Waste Management of Canada Corporation

Environmental Assessment for a New Landfill Footprint at the West Carleton Environmental Centre

SURFACE WATER EXISTING CONDITIONS REPORT

DRAFT FOR DISCUSSION AND COMMENT

Prepared by:

AECOM Canada Limited
300 – 300 Town Centre Boulevard 905 477 8400 tel
Markham, ON, Canada L3R 5Z6 905 477 1456 fax
www.aecom.com

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60191228

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1. Introduction

This report provides an overview of the existing Surface Water conditions associated with the study area for the Environmental Assessment (EA) for a proposed new landfill footprint at the West Carleton Environmental Centre (WCEC). The Minister of the Environment approved Terms of Reference (ToR) for the EA that included a preliminary description of the existing environmental conditions on-site as well as within the site vicinity (see Section 7 of the approved ToR, August 2010). The ToR made a commitment that the description of the existing conditions would be expanded during the EA[1]. With this in mind, investigative studies of the following environmental components were carried out for the purposes of generating a more detailed description and understanding of the environment for use in the assessment and evaluation of alternative landfill footprint options during the EA:

- Atmospheric;
- Geology and Hydrogeology;
- Surface Water;
- Biology – Terrestrial and Aquatic;
- Cultural Heritage Resources;
- Transportation;
- Land Use;
- Agriculture;
- Socio-economic.

Each of the above disciplines also prepared draft work plans that were presented in Appendix C of the approved ToR. The work plan presents the scope of work required to complete the EA, including the scope of technical studies for each of the environmental components, including the existing conditions. The specific work plan tasks for completing the existing conditions for the Surface Water component are provided in Attachment 8 of Appendix C to the approved ToR and are provided here for reference:

> *The surface water environmental component has the sub-components surface water quantity and surface water quality. The following tasks will be undertaken to characterize existing environmental conditions:*
>
> - *Compile and interpret information from defined background sources including:*
> - *Surface water reports from previous EA and annual monitoring reports;*
> - *Topographic mapping and aerial photography to define drainage network and drainage watersheds/sub-watersheds, discharge locations; and*
> - *Published sources (annual reports, MOE, Environment Canada, Conservation Authority) to characterize water quality and stream flow.*

1. *During the EA, and following approval of work plans by the GRT, the project team will collect further information and conduct studies (desktop and field) to describe components and sub-components of the environment identified in the ToR that may be affected by the undertaking (Approved ToR, Section 7.4, p. 41)*

- *Conduct site reconnaissance to confirm the information from available sources;*
- *Establish surface water flow and water quality monitoring station locations and monitoring program to obtain representative information;*
- *Summarize existing surface water flow and quality representative of conditions upstream and downstream of proposed new landfill expansion alternatives; and*
- *Using a hydrological model, calculate surface water runoff and peak flows in the area of the proposed expansion under existing conditions, using designs storms as set out in Ont. Reg. 232/98.*

1.1 Documentation

The results of these individual studies will be documented in separate stand-alone technical memorandums during the EA. The final Existing Conditions will form a chapter of the EA Report with each of the stand-alone memorandums becoming supporting documents/appendices to the EA Report.

1.2 Surface Water Study Team

The Surface Water study team consisted of AECOM staff. The actual individuals and their specific roles are provided as follows:

- **Paul Frigon**, P.Eng. – Senior Project Engineer
- **Chris O'Donnell**, EIT – Junior Project Engineer
- **Joe Puopolo**, P.Eng. – QA/QC

2. The Study Area

The existing landfill site and proposed expansion area is situated adjacent to the south tributary of the Huntley Creek subwatershed of the Carp River and its location is illustrated on **Figure 1** and **Figure 2**. The subwatershed area is relatively flat with a significant amount of wetland and scattered agricultural use as well as ongoing estate-lot residential development.

The south tributary has a limited drainage area with a headwater area generally defined to the west and south by Highway 417, to the north by Cavanmore Road and to the east by the Carp Road. Local drainage patterns are somewhat undefined and are characterized by large wetland areas, especially in the vicinity of the landfill site (as discussed in **Section 4.1**), that have

significant storage potential. Depending on the magnitude of rainfall, flow from these locations may or may not be realized on adjacent lands and at the landfill site.

