F1 Soil Management Plan
for
PROJECT
Heavy Water Management Building (HWMB)
D2O Storage Facility
Purchase Order No: 00217807

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Table of Contents

1.0 General 6
1.1 Purpose 6
1.2 Scope 6
2.0 Background 7
3.0 Regulatory Requirements 8
4.0 Roles and Responsibilities 8
5.0 Managing Excavated Materials 8
5.1 Daylighted Soils 9
5.2 Excavated Soils 9
6.0 Laydown Area F1 10
6.1 Description of F1 10
6.2 Background of F1 10
6.3 Preparation of F1 (F1 Early Works Plan) 11
6.4 F1 Design 12
7.0 Mobilization Plan 13
8.0 Control of Access to F1 14
9.0 Soil Segregation Plan and Volume Tracking 14
10.0 Soil Sampling Protocol 15
11.0 Sump sampling 16
12.0 Yard Drainage points 18
13.0 Groundwater Monitoring at F1 18
14.0 Restoration of F1 19
15.0 Backout Provisions 19
16.0 References 21

APPENDICES

Appendix A Figures
Location of F1
F1 Site Plan
Erosion, Sediment, & Drainage Control Plan
Pad Liner Cross-Section
Appendix B Yard Drainage (Catch basin locations)
Appendix C Transportation Route to Yard Drainage
Appendix D F1 SMP Inspection Forms
Appendix E Groundwater Monitoring

List of Acronyms

B&M	-	Black and McDonald
BBA	-	Barry Bryan Associates (1991) Limited
bgs	-	below ground surface
BH	-	borehole
COG	-	CANDU Owners Group Inc.
CLOCA	-	Central Lake Ontario Conservation Authority
CTP	-	conditional transfer permit
DNGS	-	Darlington Nuclear Generating Station
GG	-	Gross Gamma
GS	-	Gamma Spectroscopy
H3	-	Tritium
HWMB	-	Heavy Water Management Building
IWST	-	Injection Water Storage Tanks
LPSW	-	Low Pressure Service Water Line
MOE	-	Ontario Ministry of Environment
MW##	-	monitoring well
NORM	-	normally occurring radioactive material
OPG	-	Ontario Power Generation
PA	-	protected area
PCBs	-	polychlorinated biphenyls
PGL	-	Pottinger Gaherty Environmental Consultants Ltd.
PHC	-	petroleum hydrocarbons
sVOC	-	semi-volatile organic compounds
TCLP	-	Toxicity Characteristic Leaching Procedure
VOC	-	volatile organic compounds

1.0 GENERAL

The scope of this plan is to provide a means for Black and McDonald (B&M) to inform all interested parties of B&M's intended methods and means for handling the excavated soil for the new Heavy Water Management Building (HWMB) and associated shallow excavations for relocation of utility services, transportation of excavated soil from the Protected Area to Campus Plan F1 (F1) laydown area, and soil management. This plan does not address the decision for the final soil destination (i.e., F3 location or offsite). The decision for the final soil destination will need to be endorsed by the Director Refurbishment Operations and Maintenance, SVP Darlington, VP Nuclear Services and VP Environment.

As part of the Darlington Refurbishment and Continued Operations Project, large volumes of soil (including bedrock) will be excavated at the Darlington Nuclear Generating Station (DNGS) site to accommodate new infrastructure within the Protected Area (PA), including the HWMB, Low Pressure Service Water line (LPSW) relocation as well as other shallow excavations for relocation of services.

Large volumes of soil from within the PA will be removed as a result of these excavations and there is insufficient laydown area within the PA to stage these materials. Therefore, the excavated soil will be transported and staged on a geotextile pad to be constructed at F1. This pad is required to be in-service application for up to 10 years. The design of the pad is described in Section 6.

1.1 Purpose

The purpose/objective of the Soil Management Plan is to:

a. Ensure compliance with environmental legislation, regulations and conditions of approval;
b. Ensure proper records are maintained to meet regulatory environmental requirements; and
c. Ensure that all personnel involved with the F1 area are aware of the scope of work and the requirements for soil transportation and soil management.

1.2 Scope

This plan deals with the following excavated materials from the HWMB and various shallow excavations within the PA:

a. Daylighting soil using a vacuum truck (top three (3) metres);
b. Spoils from caisson drilling; from surface to 16m below ground surface (bgs), installing caissons along the outer perimeter of the HWMB foot print;
c. Excavation of soils within the HWMB foot print, inside the enclosed caisson area from surface to 3m bgs;
d. Bulk excavation; soil from 3m to a depth of 13m bgs within the HWMB foot print, inside the enclosed caisson area; and
e. Bulk excavation; bedrock from 13m to a depth of 16m bgs within the HWMB foot print, inside the enclosed caisson area.

This plan is to be used in conjunction with "Contractor Environmental Management Plan" (Ref. 16.4).

2.0 BACKGROUND

B&M contracted Kinectrics Inc./Pottinger Gaherty Environmental Consultants Ltd (PGL) to evaluate environmental soil quality within the HWMB footprint in spring 2013.

The Borehole Drilling Investigation (NK38-REF-38000-0483285) consisted of the installation of six new boreholes to determine options for soil generated by HWMB excavation. PGL logged and sampled the soils. Groundwater samples were collected from six existing monitoring wells and one sump. As a part of the work, PGL also reviewed historical reports pertaining to the Injection Water Storage Tanks (IWST) spill in 2009.

The IWST water was primarily demineralized water containing 44,807,000Bq/L of tritium and 58.8mg/kg of hydrazine. Historically, 29 boreholes and 28 wells were used to investigate spill effects. The investigation identified tritium impacts near the HWMB. Two samples both from MW148 had tritium levels over 0.02µCi/kg (0.041µCi/kg and 0.074µCi/kg at 3.6m and 9.7m, respectively). The investigation also identified petroleum hydrocarbons (PHC) and limited volatile organic compounds (VOC) impacts. The soil and groundwater quality were evaluated against Ontario Regulation 153/04 Table 3 industrial/commercial/community standards for coarse-textured soil in a non-potable groundwater condition (Ministry of Environment [MOE] Table 3). Soil and bedrock samples from two locations were submitted for Toxicity Characteristic Leaching Procedure (TCLP) waste characterization to assist with soil management. The TCLP results were compared to Schedule 4 of the General Waste Management Regulation (Ontario Regulation 347). None of the soil and bedrock samples were leachate toxic (i.e., soil and bedrock are non-hazardous).

The results of the work completed by PGL were consistent with IWST findings. The general soil quality within the proposed excavation is good. Tritium in soil was below the 0.02µCi/Kg limit in all samples tested. Testing for conventional parameters indicated that additional testing will not be required for landfilling.

However, there are MOE Table 1 and MOE Table 3 soil exceedences. If the soil is to be reused at DNGS or offsite, then additional testing of the material should be conducted according to Ontario Regulation 153/04.

Two soil samples from the IWST work (conducted in 2009) had elevated tritium levels. Therefore, PGL recommended that their investigation report and results be provided to OPG Health Physics to assess if additional radiological sampling was required for the release of the material. Additional asphalt samples and soil samples were collected as a part of the project to facilitate offsite shipment of soil. This report (NK38-REF-38000-0483285) was previously provided and is available on request.

3.0 REGULATORY REQUIREMENTS

The following regulatory requirements need to be met to use the area at F1:

a. Soil sampling and management procedure will follow Ontario Regulation 153/04 soil sampling requirements;
b. OPG's standard for F1 is the MOE Table 3 Industrial Commercial Community standards for a coarse-textured soil in a non-potable groundwater condition;
c. The F1 area is within a wetland area regulated by Central Lake Ontario Conservation Authority (CLOCA); therefore, a Large Fill permit was prepared and submitted to CLOCA for approval. The Permit expires on September 23, 2015, and will be reapplied for, as required by the Project;
d. Soil transportation and soil movement at the F1 laydown area has been designed such that it will not interrupt bird migratory season and will not interfere with endangered species habitat;
e. All federal, provincial and municipal regulations will be followed, including conditions stipulated by the CLOCA Large Fill permit; and
f. Completion of OWRA – Minor Modification Notice (N-FORM-10559) within 30 days of discharging F1 sump water to OPG yard drainage/forebay.

4.0 ROLES AND RESPONSIBILITIES

B&M (with their subcontractors, PGL and EllisDon) will work in coordination with OPG to ensure compliance of this Plan. The list below identifies personnel involved in the Plan and their roles and responsibilities.

a. Project Manager (PM) – responsible for the overall F1 Soil Management Plan, ensuring that it is prepared, approved and followed. (Bruce Smith 416-791-1898).
b. Construction Manager (CM) – responsible for the implementation of the F1 Soil Management Plan on the project. (Kurt McDonald 416-677-7273).
c. Environmental sampling, analysis, and monitoring (ES) – Responsible for all environmental sampling, analysis, and monitoring activities at F1. (Salima Jaffer/Brandon Partridge 905-668-4908)
d. All onsite personnel – all personnel are responsible for identifying and reporting any adverse conditions or issues that could affect soil management.

5.0 MANAGING EXCAVATED MATERIALS

This section describes how excavated materials are removed from the PA and additional requirements, if any, prior to being transported to F1. Details pertaining to Campus Plan C13 are not duplicated herein. Information on the specifics of C13 are detailed in the Soil Management Plan for C13 Area (Ref. 16.9).

5.1 Daylighted Soils

Soil will be removed by vacuum truck from various small excavations within the PA and taken to area C13 pad. The soil will be dewatered and tested for radiological parameters. PGL will provide the analytical results to Radiation Protection for evaluation. When Radiation Protection provides a decision regarding the pathway, the tested soil may be shipped offsite to a landfill site or to soil staging areas F1/F3 (as available) at Darlington Nuclear outside the PA.

5.2 Excavated Soils

Excavation work will be conducted using various types of heavy equipment.

Trucks will be used to transport excavated soil material from the PA to Area F1 outside the PA. The trucks will be loaded with soil from the HWMB excavation while the truck is stationed on the asphalt of the roadway. Once truck has been loaded, a laborer will walk around the truck and inspect the immediate area for debris. The laborer will sweep the dry debris away from the truck and the truck tires will be swept using a stiff bristle broom/brush.

The truck tires will be inspected by PGL prior to the truck leaving the PA and confirmation will be communicated to the driver that the truck is clean and can proceed to F1. A specific route will be followed and inspected on a daily basis. Refer to the Traffic and Logistics Plan (TLP Ref. 16.8).

Two types of trucks may be used to transport soil from the PA to Area F1: Tri-axel (dump trucks) and/or Rock trucks with a low “belly” to contain soil/water.

a. For the installation of the caissons, a drill rig will auger down to bedrock while inserting a steel liner. The soil pulled up by the auger is the caisson spoils.
    i. The caisson spoils will be removed from augers within the HWMB foot print.
    ii. The spoils will be allowed to dewater for a period of time but will not remain within the HWMB footprint. Any water generated from saturated spoils will be contained on the HWMB foot print and will be directed/stopped using soil berms or straw bales from migrating from the HWMB footprint.
    iii. If soil is saturated and needs to be removed from the footprint, then rock trucks will be used exclusively.
    iv. The caisson spoils will be loaded using an excavator or loader onto trucks and transferred to F1.
    v. The caisson spoils will be off loaded onto the F1 geotextile pad in a cell designated for caisson spoils.
b. The bulk excavation will be completed as described in the following steps. The top one (1) metre of material that the spoils were allowed to drain on will be excavated and placed in the same cell as the caisson spoils. The next two (2) metres will be loaded and transferred to F1 and unloaded on the geotextile pad in a cell designated for this material.
c. Below the three (3) metre markdown to bedrock the soil will be excavated into trucks at grade. This material will likely be damp and will be placed in the same cell as the caisson spoils.

d. Using a jack hammer attachment to the excavator the bedrock will be broken up, loaded into trucks and transferred to F1 and unloaded on the geotextile pad in a cell designated for this material.

The F1 pad will be constructed with two separate cells to hold at least 25,000m^3 of soil/bedrock. The estimated volume of material type being generated during excavation work is listed below in Table A with the storage cell number identified.

Table A: Estimated Volumes of Material Generated During Excavation Works

Cell	Origin of soil	Estimated Volume
Cell 1	Grade to 3m below grade (shallow excavations within PA) 1 to 3m below grade (HWMB) estimated amount	7,000m^3
Cell 1	Bedrock (HWMB excavation)	2,300m^3
Cell 2	Caisson Spoils (full depth of HWMB excavation)	2,254m^3
Cell 2	3m below grade to Bedrock (HWMB excavation)	12,650m^3
	Total	**24,204m^3**

***Due to construction delays at F1, soil generated during the caisson work of the HWMB construction project will be staged in Cell 1. The caisson spoils will be positioned towards the north end of Cell 1 to segregate it from shallow soil from C13. When Cell 2 is complete, soil from the caisson work will be moved to Cell 2.*

6.0 LAYDOWN AREA F1

6.1 Description of F1

Area F1 is shown on the Campus Plan Appendix A. The site is covered with vegetation and mixed gravel fill. An existing concrete pad, approximately 72m x 23m, is on the northwest side of F1. On the east side is an existing building that is not being used. East of the F1 pad is an area designated F1a which is approximately 90m x 30m. Once the excavated material has been dewatered, sampled, tested and declared suitable for transfer under a UTP; it will be shipped offsite for landfilling or spread out on area F1a or area F3 (another soil staging area at OPG DN) as available.

6.2 Background of F1

In preparation for the design of the F1 soil staging pad, B&M requested PGL to prepare a design scope document as well as assess existing soil quality (environmental and geotechnical) conditions at the proposed F1 area.

A design document "F1 Soil Staging Pad Scope Document" was prepared and accepted by OPG on August 9, 2013. The functional design requirements included allowing end-users to use the geotextile pad facility for soil storage over a 10-year period. PGL contracted Barry Bryan Associates (1991) Limited (BBA) to design the F1 Pad. The following general design elements were required:

a. The designed pad shall abutt the existing concrete pad to the north;
b. Four chambers to hold soil/bedrock;
c. Berms to separate the chambers to delineate the area;
d. Sump and holding tank need to be included for each of the chambers; and
e. The pad shall follow the natural grade of the Site to the south be graded.

