

**BIO-SWALE & STORMCEPTOR®
OPERATION & MAINTENANCE MANUAL**

Neighbourhoods of Delphi Point Inc.

**NEIGHBOURHOODS OF DELPHI POINT PHASE 2
TOWN OF THE BLUE MOUNTAINS**

PREPARED BY:

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MARCH 2013

CFCA FILE NO. 226-2678

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1.0 INTRODUCTION

CF Crozier & Associates Inc. ("Crozier") was retained by The Neighbourhoods of Delphi Point Inc. ("Developer") to complete the engineering design for Phase 2 of a proposed residential condominium development in the Town of The Blue Mountains ("Town"). The 12.89ha property is bound by Highway 26 to the south, Watercourse #26 to the east, Watercourse #27 to the west, and Georgian Bay to the north. Phase 2 represents approximately 7.4 ha of developable lands of the 12.89 ha property. The 12.89-ha holdings are legally described as Part of Lot 26, Concession 5, Town of The Blue Mountains, County of Grey.

This manual has been prepared to provide a detailed summary of the operation and maintenance procedures and protocols for the Stormceptor® treatment unit and water quality bio-swale to ensure the long-term successful operation of the onsite stormwater management system.

Contained within this manual is a description of the swale and Stormceptor® (Section 2.0); a discussion of the operation and maintenance procedures (Section 3.0); and appropriate contact information (Section 4.0).

2.0 FACILITY DESCRIPTION

The management of stormwater and site drainage for the development must comply with the policies and standards of the various agencies including the Town of The Blue Mountains, Grey Sauble Conservation Authority and Ministry of Environment. The primary method implemented to meet these standards is a Best Management Practices treatment train, consisting of a Stormceptor® oil/grit separator and a water quality bio-swale.

Three Stormceptors® will be used on the site. These units will be located upstream of the bio-swale, at the downstream end of the internal storm sewer systems, servicing the proposed development roadways, front half of lots, and some rear lots. Ownership of the Stormceptors® and bio-swales will be conveyed to the condominium corporation. Minor flows from this sewer system will be treated by the oil/grit separator prior to discharging to the bio-swale for final treatment and polishing.

The bio-swales are located in the northeast, north and northwest portions of the subject property. The swales will discharge treated runoff to Watercourse #26 and Georgian Bay. The locations of the swales are shown in Figure 5, and the detailed engineering of the swales are shown in Figures 11, 12 and 13.

3.0 FACILITY OPERATIONS AND MAINTENANCE

It is understood that the Developer will be responsible for the operation and maintenance of the treatment systems post-construction and for a two year warranty period. Following the end of the Developer's warranty and open registration the condominium corporation will assume ownership of and responsibility for the operations and maintenance of the OGS and bio-swale. Maintenance procedures associated with the oil/grit separator and bio-swale are detailed below.

3.1 Maintenance Schedule and Operations for Oil Grit Separator

3.1.1 Access

Access to the oil grit separators is provided via a three metre wide access driveway accessible from the adjacent street.

3.1.2 Inspections

Each Stormceptor ® unit is eligible for the Quality Assurance Program provided by the supplier, Hanson Pipe, and administered by Minotaur Guardian Service Ltd. Maintenance of most OGS units is performed using vacuum trucks at regular intervals. Inspections are to be conducted every 6 months. The presence of oil in the unit may be determined visually. A dipstick should be used to measure the depth of oil and sediment in the unit. Further information regarding this program is included in Appendix A. The record of post-installation certification and inspection will be provided to both the Developer and the condominium corporation.

3.1.3 Sediment and Oil Removal and Maintenance

If a large presence of oil is measured, or if a spill is known to have occurred, the unit should be serviced immediately. If the depth of sediment measured exceeds 200mm, the unit should be serviced to ensure continued sediment removal efficiency.

As indicated above, Minotaur Guardian Services Ltd. performs inspection and maintenance for Stormceptor ® units in Ontario. We recommend that Minotaur be retained by the Developer to perform the maintenance duties for the oil/grit separator, and that the maintenance contract be assumed by the condominium corporation.

3.2 Maintenance Schedule and Operations for Bio-swale

3.2.1 Access

Three metre wide maintenance laneways have been provided through the drainage corridor to provide access to the bio-swale micro pool for sediment cleanout. The laneway extends from the adjacent street to the bio-swale inlet headwall.

3.2.2 Inspections

Inspections are to be conducted by the Developer after every storm over 10mm during the warranty period to ensure proper functioning. After this period inspections should be conducted annually after the spring melt has stabilized. A suggested inspection routine is listed below.

Table 1: Inspection Routine for Bio-swale

| Abnormal Observation | Inspected Component | Maintenance Required |
|--|----------------------------|--|
| Water level persists 24 to 48 hours after a storm. | Outlet to Ditch | Clear blockage by removing trash and/or sediment. |
| Surrounding vegetation is in poor condition; lack of vegetation. | Vegetation | Re-planting in affected areas. Watering may be required during dry spells. |
| Elevated sediment depth. | Micropool | Remove built-up sediment. This may occur particularly in the spring when snowmelt causes deposition of sand in the bioswale. |
| Erosion/exposed earth around inlet to swale | Inlet | Stabilization of micropool area with vegetation or rip-rap. |

During these inspections, if an oily sheen or abnormal colouring of the water is noted it may indicate that an industrial spill may have occurred. MOE Spills Action Centre should be contacted immediately; refer to enclosed contact information, included in Section 4.0.

3.2.3 Grass Cutting

Grass should be cut as infrequently as possible to further enhance water quality and discourage the formation of habitat for geese. Therefore, grass cutting should be undertaken solely to enhance the aesthetics of the facility and must comply with local by-laws. Cutting will be performed at the discretion of the condominium corporation.

3.2.4 Plantings

The base of the bio-swale may require some replanting or enhancement during the first two years of operation following completion of house construction. The extent of replanting or enhancement required will be determined during regular inspections and following consultation with landscape architect. Watering may be required during dry spells, as frequently as weekly during the first year. After the first year, watering should be performed as needed.

The planting of vegetation should be carried out under the direction of the landscape architect after spring runoff has stabilized.

3.2.5 Trash Removal

Annual "spring cleanup" should be conducted to remove accumulated trash from the swale. Further trash removal may be required as determined by regular inspections.

3.2.6 Sediment Removal and Maintenance

The removal of sediment from the micropool should be conducted each spring, along with any other maintenance prompted by the inspection. For further information, refer to an excerpt from the CVC/TRCA *Low Impact Development Stormwater Management Manual*(2008) attached in Appendix B.

4.0 CONTACT INFORMATION

The following table gives the relevant contact information for the operation and maintenance of the stormwater treatment system.

| Agency | Contact Information | Contact Person |
|--|--|--|
| MOE Spill Action Centre | 5775 Yonge Street 5th floor North York ON M2M 4J1 Toll Free: 1-800-268-6060 Tel: (416) 325-3000 Fax (416) 325-3011 | |
| C.F. Crozier & Associates Inc. (Engineers) | 40 Huron Street, Suite 301 Collingwood, ON L9Y 4R3 Tel: (705) 446-3510 Fax: (705) 446-3520 Email: kmorris@cfcrozier.ca | Kevin Morris, P.Eng. Senior Project Manager |
| Hensel Design Group Inc. (Landscape Architect) | Tel: (705) 443-8394 Email: mike_h@rogers.com | Mike Hensel Landscape Architect |
| Minotaur Guardian Services Ltd. (Stormceptor Maintenance) | RR8, 566 Lynden Road Brantford, ON N3T 5M1 Tel: (519) 647 3729 Fax: (519) 647 3198 Email: info@minotaur ltd.com | |

5.0 REFERENCES

This O&M Manual was developed based on recommendations from:

1. Ministry of the Environment *Stormwater Planning and Design Manual*(2003)
2. TRCA and CVC *Low Impact Development Stormwater Management Manual*(2008) [Excerpt Attached]

APPENDIX A:

STORMCEPTOR ® OPERATION AND MAINTENANCE LITERATURE

5.0 SERVICING

5.1 Maintenance Procedure

Maintenance of the Stormceptor® system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). Entry at the level of the insert may be required for servicing the larger models. The Vacuum Service Industry is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean a Stormceptor will vary based on the size of unit and transportation distances.

The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the interceptor can be determined by inserting a dipstick in the oil inspection/cleanout port.

Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve (Sludge Judge®). This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds the guideline values provided in Table 4.