A portion of the existing landfill site was a former gravel pit and has relatively permeable, silty-sandy soils. Municipal water supply in adjacent built-up areas to the south (Ottawa – Stittsville) and east (Ottawa-Kanata) is from the Ottawa River at the Britannia intake while water supply for a built up area to the north (Ottawa-Carp) is from local municipal wells.

In accordance with the approved ToR, the generic On-Site and Site-Vicinity Study Areas for the proposed new landfill footprint at the WCEC are listed below:

On-Site ..... the lands owned or optioned by WM and required for the new landfill. The Site is bounded by Highway 417, Carp Road and Richardson Sideroad;

Site-Vicinity..... the lands in the vicinity of the site extending about 500 m in all directions; and,

Regional..... the lands within approximately 3 to 5 kilometres (km) of the Site.

The above noted descriptions were presented in the approved ToR with the commitment that these generic Study Areas have been modified to suit the requirements of the Surface Water component.

The Regional surface water context is provided on **Figure 1** as derived from supporting documentation provided as part of the Carp River Restoration EA. It illustrates the WM site location within the context of the Huntley Creek subwatershed and its relationship to the Carp River.

The On-site Study Area for surface water is indicated on **Figure 2** and illustrates the existing operational landfill footprint as well as those lands being considered for expansion. The Site-Vicinity Study Area is also illustrated on **Figure 2** and includes all lands bounded by Highway 417, Richardson Sideroad and Carp Road including all lands owned or optioned by WM as well as adjacent off-site drainage areas.

3. Methodology

Information on existing surface water conditions at the existing WM Ottawa landfill site and vicinity was gathered from a combination of field investigations, research of existing documents and agency consultation. Site specific field investigations were conducted in 2006 and 2011 as discussed in this report.

3.1 Available Secondary Source Information Collection and Review

Available secondary sources of information were collected and reviewed by the Study Team in order to determine the existing surface water conditions within the Study Area(s). The following sources of secondary information were collected and reviewed:

- Development and Operations Report - Laidlaw Waste Systems (Ottawa) Ltd. – West Carleton Landfill Site (HPE 1994)
- Development and Operations Update Report - Canadian Waste Services Inc. – Ottawa Landfill Site (HPE 2002)
- Development and Operations Update Report (revised) - Canadian Waste Services Inc. – Ottawa Landfill Site (HPE 2003)
- Carp River Subwatershed Study (AJR 2004)
- Carp River Restoration EA (TSH 2006)
- Post-Development Flow Characteristics and Flood Level Analysis for Carp River, Feedmill Creek and Poole Creek – (CH2MHill 2006)
- Annual Report – Waste Management Ottawa Landfill (WESA 2003 through 2010 inclusive)
- Proposed Assessment Report – Mississippi Valley Source Protection Area (RVCA-MVC 2010)
- Natural Environment Baseline Conditions Report (AECOM 2011)

3.2 Process Undertaken

The following outlines the process followed to determine existing surface water conditions.

- Information was compiled and interpreted from the secondary source information.
- Site reconnaissance identified, to the extent possible, existing drainage patterns; although this is difficult given the headwater and wetland nature of adjacent and upstream lands.

- Previous surface water flow and water quality monitoring station locations were identified and additional surface water quantity and quality monitoring is proposed to obtain further representative information.
- Existing surface water flow upstream and downstream of the area being considered for a new landfill expansion has been estimated using modelling tools.
- Surface water runoff and peak flows in the area of the proposed expansion under existing conditions have been estimated using design storms as set out in Ont. Reg. 232/98.
- Potential need for a source protection plan for municipal groundwater use has been reviewed.

4. Existing Surface Water Conditions

4.1 Surface Water Features

Current drainage patterns at the site and vicinity have been delineated on **Figure 2** based on topographic mapping and site reconnaissance**.** Twenty-two (22) catchments have been identified, that contribute flow to the south tributary of Huntley Creek at the crossing located south of the intersection of Carp Road and Richardson Sideroad. The remaining drainage area for the south tributary, upstream of Richardson Sideroad, has not been formally identified but is likely constrained to the west by Highway 417 and to the north by Cavanmore Road.

Surface runoff from these drainage areas are conveyed by either small natural streams or roadside ditches. Roadway crossings along William Mooney Road, Richardson Sideroad and Carp Road typically comprise corrugated steel pipes (CSP) or small concrete box structures as identified in photos included in **Appendix A**.

