



Initial Subsurface Investigation – Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoate (PFOA)

**Former Fire Training Facility,
9800 Airport Road, Hamilton, ON**

Project Number
Hamilton International Airport

Project Number
HAM-000200231-A0

Prepared By:
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Date Submitted
December 9, 2011



The new identity of **Trow Associates**

December 9, 2011

Mr. Frank Scremin
John C. Munro Hamilton International Airport
9300 Airport Road, Suite 2206
Mount Hope, Ontario
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Re: **Initial Subsurface Investigation - Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoate (PFOA)
Former Fire Training Facility, Hamilton International Airport
9800 Airport Road, Hamilton, Ontario
exp reference: HAM-00200231-A0**

Dear Mr. Scremin:

As per your request, we have completed the Initial Subsurface Investigation to determine the presence or absence of Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoate (PFOA) within soil, groundwater, surface water and sediment in the vicinity of the former fire training area at the Hamilton International Airport. The results and discussion of the investigation are presented in the attached report.

Please note that the purpose of this preliminary report was to confirm the presence/absence of PFOS and PFOA only. Additional work will be required to assess lateral and vertical extent and ultimately provide remedial recommendations.

We trust this information is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Yours truly,

exp Services Inc.

A handwritten signature in blue ink, appearing to read "Erik Enders".

Erik Enders, B.Sc.
Environmental Scientist

A handwritten signature in blue ink, appearing to read "Darko Strajin".

Darko Strajin, P. Eng.
Manager Central Ontario – Environmental Services



Executive Summary

Exp Services Inc. (exp) was retained by the Hamilton International Airport (HIA) of Hamilton, Ontario to complete a historical review and conduct an initial subsurface environmental investigation at the former fire training facility located on the property at 9800 Airport Road, Hamilton, Ontario hereinafter referred to as the 'Site'.

A figure showing the location of the Site and a Site plan is included in Appendix A. Authorization to proceed with the investigation was provided by Mr. Frank Scremin, Director of Operations, HIA.

The purpose of the initial subsurface investigation was to determine the presence or absence of Perfluorooctane sulfonate (PFOS) and perfluorooctanoate (PFOA) within the soil, groundwater, surface water and sediment in the vicinity of the former fire training facility at the HIA.

Perfluorinated Alkyl Chemicals (PFCs) are a group of man-made chemicals which consist of carbon chains saturated with fluorine atoms. The carbon-chains terminate in an end group such as a sulfonate or carboxylate group (Siemens Kennedy and Paterson, 2008). PFCs have been used in a variety of consumer and industrial products, including use as surfactants in fire-fighting foams and the electroplating industry, fabric coatings, carpet coatings, paper coatings, floor polish, alkaline cleaners, denture cleaners, shampoos, aviation hydraulic fluid, mining/oil well surfactants, acid rust suppressant and ant/roach insecticides. The term PFC may indicate perfluorocarbons, but is often used to include perfluorocarbon derivatives. The two PFCs derivatives manufactured in the largest amounts were PFOA and PFOS.

The PFCs used in Aqueous Film-Forming Foam (AFFF) reduce the surface tension of water, allowing an aqueous film to spread over the flammable liquid and further act as vapour sealants during fire-fighting. In recent years, research has focused on the environmental fate and impact of the eight carbon chain carboxylate and sulfonate compounds, PFOA and PFOS. The chemical bond of the carbon and fluorine is very strong making PFCs persistent in the environment. In addition, PFOS is reportedly "resistant to hydrolysis, photolysis, microbial degradation and metabolism by vertebrates" (Environment Canada, 2006).

The former fire training facility is approximately 1.6 ha in size and consists mainly of loosely packed gravel pad with some vegetation and was reportedly constructed in 1985. The gravel pad is gently sloped from a perimeter ditch that captures surface water runoff from the Site. The ditch appears to convey surface water runoff to a small pond located approximately 27 m south of the gravel pad's south edge. The pond discharges water into a ditch which also carries discharge water from approximately 9 ha of upstream drainage area. A simulation fuselage is located in the centre of the Site. Underground fuel lines connect the fuselage to a fuel operating station located on the northeast corner of the pad. Typical fire-fighting sessions included using petroleum hydrocarbons to ignite the fuselage and fire crews would practice extinguishing the fires using AFFF products. The Fire Training facility was in use by Transport Canada as a Regional fire training facility between 1985 and 1994, prior to Tradeport taking over Site operations. Currently there is no fire training carried out at the facility

The Ministry of the Environment (MOE) undertook an investigation in the Spring of 2011 to further advance the knowledge of potential sources and distribution of PFOS within the Welland River and Lake Niapenco (PFOS in the Welland River and Lake Niapenco, MOE, June 3, 2011). PFOS was historically found in elevated concentrations in select aquatic organisms in a study completed by Environment Canada. Concentrations were also found in fish, which lead to issuing a fish consumption advisory at the Binbrook Conservation Area. As indicated by the water quality data, the MOE concluded that the predominant source of PFOS is occurring from the HIA. No measurable water or sediment contributions from the closed Glanford Landfill site (located downgradient of the HIA) were observed at the time of their investigation.

The scope of work undertaken by exp in June of 2011 included a review of the Site history, installation of groundwater monitoring wells and collection of surface water, sediment, soil and ground water samples

to determine the presence/absence of PFOS, PFOA and associated compounds within the sub-surface of the Fire Training Facility.

Based on the results of the initial subsurface investigation conducted at the Site, the following findings are presented:

- 1) The general stratigraphy at the Site, as observed in the boreholes, consists of gravel and silt fill material, overlying native silt to silty clay till.
- 2) Regional groundwater flow is expected to be generally north towards Lake Ontario. Shallow groundwater at the former fire training area generally flows north. Depth to groundwater ranges from 1.4 to 5.0 m below ground surface (bgs) across the former fire training area.
- 3) Measurable concentrations of PFOS and PFOA were detected in soil, groundwater, sediment and surface water samples collected from the former fire training facility.

The following recommendations are presented for your consideration:

- 1) It is recommended that additional boreholes and groundwater monitoring wells be completed on-site to further delineate PFOS and PFOA concentrations within the soil and groundwater on the former fire training facility site. It is noted that several surface water and sediment samples have been collected by the MOE, both on and off-site which identifies areas of concern within drainage ditches in the vicinity of the former fire training area.
- 2) It is recommended that a preliminary Risk Assessment be undertaken at the Site to determine soil, groundwater and sediment Site specific standards.
- 3) As recommended in the letter report dated June 15, 2011, Culverts #1 (upgradient) and #2 (within Pond) were plugged as a short term mitigation measure to prevent the flow of surface water onto or off of the Site. Water levels within the ditch and pond should be monitored on a weekly basis.
- 4) Concurrent with the soil and groundwater delineation program, it is recommended that a bench scale study using Nanozox™ be undertaken to determine concentrations of ozone required to treat groundwater. In addition, a bench scale study using cement kiln dust and a binding agent to stabilize/solidify the soil should be undertaken within the area identified as having the highest concentrations of PFOS and PFOA. The remainder of the former fire training area should be capped to prevent infiltration or surface water flow on the Site.

This executive summary is a brief synopsis of the report and should not be read in lieu of reading the report in its entirety.

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1. Introduction and Background

Exp Services Inc. (exp) was retained by John C. Munro Hamilton International Airport (HIA) of Hamilton, Ontario to complete a historical review and conduct an initial subsurface environmental investigation at the former fire training facility located on the property at 9800 Airport Road, Hamilton, Ontario herein after referred to as the 'Site'.

A figure showing the location of the Site and a Site plan is included in Appendix A. Authorization to proceed with the investigation was provided by Mr. Frank Scremin, Director of Operations, HIA.

The purpose of the limited subsurface investigation was to determine the presence or absence of perfluorooctanoate acid (PFOA) and perfluorooctane sulfonate acid (PFOS) within the soil, groundwater, surface water and sediment within the vicinity of the former fire training facility at the HIA.

1.1 Site Description and History

HIA was first built in October 1940 as a wartime air force training station. Originally designed as a multi-purpose military field, the airport was used for flight training, air navigation, telegraphy, and air gunnery. After World War II, the airport transitioned from a military establishment into a public facility. In 1981 construction to expand the existing airport began. Expansion to HIA was complete by 1986 and the new facility attracted larger aircraft and accommodated increased passenger and cargo traffic. The airport facility and grounds were owned and operated by Transport Canada until 1995, at which time the City of Hamilton purchased the property. Beginning in 1996 Tradeport International Corporation was chosen to undertake the management of the HIA and associated businesses and operators.

The former fire training facility is approximately 1.6 ha in size and consists mainly of loosely packed gravel pad with some vegetation and was reportedly constructed in 1985. The gravel pad is gently sloped from a perimeter ditch that captures surface water runoff from the Site. The ditch appears to convey surface water runoff to a small pond located approximately 27 m south of the gravel pad's south edge. The pond discharges water into a ditch which also carries discharge water from approximately 9 ha of upstream drainage area. A simulation fuselage is located in the centre of the Site. Underground fuel lines connect the fuselage to a fuel operating station located on the northeast corner of the pad. Typical fire-fighting sessions included using petroleum hydrocarbons to ignite the fuselage and fire crews would practice extinguishing the fires using Aqueous Film-Forming Foam (AFFF) products.

The Fire Training facility was in use by Transport Canada as a Regional fire training facility between 1985 and 1994. Aerial photographs reviewed as part of this investigation indicate that the fire training facility was constructed in 1985. Prior to 2005 aerial photographs indicate that there was a berm located around the central grassy area that houses the fuselage. This berm was removed sometime after 2005 and a layer of granular material was spread over the Site.

The fire training facility was taken out of service in 1994. In 1995 the following report was completed for the area "*Surface and Groundwater Monitoring Program at the Hamilton Airport Fire Training Area, Final Report, Decommissioning Consulting Services Limited, July 1995*". This report concluded that there was potential risk to the environment from the fire training area from surface water pathways. Reportedly, groundwater samples collected at the time of the investigation did not indicate contamination of groundwater was present.

Currently there is no fire training carried out at the facility.

1.2 PFOS, PFOA and AFFF

Perfluorinated Alkyl Chemicals (PFCs) are a group of man-made chemicals which consist of carbon chains saturated with fluorine atoms. The carbon-chains terminate in an end group such as a sulfonate or carboxylate group (Siemens Kennedy and Paterson, 2008). PFCs have been used in a variety of

consumer and industrial products, including use as surfactants in fire-fighting foams and the electroplating industry, fabric coatings, carpet coatings, paper coatings, floor polish, alkaline cleaners, denture cleaners, shampoos, aviation hydraulic fluid, mining/oil well surfactants, acid rust suppressant and ant/roach insecticides. The term PFC may indicate perfluorocarbons, but is often used to include perfluorocarbon derivatives. The two PFCs derivatives manufactured in the largest amounts were PFOA and PFOS.

The PFCs used in AFFF reduce the surface tension of water, allowing an aqueous film to spread over the flammable liquid and further act as vapour sealants during fire-fighting. In recent years, research has focused on the environmental fate and impact of the eight carbon chain carboxylate and sulfonate compounds, PFOA and PFOS. The chemical bond of the carbon and fluorine is very strong making PFCs persistent in the environment. In addition, PFOS is reportedly “resistant to hydrolysis, photolysis, microbial degradation and metabolism by vertebrates” (Environment Canada, 2006).

The MOE undertook an investigation in the Spring of 2011 to further advance the knowledge of potential sources and distribution of PFOS within the Welland River and Lake Niapenco (*PFOS in the Welland River and Lake Niapenco, MOE, June 3, 2011*). PFOS was historically found in elevated concentrations in select aquatic organisms in a study completed by Environment Canada. Concentrations were also found in fish, which lead to issuing a fish consumption advisory at the Binbrook Conservation Area.

The MOE completed their study in two phases of field work. Phase 1 was conducted on May 2nd 2011, and Phase II will potentially be completed in late summer of 2011. Sampling efforts investigated the quality of water and sediment within the Welland River upstream of Lake Niapenco to aid in identifying the source of PFOS.

The MOE selected a total of 15 sampling locations to ascertain concentrations of PFOS in the Welland River, within tributaries of the Welland River, and at the outlet of Lake Niapenco with one additional sampling site located within the Twenty Mile Creek Watershed. All locations were sampled for water however only 9 locations were sampled for sediment.

The water quality results indicated to the MOE that the HIA is the primary source of PFOS relative to background concentrations. Also, PFOS concentrations exceed the lowest observed effect concentration (LOEC) at both on-site testing locations and off-site testing locations adjacent to the airport. Based on the concentrations at sampling locations HIA Pond and Ditch, impacts to aquatic organisms are expected by the MOE.

Based on the water quality data, the MOE concluded that the predominant source of PFOS is occurring from the HIA. No measurable water or sediment contributions from the closed Glanford Landfill site (located downgradient of the HIA) were observed at the time of their investigation.

1.3 Scope of Work

The scope of work included a review of the Site history, borehole drilling, installation of groundwater monitoring wells and collection of surface water, sediment, soil and ground water samples to determine the presence/absence of PFOS and PFOA within the area of the Fire Training Facility.

2. Methodology

2.1 Drilling and Soil Sampling

Prior to the commencement of drilling activities, the locations of underground utilities including telephone, natural gas and electrical lines were marked out by a private utility locating service that also cleared the individual borehole locations.

The fieldwork for the subsurface investigation was completed on June 16, 2011. A total of three (6) boreholes (BH-1 to BH-6) were advanced at the Site by Profile Drilling Inc. (Profile) under the full-time supervision of **exp** staff. A direct push, continuous core Geoprobe was used to advance the boreholes on-site. No petroleum-based greases or solvents were used during drilling activities. Boreholes were advanced to completion depths between approximately 3.5 and 5.0 m below ground surface (bgs).