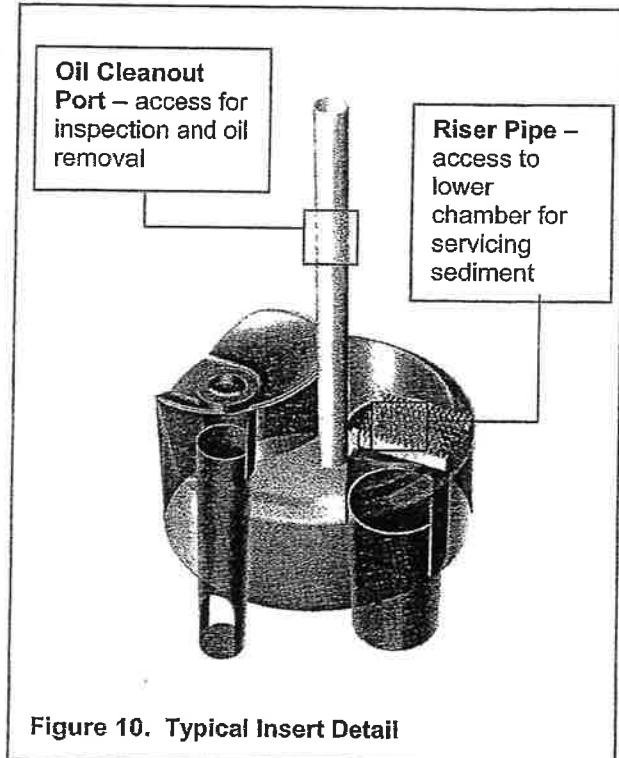


Figure 10. Typical Insert Detail

Although annual servicing is recommended, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required every two or three years).

Oil is removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively oil could be removed from the 610 mm opening if water is removed from the lower chamber to lower the oil level below the drop pipes.

The following procedures should be taken when cleaning out Stormceptor:

1. Check for oil
2. Remove any oil separately using a small portable pump

3. Decant the water from the unit to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank
4. Remove the sludge from the bottom of the unit using the vacuum truck
5. Re-fill Stormceptor with water where required by the local jurisdiction

| Table 4. Sediment Depths Indicating Required Servicing * | |
|--|---------------------|
| Model | Sediment Depth (mm) |
| 300i | 225 |
| 750 | 230 |
| 1000 | 275 |
| 1500 | 400 |
| 2000 | 350 |
| 3000 | 475 |
| 4000 | 400 |
| 5000 | 500 |
| 6000 | 425 |
| 9000 | 400 |
| 10000 | 500 |
| 14000 | 425 |
| * based on 15% of the Stormceptor unit's total storage | |

5.2 Hydrocarbon Spills

The Stormceptor® is often installed in areas where the potential for spills is great. The Stormceptor System should be cleaned immediately after a spill occurs by a licensed liquid waste hauler.

5.3 Disposal

Requirements for the disposal of material from the Stormceptor System are similar to that of any other stormwater Best Management Practice (BMP) where permitted. Disposal options for the sediment may range from disposal in a sanitary trunk sewer upstream of a sewage treatment plant to disposal in a sanitary landfill site. Petroleum waste products collected in the Stormceptor (free oil/chemical/fuel spills) should be removed by a licensed waste management company.

5.4 Hanson Stormceptor Service Package

Each Stormceptor unit supplied by Hanson includes a maintenance service package. A fixed budget is allocated to each Stormceptor unit sold for servicing. The service package includes a combination of inspection(s) and/or servicing, depending on specific site conditions and the remaining budget allocated to each Stormceptor unit. This ensures a high level of performance



for longer periods of time. Please contact Minotaur Guardian Services Limited (519.647.3729) for further information.

5.5 Minotaur Guardian Services Ltd.

Minotaur Guardian Services Ltd. is the recommended service contractor for the Stormceptor® System in Ontario. Minotaur Guardian Services Ltd. are trained and have a high level of understanding of the product. In addition to managing the service packages included with each Stormceptor unit, they provide long term servicing for Stormceptor units. Their services include bi-annual inspections, reporting and servicing. For further information on Minotaurs services and products please call (519) 753-2656.

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Hanson Stormceptor Servicing

To ensure long term environmental protection, the Stormceptor system must be serviced. The need for servicing is determined through inspection of the Stormceptor System. Generally, annual servicing is recommended or when the sediment depth reaches 15% of the total storage volume of the treatment chamber. Procedures for inspection are provided in the Hanson Stormceptor Owner's Manual, November 2002. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

Maintenance and servicing of the Stormceptor System is accomplished in partnership with the Hanson Stormceptor Quality Assurance Program and the site owner. The maintenance and servicing is as follows:

Hanson Stormceptor Quality Assurance Program

The Hanson Stormceptor System includes a Quality Assurance Program designed to ensure that long term environmental protection is satisfied. The Hanson Stormceptor Quality Assurance Program consists of the following:

Installation Inspection

Upon installation of each Stormceptor unit, a Hanson representative will visit the site to inspect the unit for conformance to the recommended assembly instructions. If the assembled unit has met Hanson's recommendations, a Stormceptor Details Report will be issued to the owner, consulting engineer and the local regulating agency identifying the location of the unit (global positioning system (GPS) coordinates), servicing recommendations and information if the unit has been properly assembled. Any deficiencies will be noted and addressed to the contractor for rectification.

Servicing Package

Approximately six months after the Stormceptor Details Report is completed the Hanson Stormceptor Service package comes into effect. A budget has been allocated to each Stormceptor unit to ensure that the unit is inspected and/or serviced when required after purchase. The service package is managed on behalf of Hanson by Minotaur Guardian Services Ltd (MGS). MGS will provide a combination of inspection(s) and/or servicing depending on the budget available after the first inspection of the unit. MGS will work closely with the owner to educate and to provide professional services for the servicing of Stormceptor units across Ontario.



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Site Owner Servicing

On completion of the Hanson Quality Assurance Program, the owner will be required to inspect and service the Stormceptor System on a regular basis. The owner's will be required to complete two activities to ensure the long term efficiency of the Stormceptor System: 1) inspection, and 2) servicing.

Inspection

Using a dipstick or a similar device, the Stormceptor unit will be inspected at least once every six months. The sediment depth and oil level is to be measured. Once the sediment depth reaches the recommended levels as indicated by the Stormceptor model numbers below, the units should be serviced. If any large presence of oil is measured, the oil should be removed and disposed of.

| Sediment Depths Indicating Required Servicing | |
|---|----------------|
| Model | Sediment Depth |
| STC 300i | 200 |
| STC 750 | 200 |
| STC 1000 | 250 |
| STC 1500 | 375 |
| STC 2000 | 300 |
| STC 3000 | 425 |
| STC 4000 | 375 |
| STC 5000 | 450 |
| STC 6000 | 375 |
| STC 9000 | 375 |
| STC 10000 | 450 |
| STC 14000 | 375 |

Servicing

Once the sediment depth has reached the recommended depth for maintenance, the Stormceptor unit should be serviced. A vacuum truck company licensed for solid waste disposal should be contracted to clean out the unit. Without any inspection, as a rule of thumb, the Stormceptor unit should be serviced a minimum of once per year.

APPENDIX B:
TRCA AND CVC
LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT
MANUAL EXCERPT

Landscaping and Stabilization

- Correct vegetation should be planted.
- Pretreatment area should be stabilized.
- Drainage area should be stabilized prior to directing water to the swale.

The following items should be checked after the first rainfall event, and adjustments should be made as necessary:

- Sheet flow should occur as designed.
- Outfall protection/energy dissipation at concentrated inflow should be stable.
- Flow should not concentrate within the swale.
- Swale should drain within the designed draw down time (24-48 hours).
- Sediment accumulation should not be present.

Dry Swales Maintenance and Costs

Maintenance

Maintenance of dry swales mostly involves maintenance of the vegetative cover. Routine maintenance activities are outlined in Table 3.6.48. Regular inspections should be conducted on the swale to schedule maintenance operations such as sediment removal, spot re-vegetation, and inlet stabilization. For the first six months following construction, the site should be inspected after each storm event greater than 10 mm, or a minimum of twice. A sample construction inspection checklist is provided in Appendix A. Subsequently, inspections should be conducted in the spring of each year.

Two or three growing seasons may be required to establish vegetation to the desired level. During this period, erosion and sediment control practices, such as mats or blankets, should be used to help protect swale structure.

Routine Maintenance and Operation

Routine maintenance activities as shown in Table 3.6.48 are necessary for the continued operation of dry swales.

Table 3.6.48 Suggested Routine Maintenance Activities for Dry Swales

| Activity | Frequency |
|--|---|
| Trash Removal | As needed. |
| Pruning and Weeding | As needed. |
| Mow grass to remove woody material. Maintain minimum grass height of 150 mm. | As needed. |
| Watering | Weekly during first year. Bi-weekly during second year. (Apr – Oct). As needed based on rainfall. |

Annual Inspection and Maintenance

The annual spring cleaning should consist of an inspection and the maintenance tasks described in Table 3.6.49.