4.1.1 Water Quantity

The existing condition surface drainage patterns, as shown on **Figure 2,** include those identified in the existing landfill design and operations plan and consider existing stormwater management (SWM) practices. In general, surface drainage from four overall catchments comprising the existing operational site are confined to on-site retention and groundwater recharge in the form of two constructed SWM facilities as well as two locally depressed areas that collect surface runoff with no off-site discharge except through evaporation or infiltration to groundwater. These areas are identified on **Figure 2** and summarized below:

- Catchments 1 and 4 draining to SWM Facility #1;
- Catchment 3 draining to Depression #2;
- Catchments 2A and 2B draining to SWM Facility #2; and,
- Catchments 5 and 6 draining to the natural depressions identified as Depression Area "#1" and "#2" respectively.

Currently, Catchment #2B drains non-landfill areas of the site and drainage conditions may be influenced not only by increased runoff from recent (2005) MTO Highway 417 widenings and roadway re-configuration south and west of the site, but also by the cutoff of natural drainage to William Mooney Road ditches and tributaries of Huntley Creek, to the northwest, by a new landfill access ramp at the southwest corner of the operational footprint. Based on local topography, as shown on **Figure 2**, it appears that the existing site (Catchment 2B) receives drainage from Highway 417 (Catchment 19). Recent construction of the interchange may have increased peak flows and runoff volume contributing to the site.

The area to the north and immediately east and west of the current operation is characterised by eleven drainage areas, identified as Catchments 7 through 17 on **Figure 2**, and are summarized below:

- Catchments 9, 11 and 12 drain north through small tributaries to Huntley Creek via the Richardson Sideroad south ditch;
- Surface drainage from Catchments 10, 13, and 14 is conveyed to self-contained low lying areas noted on **Figure 2** as "Depression #3", "Depression #4" and "Depression #5" respectively; and,
- Catchments 7 and 8 as well as 15, 16 and 17 drain to roadside ditches along William Mooney Road and Carp Road.

Catchments 20 and 21 are located adjacent to Highway 417 and, based on current topographic mapping and field observations carried out during periods of high flow (June 25, 2011 – 75mm rainfall), it is likely that they eventually drain north to Catchment 18: during low flow rainfall events, the existing wetland areas may attenuate runoff; under higher runoff events, general topography and site investigations indicate that flows would be directed to Catchment 18.

Existing condition peak flow estimates for the Study Area were determined using the SWMHYMO computer program. The model's NASHYD subroutine was used to represent the predominantly pervious land cover (Ia=1.5 mm) within the Study Area. Runoff Curve Numbers (CN) ranging from 60 to 78 (AMC II) were selected based on a Hydrologic Soil Group (HSG) B with land use conditions ranging from woodland to agriculture (i.e., row crop) with existing landfill areas considered to maintain a land use equivalent to "Open Pasture".

A summary of SWMHYMO model input parameters and resultant 5-year and 100-year return period peak flows, determined using an SCS Type II 24 hour rainfall distribution, have been summarized in **Table 1.** The table includes catchment flows as well as flows at points of interest as identified in **Figure 2**.