The approximate locations of the boreholes and monitoring well are shown on the Borehole Location Plan (Figure 2).

Exp continuously monitored the drilling activities to record the physical characteristics of the soil, depth of soil sample collection and total depth of boreholes. Field observations are summarized on the borehole logs provided in Appendix B. Representative soil samples were recovered in the overburden of the boreholes at regular intervals using a continuous core sampler with PVC liners in all boreholes.

Dedicated nitrile gloves (i.e., one pair per sample) were used during sample handling. A portion of each soil core was placed directly into pre-cleaned, laboratory-supplied glass sample jars/vials. All soil samples were placed in clean ice-packed coolers prior to and during transportation to the subcontract laboratory, Maxxam Analytics Inc. (Maxxam) of Mississauga, Ontario. The samples were transported/submitted under Chain of Custody documentation.

Soil samples were selected for laboratory analysis on the basis of potential for contaminant presence and/or water-bearing zones. The following soil samples were submitted for laboratory analysis:

Table 2.1: Summary of Soil Samples Submitted for Chemical Analyses

Sample Identification	Depth (m bgs)	Rationale	Analysis
BH-1 S1	0 – 0.6	Surficial soil sample – potential area of impact from AFFF	PFOS, PFOA
BH-1 S3	1.2 – 1.8	Potential water bearing zone	
BH-1 S5	2.1 – 2.6	Vertical delineation	
BH-1 S6	2.6 – 3.4	Vertical delineation	
BH-1 S7	3.4 – 4.3	Vertical delineation	
BH-1 S8	4.3 – 4.7	Vertical delineation	
BH-2 S1	0 – 0.6	Surficial soil sample – potential area of impact from AFFF	
BH-2 S3	1.2 – 1.8	Potential water bearing zone	
BH-2 S5	2.1 – 2.6	Vertical delineation	
BH-3 S1	0 – 0.6	Surficial soil sample – potential area of impact from AFFF	
BH-3 S3	1.2 – 1.8	Potential water bearing zone	
BH-4 S1	0 – 0.6	Surficial soil sample – potential area of impact from AFFF	
BH-4 S3	1.2 – 1.8	Potential water bearing zone	
BH-4 S5	2.1 – 2.6	Vertical delineation	
BH-5 S1	0 – 0.6	Surficial soil sample – potential area of impact from AFFF	
BH-5 S3	1.2 – 1.8	Potential water bearing zone	
BH-5 S5	2.1 – 2.6	Vertical delineation	
BH-6 S1	0 – 0.6	Surficial soil sample – potential area of impact from AFFF	
BH-6 S3	1.2 – 1.8	Potential water bearing zone	
BH-6 S5	2.1 – 2.6	Vertical delineation	

Note: PFOS – perfluorooctane sulfonate
 PFOA – perfluorooctanoate
 bgs – below ground surface

2.2 Monitoring Well Installations

Three (3) groundwater monitoring wells were installed at the Site (MW-1, MW-2 and MW-3). The monitoring wells were installed in general accordance with the Ontario Water Resources Act – R.R.O. 1990, Regulation 903 – Amended to O. Reg. 128/03 and were installed by a licensed drilling contractor (Profile).

The monitoring wells consisted of a 3.2 m length of 38 mm diameter PVC screen and an appropriate length of PVC riser pipe. The annular space around the well was backfilled with sand to a height of 0.3 m above the top of the screen. A bentonite seal was added from the top of the sand pack to approximately 0.3 m below ground surface. The monitoring wells were completed with a flush mount protector at ground surface.

When the monitoring wells are no longer required, they must be decommissioned in accordance with the procedure outlined in the Ontario Water Resources Act – R.R.O. 1990, Regulation 903 – Amended to O. Reg. 128/03.

The installation details of the monitoring wells are summarized in Table 2.2.

Table 2.2: Monitoring Well Installation Details

Monitoring Well	Surface Elevation (m)	Top of Sand Elevation (m)	Top of Screen Elevation (m)	Bottom of Screen Elevation (m)	Screened Interval (mbgs)	Bottom of Borehole Elevation (m)	Depth of Borehole (mbgs)
MW-1	233.88	232.58	232.18	229.68	1.7 – 4.7	229.68	4.7
MW-2	232.88	231.68	231.18	228.08	1.7 – 4.8	228.08	4.8
MW-3	233.86	232.66	231.96	228.96	1.9 – 4.9	228.96	4.9

Note: Elevations were measured in relation to a local benchmark as provided during the surface water/drainage investigation completed in 2009.

2.3 Groundwater Sampling

Following development of a minimum of three volumes of groundwater from each well, a groundwater sample was collected from monitoring well MW-2 on June 16, 2011 (Figure 2). In addition, groundwater samples were collected from existing on-site groundwater monitoring wells MW-A17-1, MW-E1A, MW-E2B, MW-E3B on June 20, 2011. A groundwater sample was collected from monitoring wells MW-1 and MW-3 on June 17, 2011. A total of eight (8) groundwater samples (including one field duplicate) were submitted to Maxxam for chemical analysis of PFOS and PFOA.

2.4 Sediment Sampling

Three sediment samples were collected from the vicinity of the former fire training facility for laboratory analysis. Sediment samples were collected from near surface as grab samples and were placed directly into pre-cleaned, laboratory-supplied glass sample jars/vials. All sediment samples were placed in clean ice-packed coolers prior to and during transportation to Maxxam. The samples were transported/submitted under Chain of Custody documentation.

Table 2.4: Sediment Samples Submitted for Analysis

Sample Identification	Sample Location	Analysis
SED-1	Upgradient of fire training facility near west border of airport	PFOS, PFOA
SED-2	Downgradient of fire training facility from within perimeter ditch	
SED-PD	Collection pond downgradient of fire training facility	

Note: PFOS – perfluorooctane sulfonate
 PFOA – perfluorooctanoate

2.5 Surface Water Sampling

Three surface water samples were collected from the vicinity of the former fire training facility for laboratory analysis. Surface water samples were collected from near surface as grab samples and were placed directly into pre-cleaned, laboratory-supplied glass sample jars/vials. All surface water samples were placed in clean ice-packed coolers prior to and during transportation to the subcontract laboratory, Maxxam Analytics Inc. (Maxxam) of Mississauga, Ontario. The samples were transported/submitted under Chain of Custody documentation. Surface water samples were collected directly from the location of the collection of the sediment samples.

Table 2.5: Surface Water Samples Submitted for Analysis

Sample Identification	Sample Location	Analysis
SW-1	Upgradient of fire training facility near west border of airport	PFOS, PFOA
SW-1	Downgradient of fire training facility from within perimeter ditch	
SW-Pond	Collection pond downgradient of fire training facility	

Note: PFOS – perfluorooctane sulfonate
 PFOA – perfluorooctanoate

3. Observations

3.1 Subsurface Conditions

The detailed soil profiles encountered in each borehole are provided on the attached borehole logs (Appendix B). Boundaries of soil indicated on the log sheets are intended to reflect transition zones for the purpose of environmental assessment and should not be interpreted as exact planes of geological change. The general stratigraphy at the Site, as observed in the boreholes, consists of gravel and silt fill material, overlying native silt and silty clay till. A brief description of the soil stratigraphy at the Site, in order of depth, is summarized in the following sections.

3.1.1 Fill Material

Gravel ranging from 0.2 to 0.5 m in thickness was encountered at surface in all boreholes. A faint petroleum hydrocarbon odour was observed in granular material at surface in BH-2. Fill material predominately consisting of brown silt was encountered below gravel layers in BH-1 and BH-3 to approximately 1 m bgs (below ground surface).

A granular layer was encountered at approximately 1.0 m bgs underlying the silt fill at BH-1. A faint petroleum hydrocarbon odour was observed within the gravel layer.

3.1.2 Native Material

Brown silt was observed in all boreholes ranging in depth from 1.6 to 3.7 m bgs. Solvent odour and faint petroleum hydrocarbon odour were observed in BH-1. Faint petroleum hydrocarbon odour was also observed in BH-3 within the native material.

Brown silt till to gray silty clay till was observed below the silt layer in all boreholes to depth.

3.2 Groundwater

The depth to groundwater was measured on June 16, June 17 and June 20, 2011 from newly installed and existing on-site monitoring wells installed by others.

Table 3.2: Groundwater Depths

Monitoring Well	Groundwater Depth (m bgs)	Groundwater Depth (m bgs)	Groundwater Depth (m bgs)
Date	16-Jun-11	17-Jun-11	20-Jun-11
MW-1		4.20	
MW-2		4.54	
MW-3	1.38		2.93
MW-A17-1	1.81		
MW-E1A	3.58		
MW-E1B	4.26		
MW-E1C	4.99		
MW-E2A	2.01		
MW-E2B	2.80		
MW-E3A	1.94		
MW-E3B	3.10		
MW-E3C			

Note: mbgs – meters below ground surface

Regional groundwater flow is expected to generally flow to the north towards Lake Ontario. Local groundwater generally flows north across the former fire training area.

It should be noted that only a single round of groundwater measurements were taken and the existence of equilibrium conditions (quasi-static water levels) has not been confirmed within MW-1, MW-2 and MW-3.

3.3 Single Well Response Test (SWRT)

A single well response test (SWRT) was performed in monitoring well MW-1 on June 28, 2011, to establish the hydraulic conductivity of groundwater within the former fire training facility area. The well was purged dry and the water level of the groundwater recovering within the well was measured at regular time intervals (rising-head test).

The field data from the SWRT test and interpretation are included in Appendix C.

Based on the SWRT results, the hydraulic conductivity value for the MW-1 was 10⁻⁹ m/s, which is soil with low permeability.

4. Soil, Groundwater, Sediment and Surface Water Quality

4.1 General

In accordance with the scope of work, chemical analyses were performed on selected soil samples recovered from the boreholes. Soil samples were selected for laboratory analysis on the basis of potential for contaminant presence and/or water-bearing zones.

Copies of the laboratory Certificates of Analysis for the analyzed samples are provided in Appendix D.

4.2 Soil Quality

Twenty (20) soil samples were analyzed for PFOS and PFOA. The results of the analysis are presented below in Table 4.2.

Table 4.2: Analytical Results for PFOS and PFOA for Soil Samples

SAMPLE ID	PFOS	PFOA
BH-1 S1 (0 – 0.6 m)	16	0.350
BH-1 S3 (1.2 – 1.8 m)	0.230	0.110
BH-1 S5 (2.1 – 2.6 m)	0.930	0.041
BH-1 S6 (2.6 – 3.4 m)	0.700	0.023
BH-1 S7 (3.4 – 4.3 m)	0.340	0.055
BH-1 S8 (4.3 – 4.7 m)	0.041	0.037
BH-2 S1 (0 – 0.6 m)	0.120	0.033
BH-2 S3 (1.2 – 1.8 m)	0.260	0.051
BH-2 S5 (2.1 – 2.6 m)	<0.025	<0.0025
BH-3 S1 (0 – 0.6 m)	26	0.220
BH-3 S3 (1.2 – 1.8 m)	<0.025	0.022
BH-4 S1 (0 – 0.6 m)	0.270	<0.0025
BH-4 S3 (1.2 – 1.8 m)	0.200	0.0052
BH-4 S5 (2.1 – 2.6 m)	<0.025	0.0082
BH-5 S1 (0 – 0.6 m)	0.210	<0.0025
BH-5 S3 (1.2 – 1.8 m)	0.063	0.011
BH-5 S5 (2.1 – 2.6 m)	<0.025	0.0030
BH-6 S1 (0 – 0.6 m)	0.110	<0.0025
BH-6 S3 (1.2 – 1.8 m)	<0.025	<0.0025
BH-6 S5 (2.1 – 2.6 m)	<0.025	<0.0025

Notes: Concentrations are expressed in mg/kg
 PFOS – perfluorooctane sulfonate
 PFOA – perfluorooctanoate

As shown in Table 4.2, concentrations of PFOS were generally detected in select soil samples between 0 and 1.8 m below ground surface (bgs). PFOS was not detected by the laboratory deeper than 1.2 – 1.8 m bgs at BH-3 and BH-6. PFOS was not detected by the laboratory deeper than 2.1 – 2.6 m bgs at BH-2, BH-4 and BH-5. PFOS was detected to the maximum sampled depth of 4.7 m bgs in BH-1.

PFOA was not detected in near surface soil (0 – 0.6 m bgs) in BH-4 and BH-5. PFOA was not detected in BH-6. PFOA concentrations decreased with depth to a depth of 4.7 m bgs. PFOA was detected to a depth of 2.6 m bgs in BH-3, BH-4 and BH-5 and to a depth of 1.8 m bgs in BH-2.

4.3 Groundwater Quality

Seven (7) groundwater samples were analyzed for PFOS and PFOA. The results of the analysis are presented below in Table 4.3.

Table 4.3: Analytical Results for PFOS and PFOA for Groundwater Samples

SAMPLE ID	PFOS	PFOA
MW-1	560	130
MW-2	4.7	5.6
MW-3	18	2.1
MW-A17-1	8.2	1.3
MW-E1A	<0.02	<0.02
MW-E2B	<0.02	<0.02
MW-E3B	2.8	0.67

Notes: Concentrations are expressed in µg/L
 PFOS – perfluorooctane sulfonate
 PFOA – perfluorooctanoate

PFOS and PFOA parameters in the submitted groundwater samples were not detected above the laboratory MDLs at monitoring wells MW-E1A and MW-E2B. Concentrations of PFOS and PFOA were detected at MW-1, MW-2, MW-3, MW-A17-1 and MW-E3B.

