 2 year storm in the lower reaches and 2/3 of a 2 year storm in the upper reaches. New culverts have been designed to different levels of service depending on the specific requirements and are listed below under design considerations.

All of the proposed work has been generally designed in accordance with the DESIGN AND CONSTRUCTION GUIDELINES FOR WORK UNDER THE DRAINAGE ACT.

12.0 DESIGN CONSIDERATIONS AND ALTERNATIVES – YOUNG DRAIN

Further investigations were completed and alternatives considered based on input from stakeholders as follows:

12.1 CHANNEL REPAIR AND IMPROVEMENT

In order to construct and re-establish adequate channel depth to provide a sufficient surface and subsurface outlet for adjacent and upstream lands and roads tributary to the Young Drain, an average, 0.7 meters of earth will be removed from the ditch.

In view of the improved outlet at Tee Creek 1998, north of Koabel Road, an increase of the ditch bottom design gradient to 0.05% is possible for approximately 2,000 meters from the Young Drain outlet point to Schneider Road. The higher gradient increases the flow capacity of the reconstructed channel through this lower section which is flood prone.

12.2 RAILWAY CULVERTS

In order to restore the channel depth to its original design grade and provide additional depth, low flow culverts at the railway crossings both upstream and downstream of Forkes Road could be installed adjacent to the existing surface culverts. This would save the cost of having to replace the existing culverts. In order to complete this work, a geotechnical report would be required by the C.N.R. The design of the low flow pipe culverts provide a capacity of no less than 15% of a 2 year storm.

12.3 WILLODELL ROAD BRIDGE REPLACEMENT

Due to the above mentioned poor condition of this existing bridge, the City of Niagara Falls Drainage and Public Works are intending to replace this structure. We consider a twin steel pipe culvert pipe installation to be the most practical. This crossing has been designed for a 25 year storm rainfall event for its watershed tributary watershed. Relief flow over the roadway has been designed into the roadway profile for this crossing.

12.4 POTENTIAL FARM CULVERT ON THE SAUER PROPERTY

We were requested by the owner to investigate the construction of a new farm crossing on the Sauer property in Lot 1, Concession 6, (Willoughby) in the City of Niagara Falls. We completed a survey as mention above, then completed a preliminary design and cost estimate. Upon review of this with the owner and through discussions with Niagara Falls, it was decided to investigate and confirm the ownership of the portion of the Schneider Road allowance containing the existing concrete culvert. As a result of this investigation and Niagara Falls owning the road allowance, it was requested we not proceed with any proposed farm crossing on this property at this time.

12.0 DESIGN CONSIDERATIONS AND ALTERNATIVES – YOUNG DRAIN (cont'd)

12.5 SCHNEIDER ROAD CULVERT REPLACEMENT

Due to the elevation profile of Schneider Road, the flood stage begins when the water level is at the underside of deck with relief flow over the roadway west side of the structure. The flow capacity of this concrete structure is less than a 10 year storm. Also, there is potential that the ditch excavation work may undermine the culvert footings, and therefore the City of Niagara Falls Drainage and Public Works intends to replace this structure. We consider a twin steel pipe culvert installation to be most practical. This crossing has been designed for a 25 year storm rainfall event. Relief flow over the roadway has been designed into the roadway profile for Schneider Road.

12.6 DRAIN RELOCATION ON NORTH SIDE OF C.N.R. TRACKS

At the request of the landowner in Lot 10 Concession 4 (Humberstone) in the City of Port Colborne, we investigated relocating the existing ditch from the field a short distance to the south so it would be adjacent to the north limit of the C.N.R. tracks but still within private property. It was found to be feasible.

13.0 DESIGN CONSIDERATIONS AND ALTERNATIVES – HOPF-WAGNER DRAIN

13.1 CHANNEL REPAIR AND IMPROVEMENT

In order to construct adequate channel depth to provide a sufficient surface and subsurface outlet for adjacent and upstream lands and roads tributary to the Hopf-Wagner Drain, an average, 0.7 meters of earth will be removed from the ditch. The new ditch gradient upstream of Brookfield Road will be two times greater than the original 1917 design for that section.

13.2 BROOKFIELD ROAD AND SHERK ROAD CULVERTS

It was originally concluded that the condition of the Brookfield Road culvert would be inspected at the time of construction, and if in poor condition, this culvert would have to be replaced. Due to its existing location a significant distance south, the new culvert should be installed in line with the existing channel. It was determined that existing concrete culvert under Sherk Road should be replaced. Upon review with the the City of Port Colborne Drainage Superintendent, it was recommended that these culverts replacements, when completed should consist of concrete sewer pipe.

13.0 DESIGN CONSIDERATIONS AND ALTERNATIVES – HOPF-WAGNER DRAIN (cont'd)

13.3 FORKES ROAD NORTH RELOCATRION ALTERNATIVE

The 1917 report called for an open ditch drain which formed part of the Forkes Road south roadside storm drainage system. The first proposal brought forward was to reconstruct this drain to original 1917 design grade from White Road East to Station 9+313 in its original location. By so doing the depth of earth cover over an Enbridge Gas Distribution trunk gas main in the south ditch would be reduced. In addition, the gas feed lines across Forkes Road, which feeds gas to the underground bedrock storage, could also be affected. At the request of Enbridge Gas Distribution, the alternative to relocate the drain to the north roadside ditch on Forkes Road was investigated. Although this alternative addressed the trunk main, the concern for the ground cover over their feed lines was not eliminated. There was also now a concern by the Niagara Peninsula Conservation Authority (N.P.C.A.) due to Ontario Regulation 155/06 that a deeper north ditch would impact the wetland area in Lots 11 and 12, Concession 5.

13.4 SOUTH C.N.R. RELOCATION ALTERNATIVE

In view of the grade and cover conflict issue with the open drain on the south side of Forkes Road, and N.P.C.A.'s concerns regarding the North side of Forkes Road and through discussions with Mr. Bennemeer, the City of Port Colborne's Drainage Superintendent, and Enbridge Gas Distribution, it was decided the best alternative may to abandon the portion of the 1917 open drain along Forkes Road and construct a new ditch along the CN Railway south property limit from between Sherk and White Road. This new ditch would have an average depth of approx. 0.7 meters.

This new Hopf-Wagner Municipal Drain would turn north on the east side of White Road, cross under the CN track by way of a 610mm steel bore to a short section of open ditch connecting both the CN and Enbridge Gas Distribution properties. A survey was completed and the alternative was found feasible with exception of two feeder lines. The Enbridge Gas Distribution pipelines were located and exposed where required along White Road to confirm their relocation was required. Enbridge Gas Distribution had agreed to adjust these two natural gas feed lines at their expense in accordance with Section 26 of the Drainage Act, and in Fall 2016 relocated these two lines.

A portion of the original Hopf-Wagner Drain would still need to remain from Sherk Road to Forkes Road to be identified as the Nease Branch of the Hopf-Wagner Drain, for a distance of 357 meters, to provide a municipal outlet for Forkes Road and adjacent lands closer to Sherk Road.

13.5 RAILWAY CULVERTS

In order to restore the channel depth to its original grade and provide additional depth, low flow culverts at the railway crossings on the east side of White Road and west side of Sherk road could be installed adjacent to the existing surface culverts. This would save the cost having to replace the existing structures.

14.0 ENVIRONMENTAL CONSIDERATIONS

A meeting to inspect the Young Drain and the Hopf-Wagner Drain was held on August 29, 2006 with representatives from the Niagara Peninsula Conservation Authority (N.P.C.A.), the Department of Fisheries and Oceans (D.F.O.), the Drainage Superintendent, R. Landry and the Engineer. The drain was walked for the lower 5,000 meters and spot inspected from Netherby Road upstream, with special attention to the roadside drain along Forkes Road near the Enbridge Gas Distribution gas storage facility in Lot 11, Concession 5. The N.P.C.A. and the D.F.O. provided suggestions with respect to the proposed reconstruction at that meeting. Subsequent to this meeting, the agencies suggested that improvements to the Young and Hopf-Wagner Drains should provide water quality for flow in the ditch. They also recommended vegetated buffers, sediment traps/pools, siltation prevention, and sections of little and no work in wooded areas, be included in the report to mitigate disruption of fish habitat.

Further discussions and correspondence with the above agencies were completed including submissions as required to address specific additional requirements such as low flow considerations and culverts requirements. The D.F.O. initially recommended a three year phased work schedule be implemented, but later through correspondence agree to an one year work plan

Correspondence with the Ministry of Natural Resources confirmed and provided input with respect to potential affected species under the Endangered Species Act including recommendations. They also provided input with respect to timing windows for the proposed work, indicating that work cannot occur from October 1st – April 1st and that work should be avoided from during the last week of May and June.

The N.P.C.A. required that due to the extensive floodplains which are associated the Young and Hopf-Wagner Drains that the excavated material must be graded and levelled to avoid impacts to the floodplain. They also required that the work be conducted on the side of the of the channel which would require the least amount of disturbance to the existing vegetation.

15.0 FURTHER PUBLIC PARTICIPATION AND FOLLOW UP

In 2004, the Ontario government eliminated the Agriculture Drain Improvement Program which supplied funding in the form of a 1/3 grant against agricultural assessments. The Ministry of Agriculture (OMAF) at the time gave the municipalities the option of cancelling the project and being refunded the engineering cost to date, however there were ongoing discussions with many parties to have the program reinstated. Therefore, the municipality instructed that the report process be put on hold until the potential new program could be put in place. A new policy was implemented by OMAF in 2005 and the process was restarted.

The draft final design, drawings, cost estimates, allowances, and assessments were then prepared and reviewed with the affected parties including, City of Port Colborne, City of Niagara Falls, Town of Fort Erie, C.N.R., Enbridge Gas Distribution, Ontario Hydro, Bell

15.0 FURTHER PUBLIC PARTICIPATION AND FOLLOW UP (cont'd)

Canada, D.F.O., N.P.C.A., M.N.R., etc. prior to arranging an informal public meeting with the property owners. This public meeting was arranged and held on December 5, 2007 to review the proposed Young Drain and Hopf-Wagner Drain improvements with the invited ratepayers. Based on review of this draft report, further input was received from several affected parties at that time and at later dates.

This included the following:

- City of Port Colborne Drainage Superintendent, René Landry, on behalf of the City Road Authority, requesting improved drainage for the Forkes and White Road intersection and near the CN Rail level crossing
- The inclusion of the cost estimate to replace the Schneider Road structure
- The determination that the potential farm crossing on the Sauer property would not be constructed
- That there may be a conflict between surrounding municipal drain watershed limits and the current Young Drain watershed limit, the watersheds were compared to the recent Black Creek Drain and corrected
- That due the time that had elapsed to complete the report, property fabric would need to be updated
- That upon further review, the D.F.O. recommended and approved a phasing of the proposed work but all within one construction year
- That grassed buffer strips be expanded to 9m consistent with the Great Lakes Protection Act 2015, Ontario's Great Lakes Strategy and the Great Lakes Water Quality Initiative and as directed by the City of Port Colborne
- Port Colborne staff exposed and inspected the culvert invert under Brookfield Road and found it to be in satisfactory condition and therefore requested we remove the proposed replacement from the cost estimate

Neither Enbridge Gas Distribution nor the C.N.R. attended the public meetings and therefore they were contacted to review the proposed work. It was at this time Enbridge Gas Distribution indicated relocating their gas mains that were conflict with the proposed in along Forkes Road was not feasible. This was when the alternative mentioned above to relocate the drain to the south side of the C.N.R. was investigated and proposed. The C.N.R. was informed that the ditch was now intended to be relocated to the south side of the tracks and they provided their requirements for any work being completed on their right-of-way or that may impact the railway including, geotechnical reports, settlement monitoring, flagging, approvals etc. The maintenance corridor for this section of drain will be located on the south side of the drain.

16.0 REVISIONS AND FINALIZATION

As a result of the above, the watershed limit between the Young Drain and Tee Creek Drain was investigated and confirmed in the field. Further watershed adjustments were investigated and made to reflect conflicts with the Henry, Union Marsh, and Schihl Drains. At this time, adjustments to the Schedule of Assessment were also made to reflect unopened and closed road allowances, buffer strips, and updated property parcel fabric.

16.0 REVISIONS AND FINALIZATION (cont'd)

Upon review with the affected parties, it was confirmed that we were proceeding with the proposed culvert work across the C.N.R. at four locations, and a geotechnical report by Golders Associates. Ltd. was commissioned and received (see Appendix B). The revised drawings detailed cross sections were also submitted to the C.N.R. along with the special assessments for special works for their approval. The revised costs and special assessments dealing with the drain relocation along the railway and required minor adjustments to their gas mains was submitted to and reviewed by Enbridge Distribution

A detailed topographical survey was completed of the Schneider Road culvert so that the replacement culvert details and costs could be included in the report. A legal surveyor was also consulted to help provide advice and clarification regarding ownership of the road allowance in this location.

Other additions, deletions, and revisions to the proposed work were added to the drawings, cost estimate and schedule of assessment including the work along and across White Road, the single year construction schedule, and buffer strip adjustment, and removal of the Brookfield Road Culvert from the cost estimate.

17.0 RECOMMENDATIONS

We are therefore recommending the following:

17.1 YOUNG DRAIN

- that the Young Drain open ditch be reconstructed and cleaned out to restore and improve drainage capacity for the watershed area
- that newly exposed ditch banks be hand seeded daily during excavation
- that the excavated material be levelled adjacent to the drain on the top of bank and levelled in a way that it will not impede surface flows to the ditch
- the portion grassed buffer strip covered by the material be re-seeded upon completion
- that the ditch work include clearing and grubbing of brush and trees within the channel and within the working space as required
- that sediment in the existing bridges and culverts under Koabel, Montrose, Netherby, Green, and Forkes Roads be removed and disposed of
- that sediment in the existing C.P.R. culvert be removed
- that new low flow pipe culverts be constructed adjacent to the existing concrete culvert under the CN Railway Sta.7+086 and Sta.7+542 as shown on Dwg No. 4 to re-establish the original design depth for this drain

17.0 RECOMMENDATIONS (cont'd)

17.1 YOUNG DRAIN (cont'd)

- that the ditch be relocated from station 7+558 to 7+764 as requested by owner of the property Roll No. 040-006-102-00 (C. & H. Aimsbury). The relocation will eliminate the need for a farm culvert crossing on this portion of the Young Drain.
- that a new culvert crossing for Willodell Road in the City of Niagara Falls be constructed to replace the old steel truss bridge & abutments as shown on drawing No. 4 and Special Assessment item on page 30 of this report
- that a new culvert crossing for Schneider Road in the City of Niagara Falls be constructed to replace the existing concrete culvert as shown on drawing No. 4 and Special Assessment item on page 30 of this report

17.2 HOPF-WAGNER DRAIN

- that the Hopf-Wagner Drain open ditch be reconstructed to restore and improve drainage capacity for the watershed area
- that newly exposed ditch banks be hand seeded daily during excavation
- that the excavated material be levelled adjacent to the drain on the top of bank and levelled in a way that it will not impede surface flows to the ditch
- the portion grassed buffer strip covered by the material be re-seeded upon completion
- that the ditch work include clearing and grubbing of brush and trees within the channel and within the working space
- that the sediment in the existing culvert under the C.N.R. track east of Brookfield Road be removed
- that the existing culvert under Brookfield Road be cleaned out and sediment disposed of
- that a new concrete pipe culvert be constructed across Sherk Road to replace the existing concrete culvert
- that the original portion of the drain along Forkes Road between Sherk Road and White Road in Lots 13 and 14, Concession 4 in the City of Port Colborne be relocated from the existing south side of the road to the south limit of the CN Railway right-of-way, at a distance of 5 to 7 meters north of the south property line

17.0 RECOMMENDATIONS (cont'd)

17.2 HOPF-WAGNER DRAIN (cont'd)

- that a low flow pipe be installed adjacent to the existing 900mm C.S.P. under the C.N.R. tracks at Station 9+796 on the east side of White Road as shown on Dwg No. 4 to provide the original design depth and improved depth outlet for the portion of the upstream watershed
- that 13m of new ditch and 76 meters of 600mm sewer pipe is to be constructed from the above low flow culvert northerly along the east side of White Road to Forkes Road. This portion is to be located within the Enbridge Gas Distribution property and is proposed as a pipe to provide earth cover and protection for four gas main crossings
- that the excavated material from the new ditch is to be hauled away and disposed of
- that two of the gas mains, three Bell cables, and one buried hydro cable, all are required to be relocated under the proposed pipe location
- that the original open portion of the drain along the south side of Forkes Road east of White Road be abandoned from municipal drain status in accordance with section 19 of the Drainage Act
- that the existing 450mm culvert under White Road on the South side of Forkes Road shall continue to be part of the Hopf-Wagner Municipal Drain. It was noted to be poor condition, but the City of Port Colborne intends to replace this culvert in conjunction with their roadside ditching maintenance program

17.3 HOPF-WAGNER DRAIN –NEASE BRANCH

- that the portion of the original Hopf-Wagner Drain from Sherk Road to where it reaches Forkes Road is to be identified as the Nease Branch of the Hopf-Wagner Drain
- that this portion of open ditch be reconstructed in its original location
- that newly exposed ditch banks be hand seeded daily
- that the excavated material be levelled adjacent to the ditch beyond the grassed buffer strip
- that the ditch work include clearing and grubbing of brush and trees within the channel and within the working space

17.0 RECOMMENDATIONS (cont'd)

17.3 HOPF-WAGNER DRAIN – NEASE BRANCH (cont'd)

- that a new low flow pipe be installed under the CN Railway at Station 8+969 on the west side of Sherk Road to provide an improved outlet for an open ditch reconstruction from the north side of the track at Station 8+977 to the culvert under Forkes Road at Station 9+324
- that the existing 1200mm X 700mm concrete box culvert under Forkes Road at the head of the Branch be included as part of the municipal drain and have the sediment removed and disposed of

18.0 ENVIRONMENTAL MITIGATION MEASURES

We are recommending that the following environmental mitigation measures be included as part of the reconstruction proposal to help mitigate any potential adverse impacts of the proposed drainage works on water quality and fish habitat:

- timing of construction is to be only at times of low or no flow
- sediment basins are to be constructed and maintained along the course of the drain at the locations specified on the profile
- a temporary flow check of silt fencing is to be installed and maintained for the duration of the construction at the bottom end of the ditch reconstruction
- a low flow channel, one to two meters in bottom width, depending on location, shall be excavated as noted on the profiles along the entire length of the drain and the remaining original ditch bottom width will not be excavated/dredged in order to maintain a natural, undisturbed buffer along each side of the low flow channel
- excavated material from ditch cleanout is to be levelled
- a 9 meter wide buffer strip of existing vegetation between the top of the bank and adjacent lands on both sides is to be incorporated as part of the drain
- quarry stone rock chutes are to be constructed at surface inlet points to reduce erosion from direct surface water access into the ditch
- all work is to be completed from one side of the ditch with any natural vegetation, brush, trees, etc. that exist on the unaffected side of the ditch being retained to provide shade and cover
- that plantings be done on the lower portion on the drain Sta. 0+092 to 1+997 as requested by the D.F.O. using native species under recommendation of N.P.C.A.

18.0 ENVIRONMENTAL MITIGATION MEASURES (cont'd)

- all tile drain future outlets are to be installed with quarry stone rip-rap protection
- that the reconstruction and improvements to the Young and Hopf-Wagner Drains be undertaken through the work plan as described in the D.F.O. amended authorization 06-HCAA-CA4-2104. Drawing 1A forms part of this report which details recommendations with respect to construction timing, grassed buffers, re-vegetation including plantings for shade and protection of fish habitat, erosion protection and sediment control by way of construction staging and monitoring

19.0 SUMMARY OF PROPOSED WORK

The proposed work consists of approximately 10,138 lineal meters of low flow channel cleanout and reconstruction including rock chutes, bank seeding, construction of road culverts, railway low flow culverts and sediment basins as well as 76 lineal meters of 600mm dia. sewer pipe on the east side of White Road.

The following is a summary of the work to be completed on each individual property

19.1 YOUNG DRAIN

Sta. 0+072 – Sta. 0+092 Koabel Road

- Create low flow channel through existing rock check dam
- Clean through existing bridge

Sta. 0+092 – Sta. 0+986 L. Kit & D. Kit-Mete (Roll No. 130-004-211-00)

- Sta 0+092 – Sta. 0+300 work to be done from North Side
- Sta 0+300 – Sta. 0+986 work to be completed from South Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain
- Levelling of excavated material beside ditch, one side
- Seeding of ditch banks and buffer strips covered with excavated material
- Rearing and nursery plantings as required by D.F.O.

Sta. 0+986 – Sta. 1+006 Willodell Road

- Remove and dispose of the Steel truss bridge, including wood deck and abutments
- Installation of Twin- 3000mm dia. Culverts complete with quarry stone rip-rap protection around ends of culverts

19.0 SUMMARY OF PROPOSED WORK (cont'd)

19.1 YOUNG DRAIN (cont'd)

Sta. 1+006 – Sta. 1+487 D. & A. Silverthorne & R. & T. Portugaise (Roll No.130-004-180-00)

- Sta 1+006 – Sta. 1+325 Work to be completed from South Side
- Sta 1+325 – Sta. 1+487 Work to be completed from West Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks & buffer strips covered with excavated material
- Rearing and nursery plantings as required by D.F.O.

Sta. 1+487 – Sta. 1+997 N. Sauer (Roll No. 130-004-181-00)

- Work to be completed from West Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material
- Backfill washouts and install quarry stone rock chute along the drain (7 locations)
- Rearing and nursery plantings as required by D.F.O.

Sta. 1+997 – Sta. 2+017 Schneider Road

- Remove and dispose of the existing concrete culvert
- Installation of Twin- 2700mm dia. Culverts complete with quarry stone rip-rap protection around ends of culverts

Sta. 2+017 – Sta. 2+324 E. Landrum (Roll No. 130-004-228-00)

- Work to be completed from West Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 2+324 – Sta. 2+810 V. Scott (Roll No 130-004-234-00)

- Work to be completed from West Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

19.0 SUMMARY OF PROPOSED WORK (cont'd)

19.1 YOUNG DRAIN (cont'd)

Sta. 2+810 – Sta. 3+357 *J. & H. Swanson (Roll No 130-004-232-10)*

- Work to be completed from East / South Side
- Existing bridge to be worked around and not disturbed
- Existing low level crossing to be lowered and regraded
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material.

Sta. 3+357 – Sta. 3+454 *J. & D. Pierrynowski (Roll No. 130-004-232-02)*

- Debris jam (removal where required)
- Brushing to access debris to be to be done if necessary

Sta. 3+454 – Sta. 3+563 *J. & C. Castellanos (Roll No. 130-004-230-00)*

- Debris jam (removal where required)
- Brushing to access debris to be to be done if necessary

Sta. 3+563 – Sta. 3+593 *Regional Road 98 (Montrose Road)*

- No work required

Sta. 3+593 – Sta. 3+961 *P. & M. Kikkert (Roll No. 140-001-027-00)*

- Work to be completed from East / South Side
- Debris jam (removal where required)
- Brushing to access debris to be to be done if necessary

Sta. 3+961 – Sta. 4+161 *A. & R. Armenti (Roll No 140-001-026-00)*

- Work to be completed from East / South Side
- Debris jam (removal where required)
- Brushing to access debris to be to be done if necessary

Sta. 4+161 – Sta. 4+496 *E. & K. Edwards (Roll No. 140-001-029-00)*

- Work to be completed from East / South Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material
- Backfill washouts and install quarry stone rock chute along the drain (4 locations)

Sta. 4+496 – Sta. 4+524 *Regional Road 25 (Netherby Road)*

- Clean through culvert to grade
- Footings to be inspected once culvert is cleaned out to ensure stability
- Provisionally struts will have to be installed if excavation is below footings

19.0 SUMMARY OF PROPOSED WORK (cont'd)

19.1 YOUNG DRAIN (cont'd)

Sta. 4+524 – Sta. 4+622 *J. & D. Deschamps (Roll No. 150-001-007-00)*

- Work to be completed from West / North Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 4+622 – Sta. 4+867 *H. Najmudin (Roll No. 150-001-007-04)*

- Work to be completed from West / North Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 4+867 – Sta. 4+892 *L. McMahon (Roll No. 150-001-008-00)*

- Work to be completed from West / North Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 4+892 – Sta. 5+037 *L. McMahon (Roll No 040-006-124-15)*

- Work to be completed from West / North Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 5+037 – Sta. 5+333 *N. & L. Bateman (Roll No. 004-006-124)*

- Work to be completed from West / North Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 5+333 – Sta. 5+356 *Koable Road*

- Clean through Road culvert to grade
- Excavated material to be trucked away
- Footings to be inspected once culvert is cleaned out to ensure stability

19.0 SUMMARY OF PROPOSED WORK (cont'd)

19.1 YOUNG DRAIN (cont'd)

Sta. 5+536 – Sta. 5+450 *J. Ruicci & D. Borg (Roll No. 004-006-125-00)*

- Work to be completed from West / North Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 5+450 – Sta. 5+480 *Canadian Pacific Railway (Roll No. 004-006-996-00)*

- Clean through the C.P. Rail culvert to grade and material to be hauled

Sta. 5+480 – Sta. 5+770 *S. & S. Hall (Roll No. 040-006-129-00)*

- Work to be completed from North / West Side (Sta 5+480-5+580)
- Work to be completed from South / East Side (Sta 5+580-5+770)
- Existing crossing not to be disturbed
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 5+770 – Sta. 5+983 *Heritage Family Holdings LLC (Roll No. 004-006-128-00)*

- Work to be completed from East / South Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 5+983 – Sta. 6+430 *J. Post & S. Robb (Roll No. 004-006-131-00)*

- Work to be completed from East/South Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 6+430 – Sta. 6+683 *J. Grimaldi (Roll No. 004-006-133-00)*

- Work to be completed from East / South Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 6+683 – Sta. 6+706 *Green Road*

- Clean through culvert to grade
- Excavated material to be trucked away
- Footings to be inspected once culvert is cleaned out to ensure stability

19.0 SUMMARY OF PROPOSED WORK (cont'd)

19.1 YOUNG DRAIN (cont'd)

Sta. 6+706 – Sta. 7+007 *L. & P. Durliat (Roll No. 004-006-134-00)*

- Work to be completed from East / South Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 7+007 – Sta. 7+060 *L. & C. Schneider (Roll No. 040-006-135-00)*

- Work to be completed from East / South Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 7+060 – Sta. 7+107 *Canadian National Railway (Roll No. 004-006-999-00)*

- Installation of 30m length – 750mm dia. steel pipe under railway by boring
- access to be gained through the L. & C. Schneider property (Roll No. 040-006-135-00)
- bore to be done from the south side of the railway

Sta. 7+107 – Sta. 7+159 *L. & C. Schneider (Roll No. 040-006-135-00)*

- Work to be completed from East / South Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 7+159 – Sta. 7+191 *Forkes Road*

- Clean through existing culvert to grade
- Excavated material to be trucked away
- Footings to be inspected once culvert is cleaned out to ensure stability, provisionally if there are concerns struts will have to be installed by the road authority

Sta. 7+191 – Sta. 7+528 *W. & L. Collard (Roll No.004-006-099-02)*

- Work to be completed from North / West Side
- Existing culvert to be cleaned through and then footing inspected to ensure stability, provisionally if there are concerns the owner will have to install struts otherwise the structure will need to be removed
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

19.0 SUMMARY OF PROPOSED WORK (cont'd)

19.1 YOUNG DRAIN (cont'd)

Sta. 7+528 – Sta. 7+558 *Canadian National Railway (Roll No. 004-006-999-00)*

- Installation of 30m length – 750mm dia. steel pipe under railway by boring
- Access to be gained through the E. & M. Geyer property (Roll No. 040-006-101-00)
- Bore to be done from the west side of the railway

Sta. 7+558 – Sta. 7+630 *E. & M. Geyer (Roll No. 040-006-101-00)*

- Relocate drain and backfill existing ditch including stripping and redistributing topsoil
- Low flow channel excavation including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material
- Future maintenance excavated material to be spread adjacent to drain (North side)

Sta. 7+630 – Sta. 7+764 *C. & H. Aimesbury (Roll No. 040-006-102-00)*

- Relocate drain and backfill existing ditch including stripping and redistributing topsoil
- Low flow channel excavation drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material
- Future maintenance excavated material to be spread adjacent to drain (North side)

19.2 HOPF-WAGNER DRAIN

Sta. 7+764 – Sta 7+885 *C. & H Aimesbury (Roll No. 040-006-102-00) & C. N. Railway*

- Work to be completed from North Side
- Ditch to be located on the C.N right-of-way work to be done and material levelled on the Aimesbusy property
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks
- Excavated material to be relocated to backfill existing ditch
- Future maintenance excavated material to be spread adjacent to drain

Sta. 7+885 – Sta. 8+078 *Canadian National Railway (Roll No. 004-006-999-00)*

- Sta 7+885 – Sta. 7+891 Work to be completed from North Side
- Sta 7+891 – Sta. 7+914 Clean through existing culvert (if required)
- Sta 7+914 – Sta. 8+078 Work to be completed from South Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

19.0 SUMMARY OF PROPOSED WORK (cont'd)

19.2 HOPF-WAGNER DRAIN

Sta. 8+078 – Sta. 8+098 Brookfield Road

- Clean through existing Brookfield Road culvert
- Excavated material to be trucked away
- Culvert to be inspected once culvert is cleaned out to verify condition, provisionally if in poor condition then culvert will be replaced and ditch relocated

Sta. 8+098 – Sta. 8+326 G. & J. Tice (Roll No.004-006-112-00) & C. N. Railway

- Ditch located on the C.N. Railway property
- Work to be completed from South Side
- Material to be spread on the South Side (G. & J. Tice property Roll No. 004-006-112-00)
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 8+326 – Sta. 8+530 E. Carver (Roll No. 040-006-110-00) & Canadian National Railway

- Ditch located on the C.N. Railway property
- Work to be completed from South Side
- Material to be spread on the South Side (E. Carver property Roll No. 004-006-110-00)
- Existing concrete culvert to be removed and disposed of
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 8+530 – Sta. 8+745 K. & S. Fox (Roll No. 040-006-142-00) & Canadian National Railway

- Ditch located on the C.N. Railway property
- Work to be completed from South Side
- Material to be spread on the South Side (K. & S. Fox property Roll No. 004-006-110-00)
- New 1200mm dia. C.S.P. culvert to be installed and existing concrete culvert to be broke up and used as rip-rap protection
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 8+745 – Sta. 8+937 C. Menard & C. Barker (Roll No. 040-006-146-01) & C. N. Railway

- Ditch located on the C.N. Railway property
- Work to be completed from South Side
- Material to be spread on the South Side (C. Menard & C. Barker property Roll No. 004-006-146-01)
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

19.0 SUMMARY OF PROPOSED WORK (cont'd)

19.2 HOPF-WAGNER DRAIN

Sta. 8+937 – Sta. 8+957 *Sherk Road*

- Remove and dispose exist conc. culvert
- Installation of 17m length-1200mm dia. concrete culvert by open cut
- Quarry stone rip-rap protection around ends of culvert
- Surface restoration of road with Hot Mix Asphalt

Sta. 8+957 – Sta. 9+365 *B. & H. Sonnenberg (Roll No. 040-006-145-00) & C. N. Railway*

- Ditch located on the C.N. Railway property
- Material to be spread on the South Side B. & H. Sonnenberg (Roll No. 040-006-145-00) property and Railway lands
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 9+365 – Sta. 9+571 *M. Butler Est.(Roll No. 040-006-149-00) & Canadian National Railway*

- Ditch located on the C.N. Railway property
- Material to be spread on the South Side M. Butler (Roll No. 040-006-149-00) property and Railway lands
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 9+571 – Sta. 9+796 *A. & R. Dickey(Roll No. 040-006-147-00) & C. N. Railway*

- Work to be completed from South Side within Railway property
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material
- Buffer only on Dickey property (4m) all material to be levelled on railway

Sta. 9+796 – Sta. 9+828 *Canadian National Railway(Roll No. 004-006-999-00)*

- Installation of 22m length – 600mm dia. steel pipe under railway by boring

Sta. 9+828 – Sta. 9+906 *Enbridge Gas Distribution(Roll No. 004-006-154-05)*

- Excavate open ditch between new railway bore pipe and new H.D.P.E. pipe
- Installation of 600mm dia. H.D.P.E. sewer pipe parallel to White Road
- Excavate three Bell cables and one Hydro cable and relocate over and under new pipe

Sta. 9+906 – Sta. 9+929 *White Road & Forkes Road*

- No work required

19.0 SUMMARY OF PROPOSED WORK (cont'd)

19.3 NEASE BRANCH

Sta. 8+959 – Sta. 8+981 *Canadian National Railway (Roll No. 004-006-999-00)*

- Installation of 18m length– 600mm dia. steel pipe under railway by boring

Sta. 8+981 – Sta. 9+195 *S. & D. Nease (Roll No. 040-06-146-00) & C. N. Railway*

- Work to be completed from North Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 9+195 – Sta. 9+313 *S. & D. Nease (Roll No. 040-06-146-00)*

- Work to be completed from East Side
- Mechanical brushing and clearing of trees on one side for excavation work and levelling
- Low flow channel excavation from the bottom of the existing drain including sediment pools
- Seeding of ditch banks and buffer strips covered with excavated material

Sta. 9+313 – Sta. 9+324 *Forkes Road*

- Clean through exist C.S.P. under Forks Road and dispose of excavated material

20.0 SCHEDULES

Four schedules are attached hereto and form part of this report, being Schedule 'A' - Allowances, Schedule 'B' - Cost Estimate, Schedule 'C' - Assessment for Construction and Schedule 'D' - Assessment for Maintenance.

Schedule 'A' - Allowances. In accordance with Sections 29 and 30 of the Drainage Act, allowances are provided for right-of-way and damages to lands and crops along the route of the drain as defined below.

Schedule 'B' - Cost Estimate. This schedule provides for a detailed cost estimate of the proposed work which is in the amount of \$790,600.00. This estimate includes engineering and administrative costs associated with this project. The estimated cost in the City of Niagara Falls is \$298,900.00 and the estimated cost in the City of Port Colborne is \$491,700.00.

Schedule 'C' - Assessment for Construction. This schedule outlines the distribution of the total estimated cost of construction over the roads and lands which are involved.

Schedule 'D' - Assessment for Maintenance. In accordance with Section 38 of the Drainage Act, this schedule outlines the distribution of future repair and/or maintenance costs for portions of, or the entire drainage works.

20.0 SCHEDULES (cont'd)

Drawing No.'s 1A and 1 - 5, Job No. 90070 and specifications form part of this report. They show and describe in detail the location and extent of the work to be done and the lands which are affected.

21.0 ALLOWANCES

20.1 DAMAGES: Section 30 of the Drainage Act provides for the compensation to landowners along the drain for damages to lands and crops caused by the construction of the drain.

The amounts granted for open drain work with excavated material leveled adjacent to drain is \$ 2,480.00/ha. This base rate is multiplied by the hectares derived from the working widths shown on the plans and the applicable lengths.

20.2 RIGHT-OF-WAY: Section 29 of the Drainage Act provides for an allowance to the owners whose land must be used for the construction, repair, or future maintenance of a drainage works.

For open sections of drain, the allowance provides for the loss of land due to the construction provided for in the report. The amounts granted are based on the value of the land, and the rate used was \$1,250.00/ha. for woodlot and \$2,500.00/ha. for cropped lands. When any buffer strip is incorporated, the allowance granted is for any land beyond a 2.0 meter width deemed to have always been part of the drain. For existing open sections of drain, the right-of-way to provide for the right to enter and restrictions imposed on those lands, was not granted under the 1928 Young Drain or 1917 Hopf-Wagner Drain reports.

22.0 ASSESSMENT DEFINITIONS

In accordance with the Drainage Act, lands that make use of a drainage works are liable for assessment for part of the cost of constructing and maintaining the system. These assessments are known as benefit, outlet liability and special benefit as set out under Sections 22,23,24 and 26 of the Act.

BENEFIT as defined in the Drainage Act means the advantages to any lands, roads, buildings or other structures from the construction, improvement, repair or maintenance of a drainage works such as will result in a higher market value or increased crop production or improved appearance or better control of surface water, or any other advantages relating to the betterment of lands, roads, buildings or other structures.

SPECIAL BENEFIT is assessed to lands for which some additional work or feature has been included in the report that does not affect the functioning of the drain such as culverts or outlet pipes.

22.0 ASSESSMENT DEFINITIONS (cont'd)

OUTLET Liability is assessed to lands or roads that may make use of a drainage works as an outlet either directly or indirectly through the medium of any other drainage works or of a swale, ravine, creek or watercourse.

In addition, a Public Utility or Road Authority shall be assessed for and pay all the increased cost to a drainage works due to the construction and operation of the Public Utility or the Municipal Road System. This may be shown as either benefit or Special Assessment.

23.0 ASSESSMENT

A modified "*Todgham Method*" was used to calculate the assessments shown on Schedule 'C' - Assessment for Construction. This entailed breaking down the costs of the drain into sections along its route. Special Assessments and Special Benefits were then extracted from each section.

The remainder is then separated into Benefit and Outlet costs. The Benefit cost is distributed to those properties receiving benefit as defined under "Assessment Definitions", with such properties usually being located along or close to the route of the drain. The Outlet Costs are distributed to all properties within the watershed area of that section on an adjusted basis. The areas are adjusted for location along that section, and relative run-off rates. Due to their different relative run-off rates, forested lands have been assessed for outlet at lower rates than cleared lands. Also, roads and residential properties have been assessed for outlet at higher rates than cleared farm lands.

The actual cost of the work involving this report, with the exception of Special Assessments, is to be assessed on a pro-rata basis against the lands and roads liable for assessment for benefit and outlet as shown in detail on Schedule 'C' - Assessment for Construction. The Special Assessments shall be levied as noted in the section "Special Assessment".

24.0 SPECIAL ASSESSMENT

In accordance with Section 26 of the Drainage Act, a Special Assessment has been made against the City of Niagara Falls Road Authority being the increased cost to the drainage work for removal of the existing bridge structure and abutments and the installation of a new twin pipe culvert crossing across their road allowance on the Young Drain, due to the construction and operation of Willodell Road. The Special Assessment shall be made up of the actual cost of this work and both the final and estimated values of the Special Assessment are to be calculated as follows:

<i>Drain</i>	<i>Cost of Work</i>	<i>Less Equivalent Drain Cost (Fixed)</i>	<i>Plus Administration Cost</i>	<i>Plus Net H.S.T.</i>	<i>Special Assessment</i>
<i>Young Drain (Willodell Road) Sta.0+996 (Niagara Falls)</i>	\$40,800	\$400	\$9,600	\$880	\$50,880

The above special assessment shall not apply for future maintenance purposes.