Table 1. Summary of 5-Year and 100-Year Peak Flow Estimates

Catchment / Flow Point (Refer to Figure 2)	Area (ha)	Time to Peak Tp (hrs)	SCS Curve Number CN (AMC II)	Landuse	Peak Flow Estimates- Q (m^3/s)	
					5 year	100 year
1	12.8	0.39	58	Landfill	0.306	0.756
2a	7.5	0.46	58	Landfill	0.160	0.393
2b	34.5	0.41	58	Landfill	0.787	1.944
3	10.7	0.21	58	Landfill	0.408	1.003
4	9.0	0.35	58	Landfill	0.236	0.580
5	10.3	0.10	60	Woods	0.642	1.546
6	10.9	0.07	60	Woods	0.721	1.733
7	13.2	0.45	78	Rowcrops	0.545	1.186
8	11.9	0.42	60	Woods	0.284	0.693
9	14.7	0.30	78	Rowcrops	0.810	1.758
10	14.4	0.43	58	Meadow	0.318	0.782
11	21.1	0.31	58	Meadow	0.598	1.470
12	29.4	0.58	60	Woods	0.565	1.375
13	10.1	0.19	58	Meadow	0.420	1.032
14	12.1	0.15	58	Meadow	0.596	1.457
15	7.9	0.35	58	Meadow	0.207	0.510
16	5.7	0.24	60	Woods	0.203	0.497
17	2.0	0.42	74	Farmstead	0.075	0.170
18	73.9	0.83	78	Rowcrops	1.970	4.303
19	9.5	0.36	60	Woods	0.260	0.634
20	134.6	0.91	60	Woods	1.870	4.555
21	29.8	0.40	59	Woods/Meadow	0.719	1.768
22	53.7	0.96	59	Woods/Meadow	0.693	1.697
A_1CarpRdDitch	15.6	--	--	Mixed	0.469	1.131
A	397.9	--	--	Mixed	7.203	16.852
C	251.5	0.8	78	Rowcrops	4.684	10.798
G	13.2	0.4534	78	Rowcrops	0.545	1.186
H	21.1	0.31	58.00	Meadow	0.598	1.470

Notes: 1. CN value for existing landfill area utilize value equivalent to "Open Pasture".
2. Peak flow estimates based on SCS Type II 24 hour storm event rainfall.

A surface water flow monitoring program was undertaken in 2006 with results reported in the *Natural Environment Baseline Conditions Report (AECOM 2011)*. Additional flow monitoring was undertaken in the late Summer and Fall of 2011. All monitoring locations are identified in **Figure 3**. Flow was derived from velocity estimates obtained using a GlobalWater meter and applied to the representative area of the stream. The results suggest that there is typically little

or no flow at the William Mooney Road culvert in the southwest corner of the existing site, and at the Carp Road culvert to the northwest of the site (Sites G, C and A - **Figure 2** and **Figure 3**). However, continuous flow (1-2 L/s) was observed at site J throughout the Summer/Fall monitoring period in 2011, during which time every other site had no flow, including Site A less than 1 km upstream . This suggests that, for this reach, there may either be some groundwater discharge area or pumping from a quarry that has intercepted the water table. Except during Springmelt, there is little to no flow in South Huntley Creek for most of the year.

With regard to any potential assimilative capacity of nearby streams and rivers, supporting documentation for the Carp River restoration project (*Post-Development Flow Characteristics and Flood Level Analysis for Carp River, Feedmill Creek and Poole Creek – CH2MHill 2006)* identifies 2-year peak flows for the Carp River at Highway 417, Richardson Sideroad and Huntmar Road of 8.6 m^3/s, 8.3 m^3/s and 11.7 m^3/s, respectively. Notwithstanding these flow magnitudes for given Return Periods, the report notes that there are extensive periods during the summer when flows at these sites are minimal and there is no sustained baseflow. During the 2006 monitoring program noted above, flows ranging from 0.001 m^3/s to 0.114 m^3/s were recorded in South Huntley Creek at Site A (refer to **Figure 2**) and from 0.012 m^3/s to 0.109 m^3/s at Richardson Sideroad west of Carp Road and downstream of M-Con Products Inc. In 2011, there was no sustained baseflow at these sites over a three month monitoring period.

4.1.2 Water Quality

4.1.2.1 Background

Surface runoff from the landfill and on-site service roadways generally does not discharge off-site. Runoff is directed to stormwater management (SWM) facilities where collected surface water either evaporates or recharges to groundwater. An exception is the southwest corner of the landfill site where the site currently drains west to William Mooney Road. A proposed transfer station and construction and demolition materials recovery pad located in this area of the site will re-direct stormwater to a site specific storage/recharge facility.

The original water quality monitoring program for surface water included both on-site and off-site sampling locations relating to the Annual Reports (WESA 2003 through 2010). The relevant sites are identified in **Figure 3**. Detailed results for this monitoring program can be found in the annual report series: *Annual Report – Waste Management Ottawa Landfill (WESA 2003 through 2010)* and in **Appendix B** which contains detailed summaries of on- and off-site surface water monitoring results, including the baseline monitoring mentioned in the next section.