4.4 Sediment Quality

Three (3) sediment samples were analyzed for PFOS and PFOA. The results of the analysis are presented below in Table 4.4.

Table 4.4: Analytical Results for PFOS and PFOA for Sediment Samples

Parameter	PFOS	PFOA
SED 1	0.044	<0.0025
SED 2	3	0.027
SED-PD	1.1	0.0084

Notes: Concentrations are expressed in mg/kg
 PFOS – perfluorooctane sulfonate
 PFOA – perfluorooctanoate

Concentrations of PFOS were detected in all sediment sampling locations. It is noted that SED 1 was collected upgradient of the former fire training facility. Concentrations of PFOA were detected in sediment samples collected from the perimeter ditch (SED 2) and the collection pond (SED-PD).

4.5 Surface Water Quality

Three (3) surface water samples were analyzed for PFOS and PFOA. The results of the analysis are presented below in Table 4.5.

Table 4.5: Analytical Results for PFOS and PFOA for Sediment Samples

Parameter	PFOS	PFOA
SW 1	1.2	0.15
SW 2	22	2.0
SW-POND	45	2.6

Notes: Concentrations are expressed in µg/L
PFOS – perfluorooctane sulfonate
PFOA – perfluorooctanoate

Concentrations of PFOS and PFOA were detected in all surface water sampling locations. It is noted that SW 1 was collected from upgradient of the former fire training facility.

4.6 Quality Assurance

Details regarding quality assurance measures taken in the field, including instrument calibration, decontamination procedures, use of dedicated equipment, sample storage and Chain of Custody documentation are provided in Section 2, Methodology.

The subcontract laboratory used during this investigation, Maxxam Analytics Inc., is accredited by the Standards Council of Canada/Canadian Association of Environmental Analytical Laboratories in accordance with ISO/IEC 17025:1999 – “General Requirements for the Competence of Testing and Calibration Laboratories” for the analysis of all parameters for all samples in the scope of work for which SCS have been established under Ontario Regulation 153/04.

The “Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” (“the Analytical Protocol”), MOE, March 2004, establishes criteria used in assessing the performance of analytical laboratories when the data are used in support of the filing of Records of Site Condition.

The laboratory quality assurance program included the analysis of laboratory duplicate (replicate) samples, method blanks, spiked blanks, spiked samples and samples of reference materials in accordance with the Analytical Protocol. These analytical results comprise portions of the Certificates of Analysis in Appendix D.

5. Remedial Considerations and Recommendations

It is recommended that additional boreholes and groundwater monitoring wells be completed on-site to further delineate PFOS and PFOA concentrations within the soil and groundwater on the former fire training facility site. It is noted that several surface water and sediment samples have been collected by the MOE, both on and off-site which identifies areas of concern within drainage ditches in the vicinity of the former fire training area.

Perfluorinated chemicals such as PFOS and PFOA are environmentally persistent and recalcitrant to most conventional chemical and microbial treatment technologies. The chemicals are highly stable and are not known to break down in water or light or to biodegrade.

As there are currently no site specific sediment, soil, surface water or groundwater standards for PFOS and PFOA within Ontario, **exp** proposes to develop Risk Based Standards for the Site. The Risk Assessment will be completed concurrently with further delineation of contaminants and any temporary measures put in place to reduce the levels of PFOS and PFOA leaving the Site in surface and/or groundwater.

Based on our experience and research completed, **exp** recommends two remedial activities that can be used to manage the PFC chemicals at the airport Site.

- 1) Solidification/Stabilization using cement products for soil; and
- 2) Nanozox™ Technology for groundwater

Approach

Exp recommends the following approach to addressing the contamination at the airport Site:

- 1) Stabilization/Solidification of the presumed source area (fuselage area/pond);
- 2) Design and implementation of cover system for the remainder of the fire training area;
- 3) Remediation of groundwater; and
- 4) Remediation of sediment and surface water.

Solidification/Stabilization – Bench Scale Study

Solidification/Stabilization (S/S) is a treatment technology for contaminated soils. Portland cement, often augmented with other materials, such as fly ash, lime kiln dust, cement kiln dust, and lime, is used as a binding reagent in S/S because of its ability to both solidify -- change the physical properties -- and stabilize -- change the chemical properties-- of a wide range of hazardous materials. Solidification increases the compressive strength, decreases the permeability, and encapsulates toxic elements. Stabilization converts hazardous elements into less soluble, mobile or toxic forms. Mixing the right combination of binding reagents into contaminated soils allows them left on-site as inert fill material.

In order to develop the most appropriate mix, it will be necessary to complete a Bench Scale Study.

Nanozox™ - Bench Scale Study

The Nanozox™ system generates nanobubbles containing ozone with a hydrogen peroxide coating which is a highly reactive chemical oxidant. The main reactive surface is a film layer around the nanobubbles formed by ozonides and hydroxyl and associated radicals. Special coatings allow the oxidative/reduction potential to be controlled to avoid material degradation. The ozone/peroxide destroys organic chemicals through the process of chemical oxidation, breaking targeted organic chemical and daughter products into carbon dioxide and water as end products.

Preliminary Risk Assessment

The objective of the preliminary Risk Assessment (RA) is to establish target clean up levels that would be protective of human and ecological receptors through the continued use of the site as an airport. The target clean up levels will be used to develop mitigation measures and remediation efforts at the site.

The risk assessment is an iterative predictive modeling process which is applied to determine the level of exposure for an individual site and establish risk-based clean-up criteria.

The key elements involved in a risk assessment and their purpose are detailed below:

1. Detailed review of all available background information and develop an understanding of site setting.
2. Problem formulation—to identify who will be exposed to on-site contamination and determine exposure routes (e.g. future commercial workers, off-site residents, property visitors, maintenance workers);
3. Toxicity assessment—to determine what kind of toxic effect the contaminant will have on the human receptor and ecological receptors;
4. Exposure assessment and risk characterization—through numerical modeling, estimate the level of exposure one would receive from on-site contamination, determine the risk levels.
5. Risk management and mitigation measures.

It is understood that only limited information is available on the fate and transport of the PFOS and PFOA and toxicological effects. The RA study will be expanded, if required, to conduct site specific studies such as toxicity studies or bioavailability reviews to more accurately establish the toxic effects of PFOS and PFOA. These studies will allow all stakeholders to provide input and participate in the development of the target levels. These target levels will allow the site to be managed in a safe and environmentally responsible manner.

Next Steps

Exp proposes that remedial activities be undertaken in a phased approach beginning with bench scale and pilot studies to determine if the above described technologies will adequately addresses the PFOS and PFOA contamination on the Site and prevent any further migration of the chemicals off-site.

Exp is prepared to initiate this work immediately upon receipt of proper authorization.

Following the bench scale studies, remedial activities at the Site can begin immediately assuming the treatment methods are appropriate for contaminants of concern.

It is expected that the remedial program will concentrate on the fire training and pond area in order to address the source of the contamination. Further remedial options to address secondary contamination within drainage ditches (i.e. plant uptake and/or endpoint surface water treatment) will be investigated following source removal/treatment.

6. References

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13. XCG Environmental Services Inc., October 1996. Final Report, Hamilton Airport Phase I Environmental Baseline Study, Final Audit Report, Project No. 4350-0049-18. Volume 1. Prepared for Public Works and Government Services Canada, Ontario Region.

7. Limitations

The information presented in this report is based on a limited investigation designed to provide information to support an assessment of the current sub-surface conditions within the subject property. The conclusions and recommendations presented in this report reflect Site conditions existing at the time of the investigation (June 2011) within the former fire training facility.

More specific information with respect to the conditions between samples, or the lateral and vertical extent of materials may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during any such excavation operations. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent. Should this occur, **exp** Services Inc. should be contacted to assess the situation, and the need for additional testing and reporting. **Exp** has qualified personnel to provide assistance in regards to any future geotechnical and environmental issues related to this property.

The environmental investigation was carried out to address the intent of applicable provincial Regulations, Guidelines, Policies, Standards, Protocols and Objectives administered by the Ministry of Environment. It should also be noted that current environmental Regulations, Guidelines, Policies, Standards, Protocols and Objectives are subject to change, and such changes, when put into effect, could alter the conclusions and recommendations noted throughout this report. Achieving the study objectives stated in this report has required us to arrive at conclusions based upon the best information presently known to us. No investigative method can completely eliminate the possibility of obtaining partially imprecise or incomplete information; it can only reduce the possibility to an acceptable level. Professional judgment was exercised in gathering and analyzing the information obtained and in the formulation of the conclusions. Like all professional persons rendering advice we do not act as absolute insurers of the conclusions we reach, but we commit ourselves to care and competence in reaching those conclusions.

Our undertaking at **exp**, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the engineering profession. It is intended that the outcome of this investigation assist in reducing the client's risk associated with environmental impairment. Our work should not be considered 'risk mitigation'. No other warranty or representation, either expressed or implied, is included or intended in this report.

This report was prepared for the exclusive use of Hamilton International Airport, Tradeport International Corporation and The City of Hamilton and may not be reproduced in whole or in part, without the prior written consent of **exp**, or used or relied upon in whole or in part by other parties for any purposes whatsoever. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. **Exp** Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust this summary report is satisfactory for your purposes. If you have any questions regarding our submission, please do not hesitate to contact this office.

exp Services Inc.