Table 3.6.49 Suggested Annual Inspection and Maintenance Activities

| Activity |
|---|
| Add reinforcement planting to maintain desired vegetation density. The construction contract should include a care and replacement warranty to ensure vegetation is properly established and survives during the first growing season following construction. |
| Remove sand that may accumulate on the filter bed surface following snow melt. Replace vegetation that is impacted. |
| Check inflow points for clogging and remove any sediment. |
| Inspect grass filter strips for erosion or gullies. Reseed as necessary. |
| Examine the drainage area for bare soil. These areas should be stabilized immediately. Silt fence or other measures may be needed until the area is reseeded. |

Repair Tasks

The following repairs may be needed as determined by the annual inspection:

- *Surface Cover/Filter Bed:* The surface of the filter bed can become clogged with fine sediment over time. Core aeration or deep tilling of non-vegetated areas may relieve the problem. The surface cover layer (e.g., mulch) will need to be removed and replaced every three years in areas where vegetation has not yet colonized. The inlets and pretreatment measures for the bioretention retrofit also need frequent inspections to ensure they are working properly and to remove deposited sediments.
- *Ponded water:* If water remains for more than 48 hours after a storm, adjustments to the grading may be needed or underdrain repairs may be needed. The surface of the filter bed should also be checked for accumulated sediment.

References

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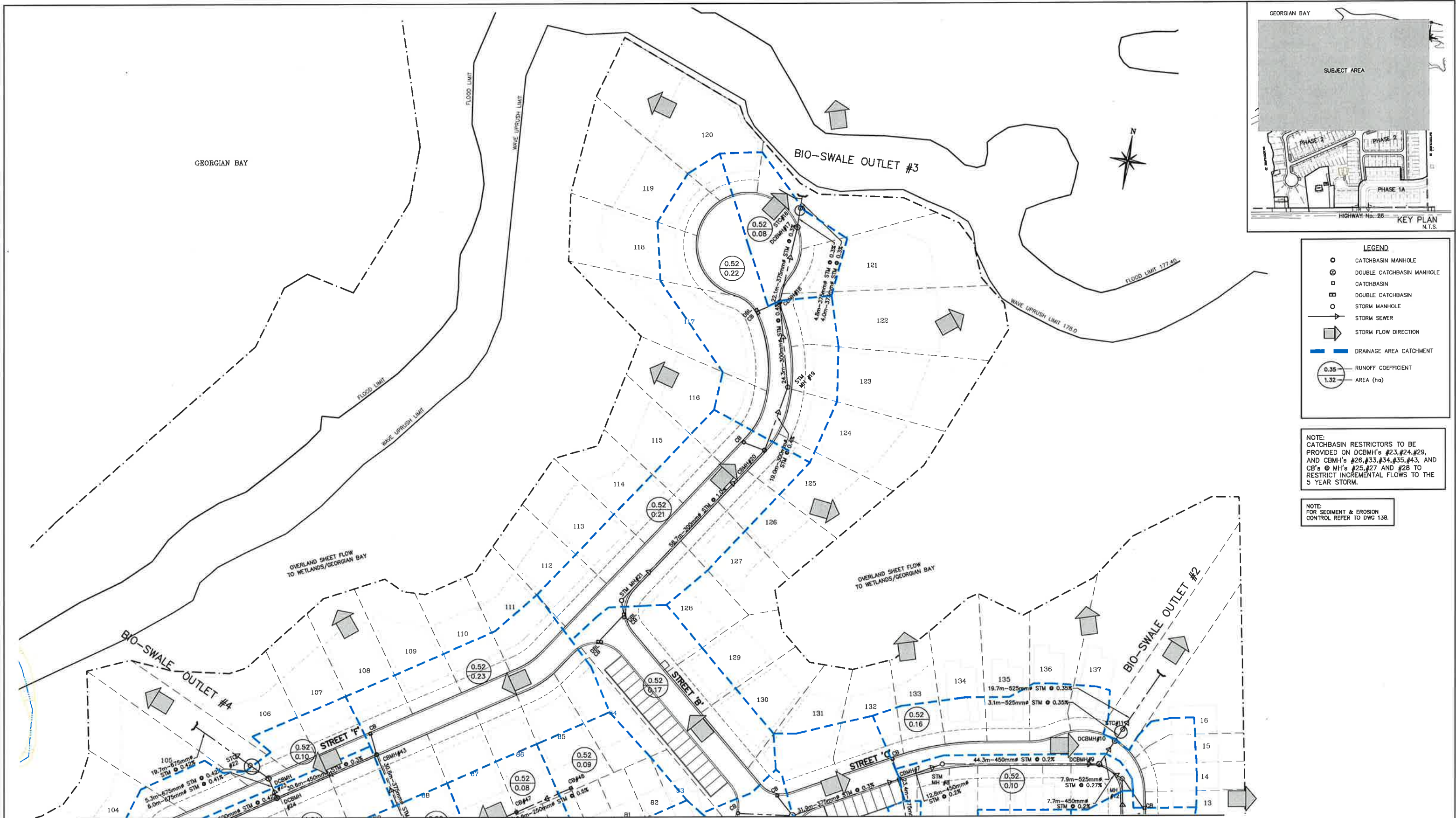
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^{CDN}Ontario Ministry of the Environment (MOE). 2003. Stormwater Management Planning and Design Manual. Ontario, Canada.

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FIGURES

- | | |
|-------------------|---|
| Figure 5: | Storm Drainage Plan - North |
| Figure 11: | Plan & Profile, Grading Details Bio-Swale Outlet #2 |
| Figure 12: | Plan & Profile, Grading Details Bio-Swale Outlet #3 |
| Figure 13: | Plan & Profile, Grading Details Bio-Swale Outlet #4 |



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3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.

4. Do not scale the drawings.

5. All existing underground utilities to be verified in the field by the contractor prior to construction.

GEODETIC BENCHMARKS

BM# 1
IRON PIPE WITH BRASS CAP, NORTH SIDE OF HWY, 0.3km EAST OF PEAKS ROAD, 5.2m WEST OF HYDRO POLE #37.
ELEV. = 181.444m

TEMPORARY BENCHMARKS

BM# 2
N.W. CORNER OF TRANSFORMER #896 PAD ON STREET 'A' IN FRONT ON UNITS 9 AND 10
ELEV. = 181.763m

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Engineer
K. A. MORRIS
LICENSED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