Surface water monitoring at additional offsite locations was undertaken in 2006 and 2011 to identify baseline water quality conditions. The results from these surveys have been

summarised for water quality field parameters including pH, temperature, conductivity, and dissolved oxygen and assessment criteria parameters as identified in Table A and Table B in *Technical Guidance Document - Monitoring and Reporting for WDS - Ground and Surface Water (MOE 2010* – see **Appendix B***)*. **Table 2** summarises the results for the additional offsite locations monitored in 2006 and 2011.

The on-site surface water monitoring was undertaken for several years in the vicinity of the SWM ponds, at sites S6, S8, S17 and "POND" but was discontinued in 2008 given that surface water does not discharge off-site from the SWM facilities. A review of the parameter values summarised in **Appendix B** suggest that onsite SWM runoff is not impacted by waste or waste management activities: typically the values for surface water parameters do not exceed Provincial Water Quality Objectives (PWQO). Accordingly, the site Environmental Monitoring Plan (EMP) was revised to reflect the reduced monitoring and focused on potential down-gradient groundwater impacts and monitoring. This included monitoring in the Highway 417 north ditch which is believed to intercept the groundwater table.

Current surface water monitoring sites located along the Highway 417 north ditch east of Carp Road include S1, S3 and S10 as identified in **Figure 2** and **Figure 3** and drain to Feedmill Creek. Sampling is conducted on a semi-annual basis (Spring and Fall).

The 2010 surface water quality monitoring results, as reported in the 2010 Annual Report, suggest continued improvements in water quality subsequent to the start of the purge well system operations but notes PWQO exceedances along the Highway 417 drainage ditch for both Boron and Iron. However, the report indicates that Iron is not an Assessment Parameter for the landfill site and that the drainage ditch receives additional runoff from Highway 417 and other potential sources, including truck traffic and quarry activities that may be contributing to the observed concentrations of both Boron and Iron.

4.1.2.2 Baseline Water Quality Monitoring

Baseline surface water quality samples from Huntley Creek, South Huntley Creek and its tributaries were collected by AECOM three times in 2006 and three times in 2011 to provide a baseline for future landfill activities.

In 2006, samples were taken at Sites G, C, A and J as shown on **Figure 2** and **Figure 3**. Site G was not flowing (hence not sampled) during the July sampling event and Site C was not sampled during the April sampling event. Only Sites G and C were sampled during the October sampling event. The spring sample was taken on April 11, 2006 after more than three days without rain. The second sample was taken on July 26, 2006 immediately after a 32 mm rain event. The third sample was taken on October 24, 2006 during a rain event and after several weeks of wet

weather. Results of the water quality sampling are presented in **Table 2** for MOE assessment criteria parameters and in detail in **Appendix B**.

In 2011, samples were again taken at sites G, C, A and J as well as at a new site, K, on the main branch upstream of the confluence with South Huntley Creek. Site K is likely the only surface water monitoring site that reflects runoff from a relatively undisturbed "natural" upstream drainage area. The samples collected in September reflect baseflow conditions while the October samples were the result of runoff from an extended period of rainfall. Again, results for MOE assessment criteria parameters are summarised in **Table 2**.

The results were compared to the PWQO (MOE 1994). PWQOs are a set of guidelines used for the management of the province's water resources. During the sampling periods, and for all sites, MOE assessment criteria parameters were below their PWQO except for one occurrence of Boron and two for Iron.

Of note, from the detailed results in 2006 as reported in **Appendix B** and that were not MOE assessment criteria parameters:

- *E. coli* exceeded the guideline in all samples and nutrient levels are high, both of which and can be attributed to upstream agricultural activity. The presence of cattle from local dairy farming operations and local wildlife sources, including waterfowl and beaver/muskrat, could be major sources of any *E.coli* found within surface water in the vicinity of the existing landfill. As well, local residential septic systems could be a contributing factor if they were not performing to specification.
- Site J showed PWQO exceedances. During the April sampling event, Total Phosphorus and Aluminum were above their respective PWQO. In addition, Ammonia, Magnesium, and Zinc were higher than their upstream counterparts. During the July sampling event, Total Phosphorus and Aluminum were again above their respective PWQO. In addition, Ammonia, Magnesium and E. coli were higher than their upstream counterparts. The samples do not reflect signature characteristics of leachate contamination and, therefore, the elevated metal levels are assumed to be a function of the activities of industrial land uses in the area, including truck traffic. If necessary, this could be re-confirmed by reviewing leachate composition at the site and degree of leachate capture by internal treatment systems and comparing these results to the ditch samples. The potential for debris and airborne contamination from the landfill to impact runoff in other catchments is minimal, as the landfill is regularly covered and screens are employed during operations on windy days.