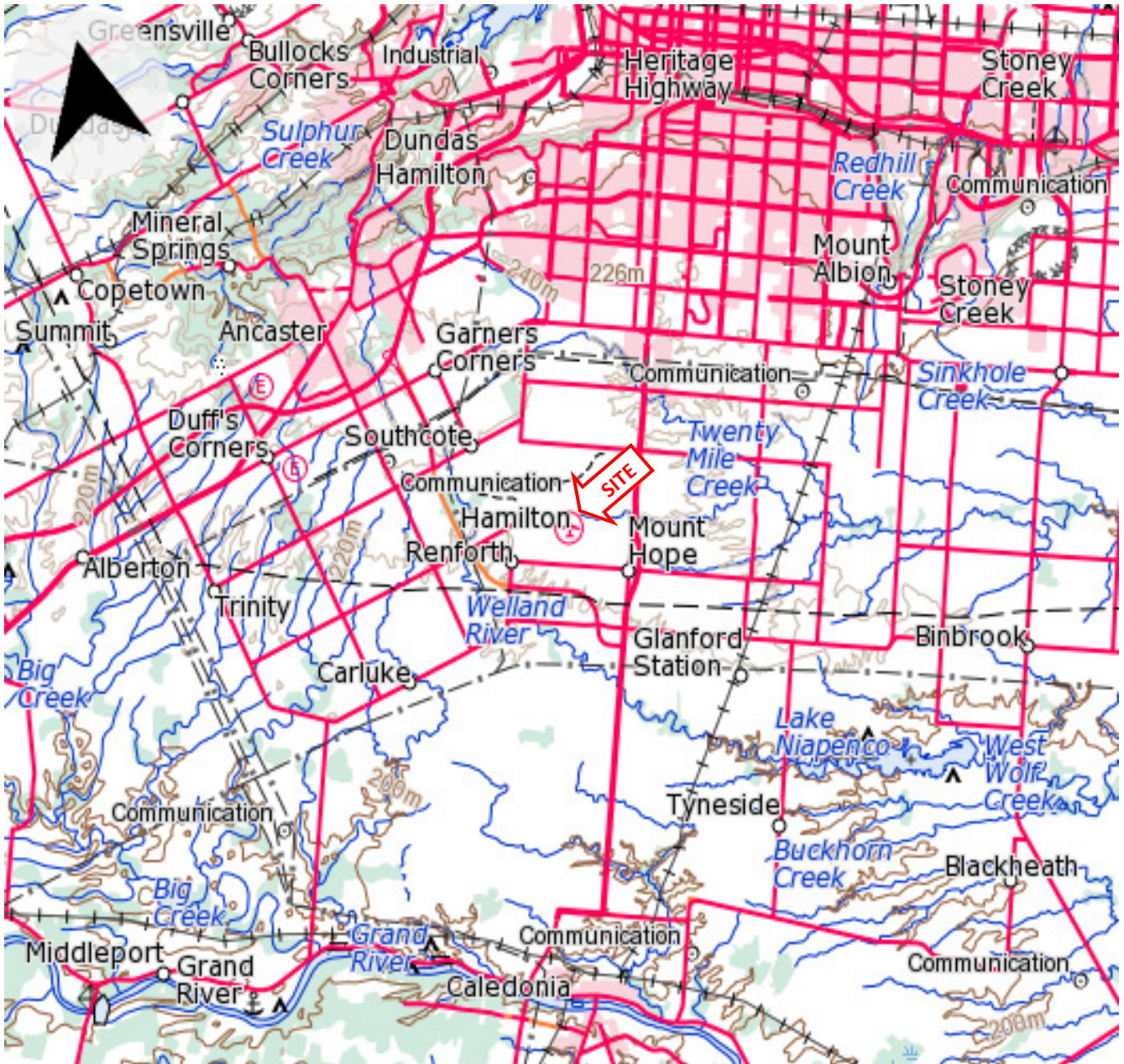


Erik Enders, B.Sc.
Environmental Scientist



Darko Strajin, P. Eng.
Manager Central Ontario – Environmental Services

Appendix A: Figures



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SITE LOCATION PLAN

PROJ. NO: HAM-00200231-A0

SOIL & GROUNDWATER
INVESTIGATION
HAMILTON INTERNATIONAL
AIRPORT
HAMILTON, ONTARIO

SCALE: AS SHOWN

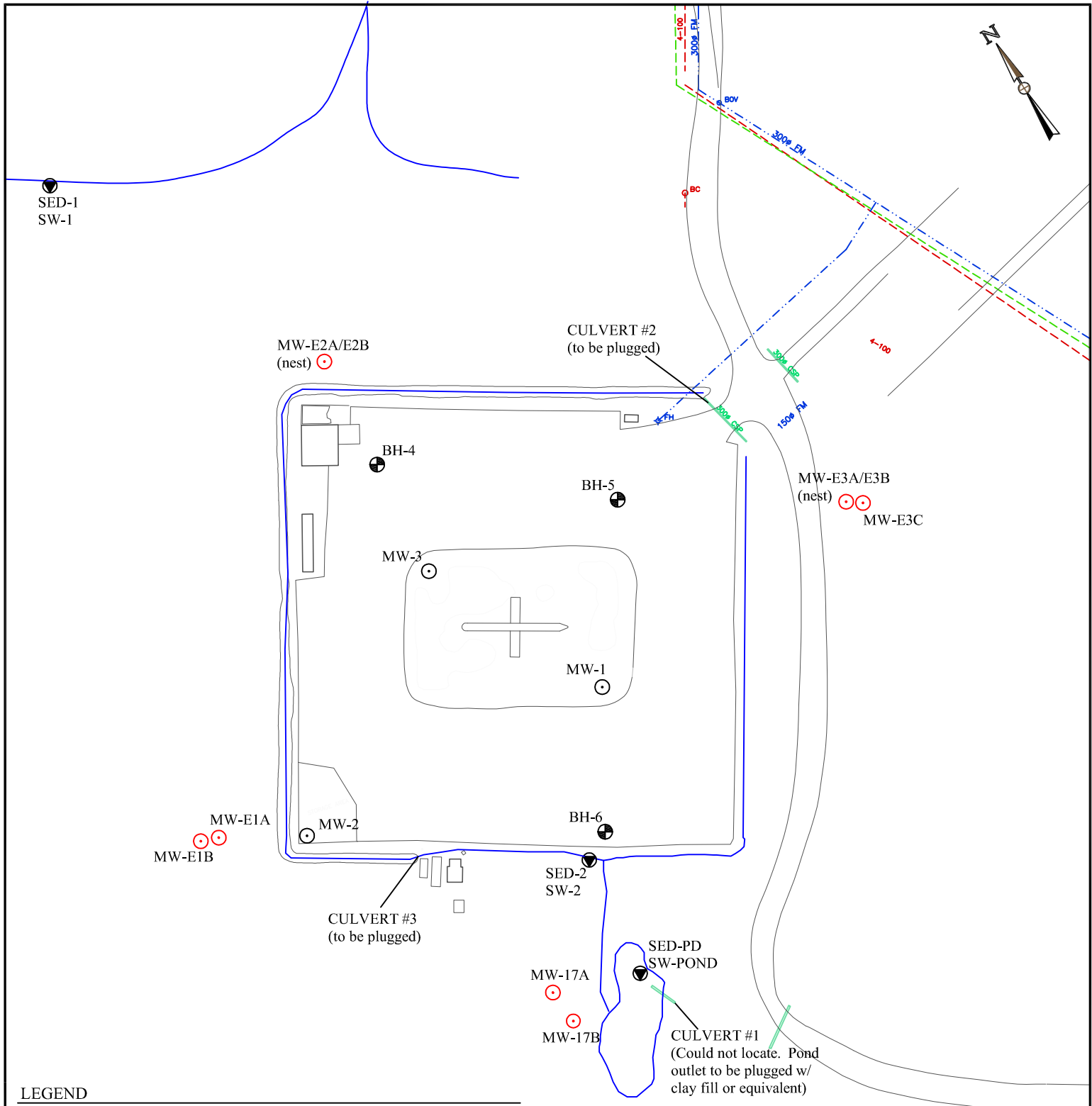
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CHECKED: JC





FIGURE





1

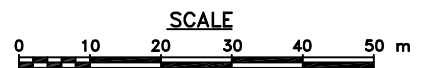
JULY 2011



LEGEND

- BH-4  SOIL BOREHOLE LOCATION (exp June 2011)
- BH-1/MW-1  GROUNDWATER MONITORING WELL LOCATION (exp June 2011)
- MW-E1  PREVIOUSLY INSTALLED GROUNDWATER MONITORING WELL LOCATION
- SED-1 SW-1  SURFACE WATER & SEDIMENT SAMPLE LOCATION (exp June 2011)

-  CULVERT
-  ELECTRICAL UTILITIES
-  GAS LINE
-  WATERMAIN



Appendix B: Borehole Logs

Log of Borehole BH-1/MW-1

Project No. HAM-00200231-A0

Drawing No. B1

Project: Soil, Groundwater & Surface Water Sampling & Analysis Program

Sheet No. 1 of 1

Location: Hamilton International Airport - Fire Training & Storage Area

Please refer to Borehole Location Plan

Date Drilled: June 16, 2011

Chemical Analysis

Drill Type: Powerprobe

BTEX Petroleum Hydrocarbons (F1) plus Benzene, Toluene, Ethylbenzene and Xylenes
 ING Metals and Inorganics PCB Polychlorinated Biphenyls
 MET Metals PHC Petroleum Hydrocarbons (F2-F4)
 PAH Polycyclic Aromatic Hydrocarbons VOC Volatile Organic Compounds

Datum: Geodetic

* Duplicate Sample

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value			Combustible Vapour Reading (ppm)			SOIL REMEDIATION	% RECOVERY	SAMPLING ID	ANALYSIS
					20	40	60	25	50	75				
		Gravel: Trace organics, loose	233.88	0								75	S1	PFOA
		Fill: Brown silt, damp	~233.8											
		Gravel layer, 0.15 m thick, some sand, some silt, PHC odour	~232.8	1								75	S2	
		SILT: Brown, damp, soft, faint PHC odour										100	S3	PFOA
		Becoming very moist		2								100	S4	
		Becoming moist, trace clay, firm										100	S5	PFOA
		Some clay, solvent odour	~231.0	3								100	S6	PFOA
		SILTY CLAY TILL: Brown, moist, firm, trace clay, solvent odour										100	S7	PFOA
		Becoming damp, no odour noted	~229.6	4								100	S8	PFOA
		Becoming grey	~229.1	5										
		END OF BOREHOLE		5										
		NOTES:		6										
		1) This drawing is to be read with the subject report and project number as presented above.		7										
		2) Interpretation assistance by exp. is required before use by others.		8										
		3) Borehole backfilled with bentonite upon completion.		9										
				10										
				11										
				12										
				13										
				14										
				15										
				16										

ENVIRONMENTAL-EXP BOREHOLE LOGS.GPJ 27/7/11



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Time	Water Level (m)	Depth to Cave (m)
June 17, 2011	4.32	

Log of Borehole BH-2/MW-2

Project No. HAM-00200231-A0

Drawing No. B2

Project: Soil, Groundwater & Surface Water Sampling & Analysis Program

Sheet No. 1 of 1

Location: Hamilton International Airport - Fire Training & Storage Area

Please refer to Borehole Location Plan

Date Drilled: June 16, 2011

Chemical Analysis

Drill Type: Powerprobe

BTEX Petroleum Hydrocarbons (F1) plus Benzene, Toluene, Ethylbenzene and Xylenes

ING Metals and Inorganics PCB Polychlorinated Biphenyls

MET Metals PHC Petroleum Hydrocarbons (F2-F4)


Datum: Geodetic

PAH Polycyclic Aromatic Hydrocarbons VOC Volatile Organic Compounds

* Duplicate Sample

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value			Combustible Vapour Reading (ppm)			SAMPLING DEPTH (m)	% RECOVERY	SAMPLE ID	ANALYSIS
					20	40	60	25	50	75				
		Gravel with silt: Damp, loose, faint PHC odour SILT: Brown, moist to very moist, firm	232.87 ~232.6 ~232.3	0							75	S1	PFOS PFOA	
		Some clay		1							75	S2		
		SILTY CLAY TILL: Brown, firm, moist to very moist	~230.4	2							100	S3	PFOS PFOA	
		Becoming grey		3							100	S4		
				4							75	S5	PFOS PFOA	
				5							75	S6		
		END OF BOREHOLE	~228.3	6								S7		
		NOTES: 1) This drawing is to be read with the subject report and project number as presented above. 2) Interpretation assistance by exp. is required before use by others. 3) Borehole backfilled with bentonite upon completion.		7										
				8										
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				13										
				14										
				15										
				16										

ENVIRONMENTAL-EXP BOREHOLE LOGS.GPJ 27/7/11

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Time	Water Level (m)	Depth to Cave (m)
June 17, 2011	0.54	

Log of Borehole BH-3/MW-3

Project No. HAM-00200231-A0

Drawing No. B3

Project: Soil, Groundwater & Surface Water Sampling & Analysis Program

Sheet No. 1 of 1

Location: Hamilton International Airport - Fire Training & Storage Area

Please refer to Borehole Location Plan

Date Drilled: June 16, 2011

Drill Type: Powerprobe

Datum: Geodetic


Chemical Analysis

BTEX Petroleum Hydrocarbons (F1) plus Benzene, Toluene, Ethylbenzene and Xylenes
 ING Metals and Inorganics PCB Polychlorinated Biphenyls
 MET Metals PHC Petroleum Hydrocarbons (F2-F4)
 PAH Polycyclic Aromatic Hydrocarbons VOC Volatile Organic Compounds

* Duplicate Sample

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value			Combustible Vapour Reading (ppm)			SAMPLING DEPTH (m)	% RECOVERED	SAMPLE ID	ANALYSIS
					20	40	60	25	50	75				
		Gravel and silt: Some organics, damp, loose	233.88 ~233.6	0							75	S1	PFOS PFOA	
		Fill: Brown silt, damp, firm	~233.1	1							75	S2		
		Gravel layer, 0.15 m thick, moist, strong PHC odour	~232.7	2							100	S3	PFOS PFOA	
		SILT: Brown, damp, soft, faint PHC odour		3							100	S4		
		SILT TILL: Brown, moist, soft, faint PHC odour, some clay		4							100	S5		
		SILTY CLAY TILL: Brown, moist, firm	~230.2	5							100	S6		
		Becoming grey, spoon refusal, augered to 4.88m	~229.5 ~229.3	6										
		END OF BOREHOLE		7										
		NOTES:		8										
		1) This drawing is to be read with the subject report and project number as presented above.		9										
		2) Interpretation assistance by exp. is required before use by others.		10										
		3) Borehole backfilled with bentonite upon completion.		11										
				12										
				13										
				14										
				15										
				16										

ENVIRONMENTAL-EXP BOREHOLE LOGS.GPJ 27/7/11

 exp Services Inc.
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Time	Water Level (m)	Depth to Cave (m)
June 17, 2011	4.63	

Log of Borehole BH-4

Project No. HAM-00200231-A0

Drawing No. B4

Project: Soil, Groundwater & Surface Water Sampling & Analysis Program

Sheet No. 1 of 1

Location: Hamilton International Airport - Fire Training & Storage Area

Please refer to Borehole Location Plan

Date Drilled: June 16, 2011

Chemical Analysis

BTEX Petroleum Hydrocarbons (F1) plus Benzene, Toluene, Ethylbenzene and Xylenes
 ING Metals and Inorganics PCB Polychlorinated Biphenyls
 MET Metals PHC Petroleum Hydrocarbons (F2-F4)
 PAH Polycyclic Aromatic Hydrocarbons VOC Volatile Organic Compounds

Drill Type: Powerprobe

Datum: Geodetic

* Duplicate Sample

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value			Combustible Vapour Reading (ppm)			SOUNDING	% RECOVER	SAMPLE ID	ANALYSIS
					20	40	60	25	50	75				
	●●●	Gravel and silt: damp, loose SILT: Brown, very moist, soft		0								75	S1	PFOS PFOA
		Becoming moist		1								75	S2	
	▨	SILTY CLAY: Brown, moist, firm, some oxidation		2								100	S3	PFOS PFOA
	▨	SILTY CLAY TILL: Brown, moist, firm, no odour		3								100	S4	
		END OF BOREHOLE		4										
		NOTES: 1) This drawing is to be read with the subject report and project number as presented above. 2) Interpretation assistance by exp. is required before use by others. 3) Borehole backfilled with bentonite upon completion.		5										
				6										
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ENVIRONMENTAL-EXP BOREHOLE LOGS.GPJ 27/7/11



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 Telephone: 905-573-4000
 Facsimile: 905-573-9693

Time	Water Level (m)	Depth to Cave (m)

Log of Borehole BH-5

Project No. HAM-00200231-A0

Drawing No. B5

Project: Soil, Groundwater & Surface Water Sampling & Analysis Program

Sheet No. 1 of 1

Location: Hamilton International Airport - Fire Training & Storage Area

Please refer to Borehole Location Plan

Date Drilled: June 16, 2011

Chemical Analysis

Drill Type: Powerprobe

BTEX Petroleum Hydrocarbons (F1) plus Benzene, Toluene, Ethylbenzene and Xylenes

ING Metals and Inorganics PCB Polychlorinated Biphenyls

MET Metals PHC Petroleum Hydrocarbons (F2-F4)

Datum: Geodetic

PAH Polycyclic Aromatic Hydrocarbons VOC Volatile Organic Compounds

* Duplicate Sample

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value			Combustible Vapour Reading (ppm)			SPT	% R	SAMP	ANALYSIS			
					20	40	60	25	50	75					SOIL	COV	JD
	●●●	Gravel and silt: Damp, loose Becoming wet		0							//	75	S1	PFOS PFOA			
		SILT: Brown, damp, soft															
		Becoming moist and firm		1							//	75	S2				
		SILTY CLAY: Brown, moist, firm		2							//	100	S3	PFOS PFOA			
		SILTY CLAY TILL: Brown, moist, firm		3							//	100	S4				
		END OF BOREHOLE		4							//	100	S5	PFOS PFOA			
		NOTES: 1) This drawing is to be read with the subject report and project number as presented above. 2) Interpretation assistance by exp. is required before use by others. 3) Borehole backfilled with bentonite upon completion.		5													
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				7													
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				10													
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				12													
				13													
				14													
				15													
				16													