PGL reviewed historical environmental documents provided by OPG and then conducted a limited test-pit investigation program at the proposed F1 area to characterize background soil quality (environmental and geotechnical). PGL completed the environmental evaluation and contracted Soil Engineers Ltd. to complete a geotechnical evaluation of the proposed F1 pad area.

Nine test pits were conducted within the footprint of the F1 pad south of the existing concrete pad. Soil samples were tested for conventional (environmental and geotechnical) and radiological parameters. PGL prepared and submitted a report for the environmental findings; all tritium limits of samples collected were below the method detection limit of 15bq/kg (Ref. 16.10). This document was previously provided and is not included herein.

Soil Engineers Ltd. provided a report of their findings; their report indicated that 0.6m of material would need to be removed and engineered material supplied to support the volume of soil/bedrock on the pad (Ref. 16.11).

6.3 Preparation of F1 (F1 Early Works Plan)

To support the initial construction activities for F1, B&M requested PGL to prepare an F1 Early Works Plan. This plan included the evaluation of the items listed below.

- **Sediment Control:** a silt fence will be erected around the full Disturbance Limit (as shown Appendix A – Erosion, Sediment, & Drainage Control Plan). The silt fence will be inspected on a weekly basis and within 12 hours of a rainfall event. Additionally, there will be berms erected around the soil staging area to prevent sediment from leaving the staging area. There are no water courses in close proximity to the F1 Area so further measures are not warranted.
- **Drainage Control:** the site will be graded per the Engineer's requirements (BBA) and the facility will be constructed on the west half of F1. The Pad will be approximately 100m x 80m. Additional drainage swales with straw-bale check dams will be installed to route water around the pad (see Appendix A – Figures).
- **Soil Removal:** soil with low engineering value will be removed (about 10,000m^3) and placed east of the onsite building (F1a). This soil was tested *in situ* during the F1 Preparation works. PGL confirmed that the soil meets MOE Table 3 coarse-grain standards for the tested parameters of concern. This soil will be placed on a geotextile fabric, staked in place to mark the existing ground elevation (to assist during site restoration works). A copy of this report has been provided and is not included in this document.
- **Dust Control:** all trucks will have a bed cover that will be closed once the truck is filled. It is anticipated that once the soil is placed at F1a it will remain there until such time the area is required to be developed for additional plant operations. The soil will be placed using heavy equipment (i.e., rock trucks, dozers) in flattened mounds and hydro-seeded. Side slopes will be maintained at 3H:1V.

- **Public Access:** all driveway entrances to F1 will be fitted with a chain and signage to prevent public access to the area. As part of the site fence perimeter, a locked gate already exists at the Maple Grove Road extension, north east of the F1 area. The construction silt fence will also demark the construction area.

6.4 F1 Design

The four-cell pad design described in Section 6.2 was revised by the Project Team (BBA, PGL, EllisDon and B&M) based on discussions, evaluations, and existing site conditions. All design changes have been presented and approved by OPG prior to implementation.

To maintain separation between the excavated soil/bedrock and the native soil an impermeable geo-membrane pad will be built on Area F1 with two distinct cells with berms (or similar) separating the cells to avoid cross contamination of materials. See Appendix A – Figures (Site Plan).

F1 pad will include two cells, as described in Section 1, to hold caisson spoils, soil from the top 3m (10ft) of the excavation and shallow daylighting activities, soil from 3m below grade to the top of bedrock and bedrock material.

A general overview of the F1 Early work activities are provided below:

1) Clean up surficial material (Black Beauty) at F1 identified;
2) Install a silt fence around F1 area;
3) Install bollards with chains to limit site access at all three driveway entrances to F1 area;
4) Excavate the top 0.6m of soil within the F1 pad footprint. This material will be stockpiled east of the existing building;
5) Stockpile excavated soil from Item 4 on a geotextile fabric. The soil will be mounded with side slopes of 3:1 (H:V) and hydro-seeded; and
6) Remove vegetation from existing drainage swale on the south side of F1 area if required.

BBA and B&M are evaluating/approving materials (geotextile liner, sump, concrete additive, piping, valves, etc.) to be used to construct the pad to support the 10-year application.

Once the early works are completed the F1 area will be graded (see Appendix A – Liner Cross-Section). This will be covered with a 16oz, non-woven geotextile; a double layer of Enviro Liner 4040 will be installed, followed by another layer of 16oz, non-woven geotextile topped with six inches of sand and a final layer of woven geotextile.

To protect the liner, a 4-inch Geoweb (Geo Cell) will be in placed on top of the liner, filled with Granular B and compacted. This Geoweb is rated for 40,000lbs and will protect the liner from possible damage from equipment. In order to secure the Enviro Liner, the liner has to be anchored to the block walls/berms.

Sediment runoff will be prevented by using a geotextile filter to prevent any sediment from flowing out of F1. Three underground sumps will be installed, one for Cell 1 and two for Cell 2. Any remaining moisture in the soil will infiltrate to the liner and be directed to the sumps. Sumps will be inspected and emptied as identified in Section 11.

The cells will be covered by a manual tarping system. The tarps are multi-layered material and will be provided in roughly 100ft by 30ft sections. The sections will be positioned using an excavator (similar) and manually joined together in the field using woven straps. Tarps will be placed on the soil pile as the cell is filled, typically starting from the concrete-block wall out. The tarps will limit the amount of rainwater that F1 cells accumulate and minimize the volume of rain water that enters the F1 sump system.

7.0 MOBILIZATION PLAN

a. Caisson spoils and bulk excavation soil will be loaded into trucks as identified in Section 5.2. The trucks will leave the PA following a pre-planned route as shown in the TLP (Ref. 16.8). The specific route will be followed and inspected by B&M (or their subcontractor) on a daily basis.

b. As required, street sweeper vehicles (or similar) will be deployed to clean the pre-planned route between the PA and F1. The sweeper deployed should sweep and vacuum up the debris. Debris collected will be discharged at the F1 pad.

c. Trucks leaving the PA will have the tires cleaned to remove debris off the truck and tires. A laborer will walk around the truck and inspect the immediate area for debris. The laborer will sweep the dry debris away from the truck and the truck tires will be cleaned using a stiff bristle broom/brush. The truck tires will be inspected by PGL prior to the truck leaving the PA and confirmation will be communicated to the driver that the truck is clean and can proceed to F1.

d. B&M (or their subcontractor) will provide the personnel to inspect and clean the trucks at the HWMB excavation site. The trucks will be inspected for (hydraulic/seal) leaks prior to leaving the PA by the truck operator. If a leak is discovered the truck will unload excavated soil back on to the HWMB excavation area. The truck will be cleaned/washed and sent for repair.

e. The trucks will be monitored by the Exploranium when exiting the PA.

f. The trucks will deposit the soil from the HWMB footprint onto the F1 laydown area in the entrance of the appropriate cell. To minimize tracking of soil via the truck tires; trucks should remain on the concrete apron at F1.

g. Trucks leaving F1 will cross a rip-rap section of road which will shake debris off the truck and tires. Drivers will stop the truck near the F1 gate and will inspect the truck/tires and remove any additional debris using a stiff-bristle broom prior to exiting the site. The trucks will travel back to the PA on the assigned route (Ref. 16.8).

h. Trucks will stop before leaving F1 area to allow PGL personnel time to inspect truck tires before leaving F1. PGL personnel will provide go/no-go to the driver after visual inspection. If it is a no-go, the driver will have to clean the tires again.

i. To leave the Site at the end of the day (i.e., travel on public roads); Tires and truck box will be inspected by PGL personnel and driver will brush truck tires before allowing the trucks to leave OPG property.

j. For traffic management and vehicle-noise management, see TLP (Ref 16.8).

8.0 CONTROL OF ACCESS TO F1

Access to F1 area will be controlled. Only soil generated from construction projects within the Darlington PA with potential radiological impacts (e.g., the D20 Storage Project) will be accepted.

a. All three access points at F1 will be secured with gates/chains and locks. A silt fence will enclose rest of the area.

b. A placard will be installed on the gate identifying F1 site contact names.

c. EllisDon will issue placard/magnetic stickers to authorized truck operators for offloading soil during the D20 project works.

d. PGL will record truck number and license plate (Truck tracking form – see Appendix D) and provide direction for offloading soil to the correct cell based on excavated materials.

9.0 SOIL SEGREGATION PLAN AND VOLUME TRACKING

Excavated soil from in the OPG's D20 Project will be placed in Cell 1 or Cell 2 at Area F1 based on *in situ* soil analytical data (i.e., where and from what depth below grade the soil originated from LPSW and HWMB excavations). Excavated material is described in Section 1, Table A.

Soil will be transported to F1 in a dump truck or similar. The soil will be unloaded at the entrance to the cell and moved into the cell with a second piece of earth moving equipment. This method will minimize trucks tracking mud across the site.

Soil will be placed in either Cell 1 or 2. To facilitate manual tarping of the cells, soil will be placed adjacent to the cell walls to provide support to the tarp to be deployed. Moving the soil from the entrance area to where it is to remain while the cell is being filled will provide aeration.

While the cells are being filled, tarps will only be deployed to cover specific areas. During this time, weighted-sand bags or similar may need to be used to secure the tarps.

a) Once the soil has been received at F1, active soil management will be evaluated on an ongoing basis. All segregated soil piles located at the F1 area will be sampled and submitted an external lab for analysis. The analytical results will determine active soil management (i.e., aeration of the soil using mechanical equipment). Initial soil turnover will be performed two times a week to a maximum depth of 1m. Sampling and analysis will be conducted weekly per gridded area within the cell until a baseline can be established. Once the baseline is established (after one month) the sampling and aeration frequency will increase or decrease based on the soil-turnover aeration and tritium-removal efficiency. PGL will document sampling work conducted and track sample results versus depth and area within the cell. Other factors that will affect soil-turnover aeration are weather and temperature. Once a soil pile is deemed inert (i.e., meets the requirements of a UTP) the material will be removed at the earliest convenience to the final destination that is either offsite landfilling or at F3 as available.

b) The volume of soil for each area will be tracked by monitoring the number of trucks for each area being excavated and/or calculation of area excavated. A truck-tracking form will be used to document this information. (Appendix D – Inspection Forms).

c) Two construction entrances will be provided at F1 equipped with 20m-long mud mats/clear stone for removing mud/debris from truck tires. (Appendix A – Erosion, Sediment, & Drainage Control Plan). This option has been selected as there is no electrical power or water available at F1. Once construction of the pad is complete, truck access to offload material at F1 will only be through the west entrance.

10.0 SOIL SAMPLING PROTOCOL

a) The sampling methodology for moving soil from the Protected Area to F1 meets the sampling requirements in Ontario Regulation 153/04. Mainly, the sampling protocol consists of *in situ* soil characterization, augmented with 2% audit sampling of the trucks as they leave the protected area.

i. Ontario Regulation 153/04 characterizes imported fill at a site for purposes of filing a Record of Site Condition. It is also used as an industry standard for providing an acceptable level of characterizing soil.

ii. The regulation specifies sampling requirements if soil is to be re-used as clean fill onsite or offsite. If offsite, one sample is required for every 160m^3 for the first 5,000m^3 and one sample per 300m^3 after that. The regulation also identifies the number of samples required to reuse soil onsite. This consists of field screening 50 soil samples and analyzing 10 samples for every 1,000m^3. Based on the nature of the work and the potential contaminants, we recommend that 10 soil samples be analyzed for every 1,000m^3.

iii. The estimated quantity of soil that will be moved to temporary laydown pad F1 area is 24,204m^3. Field screening of soil will not be conducted at this time as the material will only be moved from within the PA to outside the PA. Based on the estimated 2,800 truckloads, PGL will collect soil samples from 2% of the trucks (i.e., at a frequency of 1 sample per 50 trucks). Soil samples collected will be sent to an external lab for testing of conventional parameters, tritium and gross gamma for documentation purposes only. Representative soil sampling to facilitate removal of the material from the PA was conducted and reported by PGL in spring 2013 (NK38-REF-38000-0483285).

iv. Based on the *in situ* soil characterization completed as well as the 2% audit sampling to be conducted (on soil from trucks leaving the PA). Radiation Protection has provided a blanket Conditional Transfer Permit (CTP).

b) The sampling methodology for moving soil from F1 to F3 or F1 to offsite will meet the requirements in Ontario Regulation 153/04 and be consistent with the CANDU Owners Group Inc. (COG) sampling methodology recommendations described in the report, "COG-08-3105I, "Protocols for sampling of representative scenarios of recurrent non-homogenous solid waste".

i. The sampling protocol to evaluate material prior to removing from the F1 pad will be conducted at a frequency of one sample for 100m^3, for a minimum total of 207 samples that will be sent to an external lab for analysis. These samples will be shipped under the blanket CTP provided by Radiation Protection. Additional sampling may be required based on evaluation of radiological and conventional results for material to be re used at Darlington.

ii. Radiological and TCLP parameters will be tested and results evaluated prior to determining offsite shipment from F1 to F3 if available or to a MOE-approved landfill facility if necessary. The soil must meet: (i) the applicable release limits for radiological testing and be in compliance with the Nuclear Substances and Radiation Device

regulation, and (ii) MOE Table 3 coarse-grain standards for the tested parameters of concern.

iii. Sample parameters associated with each type of analyses are listed in the Table B below.

c) Soil placed in the F1 laydown area cells will be tracked weekly as soil is moved from inside the PA to the F1 pad. Cells will be mapped in a grid system and soil will be traced to segregate any abnormal tritium, gamma or conventional parameter results.

Table B: Soil Sample Parameter Summary

Parameter Type	Analytical Testing
Radiological Parameters	H3 = Tritium GG = Gross Gamma GS = Gamma Spectroscopy
Conventional Parameters	PHC = Petroleum Hydrocarbons F1 to F4 M&I= Metals and inorganics VOC =volatile organic compounds (including benzene, toluene, ethylbenzene and xylenes
TCLP	TCLP = metals and inorganics, VOC, sVOC, bulk and leachate PCBs, soil pH and ignitibility.