Table 2. Surface Water – Water Quality Results, 2006 and 2011

Sample ID:	Type:	Field				Lab																
	PARAMETER:	Temperature	pH	Conductivity	Dissolved Oxygen	Arsenic	Barium	Boron	Cadmium	Chloride	Chromium	Copper	Iron	Lead	N-NH3 (Ammonia)	N-NH3 (unionized)	N-NO2 (Nitrite)	N-NO3 (Nitrate)	pH	Phenols	Toltal Dissolved Solids	Total Suspended Solids	Zinc
	UNITS:	°C	-	mS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L	mg/L	mg/L	mg/L
	PWQO:	--	6.5-8.5	--	--	0.1	--	0.2	0.0002	0	0	0.005	0.3	0.005	--	0.02	--	--	6.5-8.5	0.001	--	0.00	0.03
	Detecion Limit:	0.5	0.01	--	0.01	0.001	0.01	0.01	0.0001	1	0.001	0.001	0.03	0.001	0.02	0.02	0.1	0.1		0.001	1	2	0.01
	Sample Date																						
Site A	2011-10-20	11.5	6.95	482	6.5	<0.001	0.05	--	<0.0001	62	<0.001	0	--	--	0.04	<0.02	<0.10	0.16	--	--	241	22	0
Site A	2006-11-04	11.7	8.08	670	12.27	ND	0.061	0.012	ND	112	ND	0.001	0.06	ND	ND	-	ND	0.50	8.30	--	503	1.00	ND
Site A	2006-07-06	21.3	-	965	8.9	ND	0.11	0.038	ND	138	ND	0.001	0.10	ND	0.05	0.00	ND	ND	8.30	--	707	ND	0.01
Site C	2011-10-20	12.1	7.41	762	3.9	<0.05	0.11	--	<0.01	86	<0.05	0	--	--	0.42	<0.02	<0.10	7.73	--	--	381	54	<0.05
Site C	2006-10-24	--	--	--	--	ND	0.075	0.04	ND	163	ND	0.002	0.17	ND	0.20	0.02	ND	1.60	8.10	--	--	10.00	ND
Site G	2006-11-04	18.3	7.72	976	10.25	ND	0.059	0.022	ND	127	ND	0.001	ND	ND	ND	--	ND	0.70	8.30	--	551	ND	ND
Site G	2006-10-24	--	--	--	--	0.002	0.1	0.63	0.0002	193	ND	0.017	**0.91**	0.0035	9.73	1.00	0.29	2.50	8.00	--	--	2.00	0.02
Site C	2006-07-06	25.8	--	960	10.7	ND	0.084	0.03	ND	170	ND	0.002	0.27	ND	0.11	0.01	0.04	0.20	8.30	--	664	1.00	0.009
Site J	2011-10-20	12.7	7.73	693	6.1	<0.001	0.06	--	<0.0001	89	0.001	0.002	--	--	0	<0.02	<0.10	0.67	--	--	346	20	<0.01
Site J	2011-09-30	16	7.89	1193	8.2	<0.001	0.12	0.12	<0.0001	166	0.004	0.001	<0.03	<0.001	<0.02	<0.02	<0.10	0.31	8.04	<0.001	596	<2	<0.01
Site J	2011-09-27	19.2	7.98	1200	8.9	<0.001	0.13	0.15	<0.0001	174	0.003	<0.001	<0.03	<0.001	0.02	<0.02	<0.10	0.66	8.19	<0.001	597	<2	<0.01
Site J	2006-11-04	11.5	8.13	739	13.21	0.001	0.077	0.084	ND	116	ND	0.005	0.27	0.0013	0.41	0.01	0.05	0.50	8.30	--	672	ND	0.006
Site J	2006-07-06	18.7	-	1019	6.9	ND	0.13	0.11	ND	133	ND	0.002	**0.53**	ND	0.17	0.01	0.04	1.10	8.10	--	754	ND	ND
Site K	2011-10-20	11.1	6.96	432	7.6	<0.05	0.09	--	<0.01	76	<0.05	<0.01	--	--	<0.02	<0.02	<0.10	0.34	--	--	217	121	<0.05
Site K	2011-09-30	18.2	7.89	1061	7.4	<0.001	0.12	0.02	<0.0001	200	0.004	<0.001	0.16	<0.001	0.07	<0.02	<0.10	0.12	8.03	<0.001	530	20	<0.01
Site K (2006 Site)	2011-09-27	19.8	7.98	1164	8.4	<0.001	0.14	0.11	<0.0001	181	0.003	<0.001	0.06	<0.001	0.03	<0.02	<0.10	0.24	8.19	<0.001	587	<2	<0.01
Notes											Detection limit for 2006 = 0.005			Detection limit for 2006 = 0.005									