If the City of Niagara Falls elects to perform the works themselves under a separate contract, the above Special Assessment shall be reduced by \$40,800. Otherwise this portion of the work shall be included in the general contract.

In accordance with Section 26 of the Drainage Act, a Special Assessment has been made against the City of Niagara Falls Road Authority being the increased cost to the drainage work for the removal of the existing concrete culvert and the installation of a twin pipe culvert crossing of the road allowance on the Young Drain, due to the construction and operation of Schneider Road. The Special Assessment shall be made up of the actual cost of this work and both the final and estimated values of the Special Assessment are to be calculated as follows:

<i>Drain</i>	<i>Cost of Work</i>	<i>Less Equivalent Drain Cost (Fixed)</i>	<i>Plus Administration Cost</i>	<i>Plus Net H.S.T.</i>	<i>Special Assessment</i>
<i>Young Drain (Schneider Road) Sta.2+006 (Niagara Falls)</i>	\$37,000	\$400	\$10,800	\$830	\$48,230

The above special assessment shall not apply for future maintenance purposes.

If the City of Niagara Falls elects to perform the works themselves under a separate contract, the above Special Assessment shall be reduced by \$37,000. Otherwise this portion of the work shall be included in the general contract.

In accordance with Section 26 of the Drainage Act, Special Assessments have been made against the CN Railway being the increased cost to the drainage work for installing four railway low flow pipes across their right-of-way on the Young and Hopf-Wagner Drains, due to the construction and operation of the railways. No cost of flagging has been included as the CNR indicated they would not pass this cost on to the municipality. If it is passed along then it is to be included. The Special Assessments shall be made up of the actual cost of this work and both the final and estimated values of the Special Assessment are to be calculated as follows:

24.0 SPECIAL ASSESSMENT (cont'd)

<i>Drain</i>	<i>Cost of Work</i>	<i>Less Equivalent Drain Cost (Fixed)</i>	<i>Plus Administration Cost</i>	<i>Soil Report & Inspection</i>	<i>Plus Net H.S.T.</i>	<i>Special Assessment</i>
<i>Young Drain (CN Rail) Sta.7+086</i>	\$29,600	\$500	\$8,700	\$10,950	\$860	\$49,610
<i>Young Drain (CN Rail) Sta.7+542</i>	\$26,600	\$500	\$8,700	\$10,950	\$810	\$46,560
<i>Hopf-Wagner Drain Nease Branch Sta.8+969 (CN Rail)</i>	\$18,000	\$500	\$8,700	\$10,950	\$650	\$37,800
<i>Hopf-Wagner Drain STA 9+807 (CN Rail)</i>	\$18,000	\$500	\$8,700	\$10,950	\$650	\$37,800

The above special assessments shall not apply for future maintenance purposes.

In accordance with Section 26 of the Drainage Act, a Special Assessment has been made against the City of Port Colborne Road Authority being the increased cost to the drainage work for cleaning of the existing culvert under Brookfield Road to grade during construction on the Hopf - Wagner Drain. The special assessment shall also include the engineering cost to design and include the potential replacement culvert on the drawing and prepare the appropriate special assessment as well as to remove it from the proposal. The cost of the above shall be \$7,070 and shall not be prorated.

In accordance with Section 26 of the Drainage Act, a Special Assessment has been made against the City of Port Colborne Road Authority being the increased cost to the drainage work for the removal of an existing culvert and the installation of a new road culvert on the Hopf-Wagner Drain, due to the construction and operations of Sherk Road. The Special Assessment shall be made up of the actual cost of this work and both the final and estimated values of the Special Assessment are to be calculated as follows:

<i>Drain</i>	<i>Cost of Work</i>	<i>Less Equivalent Drain Cost (Fixed)</i>	<i>Plus Administration Cost</i>	<i>Plus Net H.S.T.</i>	<i>Special Assessment</i>
<i>Hopf-Wagner Drain Sherk Road (Port Colborne)</i>	\$28,600	\$400	\$6,250	\$620	\$36,070

The above special assessment shall not apply for future maintenance purposes.

If the City of Port Colborne elects to perform the works themselves under a separate contract, the above Special Assessment shall be reduced by \$28,600. Otherwise this portion of the work shall be included in the general contract.

24.0 SPECIAL ASSESSMENT (cont'd)

A Special Assessment under Section 26 of the Drainage Act has been made against the Enbridge Gas Distribution property (Roll No. 004-006-179-00) on the Hopf-Wagner Drain for part of the cost of relocating the municipal drain from the Forkes Road, south ditch to a new location along the Canadian National Railway right-of-way and White Road, due to the proximity of their existing high pressure gas main along and across Forkes Road. The Special Assessment shall be \$50,170.00 and shall not be pro-rated based on the final drain costs.

If any other additional work is required to the drainage works due to the existence of buried utilities such as gas pipe lines, communications cables, etc. or if any of the utilities require relocation or repair, then, the extra costs incurred shall be borne by the utility involved in accordance with the provisions of Section 26 of the Drainage Act.

25.0 GRANTS

In accordance with the provisions of Section 85 of the Drainage Act, a grant **may** be available for assessments against privately owned parcels of land which are used for agricultural purposes and eligible for the Farm Property Class Tax rate. Section 88 of the Drainage Act directs the Municipality to make application for this grant upon certification of completion of this drain. The Municipality will then deduct the grant from the assessments prior to collecting the final assessments.

26.0 MAINTENANCE

Upon completion of construction, all owners are hereby made aware of Sections 80 and 82 of the Drainage Act which forbid the obstruction of, and damage or injury to, a municipal drain.

After completion, the portion of the Young Drain located within the City of Niagara Falls shall be maintained by the City of Niagara Falls and the portion of the Young Drain located within the City of Port Colborne and the entire Hopf-Wagner Drain including the Nease Branch shall be maintained by the City of Port Colborne at the expense of all upstream lands and roads assessed in Schedule 'D' - Assessment for Maintenance and in the same relative proportions, until such time as the assessment is changed under the Drainage Act.

Repairs or improvements to any road and railway culvert or bridge required by the performance of this work and for future repair and/or replacement, shall be the responsibility of the applicable Road and Railway Authority, entirely at their cost. If the culvert under Brookfield Road is replaced in the future, the work shall be completed in accordance with Detail "C" on Drawing No. 4 of 5.

26.0 MAINTENANCE (cont'd)

The Barnhart Drains No.1 and No.2 were constructed and are to be maintained as set out in accordance with the 1906 Award by George Ross. These Award Drains have no status under the current Drainage Act. If an Award Drain falls into disrepair and the parties assessed do not comply with the requirements as set out, civil court action may be required to honour the original Award. An alternative action can be taken under Section 4 of the Drainage Act. The now current parties to the Award can petition for a new report by an engineer to reconstruct and maintain these two drains.



JRS:bv

Respectfully submitted,

SPRIET ASSOCIATES LONDON LIMITED

A handwritten signature in black ink that reads 'J R Spriet'.

J. R. Spriet, P. Eng.

SCHEDULE 'A' - ALLOWANCES
YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

In accordance with Sections 29 and 30 of the Drainage Act, we determine the allowances payable to owners entitled thereto as follows:

CONCESSION	LOT	ROLL NUMBER (Owner)	Section 29 Right-of-Way	Section 30 Damages	TOTALS
YOUNG DRAIN - (Sta. 0+072 to 7+764)					
City of Port Colborne					
<i>(Geographic Humberstone)</i>					
4	Pt. 9	040 00609902 (W. & L. Collard)	\$ 740.00	\$ 1,250.00	\$ 1,990.00
4	Pt. 9	040 00610100 (E. & M. Geyer)	170.00	480.00	650.00
4	Pt. 10	040 00610200 (C. & H. Aimsbury)	230.00	500.00	730.00
5	Pt. 4	040 00612400 (N. & L. Bateman)	870.00	1,100.00	1,970.00
5	Pt. 4	040 00612415 (L. McMahon)	380.00	540.00	920.00
5	Pt. 5	040 00612500 (D. Borg-Rucci)	240.00	350.00	590.00
5	Pt. 5	040 00612800 (Heritage Family Holdings LLD')	770.00	790.00	1,560.00
5	Pt. 5	040 00612900 (S. & S. Hall)	630.00	1,260.00	1,890.00
5	Pt. 6	040 00613100 (J. Post & S. Robb)	1,000.00	1,340.00	2,340.00
5	Pt. 6	040 00613300 (J. Grimaldi)	440.00	760.00	1,200.00
5	Pt. 7	040 00613400 (L. & P. Durliat)	1,050.00	1,120.00	2,170.00
5	SWPt. 7	040 00613500 (L. & C. Schneider)	380.00	450.00	830.00
City of Niagara Falls					
<i>(Geographic Willoughby)</i>					
6	1	130 00418100 (N.. Sauer)	\$ 1,550.00	\$ 1,900.00	\$ 3,450.00
6	WPt. 2	130 00418000 (D.&A.Silverthorne,R.&T.Portugaise)	970.00	280.00	1,250.00
7	2	130 00421100 (L. Kit, D. Kit-Mete)	1,560.00		1,560.00
1st Cross	WPt. 13	130 00422800 (E. Landrum)	1,070.00	1,140.00	2,210.00
1st Cross	Pt.14 & 15	130 00423210 (J. & H. Swanson)	1,790.00	2,030.00	3,820.00
1st Cross	Pt.14 & 15	130 00423400 (V. Scott)	1,280.00	1,810.00	3,090.00
1st Cross	Pt. 15	130 00423000 (J. & C. Castellanos)	190.00	410.00	600.00
1st Cross	Pt. 15	130 00423202 (J. & D. Pierrynowski)	170.00	360.00	530.00
<i>(Geographic Crowland)</i>					
7,Gore	Pt. 1	140 00102600 (A. & R. Armenti)	\$ 350.00	\$ 600.00	\$ 950.00
7	Pt. 1	140 00102700 (P. & M. Kikkert)	640.00		640.00
7,Gore	Pt. 2	140 00102900 (E. & K. Edwards)	1,100.00	1,250.00	2,350.00
<i>(Geographic Humberstone)</i>					
5	Pt.3 & 4	150 00100700 (J. & D. Deschamps)	\$ 170.00	\$ 290.00	\$ 460.00
5	Pt. 4	150 00100704 (H. Najmudin)	430.00	740.00	1,170.00
5	Pt. 4	150 00100800 (L. McMahon)	40.00	90.00	130.00
Total Allowances			\$ 18,210.00	\$ 20,840.00	\$ 39,050.00

Total Allowances under Sections 29 and 30 of the Drainage Act on
 YOUNG DRAIN - (Sta. 0+072 to 7+764)

\$ 39,050.00

SCHEDULE 'A' - ALLOWANCES (Cont'd)

YOUNG & HOPF-WAGNER DRAINS
City of Port Colborne

CONCESSION	LOT	ROLL NUMBER (Owner)	Section 29 Right-of-Way	Section 30 Damages	TOTALS
HOPF WAGNER DRAIN - MAIN DRAIN (STA. 7+764 to 9+929)					
<i>(Geographic Humberstone)</i>					
4	Pt. 10	040 00610200 (C. & H. Aimsbury)	\$ 110.00	\$ 450.00	\$ 560.00
4	Pt.W½ 11	040 00611000 (J. Carver)	180.00	760.00	940.00
4	Pt.E½ 11	040 00611200 (G. & J. Tice)	180.00	850.00	1,030.00
4	Pt. 12	040 00614200 (K. & S. Fox)	180.00	800.00	980.00
4	Pt.W½ 12	040 00614601 (C. Menard, C. Barker)	180.00	710.00	890.00
4	Pt. 13	040 00614500 (B. & H. Sonnenberg)	710.00	1,520.00	2,230.00
4	Pt. 14	040 00614900 (M. Butler Est.)	260.00		260.00
4	Pt. 14	040 00614700 (A. & R. Dickey)	280.00		280.00
4	Pt. 14	040 00615405 (Enbridge Gas Distribution)	200.00	450.00	650.00
4&5	Pt. 10 - 15	040 00699900 (C.N.R.)	1,050.00		1,050.00
Total Allowances			\$ 3,330.00	\$ 5,540.00	\$ 8,870.00

**Total Allowances under Sections 29 and 30 of the Drainage Act on
HOPF WAGNER DRAIN - MAIN DRAIN (STA. 7+764 to 9+929) \$ 8,870.00**

HOPF WAGNER DRAIN - NEASE BRANCH (STA. 8+957 to 9+324)

<i>(Geographic Humberstone)</i>					
4	NPt. 13	040 00614600 (S. & D. Nease)	\$ 310.00	\$ 1,240.00	\$ 1,550.00
Total Allowances			\$ 310.00	\$ 1,240.00	\$ 1,550.00

**Total Allowances under Sections 29 and 30 of the Drainage Act on
HOPF WAGNER DRAIN - NEASE BRANCH (STA. 8+957 to 9+324) \$ 1,550.00**

**Total Allowances under Sections 29 and 30 of the Drainage Act on
YOUNG & HOPF-WAGNER DRAINS \$ 49,470.00**

SCHEDULE 'B' - COST ESTIMATE

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

We have made an estimate of the cost of the proposed work which is outlined in detail as follows:

YOUNG DRAIN - (Sta. 0+072 to 7+764)

Sta. 0+072 - Sta. 3+350 and Sta. 4+161 - Sta. 7+764		
Mechanical brushing and clearing of trees on one side for excavation work and levelling	\$	24,300.00
6,953 meters of low flow channel excavation from the bottom of the existing drain including sediment pools. (Approx. 18,000m ³)	\$	58,500.00
Levelling of excavated material beside ditch, one side	\$	13,900.00
Seeding of buffer strips covered with excavated material. (Approx. 42000m ²)	\$	8,400.00
Seeding of ditch banks. (Approx. 28,600m ²)	\$	10,000.00
Sta. 0+072		
Create low flow channel through existing rock chute under Koable Road	\$	500.00
Sta. 0+996		
Remove and dispose of the Willodell Road Steel truss bridge, including wood deck and abutments	\$	5,000.00
Two 15 meter lengths of 3000mm dia., 3.5mm thick aluminized corrugated steel pipes for a new culvert replacement under Willodell Road		
Supply of pipe and couplers (125mm x 25mm corrugations)	\$	20,700.00
Installation as noted on plan with granular backfill and quarry stone rip-rap protection and granular for lane crossing (Approx. 20m ³ quarry stone required)	\$	15,100.00
Sta. 1+487 - Sta 1+997, Sta 4+161 - Sta. 4+496, Sta. 6+706 - Sta. 7+007		
Backfill washouts and install quarry stone rock chute along the drain (13 locations)	\$	5,900.00
Sta. 2+006		
Remove and dispose of the ex. concrete culvert under Schneider Road	\$	4,000.00
Two 15 meter lengths of 2,700mm diameter, 3.5mm thick aluminized corrugated steel pipes for a culvert replacement under Schneider Road		
Supply of pipe and couplers (125mm x 25mm corrugations)	\$	18,600.00
Installation as noted on plan with granular backfill and quarry stone rip-rap protection (Approx. 20m ³ quarry stone required)	\$	14,400.00
Sta. 2+900		
Remove and reinstall existing timber low level crossing, newly constructed slopes to be a minimum of 8:1slopes	\$	5,000.00

SCHEDULE 'B' - COST ESTIMATE (cont'd)

YOUNG & HOPF-WAGNER DRAINS
City of Port Colborne**YOUNG DRAIN - (Sta. 0+005 to 7+764) Cont'd**

Sta. 3+593 - Sta. 4+161		
Brushing and tree removal for spot access and debris removal through woodlot area	\$	5,500.00
Sta. 4+509		
Clean through the Netherby Road culvert to grade including traffic control	\$	1,500.00
Sta. 5+346		
Clean through the Koable Road culvert to grade including traffic control	\$	1,500.00
Sta. 5+467		
Clean through the C.P. Rail culvert to grade	\$	2,000.00
Sta. 6+697		
Clean through the Green Road culvert to grade including traffic control	\$	1,500.00
Sta. 7+068 - Sta. 7+098		
30 meters of 750mm dia. 10.3mm thickness smooth wall steel pipe		
Supply	\$	10,000.00
Installation under C.N. Railway by boring, including supply and installation of quarry stone rip-rap protection at each end of pipe (approx. 4m ³ quarry stone required)	\$	19,600.00
Sta. 7+171		
Clean through exist. culvert to grade under Forks Road including traffic control	\$	1,500.00
Sta. 7+531 - Sta. 7+557		
26 meters of 750mm dia. 10.3mm thickness smooth wall steel pipe		
Supply	\$	9,000.00
Installation under CN Railway by boring, including supply and installation of quarry stone rip-rap protection at each end of pipe (approx. 4m ³ quarry stone required)	\$	17,600.00
Sta. 7+557 - Sta. 7+764		
Relocate 207 meters of drain and backfill exist. ditch	\$	5,200.00
Sta. 0+092 - Sta. 0+988, Sta. 1+008 - 1+997		
Rearing and nursery plantings as required by D.F.O.	\$	9,600.00
Contingencies	\$	8,700.00
Allowances under Sections 29 & 30 of the Drainage Act	\$	39,050.00

SCHEDULE 'B' - COST ESTIMATE (cont'd)

YOUNG & HOPF-WAGNER DRAINS
City of Port Colborne**HOPF WAGNER DRAIN - MAIN DRAIN (STA. 7+764 to 9+929)**

Sta. 7+764 - Sta. 9+796		
Mechanical brushing and clearing of trees on one side for excavation work and levelling	\$	7,100.00
1,195 meters of low flow channel excavation from the bottom of the existing drain and 837 meters of new ditch construction including sediment pools, (Approx. 5,000m ³)	\$	17,500.00
Levelling of excavated material	\$	3,600.00
Seeding of ditch banks. (Approx. 8,000m ²)	\$	2,800.00
Seeding of buffer strips covered with excavated material, (Approx. 12000m ²)	\$	2,400.00
Sta. 7+899		
Clean through existing C.N. culvert to grade	\$	1,500.00
Sta. 8+082		
Clean through Brookfield Road culvert including traffic control	\$	1,500.00
Sta. 8+524		
Remove and Disposed of existing 1.2m span concrete culvert	\$	800.00
Sta. 8+731 - Sta. 8+740		
9 meters of 1200mm dia., 2.0mm thick, aluminized steel pipe under Laneway		
Supply of pipe and couplers	\$	2,300.00
Remove and break up existing 1.2m span concrete culvert and us as rip-rap		
Installation by open cut, including bedding and backfill materials (Approx 4m ³ Additional Quarry Stone Req'd)	\$	2,800.00
Sta. 8+939 - Sta. 8+956		
Remove and dispose exist 1.2m span conc. culvert under Sherk Road	\$	3,000.00
17 meters of 1200mm dia., Class 65-D reinforced concrete pipe under Sherk Road		
Supply of pipe and couplers	\$	11,900.00
Installation by open cut, including bedding and backfill materials including traffic control (Detour) (Approx 8m ³ Quarry Stone Req'd)	\$	10,200.00
Surface Restoration with Hot Mix Asphalt	\$	3,500.00
Sta. 9+796 - Sta. 9+818		
22 meters of 600mm dia., 9.5mm thickness smooth wall steel pipe		
Supply	\$	6,000.00
Installation under CN Railway by boring, including supply and installation of quarry stone rip-rap protection at each end of pipe (approx. 4m ³ quarry stone required)	\$	12,000.00
Sta. 9+818 - Sta. 9+831		
13 meters of open ditch excavation between the end of the railway bore pipe and the 600mm HDPE pipe, including hauling of material and seeding disturbed areas	\$	500.00

SCHEDULE 'B' - COST ESTIMATE (cont'd)

YOUNG & HOPF-WAGNER DRAINS**City of Port Colborne****HOPF WAGNER DRAIN - MAIN DRAIN (STA. 7+764 to 9+929)**

Sta. 9+831 - Sta. 9+907

76 meters of 600mm dia. H.D.P.E. sewer pipe

Supply

\$ 6,200.00

Install on Enbridge Gas Distribution Inc. property including bedding, backfill restoration, and traffic control as required

\$ 10,300.00

Sta. 9+841 , Sta. 9+843, Sta. 9+845, Sta. 0+868

Excavate three Bell cables and one Hydro cable and relocate over and under sewer pipe

\$ 4,800.00

Sta. 9+865

Supply and Installation of 600mm x 600mm off-set ditch inlet catchbasin with 5m length - 200mm lead including grate, and grading

\$ 2,500.00

Contingencies

\$ 3,400.00

Allowances under Sections 29 and 30 of the Drainage Act

\$ 8,870.00

HOPF WAGNER DRAIN - NEASE BRANCH (STA. 8+957 to 9+324)

Sta 8+959 - Sta. 8+977

One 18 meter length of 600mm dia. 9.5 thickness smooth wall steel pipe (Sta. 8+969)

Supply

\$ 6,000.00

Installation under C.N. Railway by boring, including supply and installation of quarry stone rip-rap protection at each end of pipe (approx. 4m³ quarry stone required)

\$ 12,000.00

Sta 8+977 - Sta. 9+324

347 meters of open ditch excavation (approx. 490m³)

\$ 1,500.00

Levelling of excavated material

\$ 800.00

Seeding of buffer strips covered with excavated material, approx. 1500m²

\$ 300.00

Seeding of ditch banks (Approx. 1050m²)

\$ 500.00

Mechanical brushing and clearing

\$ 800.00

Sta. 9+317

Clean through exist. C.S.P. under Forks Road and dispose of excavated material

\$ 500.00

Contingencies

\$ 500.00

Allowances under Sections 29 and 30 of the Drainage Act

\$ 1,550.00

SCHEDULE 'B' - COST ESTIMATE (cont'd)

YOUNG & HOPF-WAGNER DRAINS
City of Port Colborne**ADMINISTRATION**

Net Harmonized Sales Tax	\$ 12,200.00
Preliminary Report	\$ 4,530.00
Revised Preliminary Report	\$ 4,100.00
Survey, Plan and Final Report	\$ 191,170.00
Expenses	\$ 7,390.00
Soils Report, Soils Construction Inspection, and Field Monitoring	\$ 43,800.00
Tender documents, review of Tenders, field and office supervision of construction final inspection and expenses	\$ 40,940.00
TOTAL ESTIMATED COST	\$ 790,600.00

SCHEDULE 'C' - ASSESSMENT FOR CONSTRUCTION

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

Job No. 90070

July 27, 2017

CON.	LOT	HECTARES AFFECTED	ROLL No.	(OWNER)	BENEFIT	OUTLET	TOTAL
YOUNG DRAIN - (Sta. 0+072 to 7+764)							
City of Port Colborne							
<i>(Geographic Humberstone)</i>							
*	4	Pt. 4	1.10	040 00607800 (D. & S. Anderson)	\$	\$ 87.00	\$ 87.00
	4	Pt.E½	5 2.50	040 00608100 (D. & L. Pirson)		316.00	316.00
*	4	Pt.W½	5 3.60	040 00608200 (M. & R. Nicholls)		489.00	489.00
*	4	Pt.E½	6 5.59	040 00609200 (V. Hermoza)		755.00	755.00
*	4	Pt.W½	6 2.30	040 00608600 (Heritage Family Holdings)		283.00	283.00
*	4	Pt.W½	6 1.48	040 00608601 (Heritage Family Holdings)		179.00	179.00
	4	Pt.E½	7 4.39	040 00609301 (A. Ruigrok)		859.00	859.00
	4	Pt.NW½	7 3.64	040 00609400 (D. & L. Showler)		801.00	801.00
	4	Pt.SW½	7 8.05	040 00609405 (L. & B. Durliat)		1,935.00	1,935.00
*	4	Pt. 8	1.03	040 00609500 (W. Schneider, B. Gingras)		242.00	242.00
	4	Pt. 8	1.89	040 00609600 (L. & P. Durliat)		388.00	388.00
	4	Pt. 8	5.17	040 00609606 (L. & P. Durliat)		1,243.00	1,243.00
	4	Pt. 8	19.48	040 00609607 (L. & P. Durliat)		3,405.00	3,405.00
*	4	Pt. 9	5.71	040 00609902 (W. & L. Collard)	7,190.00	1,287.00	8,477.00
	4	Pt. 9	14.42	040 00609900 (A. Collard)		3,710.00	3,710.00
*	4	Pt. 9	4.01	040 00609901 (H. & D. Noyes)		626.00	626.00
*	4	Pt. 9	0.11	040 00609904 (City of Port Colborne)		47.00	47.00
	4	Pt. 9	1.72	040 00610100 (E. & M. Geyer)	1,540.00	412.00	1,952.00
	4	Pt. 9	1.90	040 00610301 (J. Murray)		311.00	311.00
*	4	Pt.9 & 10	16.39	040 00610305 (M. Dumont)		2,923.00	2,923.00
	4	Pt. 10	6.74	040 00610200 (C. & H. Aimsbury)	2,860.00	1,738.00	4,598.00
*	4	Pt. 10	0.53	040 00610205 (R. & L. Eckmier)		163.00	163.00
	4	Pt. 10	4.45	040 00610300 (M. Dumont)		998.00	998.00
*	4	Pt. 10	0.41	040 00610400 (R. Wiggin, M. Friedlein)		190.00	190.00
*	4	Pt. 10	0.41	040 00610500 (J. Rudd, R. Begley)		190.00	190.00
	4	Pt. 10	9.85	040 00610600 (K. & S. Fox)		2,849.00	2,849.00
	4	Pt. 10	10.93	040 00610700 (W. & M. Aiken)		2,952.00	2,952.00
	4	Pt. 11	0.30	040 00611100 (J. Walker, T. Stroomer)		143.00	143.00
	4	Pt. 11	3.20	040 00614205 (R. Walker)		902.00	902.00
	4	Pt. 11	3.56	040 00614201 (D. & H. Carver)		1,000.00	1,000.00
	4	Pt.W½	11 12.76	040 00611000 (J. Carver)		3,771.00	3,771.00
	4	Pt.E½	11 13.30	040 00611200 (G. & J. Tice)		3,937.00	3,937.00
	4	Pt. 12	10.56	040 00614200 (K. & S. Fox)		2,238.00	2,238.00
	4	Pt.W½	12 16.03	040 00614601 (C. Menard, C. Barker)		4,680.00	4,680.00
*	4	Pt. 12	0.83	040 00614300 (A. & V. Kertesz)		258.00	258.00
*	4	Pt. 12	1.01	040 00614400 (J. & S. Price)		314.00	314.00
	4	Pt. 13	18.33	040 00614500 (B. & H. Sonnenberg)		5,551.00	5,551.00
	4	NPt. 13	4.69	040 00614600 (S. & D. Nease)		1,133.00	1,133.00
*	4	Pt. 14	1.00	040 00615100 (J. & E. Vidal)		234.00	234.00
	4	Pt. 14	4.05	040 00615000 (R. & S. Little)		638.00	638.00

SCHEDULE 'C' - ASSESSMENT FOR CONSTRUCTION (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

CON.	LOT	HECTARES AFFECTED	ROLL No.	(OWNER)	BENEFIT	OUTLET	TOTAL
YOUNG DRAIN - (Sta. 0+005 to 7+764) City of Port Colborne (Cont'd)							
<i>(Geographic Humberstone)</i>							
4	Pt. 14	6.07	040	00614900 (M. Butler Est.)	\$	\$ 1,112.00	\$ 1,112.00
* 4	Pt. 14	0.40	040	00614800 (R. & C. Betts)		186.00	186.00
4	Pt. 14	2.39	040	00614700 (A. & R. Dickey)		432.00	432.00
* 4	Pt. 14	2.79	040	00615400 (D. & M. Orłowski)		478.00	478.00
* 4	Pt. 14	1.00	040	00615405 (Enbridge Gas Distribution)		234.00	234.00
4	Pt. 15	1.80	040	00515901 (Stam Acres Limited)		559.00	559.00
* 4	Pt. 15	0.80	040	00515902 (D. & J. Culp)		171.00	171.00
* 4	Pt. 15	0.28	040	00515903 (R.J. Gillespie Enterprise Limited)		128.00	128.00
* 4	Pt. 15	0.28	040	00515904 (D. & M. Orłowski)		130.00	130.00
5	Pt. 3	10.79	040	00611900 (Loeffen Farms Ltd., 1448077 Ontario Ltd.)		1,270.00	1,270.00
5	Pt. 3 & 4	12.53	040	00612000 (D. & J. Deschamps.)		1,404.00	1,404.00
* 5	Pt. 4	4.53	040	00612002 (H. Najmudin)		530.00	530.00
5	Pt. 4	6.50	040	00612200 (P. Aiello)		730.00	730.00
5	Pt. 4	30.35	040	00612300 (H. & B. Bos)		3,922.00	3,922.00
* 5	Pt. 4	1.19	040	00612301 (D. & H. Matthews)		116.00	116.00
5	Pt. 4	8.09	040	00612400 (N. & L. Bateman)	5,710.00	677.00	6,387.00
5	Pt. 4	2.90	040	00612415 (L. McMahon)	2,800.00	312.00	3,112.00
5	Pt. 5	4.96	040	00612500 (D. Borg-Rucci)	1,810.00	523.00	2,333.00
5	Pt. 5	14.75	040	00612600 (G. Sovejarto)		1,825.00	1,825.00
* 5	Pt. 5	0.40	040	00612700 (T. Chambers, L. Freeborn)		83.00	83.00
5	Pt. 5	40.27	040	00612800 (Heritage Family Holdings LLD)	5,750.00	5,181.00	10,931.00
* 5	Pt. 5	4.95	040	00612900 (S. & S. Hall)	3,950.00	403.00	4,353.00
* 5	Pt. 6	29.49	040	00613100 (J. Post & S. Robb)	9,160.00	2,695.00	11,855.00
5	Pt. 6	5.20	040	00613105 (J. & A. Ens)		707.00	707.00
5	Pt. 6	3.23	040	00613200 (P. Czartowski)		409.00	409.00
* 5	Pt. 6	20.28	040	00613300 (J. Grimaldi)	5,400.00	1,716.00	7,116.00
* 5	Pt. 6	7.90	040	00613301 (F. & E. Joudrey)		535.00	535.00
5	Pt. 7	19.83	040	00613400 (L. & P. Durliat)	6,420.00	3,309.00	9,729.00
5	SWPt.	7 18.47	040	00613500 (L. & C. Schneider)	2,240.00	2,844.00	5,084.00
5	NEPt.	7 6.72	040	00615700 (Davison Farms Ltd.)		801.00	801.00
5	Pt. 7	6.07	040	00615705 (Davison Farms Ltd.)		801.00	801.00
5	NWPt.	7 12.04	040	00615800 (A. Pruyn)		1,533.00	1,533.00
* 5	Pt. 8	0.07	040	00613505 (City of Port Colborne)		24.00	24.00
* 5	Pt. 8	0.08	040	00613510 (City of Port Colborne)		34.00	34.00
5	Pt. 8	6.90	040	00613600 (M. & E. Geyer)		1,026.00	1,026.00
5	Pt. 8	15.33	040	00613700 (M. & M. Young)		2,617.00	2,617.00
5	Pt. 8	28.80	040	00613705 (J. & D. Rauscher)		4,317.00	4,317.00
* 5	Pt. 8	0.09	040	00615900 (C. Wilson)		18.00	18.00
5	Pt. 8	3.81	040	00616000 (J. & H. Swanson)		515.00	515.00
* 5	Pt. 8	0.58	040	00616300 (C. Vanderloos)		79.00	79.00
* 5	Pt. 8	0.22	040	00616400 (R. Stegner)		48.00	48.00
* 5	Pt. 8	0.53	040	00616500 (D. Little)		125.00	125.00
* 5	Pt. 9	0.19	040	00616600 (R. Vincelette)		88.00	88.00
* 5	Pt. 9	3.72	040	00616700 (S. Johnston, H. Keeso)		414.00	414.00
* 5	Pt. 9	4.35	040	00616800 (S. Johnston, H. Keeso)		344.00	344.00
* 5	Pt. 9	0.62	040	00616900 (A. & S. Miljanic)		98.00	98.00
* 5	Pt. 9	0.31	040	00617000 (K. Cooke)		72.00	72.00

SCHEDULE 'C' - ASSESSMENT FOR CONSTRUCTION (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

CON.	LOT	HECTARES AFFECTED	ROLL No.	(OWNER)	BENEFIT	OUTLET	TOTAL
YOUNG DRAIN - (Sta. 0+005 to 7+764) City of Port Colborne (Cont'd)							
<i>(Geographic Humberstone)</i>							
5	Pt. 9	5.34	040	00616501 (K. Pagnotta)	\$	\$ 842.00	\$ 842.00
5	Pt. 9	12.03	040	00616502 (R. & M. Bilodeau)		1,426.00	1,426.00
* 5	Pt. 9	5.82	040	00617005 (K. & A. Warner)		584.00	584.00
* 5	Pt. 9	2.84	040	00616505 (V. & F. Kersch)		329.00	329.00
5	Pt. 10	6.37	040	00617700 (M. & T. Novotny)		867.00	867.00
* 5	Pt. 10	2.04	040	00617601 (M. Miedema, J. Ceply)		478.00	478.00
* 5	Pt. 10	2.03	040	00617602 (D. & D. Taylor)		376.00	376.00
5	Pt. 10	72.49	040	00618103 (M. & L. Koabel)		9,392.00	9,392.00
* 5	Pt. 10	1.49	040	00618105 (J. Wayne)		180.00	180.00
* 5	Pt. 10	1.22	040	00618110 (A. Troczynska)		145.00	145.00
* 5	Pt. 11	4.05	040	00617800 (L. Adams)		793.00	793.00
* 5	Pt. 11	37.49	040	00617900 (Enbridge Gas Distribution)		3,318.00	3,318.00
5	Pt. 11	18.60	040	00617905 (J. Stam)		2,355.00	2,355.00
* 5	Pt. 11	2.06	040	00617500 (M. Chow, K. Lee)		246.00	246.00
* 5	Pt. 12	1.43	040	00619200 (A. & T. Mattiazzo)		224.00	224.00
* 5	Pt. 12	6.07	040	00619400 (A. & C. Game)		948.00	948.00
* 4&5	Pt. 7 - 15	20.97	040	00699900 (C.N.R.)	1,640.00	4,917.00	6,557.00
* 5	Pt. 4 - 11	12.00	040	00699600 (C. P. Rail)	2,920.00	988.00	3,908.00
TOTAL ASSESSMENT ON LANDS					\$ 59,390.00	\$ 128,160.00	\$ 187,550.00
Regional Road 98		0.24		Region of Niagara	\$	\$ 114.00	\$ 114.00
Koable Road		2.72		City of Port Colborne	2,270.00	1,255.00	3,525.00
Green Road		2.72		City of Port Colborne	2,320.00	1,153.00	3,473.00
Brookfield Rd		4.75		City of Port Colborne		2,634.00	2,634.00
Stauth Road		2.63		City of Port Colborne		1,192.00	1,192.00
Troup Road		1.18		City of Port Colborne		728.00	728.00
Sherk Road		1.38		City of Port Colborne		1,074.00	1,074.00
White Road		0.86		City of Port Colborne		669.00	669.00
Forkes Road		9.20		City of Port Colborne	2,510.00	5,116.00	7,626.00
TOTAL ASSESSMENT ON ROADS					\$ 7,100.00	\$ 13,935.00	\$ 21,035.00
SPECIAL ASSESSMENT against the Canadian National Railway for the increased cost of installing a 750mm dia. (30") smooth wall steel low flow pipe under their Right of Way on the Young Drain Sta. (7+085.6).							\$ 49,610.00
SPECIAL ASSESSMENT against the Canadian National Railway for the increased cost of installing a 750mm dia. (30") smooth wall steel low flow pipe under their Right of Way on the Young Drain Sta. (7+541.5).							\$ 46,560.00
TOTAL ASSESSMENT ON YOUNG DRAIN - (Sta. 0+072 to 7+764) IN THE CITY OF PORT COLBORNE							\$ 304,755.00

SCHEDULE 'C' - ASSESSMENT FOR CONSTRUCTION (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

CON.	LOT	HECTARES AFFECTED	ROLL No.	(OWNER)	BENEFIT	OUTLET	TOTAL
YOUNG DRAIN - (Sta. 0+005 to 7+764) Town of Fort Erie (Cont'd)							
<u>Town of Fort Erie</u>							
<i>(Geographic Bertie)</i>							
*	16NR	Lot Rear 16	0.71	020 03117301 (F. Iuliani)	\$	\$ 36.00	\$ 36.00
<i>(Geographic Willoughby)</i>							
	2nd Cross	Pt. 29	1.00	040 05532401 (R. Guglielmi)		70.00	70.00
	2nd Cross	Pt. 29	4.98	040 05532800 (Kenneth Chacra Enterprises Inc.)		348.00	348.00
	2nd Cross	Pt. 30	5.17	040 05532805 (K. & A. Duerksen)		433.00	433.00
	2nd Cross	Pt. 30	4.54	040 05532900 (C. & E. Upper)		381.00	381.00
*	2nd Cross	Pt. 30	0.76	040 05532901 (N. & C. Horton)		65.00	65.00
TOTAL ASSESSMENT ON LANDS					\$	\$ 1,333.00	\$ 1,333.00
=====							
	Regional Road 25	1.39		Region of Niagara	\$	\$ 604.00	\$ 604.00
	Willow Road	2.00		Town of Fort Erie		412.00	412.00
	Unopened Rd Lt 30	0.46		Town of Fort Erie		37.00	37.00
TOTAL ASSESSMENT ON ROADS					\$	\$ 1,053.00	\$ 1,053.00
=====							
TOTAL ASSESSMENT ON YOUNG DRAIN - (Sta. 0+072 to 7+764) IN THE TOWN OF FORT ERIE							\$ 2,386.00