ENVIRONMENTAL-EXP BOREHOLE LOGS.GPJ 27/7/11

exp Services Inc.
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Time	Water Level (m)	Depth to Cave (m)

Log of Borehole BH-6

Project No. HAM-00200231-A0

Drawing No. B6

Project: Soil, Groundwater & Surface Water Sampling & Analysis Program

Sheet No. 1 of 1

Location: Hamilton International Airport - Fire Training & Storage Area

Please refer to Borehole Location Plan

Date Drilled: June 16, 2011

Chemical Analysis

Drill Type: Powerprobe

BTEX Petroleum Hydrocarbons (F1) plus Benzene, Toluene, Ethylbenzene and Xylenes
 ING Metals and Inorganics PCB Polychlorinated Biphenyls
 MET Metals PHC Petroleum Hydrocarbons (F2-F4)
 PAH Polycyclic Aromatic Hydrocarbons VOC Volatile Organic Compounds

Datum: Geodetic

* Duplicate Sample

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value			Combustible Vapour Reading (ppm)			SAMPLING DEPTH (m)	% RECOVERY	SAMPLE ID	ANALYSIS
					20	40	60	25	50	75				
	●●●	Gravel and silt: Damp, loose		0								75	S1	PFOS PFOA
		SILT: Brown, damp, soft										75	S2	
		Becoming moist		1								100	S3	PFOS PFOA
		Trace clay		2								100	S4	
	▨	SILTY CLAY TILL: Brown, moist, firm		3								100	S5	PFOS PFOA
		END OF BOREHOLE		4								100	S6	
		NOTES: 1) This drawing is to be read with the subject report and project number as presented above. 2) Interpretation assistance by exp. is required before use by others. 3) Borehole backfilled with bentonite upon completion.		5										
				6										
				7										
				8										
				9										
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				15										
				16										

ENVIRONMENTAL-EXP BOREHOLE LOGS.GPJ 2/7/11



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Time	Water Level (m)	Depth to Cave (m)

Appendix C: Single Well Response Test (SWRT)



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Slug Test - Water Level Data

Project: PFOS Testing

Number: HAM-00200231-A0

Client: HIA

Location: Fire Training Area

Slug Test: MW1 Rising Head Test

Test Well: MW1

Test conducted by: EE

Test date: 6/29/2011

Water level at t=0 [m]: 4.20

Static water level [m]: 1.80

Water level change at t=0 [m]: 2.40

	Time [min]	Water Level [m]	WL Change [m]
1	0.5	4.19	2.39
2	1	4.185	2.385
3	1.5	4.18	2.38
4	2	4.175	2.375
5	2.5	4.17	2.37
6	3	4.165	2.365
7	4	4.16	2.36
8	5	4.16	2.36
9	6	4.16	2.36
10	8	4.155	2.355
11	10	4.15	2.35
12	12	4.145	2.345
13	13	4.14	2.34
14	15	4.14	2.34
15	20	4.135	2.335
16	25	4.13	2.33
17	30	4.13	2.33
18	35	4.125	2.325
19	45	4.12	2.32
20	60	4.115	2.315



exp Services Inc.
 80 Bancroft Street
 Hamilton, ON
 L8E 2W5
 905.573.4000

Slug Test Analysis Report

Project: PFOS Testing

Number: HAM-00200231-A0

Client: HIA

Location: Fire Training Area

Slug Test: MW1 Rising Head Test

Test Well: MW1

Test conducted by: EE

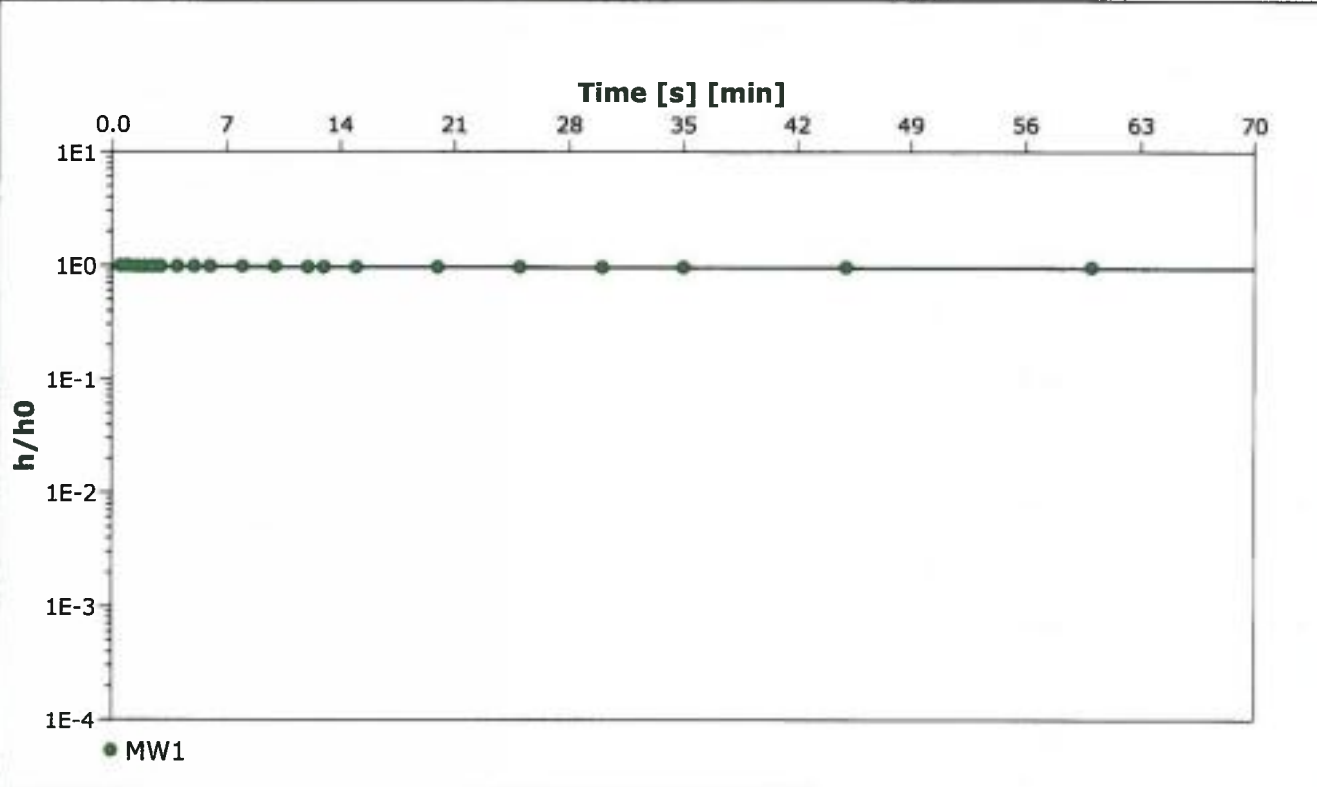
Test date: 6/29/2011

Analysis performed by: EE

Rising Head Test

Date: 6/29/2011

Aquifer Thickness: 3.00 m



Calculation after Hvorslev

Observation well	K [m/s]	
MW1	2.58×10^{-9}	

Appendix D: Certificates of Analysis

Your Project #: HAM-00200231-A
 Site: 9800 AIRPORT RD-FTA
 Your C.O.C. #: EO527711

Attention: Kylie Boyd
 exp.
 80 Bancroft St
 Hamilton, ON
 L8E 2W5

Report Date: 2011/06/24

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B188933
Received: 2011/06/17, 14:23

Sample Matrix: Soil
 # Samples Received: 16

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Moisture	10	N/A	2011/06/21	CAM SOP-00445	McKeague 2nd ed 1978
Moisture	6	N/A	2011/06/22	CAM SOP-00445	McKeague 2nd ed 1978
PFOS and PFOA in soil	16	2011/06/21	2011/06/22	CAM SOP-00894	In house method

Sample Matrix: Water
 # Samples Received: 9

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
PFOS and PFOA in water	9	2011/06/22	2011/06/22	CAM SOP-00894	In house method

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
 * Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

SARA SAROOP, Project Manager
 Email: SSaroop@maxxam.ca
 Phone# (905) 817-5700 Ext:5821

=====
 Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B188933
 Report Date: 2011/06/24

 exp.
 Client Project #: HAM-00200231-A
 Project name: 9800 AIRPORT RD-FTA

RESULTS OF ANALYSES OF SOIL

Maxxam ID		JW6604	JW6605	JW6606	JW6607	JW6608	JW6609	JW6610	JW6611		
Sampling Date		2011/06/16 09:00	2011/06/16 09:00	2011/06/16 10:00	2011/06/16 10:00	2011/06/16 11:00	2011/06/16 11:00	2011/06/16 12:00	2011/06/16 12:00		
	Units	BH -1 S1	BH -1 S3	BH -2 S1	BH -2 S3	BH -3 S1	BH -3 S3	BH -4 S1	BH -4 S3	RDL	QC Batch
Inorganics											
Moisture	%	12	17	7	16	8	18	6	17	1	2526958
Miscellaneous Parameters											
Perfluoro-1-Octanesulfonate (PFOS)	ug/kg	16000	230	120	260	26000	<25	270	200	25	2526419
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	350	110	3.3	5.1	220	22	<2.5	5.2	2.5	2526419

Maxxam ID		JW6611	JW6612	JW6613	JW6613		JW6614		
Sampling Date		2011/06/16 12:00	2011/06/16 13:00	2011/06/16 13:00	2011/06/16 13:00		2011/06/16 14:00		
	Units	BH -4 S3 Lab-Dup	BH -5 S1	BH -5 S3	BH -5 S3 Lab-Dup	QC Batch	BH -6 S1	RDL	QC Batch
Inorganics									
Moisture	%	17	5	15		2526958	7	1	2528113
Miscellaneous Parameters									
Perfluoro-1-Octanesulfonate (PFOS)	ug/kg		210	63	60	2526419	110	25	2526419
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg		<2.5	11	11	2526419	<2.5	2.5	2526419

Maxxam ID		JW6615	JW6616		JW6620	JW6621	JW6622		
Sampling Date		2011/06/16 14:00	2011/06/16 10:00		2011/06/16 10:00	2011/06/16 10:00	2011/06/16 10:00		
	Units	BH -6 S3	BH -12 S3	QC Batch	SED 1	SED 2	SED-PD	RDL	QC Batch
Inorganics									
Moisture	%	19	17	2528113	49	73	38	1	2528157
Miscellaneous Parameters									
Perfluoro-1-Octanesulfonate (PFOS)	ug/kg	<25	48	2526419	44	3000	1100	25	2526419
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	<2.5	<2.5	2526419	<2.5	27	8.4	2.5	2526419

 RDL = Reportable Detection Limit
 QC Batch = Quality Control Batch

Maxxam Job #: B188933
 Report Date: 2011/06/24

 exp.
 Client Project #: HAM-00200231-A
 Project name: 9800 AIRPORT RD-FTA

RESULTS OF ANALYSES OF WATER

Maxxam ID		JW6617		JW6618			JW6619		JW6623		JW6624		
Sampling Date		2011/06/16 10:00		2011/06/16 10:00			2011/06/16 10:00		2011/06/17 10:00		2011/06/17 10:00		
	Units	SW 1	QC Batch	SW 2	RDL	QC Batch	SW-POND	RDL	MW-A17-1	QC Batch	MW-E1A	RDL	QC Batch
Miscellaneous Parameters													
Perfluoro-1-Octanesulfonate (PFOS)	ug/L	1.2	2527921	22	0.02	2527921	45	0.02	8.2	2527921	<0.02	0.02	2527922
Perfluorobutane Sulfonate (PFBS)	ug/L	0.31	2527922	0.77	0.02	2527922	<1	1	2.0	2527921	<0.02	0.02	2527922
Perfluorobutanoic acid	ug/L	0.27	2527922	0.71	0.02	2527922	1.3	0.02	2.6	2527921	<0.02	0.02	2527922
Perfluorodecanoic Acid (PFDA)	ug/L	<0.02	2527922	0.03	0.02	2527922	0.03	0.02	<0.02	2527922	<0.02	0.02	2527922
Perfluorododecanoic Acid (PFDoA)	ug/L	<0.02	2527922	<0.02	0.02	2527922	<0.02	0.02	<0.02	2527922	<0.02	0.02	2527922
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.16	2527922	1.1	0.02	2527921	1.4	0.02	2.4	2527921	<0.02	0.02	2527922
Perfluorohexane Sulfonate (PFHxS)	ug/L	1.2	2527921	5.7	0.02	2527921	12	0.02	13	2527921	<0.02	0.02	2527922
Perfluorohexanoic Acid (PFHxA)	ug/L	0.71	2527922	3.7	0.02	2527921	7.5	0.02	15	2527921	0.02	0.02	2527922
Perfluoro-n-Octanoic Acid (PFOA)	ug/L	0.15	2527922	2.0	0.02	2527921	2.6	0.02	1.3	2527921	<0.02	0.02	2527922
Perfluorononanoic Acid (PFNA)	ug/L	0.02	2527922	0.18	0.02	2527922	0.14	0.02	0.06	2527922	<0.02	0.02	2527922
Perfluorooctane Sulfonamide (PFOSA)	ug/L	<0.02	2527922	0.03	0.02	2527922	0.28	0.02	<0.02	2527922	<0.02	0.02	2527922
Perfluoropentanoic Acid (PFPeA)	ug/L	1.4	2527921	3.7	0.02	2527921	5.4	0.02	12	2527921	0.03	0.02	2527922
Perfluoroundecanoic Acid (PFUnA)	ug/L	<0.02	2527922	<0.02	0.02	2527922	<0.02	0.02	<0.02	2527922	<0.02	0.02	2527922