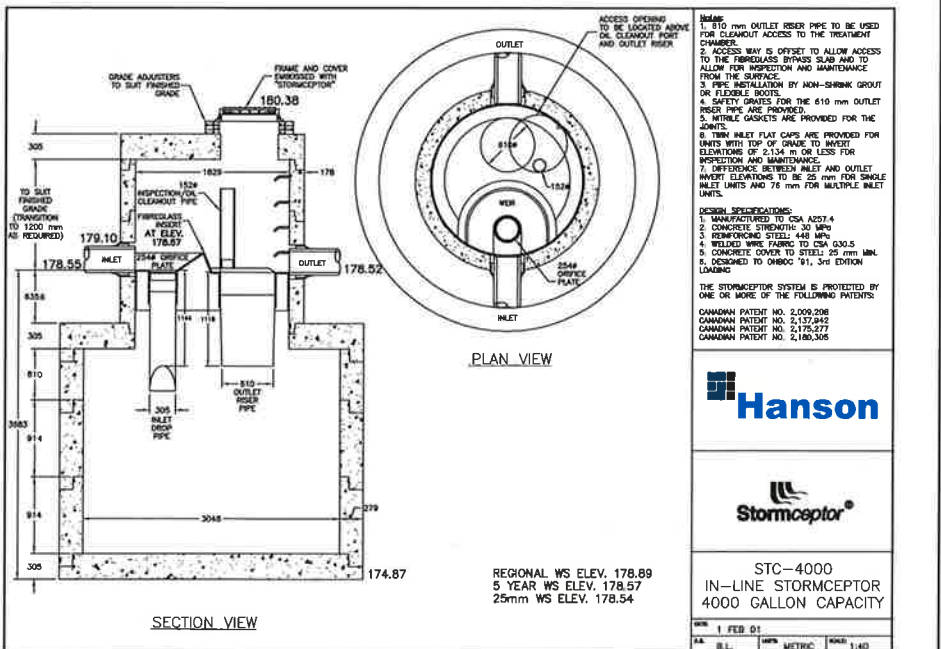
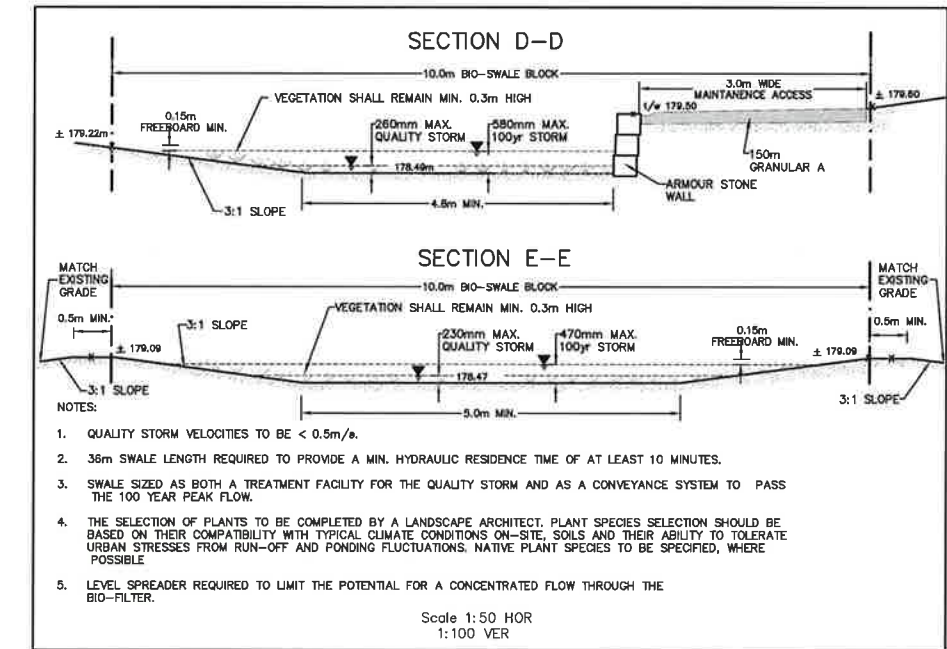
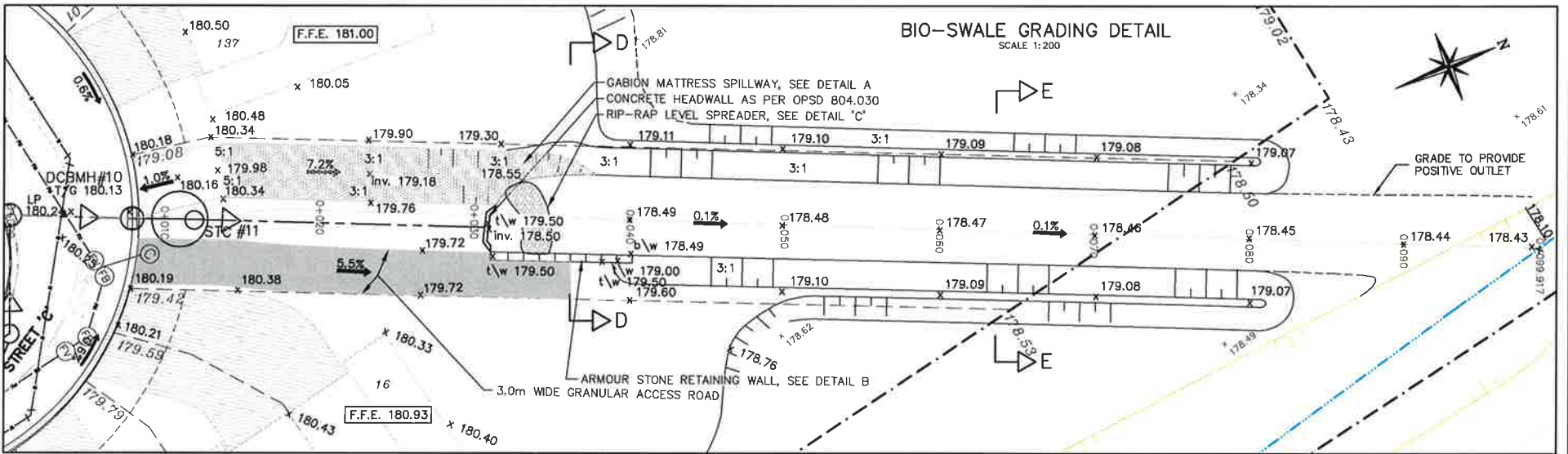
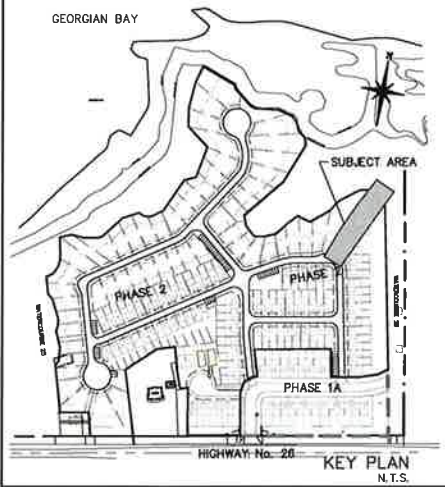
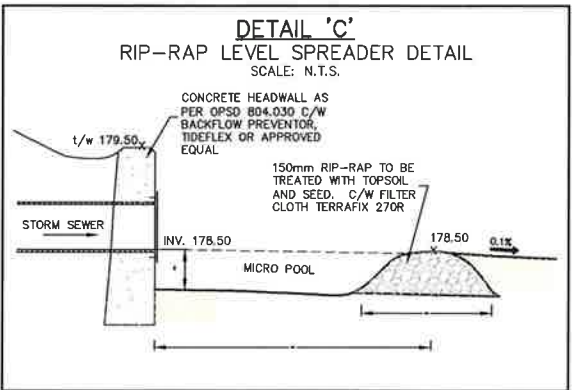
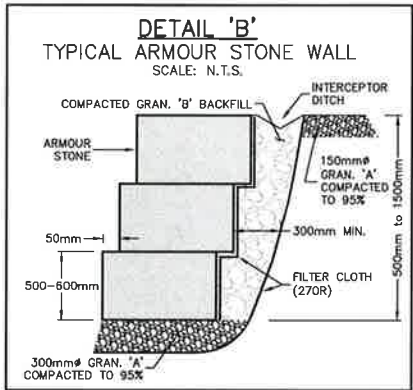
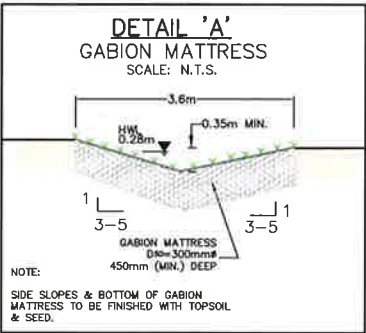
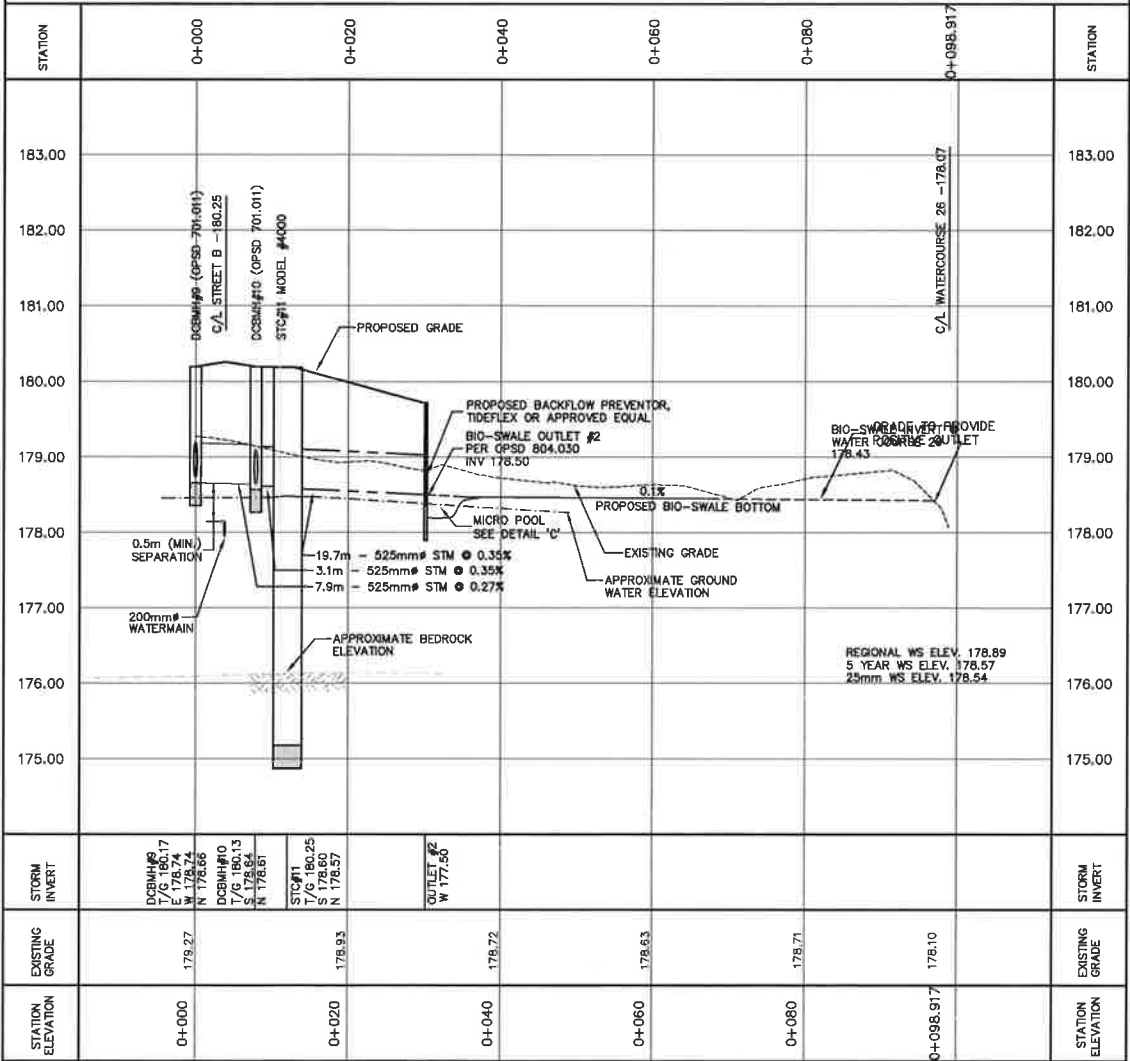
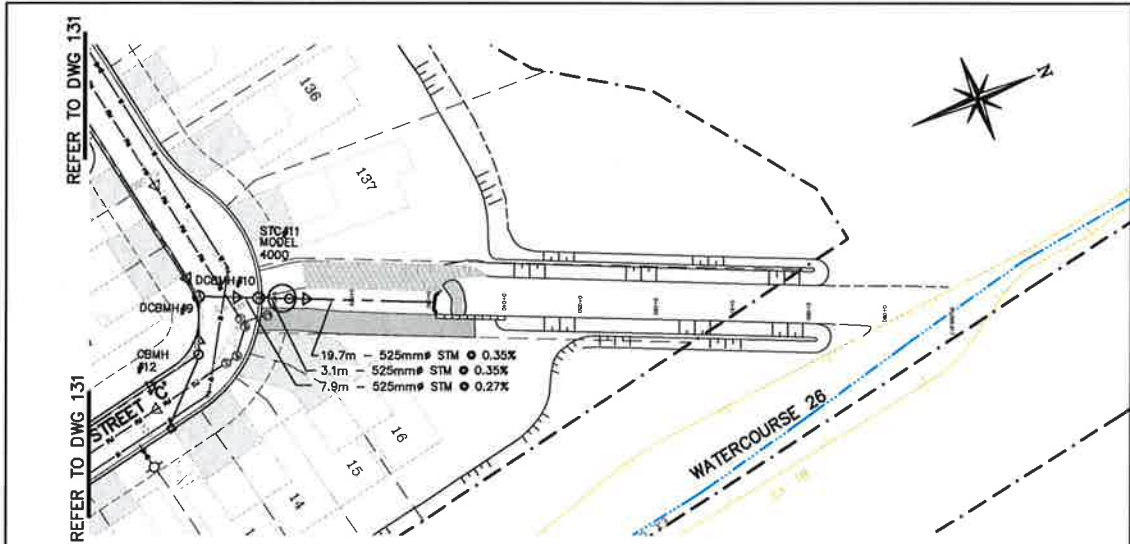
Engineer
Project
NEIGHBOURHOODS OF DELPHI POINT
TOWN OF THE BLUE MOUNTAINS
PHASE 2