-- Not Sampled

2011 =Field Reading

Exceeds PWQO

4.1.2.3 Water Quality Summary

Water quality in South Huntley Creek varied significantly between sites and sampling dates, generally reflecting local upstream land uses. Overall, water quality varied from poor to moderate influenced by nutrient enrichment and the presence of E. coli.

4.1.2.4 Source Protection Planning

A review of information obtained from the *Proposed Assessment Report – Mississippi Valley Source Protection Area (RVCA-MVC 2010)* confirms that the subject Study Area is located well south of the Village of Carp Wellhead Protection Zone (WHPZ). Further, a review of the Ottawa (Britannia) Intake Protection Zone (IPZ) Vulnerability Scoring map indicates that the Study Area is situated within the lowest scoring zone (3.6) and would therefore not be subject to any special source protection policies. Further details regarding Source Protection Planning are contained within the Geology/Hydrogeology Existing Conditions Report.

4.2 Stormwater Management Facilities

The existing surface water drainage system directs stormwater runoff to three SWM facilities (recharge ponds) with stormwater eventually being discharged to the overburden water table. The SWM facility volume is sized to handle the 5-year design event rainfall. The SWM facility areas were found to have silty-sand soils that are excellent for recharge ponds. The three recharge pond surface areas were determined by undertaking hydraulic calculations using the Hantush Analytical Model to ensure groundwater mounding was at or below the pond bottom elevations. A sedimentation cell was incorporated in front of the recharge ponds to minimize potential plugging of recharge areas.

The two constructed SWM facilities have emergency overflow spillways to prevent overtopping if the ponds are full or the design flow/volume is exceeded and will flow to lower site areas and pond or recharge at these lower elevations. Depressions #3/#4 and Depression #1 fulfil these functions for SWMF #1 and SWMF #2, respectively and have capacity to accommodate between 15 to 20 times the runoff from the 1:100 year rainfall event before capacity is exceeded. The third recharge pond was never constructed and existing Depression Area #2 currently fulfils the recharge function with a capacity that is over 20 times the runoff from the 1:100 year event.

This also implies a significant capacity to store the 1:100 Year Springmelt runoff whose volume would likely be in the order of 7 times the 1:100 year rainfall runoff implying the depression areas have storage capacity at 2 to 3 times the volume of a 1:100 Year Springmelt event.

Should these capacities ever be exceeded, which is unlikely, flow would be east overland to the Carp Road and/or north to South Huntley Creek.

5. Conclusions

The existing surface water regime does not pose any significant problems from a water quantity perspective, although there is some concern about drainage in the southeast quadrant and the observed potential to flood SWM Facility #2 and Depression #1. Drainage in the southwest quadrant should be investigated further in an effort to better define the catchment areas and the drainage patterns.

Drainage to/in Catchments 5, 6, 10, 13 and 14 have no natural outlet and current site runoff is directed to Catchments 5, 6 and 10.

Stormwater from the existing landfill site is generally managed on-site and not discharged.

Water quality in South Huntley Creek, when tested in 2006 and 2011, varied significantly between sites and sampling dates, generally reflecting local upstream land uses. Overall, water quality varied from poor to moderate.

6. Recommendations / Further Work

Ongoing surface water monitoring for both water quantity and quality is warranted to confirm flow and water quality conditions of South Huntley Creek and Huntley Creek, Main Branch.

Report Prepared By:

Chris O'Donnell, EIT
Junior Engineer

Report Reviewed By:

Paul Frigon, P.Eng.
Senior Project Engineer