City of Niagara Falls

<i>(Geographic Willoughby)</i>							
*	5	Pt.1 - 4	21.75	130 00416700 (N.P.C.A.)	\$	\$ 377.00	\$ 377.00
	5	Ept. 2	0.11	130 00410100 (N. Sauer)		2.00	2.00
	5	Ept. 3	2.60	130 00409900 (K. & C. Brown)		90.00	90.00
	5	NEPt. 4	5.91	130 00409500 (J. Kulhanek)		205.00	205.00
*	5	SEPt. 4	4.91	130 00409600 (G. Williamson)		85.00	85.00
	6	1	50.30	130 00418100 (N.. Sauer)	9,960.00	1,659.00	11,619.00
	6	WPt. 2	18.21	130 00418000 (D.&A.Silverthorne,R.&T.Portugaise)	8,270.00	528.00	8,798.00
*	6	Pt.3 - 4	34.88	130 00416700 (N.P.C.A.)		664.00	664.00
	6	SWPt. 3	15.79	130 00417600 (P. Fiorentino)		421.00	421.00
	6	NWPt. 3	11.80	130 00417800 (E. & S. Friskie)		314.00	314.00
*	6	Pt. 3	0.40	130 00417700 (W. Holowitz)		16.00	16.00
*	6	Pt. 4	3.77	130 00417000 (R. Ferraro, T. Millington-Ferraro)		99.00	99.00
*	6	Pt. 4	3.31	130 00417001 (B. Flores)		87.00	87.00
*	6	Pt. 4	0.41	130 00417100 (J. Graham)		16.00	16.00
*	6	Pt. 4	4.38	130 00417200 (W. Lamb)		116.00	116.00
*	6	Pt. 4	0.50	130 00417300 (M. & J. Royer)		13.00	13.00
	7	Pt. 1	21.00	130 00421200 (A. & G. & A. Tavano)		325.00	325.00
	7	2	30.00	130 00421100 (L. Kit, D. Kit-Mete)	7,650.00	318.00	7,968.00

SCHEDULE 'C' - ASSESSMENT FOR CONSTRUCTION (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

CON.	LOT	HECTARES AFFECTED	ROLL No.	(OWNER)	BENEFIT	OUTLET	TOTAL
YOUNG DRAIN - (Sta. 0+005 to 7+764) City of Niagara Falls (Cont'd)							
<i>(Geographic Willoughby)</i>							
	7	Pt. 3 6.21	130	00421001 (A. Subramanian)	\$	\$ 115.00	\$ 115.00
*	7	Pt. 3 4.05	130	00421000 (S. Hilton)		47.00	47.00
*	7	Pt. 3 0.19	130	00420900 (R. & T. Warner)		5.00	5.00
	7	Pt. 3 1.80	130	00420715 (N. & J. Vandenberg)		17.00	17.00
1st Cross	SPt. 12	1.73	130	00422300 (F. & C. Muileboom)		60.00	60.00
* 1st Cross	NPt. 12 & 13	31.25	130	00416700 (N.P.C.A.)		606.00	606.00
1st Cross	SEPt. 13	21.70	130	00422500 (W. & S. Young)		1,027.00	1,027.00
1st Cross	WPt. 13	28.33	130	00422800 (E. Landrum)	6,350.00	1,642.00	7,992.00
1st Cross	Pt. 14 & 15	6.14	130	00422900 (A. & K. Duerksen)		502.00	502.00
1st Cross	Pt. 14 & 15	40.17	130	00423210 (J. & H. Swanson)	14,120.00	2,780.00	16,900.00
1st Cross	Pt. 14 & 15	21.00	130	00423400 (V. Scott)	10,060.00	1,231.00	11,291.00
* 1st Cross	Pt. 15	2.44	130	00423000 (J. & C. Castellanos)	410.00	146.00	556.00
* 1st Cross	Pt. 15	0.31	130	00423100 (S. & M. Eggleton)		39.00	39.00
* 1st Cross	Pt. 15	1.57	130	00423202 (J. & D. Pierrynowski)		88.00	88.00
* 1st Cross	Pt. 15	0.37	130	00423320 (S. Jasek)	360.00	26.00	386.00
<i>(Geographic Crowland)</i>							
* Gore	Pt. 1	1.21	140	00102500 (A. Secco)	\$	\$ 72.00	\$ 72.00
7,Gore	Pt. 1	14.06	140	00102600 (A. & R. Armenti)	2,220.00	1,035.00	3,255.00
7	Pt. 1	27.00	140	00102700 (P. & M. Kikkert)	4,080.00	1,686.00	5,766.00
7,Gore	Pt. 2	37.00	140	00102900 (E. & K. Edwards)	6,190.00	3,480.00	9,670.00
7,Gore	Pt. 3	17.50	140	00103200 (1532044 Ontario Inc.)		1,378.00	1,378.00
Gore	Pt. 4	0.94	140	00103800 (B. & L. Gatto)		101.00	101.00
<i>(Geographic Humberstone)</i>							
* 5	Pt. 3	0.28	150	00100500 (E. Michaud)	\$	\$ 45.00	\$ 45.00
5	Pt. 3	5.87	150	00100600 (Loeffen Farms Ltd., 1448077 Ont. Ltd.)		653.00	653.00
* 5	Pt. 3	1.73	150	00100650 (J. & E. Hersom)		144.00	144.00
* 5	Pt. 3	1.80	150	00100605 (B. & C. Newell)		147.00	147.00
* 5	Pt. 3	2.07	150	00100701 (R. & V. Dekker)		171.00	171.00
* 5	Pt. 3 & 4	4.16	150	00100700 (J. & D. Deschamps)	2,180.00	410.00	2,590.00
* 5	Pt. 4	2.83	150	00100704 (H. Najmudin)	2,880.00	231.00	3,111.00
* 5	Pt. 4	7.59	150	00100800 (L. McMahon)	490.00	800.00	1,290.00
5	Pt. 5	3.64	150	00100900 (J. Ruicci, D. Borg-Ruicci)		403.00	403.00
* 5	Pt. 5	11.63	150	00101000 (G. Sovegarto)		1,573.00	1,573.00
* 5	Pt. 6	2.83	150	00101400 (P. Czartowski)		329.00	329.00
* 5	Pt. 6	4.86	150	00101300 (A. Vibent)		576.00	576.00
* 5	Pt. 6	0.23	150	00101200 (S. Pandur)		47.00	47.00
* 5	Pt. 6	7.39	150	00101500 (E. & F. Joudrey)		594.00	594.00
* 5	Pt. 8	0.02	150	00102000 (C. Wilson)		4.00	4.00
* 5	Pt. 9	2.00	150	00102101 (K. Warner)		203.00	203.00
* 5	Pt. 9	0.60	140	00105800 (C. P. Rail)		80.00	80.00
TOTAL ASSESSMENT ON LANDS					\$ 75,220.00	\$ 27,828.00	\$ 103,048.00

SCHEDULE 'C' - ASSESSMENT FOR CONSTRUCTION (Cont'd)

YOUNG & HOPF-WAGNER DRAINS
City of Port Colborne

CON.	LOT	HECTARES AFFECTED	ROLL No.	(OWNER)	BENEFIT	OUTLET	TOTAL
YOUNG DRAIN - (Sta. 0+005 to 7+764) City of Niagara Falls (Cont'd)							
	Regional Road 98	3.40		Region of Niagara	\$ 620.00	\$ 1,183.00	\$ 1,803.00
	Regional Road 25	4.59		Region of Niagara	2,350.00	873.00	3,223.00
	Beck Road	0.52		City of Niagara Falls		45.00	45.00
	Willodell Road	2.21		City of Niagara Falls	1,270.00	80.00	1,350.00
	Schaubel Road	2.25		City of Niagara Falls		150.00	150.00
	Unopened Rd Lt 14	2.25		City of Niagara Falls		150.00	150.00
	Misner Road	1.39		City of Niagara Falls		350.00	350.00
	Koable Road	0.60		City of Niagara Falls		259.00	259.00
	Green Road	0.60		City of Niagara Falls		245.00	245.00
	Brookfield Rd	0.04		City of Niagara Falls		15.00	15.00
	Sauer Road	1.67		City of Niagara Falls		145.00	145.00
	Koabel Road	1.63		City of Niagara Falls	1,390.00	11.00	1,401.00
	Schneider Road	3.06		City of Niagara Falls	\$ 1,360.00	\$ 405.00	\$ 1,765.00
TOTAL ASSESSMENT ON ROADS					\$ 6,990.00	\$ 3,911.00	\$ 10,901.00

SPECIAL ASSESSMENT against the City of Niagara Falls for the increased cost of removing existing steel truss bridge including wood deck and abutments and installing two 3000mm Dia. C.S.P.s under Willodell Road on the Young Drain Sta. (0+996) \$ 50,880.00

SPECIAL ASSESSMENT against the City of Niagara Falls for the increased cost of removing existing concrete culvert and installing two 2700m Dia. C.S.P.s under Schneider Road on the Young Drain Sta. (2+006) \$ 48,230.00

**TOTAL ASSESSMENT ON YOUNG DRAIN - (Sta. 0+072 to 7+764)
IN THE CITY OF NIAGARA FALLS** \$ 213,059.00

TOTAL ASSESSMENT ON YOUNG DRAIN - (Sta. 0+072 to 7+764) \$ 520,200.00

NOTE: All the above lands, with the exception of those noted with an asterisk, are classified as agricultural.

SCHEDULE 'C' - ASSESSMENT FOR CONSTRUCTION (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

CON.	LOT	HECTARES AFFECTED	ROLL No.	(OWNER)	BENEFIT	OUTLET	TOTAL	
HOPF WAGNER DRAIN - MAIN DRAIN (STA. 7+764 to 9+929)								
City of Port Colborne								
<i>(Geographic Humberstone)</i>								
4	Pt. 10	2.74	040	00610200 (C. & H. Aimsbury)	\$ 1,230.00	\$ 61.00	\$ 1,291.00	
4	Pt. 10	4.45	040	00610300 (M. Dumont)		303.00	303.00	
*	4	Pt. 10	0.41	040	00610400 (R. Wiggin, M. Friedlein)		27.00	27.00
*	4	Pt. 10	0.41	040	00610500 (J. Rudd, R. Begley)		27.00	27.00
4	Pt. 10	4.93	040	00610600 (K. & S. Fox)		334.00	334.00	
4	Pt. 10	4.93	040	00610700 (W. & M. Aiken)		334.00	334.00	
4	Pt. 11	0.30	040	00611100 (J. Walker, T. Stroomer)		20.00	20.00	
4	Pt. 11	3.20	040	00614205 (R. Walker)		115.00	115.00	
4	Pt. 11	3.56	040	00614201 (D. & H. Carver)		341.00	341.00	
4	Pt.W½ 11	12.76	040	00611000 (J. Carver)	2,140.00	1,285.00	3,425.00	
4	Pt.E½ 11	13.30	040	00611200 (G. & J. Tice)	2,140.00	504.00	2,644.00	
4	Pt. 12	10.56	040	00614200 (K. & S. Fox)	4,980.00	1,086.00	6,066.00	
4	Pt.W½ 12	16.03	040	00614601 (C. Menard, C. Barker)	2,140.00	2,920.00	5,060.00	
*	4	Pt. 12	0.83	040	00614300 (A. & V. Kertesz)		160.00	160.00
*	4	Pt. 12	1.01	040	00614400 (J. & S. Price)		208.00	208.00
4	Pt. 13	18.33	040	00614500 (B. & H. Sonnenberg)	1,910.00	6,324.00	8,234.00	
4	NPt. 13	4.69	040	00614600 (S. & D. Nease)	590.00	833.00	1,423.00	
*	4	Pt. 14	1.00	040	00615100 (J. & E. Vidal)		358.00	358.00
4	Pt. 14	4.05	040	00615000 (R. & S. Little)		1,111.00	1,111.00	
4	Pt. 14	6.07	040	00614900 (M. Butler Est.)	965.00	1,937.00	2,902.00	
*	4	Pt. 14	0.40	040	00614800 (R. & C. Betts)		447.00	447.00
4	Pt. 14	2.39	040	00614700 (A. & R. Dickey)	1,065.00	944.00	2,009.00	
*	4	Pt. 14	2.79	040	00615400 (D. & M. Orłowski)	990.00	843.00	1,833.00
*	4	Pt. 14	1.00	040	00615405 (Enbridge Gas Distribution)	970.00	593.00	1,563.00
4	Pt. 15	1.80	040	00515901 (Stam Acres Limited)		1,467.00	1,467.00	
*	4	Pt. 15	0.80	040	00515902 (D. & J. Culp)		448.00	448.00
*	4	Pt. 15	0.28	040	00515903 (R.J. Gillespie Enterprise Limited)		335.00	335.00
*	4	Pt. 15	0.28	040	00515904 (D. & M. Orłowski)		342.00	342.00
5	Pt. 10	0.64	040	00617700 (M. & T. Novotny)		142.00	142.00	
5	Pt. 10	2.04	040	00617601 (M. Miedema, J. Ceply)		339.00	339.00	
5	Pt. 10	1.38	040	00617602 (D. & D. Taylor)		237.00	237.00	
5	Pt. 11	4.05	040	00617800 (L. Adams)		576.00	576.00	
5	Pt. 11	5.07	040	00617900 (Enbridge Gas Distribution)		574.00	574.00	
5	Pt. 12	1.43	040	00619200 (A. & T. Mattiazzo)		163.00	163.00	
5	Pt. 12	6.07	040	00619400 (A. & C. Game)		686.00	686.00	
* 4&5	Pt. 10 - 15	6.80	040	00699900 (C.N.R.)	18,500.00	1,812.00	20,312.00	
TOTAL ASSESSMENT ON LANDS					\$ 37,620.00	\$ 28,236.00	\$ 65,856.00	

SCHEDULE 'C' - ASSESSMENT FOR CONSTRUCTION (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

CON.	LOT	HECTARES AFFECTED	ROLL No.	(OWNER)	BENEFIT	OUTLET	TOTAL
HOPF WAGNER DRAIN - MAIN DRAIN - (Sta. 7+764 to 9+929) City of Port Colbourne (Cont'd)							
	Brookfield Rd	1.49		City of Port Colborne	\$ 410.00	\$ 131.00	\$ 541.00
	Stauth Road	0.32		City of Port Colborne		181.00	181.00
	Sherk Road	1.38		City of Port Colborne	410.00	779.00	1,189.00
	White Road	0.86		City of Port Colborne	4,430.00	1,652.00	6,082.00
	Forkes Road	3.80		City of Port Colborne	11,730.00	3,011.00	14,741.00
TOTAL ASSESSMENT ON ROADS					\$ 16,980.00	\$ 5,754.00	\$ 22,734.00

SPECIAL ASSESSMENT against the City of Port Colborne for the increased cost of cleaning and inspecting the existing culvert as well as designing and including the potential replacment on the drawings for the culvert under Brookfield Road on the Hopf Wagner Drain Sta. (8+082). \$ 7,070.00

SPECIAL ASSESSMENT against the City of Port Colborne for the increased cost of installing an 1200mm dia. concrete surface pipe under Sherk Road on the Hopf Wagner Drain Sta. (8+947). \$ 36,070.00

SPECIAL ASSESSMENT against the Canadian National Railway for the increased cost of installing a 600mm dia. (24") smooth wall steel low flow pipe under their Right of Way on the Hopf Wagner Drain Sta. (9+807). \$ 37,800.00

SPECIAL ASSESSMENT against Enbridge Gas Distribution, Property Roll No. 6-179, for part of the cost of relocating the Hoff-Wagner Ditch to the south side of the C.N.R. Right of Way \$ 50,170.00

**TOTAL ASSESSMENT ON HOPF WAGNER DRAIN - MAIN DRAIN (STA. 7+764 to 9+929)
IN THE CITY OF PORT COLBORNE** \$ 219,700.00

TOTAL ASSESSMENT ON HOPF WAGNER DRAIN - MAIN DRAIN (STA. 7+764 to 9+929) \$ 219,700.00

NOTE: All the above lands, with the exception of those noted with an asterisk, are classified as agricultural.

SCHEDULE 'C' - ASSESSMENT FOR CONSTRUCTION (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

CON.	LOT	HECTARES AFFECTED	ROLL No.	(OWNER)	BENEFIT	OUTLET	TOTAL
HOPF WAGNER DRAIN - NEASE BRANCH (STA. 8+957 to 9+324)							
<u>City of Port Colborne</u>							
<i>(Geographic Humberstone)</i>							
	4	NPt. 13	4.69	040 00614600 (S. & D. Nease)	\$ 3,900.00	\$ 648.00	\$ 4,548.00
*	4	Pt. 14	1.40	040 00615400 (D. & M. Orlowski)		366.00	366.00
*	5	Pt. 11	4.05	040 00617800 (L. Adams)		1,331.00	1,331.00
*	5	Pt. 11	5.07	040 00617900 (Enbridge Gas Distribution)		1,327.00	1,327.00
*	4&5	Pt. 10 - 15	1.26	040 00699900 (C.N.R.)	1,800.00	230.00	2,030.00
TOTAL ASSESSMENT ON LANDS					\$ 5,700.00	\$ 3,902.00	\$ 9,602.00
Forkes Road					1,230.00	2,068.00	3,298.00
TOTAL ASSESSMENT ON ROADS					\$ 1,230.00	\$ 2,068.00	\$ 3,298.00
SPECIAL ASSESSMENT against the Canadian National Railway for the increased cost of installing a 600mm dia. (24") smooth wall steel low flow pipe							\$ 37,800.00
TOTAL ASSESSMENT ON HOPF WAGNER DRAIN - NEASE BRANCH (STA. 8+957 to 9+324) IN THE CITY OF PORT COLBORNE							\$ 50,700.00
TOTAL ASSESSMENT ON YOUNG & HOPF-WAGNER DRAINS							\$ 790,600.00

NOTE: All the above lands, with the exception of those noted with an asterisk, are classified as agricultural.

SCHEDULE 'D' - ASSESSMENT FOR MAINTENANCE

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

Job No. 90070

July 27, 2017

CON.	LOT	HECTARES AFFECTED	ROLL No. (OWNER)	MAINTENANCE BENEFIT	PERCENTAGE OUTLET	TOTAL
YOUNG DRAIN - (Sta. 0+072 to 7+764)						
City of Port Colborne						
<i>(Geographic Humberstone)</i>						
*	4	Pt. 4	1.10	040 00607800 (D. & S. Anderson)	%	0.03 %
	4	Pt.E½	5	040 00608100 (D. & L. Pirson)		0.13
*	4	Pt.W½	5	040 00608200 (M. & R. Nicholls)		0.20
*	4	Pt.E½	6	040 00609200 (V. Hermoza)		0.30
*	4	Pt.W½	6	040 00608600 (Heritage Family Holdings)		0.11
*	4	Pt.W½	6	040 00608601 (Heritage Family Holdings)		0.07
	4	Pt.E½	7	040 00609301 (A. Ruigrok)		0.34
	4	Pt.NW½	7	040 00609400 (D. & L. Showler)		0.32
	4	Pt.SW½	7	040 00609405 (L. & B. Durliat)		0.77
*	4	Pt.	8	040 00609500 (W. Schneider, B. Gingras)		0.10
	4	Pt.	8	040 00609600 (L. & P. Durliat)		0.15
	4	Pt.	8	040 00609606 (L. & P. Durliat)		0.50
	4	Pt.	8	040 00609607 (L. & P. Durliat)		1.36
*	4	Pt.	9	040 00609902 (W. & L. Collard)	1.43	0.51
	4	Pt.	9	040 00609900 (A. Collard)		1.48
*	4	Pt.	9	040 00609901 (H. & D. Noyes)		0.25
*	4	Pt.	9	040 00609904 (City of Port Colborne)		0.02
	4	Pt.	9	040 00610100 (E. & M. Geyer)	0.31	0.16
	4	Pt.	9	040 00610301 (J. Murray)		0.12
*	4	Pt.9 & 10	16.39	040 00610305 (M. Dumont)		1.17
	4	Pt.	10	040 00610200 (C. & H. Aimsbury)	0.57	0.69
*	4	Pt.	10	040 00610205 (R. & L. Eckmier)		0.07
	4	Pt.	10	040 00610300 (M. Dumont)		0.40
*	4	Pt.	10	040 00610400 (R. Wiggin, M. Friedlein)		0.08
*	4	Pt.	10	040 00610500 (J. Rudd, R. Begley)		0.08
	4	Pt.	10	040 00610600 (K. & S. Fox)		1.14
	4	Pt.	10	040 00610700 (W. & M. Aiken)		1.18
	4	Pt.	11	040 00611100 (J. Walker, T. Stroomer)		0.06
	4	Pt.	11	040 00614205 (R. Walker)		0.36
	4	Pt.	11	040 00614201 (D. & H. Carver)		0.40
	4	Pt.W½	11	040 00611000 (J. Carver)		1.50
	4	Pt.E½	11	040 00611200 (G. & J. Tice)		1.57
	4	Pt.	12	040 00614200 (K. & S. Fox)		0.89
	4	Pt.W½	12	040 00614601 (C. Menard, C. Barker)		1.87
*	4	Pt.	12	040 00614300 (A. & V. Kertesz)		0.10
*	4	Pt.	12	040 00614400 (J. & S. Price)		0.13
	4	Pt.	13	040 00614500 (B. & H. Sonnenberg)		2.22
	4	NPt.	13	040 00614600 (S. & D. Nease)		0.45
*	4	Pt.	14	040 00615100 (J. & E. Vidal)		0.09
	4	Pt.	14	040 00615000 (R. & S. Little)		0.25

SCHEDULE 'D' - ASSESSMENT FOR MAINTENANCE (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

CON.	LOT	HECTARES AFFECTED	ROLL No. (OWNER)	MAINTENANCE PERCENTAGE		
				BENEFIT	OUTLET	TOTAL
YOUNG DRAIN - (Sta. 0+072 to 7+764) City of Port Colborne (Cont'd)						
<i>(Geographic Humberstone)</i>						
	Pt. 14	6.07	040 00614900 (M. Butler Est.)	%	0.44 %	0.44 %
*	Pt. 14	0.40	040 00614800 (R. & C. Betts)		0.07	0.07
	Pt. 14	2.39	040 00614700 (A. & R. Dickey)		0.17	0.17
*	Pt. 14	2.79	040 00615400 (D. & M. Orłowski)		0.19	0.19
*	Pt. 14	1.00	040 00615405 (Enbridge Gas Distribution)		0.09	0.09
	Pt. 15	1.80	040 00515901 (Stam Acres Limited)		0.22	0.22
*	Pt. 15	0.80	040 00515902 (D. & J. Culp)		0.07	0.07
*	Pt. 15	0.28	040 00515903 (R.J. Gillespie Enterprise Limited)		0.05	0.05
*	Pt. 15	0.28	040 00515904 (D. & M. Orłowski)		0.05	0.05
	Pt. 3	10.79	040 00611900 (Loeffen Farms Ltd., 1448077 Ontario Ltd.)		0.51	0.51
	Pt. 3 & 4	12.53	040 00612000 (D. & J. Deschamps.)		0.56	0.56
*	Pt. 4	4.53	040 00612002 (H. Najmudin)		0.21	0.21
	Pt. 4	6.50	040 00612200 (P. Aiello)		0.29	0.29
	Pt. 4	30.35	040 00612300 (H. & B. Bos)		1.57	1.57
*	Pt. 4	1.19	040 00612301 (D. & H. Matthews)		0.05	0.05
	Pt. 4	8.09	040 00612400 (N. & L. Bateman)	1.14	0.27	1.41
	Pt. 4	2.90	040 00612415 (L. McMahon)	0.56	0.12	0.68
	Pt. 5	4.96	040 00612500 (D. Borg-Rucci)	0.36	0.21	0.57
	Pt. 5	14.75	040 00612600 (G. Sovegarto)		0.73	0.73
*	Pt. 5	0.40	040 00612700 (T. Chambers, L. Freeborn)		0.03	0.03
	Pt. 5	40.27	040 00612800 (Heritage Family Holdings LLD)	1.15	2.07	3.22
*	Pt. 5	4.95	040 00612900 (S. & S. Hall)	0.79	0.16	0.95
*	Pt. 6	29.49	040 00613100 (J. Post & S. Robb)	1.83	1.08	2.91
	Pt. 6	5.20	040 00613105 (J. & A. Ens)		0.28	0.28
	Pt. 6	3.23	040 00613200 (P. Czartowski)		0.16	0.16
*	Pt. 6	20.28	040 00613300 (J. Grimaldi)	1.08	0.68	1.76
*	Pt. 6	7.90	040 00613301 (F. & E. Joudrey)		0.21	0.21
	Pt. 7	19.83	040 00613400 (L. & P. Durliat)	1.28	1.32	2.60
	SWPt. 7	18.47	040 00613500 (L. & C. Schneider)	0.45	1.14	1.59
	NEPt. 7	6.72	040 00615700 (Davison Farms Ltd.)		0.32	0.32
	Pt. 7	6.07	040 00615705 (Davison Farms Ltd.)		0.32	0.32
	NWPt. 7	12.04	040 00615800 (A. Pruyne)		0.61	0.61
*	Pt. 8	0.07	040 00613505 (City of Port Colborne)		0.01	0.01
*	Pt. 8	0.08	040 00613510 (City of Port Colborne)		0.01	0.01
	Pt. 8	6.90	040 00613600 (M. & E. Geyer)		0.41	0.41
	Pt. 8	15.33	040 00613700 (M. & M. Young)		1.04	1.04
	Pt. 8	28.80	040 00613705 (J. & D. Rauscher)		1.72	1.72
*	Pt. 8	0.09	040 00615900 (C. Wilson)		0.01	0.01
	Pt. 8	3.81	040 00616000 (J. & H. Swanson)		0.21	0.21
*	Pt. 8	0.58	040 00616300 (C. Vanderloos)		0.03	0.03
*	Pt. 8	0.22	040 00616400 (R. Stegner)		0.02	0.02
*	Pt. 8	0.53	040 00616500 (D. Little)		0.05	0.05
*	Pt. 9	0.19	040 00616600 (R. Vincelette)		0.04	0.04
*	Pt. 9	3.72	040 00616700 (S. Johnston, H. Keeso)		0.17	0.17
*	Pt. 9	4.35	040 00616800 (S. Johnston, H. Keeso)		0.14	0.14
*	Pt. 9	0.62	040 00616900 (A. & S. Miljanic)		0.04	0.04
*	Pt. 9	0.31	040 00617000 (K. Cooke)		0.03	0.03

SCHEDULE 'D' - ASSESSMENT FOR MAINTENANCE (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

CON.	LOT	HECTARES AFFECTED	ROLL No. (OWNER)	MAINTENANCE PERCENTAGE			
				BENEFIT	OUTLET	TOTAL	
YOUNG DRAIN - (Sta. 0+072 to 7+764) City of Port Colborne (Cont'd)							
<i>(Geographic Humberstone)</i>							
5	Pt. 9	5.34	040 00616501 (K. Pagnotta)	%	0.34 %	0.34 %	
5	Pt. 9	12.03	040 00616502 (R. & M. Bilodeau)		0.57	0.57	
* 5	Pt. 9	5.82	040 00617005 (K. & A. Warner)		0.23	0.23	
* 5	Pt. 9	2.84	040 00616505 (V. & F. Kersch)		0.13	0.13	
5	Pt. 10	6.37	040 00617700 (M. & T. Novotny)		0.35	0.35	
* 5	Pt. 10	2.04	040 00617601 (M. Miedema, J. Ceply)		0.19	0.19	
* 5	Pt. 10	2.03	040 00617602 (D. & D. Taylor)		0.15	0.15	
5	Pt. 10	72.49	040 00618103 (M. & L. Koabel)		3.75	3.75	
* 5	Pt. 10	1.49	040 00618105 (J. Wayne)		0.07	0.07	
* 5	Pt. 10	1.22	040 00618110 (A. Troczynska)		0.06	0.06	
* 5	Pt. 11	4.05	040 00617800 (L. Adams)		0.32	0.32	
* 5	Pt. 11	37.49	040 00617900 (Enbridge Gas Distribution)		1.32	1.32	
5	Pt. 11	18.60	040 00617905 (J. Stam)		0.94	0.94	
* 5	Pt. 11	2.06	040 00617500 (M. Chow, K. Lee)		0.10	0.10	
* 5	Pt. 12	1.43	040 00619200 (A. & T. Mattiazzo)		0.09	0.09	
* 5	Pt. 12	6.07	040 00619400 (A. & C. Game)		0.38	0.38	
* 4&5	Pt. 7 - 15	20.97	040 00699900 (C.N.R.)	0.33	1.96	2.29	
* 5	Pt. 4 - 11	12.00	040 00699600 (C. P. Rail)	0.58	0.39	0.97	
TOTAL ASSESSMENT ON LANDS				=====	11.86 %	51.14 %	63.00 %
				=====			
Regional Road 98		0.24	Region of Niagara	%	0.05 %	0.05 %	
Koable Road		2.72	City of Port Colborne	0.45	0.50	0.95	
Green Road		2.72	City of Port Colborne	0.46	0.46	0.92	
Brookfield Rd		4.75	City of Port Colborne		1.05	1.05	
Stauth Road		2.63	City of Port Colborne		0.48	0.48	
Troup Road		1.18	City of Port Colborne		0.29	0.29	
Sherk Road		1.38	City of Port Colborne		0.43	0.43	
White Road		0.86	City of Port Colborne		0.27	0.27	
Forkes Road		9.20	City of Port Colborne	0.50	2.04	2.54	
TOTAL ASSESSMENT ON ROADS				=====	1.41 %	5.57 %	6.98 %
				=====			
TOTAL ASSESSMENT FOR MAINTENANCE OF YOUNG DRAIN - (Sta. 0+072 to 7+764) IN THE CITY OF PORT COLBORNE				=====	13.27 %	56.71 %	69.98 %

SCHEDULE 'D' - ASSESSMENT FOR MAINTENANCE (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

CON.	LOT	HECTARES AFFECTED	ROLL No. (OWNER)	MAINTENANCE PERCENTAGE BENEFIT	OUTLET	TOTAL
YOUNG DRAIN - (Sta. 0+072 to 7+764) (Cont'd)						
<u>Town of Fort Erie</u>						
<i>(Geographic Bertie)</i>						
*	16NR	Lot Rear 16	0.71 020 03117301 (F. Iuliani)	%	0.01 %	0.01 %
<i>(Geographic Willoughby)</i>						
	2nd Cross	Pt. 29	1.00 040 05532401 (R. Guglielmi)	%	0.03 %	0.03 %
	2nd Cross	Pt. 29	4.98 040 05532800 (Kenneth Chacra Enterprises Inc.)		0.14	0.14
	2nd Cross	Pt. 30	5.17 040 05532805 (K. & A. Duerksen)		0.17	0.17
	2nd Cross	Pt. 30	4.54 040 05532900 (C. & E. Upper)		0.15	0.15
*	2nd Cross	Pt. 30	0.76 040 05532901 (N. & C. Horton)		0.03	0.03
TOTAL ASSESSMENT ON LANDS				=====	%	0.53 %
				=====		0.53 %
Regional Road 25					1.39	Region of Niagara
Willow Road					2.00	Town of Fort Erie
Unopened Rd Lt 30					0.46	Town of Fort Erie
TOTAL ASSESSMENT ON ROADS				=====	%	0.24 %
				=====		0.24 %
TOTAL ASSESSMENT FOR MAINTENANCE OF YOUNG DRAIN - (Sta. 0+072 to 7+764) IN THE TOWN OF FORT ERIE				=====	%	0.94 %
				=====		0.94 %

City of Niagara Falls

<i>(Geographic Willoughby)</i>						
*	5	Pt.1 - 4	21.75 130 00416700 (N.P.C.A.)	%	0.15 %	0.15 %
	5	Ept. 2	0.11 130 00410100 (N. Sauer)		0.01	0.01
	5	Ept. 3	2.60 130 00409900 (K. & C. Brown)		0.04	0.04
	5	NEPt. 4	5.91 130 00409500 (J. Kulhanek)		0.08	0.08
*	5	SEPt. 4	4.91 130 00409600 (G. Williamson)		0.03	0.03
	6	1	50.30 130 00418100 (N.. Sauer)	1.99	0.66	2.65
	6	Wpt. 2	18.21 130 00418000 (D.&A.Silverthorne,R.&T.Portugaise)	1.65	0.21	1.86
*	6	Pt.3 - 4	34.88 130 00416700 (N.P.C.A.)		0.26	0.26
	6	SWPt. 3	15.79 130 00417600 (P. Fiorentino)		0.17	0.17
	6	NWpt. 3	11.80 130 00417800 (E. & S. Friskie)		0.13	0.13
*	6	Pt. 3	0.40 130 00417700 (W. Holowitz)		0.01	0.01
*	6	Pt. 4	3.77 130 00417000 (R. Ferraro, T. Millington-Ferraro)		0.04	0.04
*	6	Pt. 4	3.31 130 00417001 (B. Flores)		0.03	0.03
*	6	Pt. 4	0.41 130 00417100 (J. Graham)		0.01	0.01
*	6	Pt. 4	4.38 130 00417200 (W. Lamb)		0.05	0.05
*	6	Pt. 4	0.50 130 00417300 (M. & J. Royer)		0.01	0.01
	7	Pt. 1	21.00 130 00421200 (A. & G. & A. Tavano)		0.13	0.13
	7	2	30.00 130 00421100 (L. Kit, D. Kit-Mete)	1.53	0.13	1.66

SCHEDULE 'D' - ASSESSMENT FOR MAINTENANCE (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

CON.	LOT	HECTARES		ROLL No. (OWNER)	MAINTENANCE PERCENTAGE		
		AFFECTED			BENEFIT	OUTLET	TOTAL
YOUNG DRAIN - (Sta. 0+072 to 7+764) City of Niagara Falls (Cont'd)							
<i>(Geographic Willoughby)</i>							
	7	Pt. 3	6.21	130 00421001 (A. Subramanian)	%	0.05 %	0.05 %
*	7	Pt. 3	4.05	130 00421000 (S. Hilton)		0.02	0.02
*	7	Pt. 3	0.19	130 00420900 (R. & T. Warner)		0.01	0.01
	7	Pt. 3	1.80	130 00420715 (N. & J. Vandenberg)		0.01	0.01
1st Cross		SPT. 12	1.73	130 00422300 (F. & C. Muileboom)		0.02	0.02
* 1st Cross		NPt.12 & 13	31.25	130 00416700 (N.P.C.A.)		0.24	0.24
1st Cross		SEPt. 13	21.70	130 00422500 (W. & S. Young)		0.41	0.41
1st Cross		WPT. 13	28.33	130 00422800 (E. Landrum)	1.27	0.66	1.93
1st Cross		Pt.14 & 15	6.14	130 00422900 (A. & K. Duerksen)		0.20	0.20
1st Cross		Pt.14 & 15	40.17	130 00423210 (J. & H. Swanson)	2.82	1.11	3.93
1st Cross		Pt.14 & 15	21.00	130 00423400 (V. Scott)	2.01	0.49	2.50
* 1st Cross		Pt. 15	2.44	130 00423000 (J. & C. Castellanos)	0.08	0.06	0.14
* 1st Cross		Pt. 15	0.31	130 00423100 (S. & M. Eggleton)		0.02	0.02
* 1st Cross		Pt. 15	1.57	130 00423202 (J. & D. Pierrynowski)		0.04	0.04
* 1st Cross		Pt. 15	0.37	130 00423320 (S. Jasek)	0.07	0.01	0.08
<i>(Geographic Crowland)</i>							
* Gore		Pt. 1	1.21	140 00102500 (A. Secco)	%	0.03 %	0.03 %
7,Gore		Pt. 1	14.06	140 00102600 (A. & R. Armenti)	0.44	0.41	0.85
7		Pt. 1	27.00	140 00102700 (P. & M. Kikkert)	0.81	0.67	1.48
7,Gore		Pt. 2	37.00	140 00102900 (E. & K. Edwards)	1.24	1.39	2.63
7,Gore		Pt. 3	17.50	140 00103200 (1532044 Ontario Inc.)		0.55	0.55
Gore		Pt. 4	0.94	140 00103800 (B. & L. Gatto)		0.04	0.04
<i>(Geographic Humberstone)</i>							
* 5		Pt. 3	0.28	150 00100500 (E. Michaud)	%	0.02 %	0.02 %
	5	Pt. 3	5.87	150 00100600 (Loeffen Farms Ltd., 1448077 Ont. Ltd.)		0.26	0.26
* 5		Pt. 3	1.73	150 00100650 (J. & E. Hersom)		0.06	0.06
* 5		Pt. 3	1.80	150 00100605 (B. & C. Newell)		0.06	0.06
* 5		Pt. 3	2.07	150 00100701 (R. & V. Dekker)		0.07	0.07
* 5		Pt.3 & 4	4.16	150 00100700 (J. & D. Deschamps)	0.44	0.16	0.60
* 5		Pt. 4	2.83	150 00100704 (H. Najmudin)	0.57	0.09	0.66
* 5		Pt. 4	7.59	150 00100800 (L. McMahon)	0.10	0.32	0.42
	5	Pt. 5	3.64	150 00100900 (J. Ruicci, D. Borg-Ruicci)		0.16	0.16
* 5		Pt. 5	11.63	150 00101000 (G. Sovegarto)		0.63	0.63
* 5		Pt. 6	2.83	150 00101400 (P. Czartowski)		0.13	0.13
* 5		Pt. 6	4.86	150 00101300 (A. Vibent)		0.23	0.23
* 5		Pt. 6	0.23	150 00101200 (S. Pandur)		0.02	0.02
* 5		Pt. 6	7.39	150 00101500 (E. & F. Joudrey)		0.24	0.24
* 5		Pt. 8	0.02	150 00102000 (C. Wilson)		0.01	0.01
* 5		Pt. 9	2.00	150 00102101 (K. Warner)		0.08	0.08
* 5		Pt. 9	0.60	140 00105800 (C. P. Rail)		0.03	0.03
TOTAL ASSESSMENT ON LANDS					15.02 %	11.16 %	26.18 %

SCHEDULE 'D' - ASSESSMENT FOR MAINTENANCE (Cont'd)

YOUNG & HOPF-WAGNER DRAINS
 City of Port Colborne

CON.	LOT	HECTARES AFFECTED	ROLL No. (OWNER)	MAINTENANCE PERCENTAGE		
				BENEFIT	OUTLET	TOTAL
YOUNG DRAIN - (Sta. 0+072 to 7+764) City of Niagara Falls (Cont'd)						
	Regional Road 98	3.40	Region of Niagara	0.12 %	0.47 %	0.59 %
	Regional Road 25	4.59	Region of Niagara	0.47	0.35	0.82
	Beck Road	0.52	City of Niagara Falls		0.02	0.02
	Willodell Road	2.21	City of Niagara Falls	0.25	0.03	0.28
	Schaubel Road	2.25	City of Niagara Falls		0.06	0.06
	Unopened Rd Lt 14	2.25	City of Niagara Falls		0.06	0.06
	Misner Road	1.39	City of Niagara Falls		0.14	0.14
	Koable Road	0.60	City of Niagara Falls		0.10	0.10
	Green Road	0.60	City of Niagara Falls		0.10	0.10
	Brookfield Rd	0.04	City of Niagara Falls		0.01	0.01
	Sauer Road	1.67	City of Niagara Falls		0.06	0.06
	Koabel Road	1.63	City of Niagara Falls	0.28	0.01	0.29
	Schneider Road	3.06	City of Niagara Falls	0.27	0.10	0.37
				=====		
TOTAL ASSESSMENT ON ROADS				1.39 %	1.51 %	2.90 %
				=====		
TOTAL ASSESSMENT FOR MAINTENANCE OF YOUNG DRAIN - (Sta. 0+072 to 7+764) IN THE CITY OF NIAGARA FALLS				16.41 %	12.67 %	29.08 %
				=====		
TOTAL ASSESSMENT FOR MAINTENANCE OF YOUNG DRAIN - (Sta. 0+072 to 7+764)				29.68 %	70.32 %	100.00 %
				=====		

NOTE: All the above lands, with the exception of those noted with an asterisk, are classified as agricultural.