Drawing
STORM AREA DRAINAGE PLAN - NORTH

CROZIER & ASSOCIATES
Consulting Engineers

THE HARBOUREDGE BUILDING
40 HURON STREET, SUITE 301,
COLLINGWOOD, ON L9Y 4R3
705-446-3510 F
705-446-3520 T
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By J.O. Check By K.M. Project No. 226-2678
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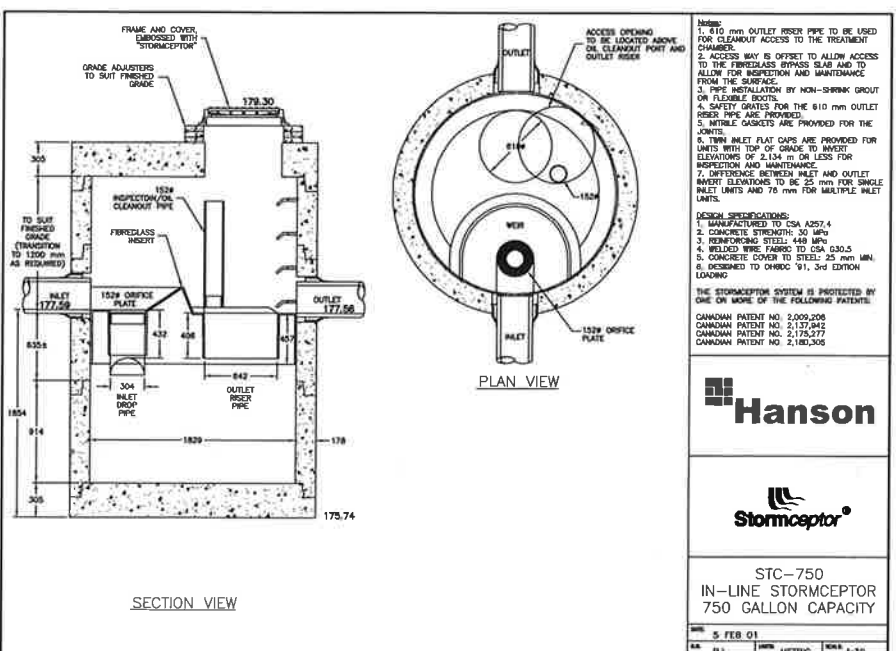
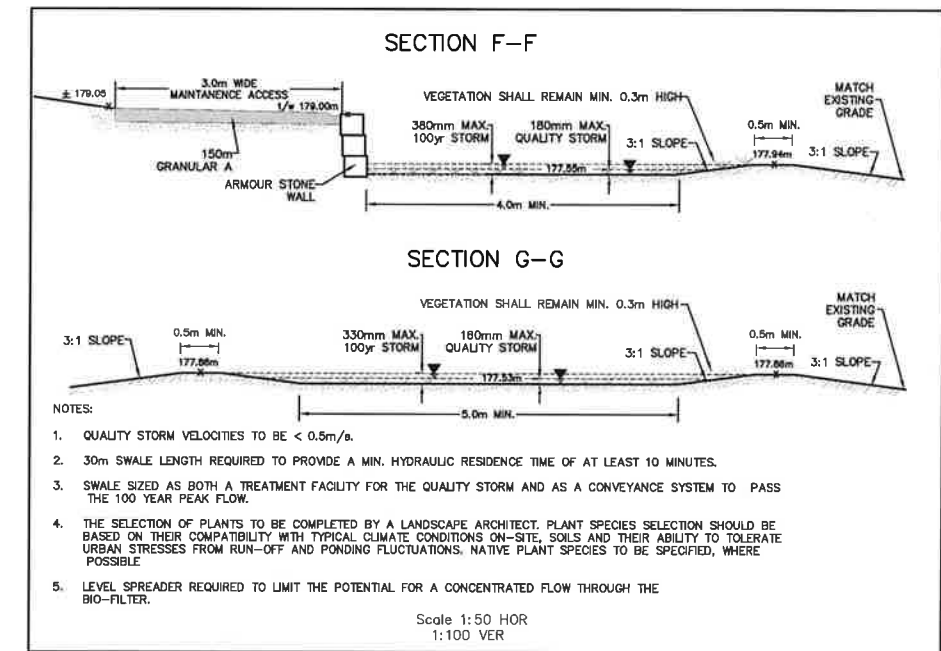
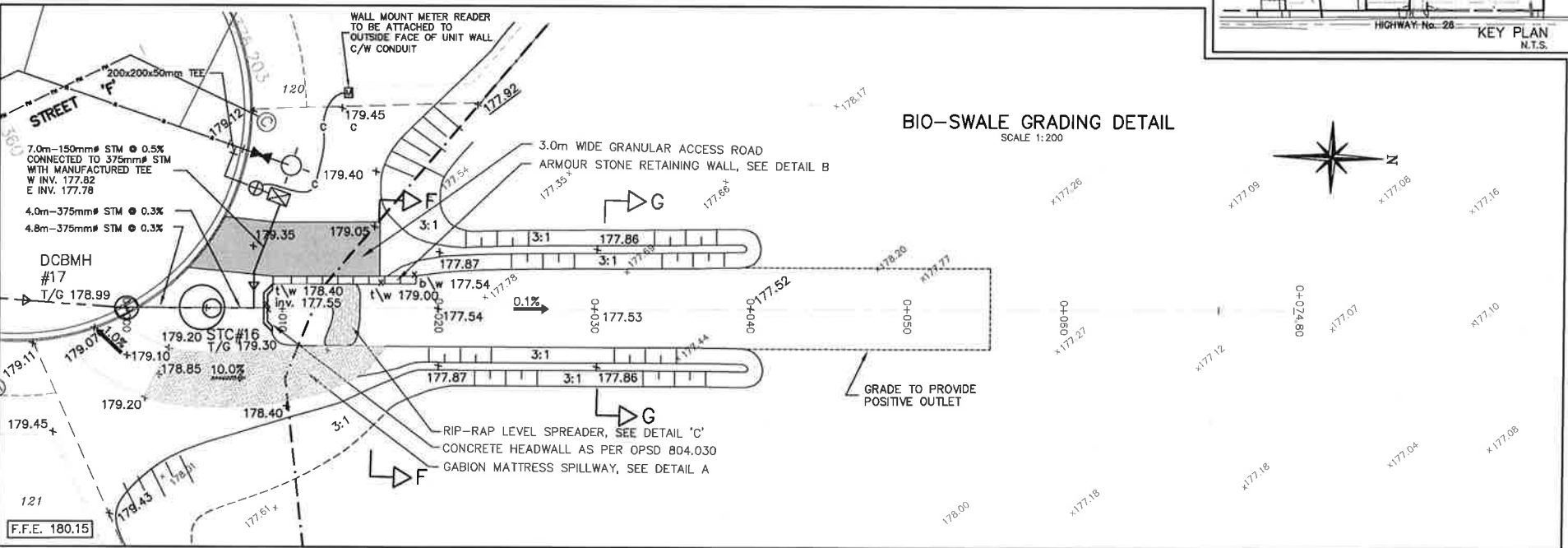
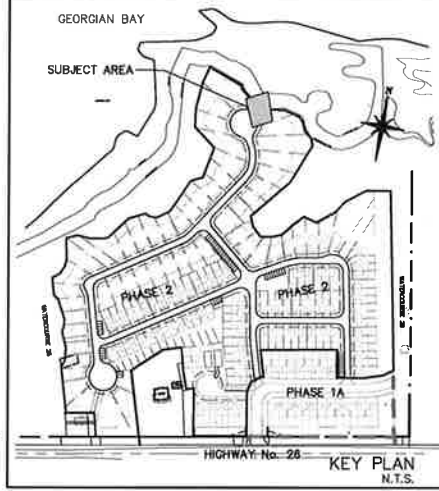
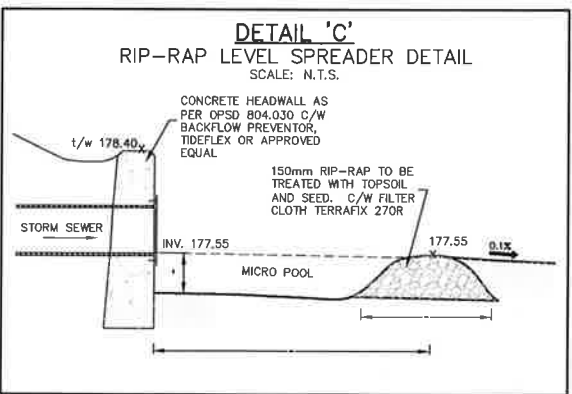
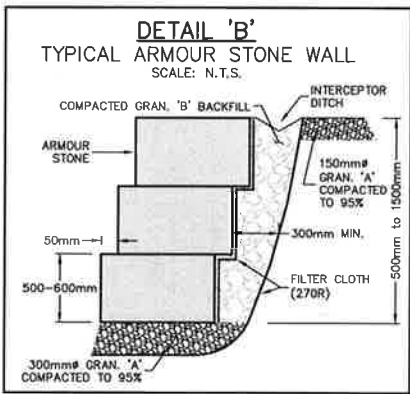
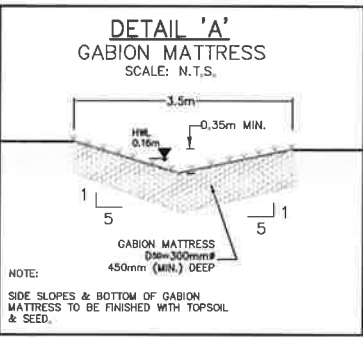