RDL = Reportable Detection Limit
 QC Batch = Quality Control Batch

Maxxam Job #: B188933
 Report Date: 2011/06/24

exp.
 Client Project #: HAM-00200231-A
 Project name: 9800 AIRPORT RD-FTA

RESULTS OF ANALYSES OF WATER

Maxxam ID		JW6625			JW6626			JW6627	JW6628		
Sampling Date		2011/06/17 10:00			2011/06/17 10:00			2011/06/17 10:00	2011/06/17 11:00		
	Units	MW-E2B	RDL	QC Batch	MW-E3B	RDL	QC Batch	MW 2	MW 2B	RDL	QC Batch
Miscellaneous Parameters											
Perfluoro-1-Octanesulfonate (PFOS)	ug/L	<0.02	0.02	2527922	2.8	0.02	2527921	4.7	5.0	0.02	2527921
Perfluorobutane Sulfonate (PFBS)	ug/L	0.10	0.02	2527922	<1	1	2527921	8.2	7.9	0.02	2527921
Perfluorobutanoic acid	ug/L	0.36	0.02	2527922	1.1	0.02	2527921	7.1	7.0	0.02	2527921
Perfluorodecanoic Acid (PFDA)	ug/L	<0.02	0.02	2527922	<0.02	0.02	2527922	<0.02	<0.02	0.02	2527922
Perfluorododecanoic Acid (PFDoA)	ug/L	<0.02	0.02	2527922	<0.02	0.02	2527922	<0.02	<0.02	0.02	2527922
Perfluoroheptanoic Acid (PFHpA)	ug/L	0.05	0.02	2527922	1.1	0.02	2527921	3.3	4.1	0.02	2527921
Perfluorohexane Sulfonate (PFHxS)	ug/L	0.19	0.02	2527922	6.6	0.02	2527921	79	120	0.02	2527921
Perfluorohexanoic Acid (PFHxA)	ug/L	0.91	0.02	2527922	3.1	0.02	2527921	39	38	0.02	2527921
Perfluoro-n-Octanoic Acid (PFOA)	ug/L	<0.02	0.02	2527922	0.67	0.02	2527922	5.6	5.8	0.02	2527921
Perfluorononanoic Acid (PFNA)	ug/L	<0.02	0.02	2527922	0.04	0.02	2527922	0.03	0.03	0.02	2527922
Perfluorooctane Sulfonamide (PFOSA)	ug/L	<0.02	0.02	2527922	<0.02	0.02	2527922	<0.02	<0.02	0.02	2527922
Perfluoropentanoic Acid (PFPeA)	ug/L	1.2	0.02	2527921	6.4	0.02	2527921	18	19	0.02	2527921
Perfluoroundecanoic Acid (PFUnA)	ug/L	<0.02	0.02	2527922	<0.02	0.02	2527922	<0.02	<0.02	0.02	2527922

RDL = Reportable Detection Limit
 QC Batch = Quality Control Batch

Maxxam Job #: B188933
Report Date: 2011/06/24

exp.
Client Project #: HAM-00200231-A
Project name: 9800 AIRPORT RD-FTA

GENERAL COMMENTS

Sample JW6619-01: Reporting limit of PFBS was raised to 1 ug/L. Sample required dilution in order to reduce matrix effects.

Sample JW6626-01: Reporting limit of PFBS was raised to 1 ug/L. Sample required dilution in order to reduce matrix effects.

Sample JW6617, PFOS and PFOA in water: Test repeated.

Sample JW6618, PFOS and PFOA in water: Test repeated.

Sample JW6619, PFOS and PFOA in water: Test repeated.

Sample JW6623, PFOS and PFOA in water: Test repeated.

Sample JW6625, PFOS and PFOA in water: Test repeated.

Sample JW6626, PFOS and PFOA in water: Test repeated.

Sample JW6627, PFOS and PFOA in water: Test repeated.

Sample JW6628, PFOS and PFOA in water: Test repeated.

Maxxam Job #: B188933
 Report Date: 2011/06/24

 exp.
 Client Project #: HAM-00200231-A
 Project name: 9800 AIRPORT RD-FTA

QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD		Reagent Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
2526419	Perfluoro-1-Octanesulfonate (PFOS)	2011/06/22	NC	70 - 130	104	70 - 130	<25	ug/kg	NC	25		
2526419	Perfluoro-n-Octanoic Acid (PFOA)	2011/06/22	NC	70 - 130	96	70 - 130	<2.5	ug/kg	NC	25		
2526958	Moisture	2011/06/21							1.8	20		
2527921	Perfluoro-1-Octanesulfonate (PFOS)	2011/06/22	103	70 - 130	114	70 - 130	<0.02	ug/L				
2527921	Perfluorobutane Sulfonate (PFBS)	2011/06/22	99	70 - 130	96	70 - 130	<0.02	ug/L				
2527921	Perfluorobutanoic acid	2011/06/22	110	70 - 130	103	70 - 130	<0.02	ug/L				
2527921	Perfluoroheptanoic Acid (PFHpA)	2011/06/22	96	70 - 130	88	70 - 130	<0.02	ug/L				
2527921	Perfluorohexane Sulfonate (PFHxS)	2011/06/22	100	70 - 130	92	70 - 130	<0.02	ug/L				
2527921	Perfluorohexanoic Acid (PFHxA)	2011/06/22	98	70 - 130	104	70 - 130	<0.02	ug/L				
2527921	Perfluoro-n-Octanoic Acid (PFOA)	2011/06/22	108	70 - 130	112	70 - 130	<0.02	ug/L				
2527921	Perfluoropentanoic Acid (PFPeA)	2011/06/22	109	70 - 130	112	70 - 130	<0.02	ug/L				
2527922	Perfluoro-1-Octanesulfonate (PFOS)	2011/06/22	108	70 - 130	105	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluorobutane Sulfonate (PFBS)	2011/06/22	105	70 - 130	100	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluorobutanoic acid	2011/06/22	90	70 - 130	86	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluorodecanoic Acid (PFDA)	2011/06/22	108	70 - 130	114	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluorododecanoic Acid (PFDoA)	2011/06/22	103	70 - 130	117	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluoroheptanoic Acid (PFHpA)	2011/06/22	104	70 - 130	100	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluorohexane Sulfonate (PFHxS)	2011/06/22	108	70 - 130	100	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluorohexanoic Acid (PFHxA)	2011/06/22	98	70 - 130	94	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluoro-n-Octanoic Acid (PFOA)	2011/06/22	94	70 - 130	102	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluorononanoic Acid (PFNA)	2011/06/22	93	70 - 130	86	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluorooctane Sulfonamide (PFOSA)	2011/06/22	111	70 - 130	124	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluoropentanoic Acid (PFPeA)	2011/06/22	108	70 - 130	107	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluoroundecanoic Acid (PFUnA)	2011/06/22	106	70 - 130	111	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2528113	Moisture	2011/06/22							1.7	20		
2528157	Moisture	2011/06/22							NC	20		

N/A = Not Applicable

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Reagent Blank: A blank matrix containing all reagents used in the analytical procedure. Used to determine any analytical contamination.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

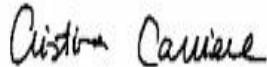
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

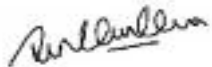
Validation Signature Page

Maxxam Job #: B188933

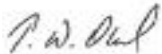
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



CRISTINA CARRIERE, Scientific Services



SIN CHII CHIA, Scientific Services



TERRY OBAL, Ph.D., C. Chem, Manager, Scientific Services

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

17-Jun-11 14:23

INVOICE INFORMATION:

Company Name: exp Cont
 Contact Name: Kyle Boyd Cont
 Address: 80 Bancroft St. Addr
Hamilton, ON
 Phone: 905-573-4000 Fax: 905-573-9693 Phon
 Email: kyle.boyd@exp.com Email

SARA SAROOP

 B188933
 SEL ENV-675

PROJECT INFORMATION:

Quotation #
 P.O. #
 Project #: HAM-00200231-A
 Project Name: HIA
 Location: 9800 Airport Rd - FTA
 Sampled By: C. Cabel/S. Hsia

MAXXAM JOB NUMBER:

CHAIN OF CUSTODY # :

E0527711

REGULATORY CRITERIA

Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form

MISA Reg. 153 Sewer Use

PWQO Table 1 Residential / Parkland Sanitary

Reg. 558 Table 2 Industrial / Commercial Storm

Table 3 Medium / Fine Municipality: _____

Table 6 Coarse

Other (specify): _____ Report Criteria on C of A?

ANALYSIS REQUESTED (Please be specific):

Regulated Drinking Water? (Y/N)	
Metals Field Filtered? (Y/N)	

PFOS
PFDA

TURNAROUND TIME (TAT) REQUIRED:

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Regular (Standard) TAT:
 5 to 7 Working Days

Rush TAT: Rush Confirmation # _____
 (call Lab for #)

1 day 2 days 3 days

DATE Required: _____
 TIME Required: _____

Please note that TAT for certain tests such as BOD and Diatoms/Parasites are > 5 days - contact your Project Manager for details

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Sample Identification	Date Sampled	Time Sampled	Matrix (GW, SW, Soil, etc.)	Regulated Drinking Water? (Y/N)	Metals Field Filtered? (Y/N)	# of Cont.	COMMENTS / TAT COMMENTS
BH-1 S1	6/16/11	9:00	SOIL		✓	1	
BH-1 S3		9:00			✓	1	as per Sara Saroop
BH-2 S1		10:00			✓	1	
BH-2 S3		10:00			✓	1	
BH-3 S1		11:00			✓	1	
BH-3 S3		11:00			✓	1	
BH-4 S1		12:00			✓	1	
BH-4 S3		12:00			✓	1	
BH-5 S1		13:00			✓	1	
BH-5 S3		13:00			✓	1	
BH-6 S1		14:00			✓	1	
BH-6 S3		14:00			✓	1	

RELINQUISHED BY: (Signature/Print) <u>Sgt (Stephanie Hsia)</u>	RECEIVED BY: (Signature/Print) <u>MAO KHARU</u>	Date: <u>2011/6/17</u>	Time: <u>14:23</u>	# JARS USED AND NOT SUBMITTED	Laboratory Use Only Temperature (°C) on Receipt <u>0/10/4°C</u>
---	--	---------------------------	-----------------------	-------------------------------	---

* MANDATORY SECTIONS IN GREY MUST BE FILLED OUT. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS

INVOICE INFORMATION:	REPORT INFORMATION (if differs from invoice):	PROJECT INFORMATION:	MAXXAM JOB NUMBER:
Company Name: <u>exp</u>	Company Name:	Quotation #	
Contact Name: <u>Kyle Boyd</u>	Contact Name:	P.O. #	
Address: <u>80 Bancroft St. Hamilton, ON</u>	Address:	Project #: <u>HAM-0020231-A</u>	CHAIN OF CUSTODY #:
Phone: <u>905-573-4000</u> Fax: <u>905-573-9693</u>	Phone: _____ Fax: _____	Project Name: <u>HIA</u>	EO527811
Email: <u>kyle.boyd@exp.com</u>	Email: _____	Location: <u>9800 Airport Rd - FTA</u>	
		Sampled By: <u>C. Cabal/S. Hsia</u>	

REGULATORY CRITERIA	ANALYSIS REQUESTED (Please be specific):	TURNAROUND TIME (TAT) REQUIRED:
<p>Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form</p> <p><input type="checkbox"/> MISA Reg. 153 <input type="checkbox"/> Sewer Use</p> <p><input type="checkbox"/> PWGO <input type="checkbox"/> Table 1 <input type="checkbox"/> Residential / Parkland <input type="checkbox"/> Sanitary</p> <p><input type="checkbox"/> Reg 558 <input type="checkbox"/> Table 2 <input type="checkbox"/> Industrial / Commercial <input type="checkbox"/> Storm</p> <p><input type="checkbox"/> Table 3 <input checked="" type="checkbox"/> Medium / Fine Municipality: _____</p> <p><input type="checkbox"/> Table 6 <input type="checkbox"/> Coarse</p> <p>Other (specify): _____ Report Criteria on C of A? <input type="checkbox"/></p>	<p>Regulated Drinking Water? (Y/N)</p> <p>Metals Field Filtered? (Y/N)</p> <p><u>PFOS</u></p> <p><u>PFAO</u></p> <p><u>PFPeA / PFHxA / PFHpA</u></p> <p><u>PFNA / PFDA / PFUNA</u></p> <p><u>PFDoA / PFTeA / PFTeA</u></p> <p><u>PFHxS / PFDS / PFOSA</u></p>	<p>PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS</p> <p>Regular (Standard) TAT: <input checked="" type="checkbox"/> 5 to 7 Working Days</p> <p>Rush TAT: Rush Confirmation # _____ (call Lab for #)</p> <p><input type="checkbox"/> 1 day <input type="checkbox"/> 2 days <input type="checkbox"/> 3 days</p> <p>DATE Required: _____</p> <p>TIME Required: _____</p> <p>Please note that TAT for certain tests such as BOD and Dissolved Fluoride are > 5 days - contact your Project Manager for details.</p>