SCHEDULE 'D' - ASSESSMENT FOR MAINTENANCE (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

CON.	LOT	HECTARES		ROLL No. (OWNER)	MAINTENANCE PERCENTAGE		
		AFFECTED			BENEFIT	OUTLET	TOTAL
HOPF WAGNER DRAIN - MAIN DRAIN (STA. 7+764 to 9+929)							
City of Port Colborne							
<i>(Geographic Humberstone)</i>							
4	Pt. 10	2.74	040	00610200 (C. & H. Aimsbury)	1.00 %	0.10 %	1.10 %
4	Pt. 10	4.45	040	00610300 (M. Dumont)		0.49	0.49
* 4	Pt. 10	0.41	040	00610400 (R. Wiggin, M. Friedlein)		0.04	0.04
* 4	Pt. 10	0.41	040	00610500 (J. Rudd, R. Begley)		0.04	0.04
4	Pt. 10	4.93	040	00610600 (K. & S. Fox)		0.54	0.54
4	Pt. 10	4.93	040	00610700 (W. & M. Aiken)		0.54	0.54
4	Pt. 11	0.30	040	00611100 (J. Walker, T. Stroomer)		0.03	0.03
4	Pt. 11	3.20	040	00614205 (R. Walker)		0.19	0.19
4	Pt. 11	3.56	040	00614201 (D. & H. Carver)		0.56	0.56
4	Pt.W½ 11	12.76	040	00611000 (J. Carver)	1.75	2.10	3.85
4	Pt.E½ 11	13.30	040	00611200 (G. & J. Tice)	1.75	0.82	2.57
4	Pt. 12	10.56	040	00614200 (K. & S. Fox)	4.06	1.77	5.83
4	Pt.W½ 12	16.03	040	00614601 (C. Menard, C. Barker)	1.75	4.76	6.51
* 4	Pt. 12	0.83	040	00614300 (A. & V. Kertesz)		0.26	0.26
* 4	Pt. 12	1.01	040	00614400 (J. & S. Price)		0.34	0.34
4	Pt. 13	18.33	040	00614500 (B. & H. Sonnenberg)	1.56	10.32	11.88
4	NPt. 13	4.69	040	00614600 (S. & D. Nease)	0.48	1.36	1.84
* 4	Pt. 14	1.00	040	00615100 (J. & E. Vidal)		0.58	0.58
4	Pt. 14	4.05	040	00615000 (R. & S. Little)		1.81	1.81
4	Pt. 14	6.07	040	00614900 (M. Butler Est.)	0.79	3.16	3.95
* 4	Pt. 14	0.40	040	00614800 (R. & C. Betts)		0.73	0.73
4	Pt. 14	2.39	040	00614700 (A. & R. Dickey)	0.87	1.54	2.41
* 4	Pt. 14	2.79	040	00615400 (D. & M. Orlowski)	0.81	1.38	2.19
* 4	Pt. 14	1.00	040	00615405 (Enbridge Gas Distribution)	0.79	0.97	1.76
4	Pt. 15	1.80	040	00515901 (Stam Acres Limited)		2.39	2.39
* 4	Pt. 15	0.80	040	00515902 (D. & J. Culp)		0.73	0.73
* 4	Pt. 15	0.28	040	00515903 (R.J. Gillespie Enterprise Limited)		0.55	0.55
* 4	Pt. 15	0.28	040	00515904 (D. & M. Orlowski)		0.56	0.56
5	Pt. 10	0.64	040	00617700 (M. & T. Novotny)		0.23	0.23
* 5	Pt. 10	2.04	040	00617601 (M. Miedema, J. Ceply)		0.55	0.55
* 5	Pt. 10	1.38	040	00617602 (D. & D. Taylor)		0.39	0.39
* 5	Pt. 11	4.05	040	00617800 (L. Adams)		0.94	0.94
* 5	Pt. 11	5.07	040	00617900 (Enbridge Gas Distribution)		0.94	0.94
5	Pt. 12	1.43	040	00619200 (A. & T. Mattiazzo)		0.27	0.27
* 5	Pt. 12	6.07	040	00619400 (A. & C. Game)		1.12	1.12
* 4&5	Pt. 10 - 15	6.80	040	00699900 (C.N.R.)	15.09	2.97	18.06
TOTAL ASSESSMENT ON LANDS					30.70 %	46.07 %	76.77 %
Brookfield Rd		1.5		City of Port Colborne	0.33 %	0.21 %	0.54 %
Stauth Road		0.3		City of Port Colborne		0.30	0.30
Sherk Road		1.4		City of Port Colborne	0.33	1.27	1.60
White Road		0.9		City of Port Colborne	3.61	2.70	6.31
Forkes Road		3.8		City of Port Colborne	9.57	4.91	14.48
TOTAL ASSESSMENT ON ROADS					13.84 %	9.39 %	23.23 %
TOTAL ASSESSMENT FOR MAINTENANCE OF HOPF WAGNER DRAIN - MAIN DRAIN (STA. 7+764 to 9+929)					44.54 %	55.46 %	100.00 %

NOTE: All the above lands, with the exception of those noted with an asterisk, are classified as agricultural.

SCHEDULE 'D' - ASSESSMENT FOR MAINTENANCE (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

CON.	LOT	HECTARES AFFECTED	ROLL No. (OWNER)	MAINTENANCE PERCENTAGE		
				BENEFIT	OUTLET	TOTAL
HOPF WAGNER DRAIN - NEASE BRANCH (STA. 8+957 to 9+324)						
<u>City of Port Colborne</u>						
<i>(Geographic Humberstone)</i>						
4	NPt. 13	4.69	040 00614600 (S. & D. Nease)	20.67 %	6.87 %	27.54 %
* 4	Pt. 14	1.40	040 00615400 (D. & M. Orłowski)		3.88	3.88
* 5	Pt. 11	4.05	040 00617800 (L. Adams)		14.11	14.11
* 5	Pt. 11	5.07	040 00617900 (Enbridge Gas Distribution)		14.06	14.06
* 4&5	Pt. 10 - 15	1.26	040 00699900 (C.N.R.)	9.54	2.44	11.98
TOTAL ASSESSMENT ON LANDS				30.21 %	41.36 %	71.57 %
Forkes Road		1.6	City of Port Colborne	6.52	21.91	28.43 %
TOTAL ASSESSMENT ON ROADS				6.52 %	21.91 %	28.43 %
TOTAL ASSESSMENT FOR MAINTENANCE OF HOPF WAGNER DRAIN - NEASE BRANCH (STA. 8+957 to 9+324)				36.73 %	63.27 %	100.00 %

NOTE: All the above lands, with the exception of those noted with an asterisk, are classified as agricultural.

SCHEDULE OF NET ASSESSMENT

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

(FOR INFORMATION PURPOSES ONLY)

Job No. 90070

July 27, 2017

CODE	ROLL NUMBER (OWNER)	TOTAL ASSESSMENT	GRANT	ALLOWANCES	APPROX. NET
<u>City of Port Colborne</u>					
*	040 00607800 (D. & S. Anderson)	\$ 87.00	\$	\$	87.00
	040 00608100 (D. & L. Pirson)	316.00	105.00		211.00
*	040 00608200 (M. & R. Nicholls)	489.00			489.00
*	040 00609200 (V. Hermoza)	755.00			755.00
*	040 00608600 (Heritage Family Holdings)	283.00			283.00
*	040 00608601 (Heritage Family Holdings)	179.00			179.00
	040 00609301 (A. Ruigrok)	859.00	286.00		573.00
	040 00609400 (D. & L. Showler)	801.00	267.00		534.00
	040 00609405 (L. & B. Durliat)	1,935.00	645.00		1,290.00
*	040 00609500 (W. Schneider, B. Gingras)	242.00			242.00
	040 00609600 (L. & P. Durliat)	388.00	129.00		259.00
	040 00609606 (L. & P. Durliat)	1,243.00	414.00		829.00
	040 00609607 (L. & P. Durliat)	3,405.00	1,135.00		2,270.00
*	040 00609902 (W. & L. Collard)	8,477.00		1,990.00	6,487.00
	040 00609900 (A. Collard)	3,710.00	1,237.00		2,473.00
*	040 00609901 (H. & D. Noyes)	626.00			626.00
*	040 00609904 (City of Port Colborne)	47.00			47.00
	040 00610100 (E. & M. Geyer)	1,952.00	651.00	650.00	651.00
	040 00610301 (J. Murray)	311.00	104.00		207.00
*	040 00610305 (M. Dumont)	2,923.00			2,923.00
	040 00610200 (C. & H. Aimsbury)	5,889.00	1,963.00	1,290.00	2,636.00
*	040 00610205 (R. & L. Eckmier)	163.00			163.00
	040 00610300 (M. Dumont)	1,301.00	434.00		867.00
*	040 00610400 (R. Wiggin, M. Friedlein)	217.00			217.00
*	040 00610500 (J. Rudd, R. Begley)	217.00			217.00
	040 00610600 (K. & S. Fox)	3,183.00	1,061.00		2,122.00
	040 00610700 (W. & M. Aiken)	3,286.00	1,095.00		2,191.00
	040 00611100 (J. Walker, T. Stroomer)	163.00	54.00		109.00
	040 00614205 (R. Walker)	1,017.00	339.00		678.00
	040 00614201 (D. & H. Carver)	1,341.00	447.00		894.00
	040 00611000 (J. Carver)	7,196.00	2,399.00	940.00	3,857.00
	040 00611200 (G. & J. Tice)	6,581.00	2,194.00	1,030.00	3,357.00
	040 00614200 (K. & S. Fox)	8,304.00	2,768.00	980.00	4,556.00
	040 00614601 (C. Menard, C. Barker)	9,740.00	3,247.00	890.00	5,603.00
*	040 00614300 (A. & V. Kertesz)	418.00			418.00
*	040 00614400 (J. & S. Price)	522.00			522.00
	040 00614500 (B. & H. Sonnenberg)	13,785.00	4,595.00	2,230.00	6,960.00
	040 00614600 (S. & D. Nease)	7,104.00	2,368.00	1,550.00	3,186.00
*	040 00615100 (J. & E. Vidal)	592.00			592.00
	040 00615000 (R. & S. Little)	1,749.00	583.00		1,166.00
	040 00614900 (M. Butler Est.)	4,014.00	1,338.00	260.00	2,416.00

YOUNG & HOPF-WAGNER DRAINS
City of Port Colborne

CODE	ROLL NUMBER (OWNER)	TOTAL ASSESSMENT	GRANT	ALLOWANCES	APPROX. NET
<u>City of Port Colborne (Cont'd)</u>					
*	040 00614800 (R. & C. Betts)	633.00			633.00
	040 00614700 (A. & R. Dickey)	2,441.00	814.00	280.00	1,347.00
*	040 00615400 (D. & M. Orłowski)	2,677.00			2,677.00
*	040 00615405 (Enbridge Gas Distribution)	1,797.00		650.00	1,147.00
	040 00515901 (Stam Acres Limited)	2,026.00	675.00		1,351.00
*	040 00515902 (D. & J. Culp)	619.00			619.00
*	040 00515903 (R.J. Gillespie Enterprise Limited)	463.00			463.00
*	040 00515904 (D. & M. Orłowski)	472.00			472.00
	040 00611900 (Loeffen Farms Ltd., 1448077 Ontari	1,270.00	423.00		847.00
	040 00612000 (D. & J. Deschamps.)	1,404.00	468.00		936.00
*	040 00612002 (H. Najmudin)	530.00			530.00
	040 00612200 (P. Aiello)	730.00	243.00		487.00
	040 00612300 (H. & B. Bos)	3,922.00	1,307.00		2,615.00
*	040 00612301 (D. & H. Matthews)	116.00			116.00
	040 00612400 (N. & L. Bateman)	6,387.00	2,129.00	1,970.00	2,288.00
	040 00612415 (L. McMahon)	3,112.00	1,037.00	920.00	1,155.00
	040 00612500 (D. Borg-Rucci)	2,333.00	778.00	590.00	965.00
	040 00612600 (G. Sovegjarro)	1,825.00	608.00		1,217.00
*	040 00612700 (T. Chambers, L. Freeborn)	83.00			83.00
	040 00612800 (Heritage Family Holdings LLD)	10,931.00	3,644.00	1,560.00	5,727.00
*	040 00612900 (S. & S. Hall)	4,353.00		1,890.00	2,463.00
*	040 00613100 (J. Post & S. Robb)	11,855.00		2,340.00	9,515.00
	040 00613105 (J. & A. Ens)	707.00	236.00		471.00
	040 00613200 (P. Czartowski)	409.00	136.00		273.00
*	040 00613300 (J. Grimaldi)	7,116.00		1,200.00	5,916.00
*	040 00613301 (F. & E. Joudrey)	535.00			535.00
	040 00613400 (L. & P. Durliat)	9,729.00	3,243.00	2,170.00	4,316.00
	040 00613500 (L. & C. Schneider)	5,084.00	1,695.00	830.00	2,559.00
	040 00615700 (Davison Farms Ltd.)	801.00	267.00		534.00
	040 00615705 (Davison Farms Ltd.)	801.00	267.00		534.00
	040 00615800 (A. Pruyne)	1,533.00	511.00		1,022.00
*	040 00613505 (City of Port Colborne)	24.00			24.00
*	040 00613510 (City of Port Colborne)	34.00			34.00
	040 00613600 (M. & E. Geyer)	1,026.00	342.00		684.00
	040 00613700 (M. & M. Young)	2,617.00	872.00		1,745.00
	040 00613705 (J. & D. Rauscher)	4,317.00	1,439.00		2,878.00
*	040 00615900 (C. Wilson)	18.00			18.00
	040 00616000 (J. & H. Swanson)	515.00	172.00		343.00
*	040 00616300 (C. Vanderloos)	79.00			79.00
*	040 00616400 (R. Stegner)	48.00			48.00
*	040 00616500 (D. Little)	125.00			125.00
*	040 00616600 (R. Vincelette)	88.00			88.00
*	040 00616700 (S. Johnston, H. Keeso)	414.00			414.00
*	040 00616800 (S. Johnston, H. Keeso)	344.00			344.00
*	040 00616900 (A. & S. Miljanic)	98.00			98.00
*	040 00617000 (K. Cooke)	72.00			72.00
	040 00616501 (K. Pagnotta)	842.00	281.00		561.00
	040 00616502 (R. & M. Bilodeau)	1,426.00	475.00		951.00

YOUNG & HOPF-WAGNER DRAINS
City of Port Colborne

CODE	ROLL NUMBER (OWNER)	TOTAL ASSESSMENT	GRANT	ALLOWANCES	APPROX. NET
<u>City of Port Colborne (Cont'd)</u>					
*	040 00617005 (K. & A. Warner)	584.00			584.00
*	040 00616505 (V. & F. Kersch)	329.00			329.00
	040 00617700 (M. & T. Novotny)	1,009.00	336.00		673.00
*	040 00617601 (M. Miedema, J. Ceply)	817.00			817.00
*	040 00617602 (D. & D. Taylor)	613.00			613.00
	040 00618103 (M. & L. Koabel)	9,392.00	3,131.00		6,261.00
*	040 00618105 (J. Wayne)	180.00			180.00
*	040 00618110 (A. Troczynska)	145.00			145.00
*	040 00617800 (L. Adams)	2,700.00			2,700.00
*	040 00617900 (Enbridge Gas Distribution)	55,389.00			55,389.00
	040 00617905 (J. Stam)	2,355.00	785.00		1,570.00
*	040 00617500 (M. Chow, K. Lee)	246.00			246.00
*	040 00619200 (A. & T. Mattiazzo)	387.00			387.00
*	040 00619400 (A. & C. Game)	1,634.00			1,634.00
*	040 00699900 (C.N.R.)	200,669.00		1,050.00	199,619.00
*	040 00699600 (C. P. Rail)	3,908.00			3,908.00
*	Regional Road 98	114.00			114.00
*	Koable Road	3,525.00			3,525.00
*	Green Road	3,473.00			3,473.00
*	Brookfield Rd	10,245.00			10,245.00
*	Stauth Road	1,373.00			1,373.00
*	Troup Road	728.00			728.00
*	Sherk Road	38,333.00			38,333.00
*	White Road	6,751.00			6,751.00
*	Forkes Road	25,665.00			25,665.00
<u>Town of Fort Erie</u>					
*	020 03117301 (F. Iuliani)	36.00			36.00
	040 05532401 (R. Guglielmi)	70.00	23.00		47.00
	040 05532800 (Kenneth Chacra Enterprises Inc.)	348.00	116.00		232.00
	040 05532805 (K. & A. Duerksen)	433.00	144.00		289.00
	040 05532900 (C. & E. Upper)	381.00	127.00		254.00
*	040 05532901 (N. & C. Horton)	65.00			65.00
*	Regional Road 25	604.00			604.00
*	Willow Road	412.00			412.00
*	Unopened Rd Lt 30	37.00			37.00

SCHEDULE OF NET ASSESSMENT (Cont'd)

YOUNG & HOPF-WAGNER DRAINS

City of Port Colborne

CODE	ROLL NUMBER (OWNER)	TOTAL ASSESSMENT	GRANT	ALLOWANCES	APPROX. NET
<u>City of Niagara Falls</u>					
*	130 00416700 (N.P.C.A.)	377.00			377.00
	130 00410100 (N. Sauer)	2.00	1.00		1.00
	130 00409900 (K. & C. Brown)	90.00	30.00		60.00
	130 00409500 (J. Kulhanek)	205.00	68.00		137.00
*	130 00409600 (G. Williamson)	85.00			85.00
	130 00418100 (N. Sauer)	11,619.00	3,873.00	3,450.00	4,296.00
	130 00418000 (D.&A.Silverthorne,R.&T.Portugaise)	8,798.00	2,933.00	1,250.00	4,615.00
*	130 00416700 (N.P.C.A.)	664.00			664.00
	130 00417600 (P. Fiorentino)	421.00	140.00		281.00
	130 00417800 (E. & S. Friskie)	314.00	105.00		209.00
*	130 00417700 (W. Holowitz)	16.00			16.00
*	130 00417000 (R. Ferraro, T. Millington-Ferraro)	99.00			99.00
*	130 00417001 (B. Flores)	87.00			87.00
*	130 00417100 (J. Graham)	16.00			16.00
*	130 00417200 (W. Lamb)	116.00			116.00
*	130 00417300 (M. & J. Royer)	13.00			13.00
	130 00421200 (A. & G. & A. Tavano)	325.00	108.00		217.00
	130 00421100 (L. Kit, D. Kit-Mete)	7,968.00	2,656.00	1,560.00	3,752.00
	130 00421001 (A. Subramanian)	115.00	38.00		77.00
*	130 00421000 (S. Hilton)	47.00			47.00
*	130 00420900 (R. & T. Warner)	5.00			5.00
	130 00420715 (N. & J. Vandenberg)	17.00	6.00		11.00
	130 00422300 (F. & C. Muileboom)	60.00	20.00		40.00
*	130 00416700 (N.P.C.A.)	606.00			606.00
	130 00422500 (W. & S. Young)	1,027.00	342.00		685.00
	130 00422800 (E. Landrum)	7,992.00	2,664.00	2,210.00	3,118.00
	130 00422900 (A. & K. Duerksen)	502.00	167.00		335.00
	130 00423210 (J. & H. Swanson)	16,900.00	5,633.00	3,820.00	7,447.00
	130 00423400 (V. Scott)	11,291.00	3,764.00	3,090.00	4,437.00
*	130 00423000 (J. & C. Castellanos)	556.00		600.00	(44.00)
*	130 00423100 (S. & M. Eggleton)	39.00		530.00	(491.00)
*	130 00423202 (J. & D. Pierrynowski)	88.00			88.00
*	130 00423320 (S. Jasek)	386.00			386.00
*	140 00102500 (A. Secco)	72.00			72.00
	140 00102600 (A. & R. Armenti)	3,255.00	1,085.00	950.00	1,220.00
	140 00102700 (P. & M. Kikkert)	5,766.00	1,922.00	640.00	3,204.00
	140 00102900 (E. & K. Edwards)	9,670.00	3,223.00	2,350.00	4,097.00
	140 00103200 (1532044 Ontario Inc.)	1,378.00	459.00		919.00
	140 00103800 (B. & L. Gatto)	101.00	34.00		67.00
*	150 00100500 (E. Michaud)	45.00			45.00
	150 00100600 (Loeffen Farms Ltd., 1448077 Ont. L	653.00	218.00		435.00
*	150 00100650 (J. & E. Hersom)	144.00			144.00
*	150 00100605 (B. & C. Newell)	147.00			147.00
*	150 00100701 (R. & V. Dekker)	171.00			171.00

YOUNG & HOPF-WAGNER DRAINS
 City of Port Colborne

CODE	ROLL NUMBER (OWNER)	TOTAL ASSESSMENT	GRANT	ALLOWANCES	APPROX. NET
<u>City of Niagara Falls (Cont'd)</u>					
*	150 00100700 (J. & D. Deschamps)	2,590.00		460.00	2,130.00
*	150 00100704 (H. Najmudin)	3,111.00		1,170.00	1,941.00
*	150 00100800 (L. McMahon)	1,290.00		130.00	1,160.00
	150 00100900 (J. Ruicci, D. Borg-Ruicci)	403.00	134.00		269.00
*	150 00101000 (G. Sovegjarto)	1,573.00			1,573.00
*	150 00101400 (P. Czartowski)	329.00			329.00
*	150 00101300 (A. Vibent)	576.00			576.00
*	150 00101200 (S. Pandur)	47.00			47.00
*	150 00101500 (E. & F. Joudrey)	594.00			594.00
*	150 00102000 (C. Wilson)	4.00			4.00
*	150 00102101 (K. Warner)	203.00			203.00
*	140 00105800 (C. P. Rail)	80.00			80.00
*	Regional Road 98	1,803.00			1,803.00
*	Regional Road 25	3,223.00			3,223.00
*	Beck Road	45.00			45.00
*	Willodell Road	52,230.00			52,230.00
*	Schaubel Road	150.00			150.00
*	Unopened Rd Lt 14	150.00			150.00
*	Misner Road	350.00			350.00
*	Koable Road	259.00			259.00
*	Green Road	245.00			245.00
*	Brookfield Rd	15.00			15.00
*	Sauer Road	145.00			145.00
*	Koabel Road	1,401.00			1,401.00
*	Schneider Road	49,995.00			49,995.00
TOTALS		\$ 790,600.00	\$ 86,205.00	\$ 49,470.00	\$ 654,925.00

* = Non-agricultural

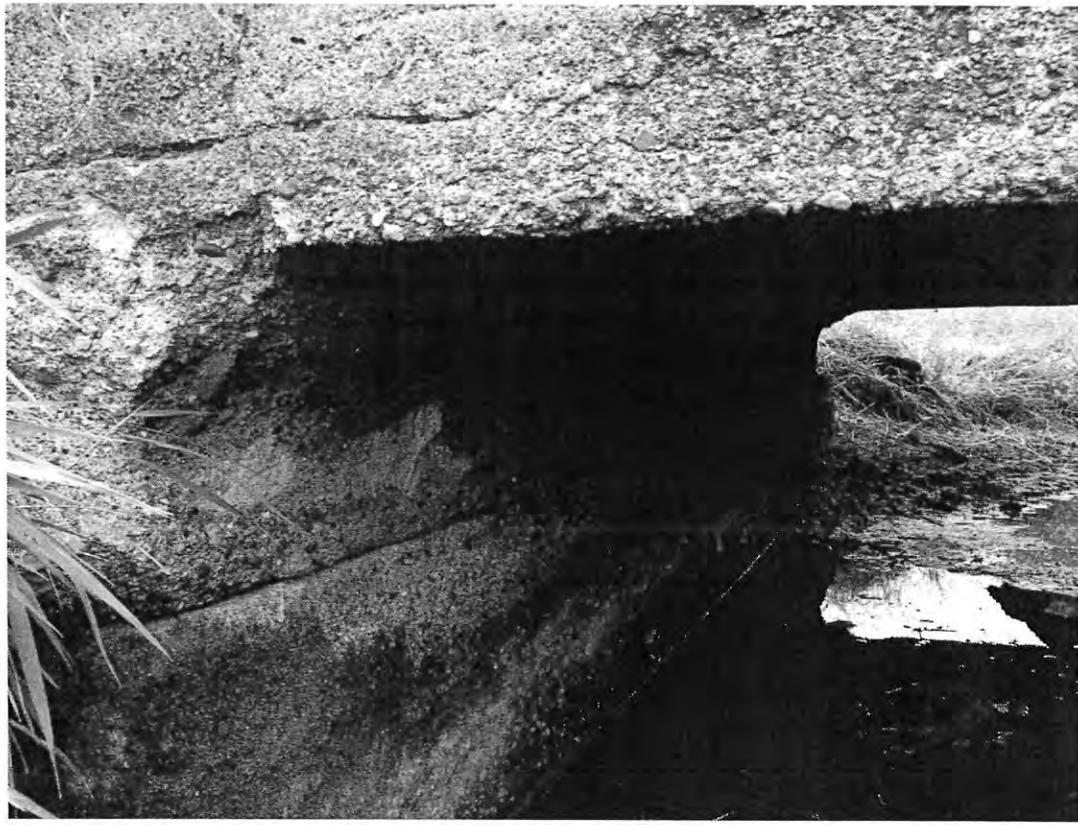
APPENDIX – A

PHOTOS

PHOTOS 1-4 SCHNEIDER ROAD BRIDGE

PHOTOS 5-6 WILLODELL ROAD BRIDGE









09/02/2016

APPENDIX – B

GOLDERS GEOTECHNICAL INVESTIGATION

(CN RAIL CROSSINGS)



October 2012

GEOTECHNICAL INVESTIGATION

**CN Rail Undercrossings
Low Flow Culvert Installations
Young Drain and Hopf-Wagner Drain
Port Colborne, Ontario**

Submitted to:
Mr. John Spriet, P.Eng.
Spriet Associates
155 York Street
London, Ontario
N6A 1A8

REPORT



**A world of
capabilities
delivered locally**

Report Number: 11-1132-0186-R01

Distribution:

- 2 Copies - Spriet Associates
- 1 Copy - Canadian National Railway
- 1 Copy - City of Port Colborne
- 2 Copies - Golder Associates Ltd.





**GEOTECHNICAL INVESTIGATION
PORT COLBORNE CNR UNDERCROSSINGS**

October 17, 2012

Project No. 11-1132-0186-R01

Spriet Associates
155 York Street
London, Ontario
N6A 1A8

Attention: Mr. John Spriet, P.Eng.

**GEOTECHNICAL INVESTIGATION
CN RAIL UNDERCROSSINGS
LOW FLOW CULVERT INSTALLATIONS
YOUNG DRAIN AND HOPF-WAGNER DRAIN
PORT COLBORNE, ONTARIO**

Dear Mr. Spriet:

This report presents the results of the geotechnical investigation carried out for the design of the replacements of the Young Drain and Hopf-Wagner Drain culvert undercrossings of the Canadian National Railway (CN Rail) tracks. The undercrossings to be replaced are located as follows:

- Drain Chainage 7+085 – Stamford Subdivision, Robins East Connecting Track, Mileage 12.62;
- Drain Chainage 7+542 – Robins West Connecting Track, Mileage 0.12;
- Drain Chainage 8+969 – (Serk Road) Stamford Subdivision, Mileage 14.17; and
- Drain Chainage 9+871 – (White Road) Stamford Subdivision, Mileage 14.69.

The project site is located in Port Colborne, Ontario, as shown on the Key Plan, Figure 1.

The purpose of the investigation was to determine the subsurface soil and groundwater conditions at the site and to provide geotechnical engineering recommendations for the design of the proposed trenchless low flow undercrossings of the CN Rail tracks.

Authorization to proceed with the geotechnical investigation was provided by Mr. John Spriet, P.Eng. of Spriet Associates (Spriet).

Important information on the limitations of this report is attached.



1.0 SITE DESCRIPTION

1.1 General

Based on the information provided, it is understood that four existing Young Drain and Hopf-Wagner Drain culvert undercrossings of CN Rail tracks are to be replaced with smooth-wall steel pipes using trenchless methods. The locations, approximate inverts, diameters and lengths of the proposed culvert replacements are summarized in the following table:

Culvert Location (Drain Chainage)	CN Rail Mileage	Proposed Invert Elevation (m)	Proposed Culvert Dimensions		Approximate Depth of Cover to Ballast Surface (m)
			Diameter (mm)	Length (m)	
Sta. 7+085	12.62	177.40	750	30	3.5
Sta. 7+542	0.12	177.60	750	26	3.0
Sta. 8+969 (Sherk Road)	14.17	178.20	750	18	1.5
Sta. 9+871 (White Road)	14.69	178.66	610	22	2.5

1.2 Site Geology

This project lies in the physiographic region of southern Ontario known as the Haldimand clay plain¹.

Based on the Ontario Geological Survey Preliminary Map 2496 entitled "Quaternary Geology, Niagara-Welland, Southern Ontario", the site lies in an area of clay and silt deposited in deep water lakes associated with former glacial ice sheets in the region.

The Geologic Survey of Canada Map 1263A entitled "Geology, Toronto-Windsor Area, Ontario" indicates that the bedrock underlying the site is dolostone and mudstone of the Salina Formation of Upper Silurian age. Based on the Ontario Department of Mines Preliminary Map P.2403 entitled "Bedrock Topography Series, Welland-Fort Erie Area, Southern Ontario", the bedrock surface at the site is typically found at about elevation 160 metres or about 19 metres below the general ground surface.

¹ L.J. Chapman and D.F. Putnam: The Physiography of Southern Ontario, Third Edition. Ontario Geological Survey, Special Volume 2, 1984.



2.0 PROCEDURE

The field work for this investigation was carried out on February 27 and 28, 2012 at which time 8 boreholes, numbered 1 to 8, were drilled at the locations shown on the Location Plan, Figure 1. The boreholes were drilled using manual equipment by members of our geotechnical engineering staff. The soil stratigraphy encountered in the boreholes is shown on the attached Record of Borehole sheets and interpreted simplified stratigraphic sections are shown on Figures 2 to 5.

Non-standard penetration testing and sampling was carried out in the manually drilled boreholes. The penetration testing was carried out with a 31.5 kilogram manual hammer. The driving resistances have been adjusted to approximate standard penetration test N values. All of the samples obtained during the investigation were brought to our laboratory for further examination and laboratory testing. The results of the laboratory testing are provided on the Records of Boreholes and on Figures 2 to 7.

Groundwater levels were observed in the boreholes during drilling. The encountered groundwater levels are shown on the Record of Boreholes. Upon completion of drilling and sampling, the boreholes were backfilled in accordance with Ontario Regulation (O. Reg.) 903, as amended.

Members of our engineering staff designated the borehole locations in the field, obtained underground utility locates, carried out the drilling, logged the boreholes and cared for the samples obtained.

The ground surface elevations at the borehole locations have been referenced to the top of the existing culverts adjacent to the boreholes. The elevations of these points were shown on the drawings provided by Spriet and are understood to be referenced to geodetic datum.

3.0 SUBSURFACE CONDITIONS

3.1 General

The subsurface conditions encountered in the boreholes drilled at the site are shown on the attached Record of Borehole sheets and interpreted simplified stratigraphic sections are shown on Figures 2 to 5. The discussion below has been simplified in terms of major soil strata for the purposes of geotechnical design. The soil boundaries have been inferred from non-continuous samples and observations of drilling resistance. These interpreted boundaries represent a transition from one soil type to another and should not be interpreted to represent exact planes of geological change. Further, subsurface conditions may vary significantly between and beyond the borehole locations.



3.2 Soil Conditions

The soil conditions encountered in the boreholes consisted of topsoil and granular fill overlying silty clay. Although access to the CN Rail embankments was not available, visual observations indicated that the embankment fill consists of cohesive materials.

3.2.1 Topsoil

Topsoil was encountered at the ground surface in boreholes 1, 2 and 4 to 8. The topsoil was 150 to 490 millimetres thick with an average thickness of about 320 millimetres. A 190 millimetre thick layer of buried topsoil was encountered beneath the fill in borehole 3.

3.2.2 Fill

A 210 millimetre thick layer of clayey topsoil fill was encountered at the ground surface in borehole 3.

The subsurface explorations carried out for this report did not explore the conditions within the fill constructed for the rail embankments due to access issues. It is cautioned that railway embankment fill may contain reworked native soils or imported soil fill and/or other debris including materials such as concrete, brick, rock fragments, timbers, wood, and metal.

3.2.3 Silty Clay

Layers of silty clay were encountered beneath the topsoil in boreholes 1, 2 and 4 to 8 and beneath the buried topsoil in borehole 3 to the final depths of the boreholes that ranged from 2.7 to 3.2 metres below the ground surface. All of the boreholes were terminated in the silty clay. Approximated N values within the silty clay ranged from about 7 to 36 blows per 0.3 metres with water contents between 17 and 32 per cent and an average water content of about 23 per cent.

The results of Atterberg limits laboratory testing indicated plastic and liquid limits of 18 to 26 and 30 to 57 per cent, respectively. The Atterberg limits data for the silty clay are presented on Figure 7. Grain size distribution curves for samples of the silty clay recovered from the penetration testing are shown on Figure 6.



3.3 Groundwater Conditions

Groundwater levels were observed in the boreholes during drilling. The levels at which groundwater was first encountered or observed are shown on the Record of Borehole sheets.

Groundwater was encountered in boreholes 4, 7 and 8 at depths ranging from 0.1 to 0.3 metres below the existing ground surface or between elevations 178.5 and 179.0 metres. Boreholes 1, 2, 3, 5 and 6 remained dry during drilling.

Groundwater conditions at the site should be expected to fluctuate seasonally and in response to significant precipitation events and the water level in the Young Drain and the Hopf-Wagner Drain.

4.0 DISCUSSION

4.1 General

This section of the report provides our interpretation of the factual geotechnical data obtained during the investigation and it 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 works should make their own interpretation of the subsurface information provided as it affects their proposed construction methods, equipment selection, scheduling and the like.

Based on the information provided, it is understood that the following replacement of the existing Young Drain and Hopf-Wagner Drain culvert undercrossings of CN Rail tracks are proposed:

- Drain Chainage 7+085 – Stamford Subdivision, Robins East Connecting Track, Mileage 12.62;
- Drain Chainage 7+542 – Robins West Connecting Track, Mileage 0.12;
- Drain Chainage 8+969 – (Sherk Road) Stamford Subdivision, Mileage 14.17; and
- Drain Chainage 9+871 – (White Road) Stamford Subdivision, Mileage 14.69.

The culverts are to be replaced using trenchless methods and will consist of smooth-wall steel pipes.

The results of the boreholes indicate that the undercrossing obvert and invert elevations will be within the stiff to hard silty clay. Based on the subsurface conditions, the undercrossings could potentially be installed using a number of construction techniques. The contractor should be fully responsible for the selection of the trenchless technology which best fits the contract requirements, the contractor's equipment and staff experience, and CN Rail's requirements.



The trenchless crossings of the CN Rail right-of-way must be conducted in accordance with CN Rail regulations. All trenchless work must be carried out by an experienced specialist contractor employing only qualified workers skilled in their trade under the direction of an experienced foreman. The contractor's work plan should include a method of sealing the ends of the tunnel at the end of each work day or in case of an emergency. It should also include a procedure for compensation grouting should uncontrolled loss of ground or drilling fluid occur. It is recommended that the geotechnical aspects of the contractor's work plan for the proposed undercrossings be reviewed by this office prior to construction. The trenchless contractor is advised to carefully expose any underground utilities which cross the undercrossing path to confirm their elevations prior to commencement of the work.

4.1.1 Conventional "Jack and Bore" Systems

Conventional "jack and bore" systems consist of a cutting bit mounted at the lead end of auger flights that operate within a steel casing. The cutting bit can often be chosen to cut soils or rock and can operate either ahead of the casing in hard ground, at the leading edge of the casing, or from within the casing, depending on the configuration of the auger flights and operational settings. This system, however, does not control saturated granular soils well since the saturated soils can readily flow into and past the face of the cutting bit and along the augers. Further, when the cutting bit is operated ahead of the casing, excess ground can be removed as the ground moves toward the excavated zone. While conventional jack and bore systems are well suited to working in cohesive soils (silt and clay), they must be used with caution in saturated granular soils and only then with adequate dewatering. Fill materials can also present difficulties for conventional jack and bore systems. In general, conventional jack and bore systems are not readily "steered" to adjust line and grade during construction.

When close control of ground displacements and ground losses (excess excavation) is necessary, a plug of soil must be maintained within the casing ahead of the cutting bit. The requirement of CN Rail is that the plug of soil between the leading edge of the casing and the leading edge of the cutting bit is at least of a length within the casing equal to the casing diameter or 0.5 metres, whichever is greater. This requirement, however, can be difficult to achieve in some soil conditions since it requires the casing pipe to be pushed into the ground ahead of the cutting bit. For this project, use of jack and bore is not recommended due to the potential for obstructions within the fill soils that may be near the obvert of the casing pipe, difficulties in controlling the alignment near the fill/native soil interface, and the need to push the casing into the ground ahead of the cutting bit to meet CN Rail's requirements.