11.0 SUMP SAMPLING

a) Each of the F1 soil-storage cells will have three underground sumps to collect water from the soil and rainwater. There will be an insulated valve controlling the flow of water between the two sumps. The sumps will be inspected daily and an inspection checklist will be completed (see Appendix D). The checklist will include the following items: date/time, personnel name, observed leaks/accumulated debris, approximate volume in sump.

b) One sump will be sampled when it is 50% full and the valve will be closed so that additional water cannot come into it. The sampling parameters are provided in Table C below. The samples will be submitted to OPG Chem Lab or an external lab for analysis.

c) If the samples are submitted to an external lab for analysis, the sample shipment will require a CTP issued by the Radiation Protection Department with the approval the Responsible Health Physicist.

d) If the limits in Table C are met, the water can be either discharged to surface or transferred to the nearest yard drainage point to F1 (see Section 12 and Appendix B).

e) If there is an oil sheen on the water and the rest of the parameters are acceptable, Detox will be called in to skim off the sheen for disposal as per item (f) or (g) below as applicable.

f) If there are total organic carbon or pH issues and the dewatering system is not available, the water will be disposed via Detox for disposal as per item (g) or (h) below as applicable.

g) If all parameters except Tritium from Table C are met, the following process can be followed to dispose of the water inside the protected area at the forebay:

i. Ensure dedicated vac truck is used for all transfers. If a new vac truck is required, or truck was utilized for a different task, then a sample must be submitted for Table C parameters;

ii. If the sump has additional water added to it during this time, it will have to be re-tested for Table B parameters;

iii. The vac truck cannot be used for other work until the sump transfer is complete; and

iv. Discharge water from vac truck to the forebay at the same location as the Box Drain Pump out in a controlled manner (approximately 1hr discharge). Ensure vac-truck tracking form is complete (Appendix D).

h) If tritium limits *and* other parameters in Table C are exceeded, the following options should be considered for practical effectiveness in achieving the parameter criteria:

i. Dilute with station non-chlorinated waste water, (if the intent is to meet (f), or

ii. Transfer to the dewatering system (if still in operation)

iii. Dispose water via Detox to Clean Harbours.

Table C: F1 Sump Sample Parameter Summary

Parameter	OPG Limits
Tritium	<100Bq/L can be discharged to surface Between 100Bq/L to 4000Bq/L will be transferred to yard drainage for release at catch basin 654 or 468 (Appendix C) >4000Bq/L can be diluted (with non-chlorinated waste water or domestic water) and re tested. If only tritium concentration persists, then either (i) dispose offsite via Detox or (ii) return water to the protected area for discharge at the forebay, provided that all other parameters have been satisfied. >8000Bq/L cannot be diluted, either (i) dispose offsite via Detox or (ii) return water to the protected area for discharge at the forebay, provided that all other parameters have been satisfied.
Gross gamma	GG < MDA/NORM (verify with Radiation Protection)
Total Suspended Solids*	≤70mg/L
Visible Oil*	No visible sheen/allowed
Total Organic Carbon*	≤15mg/L
pH	6.0-9.5

Notes:
1.(*) The effluent shall be essentially free of floating and settleable solids and cannot contain oil or any other substance in amounts sufficient to create a visible film, sheen foam or discolouration on the receiving waters.
2. Offsite disposal of sump water by Detox will be covered by the blanket CTP with an upper limit of 2µCi/L (74,000Bq/L).

In the event of extreme rainfall or predicted rainfall, PGL staff will close the gate valves to isolate the sumps from F1 pad cells 1 and 2. If standing water accumulates in the cells, the water will be vacuumed (vac truck) out of the cells before the valves are opened. Testing of the water will follow that detailed in the F1 SMP.

Table D: Additional Considerations for F1

Concern	Mitigation
Weather – rain/snow/wind events	Review weather forecast to plan for staffing, sampling of sump water, installation of tarp to cover soil pile, inspection of silt fence.
Timing for receipt of analytical results	Ensure that samples are collected timely so that sump water can be discharged/disposed of appropriately

12.0 YARD DRAINAGE POINTS

The nearest yard drainage points to F1 are provided in Appendix B. Yard Drainage Catch Basins 654 and 468 (that have a maximum discharge limit of 4,000Bq/L) are potential options for re-routing water if the 100Bq/L groundwater limit is exceeded in the sump water tested at F1. .

As a prerequisite to the use of the yard drainage system, these locations would need to be confirmed in the field (i.e., walkdown); accessibility and condition of the catch basin to receive the discharge water evaluated. This action will be completed by Ellis Don prior to soil being shipped to F1 and reported as being completed in an email communication to OPG Environment and B&M.

13.0 GROUNDWATER MONITORING AT F1

Parameters and groundwater sampling frequency requirements for the F1 soil staging area are outlined in the F1 Groundwater Monitoring technical memo (NK38-REF-38000-0483349) provided in Appendix E. There are eight wells that will be sampled on a quarterly basis to evaluate groundwater tritium concentrations in specific wells at F1 and wells in close proximity to F1 (upgradient and downgradient).

In addition to these eight wells, two new sentinel wells will be installed at F1; one east and one west the F1 lay down area. The wells will be positioned along the southern edge of the soil staging pad down gradient of the pad and sump tanks. The sentinel wells will be sampled according to the F1 Groundwater monitoring technical memo and are designed to monitor the possible introduction of tritium to groundwater from the subsurface piping system of the F1 pad and the sump tanks.

Background groundwater sampling will be conducted as a prerequisite at those well locations where historical tritium results were not available. Once soil is placed at F1, groundwater sampling will be conducted at these wells quarterly until the F1 pad is removed. The quarterly results will be tabulated and provided to OPG in an email and an annual technical memo will be generated documenting the

findings. Groundwater wells will continue to be sampled quarterly for one year after F1 has been decommissioned. A final report documenting all the work will be completed three months after the removal and restoration of F1 and a short technical memo will be completed documenting the groundwater monitoring work completed in the year after decommissioning works.

If groundwater well sampling results are higher than the prescribed limit, then: (i) increased sampling frequency will be followed per NK38-REF-38000-0483349 and (ii) remediation actions to restore F1 and surrounding affected area will discussed and scheduled for implemented by the Project.

14.0 RESTORATION OF F1

When F1 is no longer required for staging soil for the OPG Projects and/or, no longer needed by other Nuclear Refurbishment projects and/or as directed by OPG, the material installed for the soil staging (silt fence, geotextile, berms, etc.) will be removed, recycled as appropriate and or appropriately disposed of.

The area will be restored in consultation with OPG (i.e., if the area is to be developed for additional plant operations or remain unoccupied). If the area if to remain vacant, the original soil removed from the proposed pad location will be relocated, graded to allow precipitation to drain naturally to the existing swale and hydro-seeded. Imported sand fill may remain at F1 if deemed clean.

Environmental testing of (soil/granular fill) materials to remain at F1 will be required as well as testing of the native material under the pad location to confirm that the soil quality has not been altered from its original condition as documented in the test pit work conducted by PGL at F1. Material will be tested for conventional and radiological parameters as identified in Section 10.0.

Soil/granular fill will be screened and sampled according frequencies set out in Ontario Regulation 153/04: for every 100m^3; five samples will be field screened and one submitted for analytical testing.

A report documenting the post F1 removal findings will be generated based on the soil quality results. If soil impacts are identified, recommendations for remedial works will be provided after consultation with OPG's Project team and Environment Group.

15.0 BACKOUT PROVISIONS

In the event that backout condition occurs, excavation equipment should be left in a safe state.

a) Backout in the case of fire or personal injury. Notify station emergency response team (ERT) first. In addition to backout procedures, workers will immediately notify the CMO who will immediately notify the shift manager.

b) Backout in the case of an electrical storm or unsafe weather conditions such as high winds, rain or snow.

c) Backout In the event of a station alarm: stop work, listen and follow instructions given on the public address system. Ensure that the work area does not pose a safety hazard, cover any open areas. All workers shall proceed to the designated assembly area identified in the daily pre-job briefing.

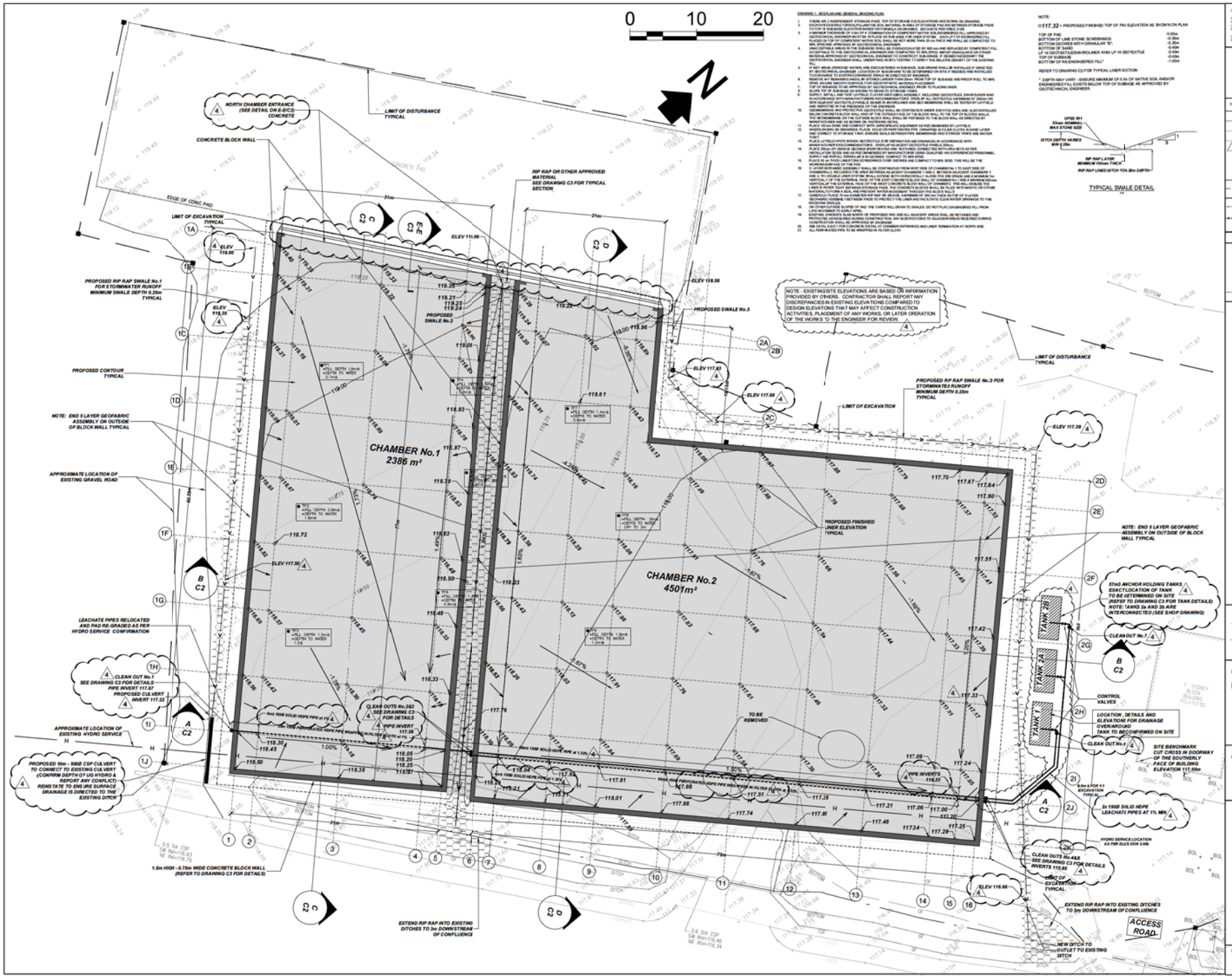
d) Backout in the case of a spill event. Follow Spill plan actions outlined in Ref 16.5.

e) Backout if tangible evidence of hydrocarbon impacted soil is encountered. Notify OPG, B&M and PGL project managers. Contact PGL personnel to investigate so that soil is segregated/sampled as determined to be required for landfilling, per options outlined in this Plan.

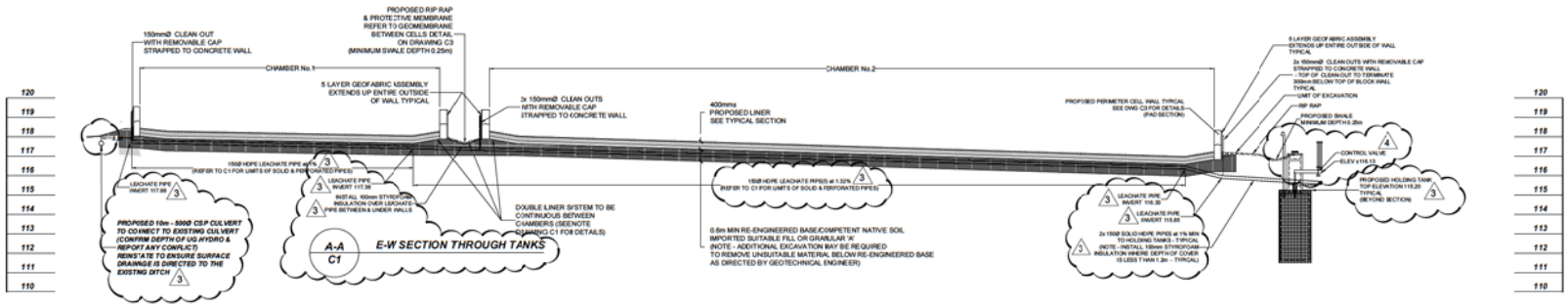
16.0 REFERENCES

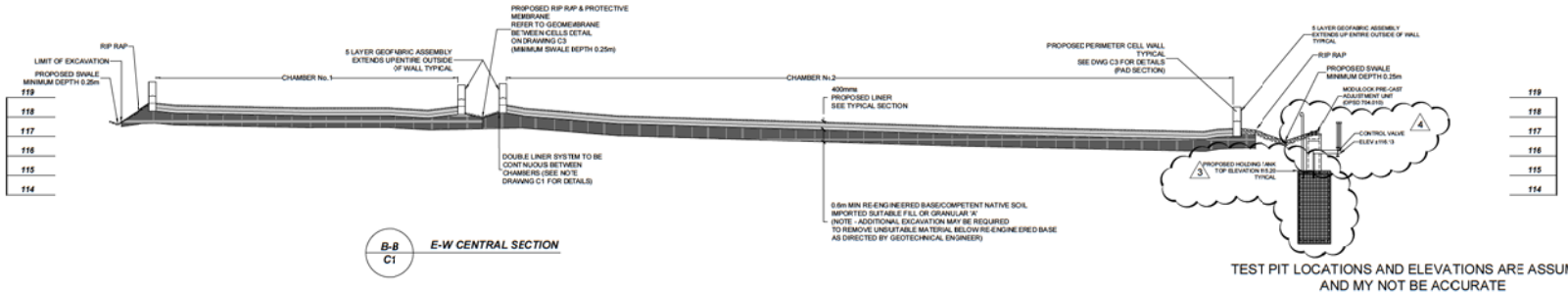
16.1. N-GUID-09701-10013: Environmental Requirements Guideline
16.2. D-INS-79000-10002: Waste Disposal Guidelines for Solid Waste and Recycling at Darlington
16.3. D-INS-07290-10000: Darlington Spill Prevention and Contingency Plan
16.4. NK38-PLAN-38000-10003: Contractor Environmental Management Plan (B&M 48070014-CEMP)
16.5. NK38-PLAN-38000-10005: Spill Prevention and Contingency Plan (B&M 48070014-SPCP)
16.6. NK38-PLAN-38000-10020: Groundwater and Dewatering Plan (B&M 48070014-GDP)
16.7. NK38-PLAN-38000-10006: Waste Management Plan (B&M 48070014-WMP)
16.8. NK38-PLAN-38000-10018: Transportation Logistics Plan (B&M 48070014-TLP)
16.9. NK38-PLAN-38000-10004: Soil Management Plan for C13 area (B&M 48070014-SMP)
16.10. NK38-REF-38000-0483816: F1 Test Pit report
16.11. NK38-PLAN-38000-0475693: F1 Early Works Plan
16.12. NK38-REF-38000-0483285: Borehole Drilling Investigation
16.13. NK38-FEX-15200-0506: Catch Basin 468 Location
16.14. NK38-FEX-15200-0507: Catch Basin 654 Location