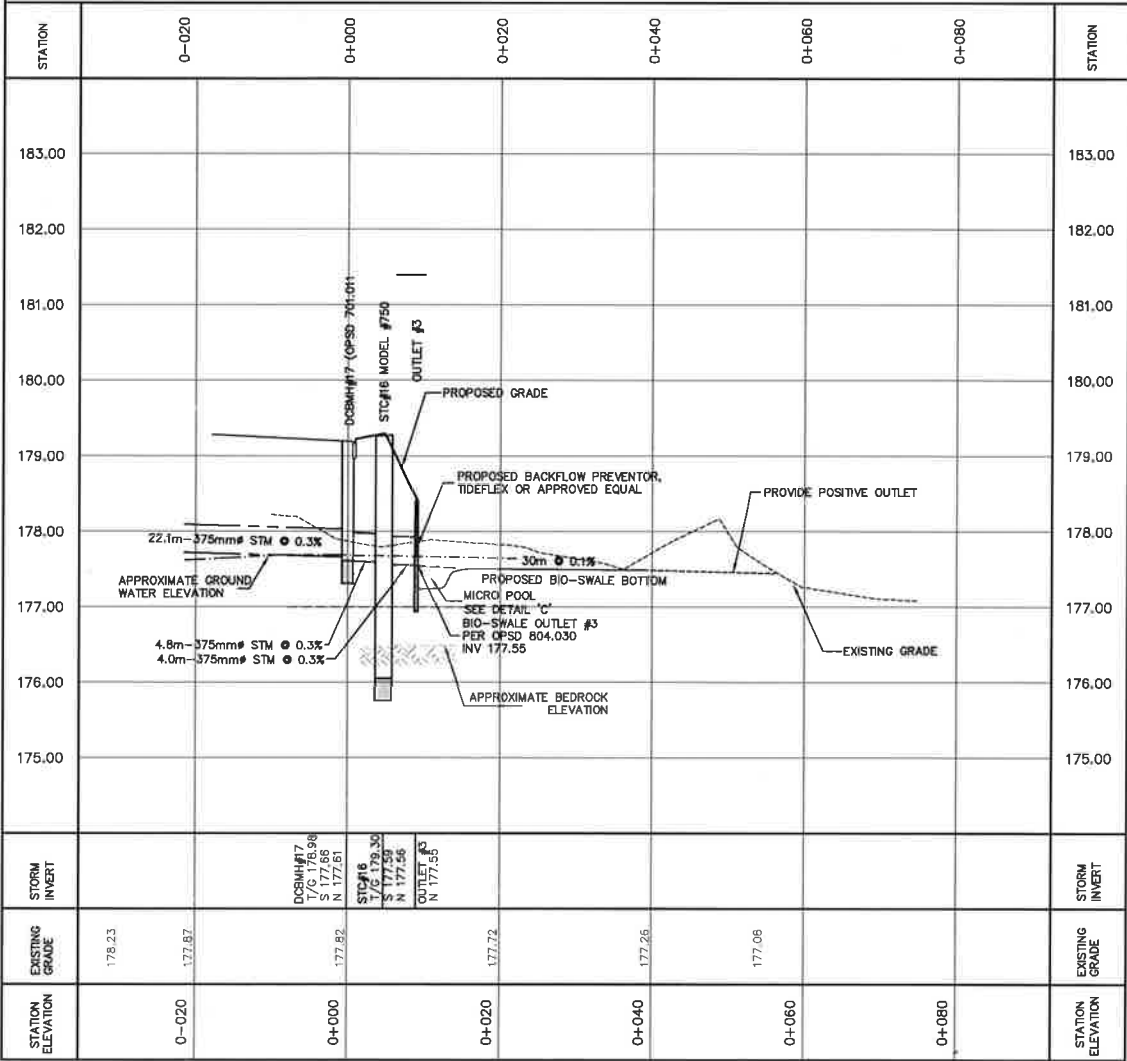
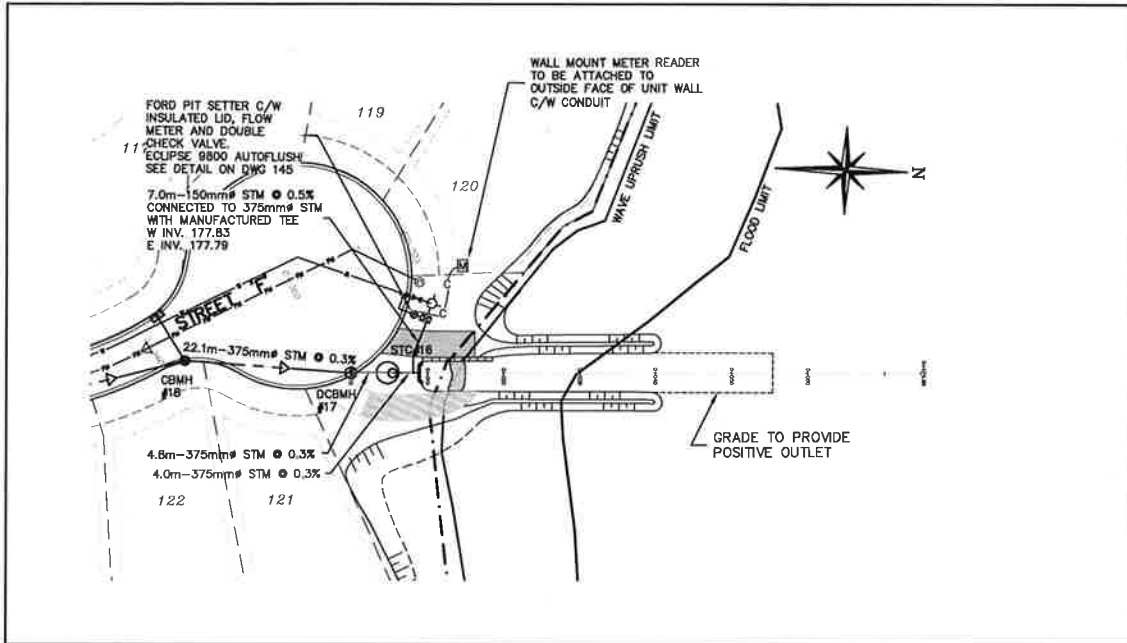
Engineer

Project: NEIGHBOURHOODS OF DELPHI POINT
TOWN OF THE BLUE MOUNTAINS
PHASE 2
Drawing: PLAN & PROFILE, GRADING DETAILS
BIO-SWALE OUTLET #2

CROZIER & ASSOCIATES
Consulting Engineers

The HARBOUREDGE BUILDING
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Scale: 1:500 Date: 07/10/2009 Drawing No: FIG 11



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4. Do not scale the drawings.
5. All existing underground utilities to be verified in the field by the contractor prior to construction.