4.1.2 Hybrid Pipe Jacking Systems

Given the technical limitations of conventional "jack and bore" systems, as discussed above, alternative "hybrid" systems have also been developed (e.g., Mighty Mole supplied by McLaughlin Boring Systems). These systems



adapt some of the advantages of microtunnelling to the simplicity of conventional jack and bore systems. Features of such hybrid systems include:

- a) The cutting head is a separate piece of machinery from the auger flights and is mounted by welding at the lead end of the casing and is then cut from the casing upon completion of the drive.
- b) The head is somewhat articulated/steerable through hydraulics and friction or drag fins to allow better control of line and grade during construction.
- c) The cutting mechanism is similar to a jack and bore system except that the bit is a smaller diameter than the leading edge and diameter of the head and typically about half the casing pipe diameter.
- d) Spoil extraction is still managed by auger flights, but the cutting bit can readily be kept a distance from the leading edge of the head equal to or more than the head diameter.
- e) Simultaneous grouting around the casing using bentonite and bentonite-cement can be accomplished as the casing is installed to assist in reducing jacking forces and filling any void spaces around the casing.
- f) If needed, the cutting bit and auger flights can be withdrawn and a core barrel can be sent through the head to remove obstacles.

Although such systems offer significant advantages over conventional jack and bore systems, vigilance is still required on the part of the operators and monitoring crew to make sure the cutting bit is indeed well behind the leading edge and that excavated and theoretical volumes of materials to be removed are well controlled.

4.1.3 Pipe Ramming

Pipe ramming utilizes a large horizontal percussion hammer to drive a steel casing into the ground. In most instances, the ground within the casing is not removed until the full length of the casing is driven. Partial removal of materials from within the casing may be needed to reduce friction and increase driving efficiency. A plug of material equal to at least one pipe diameter should be maintained within the pipe at all times to minimize the potential for adverse ground loss and ground surface/CN Rail track settlements. In some cases, depending on the depth of cover, pipe size and thickness and ground conditions, pipe ramming can also cause ground surface heave.

4.1.4 Microtunnelling

The undercrossings could possibly be installed using microtunnelling techniques. With microtunnelling, pipe/casing with a diameter often less than 900 millimetres can be jacked in place. Microtunnelling commonly uses a special-purpose, small diameter tunnel boring machine/head that is fitted at the leading end of a carrier pipe or specially-designed jacking pipe, is controlled remotely from the surface and uses slurry and piping to



remove the materials cut from ahead of the machine. Although microtunnelling is geotechnically feasible, it is unlikely to be cost effective for the relatively short undercrossing lengths.

4.1.5 Horizontal Directional Drilling (HDD)

Horizontal directional drilling (HDD) is considered to be a marginally feasible alternative for installing the casings beneath CN Rail right-of-way given the shallow cover and relatively short pipe lengths. With HDD, a small rotating and steerable bit is launched from the surface at a shallow angle and is used to drill a pilot hole supported with drilling fluid. Once the pilot bore is complete, the drill head is replaced with a backreamer or expander which enlarges the drill hole. It is adaptable to a range of drilling conditions through selection of compatible drilling fluids, downhole tools and equipment.

The HDD unit must have sufficient thrust to overcome the soil resistance typical of the stiff to hard silty clay. The drilling fluid, fluid volumes and rate of advancement must be compatible with the ground conditions. This technique relies on drilling fluids to support the drilled hole and flush cuttings to the surface. Based on the shallow depths of cover; however, there is a risk of losing fluids to the surface depending on the contractor's fluid design and operating pressures.

Upon completion any remaining annular space between the new pipe and cut ground must be filled with suitable materials to avoid generating short and/or long-term settlement above the pipe.

4.1.6 Summary of Potential Construction Methods

All of the "trenchless" construction methods described above include various advantages and disadvantages depending on soil conditions, depth of cover, vertical and horizontal alignment, length of pipe installation, cost, and availability. The relatively low depth of native soil cover over the top of the proposed installations will be a challenge for all technologies. The interface between potentially random and unexplored rail embankment fill materials and the underlying native soils may cause difficulties maintaining line and grade of the new pipes. Of the methods described above, it is considered that either pipe ramming or the hybrid systems are the most practicable and represent the lowest risk options. Conventional "jack and bore" methods should not be implemented for this work. Further, HDD systems may be impractical for a variety of reasons including the potential embankment fill materials, short pipe lengths, shallow depths, and need for control of drilling fluids.

4.1.7 Settlements

Some settlement may occur with each method of installation, even with careful workmanship. Given the anticipated subsurface and embankment conditions, settlement or heave of the ground at ballast level should be less than about 10 millimetres using pipe ramming or the hybrid pipe jacking systems described above, provided



that no obstructions are encountered and the hybrid system cutting bit remains at least 1 diameter behind the leading edge of the head. Prior to construction, the potential for and anticipated magnitude of settlement or heave should be re-evaluated depending upon the contractor's work plan and selected technology(ies). Settlement monitoring of the undercrossing should be carried out prior to, during and after the casing installation as detailed below. In addition, the trenchless installation should be monitored on a full-time basis by qualified geotechnical personnel.

4.1.8 Settlement Monitoring

A monitoring program utilizing an array of shallow settlement monitoring points is recommended. The shallow settlement monitoring points should consist of settlement plates installed at subballast level in the ground with steel riser rods at or near the end of the ties. An array of 10 shallow settlement monitoring points at each undercrossing location is recommended as outlined on Figure 8. One row will be placed at the end of the ties on each side of the tracks. Each row should have one monitoring point installed above the pipe centreline with additional points offset at intervals of 2.5 metres. In addition, one deep settlement monitoring point should be installed on the pipe centreline adjacent to the tracks at each undercrossing location, where feasible, as shown on Figure 8.

Installation of the monitoring points should be carried out by Golder and the subsequent survey monitoring should be carried out by the Contract Administrator with the results being promptly reviewed by Golder on an ongoing basis. A baseline survey should be carried out at least twice prior to construction with the points referenced to two independent benchmarks. During construction, monitoring should be carried out daily and, depending on the magnitude of any movements detected during construction, periodically for two to six months following the crossing installations. Surveying should be carried out using equipment and crews capable of achieving a precision of ± 2 millimetres.

4.2 Excavations and Groundwater Control

Based on the results of the boreholes, open cut excavations, such as those required for the jacking/receiving pits will encounter surficial topsoil underlain by silty clay. Adequate groundwater control may be achieved by pumping from properly constructed and filtered sumps in the base of the excavation. Surface water should be directed away from all excavations.

In accordance with the current Occupational Health and Safety Act and Regulations for Construction Projects (OHSAA), properly designed shoring systems would be required for the working pits.

Based on the results of the boreholes and current OHSAA criteria, the silty clay would be classified as a Type 2 soil. All unsupported open cut excavations should have side slope inclinations of 1 horizontal to 1 vertical or flatter.



Care will be required to ensure that adequate support is provided for all existing utilities and portions of the tracks which are located in the zone of influence of the excavations as defined by a line drawn from the base of the excavation at an inclination of 1 horizontal to 1 vertical. Properly designed temporary support systems could be used to limit the extent of the excavations and reduce potential impacts on adjacent services.

Deep excavations for the starting and ending pits for pipe installation are not anticipated to be necessary, given the elevations of the surrounding grades, planned pipe elevations, and the construction technologies discussed above. All pit slopes that abut the existing rail embankments should be cut such that the slopes do not intrude below a zone defined by a 2 horizontal to 1 vertical slope extending from the crest of the existing embankments. Should it be necessary to install excavation support systems to allow the start and ending pits to be closer to the rail embankments or pits that are deeper than can be accommodated by open cut slopes, additional geotechnical consultation will be required to define appropriate soil, water, embankment slope surcharge, and rail surcharge pressures for design of support systems.

5.0 GEOTECHNICAL REVIEW, INSPECTION AND TESTING

For successful design and construction of these crossings:

- Golder should be retained to carry out a detailed review of the contract technical specifications to assist in minimizing geotechnical risks associated with trenchless technologies since some elements of "standard" or common specifications may not be appropriate for this project.
- A program of geotechnical inspection and monitoring will be required during construction of the undercrossing to ensure that the intent of the design recommendations provided is being met, that the various project specifications are being achieved and that the CN Rail protocols are followed.



GEOTECHNICAL INVESTIGATION PORT COLBORNE CNR UNDERCROSSINGS

We trust that this report provides the geotechnical information required for the design at this time. Should any of the information or recommendations require clarification, please contact this office.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Tyson Pitt, P.Eng.

TP/PRB/SJB/cr

Attachments:

Limitations

Method of Soil Classification

Symbols and Terms Used on Records of Boreholes and Test Pits

List of Symbols

Records of Boreholes

Figures 1 to 8

ORIGINAL SIGNED

Storer J. Boone, Ph.D., P.Eng.
Associate

Golder, Golder Associates and the GA globe design are trademarks of Golder Associates Corporation

n:\active\2011\1132-geo\1132-0100\11-1132-0186 spriet-inv young drain-pt. colborne\rpts\1111320186-r01 oct 17 12-(final)geo inv - pt colborne cnr crossings.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.

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)

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.

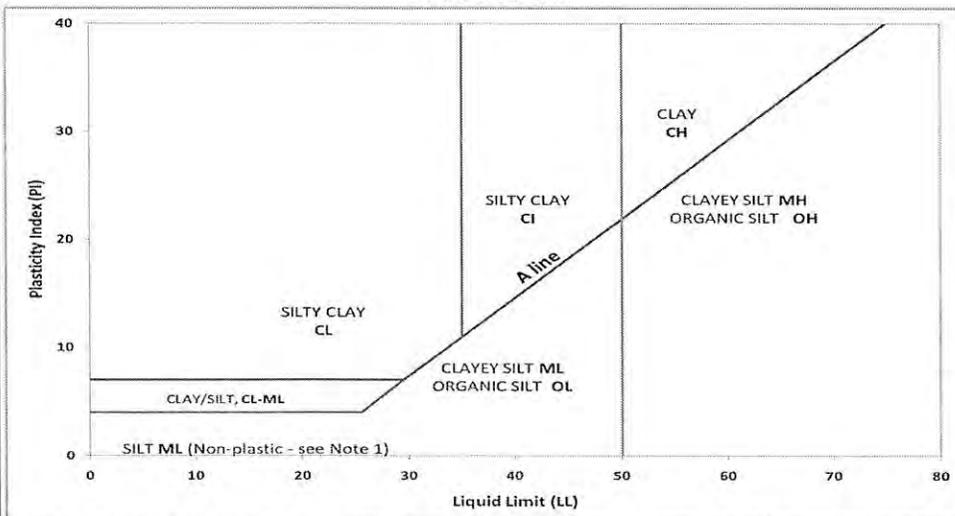


METHOD OF SOIL CLASSIFICATION

Organic or Inorganic	Soil Group	Type of Soil	Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{D_{30}^2}{D_{10} \times D_{60}}$	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 is larger than 4.75 mm)	Gravels with <12% fines (by mass)	Poorly Graded	<4	≤ 1 or ≥ 3	<30%	GP	GRAVEL	
			Gravels with >12% fines (by mass)	Well Graded	≥ 4	1 to 3		GW	GRAVEL	
			SANDS (>50% by mass is smaller than 4.75 mm)	Gravels with <12% fines (by mass)	Below A Line	n/a		GM	SILTY GRAVEL	
				Gravels with >12% fines (by mass)	Above A Line	n/a		GC	CLAYEY GRAVEL	
		SANDS (>50% by mass 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	Group Name
				Dilatancy	Dry Strength	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 (PI and LL plot below A-Line on Plasticity Chart)	Liquid Limit <50	Rapid	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
				Slow to very slow	Low to medium	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to High	1 mm to 3 mm	Medium to High	5% to 30%	OH	ORGANIC SILT
				None	Low to medium	~ 3 mm	Low to medium	0% to 30%	CL	SILTY CLAY
		Liquid Limit 35 to 50	None	Medium to High	1 mm to 3 mm	Medium	CI		SILTY CLAY	
		Liquid Limit >50	None	High	<1 mm	High	CH		CLAY	
		HIGHLY ORGANIC SOILS (Organic Content >30% by mass)	Peat and mineral soil mixtures	Predominantly peat, may contain some mineral soil, fibrous or amorphous peat					30% to 75%	PT
>75%	PEAT									

PLASTICITY CHART



Note 1 – Fine grained materials which are Non-plastic (i.e. a PL cannot be measured) are named SILT.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC, CL-ML used when the soil has between 5 and 12% fines (i.e. between "clean" sand and "dirty" sand) or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart.

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.



SYMBOLS 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	19 to 75	0.75 to 3
	Fine	4.75 to 19	(4) to 0.75
SAND	Coarse	2.00 to 4.75	(10) to (4)
	Medium	0.425 to 2.00	(40) to (10)
	Fine	0.075 to 0.425	(200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

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

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.) drive open sampler for a distance of 300 mm (12 in.).

Piezo-Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² 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; 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

NON-COHESIVE (COHESIONLESS) SOILS

Compactness

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

- SPT 'N' in accordance with ASTM D 1586, uncorrected for overburden pressure effects or energy transfer.
- Definition of compactness descriptions based on SPT 'N' ranges from Terzaghi and Peck (1967) and correspond to typical average N₆₀ 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' (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

- SPT 'N' in accordance with ASTM D 1586, uncorrected for overburden pressure effects or energy transfer.

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.

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
SS	Split-spoon
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

SOIL TESTS

w	water content
PL	plastic limit
LL	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, G _s)
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

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



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
$\log_{10} x$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time
F	factor of safety
V	volume
W	weight

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
ν	poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - \mu$)
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
μ	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

(a) Index Properties (continued)

w	water content
w_l	liquid limit
w_p	plastic limit
I_p	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_a	coefficient of secondary consolidation
m_v	coefficient of volume change
c_v	coefficient of consolidation
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

T_p, T_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = $\tan \delta$
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

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

Notes: 1 $\tau = c' + \sigma' \tan \phi'$
2 shear strength = (compressive strength)/2

PROJECT: 11-1132-0186

RECORD OF BOREHOLE 1

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: February 27, 2012

DATUM: GEODETIC

SAMPLER HAMMER, 31.75 kg; DROP, 380 mm

PENETRATION TEST HAMMER, 31.75 kg; DROP, 380 mm

NOTE: Blows/0.3m using non-standard hammer and are Approximate Standard Penetration N Value Only, Refer to accompanying text.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER		TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
									20	40	60	80	10 ⁻⁵	10 ⁻⁵			10 ⁻⁴	10 ⁻³
0	MANUAL DRILLING	GROUND SURFACE		179.24											Borehole dry during drilling on February 27, 2012.			
		TOPSOIL, clayey; brown		0.00														
				178.90														
1				0.34	1	SS	15											
2		(CL) SILTY CLAY, trace sand, gravel; brown, with silt seams; cohesive, very stiff			2	SS	15											
3				3	SS	23												
3				4	SS	23												
3		END OF BOREHOLE		176.04														
				3.20														
4																		
5																		
6																		
7																		
8																		
9																		

LDN_BHS_02 11-1132-0186.GPJ 08/05/12 DATA INPUT: LMK

DEPTH SCALE
1 : 50



LOGGED: MA
CHECKED:

PROJECT: 11-1132-0186

RECORD OF BOREHOLE 2

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: February 27, 2012

DATUM: GEODETIC

SAMPLER HAMMER, 31.75 kg; DROP, 380 mm

PENETRATION TEST HAMMER, 31.75 kg; DROP, 380 mm

NOTE: Blows/0.3m using non-standard hammer and are Approximate Standard Penetration N Value Only. Refer to accompanying text.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES			ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m		SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
									20		40		10 ⁻⁶		10 ⁻⁵			
0	MANUAL DRILLING	GROUND SURFACE		179.36												Borehole dry during drilling on February 27, 2012.		
		TOPSOIL, clayey; brown		0.00														
				178.90														
1				0.46	1	SS	16					○						
2	(C) SILTY CLAY, trace sand, gravel; brown, with silt seams; cohesive, very stiff to hard			2	SS	20					○			H				
				3	SS	32					○							
3				4	SS	29					○							
	END OF BOREHOLE		176.16															
			3.20															
4																		
5																		
6																		
7																		
8																		
9																		

LDN_BHS-02 11-1132-0186.GPJ 08/05/12 DATA INPUT: LMK

DEPTH SCALE

1 : 50



LOGGED: MA

CHECKED:

PROJECT: 11-1132-0186

RECORD OF BOREHOLE 3

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: February 27, 2012

DATUM: GEODETIC

SAMPLER HAMMER, 31.75 kg; DROP, 380 mm

PENETRATION TEST HAMMER, 31.75 kg; DROP, 380 mm

NOTE: Blows/0.3m using non-standard hammer and are Approximate Standard Penetration N Value Only. Refer to accompanying text.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE		BLOWS/0.3m	SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
									20	40	60	80	nat V. + rem V.	Q - U	Wp			W
0	MANUAL DRILLING	GROUND SURFACE		179.11												Borehole dry during drilling on February 27, 2012.		
		(CL) Clayey topsoil, clay layers; brown (FILL)		0.00														
		TOPSOIL, clayey; brown		0.21														
				0.40														
1			(CL) SILTY CLAY, trace sand; brown, w/ht silt seams; cohesive, very stiff to hard			1	SS	19										
2					2	SS	26											
3					3	SS	35											
3					4	SS	36											
		END OF BOREHOLE		175.91														
				3.20														
4																		
5																		
6																		
7																		
8																		
9																		

LDN_BHS_02 11-1132-0186.GPJ 08/05/12 DATA INPUT: LMK

DEPTH SCALE
1 : 50



LOGGED: MA
CHECKED:

PROJECT: 11-1132-0186

RECORD OF BOREHOLE 4

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: February 27, 2012

DATUM: GEODETIC

SAMPLER HAMMER, 31.75 kg; DROP, 380 mm

PENETRATION TEST HAMMER, 31.75 kg; DROP, 380 mm

NOTE: Blows/0.3m using non-standard hammer and are Approximate Standard Penetration N Value Only, Refer to accompanying text.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE		BLOWS/0.3m	SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
									20	40	60	80	nat V. + rem V.	Q - U	Wp			W
0	MANUAL DRILLING	GROUND SURFACE		178.84														
		TOPSOIL, clayey; brown		0.00														
1		(C) SILTY CLAY, trace sand; brown; cohesive, stiff to hard		0.37	1	SS	13											
2					2	SS	20											
3		END OF BOREHOLE		176.10	3	SS	31											
				2.74														
3							176											

Groundwater encountered at about elev. 178.5m during drilling on February 27, 2012.

LDN_BHS_02 11-1132-0186.GPJ 08/05/12 DATA INPUT: LMK

DEPTH SCALE
1 : 50



LOGGED: MA
CHECKED:

PROJECT: 11-1132-0186

RECORD OF BOREHOLE 5

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: February 28, 2012

DATUM: GEODETIC

SAMPLER HAMMER, 31.75 kg; DROP, 380 mm

PENETRATION TEST HAMMER, 31.75 kg; DROP, 380 mm

NOTE: Blows/0.3m using non-standard hammer and are Approximate Standard Penetration N Value Only, Refer to accompanying text.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE		BLOWS/0.3m	SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
									20	40	60	80	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴			10 ⁻³
0	MANUAL DRILLING	GROUND SURFACE		179.51												Borehole dry during drilling on February 28, 2012.		
		TOPSOIL, clayey; brown		0.00														
					0.15													
1			(Cl) SILTY CLAY, trace sand, with silt seams; brown; cohesive, stiff to very stiff			1	SS	12										
2						2	SS	16										
3						3	SS	8										
3						4	SS	7										
		END OF BOREHOLE		176.31														
				3.20														
4																		
5																		
6																		
7																		
8																		
9																		

LDN_BHS_02 11-1132-0186.GPJ 08/05/12 DATA INPUT: LMK

DEPTH SCALE
1 : 50



LOGGED: MA
CHECKED:

PROJECT: 11-1132-0186

RECORD OF BOREHOLE 6

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: February 28, 2012

DATUM: GEODETIC

SAMPLER HAMMER, 31.75 kg; DROP, 380 mm

PENETRATION TEST HAMMER, 31.75 kg; DROP, 380 mm

NOTE: Blows/0.3m using non-standard hammer and are Approximate Standard Penetration N Value Only, Refer to accompanying text.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER		TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
									20	40	60	80	10 ⁻⁶	10 ⁻⁵			10 ⁻⁴	10 ⁻³
0	MANUAL DRILLING	GROUND SURFACE		179.67											Borehole dry during drilling on February 28, 2012.			
		TOPSOIL, clayey; brown		0.00 179.49 0.18														
1		(C) SILTY CLAY, trace sand, silt seams; brown; cohesive, stiff to very stiff			1	SS	11											
2					2	SS	17											
3					3	SS	15											
3				4	SS	12												
3		END OF BOREHOLE		176.47														
4				3.20														
4																		
5																		
6																		
7																		
8																		
9																		

DEPTH SCALE

1 : 50



LOGGED: MA

CHECKED:

LDN_BHS_02 11-1132-0186.GPJ 08/05/12 DATA INPUT: LMK

PROJECT: 11-1132-0186

RECORD OF BOREHOLE 7

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: February 28, 2012

DATUM: GEODETIC

SAMPLER HAMMER, 31.75 kg; DROP, 380 mm

PENETRATION TEST HAMMER, 31.75 kg; DROP, 380 mm

NOTE: Blows/0.3m using non-standard hammer and are Approximate Standard Penetration N Value Only, Refer to accompanying text.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER		TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
									20	40	60	80	10 ⁻⁶	10 ⁻⁵			10 ⁻⁴	10 ⁻³
0	MANUAL DRILLING	GROUND SURFACE		179.07														
		TOPSOIL, clayey; brown		0.00														
				178.58														
1				0.49	1	SS	14											
2		(CL) SILTY CLAY, trace sand, silt seams; brown; cohesive, stiff to hard			2	SS	14											
				3	SS	16												
3				4	SS	32												
		END OF BOREHOLE		175.87														
				3.20														
4																		
5																		
6																		
7																		
8																		
9																		

Groundwater encountered at about elev. 179.0m during drilling on February 28, 2012.

LDN_BHS_02 11-1132-0186.GPJ 08/05/12 DATA INPUT: LMK

DEPTH SCALE
1 : 50



LOGGED: MA
CHECKED:

PROJECT: 11-1132-0186

RECORD OF BOREHOLE 8

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: February 28, 2012

DATUM: GEODETIC

SAMPLER HAMMER, 31.75 kg; DROP, 380 mm

PENETRATION TEST HAMMER, 31.75 kg; DROP, 380 mm

NOTE: Blows/0.3m using non-standard hammer and are Approximate Standard Penetration N Value Only, Refer to accompanying text.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES		ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE		BLOWS/0.3m	SHEAR STRENGTH Cu, kPa				WATER CONTENT PERCENT					
									20	40	60	80	10 ⁻⁵	10 ⁻⁵	10 ⁻⁴			10 ⁻³
0	MANUAL DRILLING	GROUND SURFACE		179.13														
		TOPSOIL, clayey; brown		178.89														
				0.00														
				0.24														
1			(CI) SILTY CLAY, trace sand, silt seams; brown; cohesive, very stiff			1	SS	16										
2					2	SS	16											
3					3	SS	29											
3					4	SS	19											
		END OF BOREHOLE		175.93														
				3.20														
4																		
5																		
6																		
7																		
8																		
9																		

Groundwater encountered at about elev. 179.0m during drilling on February 28, 2012.

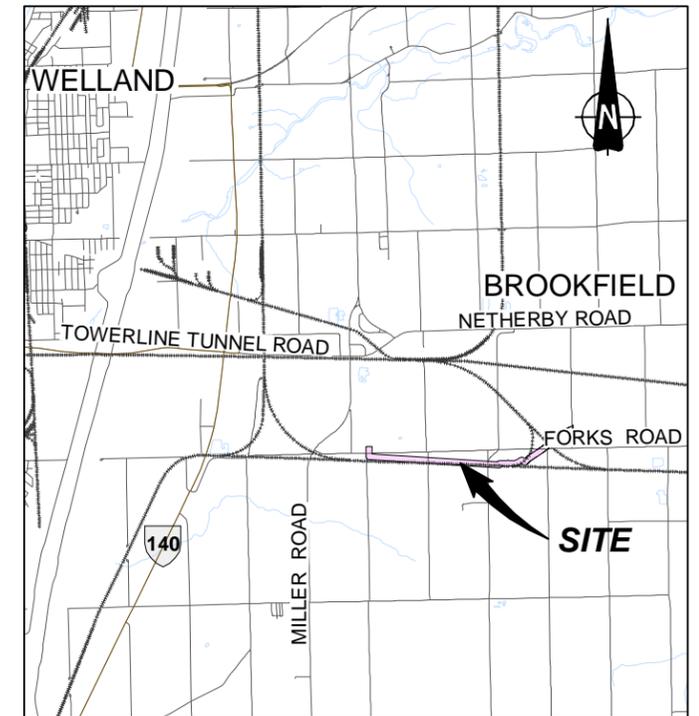
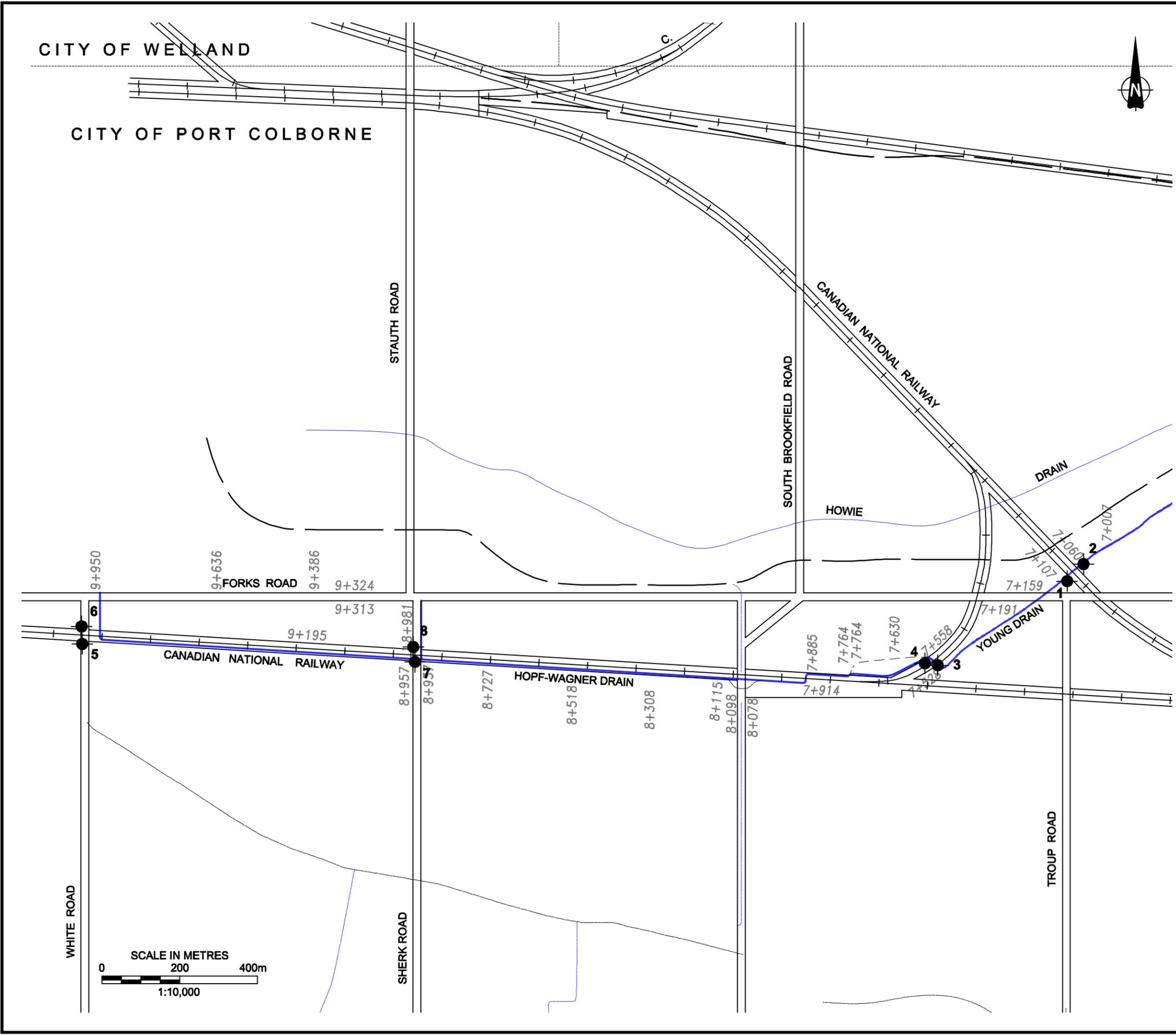
LDN_BHS_02 11-1132-0186.GPJ 08/05/12 DATA INPUT: LMK

DEPTH SCALE
1 : 50



LOGGED: MA
CHECKED:

Drawing file: 1111320186-R01001.dwg May 07, 2012 - 3:16pm



KEY PLAN

LEGEND

- BOREHOLE
- 7+885 DRAIN CHAINAGE (m)

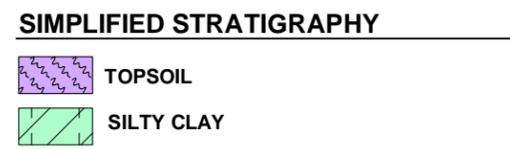
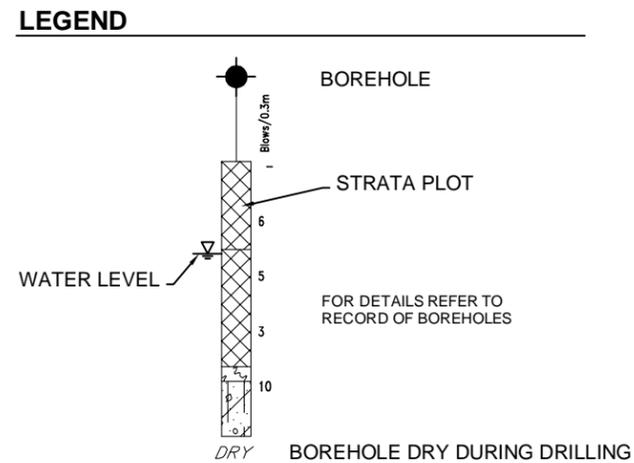
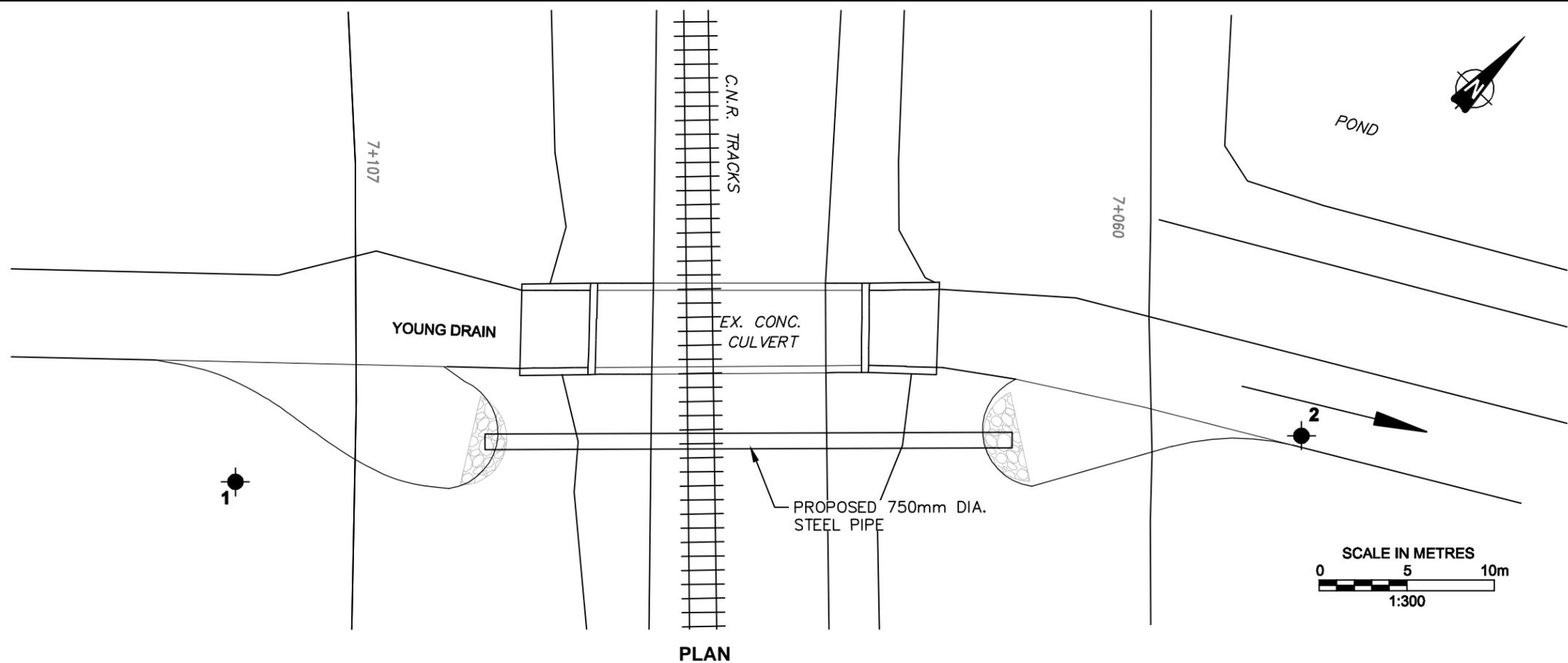
REFERENCE

PLAN PROVIDED BY SPRIET ASSOCIATES, YOUNG DRAIN, CITY OF PORT COLBORNE, MARCH 12, 2012; AND CANMAP STREETFILES V.2008.5.

NOTES

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.
- ALL LOCATIONS ARE APPROXIMATE ONLY.

PROJECT		CN RAIL UNDERCROSSINGS YOUNG DRAIN CULVERT REPLACEMENTS PORT COLBORNE, ONTARIO	
TITLE		LOCATION PLAN	
PROJECT No.	11-1132-0186	FILE No.	1111320186-R01001
CADD	LMK	SCALE	AS SHOWN
CHECK	May 7/12	REV.	
Golder Associates LONDON, ONTARIO		FIGURE 1	



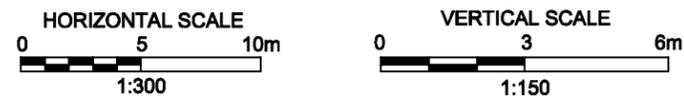
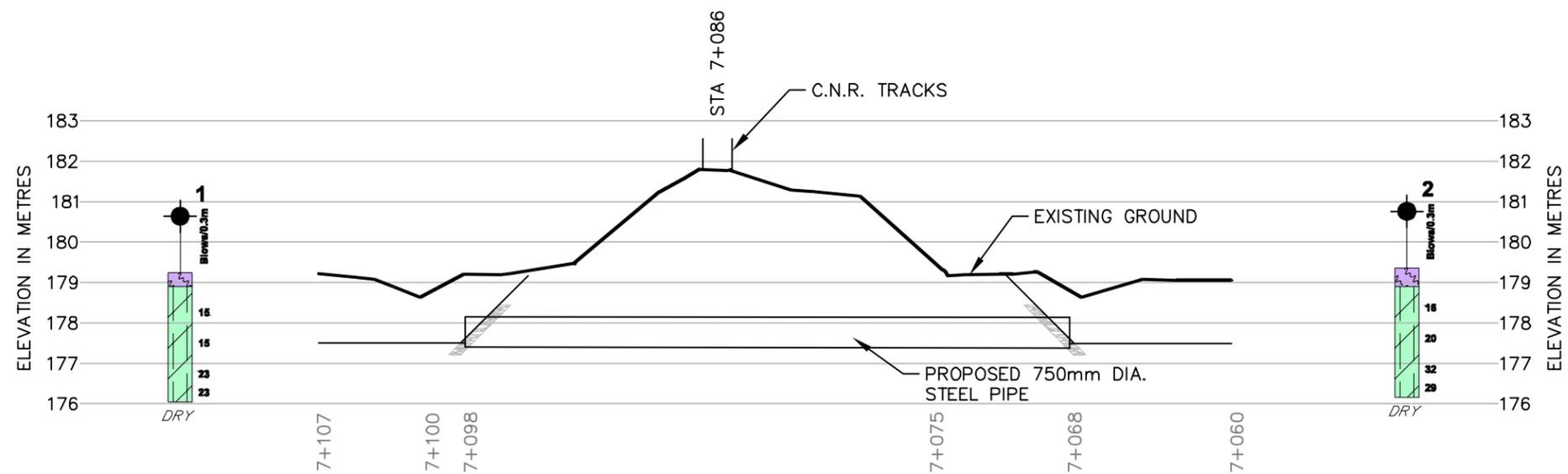
REFERENCE

PLAN PROVIDED BY SPRIET ASSOCIATES, YOUNG DRAIN, CITY OF PORT COLBORNE, MARCH 12, 2012.