APPENDIX A

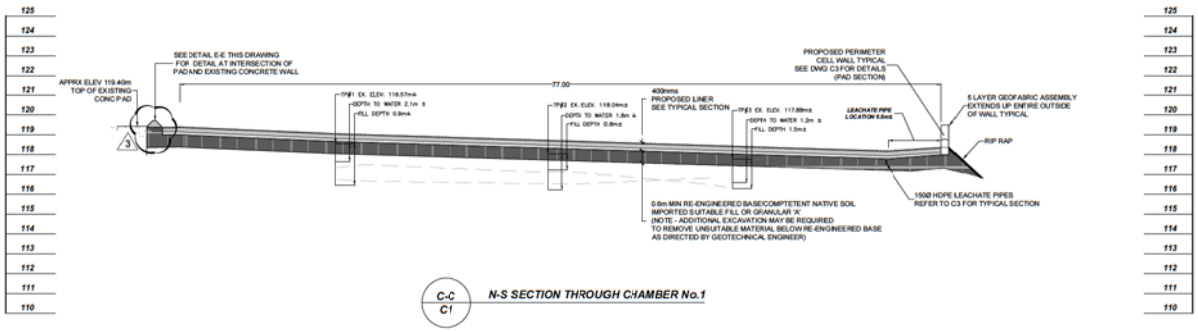


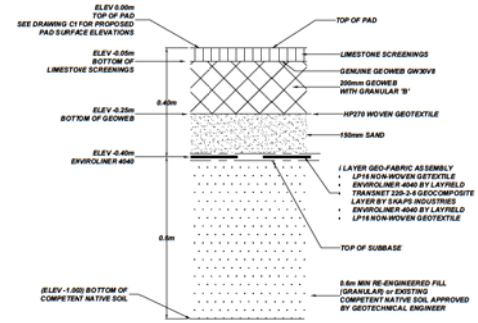
Filed: 2021-04-19
EB-2020-0290
EB-2020-0237
Exhibit L-D2-02-AMPCO-137
Attachment 112
Page 23 of 54



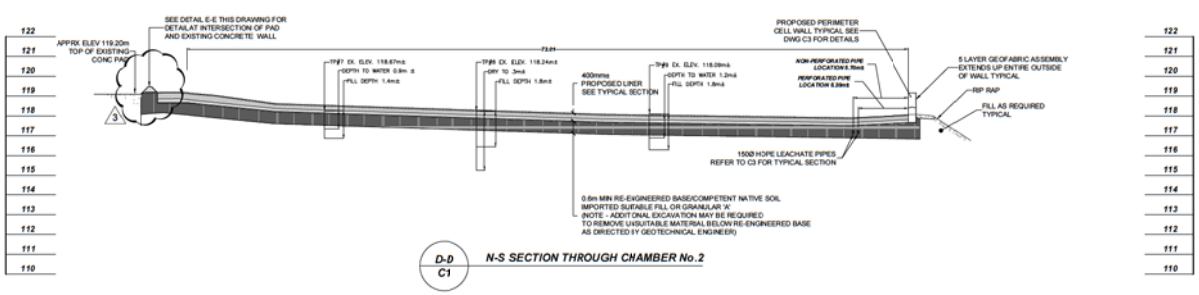


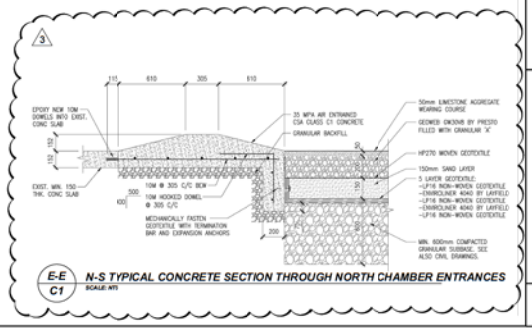
TEST PIT LOCATIONS AND ELEVATIONS ARE ASSUMED AND MY NOT BE ACCURATE





TYPICAL PROPOSED LINER DETAIL
NTS





NO.	ISSUES	DATE	BY
1	ISSUED FOR REVIEW	13/06/18	TQ
2	ISSUED FOR CONSTRUCTION	13/11/12	TQ
3	REVISED LEACHATE PIPE CONFIGURATION & PAD ELEVS	13/11/29	TQ
4	ADDITION OF VALVES & LEACHATE PIPE ELEVATIONS	14/01/14	TQ

NOTE:
- INSTALL SUB-DRAINS IN NATIVE SOIL IF REQUIRED BY GEOTECHNICAL ENGINEER TO ADDRESS HIGH WATER TABLE
- IF NECESSARY INSTALL SUBDRAINS WHERE DIRECTED BY GEOTECHNICAL ENGINEER. SUBDRAINS SHALL DISCHARGE TO EXISTING OR NEW SWALES AS APPROPRIATE
- DOUBLE LINER SYSTEM TO EXTEND BEYOND NORTH LIMIT OF PAD TO CENTERLINE OF PROPOSED BERM
- DOUBLE LINER SYSTEM TO EXTEND VERTICALLY UP OUTSIDE FACE OF ALL CONCRETE BLOCK WALLS AND BE CONTINUOUS BETWEEN ADJACENT PADS (SEE NOTE DRAWING C1)

PROJECT:
FI SOIL STAGING PAD

DRAWING:
GRADING PLAN SECTIONS

BARRY•BRYAN ASSOCIATES (1991) LIMITED
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Landscape Architect
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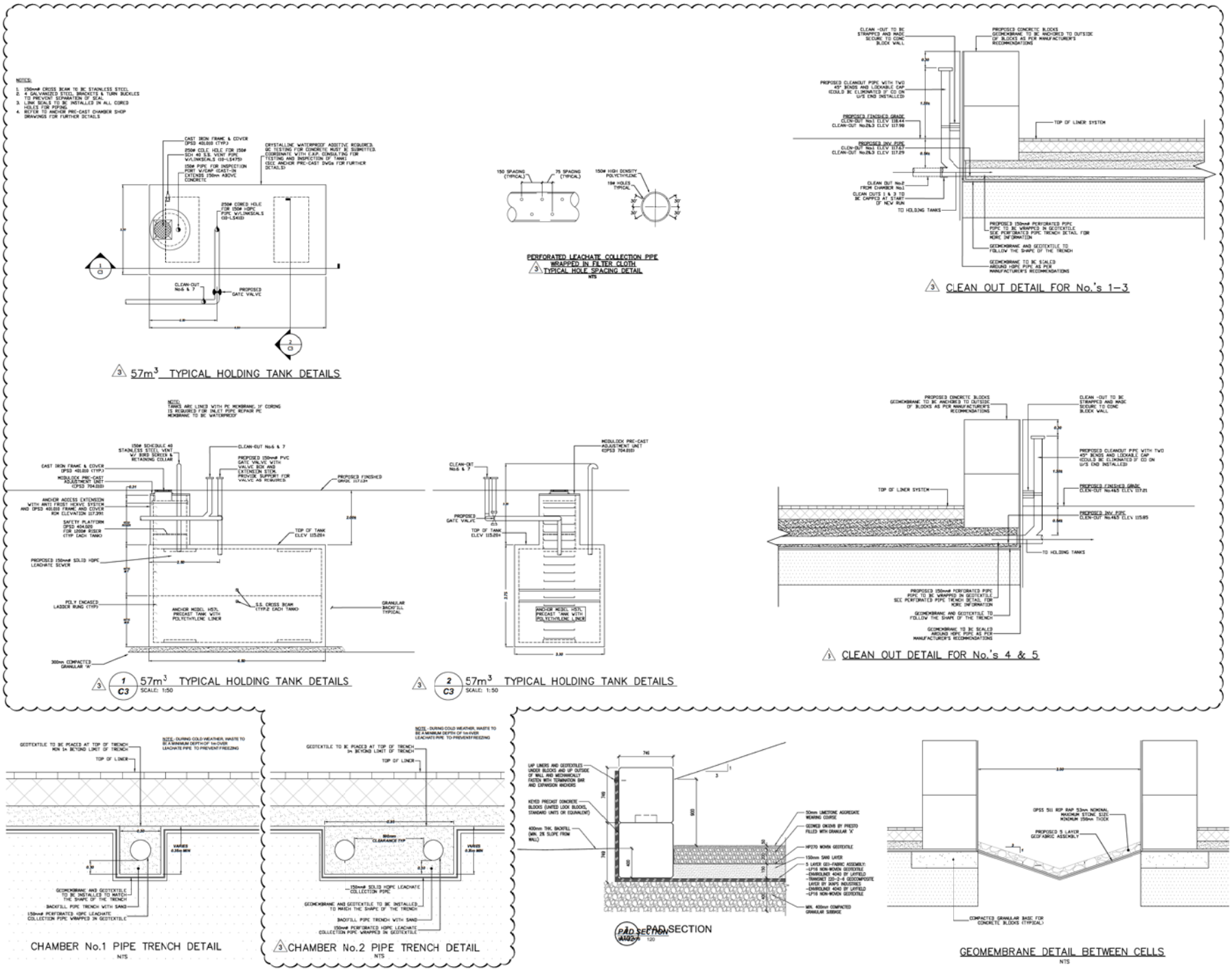
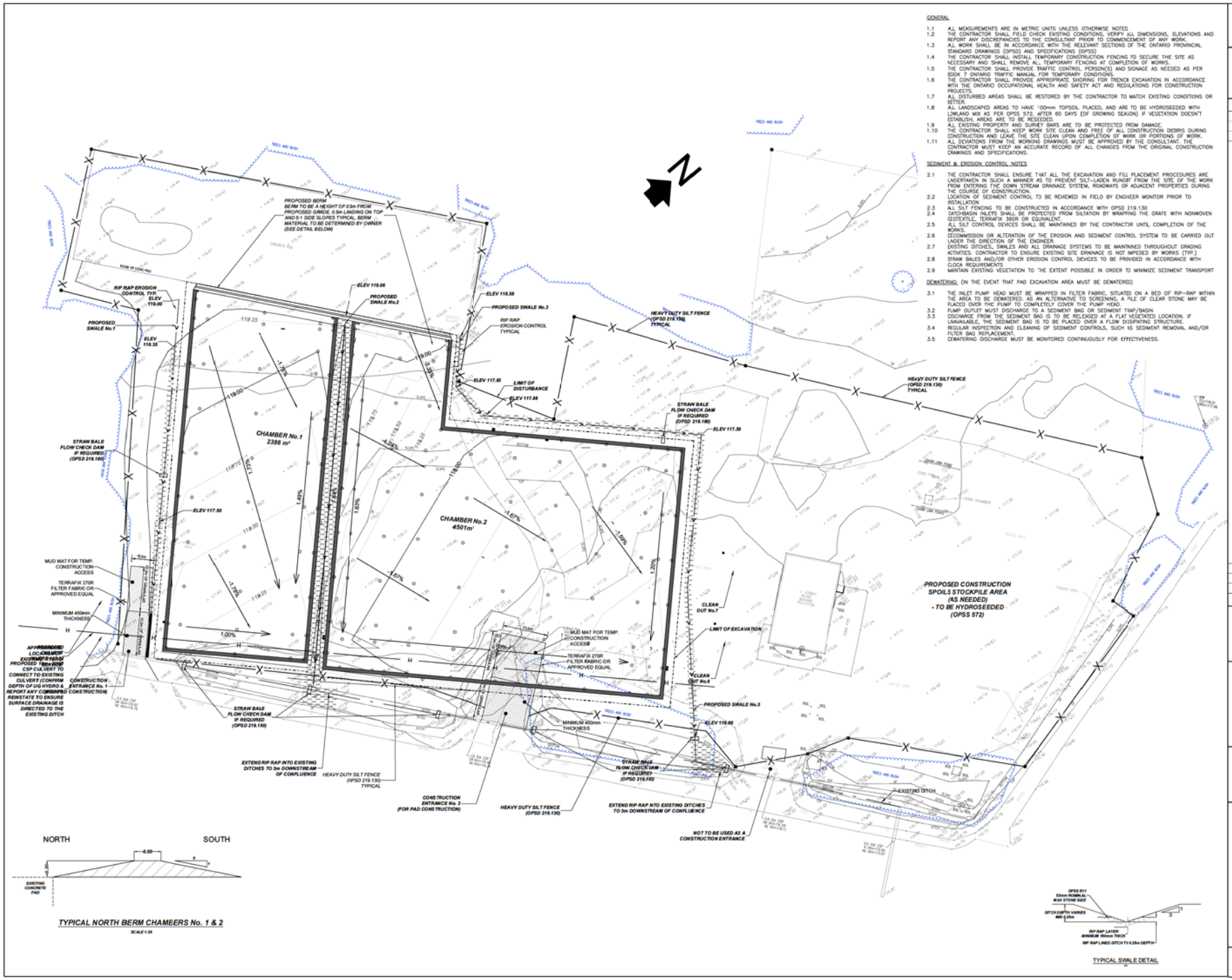
CHECKED BY: JJ
DATE: 2013/11/12
SCALE: 1:200 H 1:400 V
FILE: 13-009 DARLINGTON