GEODETIC BENCHMARKS
BM# 1
IRON PIPE WITH BRASS CAP, NORTH SIDE OF HWY, 0.3km EAST OF PEAKS ROAD, 5.2m WEST OF HYDRO POLE #37.
ELEV. = 181.444m
TEMPORARY BENCHMARKS
BM# 2
N.W. CORNER OF TRANSFORMER #896 PAD ON STREET 'A' IN FRONT ON UNITS 9 AND 10
ELEV. = 181.783m

Town

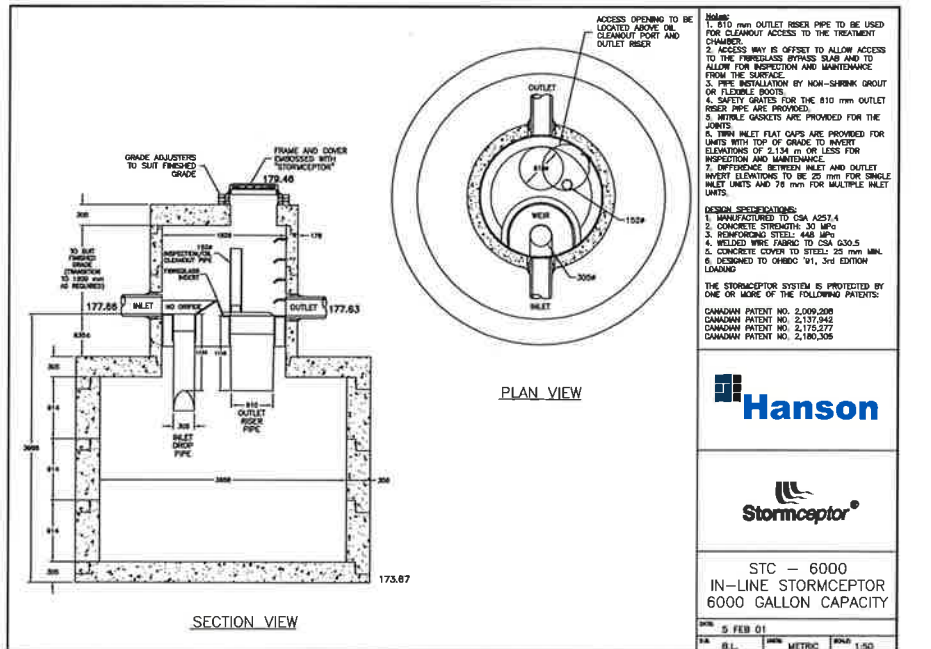
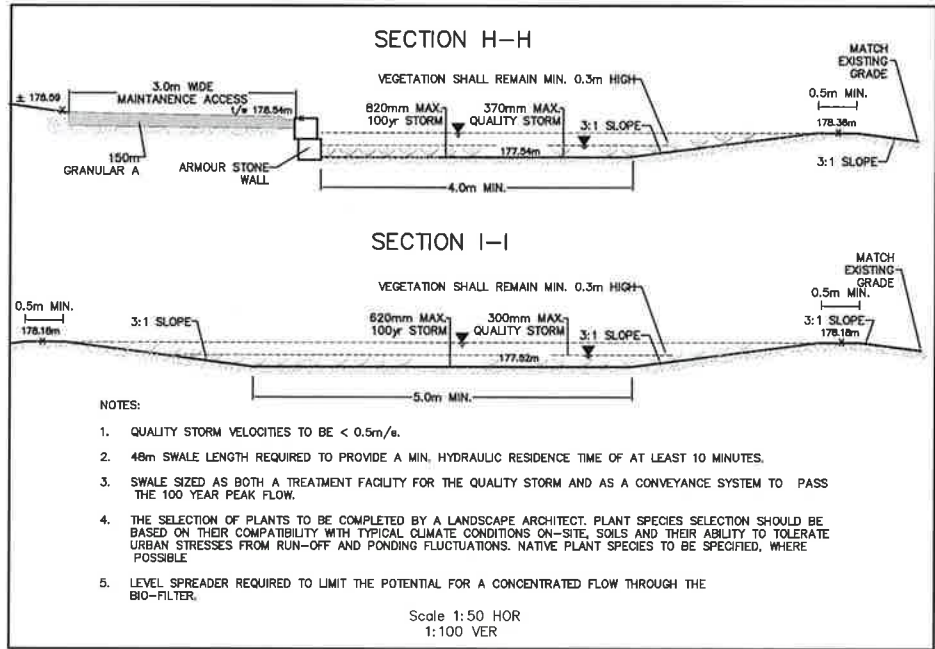
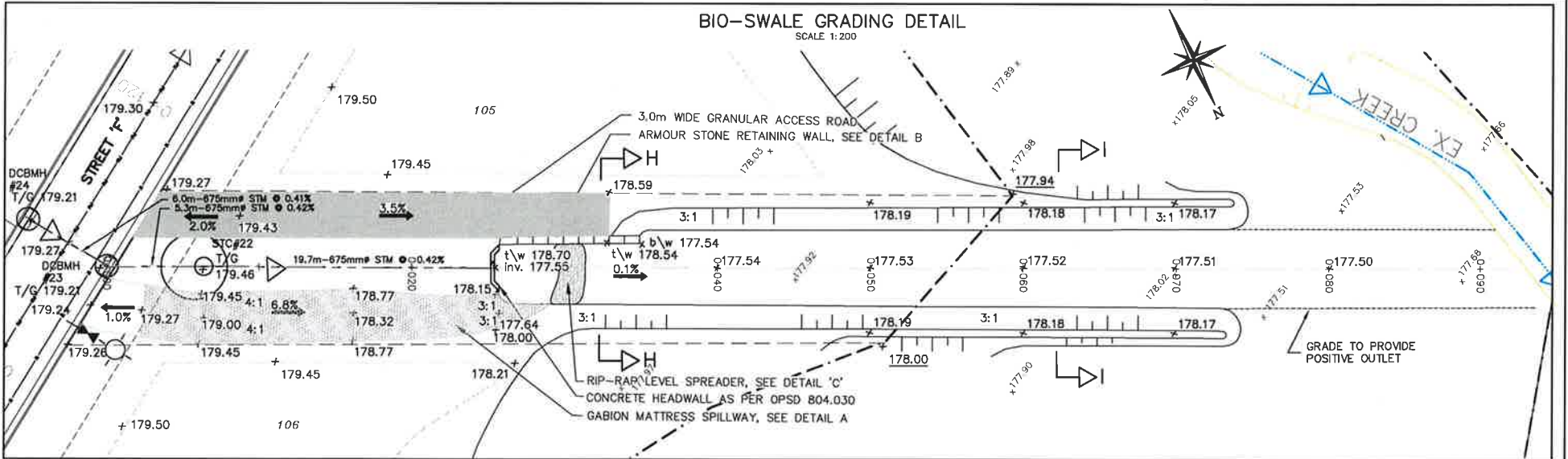
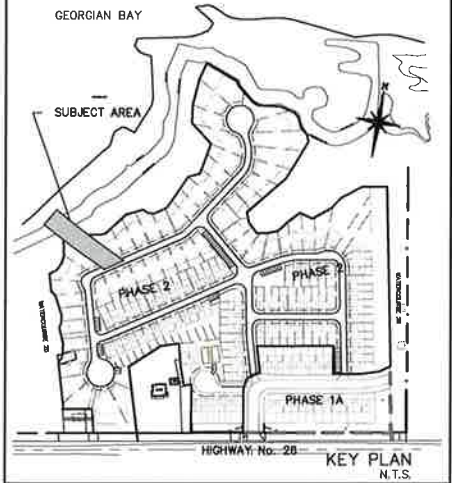
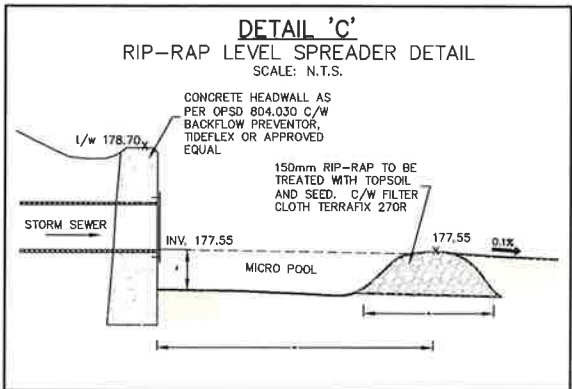
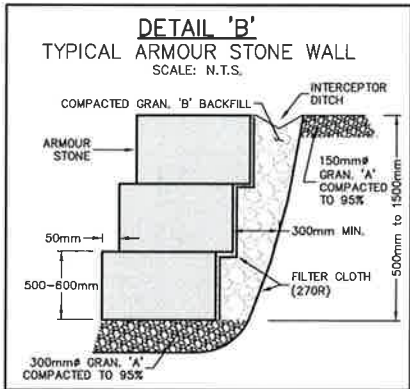
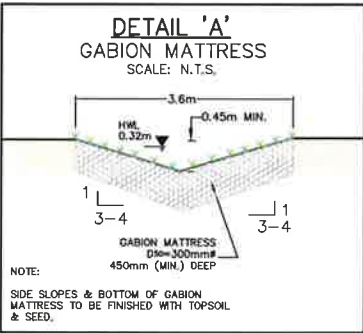
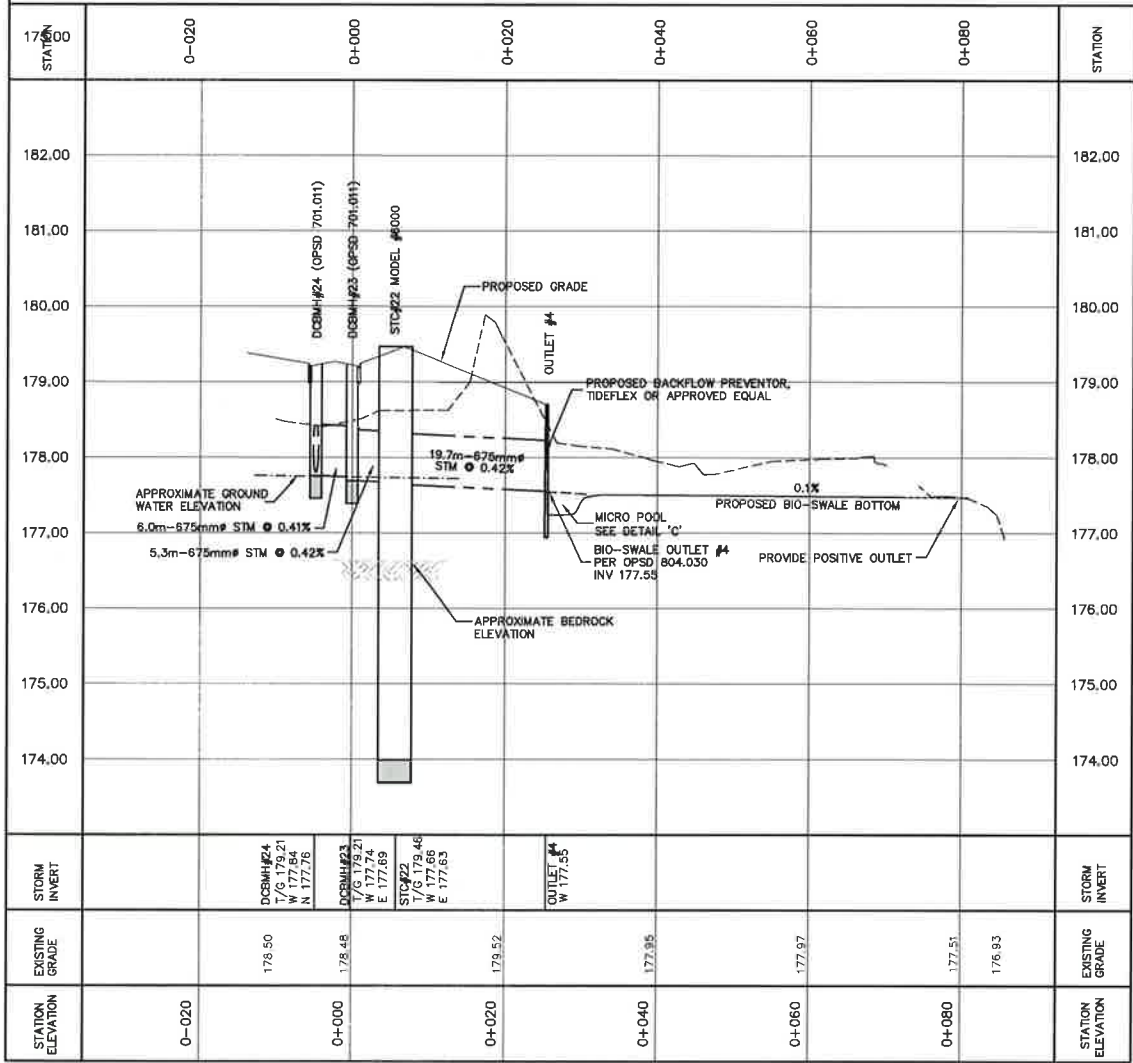
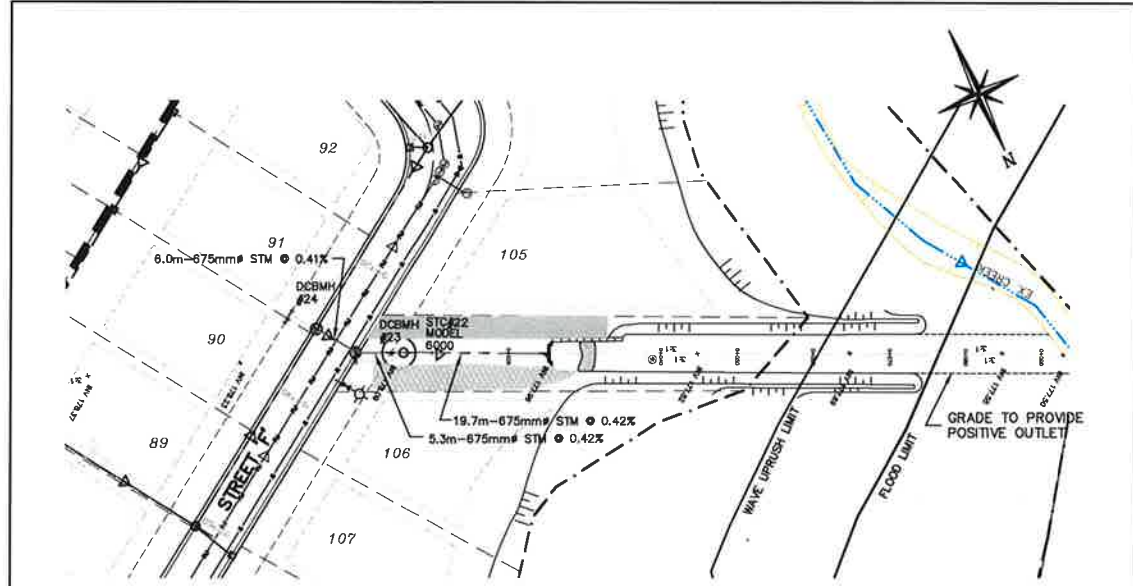
| No. | ISSUE / REVISION | DATE: MM/DD/YYYY |
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| 0 | ISSUED FOR REVIEW | 07/29/2009 |
| 1 | SECOND SUBMISSION | 03/08/2013 |