NOTES

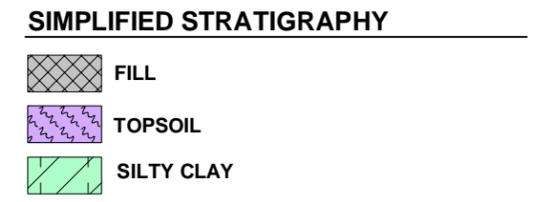
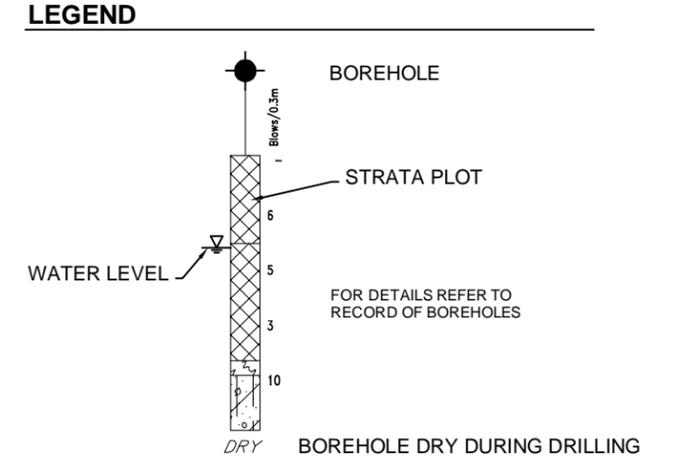
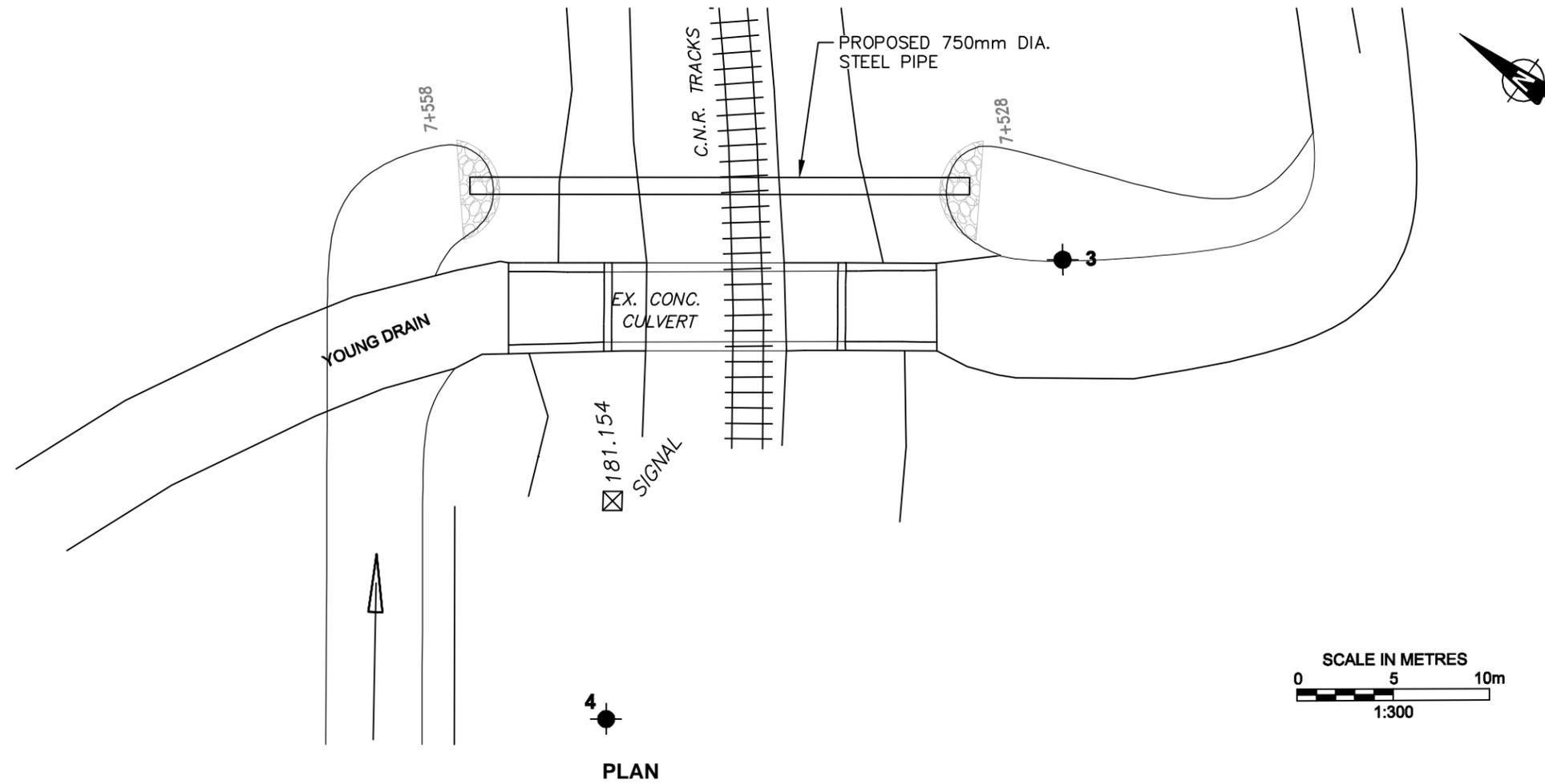
THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE ONLY.



INFERRED STRATIGRAPHIC PROFILE ALONG PROPOSED DRAIN

PROJECT		CN RAIL UNDERCROSSINGS YOUNG DRAIN CULVERT REPLACEMENTS PORT COLBORNE, ONTARIO	
TITLE			
		LOCATION PLAN AND INFERRED STRATIGRAPHIC PROFILE	
PROJECT No.	11-1132-0186	FILE No.	1111320186-R01002
CADD	LMK	Apr. 24/12	SCALE AS SHOWN REV.
CHECK			
		FIGURE 2	



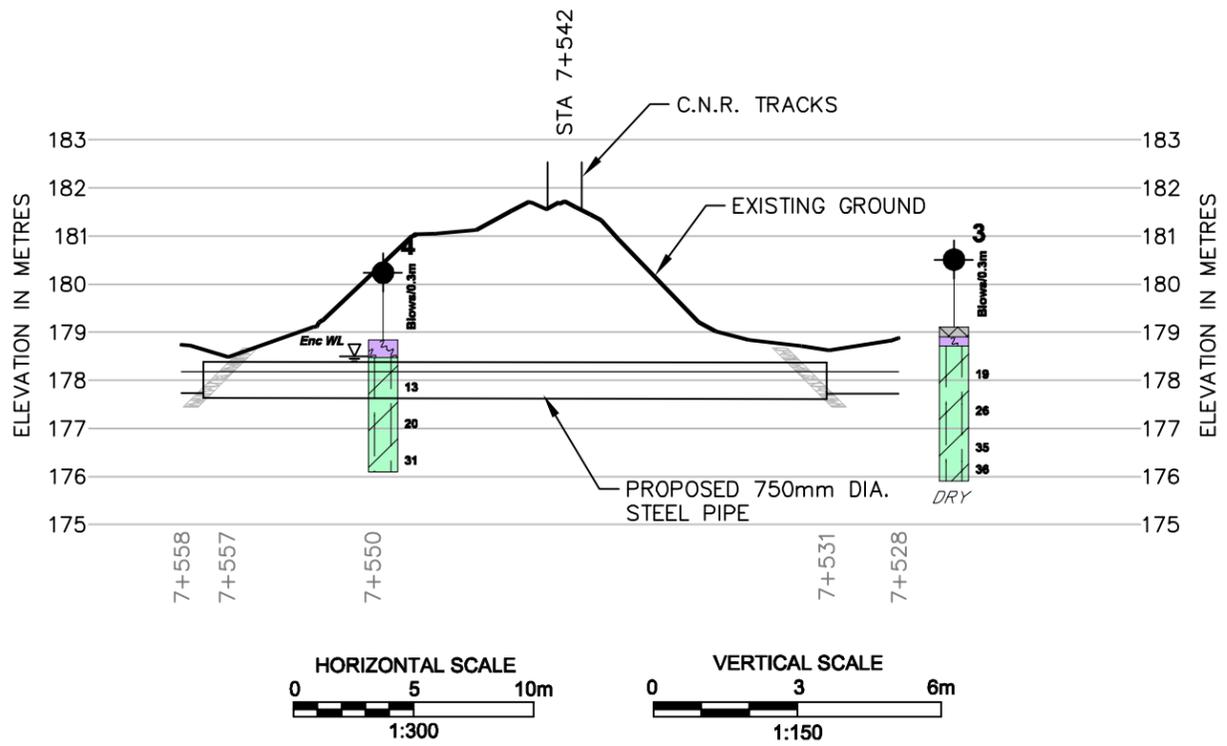
REFERENCE

PLAN PROVIDED BY SPRIET ASSOCIATES, YOUNG DRAIN, CITY OF PORT COLBORNE, MARCH 12, 2012.

NOTES

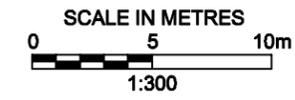
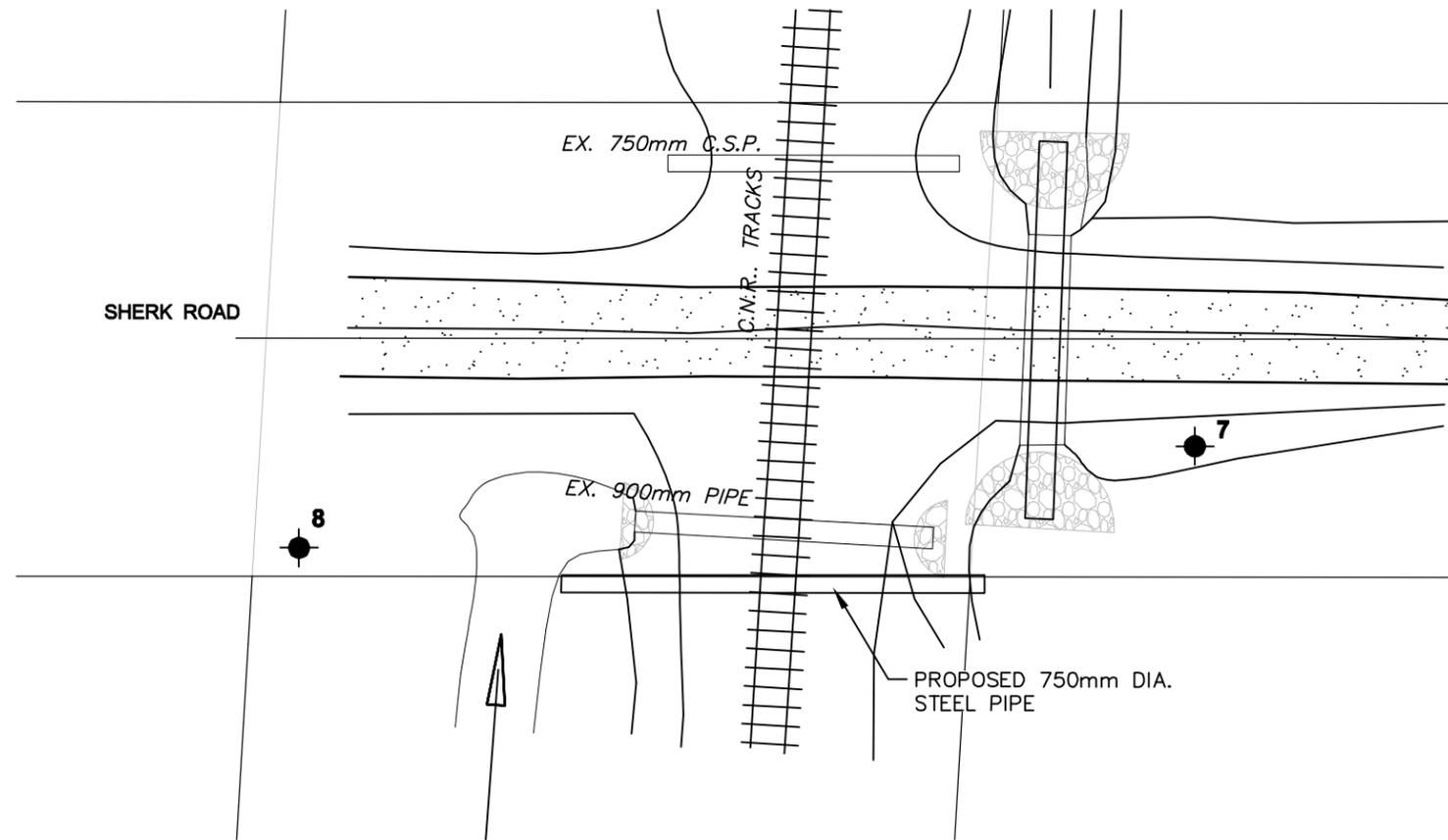
THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE ONLY.

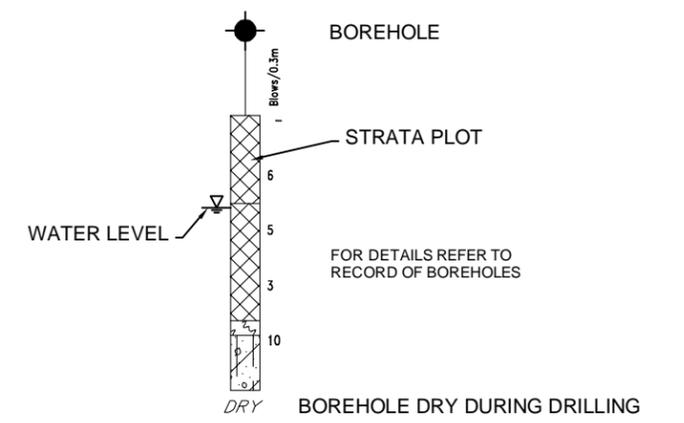


INFERRED STRATIGRAPHIC PROFILE ALONG PROPOSED DRAIN

PROJECT		CN RAIL UNDERCROSSINGS YOUNG DRAIN CULVERT REPLACEMENTS PORT COLBORNE, ONTARIO	
TITLE		LOCATION PLAN AND INFERRED STRATIGRAPHIC PROFILE	
PROJECT No.	11-1132-0186	FILE No.	1111320186-R01002
CADD	LMK	SCALE	AS SHOWN
CHECK	Apr. 24/12	REV.	
		<p>FIGURE 3</p>	



LEGEND



SIMPLIFIED STRATIGRAPHY



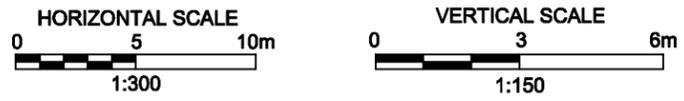
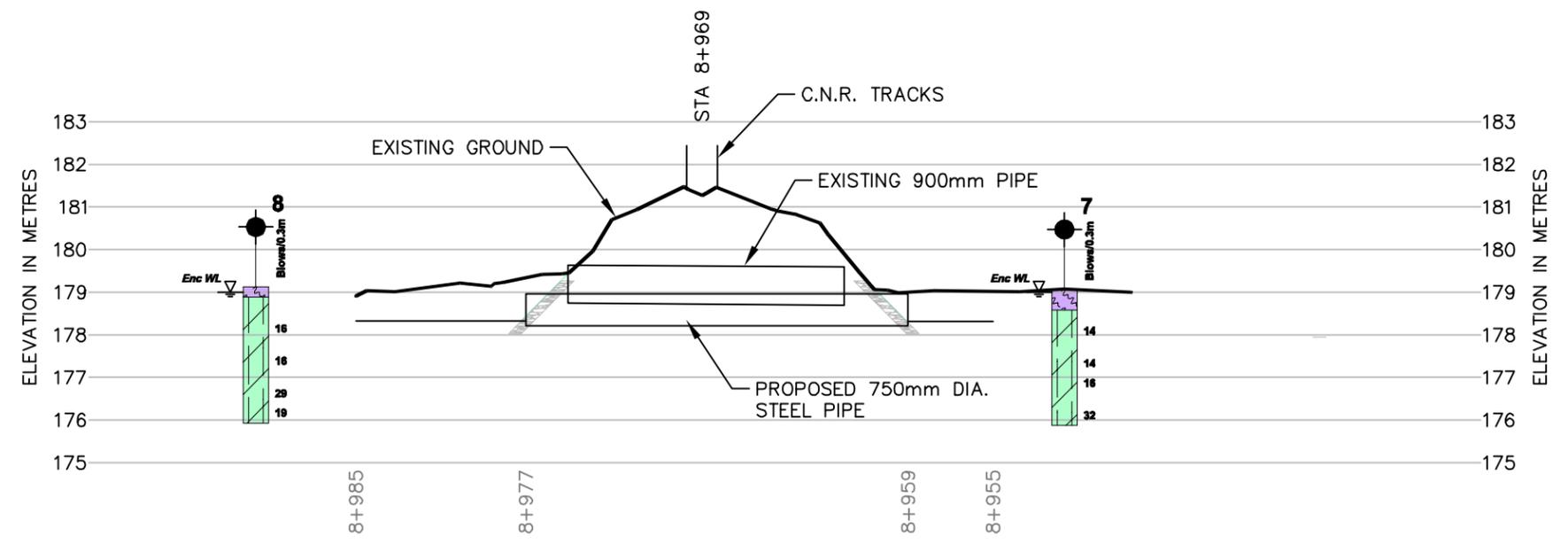
REFERENCE

PLAN PROVIDED BY SPRIET ASSOCIATES, YOUNG DRAIN, CITY OF PORT COLBORNE, MARCH 12, 2012.

NOTES

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

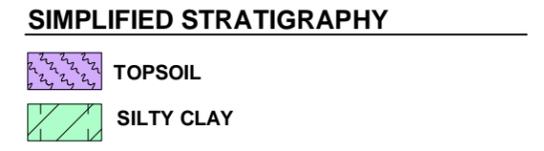
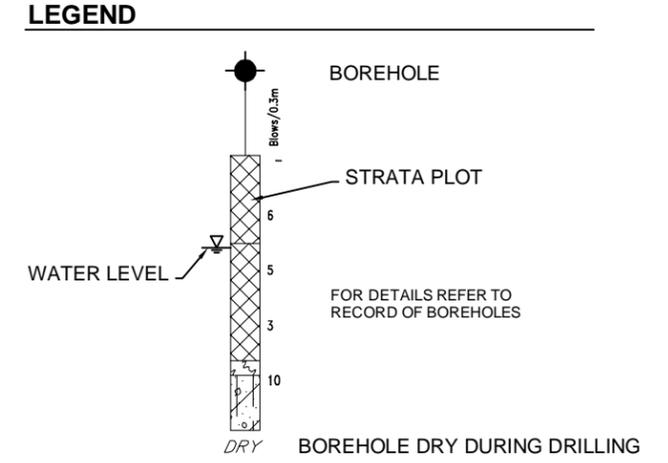
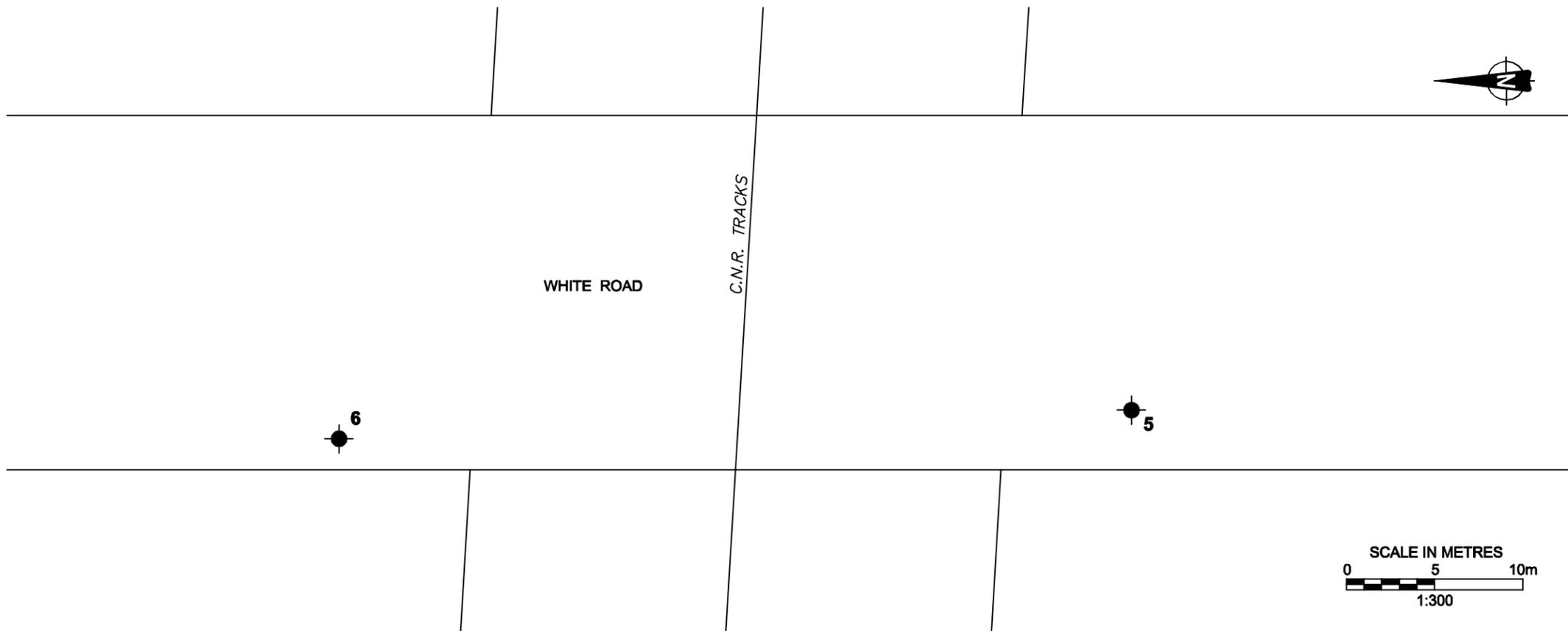
ALL LOCATIONS ARE APPROXIMATE ONLY.



INFERRED STRATIGRAPHIC PROFILE ALONG PROPOSED DRAIN

PROJECT		CN RAIL UNDERCROSSINGS YOUNG DRAIN CULVERT REPLACEMENTS PORT COLBORNE, ONTARIO	
TITLE		LOCATION PLAN AND INFERRED STRATIGRAPHIC PROFILE	
PROJECT No.	11-1132-0186	FILE No.	1111320186-R01002
CADD	LMK Apr. 24/12	SCALE	AS SHOWN REV.
CHECK			
		FIGURE 4	

Drawing file: 1111320186-R01002.dwg May 08, 2012 - 9:54am



REFERENCE

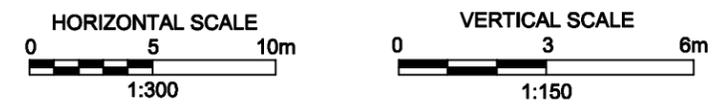
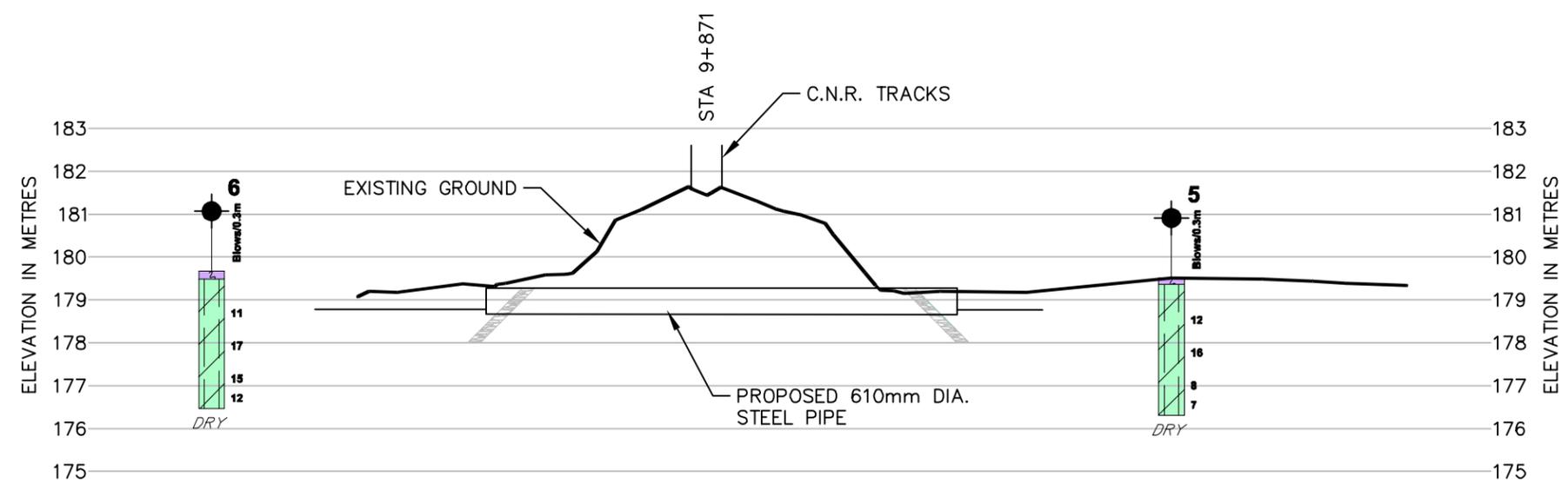
PLAN PROVIDED BY SPRIET ASSOCIATES, YOUNG DRAIN, CITY OF PORT COLBORNE, MARCH 12, 2012; AND CANMAP STREETFILES V.2008.5.

NOTES

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

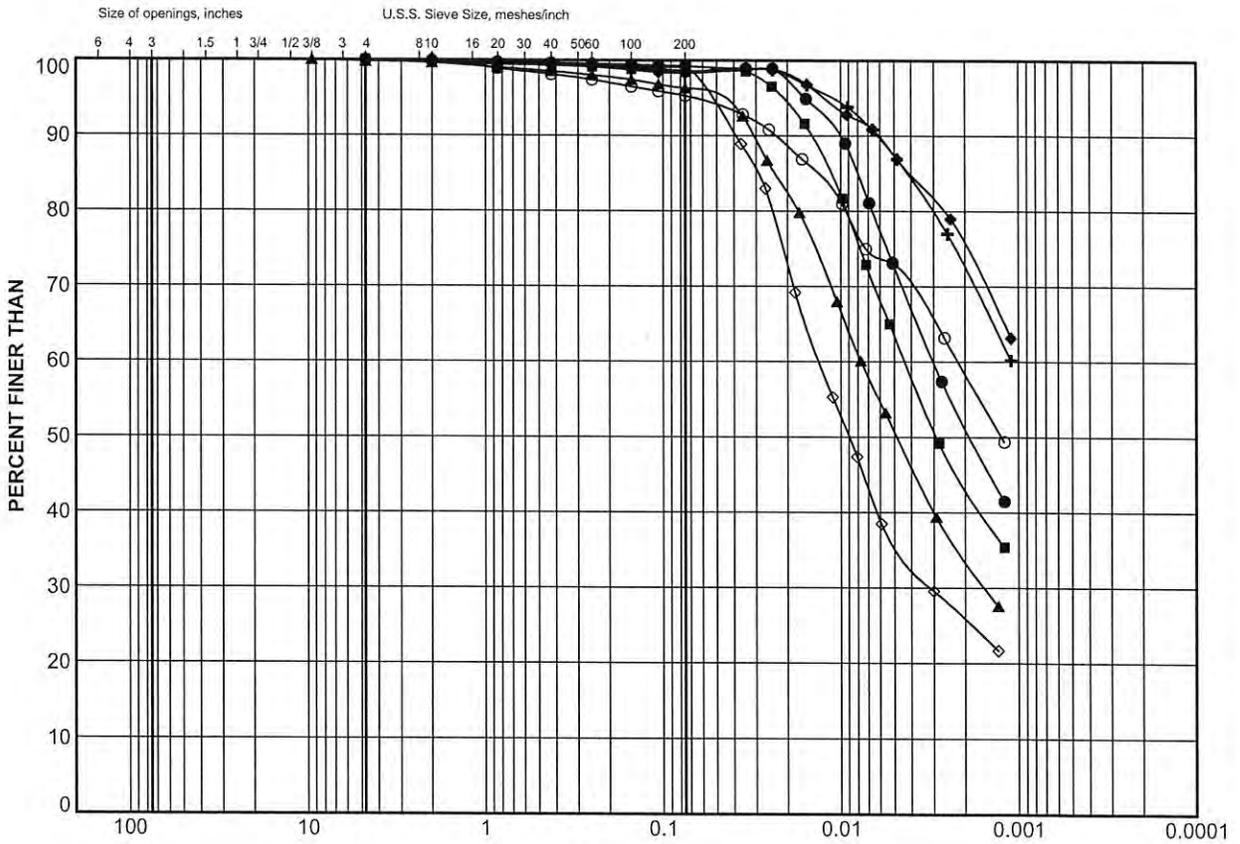
ALL LOCATIONS ARE APPROXIMATE ONLY.

GROUND SURFACE INFERRED FROM STATION 8+969



INFERRED STRATIGRAPHIC PROFILE ALONG PROPOSED DRAIN

PROJECT		CN RAIL UNDERCROSSINGS YOUNG DRAIN CULVERT REPLACEMENTS PORT COLBORNE, ONTARIO	
TITLE		LOCATION PLAN AND INFERRED STRATIGRAPHIC PROFILE	
PROJECT No.	11-1132-0186	FILE No.	1111320186-R01002
CADD	LMK Apr. 24/12	SCALE	AS SHOWN
CHECK		REV.	
		FIGURE 5	



Cobble Size	GRAVEL SIZE		SAND SIZE			SILT AND CLAY
	coarse	fine	coarse	medium	fine	

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	1	3	176.7
■	2	2	177.6
▲	3	3	176.6
+	5	3	177.0
◆	6	3	177.2
◇	7	3	176.9
○	8	2	177.4

PROJECT: CN RAIL UNDERCROSSINGS
YOUNG DRAIN CULVERT REPLACEMENTS
PORT COLBORNE, ONTARIO

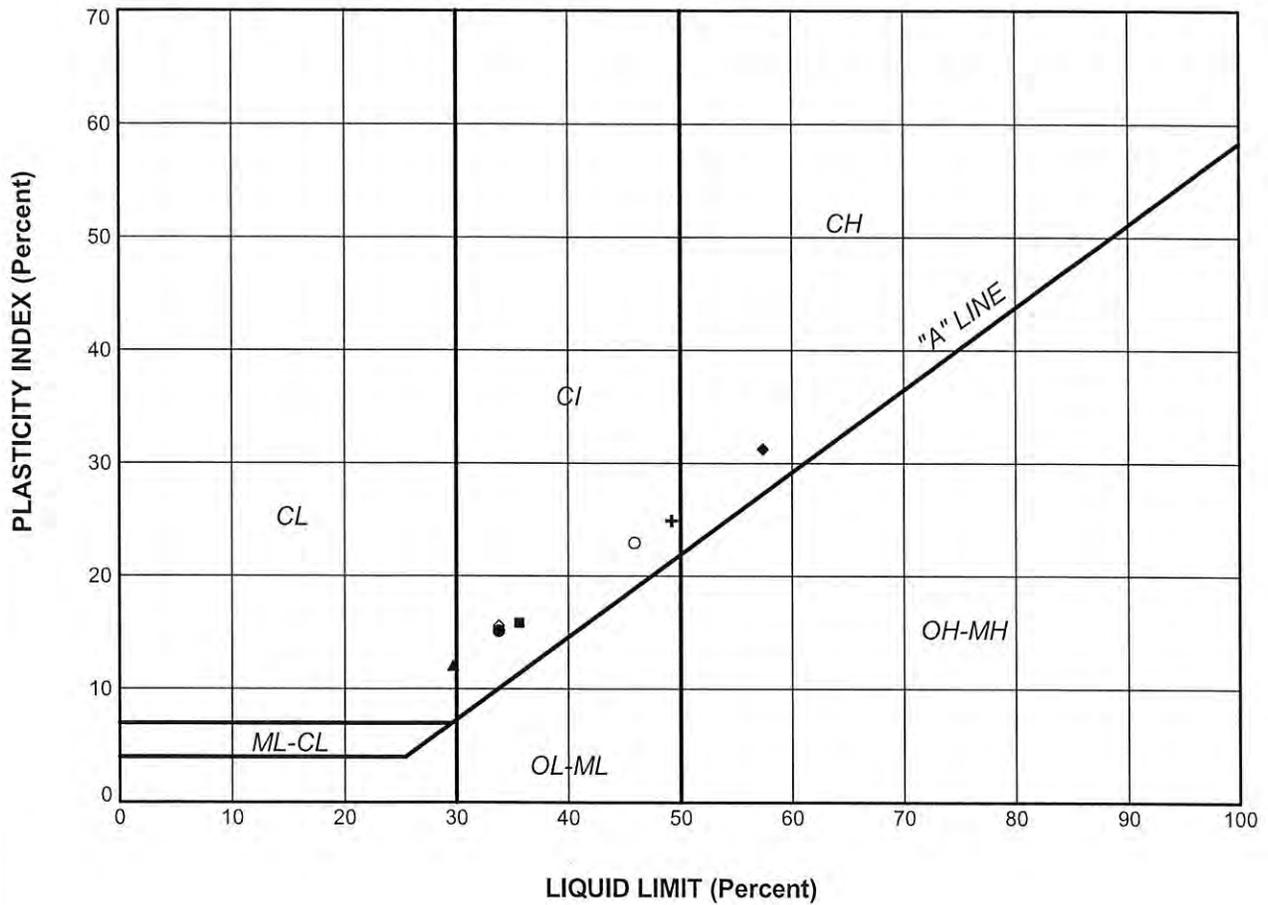
TITLE: **GRAIN SIZE DISTRIBUTION**
SILTY CLAY

PROJECT No.	11-1132-0186	FILE No.	1111320186-R01006
DRAWN	LMK	Apr 17/12	SCALE N/A
CHECK			REV.

FIGURE 6

LDN_GSD_10 GLDR_LDN.GDT





SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

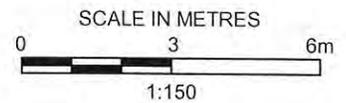
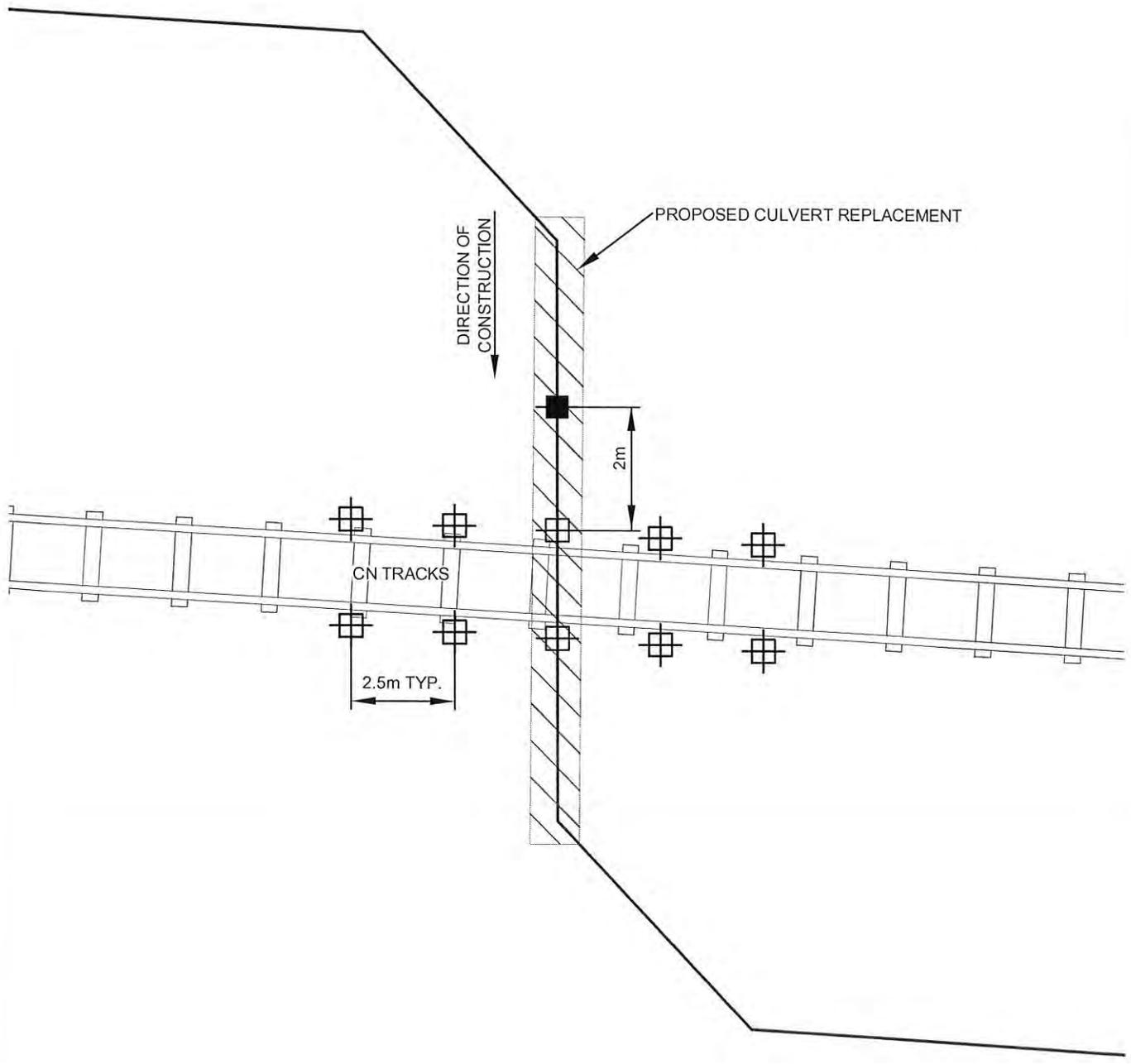
LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
●	1	3	33.8	18.7	15.2
■	2	2	35.6	19.8	15.9
▲	3	3	29.7	17.7	12.1
+	5	3	49.2	24.3	24.9
◆	6	3	57.4	26.2	31.3
◇	7	3	33.8	18.2	15.6
○	8	2	45.9	23.0	23.0

PROJECT					CN RAIL UNDERCROSSINGS YOUNG DRAIN CULVERT REPLACEMENTS PORT COLBORNE, ONTARIO									
TITLE										PLASTICITY CHART				
PROJECT No.		11-1132-0186			FILE No.		1111320186-R01007							
DRAWN		LMK		Apr 17/12		SCALE		N/A		REV.				
CHECK						FIGURE 7								



Drawing file: 1111320186-R01001.dwg May 07, 2012 - 3:16pm



LEGEND

- SURFACE SETTLEMENT MONITORING POINT
- DEEP SETTLEMENT MONITORING POINT ABOUT 1m ABOVE CASING OBVERT
- APPROXIMATE PROPOSED DRAIN

NOTES

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

ALL LOCATIONS ARE APPROXIMATE ONLY.