PROJECT NO: 13119
DRAWING NO: C2


57m³ TYPICAL HOLDING TANK DETAILS
PERFORATED LEACHATE COLLECTION PIPE WRAPPED IN FILTER CLOTH
TYPICAL HOLE SPACING DETAIL
CLEAN OUT DETAIL FOR No.'s 1–3
57m³ TYPICAL HOLDING TANK DETAILS
57m³ TYPICAL HOLDING TANK DETAILS
CLEAN OUT DETAIL FOR No.'s 4 & 5
CHAMBER No.1 PIPE TRENCH DETAIL
CHAMBER No.2 PIPE TRENCH DETAIL
PAD SECTION
GEOMEMBRANE DETAIL BETWEEN CELLS
NTS
NO. ISSUES DATE BY
1 FOR CLOCA REVIEW 11/06/11 TO
2 ISSUED FOR CONSTRUCTION 13/11/12 TO
3 REVISED TANK CONFIGURATION 13/12/04 TO
PROJECT: FI SOIL STAGING PAD
DRAWING: DETAILS
BBA
BARRY•BRYAN ASSOCIATES (1991) LIMITED
Architects Engineers Landscape Architect Project Managers
DESIGN BY: JO/TO
DRAWN BY: TO
CHECKED BY: JJ
DATE: 2013/11/12
SCALE: VARIES
FILE: 13-009 DARLINGTON
PROJECT NO: 13119
DRAWING NO: C3



GENERAL

1.1 ALL MEASUREMENTS ARE IN METRIC UNITS UNLESS OTHERWISE NOTED.
1.2 THE CONTRACTOR SHALL FIELD CHECK EXISTING CONDITIONS, VERIFY ALL DIMENSIONS, ELEVATIONS AND REPORT ANY DISCREPANCIES TO THE CONSULTANT PRIOR TO COMMENCEMENT OF ANY WORK.
1.3 ALL WORK SHALL BE IN ACCORDANCE WITH THE RELEVANT SECTIONS OF THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD) AND SPECIFICATIONS (OPSS)
1.4 THE CONTRACTOR SHALL INSTALL TEMPORARY CONSTRUCTION FENCING TO SECURE THE SITE AS NECESSARY AND SHALL REMOVE ALL TEMPORARY FENCING AT COMPLETION OF WORKS.
1.5 THE CONTRACTOR SHALL PROVIDE TRAFFIC CONTROL PERSON(S) AND SIGNAGE AS NEEDED AS PER BOOK 7 ONTARIO TRAFFIC MANUAL FOR TEMPORARY CONDITIONS.
1.6 THE CONTRACTOR SHALL PROVIDE APPROPRIATE SHORING FOR TRENCH EXCAVATION IN ACCORDANCE WITH THE ONTARIO OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.
1.7 ALL DISTURBED AREAS SHALL BE RESTORED BY THE CONTRACTOR TO MATCH EXISTING CONDITIONS OR BETTER.
1.8 ALL LANDSCAPED AREAS TO HAVE 100mm TOPSOIL PLACED, AND ARE TO BE HYDROSEEDED WITH LOWLAND MIX AS PER OPSS 572, AFTER 60 DAYS (OF GROWING SEASON) IF VEGETATION DOESN'T ESTABLISH, AREAS ARE TO BE RESEEDED.
1.9 ALL EXISTING PROPERTY AND SURVEY BARS ARE TO BE PROTECTED FROM DAMAGE.
1.10 THE CONTRACTOR SHALL KEEP WORK SITE CLEAN AND FREE OF ALL CONSTRUCTION DEBRIS DURING CONSTRUCTION AND LEAVE THE SITE CLEAN UPON COMPLETION OF WORK OR PORTIONS OF WORK.
1.11 ALL DEVIATIONS FROM THE WORKING DRAWINGS MUST BE APPROVED BY THE CONSULTANT. THE CONTRACTOR MUST KEEP AN ACCURATE RECORD OF ALL CHANGES FROM THE ORIGINAL CONSTRUCTION DRAWINGS AND SPECIFICATIONS.

SEDIMENT & EROSION CONTROL NOTES

2.1 THE CONTRACTOR SHALL ENSURE THAT ALL THE EXCAVATION AND FILL PLACEMENT PROCEDURES ARE UNDERTAKEN IN SUCH A MANNER AS TO PREVENT SILT-LADEN RUNOFF FROM THE SITE OF THE WORK FROM ENTERING THE DOWN STREAM DRAINAGE SYSTEM, ROADWAYS OR ADJACENT PROPERTIES DURING THE COURSE OF CONSTRUCTION.
2.2 LOCATION OF SEDIMENT CONTROL TO BE REVIEWED IN FIELD BY ENGINEER MONITOR PRIOR TO INSTALLATION.
2.3 ALL SILT FENCING TO BE CONSTRUCTED IN ACCORDANCE WITH OPSD 219.130
2.4 CATCHBASIN INLETS SHALL BE PROTECTED FROM SILTATION BY WRAPPING THE GRATE WITH NONWOVEN GEOTEXTILE, TERRAFIX 360R OR EQUIVALENT.
2.5 ALL SILT CONTROL DEVICES SHALL BE MAINTAINED BY THE CONTRACTOR UNTIL COMPLETION OF THE WORKS.
2.6 DECOMMISSION OR ALTERATION OF THE EROSION AND SEDIMENT CONTROL SYSTEM TO BE CARRIED OUT UNDER THE DIRECTION OF THE ENGINEER.
2.7 EXISTING DITCHES, SWALES AND ALL DRAINAGE SYSTEMS TO BE MAINTAINED THROUGHOUT GRADING ACTIVITIES. CONTRACTOR TO ENSURE EXISTING SITE DRAINAGE IS NOT IMPEDED BY WORKS (TYP.)
2.8 STRAW BALES AND/OR OTHER EROSION CONTROL DEVICES TO BE PROVIDED IN ACCORDANCE WITH CLOCA REQUIREMENTS
2.9 MAINTAIN EXISTING VEGETATION TO THE EXTENT POSSIBLE IN ORDER TO MINIMIZE SEDIMENT TRANSPORT

DEWATERING: (IN THE EVENT THAT PAD EXCAVATION AREA MUST BE DEWATERED)

3.1 THE INLET PUMP HEAD MUST BE WRAPPED IN FILTER FABRIC, SITUATED ON A BED OF RIP-RAP WITHIN THE AREA TO BE DEWATERED. AS AN ALTERNATIVE TO SCREENING, A PILE OF CLEAR STONE MAY BE PLACED OVER THE PUMP TO COMPLETELY COVER THE PUMP HEAD.
3.2 PUMP OUTLET MUST DISCHARGE TO A SEDIMENT BAG OR SEDIMENT TRAP/BASIN
3.3 DISCHARGE FROM THE SEDIMENT BAG IS TO BE RELEASED AT A FLAT VEGETATED LOCATION. IF UNAVAILABLE, THE SEDIMENT BAG IS TO BE PLACED OVER A FLOW DISSIPATING STRUCTURE.
3.4 REGULAR INSPECTION AND CLEANING OF SEDIMENT CONTROLS, SUCH AS SEDIMENT REMOVAL AND/OR FILTER BAG REPLACEMENT.
3.5 DEWATERING DISCHARGE MUST BE MONITORED CONTINUOUSLY FOR EFFECTIVENESS.

CHECK AND VERIFY ALL DIMENSIONS AT THE SITE.

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NO.	ISSUES	DATE	BY
1	ISSUED FOR REVIEW	12/09/11	TO
2	ISSUED FOR CONSTRUCTION	13/11/12	TO

NO.	REVISIONS	DATE	BY

UEM URBAN & ENVIRONMENTAL MANAGEMENT INC.

PROJECT:

FI SOIL STAGING PAD

DRAWING:

EROSION, SEDIMENT & DRAINAGE CONTROL PLAN (DURING PAD CONSTRUCTION)

BBA

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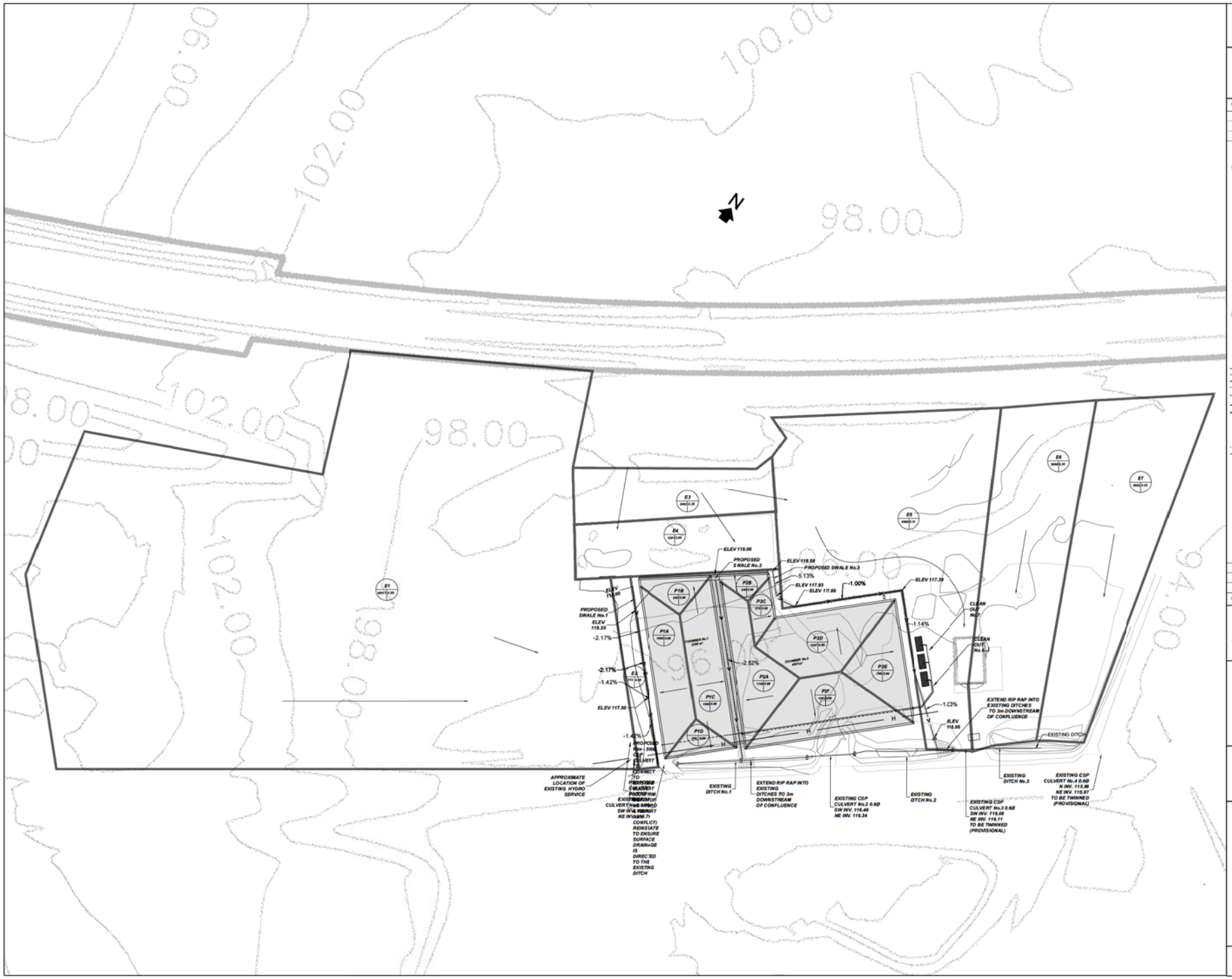
J. J. OVCJAK

DESIGN BY: JO/TO
DRAWN BY: TO
CHECKED BY: JJ
DATE: 2013/12/
SCALE:
FILE: 13
DRAWING:

PROJECT NO.: **13119**



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NO.	ISSUES	DATE	BY
1	ISSUED FOR REVIEW	13/06/18	TO
2	ISSUED FOR CONSTRUCTION	13/11/19	TO

NOTES:

1. CATCHMENT E1, LOCATED WEST OF THE PROPOSED PAD, DRAINS INTO THE EXISTING ROADSIDE DITCHES SOUTH OF THE PROPOSED PAD. THE E1 BOUNDARY SHOWN IS BASED ON THE AVAILABLE TOPOGRAPHY AND ADJACENT PROPERTY DRAINAGE PLANS. EXAMINATION OF AERIAL PHOTOGRAPHS BOUNDARIES SHOULD BE CONFIRMED, INCLUDING DRAINAGE BOUNDARY EFFECTS OF ROADSIDE DITCHES AND CULVERTS NOT AVAILABLE ON EXISTING MAPPING.
2. EXISTING IMPERVIOUS CATCHMENTS E1, E2, E3, E4, AND E7 ASSUMED TO HAVE A 35% RUNOFF COEFFICIENT FOR PEAK FLOW CALCULATIONS.
3. EXISTING IMPERVIOUS CATCHMENTS E5, AND E6 ASSUMED TO HAVE A 85% RUNOFF COEFFICIENT FOR PEAK FLOW CALCULATIONS.
4. PROPOSED TARP COVERED CATCHMENTS P1 AND P2 ASSUMED TO BE IMPERVIOUS AND HAVE A 85% RUNOFF COEFFICIENT FOR PEAK FLOW CALCULATIONS.
5. EXISTING CULVERTS 2 AND 4 WILL EXPERIENCE APPROXIMATELY 10% INCREASE IN FLOW DUE TO PAD CONSTRUCTION.
6. TWINNING OF CULVERTS 3 AND 4 (PROVISIONAL) WILL PROVIDE SUFFICIENT CAPACITY FOR A 5 YEAR STORM EVENT. THE ADDITIONAL CULVERTS WILL PROVIDE SUFFICIENT CAPACITY FOR A 5 YEAR STORM EVENT. THE ADDITIONAL CULVERTS WILL PROVIDE SUFFICIENT CAPACITY FOR A 5 YEAR STORM EVENT.
7. EXISTING DITCH GEOMETRY NEEDS TO BE CHECKED TO DETERMINE IF DITCH MODIFICATIONS ARE NECESSARY.
8. ACCESS ROAD (E3) AND EXISTING PAD (E5) SHOULD BE KEPT FREE OF DEBRIS AND SWEPT PERIODICALLY DURING CONSTRUCTION AND STOCKPILING OPERATIONS.
9. ALL PROPOSED SWALES TO BE 0.25m DEEP MINIMUM

CATCHMENT ID
RUNOFF COEFFICIENT
AREA (m²)

100.00 PROPOSED ELEVATION
EXISTING ELEVATION
PROPOSED DITCH
EXISTING DITCH
HEAVY DUTY SILT FENCE
LIMIT OF EXCAVATION
PERFORATED PIPE TO KILLEARN TANK
SEWAGE POINT OF DISPOSAL TO KILLEARN TANK
LIMIT OF DISTURBANCE
PROPOSED BERM
PROPOSED HOLDING TANK
GRID MARKER
EXISTING HYDRO

NO.	REVISIONS	DATE	BY

UEM URBAN & ENVIRONMENTAL MANAGEMENT INC.
PROFESSIONAL ENGINEERS, PLANNERS, SURVEYORS

PROJECT:
FI SOIL STAGING PAD

DRAWING:
DRAINAGE PLAN

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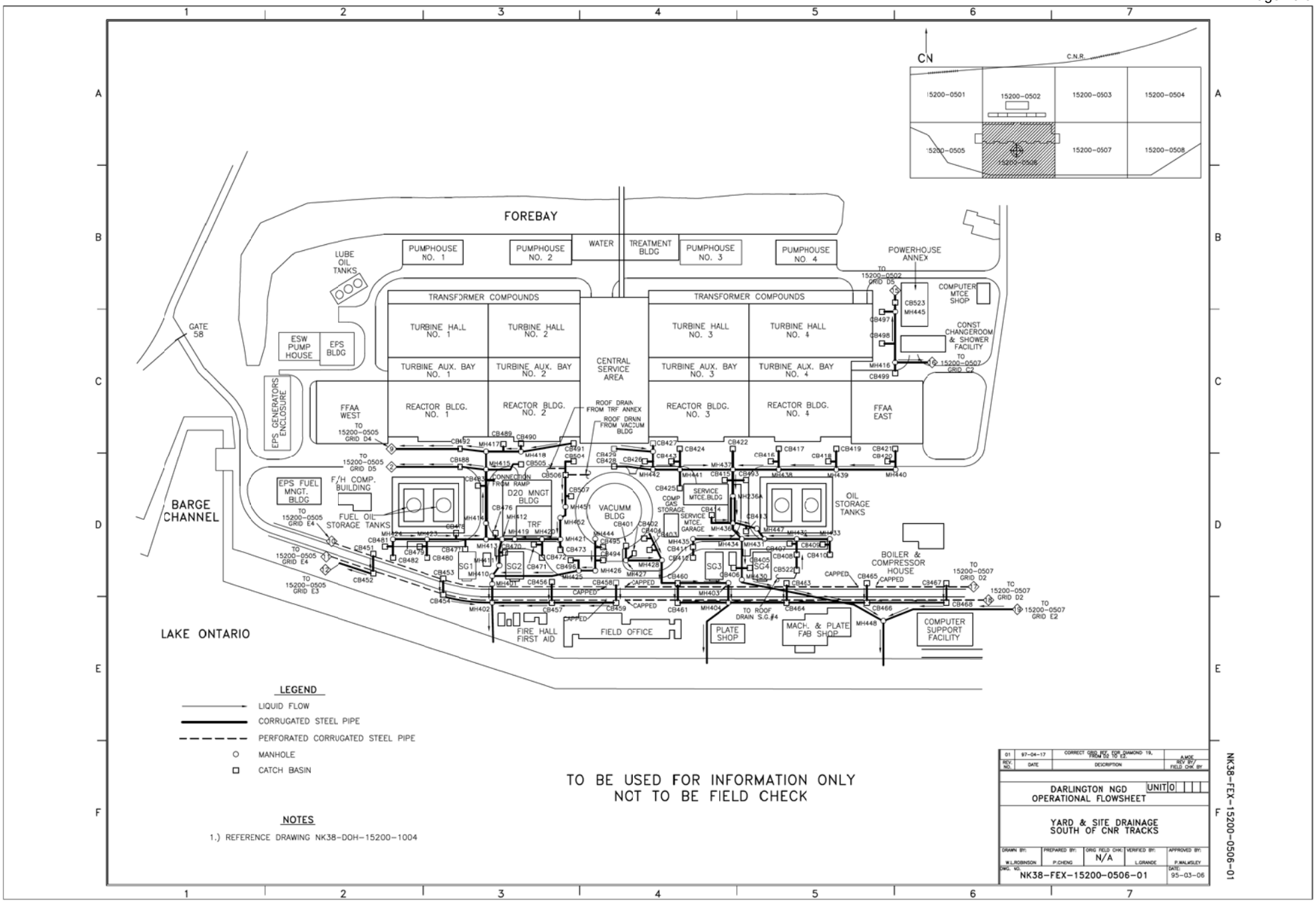
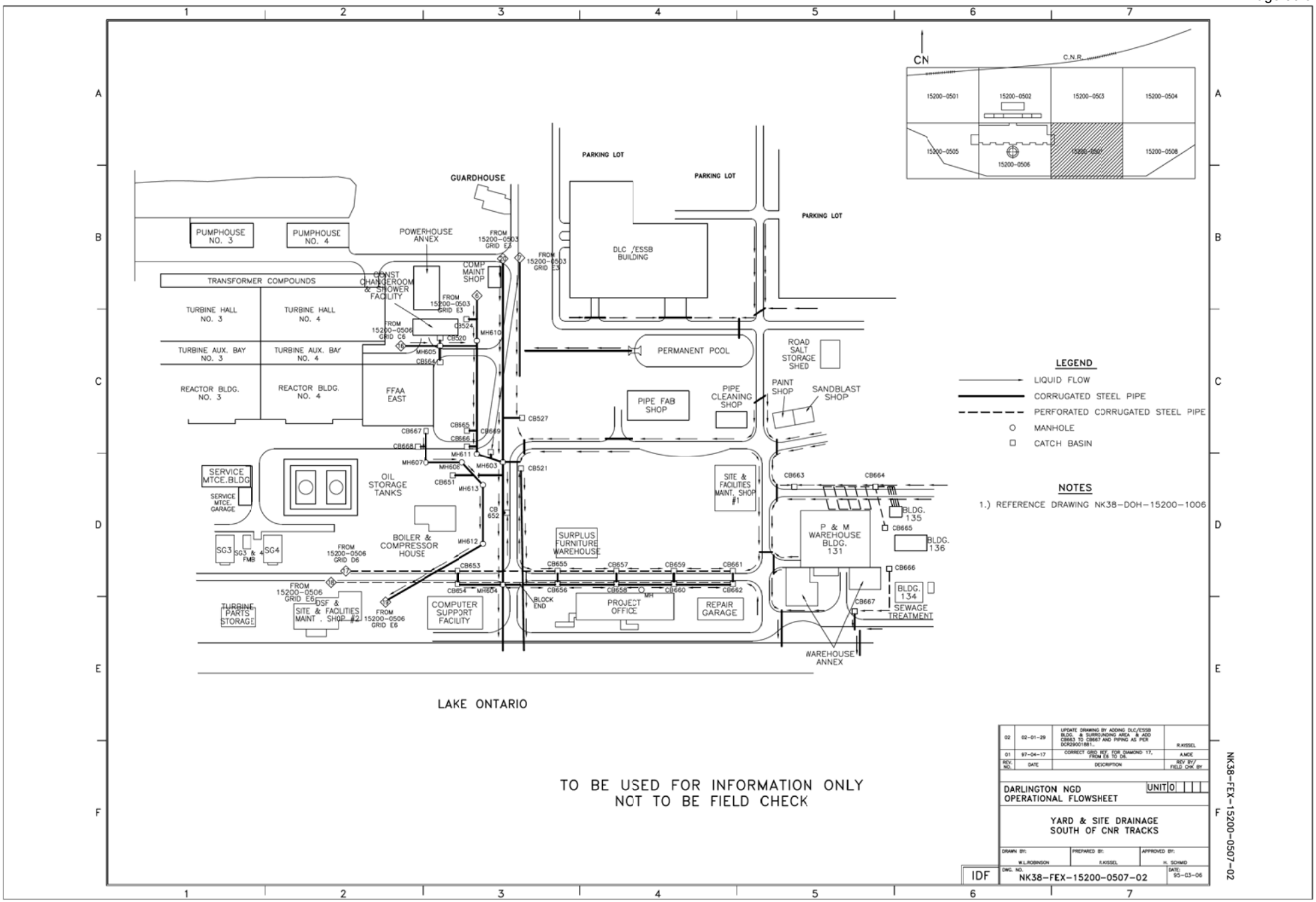
J. J. OVCJAK
LICENSED PROFESSIONAL ENGINEER

DESIGN BY: JO/TO
DRAWN BY: TO
CHECKED BY: JJ
DATE: 2013/11/19
SCALE:
FILE: 13119
DRAWING: 1

PROJECT NO.
13119

APPENDIX B


CN
C.N.R.
15200-0501
15200-0502
15200-0503
15200-0504
15200-0505
15200-0506
15200-0507
15200-0508
FOREBAY
PUMPHOUSE NO. 1
PUMPHOUSE NO. 2
WATER
TREATMENT BLDG
PUMPHOUSE NO. 3
PUMPHOUSE NO. 4
POWERHOUSE ANNEX
LUBE OIL TANKS
GATE 58
ESW PUMP HOUSE
EPS BLDG
EPS GENERATORS ENCLOSURE
TRANSFORMER COMPOUNDS
TURBINE HALL NO. 1
TURBINE HALL NO. 2
TURBINE HALL NO. 3
TURBINE HALL NO. 4
TURBINE AUX. BAY NO. 1
TURBINE AUX. BAY NO. 2
TURBINE AUX. BAY NO. 3
TURBINE AUX. BAY NO. 4
CENTRAL SERVICE AREA
REACTOR BLDG. NO. 1
REACTOR BLDG. NO. 2
REACTOR BLDG. NO. 3
REACTOR BLDG. NO. 4
FFAA WEST
FFAA EAST
COMPUTER MTCE SHOP
CONST CHANGEROOM & SHOWER FACILITY
ROOF DRAIN FROM TRF ANNEX
ROOF DRAIN FROM VACUUM BLDG
EPS FUEL MNGT. BLDG
F/H COMP. BUILDING
FUEL OIL STORAGE TANKS
D2O MNGT BLDG
TRF
VACUUM BLDG
SERVICE MTCE.BLDG
COMP GAS STORAGE
SERVICE MTCE. GARAGE
OIL STORAGE TANKS
BOILER & COMPRESSOR HOUSE
BARGE CHANNEL
LAKE ONTARIO
FIRE HALL FIRST AID
FIELD OFFICE
PLATE SHOP
MACH. & PLATE FAB SHOP
COMPUTER SUPPORT FACILITY
SG1
SG2
SG3
SG4
LEGEND
LIQUID FLOW
CORRUGATED STEEL PIPE
PERFORATED CORRUGATED STEEL PIPE
MANHOLE
CATCH BASIN
NOTES
1.) REFERENCE DRAWING NK38-DOH-15200-1004
TO BE USED FOR INFORMATION ONLY
NOT TO BE FIELD CHECK
DARLINGTON NGD
OPERATIONAL FLOWSHEET
UNIT 0
YARD & SITE DRAINAGE
SOUTH OF CNR TRACKS
NK38-FEX-15200-0506-01
95-03-06
NK38-FEX-15200-0506-01