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM					Regulated Drinking Water? (Y/N)	Metals Field Filtered? (Y/N)	PFOS	PFAO	PFPeA / PFHxA / PFHpA	PFNA / PFDA / PFUNA	PFDoA / PFTeA / PFTeA	PFHxS / PFDS / PFOSA	# of Cont.	COMMENTS / TAT COMMENTS
Sample Identification	Date Sampled	Time Sampled	Matrix (GW, SW, Soil, etc.)											
1 BH-12 S3	6/16/11	10:00	SOIL										1	
2 SW1			SW										1	asper Sara Saroop.
3 SW2			SW										1	
4 SW-POND			SW										1	
5 SED 1			Sediment										1	
6 SED 2			Sediment										1	
7 SED-POAD SED-PD			Sediment										1	
8 MW-A17-1	6/17/11	AM-8:00	GW	N									1	
9 MW-E1A				N									1	
10 MW-E2B				N									1	
11 MW-E3BB				N									1	
12 MW2				N									1	

RELINQUISHED BY: (Signature/Print)	RECEIVED BY: (Signature/Print)	Date:	Time:	# JARS USED AND NOT SUBMITTED	Laboratory Use Only Temperature (°C) on Receipt
<u>[Signature]</u> (Stephanie Hsia)	<u>[Signature]</u> ADAD BHADOV	2011/06/17	14:23		0/10/4°C

* MANDATORY SECTIONS IN GREY MUST BE FILLED OUT. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS

INVOICE INFORMATION:	REPORT INFORMATION (if differs from invoice):	PROJECT INFORMATION:	MAXXAM JOB NUMBER:
Company Name: <u>exp</u>	Company Name:	Quotation #	
Contact Name: <u>Kylie Boyd</u>	Contact Name:	P.O. #	
Address: <u>80 Bancroft St.</u>	Address:	Project #: <u>HAM-00000231-A</u>	CHAIN OF CUSTODY #:
		Project Name: <u>H1A</u>	
Phone: <u>905-573-4000</u> Fax: <u>905-573-9693</u>	Phone: Fax:	Location: <u>9800 Airport Rd - PTA</u>	EO527911
Email: <u>Kylie.Boyd@exp.com</u>	Email:	Sampled By: <u>C. Gabel / S. Hsia</u>	

REGULATORY CRITERIA	ANALYSIS REQUESTED (Please be specific):	TURNAROUND TIME (TAT) REQUIRED:
<p>Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form</p> <p><input type="checkbox"/> MISA Reg. 153 Sewer Use</p> <p><input type="checkbox"/> PWQO <input type="checkbox"/> Table 1 <input type="checkbox"/> Residential / Parkland <input type="checkbox"/> Sanitary</p> <p><input type="checkbox"/> Reg. 558 <input type="checkbox"/> Table 2 <input checked="" type="checkbox"/> Industrial / Commercial <input type="checkbox"/> Storm</p> <p><input type="checkbox"/> Table 3 <input checked="" type="checkbox"/> Medium / Fine Municipality: _____</p> <p><input type="checkbox"/> Table 6 <input type="checkbox"/> Coarse</p> <p>Other (specify): _____ Report Criteria on C of A? <input type="checkbox"/></p>	<p>Regulated Drinking Water? (Y/N) <u>N</u></p> <p>Metals Field Filtered? (Y/N) <u>N</u></p> <p><u>PFOS</u></p> <p><u>PFOA</u></p> <p><u>PFBA/PEHA/PEHBA</u></p> <p><u>PFNA/PFA/PEUA</u></p> <p><u>PFDA/PTGA/PTGA</u></p> <p><u>PFHxS/PEFS/PFOA</u></p>	<p>PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS</p> <p>Regular (Standard) TAT: <input checked="" type="checkbox"/> 5 to 7 Working Days</p> <p>Rush TAT: Rush Confirmation # _____ (call Lab for #)</p> <p><input type="checkbox"/> 1 day <input type="checkbox"/> 2 days <input type="checkbox"/> 3 days</p> <p>DATE Required: _____</p> <p>TIME Required: _____</p> <p>Please note that TAT for certain tests such as BOD and Dissolved Oxygen are > 5 days - contact your Project Manager for details.</p>

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM				Regulated Drinking Water? (Y/N)	Metals Field Filtered? (Y/N)	PFOS	PFOA	PFBA/PEHA/PEHBA	PFNA/PFA/PEUA	PFDA/PTGA/PTGA	PFHxS/PEFS/PFOA	# of Cont.	COMMENTS / TAT COMMENTS
Sample Identification	Date Sampled	Time Sampled	Matrix (GW, SW, Soil, etc.)										
1 <u>MW2B</u>	<u>6/17/11</u>	<u>AM-1100</u>	<u>GW</u>	<u>N</u>	<u>N</u>	<u>N</u>	<u>N</u>	<u>N</u>	<u>N</u>	<u>N</u>	<u>N</u>		<u>As per Sara Saroop.</u>
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													

RELINQUISHED BY: (Signature/Print) <u>Sybil (Stephanie Hsia)</u>	RECEIVED BY: (Signature/Print) <u>Arav Bhatar</u>	Date: <u>2011/06/17</u>	Time: <u>14:23</u>	# JARS USED AND NOT SUBMITTED	Laboratory Use Only Temperature (°C) on Receipt <u>0/10/4°c</u>
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* MANDATORY SECTIONS IN GREY MUST BE FILLED OUT. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS

Your Project #: HAM-00200231-A
Site: 9800 AIRPORT RD - FTA
Your C.O.C. #: EO529511

Attention: Kylie Boyd

exp.
80 Bancroft St
Hamilton, ON
L8E 2W5

Report Date: 2011/06/24

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B189686
Received: 2011/06/20, 15:00

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
PFOS and PFOA in water	2	2011/06/22	2011/06/22	CAM SOP-00894	In house method

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

SARA SAROOP, Project Manager
Email: SSaroop@maxxam.ca
Phone# (905) 817-5700 Ext:5821

=====
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Page 1 of 6

Maxxam Job #: B189686
 Report Date: 2011/06/24

exp.
 Client Project #: HAM-00200231-A
 Project name: 9800 AIRPORT RD - FTA

RESULTS OF ANALYSES OF WATER

Maxxam ID		JX0263	JX0264		
Sampling Date		2011/06/20	2011/06/20		
	Units	MW 1	MW 3	RDL	QC Batch
Miscellaneous Parameters					
Perfluoro-1-Octanesulfonate (PFOS)	ug/L	560	18	0.02	2527921
Perfluorobutane Sulfonate (PFBS)	ug/L	130	28	0.02	2527921
Perfluorobutanoic acid	ug/L	100	16	0.02	2527921
Perfluorodecanoic Acid (PFDA)	ug/L	0.11	<0.02	0.02	2527922
Perfluorododecanoic Acid (PFDoA)	ug/L	<0.02	<0.02	0.02	2527922
Perfluoroheptanoic Acid (PFHpA)	ug/L	64	4.5	0.02	2527921
Perfluorohexane Sulfonate (PFHxS)	ug/L	920	45	0.02	2527921
Perfluorohexanoic Acid (PFHxA)	ug/L	490	85	0.02	2527921
Perfluoro-n-Octanoic Acid (PFOA)	ug/L	130	2.1	0.02	2527921
Perfluorononanoic Acid (PFNA)	ug/L	0.52	0.03	0.02	2527922
Perfluorooctane Sulfonamide (PFOSA)	ug/L	0.40	<0.02	0.02	2527922
Perfluoropentanoic Acid (PFPeA)	ug/L	150	23	0.02	2527921
Perfluoroundecanoic Acid (PFUnA)	ug/L	<0.02	<0.02	0.02	2527922

RDL = Reportable Detection Limit
 QC Batch = Quality Control Batch

Maxxam Job #: B189686
Report Date: 2011/06/24

exp.
Client Project #: HAM-00200231-A
Project name: 9800 AIRPORT RD - FTA

Sample JX0263, PFOS and PFOA in water: Test repeated.
Sample JX0264, PFOS and PFOA in water: Test repeated.

Maxxam Job #: B189686
 Report Date: 2011/06/24

exp.
 Client Project #: HAM-00200231-A
 Project name: 9800 AIRPORT RD - FTA

QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD		Reagent Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
2527921	Perfluoro-1-Octanesulfonate (PFOS)	2011/06/22	103	70 - 130	114	70 - 130	<0.02	ug/L				
2527921	Perfluorobutane Sulfonate (PFBS)	2011/06/22	99	70 - 130	96	70 - 130	<0.02	ug/L				
2527921	Perfluorobutanoic acid	2011/06/22	110	70 - 130	103	70 - 130	<0.02	ug/L				
2527921	Perfluoroheptanoic Acid (PFHpA)	2011/06/22	96	70 - 130	88	70 - 130	<0.02	ug/L				
2527921	Perfluorohexane Sulfonate (PFHxS)	2011/06/22	100	70 - 130	92	70 - 130	<0.02	ug/L				
2527921	Perfluorohexanoic Acid (PFHxA)	2011/06/22	98	70 - 130	104	70 - 130	<0.02	ug/L				
2527921	Perfluoro-n-Octanoic Acid (PFOA)	2011/06/22	108	70 - 130	112	70 - 130	<0.02	ug/L				
2527921	Perfluoropentanoic Acid (PFPeA)	2011/06/22	109	70 - 130	112	70 - 130	<0.02	ug/L				
2527922	Perfluorodecanoic Acid (PFDA)	2011/06/22	108	70 - 130	114	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluorododecanoic Acid (PFDoA)	2011/06/22	103	70 - 130	117	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluorononanoic Acid (PFNA)	2011/06/22	93	70 - 130	86	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluorooctane Sulfonamide (PFOSA)	2011/06/22	111	70 - 130	124	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A
2527922	Perfluoroundecanoic Acid (PFUnA)	2011/06/22	106	70 - 130	111	70 - 130	<0.02	ug/L	NC	25	<0.02	N/A

N/A = Not Applicable

RPD = Relative Percent Difference

Reagent Blank: A blank matrix containing all reagents used in the analytical procedure. Used to determine any analytical contamination.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.

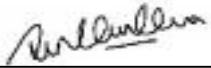
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

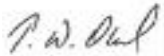
Validation Signature Page

Maxxam Job #: B189686

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



SIN CHII CHIA, Scientific Services



TERRY OBAL, Ph.D., C. Chem, Manager, Scientific Services

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



6740 Campobello Road Mississauga, ON L5N 2L8
 Phone: 905-817-5700 Fax: 905-817-5778 Toll Free: (800) 563-6266

20-Jun-11 15:00
 SARA SAROOP
 B189686
 VPA ENV-810

CHAIN OF CUSTODY RECORD

Page _____ of _____

INVOICE INFORMATION:		REPORT INFORMATION (if differs from		N: _____		MAXXAM JOB NUMBER:	
Company Name: exp. Services Inc.	Contact Name: Kyle Boyd	Address: 80 Bancroft Street Hamilton ON	Phone: 905-573-4000 Fax: 905-573-9693 Email: kyle.boyd@exp.com	Company Name:	Contact Name:	Address:	Phone: _____ Fax: 905-573-9693 Email: _____
Project #:				Project Name: HIA			
Location: 9800 Airport Road - FTA				Sampled By: SH			
						CHAIN OF CUSTODY # :	
						E0529511	

REGULATORY CRITERIA		ANALYSIS REQUESTED (Please be specific):				TURNAROUND TIME (TAT) REQUIRED:	
<p>Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form</p> <p><input type="checkbox"/> MISA Reg. 153 <input type="checkbox"/> Sewer Use</p> <p><input type="checkbox"/> PWOO <input type="checkbox"/> Table 1 <input type="checkbox"/> Residential / Parkland <input type="checkbox"/> Sanitary</p> <p><input type="checkbox"/> Reg. 556 <input type="checkbox"/> Table 2 <input checked="" type="checkbox"/> Industrial / Commercial <input type="checkbox"/> Storm</p> <p><input type="checkbox"/> Table 3 <input checked="" type="checkbox"/> Medium / Fine Municipality: _____</p> <p><input type="checkbox"/> Table 6 <input type="checkbox"/> Coarse</p> <p>Other (specify): _____ Report Criteria on C of A? <input type="checkbox"/></p>		<p>Regulated Drinking Water? (Y / N)</p> <p>Metals Field Filtered? (Y / N)</p> <p>PFOA</p> <p>PFCa/PFHx/PFHpa</p> <p>PFNA/PFDA/PFUa</p> <p>PFDa/PFTa/PFTeA</p> <p>PFHxS/PFDS/PFOSA</p>				<p>PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS</p> <p>Regular (Standard) TAT:</p> <p><input checked="" type="checkbox"/> 5 to 7 Working Days</p> <p>Rush TAT: Rush Confirmation # _____ (call Lab for #)</p> <p><input type="checkbox"/> 1 day <input type="checkbox"/> 2 days <input type="checkbox"/> 3 days</p> <p>DATE Required: _____</p> <p>TIME Required: _____</p>	

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Sample Identification	Date Sampled	Time Sampled	Matrix (GW, SW, Soil, etc.)	Analysis Requested						# of Cont.	COMMENTS / TAT COMMENTS		
				Regulated Drinking Water? (Y / N)	Metals Field Filtered? (Y / N)	PFOA	PFCa/PFHx/PFHpa	PFNA/PFDA/PFUa	PFDa/PFTa/PFTeA			PFHxS/PFDS/PFOSA	
1 MW1	June 20, 2011		GW	N		X	X	X	X	X	X	1	As per Sara Saroop
2 MW2	June 20, 2011		GW	N		X	X	X	X	X	X	1	
3 MW3	June 20, 2011		GW	N		X	X	X	X	X	X	1	
4													
5													
6													
7													
8													
9													
10													
11													
12													