PROJECT		CN RAIL UNDERCROSSINGS YOUNG DRAIN CULVERT REPLACEMENTS PORT COLBORNE, ONTARIO	
TITLE		TYPICAL PROPOSED SETTLEMENT MONITORING LOCATIONS	
PROJECT No.	11-1132-0186	FILE No.	1111320186-R01001
CADD	LAK	May 7/12	SCALE AS SHOWN REV. 0
CHECK			FIGURE 8
Golder Associates LONDON, ONTARIO			

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

Africa	+ 27 11 254 4800
Asia	+ 852 2562 3658
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Ltd.
309 Exeter Road, Unit #1
London, Ontario, N6L 1C1
Canada
T: +1 (519) 652 0099



**SPECIFICATIONS FOR CONSTRUCTION
OF
MUNICIPAL DRAINAGE WORKS**

GENERAL INDEX

SECTION A	General Conditions	Pages 1 to 9
SECTION B	Open Drain	Pages 10 to 12
SECTION C	Tile Drain	Pages 13 to 18
STANDARD DETAILED DRAWINGS		SDD-01 to SDD-05



SECTION A - GENERAL CONDITIONS

INDEX

<u>SECTION NUMBER</u>	<u>PAGE NO.</u>
A.1 SCOPE.....	1
A.2 TENDERS.....	1
A.3 DRAWINGS AND SPECIFICATIONS.....	1
A.4 PAYMENT.....	1
A.5 SUPERINTENDENT.....	1
A.6 COMMENCEMENT AND COMPLETION OF WORK.....	2
A.7 WORKING AREA AND ACCESS.....	2
A.8 SUPERVISION.....	2
A.9 INSPECTION.....	2
A.10 ALTERATIONS AND ADDITIONS.....	2
A.11 MAINTENANCE	3
A.12 INSURANCE.....	3
A.13 LIMITATIONS OF OPERATIONS.....	3
A.14 LOSSES.....	3
A.15 SUB-CONTRACTORS.....	3
A.16 PERMITS, NOTICES, LAWS AND RULES.....	3
A.17 ROAD CROSSINGS.....	4
A.18 FENCES.....	6
A.19 LIVESTOCK.....	6
A.20 STANDING CROPS	6
A.21 SURPLUS GRAVEL	6
A.22 RAILWAYS, HIGHWAYS, UTILITIES.....	6
A.23 LOCATION OF UTILITIES.....	7
A.24 TERMINATION OF CONTRACT BY THE MUNICIPALITY.....	7
A.25 ERRORS AND UNUSUAL CONDITIONS.....	7
A.26 IRON BARS	7
A.27 STAKES.....	7
A.28 RIP-RAP.....	8
A.29 GABION BASKETS.....	8
A.30 RESTORATION OF LAWNS.....	8
A.31 RESTORATION OF ROADS AND LANEWAYS.....	9

SECTION A

GENERAL CONDITIONS

A.1 SCOPE

The work to be done under this specification consists of supplying all labour, materials and equipment to construct the work as outlined on the drawing(s). In some Municipalities, the Contractor shall supply all materials while in other Municipalities, he shall supply only certain materials. The form of Tender and Agreement lists which materials are to be supplied by the Contractor.

A.2 TENDERS

Tenders are to be submitted on a lump sum basis for the complete works or a portion thereof, as set out in the Form of Tender and Agreement.

A.3 DRAWINGS AND SPECIFICATIONS

The tenderer must satisfy himself that he understands the meaning and intent of the drawings and specifications before submission of his tender. The standard specifications have been separated into sections for reference purpose only. They shall be considered complementary and, where a project is controlled under one of the sections, the remaining sections will still apply for miscellaneous works. In case of any inconsistency or conflict in the Tender Documents, the following order of precedence shall apply:

- Contract Drawings
- Form of Tender and Agreement
- General Conditions
- Standard Specifications (Open Drain, Tile Drain, Specifications for Municipal Drain Crossing County Roads)
- Standard Drawings

A.4 PAYMENT

Progress payments equal to 87±% of the value of the work done and materials incorporated in the work will be made to the Contractor on the written request of the Contractor to the Engineer. An additional 10±% will be paid 45 days after the final acceptance by the Engineer. Before this payment is released, the Contractor shall provide the Municipality with a Statutory Declaration that all material and/or labour incorporated in the work has been fully paid for, along with a Certificate of Clearance from the Workplace Safety and Insurance Board stating that all compensation has been paid. The Municipality will reserve 3%± of the Contract Price for one year as warranty. After the completion of the work, any part of this reserve may be used to correct defects which may develop within that time from faulty workmanship or material or loose backfill, provided that notice shall first be given to the Contractor and that he may promptly make good such defects, if he desires.

A.5 SUPERINTENDENT

The word "Superintendent", as used hereinafter in these specifications, shall refer to a Drainage Superintendent, appointed by the Municipality. The Superintendent will act as the Engineer's representative. The Superintendent shall have the power to direct the execution of the work and to make any necessary minor adjustments. Adjustments in tile sizes or gradients shall not be made without the approval of the Engineer. Any instructions given by the Superintendent, which changes considerably the proposed work or with which the Contractor does not agree, shall be referred to the Engineer for his decision.

A.6 COMMENCEMENT AND COMPLETION OF WORK

The work must commence immediately after the Contractor is notified of the acceptance of his tender or at a later date, if set out as a condition of the tender. If weather creates poor ground or working conditions, the Contractor may be required, at the discretion of the Engineer, to postpone or halt work until conditions become acceptable.

The Contractor shall give the Engineer and Superintendent a minimum of forty-eight (48) hours notice before commencement of work on any municipal drain. As noted on the plan, he can then arrange for a meeting to be held on the site with the Contractor and affected owners attending to review in detail the construction scheduling and other details. The Contractor's costs for attending this meeting shall be included in his lump sum tender price. If the Contractor leaves the job site for a period of time after initiation of work, he shall give the Engineer and the Superintendent a minimum of twenty-four (24) hours notice prior to returning to the project.

The work must be proceeded with in such a manner as to ensure its completion at the earliest possible date and within the time limit set out in the tender or in the contract documents.

A.7 WORKING AREA AND ACCESS

The working area available to the Contractor to construct the drain and related works including an access route to the drain shall be as specified on the drawings.

Should the specified widths become inadequate due to unusual conditions, the Contractor shall notify the Engineer immediately in order that negotiations with the affected owners can take place.

Where a Contractor exceeds the specified widths due to the nature of his operations and without authorization he shall be held responsible for the costs of all additional damages and the amount shall be deducted from his contract price and paid to the affected owners by the Municipality.

A.8 SUPERVISION

The Contractor shall give the work his constant supervision and shall keep a competent foreman in charge at the site.

A.9 INSPECTION

Final inspection by the Engineer will be made within twenty days after he has received notice in writing from the Contractor that the work is complete.

Periodic inspections by the Engineer or Superintendent will be made during the performance of the work. These interim inspections are required to check such items as location of drainage course and structures, tile grades prior to backfilling, backfilling and miscellaneous work items.

A.10 ALTERATIONS AND ADDITIONS

The Engineer shall have the power to make alterations in the work shown or described in the drawings or specifications and the Contractor shall proceed to make such changes without causing delay. In every such case, the price agreed to be paid for the work under the contract shall be increased or decreased as the case may require according to a fair and reasonable valuation of the work added or deleted. The valuation shall be determined as a result of negotiations between the Superintendent, the Contractor, and the Engineer, but in all cases, the Engineer shall maintain the final responsibility for the decision. Such alterations and variations shall in no way render void the contract. No claim for variations or alterations in the increased or decreased price shall be valid unless done in pursuance of an order from the Engineer and/or Superintendent and notice of such claims made in writing before commencement of such work. In no case shall the Contractor commence work which he considers to be extra work before receiving the Engineer's and/or Superintendent's approval in writing.

A.11 MAINTENANCE

The Contractor shall repair and make good any damages or faults in the drain that may appear within one year after its completion (as dated on the final completion certificate) as the result of imperfect or defective work done or materials furnished by the Contractor. Nothing herein contained shall be construed as in any way restricting or limiting the liability of the Contractor under the laws of the Country, Province or Locality in which the work is being done.

A.12 INSURANCE

- 1) Bodily Injury Liability: The Contractor shall effect and maintain, a Comprehensive General Liability Policy or its equivalent, covering claims for bodily injury, including death arising from and during operations under his Contract whether performed by himself, by a sub-contractor or by anyone directly or indirectly employed by either of them in the sum of \$ 2,000,000.00.
- 2) Property Damage: The Contractor shall effect and maintain Property Damage Liability Insurance to cover his and the sub-contractor's operations in the sum of \$ 1,000,000.00.
- 3) Fire Insurance: The Contractor shall procure fire and extended coverage insurance on the work to 100% of the Contract Amount.
- 4) The following are to be named as co-insured:
 - Successful Contractor
 - Sub-Contractor
 - Municipality
 - Spriet Associates London Limited
- 5) Within 7 days of award of Contract and prior to commencing work, the successful Contractor shall file with the Municipality, a copy of each insurance policy and certificate required. All such insurance shall be maintained until final completion of the work including the making good of faulty work or materials; except that coverage of completed operations liability shall in any event be maintained for twelve (12) months from the date of final completion as certified by the Engineer.

A.13 LIMITATIONS OF OPERATIONS

Except for such work as may be required by the Engineer to maintain the works in a safe and satisfactory condition, the Contractor shall not carry on his operations under the contract on Sundays without permission in writing of the Municipality.

A.14 LOSSES

The Contractor shall take all risks from floods or casualties of any kind.

A.15 SUB-CONTRACTORS

The Contractor shall not sublet the whole or any part of the contract without the approval of the Engineer or Superintendent:

A.16 PERMITS, NOTICES, LAWS AND RULES

The Contractor shall ensure that all necessary permits or licences required for the execution of the work have been obtained (but this shall not include M.T.O. encroachment permits, County Road Permit, permanent easements or rights of servitude). The Contractor shall give all necessary notices and pay all fees required by law and comply with all laws, ordinances, rules and regulations (including the Occupational Health and Safety Act) relating to the work and to the preservation of the public's health and safety and if the specifications and drawings are at variance therewith, any resulting additional expenses incurred by the Contractor shall constitute an addition to the contract price.

A.17 ROAD CROSSINGS

.1 General

- .1 Scope: These specifications apply to all road crossings - Municipal, County, Regional, or Highway Roads. Where the word "Authority" is used, it shall be deemed to apply to the appropriate owning authority. These specifications in no way limit the Authority's Specifications and Regulations governing the construction of drains on their Road Allowance. The Authority will supply no labour, equipment or materials for the construction of the road crossing unless otherwise noted on the drawings.
- .2 Road Occupancy Permit: Where applicable the Contractor must submit an Application for a Road Occupancy Permit to the Authority and allow a minimum of 5 working days (exclusive of holidays) for its review and issuance.
- .3 Road Closure Request and Construction Notification: The Contractor shall submit written notification of construction and request for road closure (if applicable) to the Road Authority/Public Works Manager and the Drainage Engineer or Superintendent for review and approval a minimum of five (5) working days (exclusive of holidays) prior to proceeding with any work on road allowance. It shall be the Road Authority's responsibility to notify all the applicable emergency services, schools, etc. of the road closure or construction taking place.
- .4 Traffic Control: Where the Contractor is permitted to close the road to through traffic, the Contractor shall provide for and adequately sign the detour route to the satisfaction of the Road Authority. Otherwise, the Contractor shall keep the road open to traffic at all times. The Contractor shall provide, for the supply, erection and maintenance, suitable warning signs and/or flagmen in accordance with the Manual of Uniform Traffic Control Devices and to the satisfaction of the Road Authority to notify the motorists of work on the road ahead.
- .5 Site Meeting/Inspection: A site meeting shall be held with the affected parties to review in detail the crossing and/or its related works. The Authority's Inspector and/or the Drainage Engineer will inspect the work while in progress to ensure that the work is done in strict accordance with the specifications.
- .6 Weather: No construction shall take place during inclement weather or periods of poor visibility.
- .7 Equipment: No construction material and/or equipment is to be left within 3 meters of the edge of pavement overnight or during periods of inclement weather.

.2 Jacking and Boring

- .1 Material: The bore pipe shall consist of new, smooth wall steel pipe, meeting the requirements of H20 loading for road crossings and E80 loading for railway crossings. The minimum size, wall thickness and length shall be as shown on the drawings. Where welding is required, the entire circumference of any joint shall be welded using currently accepted welding practices.
- .2 Site Preparation and Excavation: Where necessary, fences shall be carefully taken down as specified in the General Conditions. Prior to any excavation taking place, all areas which will be disturbed shall be stripped of topsoil. The topsoil is to be stockpiled in locations away from the bore operation, off the line of future tile placement and out of existing water runs or ditches. The bore pit shall be located at the upstream end of the bore unless otherwise specified or approved. Bore pits shall be kept back at least 1 meter from the edge of pavement and where bore pits are made in any portion of the shoulder, the excavated material shall be disposed of off the road allowance and the pit backfilled with thoroughly compacted Granular "A" for its entire depth.
- .3 Installation: The pipe shall be installed in specified line and grade by a combination of jacking and boring. Upon completion of the operations, both ends of the bore pipe shall be left uncovered until the elevation has been confirmed by the Engineer or Superintendent. The ends of the bore pipe shall be securely blocked off and the location marked by means of a stake extending from the pipe invert to 300mm above the surrounding ground surface.

.2 Jacking and Boring (cont'd)

- .4 Unstable Soil or Rock: The Contractor shall contact the Engineer immediately should unstable soil be encountered or if boulders of sufficient size and number to warrant concern are encountered. Any bore pipe partially installed shall be left in place until alternative methods or techniques are determined by the Engineer after consultation with the Contractor, the Superintendent and the owning authority.
- .5 Tile Connections: Prior to commencement of backfilling, all tile encountered in excavations shall be reconnected using material of a size comparable to the existing material. Where the excavation is below the tile grade, a compacted granular base is to be placed prior to laying the tile. Payment for each connection will be made at the rate outlined in the Form of Tender and Agreement.
- .6 Backfill: Unless otherwise specified, the area below the proposed grade shall be backfilled with a crushed stone bedding. Bore pits and excavations outside of the shoulder area may be backfilled with native material compacted to a density of 95% Standard Proctor. All disturbed areas shall be neatly shaped, have the topsoil replaced and hand seeded. Surplus material from the boring operation shall be removed from the site at the Contractor's expense.
- .7 Restoration: The entire affected area shall be shaped and graded to original lines and grades, the topsoil replaced, and the area seeded down at the rate of 85 kg/per ha. unless otherwise specified or in accordance with the M.T.O. Encroachment Permit. Fences shall be restored to their original condition in accordance with the General Conditions.
- .8 Acceptance: All work undertaken by the Contractor shall be to the satisfaction of the Engineer.

.3 Open Cut

- .1 Material: The culvert or sub-drain crossing pipe material shall be specified on the drawings.
- .2 Site Preparation and Excavation: Where necessary, fences shall be carefully taken down as specified in the general conditions. Prior to any excavation taking place, the areas which will be disturbed shall be stripped of topsoil. The topsoil is to be stockpiled in locations away from the construction area.
- .3 Installation: The pipe shall be installed using bedding and cover material in accordance with Standard Detailed Drawing No. 2 or detail provided on drawings.
- .4 Unstable Soil or Rock: The Contractor shall contact the Engineer immediately should unstable soil be encountered or if boulders of sufficient size and number to warrant concern are encountered.
- .5 Tile Connections: Prior to commencement of backfilling, all tiles encountered in excavations shall be reconnected using material of a size comparable to the existing material. Where the excavation is below the tile grade, a compacted granular base is to be placed prior to laying the tile. Payment for connections not shown on the drawings shall be an extra to the contract.
- .6 Backfill: Backfill from the top of the cover material up to the under side of road base shall meet the requirements for M.T.O. Granular "B". The backfill shall be placed in lifts not exceeding 300mm in thickness and each lift shall be thoroughly compacted to produce a density of 98% Standard Proctor. Granular "B" road base for County Roads and Highways shall be placed to a 450mm thickness and Granular "A" shall be placed to a thickness of 200mm, both meeting M.T.O. requirements. Granular road base materials shall be thoroughly compacted to produce a density of 100% Standard Proctor.

Where the road surface is paved, the Contractor shall be responsible for placing an HL-4 Hot Mix Asphalt patch of the same thickness as the existing pavement. The asphalt patch shall be flush with the existing roadway on each side and not overlap. If specified, the asphalt patch shall not be placed immediately over the road base and the Granular "A" shall be brought up flush with the existing asphalt and a liberal amount of calcium chloride shall be spread on the gravel surface. The asphalt patch must be completed within the time period set out on the drawing.

3 **Open Cut** (cont'd)

The excavated material from the trench beyond a point 1.25 meters from the travelled portion or beyond the outside edge of the gravel shoulder, may be used as backfill in the trench in the case of covered drains. This material should be compacted in layers not exceeding 600mm.

A.18 **FENCES**

No earth shall be placed against fences and all fences removed by the Contractor are to be replaced by him in as good condition as found. In general, the Contractor will not be allowed to cut existing fences but shall disconnect existing fences at the nearest anchor post or other such fixed joint and shall carefully roll it back out of the way. Where the distance to the closest anchor post or fixed joint exceeds 50 meters, the Contractor will be allowed to cut and splice in accordance with accepted methods and to the satisfaction of the owner and the Engineer or Superintendent. Where existing fences are deteriorated to the extent that existing materials are not salvageable for replacement, the Contractor shall notify the Engineer or the Superintendent prior to dismantling. Fences damaged beyond salvaging by the Contractor's negligence shall be replaced with new materials, similar to those existing, at the Contractor's expense. The replacement of the fences shall be done to the satisfaction of the owner and the Engineer or Superintendent. The site examination should indicate to the Contractor such work, if any, and an allowance should be made in the tendered price.

The Contractor shall not leave any fence open when he is not at work in the immediate vicinity.

A.19 **LIVESTOCK**

The Contractor shall provide each property owner with 48 hours notice prior to removing any fences along fields which could possibly contain livestock. Thereafter, the property owner shall be responsible to keep all livestock clear of the construction areas until further notified. Where necessary, the Contractor will be directed to erect temporary fences. The Contractor shall be held responsible for loss or injury to livestock or damage caused by livestock, where the injury or damage is caused by his failure to notify the property owner or through negligence or carelessness on the part of the Contractor.

The Contractor constructing a tile drain shall not be held responsible for damages or injury to livestock occasioned by leaving trenches open for inspection by the Engineer if he notifies the owner at least 48 hours prior to commencement of the work on that portion. The Contractor will be held liable for such damages or injury if the backfilling of such trenches is delayed more than 1 day after acceptance by the Engineer.

A.20 **STANDING CROPS**

The Contractor shall not be held responsible for damages to standing crops within the working area available and the access route provided if he notifies the owner thereof at least 48 hours prior to commencement of the work on that portion.

A.21 **SURPLUS GRAVEL**

If as a result of any work, gravel or crushed stone is required and not all the gravel or crushed stone is used in the construction of the works, the Contractor shall haul away such surplus gravel or stone unless otherwise approved.

A.22 **RAILWAYS, HIGHWAYS, UTILITIES**

A minimum of forty-eight (48) hours notice to Railways, Highways and Utilities, exclusive of Saturdays, Sundays and Holidays, shall be required by the Contractor prior to any work being performed and in the case of a pipe being installed by open cutting or boring under a Highway or Railway, a minimum of 72 hours notice is required.

A.23 UTILITIES

The attention of the Contractor is drawn to the presence of utilities along the course of the drain. The contractor will be responsible for determining the location of all utilities and will be held liable for any damage to all utilities caused by his operations. The Contractor shall co-operate with all authorities to ensure that all utilities are protected from damage during the performance of the work. The cost of any necessary relocation work shall be borne by the utility. No allowance or claims of any nature will be allowed on account for delays or inconveniences due to utilities relocation, or for inconveniences and delays caused by working around or with existing utilities not relocated.

A.24 TERMINATION OF CONTRACT BY THE MUNICIPALITY

If the Contractor should be adjudged bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he should refuse or fail to supply enough properly skilled workmen or proper materials after having received seven (7) days notice in writing from the Engineer to supply additional workmen or materials, or if he should fail to make prompt payment to sub-contractors or for material or labour or persistently disregarding laws, ordinances, or the instruction of the Engineer, or otherwise being guilty of a substantial violation of the provisions of the contract, then the Municipality, upon the certification of the Engineer that sufficient cause exists to justify such action, may without prejudice to any other right or remedy, by giving the contractor written notice, terminate the employment of the contractor and take possession of the premises and of all materials, tools and appliances, thereon, and complete the work by whatever method the Engineer may deem expedient, but without undue delay or expense. In such case, the Contractor shall not be entitled to receive any further payment until the work is completed. If the unpaid balance of the contract price exceeds the expense of completing the work, including compensation to the Engineer for his additional services, such excess shall be paid to the Contractor. If such expense does not exceed such unpaid balance, the Contractor shall pay the difference to the Municipality. The expense incurred by the Municipality, as herein provided, shall be certified by the Engineer. Where a Contractor fails to commence work within seven (7) days of his commencement date as indicated by him on his Tender Form, and such extension of time as allowed due to poor weather or ground conditions, then the Municipality shall have the option, after providing the Contractor with seven (7) days notice of their intention to terminate the contract, award the contract to another Contractor at their discretion by retendering the project, inviting bids or by appointment. The additional costs of the above or retendering, and all other administration costs shall be deducted from the Contractor's bid deposit and the balance, if any, returned to him.

A.25 ERRORS AND UNUSUAL CONDITIONS

The Contractor shall notify the Engineer immediately of any error or unusual condition which may be found. Any attempt by the Contractor to make changes because of the error or unusual condition on his own shall be done at his own risk. Any additional cost incurred by the Contractor to remedy a wrong decision on his part shall be borne by the Contractor.

The Engineer shall make the alteration necessary to correct errors or to adjust for unusual conditions during which time it will be the Contractor's responsibility to keep his men and equipment gainfully employed elsewhere on the project. The contract amount shall be adjusted in accordance with a fair evaluation of the work added or deleted.

A.26 IRON BARS

The Contractor shall be held liable for the cost of an Ontario Land Surveyor to replace any iron bars destroyed during the course of construction.

A.27 STAKES

At the time of the survey, stakes are set along the course of the drain at intervals of 50 meters. The Contractor shall ensure that the stakes are not disturbed unless approval is obtained from the Engineer. Any stakes removed by the Contractor without the authority of the Engineer, shall be replaced at the expense of the Contractor. At the request of the Contractor, any stakes which are removed or disturbed by others or by livestock, shall be replaced at the expense of the drain.

A.28 **RIP-RAP**

Rip-rap shall be specified on the drawings and shall conform to the following:

- .1 **Quarry Stone:** shall range in size from 150mm to 300mm evenly distributed and shall be placed to a 300mm thickness on a filter blanket at a 1.5 : 1 slope unless otherwise noted. Filter blanket to be Mirafi 160N or approved equal.
- .2 **Broken Concrete:** may be used in areas outside of regular flows if first broken in maximum 450mm sized pieces and mixed to blend with quarry stone as above. No exposed reinforcing steel shall be permitted.
- .3 **Shot Rock:** shall range in size from 150mm to 600mm placed to a depth of 450mm thickness on a filter blanket at a 1.5:1 slope unless otherwise noted. Filter blanket to be Mirafi 160N or approved equal.

A.29 **GABION BASKETS**

Supply and install gabion basket rip-rap protection as shown on the drawings.

Gabion baskets shall be as manufactured by Maccaferri Gabions of Canada Ltd. or approved equal and shall be assembled and installed in strict accordance with the manufacturer's recommendations.

The gabion fill material shall consist solely of fractured field stone or gabion stone graded in size from 100mm to 200mm (4" to 8") and shall be free of undersized fragments and unsuitable material.

A.30 **RESTORATION OF LAWNS**

- .1 **General:** Areas noted on the drawings to be restored with seeding or sodding shall conform to this specification, and the contractor shall allow for all costs in his lump sum bid for the following works.
- .2 **Topsoil:** Prior to excavation, the working area shall be stripped of existing topsoil. The topsoil stockpile shall be located so as to prevent contamination with material excavated from the trench. Upon completion of backfilling operations, topsoil shall be spread over the working area to a depth equal to that which previously existed but not less than the following:

Seeding and sodding	-	minimum depth of 100mm
Gardens	-	minimum depth of 300mm

In all cases where a shortfall of topsoil occurs, whether due to lack of sufficient original depth or rejection of stockpiled material due to contractors operations, imported topsoil from acceptable sources shall be imported at the contractors expense to provide the specified depths. Topsoil shall be uniformly spread, graded and cultivated prior to seeding or sodding. All clods or lumps shall be pulverized and any roots or foreign matter shall be raked up and removed as directed.

.3 **Sodding**

- .1 **Materials:** Nursery sod to be supplied by the contractor shall meet the current requirements of the Ontario Sod Growers Association for No. 1 Bluegrass Fescue Sod.
- .2 **Fertilizer:** Prior to sod placement, approved fertilizer shall be spread at the rate of 5kg/100m² of surface area and shall be incorporated into such surfaces by raking, discing or harrowing. All surfaces on which sod is to be placed shall be loose at the time of placing sod to a depth of 25mm.
- .3 **Placing Sod:** Sod shall be laid lengthwise across the face of slopes with ends close together. Sod shall be counter sunk along the joints between the existing grade and the new sodding to allow for the free flow of water across the joint. Joints in adjacent rows shall be staggered and all joints shall be pounded and rolled to a uniform surface.

A.30 **RESTORATION OF LAWNS** (cont'd)

On slopes steeper than 3:1, and in unstable areas, the engineer may direct the contractor to stake sod and/or provide an approved mesh to prevent slippages. In all cases where such additional work is required, it will be deemed an extra to the contract and shall be paid for in accordance with the General Conditions.

No sod shall be laid when frozen nor upon frozen ground nor under any other condition not favourable to the growth of the sod. Upon completion of sod laying the contractor shall thoroughly soak the area with water to a depth of 50mm. Thereafter it will be the responsibility of the property owner to maintain the area in a manner so as to promote growth.

- .4 **Seeding:** Seed to be supplied by the contractor shall be "high quality grass seed" harvested during the previous year, and shall be supplied to the project in the suppliers original bags on which a tag setting out the following information is affixed:

- Year or Harvest - recommended rate of application
- Type of Mixture - fertilizer requirements

Placement of seed shall be by means of an approved mechanical spreader. All areas on which seed is to be placed shall be loose at the time of placing seed, to a depth of 25mm. Seed and fertilizer shall be spread in accordance with the suppliers recommendations unless otherwise directed by the Engineer. Thereafter it will be the responsibility of the property owner to maintain the area in a manner so as to promote growth.

- .5 **Settlement:** The contractor shall be responsible during the one year guarantee period for the necessary repair of restored areas due to trench settlement. Areas where settlement does not exceed 50mm may be repaired by top dressing with fine topsoil. In areas where settlement exceeds 50mm, the contractor will be required to backfill the area with topsoil and restore with seeding and/or sodding as originally specified.

A.31 **RESTORATION OF ROADS AND LANEWAYS**

- .1 **Gravel:** Restoration shall be in accordance with the applicable standard detailed drawing or as shown on the drawings.
- .2 **Asphalt and Tar and Chip:** Prior to restoration all joints shall be neatly sawcut. Restoration shall be as a in gravel above with the addition of the following:
- .1 Roads shall have the finished grade of Granular 'A', allow two courses of hot-mix asphalt (M.T.O. 310), 80mm HL6 and 40mm HL3 or to such greater thickness as may be required to match the existing.
 - .2 Laneways shall have the finished grade of Granular 'A' allow one 50mm minimum course of hot-mix asphalt (HL3) or greater as may be required to match existing.

SECTION B - OPEN DRAIN

I N D E X

<u>SECTION NUMBER</u>		<u>PAGE NUMBER</u>
B.1	PROFILE.....	10
B.2	ALIGNMENT.....	10
B.3	CLEARING AND GRUBBING.....	10
B.4	EXCAVATION.....	10
B.5	EXCAVATED MATERIAL.....	11
B.6	EXCAVATION THROUGH BRIDGES AND CULVERTS.....	11
B.7	PIPE CULVERT.....	11
B.8	MOVING DRAINS OFF ROADS.....	11
B.9	TRIBUTARY OUTLETS.....	12
B.10	SEDIMENT BASINS AND TRAPS.....	12
B.11	SEEDING.....	12

SECTION B**OPEN DRAIN****B.1 PROFILE**

The profile drawing shows the depth of cuts from the ground beside the stake to the final invert of the ditch in meters and decimals of a meter and also the approximate depth of cuts from the existing bottom of the ditch to the elevation of the ditch bottom. These cuts are established for the convenience of the Contractor; however, bench marks will govern the final elevation of the drain. Bench marks have been established along the course of the drain and their locations and elevations are noted on the profile drawing. A uniform grade shall be maintained between stakes in accordance with the profile drawing.

B.2 ALIGNMENT

The drain shall be constructed in a straight line and shall follow the course of the present drain or water run unless otherwise noted on the drawings. Where it is necessary to straighten any bends or irregularities in alignment not noted on the drawings, the Contractor shall contact the Engineer or Superintendent before commencing the work.

B.3 CLEARING AND GRUBBING

Prior to commencement of work, all trees, scrub, fallen timber and debris shall be removed from the side slopes of the ditch and for such a distance on the working side so as to eliminate any interference with the construction of the drain or the spreading of the spoil. The side slopes shall be neatly cut and cleared flush with slope whether or not they are affected directly by the excavation. With the exception of large stumps causing damage to the drain, the sideslope shall not be grubbed. All other cleared areas shall be grubbed and the stumps put into piles for disposal by the owner.

All trees or limbs 150mm (6") or larger, that it is necessary to remove, shall be considered as logs and shall be cut and trimmed, and left in the working width separate from the brush, for use or disposal by the owner. Trees or limbs less than 150mm in diameter shall be cut in lengths not greater than 5 meters and placed in separate piles with stumps spaced not less than 75 meters apart in the working width, for the use or disposal of the owner. In all cases, these piles shall be placed clear of excavated materials, and not be piled against standing trees. No windrowing will be permitted. The clearing and grubbing and construction of the drain are to be carried out in two separate operations and not simultaneously at the same location.

B.4 EXCAVATION

The bottom width and the side slopes of the ditch shall be those shown on the profile drawing.

Unless otherwise specified on the drawings, only the existing ditch bottom is to be cleaned out and the side slopes are not to be disturbed. Where existing side slopes become unstable because of construction, the Contractor shall immediately contact the Engineer or Superintendent. Alternative methods of construction and/or methods of protection will then be determined, prior to continuing the work.

Where an existing drain is being relocated or where a new drain is being constructed, the Contractor shall, unless otherwise specified, strip the topsoil for the full width of the drain, including the location of the spoil pile. Upon completion of levelling, the topsoil shall be spread to an even depth across the full width of the spoil.

B.5 EXCAVATED MATERIAL

Excavated material shall be deposited on either or both sides of the drain as indicated on the drawings or as directed by the Engineer or Superintendent. A buffer strip of not less than 3 meters in width through farmed lands and 2 meters in width through bush areas shall be left along the top edges of the drain. The buffer strip shall be seeded and/or incorporated as specified on the drawings. The material shall be deposited beyond the specified buffer strip.

No excavated material shall be placed in tributary drains, depressions, or low areas which direct water into the ditch so that water will be trapped behind the spoilbank. The excavated material shall be placed and levelled to a minimum width to depth ratio of 50:1 unless instructed otherwise. The edge of the spoilbank away from the ditch shall be feathered down to the existing ground; the edge of the spoilbank nearest the ditch shall have a maximum slope of 2 to 1. The material shall be levelled such that it may be cultivated with ordinary farm equipment without causing undue hardship on machinery and personnel. No excavated material shall cover any logs, scrub, debris, etc. of any kind.

Where it is necessary to straighten any unnecessary bends or irregularities in the alignment of the ditch, the excavated material from the new cut shall be used for backfilling the original ditch. Regardless of the distance between the new ditch and the old ditch no extra compensation will be allowed for this work and must be included in the Contractor's lump sum price for the open work.

Any stones 150mm or larger left exposed on top of the levelled excavated material shall be removed and disposed of as an extra to the contract unless otherwise noted on plans.

B.6 EXCAVATION THROUGH BRIDGES AND CULVERTS

The Contractor shall excavate the drain to the full specified depth and width under all bridges. Where the bridge or culvert pipe is located within a road allowance, the excavated material shall be levelled within the road allowance. Care shall be taken not to adversely affect existing drainage patterns. Temporary bridges may be carefully removed and left on the bank of the drain but shall be replaced by the Contractor when the excavation is completed unless otherwise specified. Permanent bridges must be left intact. All necessary care and precautions shall be taken to protect the structure. The Contractor shall notify the Engineer or Superintendent if excavation may cause the structure to undermine or collapse.

B.7 PIPE CULVERTS

Where specified on the drawings, the existing culvert shall be carefully removed, salvaged and either left at the site for the owner or reinstalled at a new grade or location. The value of any damage caused to the culvert due to the Contractor's negligence in salvage operation will be determined and deducted from the contract price.

All pipe culverts shall be installed in accordance with the standard detail drawings as noted on the drawings. If couplers are required, 5 corrugation couplers shall be used for up to and including 1200mm dia. pipe and 10 corrugation couplers for greater than 1200mm dia.

B.8 MOVING DRAINS OFF ROADS

Where an open drain is being removed from a road allowance, it must be reconstructed wholly on the adjacent lands with a minimum distance of 2.0 meters between the property line and the top of the bank, unless otherwise noted on the drawings. The excavated material shall be used to fill the existing open ditch and any excess excavated material shall be placed and levelled on the adjacent lands beyond the buffer strip, unless otherwise noted. Any work done on the road allowance, with respect to excavation, disposal of materials, installation of culverts, cleaning under bridges, etc., shall be to the satisfaction of the Road Authority and the Engineer.

B.9 TRIBUTARY OUTLETS

The Contractor shall guard against damaging the outlets of tributary drains. Prior to commencement of excavation on each property the Contractor shall contact the owner and request that all known outlet pipes be marked by the owner. All outlets so marked or visible or as noted on the profile, and subsequently damaged by the Contractor's operations will be repaired by the Contractor at his cost. All outlet pipes repaired by the Contractor under direction of the Drainage Superintendent or Engineer which were not part of the Contract shall be considered an extra to the contract price.

B.10 SEDIMENT BASINS AND TRAPS

The Contractor shall excavate sediment basins prior to commencement of upstream work as shown on the plan and profile. The dimension of the basin will be in a parabolic shape with a depth of 450mm below the proposed ditch bottom and the basin will extend along the drain for a minimum length of 15 meters.

A sediment trap 300mm deep and 5 meters long with silt fence placed across ditch bottom on the downstream end of the trap shall be constructed prior to and maintained during construction, to prevent silt from flushing downstream. The silt fence shall be removed and disposed of after construction.

B.11 SEEDING

1. **Delivery:** The materials shall be delivered to the site in the original unopened containers which shall bear the vendor's guarantee of analysis and seed will have a tag showing the year of harvest.
2. **Hydro Seeding:** Areas specified on drawings shall be hydro seeded and mulched upon completion of construction in accordance with O.P.S.S. 572 and with the following application rates:

Primary Seed (85 kg/ha.):	50% Creeping Red Fescue 40% Perennial Ryegrass 5% White Clover
Nurse Crop	Italian (Annual) Ryegrass at 25% of Total Weight
Fertilizer (300 kg/ha.)	8-32-16
Hydraulic Mulch (2000 kg/ha.)	Type "B"
Water (52,700 litres/ha.)	

Seeding shall not be completed after September 30.

3. **Hand Seeding:** Hand seeding shall be completed daily with the seed mixture and fertilizer and application rate shown under "Hydro Seeding" above. Placement of the seed shall be by means of an approved mechanical spreader. Seeding shall not be completed after September 30.

SECTION C - TILE DRAIN

INDEX

<u>SECTION NUMBER</u>		<u>PAGE NUMBER</u>
C.1	PIPE MATERIALS.....	13
C.2	TESTING.....	13
C.3	LINE.....	13
C.4	CLEARING AND GRUBBING.....	14
C.5	PROFILE.....	14
C.6	GRADE.....	14
C.7	EXCAVATION.....	15
C.8	INSTALLATION.....	15
C.9	ROAD AND LANEWAY SUB-SURFACE CROSSINGS.....	16
C.10	BACKFILLING.....	16
C.11	UNSTABLE SOIL.....	16
C.12	ROCKS.....	16
C.13	BROKEN, DAMAGED OR EXCESS TILE.....	16
C.14	TRIBUTARY DRAINS.....	16
C.15	OUTLET PIPES.....	17
C.16	CATCHBASINS AND JUNCTION BOXES.....	17
C.17	BLIND INLETS.....	18
C.18	GRASSED WATERWAY.....	18
C.19	BACKFILLING EXISTING DITCHES.....	18
C.20	RECOMMENDED PRACTICE FOR CONSTRUCTION OF SUBSURFACE DRAINAGE SYSTEM.....	18

SECTION C**TILE DRAIN****C.1 PIPE MATERIALS**

- .1 **Concrete Tile**: All tile installed under these specifications shall be sound and of first quality and shall meet all A.S.T.M. Specifications current at the time of tendering. Concrete tile shall conform to Designation C412 "Extra Quality" except that the minimum compression strengths shall be increased by 25%. Heavy Duty tile shall conform to Designation C412 "Heavy Duty Extra Quality".
- .2 **Corrugated Steel Pipe**: Unless otherwise specified all metal pipe shall be corrugated, rivetted steel pipe or helical corrugated steel pipe with a minimum wall thickness of 1.6mm (16 gauge) and shall be fully galvanized.
- .3 **Plastic Tubing**: The plans will specify the type of tubing or pipe, such as non-perforated or perforated (with or without filter material).
 - i) Corrugated Plastic Drainage Tubing shall conform to the current O.F.D.A. Standards
 - ii) Heavy Duty Corrugated Plastic Pipe shall be "Boss 1000" manufactured by the Big 'O' Drain Tile Co. Ltd. or approved equal
- .4 **Concrete Sewer Pipe**: The Designations for concrete sewer pipe shall be C14 for concrete sewer pipe 450mm (18") diameter or less; and C76 for concrete sewer pipe greater than 450mm (18") diameter. Where closed joints are specified, joints shall conform to the A.S.T.M. Specification C443.
Where concrete sewer pipe "seconds" are permitted the pipe should exhibit no damages or cracks on the barrel section and shall be capable of satisfying the crushing strength requirements for No. 1, Pipe Specifications (C14 or C76). The pipe may contain cracks or chips in the bell or spigot which could be serious enough to prevent the use of rubber gaskets but which are not so severe that the joint could not be mortared conventionally.
- .5 **Plastic Sewer Pipe**: The plans will specify the type of sewer pipe, such as non-perforated or perforated (with or without filter material). All plastic sewer pipe and fittings shall be "Boss Poly-Tite", ULTRA-RIB", "Challenger 3000" or approved equal with a minimum stiffness of 320 kpa at 5% deflection..
- .6 **Plastic Fittings**: All plastic fittings shall be "Boss 2000" or "Challenger 2000" with split coupler joints or approved equal.