CN
C.N.R.
15200-0501
15200-0502
15200-0503
15200-0504
15200-0505
15200-0506
15200-0507
15200-0508
GUARDHOUSE
PARKING LOT
PARKING LOT
PARKING LOT
PUMPHOUSE NO. 3
PUMPHOUSE NO. 4
POWERHOUSE ANNEX
FROM 15200-0503 GRID E3
DLC /ESSB BUILDING
COMP MAINT SHOP
TRANSFORMER COMPOUNDS
CONST CHANGEROOM & SHOWER FACILITY
TURBINE HALL NO. 3
TURBINE HALL NO. 4
FROM 15200-0506 GRID C6
CB524
CB520
MH610
TURBINE AUX. BAY NO. 3
TURBINE AUX. BAY NO. 4
MH605
CB664
PERMANENT POOL
ROAD SALT STORAGE SHED
REACTOR BLDG. NO. 3
REACTOR BLDG. NO. 4
FFAA EAST
PIPE FAB SHOP
PIPE CLEANING SHOP
PAINT SHOP
SANDBLAST SHOP
CB527
CB667
CB665
CB669
CB666
CB668
MH611
MH607
MH608
MH603
CB521
SERVICE MTCE.BLDG
SERVICE MTCE. GARAGE
OIL STORAGE TANKS
CB651
MH613
CB652
SITE & FACILITIES MAINT. SHOP #1
CB663
CB664
BLDG. 135
CB665
BLDG. 136
P & M WAREHOUSE BLDG. 131
SG3
SG3 & FMB
SG4
BOILER & COMPRESSOR HOUSE
MH612
FROM 15200-0506 GRID D6
SURPLUS FURNITURE WAREHOUSE
CB653
CB655
CB657
CB659
CB661
CB666
FROM 15200-0506 GRID E6
CB654
MH604
CB656
CB658
MH
CB660
CB662
BLDG. 134
SEWAGE TREATMENT
TURBINE PARTS STORAGE
DSF & SITE & FACILITIES MAINT. SHOP #2
FROM 15200-0506 GRID E6
COMPUTER SUPPORT FACILITY
BLOCK END
PROJECT OFFICE
REPAIR GARAGE
CB667
WAREHOUSE ANNEX
LAKE ONTARIO
LEGEND
LIQUID FLOW
CORRUGATED STEEL PIPE
PERFORATED CORRUGATED STEEL PIPE
MANHOLE
CATCH BASIN
NOTES
1.) REFERENCE DRAWING NK38-DOH-15200-1006
TO BE USED FOR INFORMATION ONLY
NOT TO BE FIELD CHECK
02 02-01-29 UPDATE DRAWING BY ADDING DLC/ESSB BLDG. & SURROUNDING AREA & ADD CB663 TO CB667 AND PIPING AS PER DCR29001881. R.KISSEL
01 97-04-17 CORRECT GRID REF. FOR DIAMOND 17, FROM E6 TO D6. A.MOE
REV. NO. DATE DESCRIPTION REV BY/ FIELD CHK BY
DARLINGTON NGD
OPERATIONAL FLOWSHEET
UNIT 0
YARD & SITE DRAINAGE
SOUTH OF CNR TRACKS
DRAWN BY: W.L.ROBINSON
PREPARED BY: R.KISSEL
APPROVED BY: H. SCHMID
IDF
DWG. NO. NK38-FEX-15200-0507-02
DATE: 95-03-06
NK38-FEX-15200-0507-02

APPENDIX C

Transportation Route

Sally Port to F1 and Back

F1 to Catch Basins and Back

APPENDIX D

PGL

BM FORM LIST

BM-FORM-000-F1SMP Rev0

Project Information

Project Number: 4325-02.01 F1 Soil Management Plan
Site Address: OPG-DN Bowmanville, ON

Document #	Document	Revision	Date Issued
BM-FORM-000-F1SMP Rev 0	PGL BM Form List	0	22-Jan-14
BM-FORM-001-F1SMP Rev 0	PGL Truck Tracking Form - F1 Laydown Area	0	22-Jan-14
BM-FORM-002-F1SMP Rev 0	PGL Truck Tracking Form - D20 Excavation	0	22-Jan-14
BM-FORM-003-F1SMP Rev 0	PGL Daily Sump Inspection Form	0	22-Jan-14
BM-FORM-004-F1SMP Rev 0	PGL Silt Fence Inspection Form	0	22-Jan-14
BM-FORM-005-F1SMP Rev 0	PGL Vacuum Truck Tracking Form	0	22-Jan-14
BM-FORM-006-F1SMP Rev 0	PGL F1 Laydown Area Pad Grid Form	0	22-Jan-14
BM-FORM-007-F1SMP Rev 0	PGL Soil Pile Sampling Form	0	22-Jan-14
BM-FORM-008-F1SMP Rev 0	PGL Soil Pile Sampling Sketch	0	22-Jan-14

PGL

Truck Tracking Form at F1 Laydown Area

BM-FORM-001-F1SMP Rev0

Project Information

Project Number:	4325-02.01	Client:	B&M/OPG-DN
Site Address:	OPG-DN Bowmanville, ON	PGL Staff:	

				Truck Information						
Date	Load Number	Time On-Site	Time Off-Site	Company	Truck #	License Plate #	Material	Soil Location (Grid)	Truck Inspected by PGL (Y/N)	Volume (m^3)
									Total Volume	

EXAMPLE

Personnel (Print): _____

Personnel (Signature): _____

Material
(**CS**): Caisson Spoils
(**0 - 3**): 0 - 3 mbgs
(**3 - B**): 3 mbgs - bedrock
(**B**): Bedrock

Soil Location (see F1 Pad Grid Form)

Page ____ of ____

PGL

Truck Tracking Form at D20 Excavation

BM-FORM-002-F1SMP Rev0

Project Information

Project Number:	4325-02.01	Client:	B&M/OPG-DN
Site Address:	OPG-DN Bowmanville, ON	PGL Staff:	

				Truck Information						
Date	Load Number	Time On-Site	Time Off-Site	Company	Truck #	License Plate #	Material	Soil Destination (Cell)	Truck Inspected by PGL (Y/N)	Volume (m^3)
									Total Volume	

EXAMPLE

Personnel (Print): _____

Personnel (Signature): _____

Material
(**CS**): Caisson Spoils
(**0 - 3**): 0 - 3 mbgs
(**3 - B**): 3 mbgs - bedrock
(**B**): Bedrock

Page _____ of _____

PGL

Sump Inspection Form at F1 Laydown Area

BM-FORM-003-F1SMP Rev0

Project Information

Project Number:	4325-02.01	Client:	B&M/OPG-DN
Site Address:	OPG-DN Bowmanville, ON	PGL Staff:	
Weather		**Sump ID**	
Notes:	**1. Increase inspection frequency after rain event.**		

				Sample Results			
Date	Time of Inspection	Estimated Volume (fraction full)	Sample Collected (Y/N)	Table C (pass/fail)	Tritium Result	Dilution (Y/N)	Discharge Path

EXAMPLE

Personnel (Print): _____

Personnel (Signature): _____

NA - Not Applicable

PGL

Silt Fence Inspection Form

BM-FORM-004-F1SMP Rev0

Project Information

Project Number:	4325-02.01 - F1 Laydown Area
Site Address:	OPG-DN Bowmanville, ON

Notes:
1. **Inspect silt fence weekly, damages must be corrected within 3 days**
2. **Inspect silt fence within 12 hour of rainfall**
3. **Check condition of fence, identify holes, damage, deficiency**

Date:	Name:			Company:	
				Description of Repair Required	Date Defiency Corrected
North	☐ Good	☐ Ok	☐ Repair Required		
South	☐ Good	☐ Ok	☐ Repair Required		
East	☐ Good	☐ Ok	☐ Repair Required		
West	☐ Good	☐ Ok	☐ Repair Required		

Date:	Name:			Company:	
				Description of Repair Required	Date Defiency Corrected
North	☐ Good	☐ Ok	☐ Repair Required		
South	☐ Good	☐ Ok	☐ Repair Required		
East	☐ Good	☐ Ok	☐ Repair Required		
West	☐ Good	☐ Ok	☐ Repair Required		

Date:	Name:			Company:	
				Description of Repair Required	Date Defiency Corrected
North	☐ Good	☐ Ok	☐ Repair Required		
South	☐ Good	☐ Ok	☐ Repair Required		
East	☐ Good	☐ Ok	☐ Repair Required		
West	☐ Good	☐ Ok	☐ Repair Required		

EXAMPLE

PGL

Vacuum Truck Tracking Form

BM-FORM-005-F1SMP Rev0

Project Information

Project Number:	4325-02.01 - F1 Laydown Area Sump Discharge	Client:	B&M/OPG-DN
Site Address:	OPG-DN Bowmanville, ON	PGL Staff:	

Notes: **1. Discharge flow rate must be monitored to be <20 L/s.**

Weather:

SUMP ID:	Sample ID:		
SUMP Volume:	Tritium (Bq/L):	TOC (mg/L):	pH:
Date Sampled:	TSS (mg/L):	GG (µCi/L):	O&G (mg/L):
Date Empty:			

Vac Truck #	Date of Discharge	Sample Collection (Y/N)	Volume Discharged (L)	Discharge Time (hh:mm) Start	Discharge Time (hh:mm) Stop	Flowrate (L/s)	Discharge Location	Comments
		Total Volume						

General Comments:

Page _____ of _____

EXAMPLE

PGL

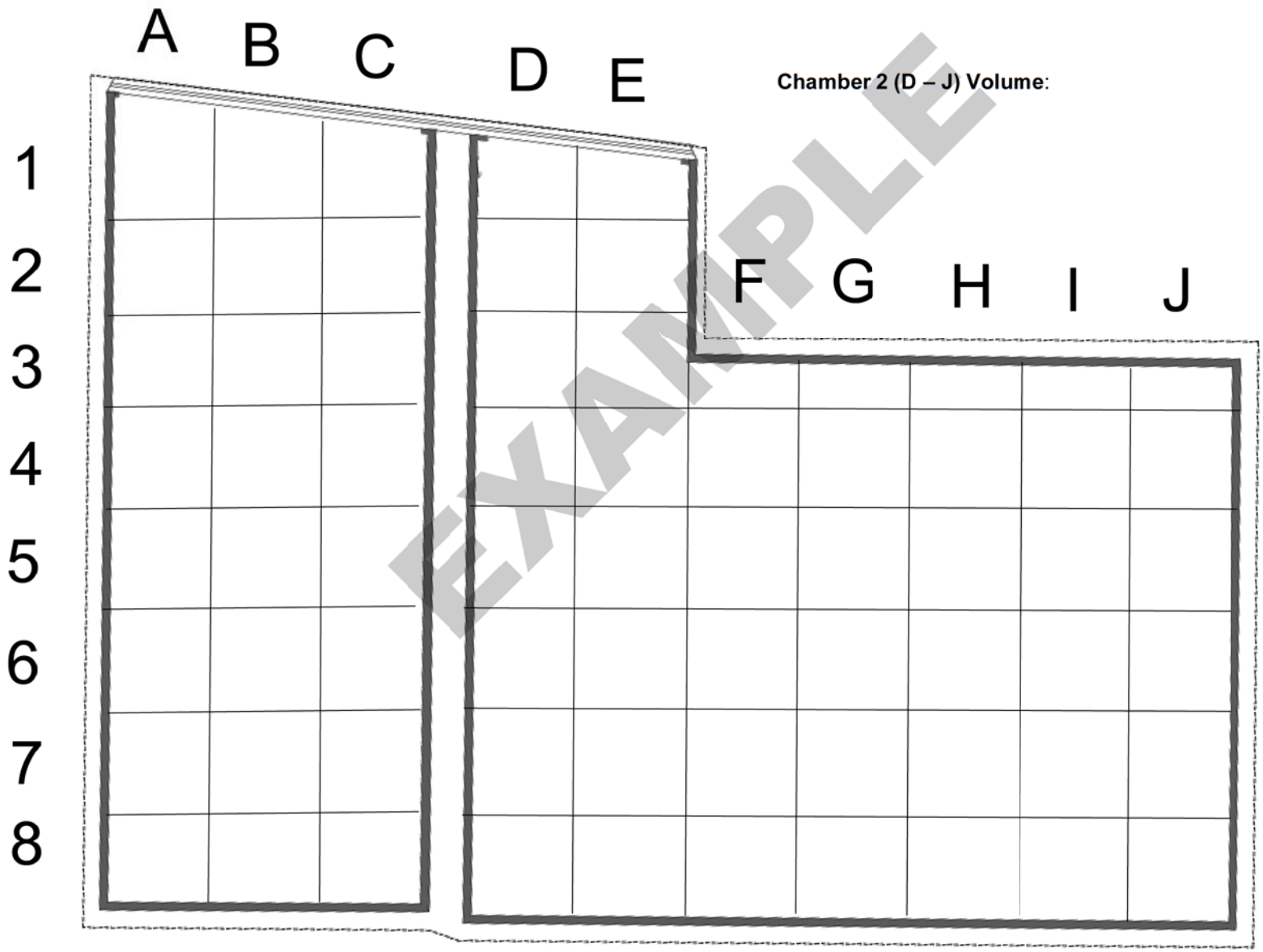
F1 Laydown Area Pad Grid Form

BM-FORM-006-F1SMP Rev0

Project Information				
	Project Number:	4325-02.01 - F1 Laydown Area	Client: B&M/OPG-DN	Date
	Site Address:	OPG-DN Bowmanville, ON	PGL Staff:	

Chamber 1 (A – C) Volume:

Chamber 2 (D – J) Volume:



Soil Pile Sampling Form

BM-FORM-007-F-19 Rev 0 112

Project Information				
	Project Number:	4325-02.01 F1 Laydown Area	Client:	B&M/OPG-DN
	Site Address:	OPG-DN Bowmanville, ON	PGL Staff:	

SOIL PILE ID: _____ DATE: _____

SOIL PILE ORIGIN: _____ PGL REP: _____

SOIL PILE LOCATION: _____ INSTRUMENT: _____

ESTIMATED SIZE: _____ CALIBRATION DATE: _____

SAMPLING FREQUENCY: _____ EXCAVATOR: _____ REP: _____

Sample Number	Volume (m^3)	Soil Type	OVM (ppmv)	Submitted Sample						Comments
				H_3	GG & GS	PHC	BTEX	VOC	M & I	

EXAMPLE

Soil Description
(minor/major soil type, texture, density, structure, colour, moisture)