RELINQUISHED BY: (Signature/Print) Sara Saroop	RECEIVED BY: (Signature/Print) Ashima Sukumaran	Date: 2011/06/20	Time: 15:00	# JARS USED AND NOT SUBMITTED	Laboratory Use Only Temperature (°C) on Receipt 9/3/12°C
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* MANDATORY SECTIONS IN GREY MUST BE FILLED OUT. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS

Your Project #: HAM-00200231A
 Your C.O.C. #: EO547311

Attention: Kylie Boyd

exp.
 80 Bancroft St
 Hamilton, ON
 L8E 2W5

Report Date: 2011/07/08

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B198668
Received: 2011/07/05, 14:35

Sample Matrix: Soil
 # Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Moisture	5	N/A	2011/07/07	CAM SOP-00445	McKeague 2nd ed 1978
PFOS and PFOA in soil	5	2011/07/06	2011/07/07	CAM SOP-00894	In house method

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited by SCC (Lab ID 97) for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

- * RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
- * Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

SARA SAROOP, Project Manager
 Email: SSaroop@maxxam.ca
 Phone# (905) 817-5700 Ext:5821

=====
 Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B198668
 Report Date: 2011/07/08

exp.
 Client Project #: HAM-00200231A

Sampler Initials: CG

RESULTS OF ANALYSES OF SOIL

Maxxam ID		KB2563	KB2563	KB2564	KB2565	KB2566	KB2567		
Sampling Date		2011/06/16 09:00	2011/06/16 09:00	2011/06/16 10:00	2011/06/16 12:00	2011/06/16 13:00	2011/06/16 14:00		
	Units	BH-1 S5	BH-1 S5 Lab-Dup	BH-2 S5	BH-4 S5	BH-5 S5	BH-6 S5	RDL	QC Batch
Inorganics									
Moisture	%	15	14	13	13	14	14	1	2543937
Miscellaneous Parameters									
Perfluoro-1-Octanesulfonate (PFOS)	ug/kg	930	630(1)	<25	<25	<25	<25	25	2542474
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	41	37	<2.5	8.2	3.0	<2.5	2.5	2542474

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

(1) - Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Maxxam Job #: B198668
Report Date: 2011/07/08

exp.
Client Project #: HAM-00200231A

Sampler Initials: CG

Test Summary

Maxxam ID KB2563
Sample ID BH-1 S5
Matrix Soil
Collected 2011/06/16
Shipped
Received 2011/07/05

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	2543937	N/A	2011/07/07	VALENTINA KAFTANI
PFOS and PFOA in soil	LCMS	2542474	2011/07/06	2011/07/07	SIN CHII CHIA

Maxxam ID KB2563 Dup
Sample ID BH-1 S5
Matrix Soil
Collected 2011/06/16
Shipped
Received 2011/07/05

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	2543937	N/A	2011/07/07	VALENTINA KAFTANI
PFOS and PFOA in soil	LCMS	2542474	2011/07/06	2011/07/07	SIN CHII CHIA

Maxxam ID KB2564
Sample ID BH-2 S5
Matrix Soil
Collected 2011/06/16
Shipped
Received 2011/07/05

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	2543937	N/A	2011/07/07	VALENTINA KAFTANI
PFOS and PFOA in soil	LCMS	2542474	2011/07/06	2011/07/07	SIN CHII CHIA

Maxxam ID KB2565
Sample ID BH-4 S5
Matrix Soil
Collected 2011/06/16
Shipped
Received 2011/07/05

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	2543937	N/A	2011/07/07	VALENTINA KAFTANI
PFOS and PFOA in soil	LCMS	2542474	2011/07/06	2011/07/07	SIN CHII CHIA

Maxxam Job #: B198668
 Report Date: 2011/07/08

exp.
 Client Project #: HAM-00200231A
 Sampler Initials: CG

Test Summary

Maxxam ID KB2566
Sample ID BH-5 S5
Matrix Soil
Collected 2011/06/16
Shipped
Received 2011/07/05

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	2543937	N/A	2011/07/07	VALENTINA KAFTANI
PFOS and PFOA in soil	LCMS	2542474	2011/07/06	2011/07/07	SIN CHII CHIA

Maxxam ID KB2567
Sample ID BH-6 S5
Matrix Soil
Collected 2011/06/16
Shipped
Received 2011/07/05

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	2543937	N/A	2011/07/07	VALENTINA KAFTANI
PFOS and PFOA in soil	LCMS	2542474	2011/07/06	2011/07/07	SIN CHII CHIA

Maxxam Job #: B198668
Report Date: 2011/07/08

exp.
Client Project #: HAM-00200231A
Sampler Initials: CG

RESULTS OF ANALYSES OF SOIL

PFOS and PFOA in soil: Duplicate results for PFOS exceeded RPD acceptance criteria. This may be due to sample heterogeneity.

PFOS reported as "total" PFOS (branched and linear isomers).

Maxxam Job #: B198668
 Report Date: 2011/07/08

exp.
 Client Project #: HAM-00200231A

Sampler Initials: CG

QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
2542474	Perfluoro-1-Octanesulfonate (PFOS)	2011/07/07	NC	70 - 130	100	70 - 130	<25	ug/kg	39.1 ⁽¹⁾	25
2542474	Perfluoro-n-Octanoic Acid (PFOA)	2011/07/07	NC	70 - 130	85	70 - 130	<2.5	ug/kg	8.0	25
2543937	Moisture	2011/07/07							5.5	20

N/A = Not Applicable

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.

(1) - Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Validation Signature Page

Maxxam Job #: B198668

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



ADAM ROBINSON, Technical Service



BRAD NEWMAN, Scientific Specialist

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

INVOICE INFORMATION:		REPORT INFORMATION:		JECT INFORMATION:		MAXXAM JOB NUMBER:	
Company Name: exp	Contact Name: Kyle Boyd	Address: 80 Bancroft Street Hamilton, ON	Phone: 905-573-4000 Fax: 905-573-8693	Email: kyle.boyd@exp.com	Company Name:	Contact Name:	Address:
EST/ENV-217				Project Name: Soil Investigation	CHAIN OF CUSTODY # :		
B198668				Location:	EO547311		
Sampled By: C.Gabel							

REGULATORY CRITERIA		ANALYSIS REQUESTED (Please be specific):				TURNAROUND TIME (TAT) REQUIRED:	
<p>Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form</p> <p><input type="checkbox"/> MISA Reg. 153 <input type="checkbox"/> Sewer Use</p> <p><input type="checkbox"/> PWQO <input type="checkbox"/> Table 1 <input type="checkbox"/> Residential / Parkland <input type="checkbox"/> Sanitary</p> <p><input type="checkbox"/> Reg. 558 <input type="checkbox"/> Table 2 <input type="checkbox"/> Industrial / Commercial <input type="checkbox"/> Storm</p> <p><input type="checkbox"/> Table 3 <input type="checkbox"/> Medium / Fine Municipality: _____</p> <p><input type="checkbox"/> Table 6 <input type="checkbox"/> Coarse</p> <p>Other (specify): _____ Report Criteria on C of A? <input type="checkbox"/></p>		<p>Regulated Drinking Water? (Y / N)</p> <p>Metals Field Filtered? (Y / N)</p> <p>PFOS</p> <p>PFOA</p>				<p>PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS</p> <p>Regular (Standard) TAT: <input checked="" type="checkbox"/> 5 to 7 Working Days</p> <p>Rush TAT: Rush Confirmation # _____ (call Lab for #)</p> <p><input type="checkbox"/> 1 day <input type="checkbox"/> 2 days <input type="checkbox"/> 3 days</p> <p>DATE Required: _____</p> <p>TIME Required: _____</p>	

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Sample Identification	Date Sampled	Time Sampled	Matrix (GW, SW, Soil, etc.)	Regulated Drinking Water? (Y/N)	Metals Field Filtered? (Y/N)	PFOS	PFOA	# of Cont.	COMMENTS / TAT COMMENTS
BH-1 SS	6/16/11	9:00	Soil			X	X	1	
BH-2 SS		10:00				X	X	1	
BH-4 SS		12:00				X	X	1	
BH-5 SS		13:00				X	X	1	
BH-6 SS		14:00				X	X	1	

RELINQUISHED BY: (Signature/Print) <i>C. Gabel</i>	RECEIVED BY: (Signature/Print) <i>SARA SAROOP</i>	Date: 7/5/11	Time: 12:00	# JARS USED AND NOT SUBMITTED	Laboratory Use Only Temperature (°C) on Receipt 3/2/3 °C
		201107/05	14:35		

* MANDATORY SECTIONS IN GREY MUST BE FILLED OUT. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS

Your Project #: HAM-00200231A
Your C.O.C. #: EO563111

Attention: Kylie Boyd

exp.
80 Bancroft St
Hamilton, ON
L8E 2W5

Report Date: 2011/07/21

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B1A3841
Received: 2011/07/13, 14:35

Sample Matrix: Soil
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Moisture	3	N/A	2011/07/16	CAM SOP-00445	McKeague 2nd ed 1978
PFOS and PFOA in soil	3	2011/07/14	2011/07/14	CAM SOP-00894	In house method

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited by SCC (Lab ID 97) for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

- * RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
- * Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

SARA SAROOP, Project Manager
Email: SSaroop@maxxam.ca
Phone# (905) 817-5700 Ext:5821

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B1A3841
 Report Date: 2011/07/21

exp.
 Client Project #: HAM-00200231A

RESULTS OF ANALYSES OF SOIL

Maxxam ID		KD7968	KD7968	KD7969	KD7970	KD7970		
Sampling Date		2011/06/16 09:00	2011/06/16 09:00	2011/06/16 09:00	2011/06/16 09:00	2011/06/16 09:00		
	Units	BH-1 S6	BH-1 S6 Lab-Dup	BH-1 S7	BH-1 S8	BH-1 S8 Lab-Dup	RDL	QC Batch
Inorganics								
Moisture	%	14		13	12	12	1	2552963
Miscellaneous Parameters								
Perfluoro-1-Octanesulfonate (PFOS)	ug/kg	700	730	340	41		25	2556833
Perfluoro-n-Octanoic Acid (PFOA)	ug/kg	23	26	55	37		2.5	2550053

RDL = Reportable Detection Limit
 QC Batch = Quality Control Batch

Maxxam Job #: B1A3841
Report Date: 2011/07/21

exp.
Client Project #: HAM-00200231A

Test Summary

Maxxam ID KD7968
Sample ID BH-1 S6
Matrix Soil
Collected 2011/06/16
Shipped
Received 2011/07/13

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	2552963	N/A	2011/07/16	MIN YANG
PFOS and PFOA in soil	LCMS	2556833	2011/07/20	2011/07/20	SIN CHII CHIA

Maxxam ID KD7968 Dup
Sample ID BH-1 S6
Matrix Soil
Collected 2011/06/16
Shipped
Received 2011/07/13

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
PFOS and PFOA in soil	LCMS	2556833	2011/07/20	2011/07/20	SIN CHII CHIA

Maxxam ID KD7969
Sample ID BH-1 S7
Matrix Soil
Collected 2011/06/16
Shipped
Received 2011/07/13

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	2552963	N/A	2011/07/16	MIN YANG
PFOS and PFOA in soil	LCMS	2556833	2011/07/20	2011/07/20	SIN CHII CHIA

Maxxam ID KD7970
Sample ID BH-1 S8
Matrix Soil
Collected 2011/06/16
Shipped
Received 2011/07/13

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	2552963	N/A	2011/07/16	MIN YANG
PFOS and PFOA in soil	LCMS	2556833	2011/07/20	2011/07/20	SIN CHII CHIA

Maxxam Job #: B1A3841
Report Date: 2011/07/21

exp.
Client Project #: HAM-00200231A

Test Summary

Maxxam ID KD7970 Dup
Sample ID BH-1 S8
Matrix Soil
Collected 2011/06/16
Shipped
Received 2011/07/13

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	2552963	N/A	2011/07/16	MIN YANG

Maxxam Job #: B1A3841
Report Date: 2011/07/21

exp.
Client Project #: HAM-00200231A

GENERAL COMMENTS

Sample KD7970-01: PFOS confirmatory ion ratios for this sample fell outside of QC tolerance limits. This is likely due to the predominance of the branched PFOS compounds in this sample, and their different fragmentation behavior. Compound confirmation in this case was verified based on supplemental matrix spiking studies.

RESULTS OF ANALYSES OF SOIL

PFOS and PFOA in soil: PFOS reported as "total" PFOS (branched and linear isomers).

Sample KD7968, PFOS and PFOA in soil: Test repeated.

Sample KD7969, PFOS and PFOA in soil: Test repeated.

Sample KD7970, PFOS and PFOA in soil: Test repeated.

PFOS and PFOA in soil: The recovery in the matrix spike was not calculated (NC). Because of the high concentration of this analyte in the parent sample, the relative difference between the spiked and unspiked concentrations is not sufficiently significant to permit a reliable recovery calculation.

Maxxam Job #: B1A3841
 Report Date: 2011/07/21

exp.
 Client Project #: HAM-00200231A

QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD		Reagent Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
2550053	Perfluoro-n-Octanoic Acid (PFOA)	2011/07/14	NC	70 - 130	114	70 - 130	<2.5	ug/kg	16.0	25		
2552963	Moisture	2011/07/16							0.9	20		
2556833	Perfluoro-1-Octanesulfonate (PFOS)	2011/07/20	NC	70 - 130	101	70 - 130	<25	ug/kg	4.0	25	<25	N/A

N/A = Not Applicable

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Reagent Blank: A blank matrix containing all reagents used in the analytical procedure. Used to determine any analytical contamination.

Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.

Validation Signature Page

Maxxam Job #: B1A3841

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



ADAM ROBINSON, Technical Service



CRISTINA CARRIERE, Scientific Services

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