C.2 TESTING

The manufacturer shall provide specimens for testing if required. The random selection and testing procedures would follow the appropriate A.S.T.M. requirements for the material being supplied. The only variation is the number of tile tested: 200mm to 525mm dia. - 5 tile tested, 600mm to 900mm dia. - 3 tile tested. The drain will be responsible for all testing costs for successful test results. Where specimens fail to meet the minimum test requirements, the manufacturer will be responsible for the costs of the unsuccessful tests. Alternately, the Engineer may accept materials on the basis of visual inspections and the receipt in writing from the Manufacturer of the results of daily production testing carried out by the Manufacturer for the types and sizes of the material being supplied.

C.3 LINE

Prior to stringing the tile, the Contractor shall contact the Superintendent or the Engineer in order to establish the course of the drain.

Where an existing drain is to be removed and replaced in the same trench by the new drain or where the new drain is to be installed parallel to an existing drain, the Contractor shall excavate test holes to locate the existing drain (including repairing drainage tile) at intervals along the course of the drain as directed by the Engineer and/or the Superintendent. The costs for this work shall be included in the tender price.

C.3 **LINE** (cont'd)

Where an existing drain is to be removed and replaced in the same trench by the new drain, all existing tiles shall be destroyed and all broken tile shall be disposed of off site.

The drain shall run in as straight a line as possible throughout its length, except that at intersections of other water courses or at sharp corners, it shall run on a curve of at least a 15 meter radius. The new tile drain shall be constructed at an offset from and generally parallel with any ditch or defined watercourse in order that fresh backfill in the trench will not be eroded by the flow of surface water. The Contractor shall exercise care not to disturb any existing tile drain or drains which parallel the course of the new drain, particularly where the new and the existing tile act together to provide the necessary capacity.

C.4 **CLEARING AND GRUBBING**

Prior to commencement of drain construction, all trees, scrub, fallen timber and debris shall be cleared and grubbed from the working area. Unless otherwise specified, the minimum width to be cleared and grubbed shall be 20 meters in all hardwood areas and 30 meters in all softwood areas (willow, poplar, etc.), the width being centred on the line of the drain.

All trees or limbs 150mm (6") or larger, that it is necessary to remove, shall be considered as logs and shall be cut and trimmed, and left in the working width separate from the brush, for use or disposal by the owner. Trees or limbs less than 150mm in diameter shall be cut in lengths not greater than 5 meters and placed in separate piles with stumps spaced not less than 75 meters apart in the working width, for the use or disposal of the owner. In all cases, these piles shall be placed clear of excavated materials, and not be piled against standing trees. No windrowing will be permitted. The clearing and grubbing and construction of the drain are to be carried out in two separate operations and not simultaneously at the same location.

C.5 **PROFILE**

The profile drawing shows the depth of cuts from the ground beside the stake to the final invert of the drain in meters and decimals of a meter. These cuts are established for the convenience of the Contractor; however, bench marks will govern the final elevation of the drain. Bench marks have been established along the course of the drain and their locations and elevations are noted on the profile drawing.

C.6 **GRADE**

The Contractor shall provide and maintain in good working condition, an approved system of establishing a grade sight line to ensure the completed works conform to the profile drawing. In order to confirm the condition of his system and to eliminate the possibility of minor errors on the drawings, he shall ensure his grade sight line has been confirmed to be correct between a minimum of two control points (bench marks) and shall spot check the actual cuts and compare with the plan cuts prior to commencement of tile installation. He shall continue this procedure from control point to control point as construction of the drain progresses. When installing a drain towards a fixed point such as a bore pipe, the Contractor shall uncover the pipe and confirm the elevation, using the sight line, a sufficient distance away from the pipe in order to allow for any necessary minor grade adjustments to be made in order to conform to the as built elevation of the bore pipe. All tile improperly installed due to the Contractor not following these procedures shall be removed and replaced entirely at the Contractor's cost.

When following the procedures and a significant variation is found, the Contractor shall immediately cease operations and advise the Engineer.

C.7 EXCAVATION

- .1 **Trench:** Unless otherwise specified, all trenching shall be done with a recognized farm tiling machine approved by the Engineer or Superintendent. The machine shall shape the bottom of the trench to conform to the outside diameter of the pipe for a minimum width of one-half of the outside diameter. The minimum trench width shall be equal to the outside diameter of the tile to be installed plus 100mm (4") on each side unless otherwise approved. The maximum trench width shall be equal to the outside diameter of the tile to be installed plus 250mm (10") on each side unless otherwise approved.
- .2 **Scalping:** Where the depths of cuts in isolated areas along the course of the drain as shown on the profile exceed the capacity of the Contractor's tiling machine, he shall lower the surface grade in order that the tiling machine may trench to the correct depth. Topsoil is to be stripped over a sufficient width that no subsoil will be deposited on top of topsoil. Subsoil will then be removed to the required depth and piled separately. Upon completion of backfilling, the topsoil will then be replaced to an even depth over the disturbed area. The cost for this work shall be included in his tender price.
- .3 **Excavator:** Where the Contractor's tiling machine consistently does not have the capacity to dig to the depths required or to excavate the minimum trench width required, he shall indicate in the appropriate place provided on the tender form his proposed methods of excavation.
Where the use of an excavator is either specified on the drawings or approved as evidenced by the acceptance of his tender on which he has indicated the proposed use of a backhoe he shall conform to the following requirements:
 - a) the topsoil shall be stripped and replaced in accordance with Section .2 "Scalping".
 - b) all tile shall be installed on a bed of 19mm crushed stone with a minimum depth of 150mm which has been shaped to conform to the lower segment of the tile.
 - c) the Contractor shall allow for the cost of the preceding requirements (including the supply of the crushed stone) in his lump sum tender price unless it is otherwise provided for in the contract documents.
- .4 **Backfilling Ditch:** Where the contract includes for a closed drain to replace an open drain and the ditch is to be backfilled, the Contractor shall install the tile and backfill the trench prior to backfilling the ditch unless otherwise noted. The distance the trench shall be located away from the ditch shall be as noted on the drawings, (beyond area required for stockpiling topsoil and backfilling). After tile installation is complete topsoil (if present) shall be stripped and stockpiled within the above limits prior to backfilling of ditch. Only tracked equipment shall be permitted to cross backfilled tile trench and must be at 90 degrees to line of tile.

C.8 INSTALLATION

The tile is to be laid with close fitting joints and in regular grade and alignment in accordance with the plan and profile drawings. The tiles are to be bevelled, if necessary, to ensure close joints (in particular around curves). Where, in heavy clay soils, the width of a joint exceeds 10mm the joint shall be wrapped with filter cloth as below. Where the width of a joint exceeds 12mm the tile shall first be removed and the joint bevelled to reduce the gap. The maximum deflection of one tile joint shall be 15 degrees. Where a drain connects to standard or ditch inlet catchbasins or junction box structures, the Contractor shall include in his tender price for the supply and installation of compacted Granular 'A' bedding under areas backfilled from the underside of the pipe to undisturbed soil. The connections will then be grouted.

Where a tile drain passes through a bore pit, the Tile Contractor shall include in his tender price for the supply and placement of compacted Granular "A" bedding from the underside of the pipe down to undisturbed soil within the limits of the bore pit.

As above and where soil conditions warrant, the Engineer may require (or as specified on the drawings) that each tile joint be wrapped with synthetic filter cloth. The width of the filter cloth shall be 300mm wide for tile sizes of 150mm to 300mm and 400mm wide for sizes of 350mm to 750mm. The filter cloth shall cover the full perimeter of the tile and overlap a minimum of 100mm or as specified on the drawings. The type of cloth shall be Mirafi 140NL for loam soils and 150N for sandy soil. Any such work not shown on the drawings shall be considered as an addition to the contract price unless specified on the drawings.

C.9 ROAD AND LANEWAY SUB-SURFACE CROSSINGS

All road and laneway crossings may be made with an open cut in accordance with standard detailed drawings in the specifications or on the drawings. The exact location of the crossing shall be verified and approved by the Road Authority and the Engineer and/or superintendent.

C.10 BACKFILLING

As the laying of the tile progresses, blinding up to the springline including compaction by tamping (by hand) is to be made on both sides of the tile. No tile shall be backfilled until inspected by the Engineer or Drainage Superintendent unless otherwise approved by the Engineer.

The remainder of the trench shall be backfilled with special care being taken in backfilling up to a height approximately 150mm above the top of the tile to ensure that no tile breakage occurs. During the backfilling operation no equipment shall be operated in a way that would transfer loads onto the tile trench. Surplus material is to be mounded over the tile trench so that when settlement takes place the natural surface of the ground will be restored. Upon completion, a minimum cover of 600mm is required over all tile. Where stones larger than 150mm are present in the backfill material, they shall be separated from the material and disposed of by the Contractor.

Where a drain crosses a lawn area, the backfilling shall be carried out as above except that, unless otherwise specified, the backfill material shall be mechanically compacted to eliminate settlement.

C.11 UNSTABLE SOIL

The Contractor shall immediately contact the Engineer or Superintendent if quicksand is encountered, such that installation with a tiling machine is not possible. The Engineer shall, after consultation with the Superintendent and Contractor, determine the action necessary and a price for additions or deletions shall be agreed upon prior to further drain installation. Where directed by the Engineer, test holes are to be dug to determine the extent of the affected area. Cost of test holes shall be considered an addition to the contract price.

C.12 ROCKS

The Contractor shall immediately contact the Engineer or Superintendent if boulders of sufficient size and number are encountered such that the Contractor cannot continue trenching with a tiling machine. The Engineer or Superintendent may direct the Contractor to use some other method of excavating to install the drain. The basis of payment for this work shall be determined by the Engineer and Drainage Superintendent.

If only scattered large stones or boulders are removed on any project, the Contractor shall haul same to a nearby bush or fenceline, or such other convenient location as approved by the Landowners(s).

C.13 BROKEN, DAMAGED TILE OR EXCESS TILE

The Contractor shall remove and dispose of off-site all broken (existing or new), damaged or excess tile or tiles. If the tile is supplied by the Municipality, the Contractor shall stockpile all excess tile in readily accessible locations for pickup by the Municipality upon the completion of the job.

C.14 TRIBUTARY DRAINS

Any tributary tile encountered in the course of the drain shall be carefully taken up by the Contractor and placed clear of the excavated earth. If the tributary tile drains encountered are clean or reasonably clean, they shall be connected into the new drain. Where existing drains are full of sediment, or contain pollutants, the decision to connect those drains to the new drain shall be left to the Engineer or Superintendent. Each tributary tile connection made by the Contractor shall be located and marked with a stake and no backfilling shall take place until the connection has been approved by the Engineer or Superintendent.

C.14 **TRIBUTARY DRAINS** (cont'd)

For tributary drains 150mm dia. or smaller connected to new tiles 250mm dia. or larger, and for 200mm dia. connected to 350mm dia. or larger, the Contractor shall neatly cut a hole in the middle of a tile length. The connections shall be made using a pre-fabricated adaptor. All other connections shall be made with pre-fabricated wyes or tees conforming to Boss 2000 split coupler or approved equal.

Where an open drain is being replaced by a new tile drain, existing tile outlets entering the ditch from the side opposite the new drain shall be extended to the new drain. All existing metal outlet pipes shall be carefully removed, salvaged, and left for the owner. Where the grade of the connection passes through the newly placed backfill in the ditch, the backfill material below the connection shall be thoroughly compacted and metal pipe of a size compatible with the tile outlet shall be installed so that a minimum length of 2 meters at each end is extending into undisturbed soil.

Where locations of tiles are shown on the drawings the Contractor shall include in his tender price, all costs for connecting those tiles to the new drain regardless of length.

Where tiles not shown on the drawings are encountered in the course of the drain, and are to be connected to the new drain, the Contractor shall be paid for each connection at the rate outlined in the Form of Tender and Agreement.

C.15 **OUTLET PIPES**

Corrugated steel pipe shall be used to protect the tile at its outlet. It shall have a hinged metal grate with a maximum spacing between bars of 40mm. The corrugated steel pipe shall be bevelled at the end to generally conform to the slope of the ditch bank and shall be of sufficient size that the tile can be inserted into it to provide a solid connection. The connection will then be grouted immediately.

The installation of the outlet pipe and the required rip-rap protection shall conform to the standard detailed drawing as noted on the drawing.

C.16 **CATCHBASINS AND JUNCTION BOXES**

.1 **Catchbasins**: Unless otherwise noted or approved, catchbasins shall be in accordance with O.P.S.D. 705.010, 705.030. All catchbasins shall include two - 150mm riser sections for future adjustments. All ditch inlet catchbasins shall include one 150mm riser section for future adjustments. The catchbasin top shall be a "Bird Cage" type substantial steel grate, removable for cleaning and shall be inset into a recess provided around the top of the structure. The grate shall be fastened to the catchbasin with bolts into the concrete. Spacing of bars on grates for use on 600mmx600mm structures shall be 65mm centre to centre. Spacing of bars on grates for use on structures larger than 600mmx600mm shall be 90mm with a steel angle frame.

The exact location and elevation of catchbasins shall be approved by the Road Authority or the Engineer/Superintendent. Catchbasins offset from the drain shall have "Boss 2000" 200mm diameter leads or approved equal unless otherwise noted and the leads shall have a minimum of 600mm of cover. The leads shall be securely grouted at the structures and the drain.

.2 **Junction Boxes**: Junction boxes shall be the precast type unless otherwise approved. Dimensions for precast junction boxes shall conform to those for catchbasins. The inside dimensions of the box shall be a minimum of 100mm larger than the outside diameter of the largest pipe being connected. The minimum cover over the junction box shall be 600mm. Benching to spring line shall be supplied with all junction boxes.

.3 **Connections**: Catchbasins and junction boxes shall not be ordered until elevations of existing pipes being connected have been verified in the field as indicated on the drawings. All connections shall be securely grouted at both the inside and outside walls of the structure.

.4 **Installation**: Where the native material is clay, all catchbasins shall be backfilled with an approved granular material placed and compacted to a minimum width of 300mm on all sides with the following exception. Where the native material is sandy or granular in nature it may be used as backfill. Filter cloth shall be placed between the riser sections of all catchbasins.

C.16 CATCHBASINS AND JUNCTION BOXES (cont'd)

Where the Contractor has over excavated or where ground conditions warrant, the structure shall be installed on a compacted granular base.

The Contractor shall include in his tender price for the construction of a berm behind all ditch inlet structures. The berm shall be constructed of compacted clay keyed 300mm into undisturbed soil. Topsoil shall be distributed to a 65mm thickness and seeded unless otherwise specified. The Contractor shall also include for regrading, shaping and seeding of road ditches for a maximum of 15 meters each way from all catchbasins.

C.17 BLIND INLETS

Where specified, blind inlets shall be installed along the course of the drain. In accordance with details on the drawings.

C.18 GRASSED WATERWAY

Topsoil to be stripped from construction area and stockpiled prior to construction of waterway. Waterway to be graded into a parabolic shape to the width shown on the drawings. Topsoil to be relevelled over the waterway and other areas disturbed by construction.

Waterway to be prepared for seeding by harrowing and then seeded by drilling followed by rolling. Seeding rate to be 85 Kg/Ha with the following mixture:

- 30% Canon Canada Bluegrass
 - 25% Koket Chewings Fescue
 - 30% Rebel Tall Fescue
 - 15% Diplomat Perennial Rye
- Plus #125 Birdsfoot Trefoil (25% of Total Weight)

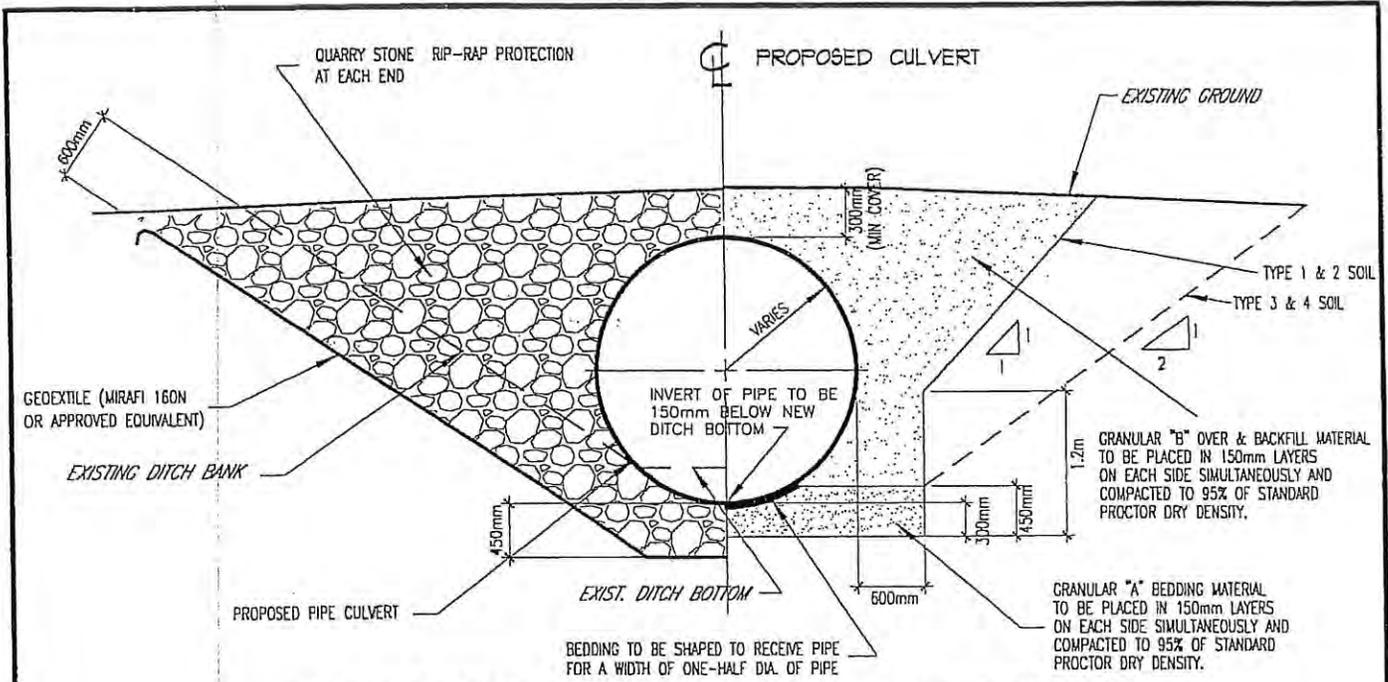
C.19 BACKFILLING EXISTING DITCHES

The Contractor shall backfill the ditch sufficiently for traversing by farm machinery. If sufficient material is not available from the old spoil banks to fill in the existing ditch, the topsoil shall be stripped and the subsoil shall be bulldozed into the ditch and the topsoil shall then be spread over the backfilled ditch unless otherwise specified on the contract drawings. The Contractor shall ensure sufficient compaction of the backfill and if required, repair excess settlement up to the end of the warranty period. The final grade of the backfilled ditch shall provide an outlet for surface water.

C.20 RECOMMENDED PRACTICE FOR CONSTRUCTION OF SUBSURFACE DRAINAGE SYSTEM

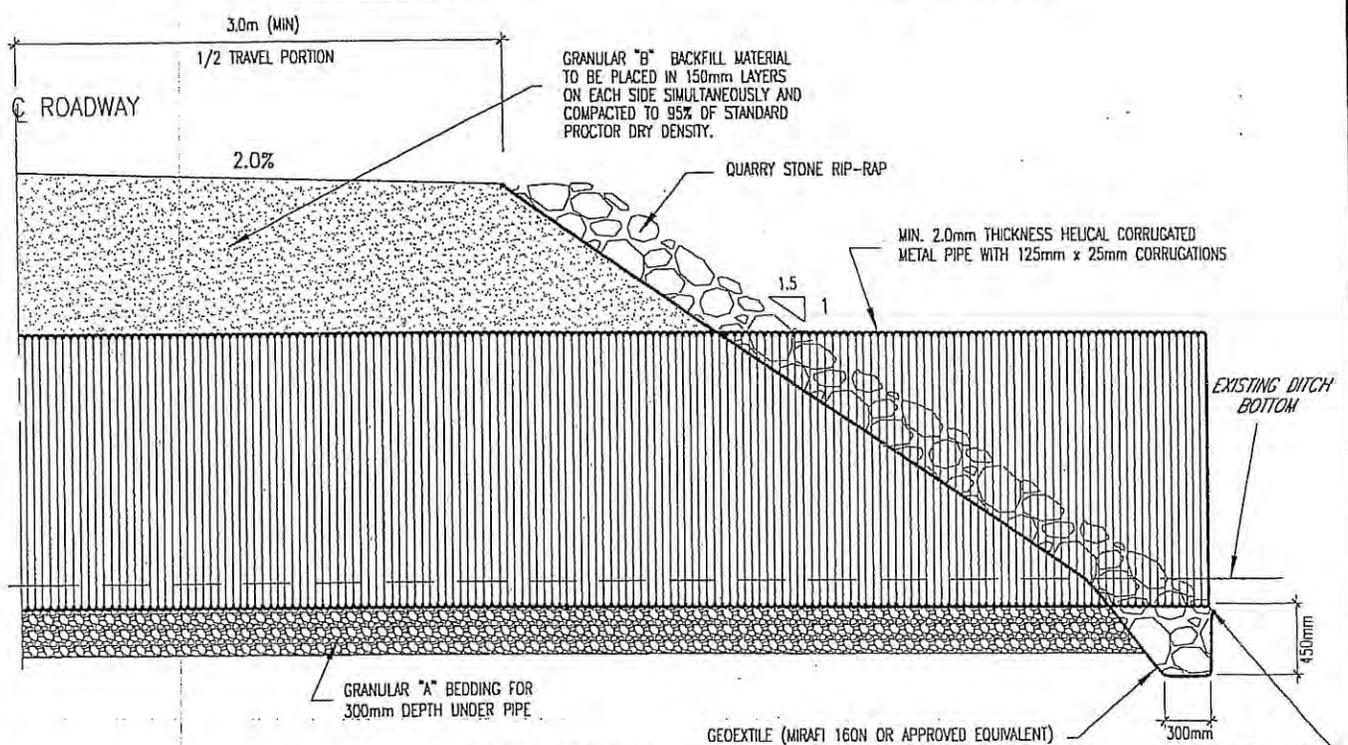
Drainage guide for Ontario, Ministry of Agriculture, Food and Rural Affairs Publication Number 29 and its amendments, dealing with the construction of Subsurface Drainage systems, shall be the guide to all methods and materials to be used in the construction of tile drains except where superseded by other specifications of this contract.

The requirements of licensing of operators, etc. which apply to the installation of closed drains under the Tile Drainage Act shall also be applicable to this contract in full unless approval otherwise is given in advance by the Engineer.



HALF ELEVATION

HALF SECTION



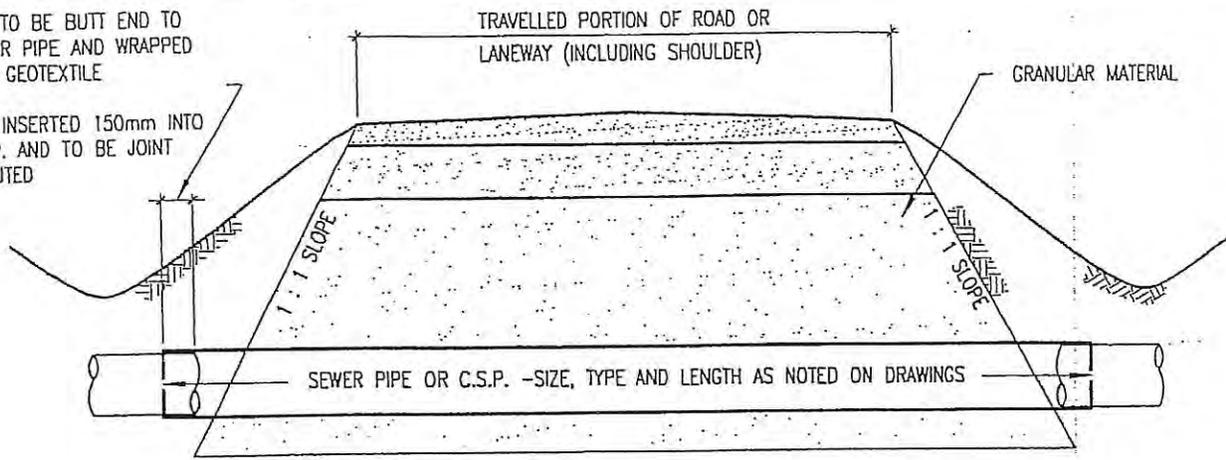
HALF SECTION THROUGH PIPE

NOTES

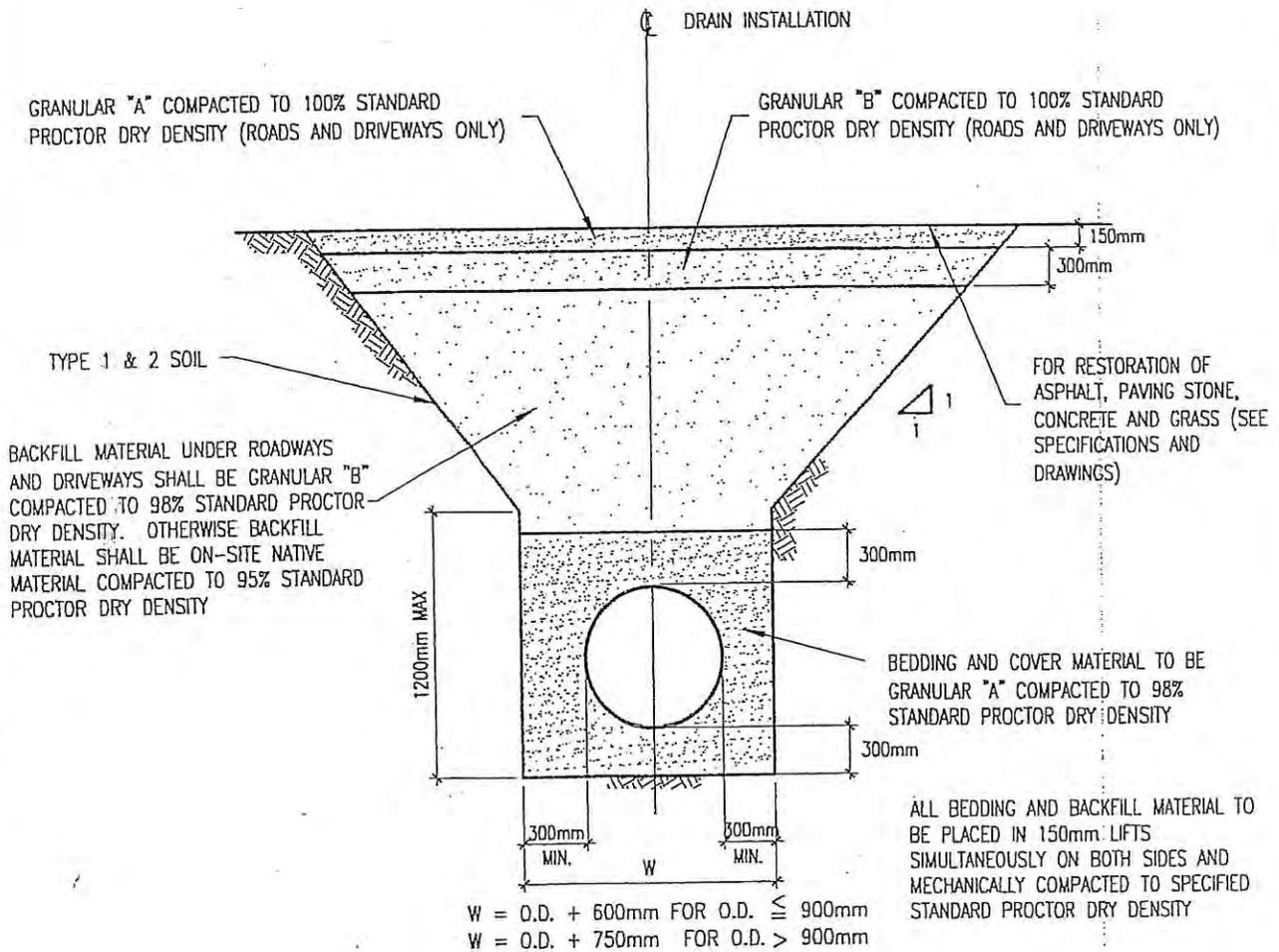
- 1) WHERE THE CULVERT IS TO BE INSTALLED IN POOR SOIL CONDITIONS, THE BEDDING MATERIAL SHALL BE 19mm CRUSHED STONE COMPLETELY WRAPPED IN GEOTEXTILE SUCH AS MIRAFI 160N OR APPROVED EQUIVALENT.

TYPICAL FARM CULVERT INSTALLATION DETAIL		
Scale: N.T.S.	Approved by: M.P.D.	Date: January 1983
Drawn by: jk		Revised: November 2000
ELEVATION & SECTION		STANDARD DETAILED DRAWING
SPRIET ASSOCIATES LONDON LIMITED CONSULTING ENGINEERS ARCHITECTS		No. 01

1. TILE TO BE BUTT END TO SEWER PIPE AND WRAPPED WITH GEOTEXTILE
2. TILE INSERTED 150mm INTO C.S.P. AND TO BE JOINT GROUTED



SECTION THROUGH PIPE



$$W = \text{O.D.} + 600\text{mm FOR O.D.} \leq 900\text{mm}$$

$$W = \text{O.D.} + 750\text{mm FOR O.D.} > 900\text{mm}$$

CROSS SECTION

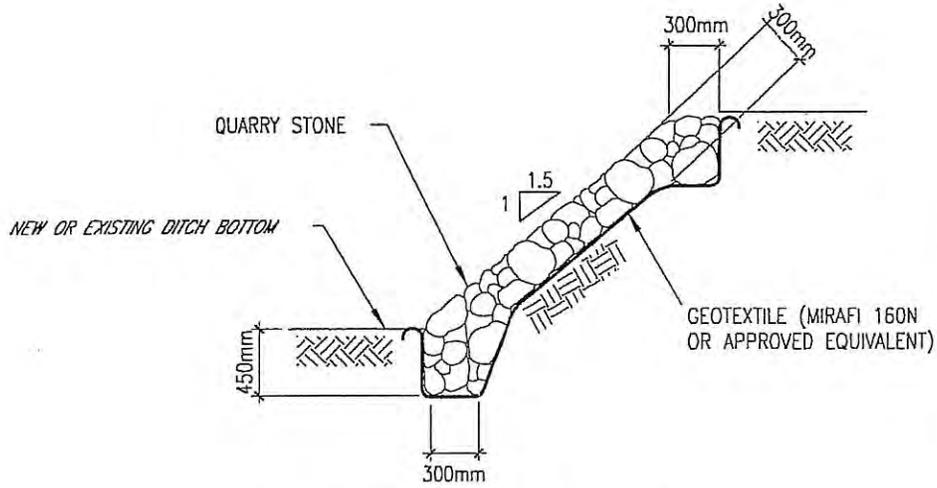
TYPICAL INSTALLATION DETAIL FOR FLEXIBLE PIPE

Scale: N.T.S.	Approved by: M.P.D.	Date: January 1983
Drawn by: jk		Revised: November 2000

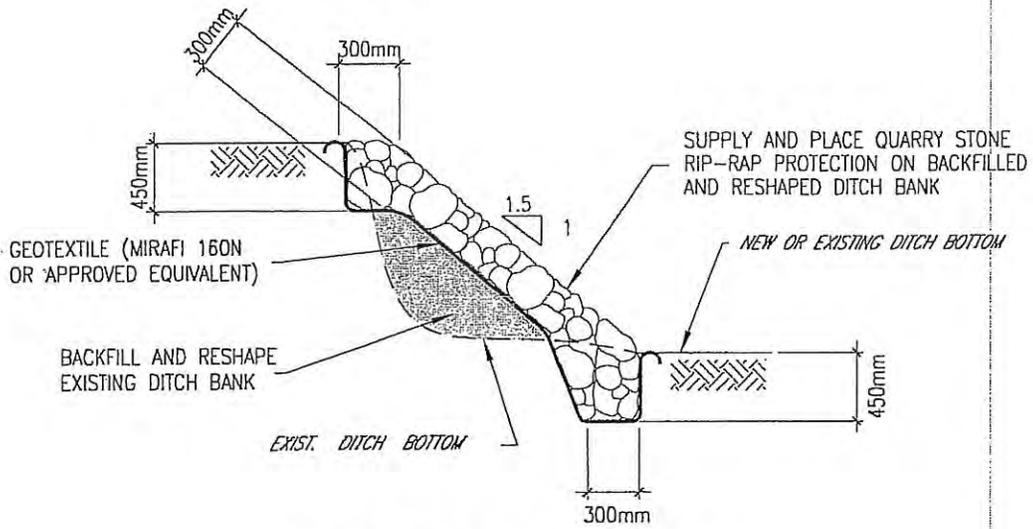
ELEVATION & SECTION

SPRIET ASSOCIATES LONDON LIMITED
CONSULTING ENGINEERS ARCHITECTS

STANDARD
DETAILED
DRAWING
No. 02



TYPICAL DITCH BANK RIP-RAP



**TYPICAL DITCH BANK RIP-RAP
WITH BACKFILLING OF WASHOUT**

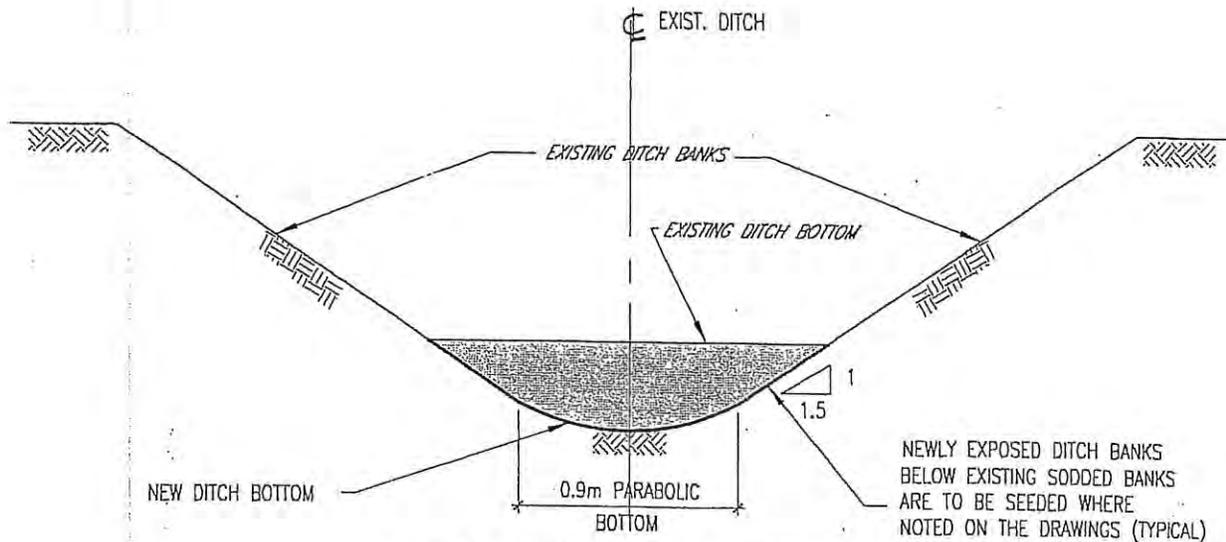
TYPICAL DITCH BANK RIP-RAP DETAILS

Scale: N.T.S.	Approved by:	Date: July 2000
Drawn by: jk	M.P.D.	Revised: November 2000

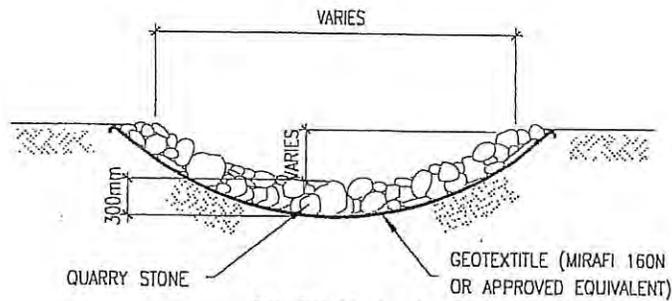
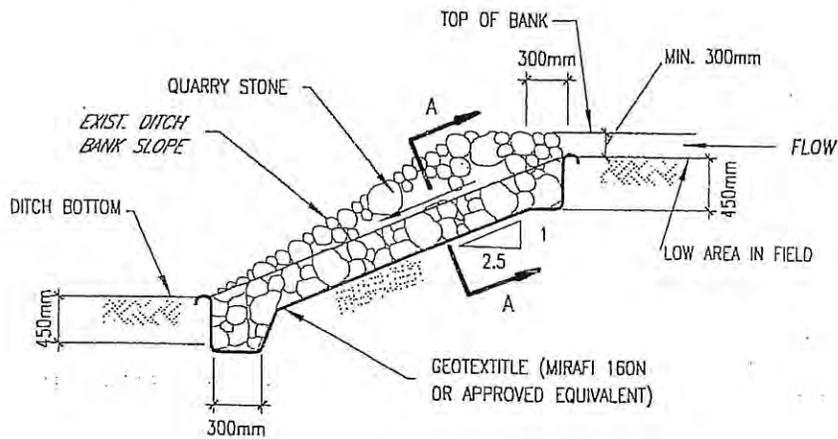
SECTIONS

SPRIET ASSOCIATES LONDON LIMITED
CONSULTING ENGINEERS ARCHITECTS

STANDARD
DETAILED
DRAWING
No. 04



TYPICAL DITCH BOTTOM CLEANOUT



SECTION A-A

TYPICAL ROCK CHUTE

TYPICAL DITCH BOTTOM CLEANOUT TYPICAL ROCK CHUTE CONSTRUCTION		
Scale: N.T.S.	Approved by:	Date: November 2000
Drawn by: jk	M.P.D.	Revised:
SECTIONS		STANDARD DETAILED DRAWING No. 05
 SPRIET ASSOCIATES LONDON LIMITED CONSULTING ENGINEERS ARCHITECTS		