A: _____

B: _____

C: _____

D: _____

E: _____

F: _____

Laboratory Parameter Submission

H_3: Tritium

GG & GS: Gross Gamma and Gamma Scan

PHC: Petroleum Hydrocarbons F1 - F4

VOC: Volatile Organic Compounds

BTEX: Benzene, Toluene, Eythlbenzene, Xylene

M & I: Metals and Inorganics

PGL

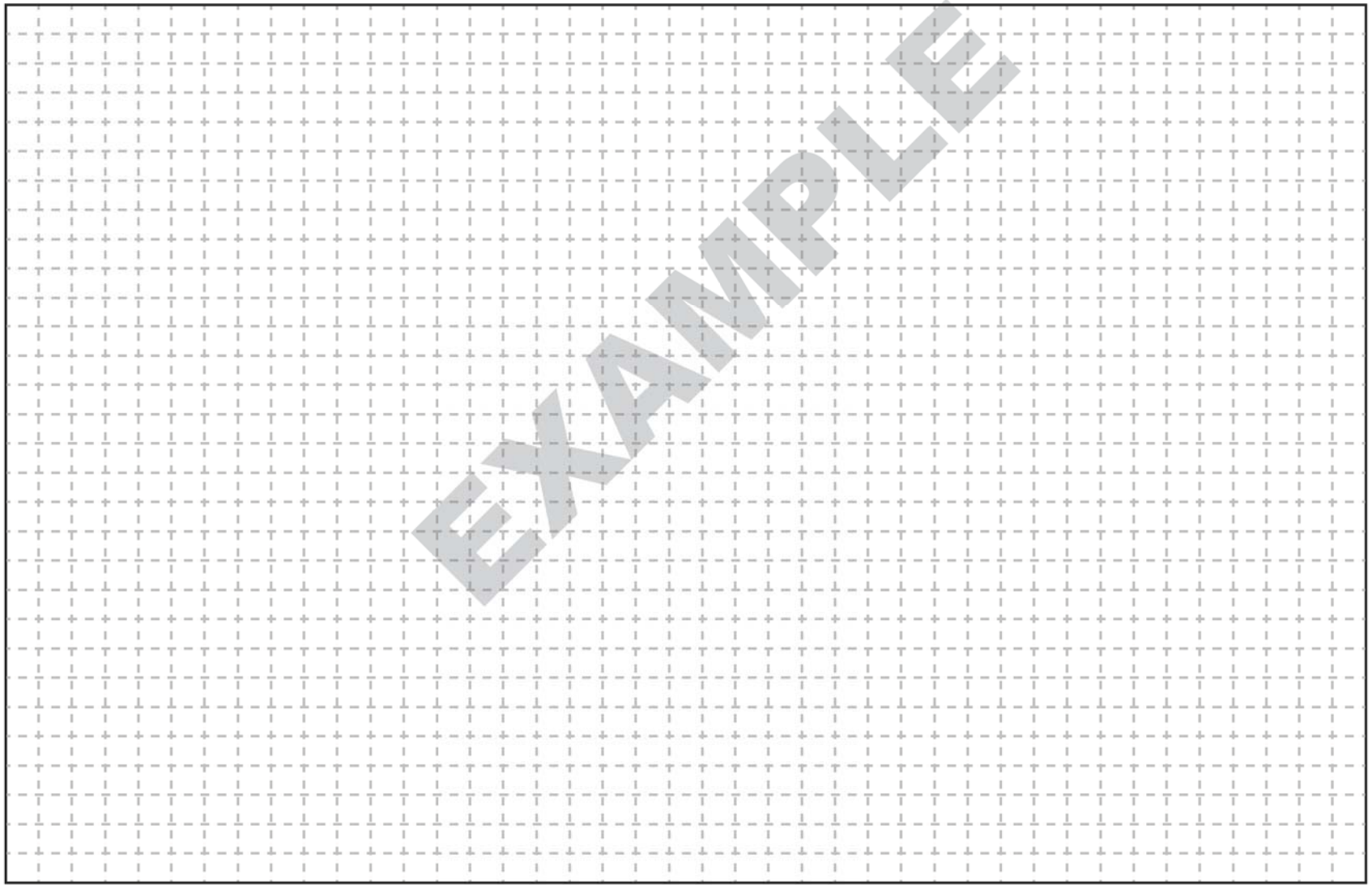
Soil Pile Sampling Sketch

BM-FORM-008-F1SMP Rev0

Project Information

Project Number:	4325-02.01 - F1 Laydown Area	Client:	B&M/OPG-DN
Site Address:	OPG-DN Bowmanville, ON	PGL Staff:	

Dimensions: _____ **Volume:** _____ **Number of Samples:** _____



APPENDIX E

Heavy Water Management Building Project: Campus Plan F1
Background Groundwater Review
Ontario Power Generation - Darlington Nuclear (OPG-DN)

Kinectrics Report: K-415072-004-TM-0004-R00
September 13, 2013

Kinectrics Inc
Analytical and Waste Services

Kinectrics Inc., 800 Kipling Avenue, Unit 2
Toronto, Ontario, Canada M8Z 5G5

Heavy Water Management Building Project: Campus Plan F1
Background Groundwater Review
Ontario Power Generation - Darlington Nuclear (OPG-DN)

Kinectrics Report: K-415072-004-TM-0004-R00
September 13, 2013

Prepared by: Pottinger Gaherty Environmental Consultants Ltd
Unit 102-250 Water Street
Whitby, ON, L1N 0G5

Reviewed by: Ruth Burany
Ruth Burany, PhD, PEng.
Engineer
Analytical and Waste Services
Kinectrics Inc

Approved by: for
Otto Herrmann, PhD
Department Manager
Analytical and Waste Services
Kinectrics Inc.

Dated: September 13, 2013

DISCLAIMER

This report was prepared for Black and McDonald under the Kinectrics Inc ISO 9001 Quality Program Registered with QMI. Kinectrics Inc. takes reasonable steps to ensure that all work performed shall meet the industry standards, and that all reports shall be reasonably free of errors, inaccuracies or omissions. This report was prepared in accordance with Purchase Order Number 48005626 R001.

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REVISIONS

Revision Number	Date	Comments	Approved
R00	September 13, 2013	Initial Release	OH

Pottinger Gaherty
Environmental Consultants Ltd.
250 Water Street, Unit 102
Whitby, ON Canada L1N 0G5
T 905.668.4908
F 905.668.4909
www.pggroup.com

Memo

PGL File #: 3821-01.03

DATE: September 16, 2013

TO: Ruth Burany, Kinectrics Inc.

FROM: Archana Uprety, PGL
Salima Jaffer, PGL
Will Gaherty, PGL

Re: Heavy Water Management Building Project: Campus Plan F1 Background Groundwater Review – Ontario Power Generation – Darlington Nuclear (OPG-DN)

PGL was retained by Black and McDonald to evaluate the existing groundwater condition in the wells near Campus Plan F1 area (F1) and develop a groundwater monitoring program to support the F1 soil management plan.

1.0 INTRODUCTION

F1 will receive soil excavated from the Protected Area during the excavation and construction work associated with the new D2O Heavy Water Management Building. A 2009 spill event in the Protective Area at the Heavy Water Management Building foot-print means excavated soil may be impacted with tritium. Therefore, OPG has requested the development of a groundwater monitoring program for F1.

2.0 PURPOSE

The purpose/objective of this memo is to:

- Review existing reports provided by OPG to determine up and downgradient tritium concentration in groundwater at F1;
- Review the reports to identify overburden and shallow bedrock groundwater-flow directions;
- Identify gaps in available data provided by OPG; and
- Develop a groundwater monitoring program to support the F1 soil management plan.

Our technical memo presents a review of existing wells, results of the groundwater programs from existing reports provided by OPG and the proposed groundwater monitoring program.

3.0 DATA

PGL reviewed specific sections (groundwater flow direction and analytical data) of the below listed reports provided by OPG:

- EcoMetrix Incorporated – *Darlington Nuclear Generating Station Groundwater Monitoring Program Design*, March 2012;
- Genivar – *OPG Darlington Nuclear Site Delineation of Areas of Elevated pH in vicinity of Former Truck Wash Area, August 2009*. OPG File Number: NK38-REP-07010-0266518; and

- CH2M HILL (Excerpt 3 pages) – *Ontario Power Generation Inc. New Nuclear – Darlington Project Geological and Hydrogeological Environment Existing Environmental Conditions* Technical Support Document, 2008. OPG File Number: NK054-REP-07730-00005.

PGL reviewed data from 3 grou ndwater wells at F1 and 25 we lls nearby to determine e xisting groundwater conditions. The groun dwater wells that were selected for review based on groundwater-flow direction, and proximity to F1 (Figure 3 and 4.4). Results were compared to Ontario Regulation 153/04 Table 3 Standards.

In aggregate, data was available from 17 of the 28 wells:

1) EcoMetrix contained maximum values measured from 2008 to 2012 from 12 wells for benzene, toluene, ethylbenzene, and xylen es (BTEX), petroleum hydrocarbons (PHC) fractions F1 to F4, metals/inorganics, volatile organic compounds (VOCs), tritium and gamma.
2) Two wells were analyzed for tritium only in February and June 2008.
3) Groundwater samples collected from the three wells at F1 were an alyzed for dissolved metals and inorganic parameters in December 2008.

There were exceedences of:

- Chloride in two wells;
- Selenium in one well;
- PHC fraction F3 in one well which a had concentration of 522 µg/L; and
- One well which had a concentration of 130Bq/L tritium, exceeding the F1 New Build limit of 100Bq/L.

All analytical results in the remaining wells were below the Table 3 Standards (See Table A).

Table A: Data Review

Groundwater Wells (EcoMetrix, March 2012)		
Well ID	**Analyzed Parameters**	**Exceedence**
MW010-18	-	NA
MW011-31	-	NA
MW012-5	-	NA
MW044-34	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	None
MW045-10	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	None
MW046-6	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	None
MW047-92	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	Chloride (37.2 M µg/L) exceeds the Table 3 Standards (2.3 M µg/L)
MW048-31	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	
MW049-20	-	NA
MW050-7	-	NA

Table A: Data Review (continued)

Groundwater Wells (EcoMetrix, March 2012)		
Well ID	**Analyzed Parameters**	**Exceedence**
MW052-15	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	Tritium (130 Bq/L) exceeds the F1 New Build limit of 100 Bq/L
MW053-31	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	PHC F3 (522µg/L) exceeds the Table 3 Standards (500µg/L).
MW054-20	-	NA
MW055-14	-	NA
MW056-85	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	Chloride (15.3M µg/L) exceeds the Table 3 Standards (2.3M µg/L)
MW057-27	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	Chloride (5.29M µg/L) and Selenium (234.7µg/L) exceed the Table 3 Standards (2.3M µg/L, 63µg/L, respectively)
MW058-6	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	None
MW059-12	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	None
MW063-98	No analytical	NA
MW064-40	BTEX and PHC F1-F4, Metals/Inorganics, VOC, Tritium and Gamma	None
MW065-25	-	NA
MW066-8	-	NA
MW106-29	-	NA
Groundwater Wells (C2M HILL, 2008)		
MW051-7	Tritium	None
MW105-6	Tritium	None
Groundwater Wells at F1 (Genivar, August 2009)		
MW08-12	Metals and inorganics	None
MW08-13	Metals and inorganics	None
MW08-14	Metals and inorganics	None

Notes: N/A = Not applicable
- = Not analyzed
M = Millions
Results evaluated against Ontario Regulation 135/04 Table 3
Last set of numbers in MW notation refer to depth of well in meters. For example, MW10-18 is 18 meters deep. This does not apply to the three wells at F1

GROUNDWATER FLOW DIRECTION

Based on the EcoMetrix report, overburden groundwater-flow direction is towards the southeast and the shallow groundwater-bedrock flow is towards the south.

3.1 DATA GAPS

PGL reviewed groundwater data from 28 wells; 11 wells did not have any analytical results available and 3 of the wells (at F1) were only analyzed for metals and inorganics. Therefore, a total of 14 wells did not have background tritium results available for review. The groundwater wells with no tritium results include the following wells: F1 wells (MW08-12 to MW0 8-14), and 1 1 downgradient wells (M W010-18, MW011-31, MW012-5, MW49-20, MW050-14, MW054-20, MW055-14, MW063-98, MW065-25, MW066-8, and MW106-29).

4.0 PROPOSED GROUNDWATER MONITORING PROGRAM

As part of the long-term strategy for groundwater protection at F1, PGL recommends a groundwater-monitoring and sampling program. No new wells are required. Eight existing groundwater wells were selected for the monitoring program which includes existing wells near and downgradient of F1 and wells with limited or no available analytical results. This includes the following wells:

- One upgradient well (MW105-6);
- Three F1 wells (MW08-12 to MW08-14); and
- Four downgradient wells (MW050-14, MW051-7, MW058-6, and MW059-12).

PGL recommends that the wells selected for the monitoring program that do not have baseline tritium results (MW08-12 to MW08-14, and MW050-14) be sampled for tritium before any soil is staged at F1.

PGL recommends quarterly monitoring and sampling as presented in Table B. The monitoring and sampling will begin approximately four months after F1 is in use and will be continued for as long as soil is staged at F1.

Table B: F1 Groundwater Monitoring program

Objective	Monitor tritium concentrations in wells in close proximity to F1.		
Monitoring Well	**Frequency**	**Analysis Parameter**	**Considerations**
MW08-12	Quarterly	Tritium	At F1
MW08-13	Quarterly	Tritium	At F1
MW08-14	Quarterly	Tritium	At F1
MW050-14	Quarterly	Tritium	South Site Boundary
MW051-7	Quarterly	Tritium	South Site Boundary
MW058-6	Quarterly	Tritium	Southeast Site Boundary
MW059-12	Quarterly	Tritium	Southeast Site Boundary
MW105-6	Quarterly	Tritium	North Site Boundary
Method detection limit for tritium:		100 Bq/L	

5.0 STANDARD LIMITATIONS

PGL prepared this memo for our client and its agents exclusively. PGL accepts no responsibility for any damages that may be suffered by third parties as a result of decisions or actions based on this report. The memo's purpose is to transmit and interpret monitoring data and so will need to be used in conjunction with previous reports by PGL or others. As is true for all environmental investigations, potential remains for the presence of unknown, unidentified, or unforeseen surface or subsurface contamination. More or different investigation may be required if other risks are identified. The data presented in this report is valid for the date of sampling, but site conditions may change with time.

The findings and conclusions are Site-specific and were developed in a manner consistent with that level of care and skill normally exercised by environmental professionals currently practicing under similar conditions in the area. Changing assessment techniques, regulations, and site conditions means that environmental investigations and their conclusions can quickly become dated, so this memo is for use now. The memo should not be used after that without PGL review/approval.

The project has been conducted according to our instructions and work program. Additional conditions and limitations on our liability are set forth in our work program/contract. No warranty, express or implied, is made.

Attachments: Figure 3 – Genivar – Groundwater Monitoring Wells Locations
Figure 4.4 – EcoMetrix – Groundwater Monitoring Wells Locations

DATE : June 2009	**Groundwater Flow Direction**	GENIVAR
SCALE : See Map		
FILE No. : MA-08-256-00-MA	**OPG Darlington Nuclear Site**	FIG No.: 3 / REV
APP'VD : M.H.		

Ontario Power Generation

Groundwater Monitoring Well Locations - Site Wide

EcoMetrix INCORPORATED | ONTARIO POWER GENERATION | Figure 4.4