Engineer
K. A. MORRIS
PROVINCE OF ONTARIO

Engineer

Project
NEIGHBOURHOODS OF DELPHI POINT
TOWN OF THE BLUE MOUNTAINS
PHASE 2
Drawing
PLAN & PROFILE, GRADING DETAILS
BIO-SWALE OUTLET #3

CROZIER & ASSOCIATES
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Scale 1:500 Date 07/10/2009 Drawing No. FIG 12



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4. Do not scale the drawings.

5. All existing underground utilities to be verified in the field by the contractor prior to construction.

GEODETIC BENCHMARKS

BM # 1
IRON PIPE WITH BRASS CAP, NORTH SIDE OF HWY, 0.3km EAST OF PEAKS ROAD, 5.2m WEST OF HYDRO POLE #37. ELEV. = 181.444m

TEMPORARY BENCHMARKS

BM # 2
N.W. CORNER OF TRANSFORMER #898 PAD ON STREET 'A' IN FRONT ON UNITS 9 AND 10. ELEV. = 181.763m

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| 1 | SECOND SUBMISSION | 03/08/2013 |



Engineer

Project: NEIGHBOURHOODS OF DELPHI POINT
TOWN OF THE BLUE MOUNTAINS
PHASE 2

Drawing: PLAN & PROFILE, GRADING DETAILS
BIO-SWALE OUTLET #4



Drawn By: J.O. Check By: K.M. Project No: 226-2678
Scale: 1:500 Date: 07/10/2009 Drawing No: FIG 13

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