

FINAL REPORT

**GROUNDWATER BEST MANAGEMENT PRACTICES PLAN
WEST CARLETON ENVIRONMENTAL CENTRE
OTTAWA, ONTARIO**

Submitted to:



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1. PURPOSE

The purpose of this report is to describe the Best Management Practices (BMPs) that Waste Management (WM) will employ with respect to groundwater protection at the West Carleton Environmental Centre (WCEC) in order to manage and minimize potential environmental effects resulting from the undertaking.

2. GENERAL / BACKGROUND INFORMATION

2.1 SITE DESCRIPTION

The West Carleton Environmental Centre is located at 2301 Carp Road, on Lots 3, 4 and 5 (South half), Concession 3, former Township of West Carleton, now in the City of Ottawa. The property layout and general site features considered for this BMP document are shown on Figure 1. The site facilities and infrastructure include the following:

- Existing closed landfill;
- Existing scalehouse/office and weigh scales;
- Existing purge well pumping system, including forcemain discharge from site;
- Leachate collection system, with connection to the forcemain discharge;
- Landfill gas collection system, gas flares and gas-to-energy plant;
- Engineered stormwater management ponds and other surface water features (ponds, ditches, etc.);
- Biosolids storage areas;
- Waste transfer & processing facility;
- Access roads and parking areas (paved and unpaved surfaces);
- Proposed landfill footprint to be constructed with double-composite liner & leachate collection system;
- Proposed new scalehouse and weigh scales;
- Proposed public drop-off area;
- Proposed stormwater management ponds.

2.2 DESCRIPTION OF HYDROGEOLOGIC ENVIRONMENT

A summary description of the hydrogeologic environment that could be potentially affected by the construction and operation of the WCEC facilities is provided below. Note that a detailed description of the environment is provided in the Hydrogeologic Assessment Report, prepared



for the application for approval of the WCEC waste disposal site, under the Environmental Protection Act (WESA, 2014a).

Site Topography & Drainage

The WCEC property consists of well-drained sandy and glacial till areas, representing the upland side of a post-glacial beach ridge. The topography is relatively flat-lying on the western half of the property with elevations between approximately 125 and 130 metres above sea level (mASL), and slopes downward toward the eastern edge of the ridge, reaching approximately 115 mASL in the northeast corner of the site. The land surface has been modified by former aggregate extraction activities and landfill operations.

North and west of the existing landfill site, surface drainage flows within the Huntley Creek subwatershed. Tributaries of Huntley Creek generally flow northward to Richardson Sideroad, and then eastward past Carp Road. Huntley Creek discharges to Carp River east of Huntmar Road.

From within the boundaries of the existing landfill property, there is minimal direct off-site discharge of surface water. Surface water drainage is primarily contained within the landfill property and is directed to on-site ponds. The exceptions to this are the external slopes of the vegetated site perimeter berms along the east and south boundaries of the landfill property; however, this amount of surface runoff is very minor and is not in contact with operational activities at the landfill. Runoff from the vegetated berms flows into the Carp Road and Highway 417 drainage systems. There is also a small area of drainage from the extreme western end of the site, north of the service entrance, which flows into the ditch along William Mooney Road, and then northward into a tributary of Huntley Creek.

The Highway 417 drainage system controls surface water flow immediately south of the existing landfill property. Surface water drainage south of the landfill property is controlled by ditches, catch basins and culverts along Highway 417 and generally flows from west to east, eventually reaching Feedmill Creek and ultimately Carp River.

Hydrogeology

The surficial geology across the WCEC property reflects the glacial history of the Ottawa region. The unconsolidated deposits consist principally of sand, silt, gravel and glacial till, and range in thickness from approximately 3 to 17 metres. The surficial deposits are interpreted to be ice-contact stratified drift sediments, consisting of a mixture of poorly to well-sorted, stratified gravels and sands, interbedded with a silty sand-gravel till. The deposits are interpreted to have



been submerged during the Champlain Sea encroachment, and therefore show indications of re-working in a subaqueous environment.

The bedrock surface generally slopes toward the northeast across the property, ranging between elevations of 125 mASL and 110 mASL. The bedrock surface features two apparent topographic highs: one located near the southwest extremity of the property, and the other in the western portion of the existing landfill site.

Bedrock consists of light to medium grey, fine to medium-grained fossiliferous limestone with some shaly and sandy interbeds. The bedrock is classified as the Bobcaygeon Formation which is described regionally as a limestone with shaly partings and intermittent sandstone. The bedrock is generally most fractured in its upper few metres, while the frequency of fractures in the bedrock decreases starting at depths of approximately 6 to 8 metres below the bedrock surface.

In the higher topographic elevations along Carp Road, the water table in the unconsolidated deposits (i.e., sand, silty sand and silty sand-gravel till) is generally found at over 10 metres depth, indicating that the majority of the unconsolidated deposits are unsaturated. The saturated thickness of these deposits, which represents the water table aquifer, is generally limited to 5 metres or less. In areas where the bedrock is closer to the surface or where the topographic elevations decline, the depth to the water table decreases, however, the saturated thickness remains limited. Groundwater is also found in the weathered bedrock at the overburden-bedrock interface. This part of the unit extends to a depth of approximately 6 to 8 metres below the bedrock surface.

The hydrogeologic setting on the WCEC property represents a zone of groundwater recharge, with a relatively shallow water table, an unconfined aquifer, and permeable hydrostratigraphic units. The area is classified as a significant groundwater recharge area (Mississippi-Rideau Source Protection Region, 2011). In a regional aquifer vulnerability study completed for the City of Ottawa, the glaciofluvial and beach ridge deposits in the area of the WCEC property are identified as having a high to very high intrinsic vulnerability (Waterloo Hydrogeologic Inc. and CH2M Hill, 2001). A high groundwater recharge potential and relatively shallow depth to the water table are the principal factors in this determination of aquifer vulnerability.

Shallow groundwater flow on the property generally follows the bedrock topography, with a water table elevation varying from 128 to 129 mASL in the southwest portion of the landfill property to less than 112 mASL east of Carp Road. The direction of groundwater flow within the overburden-shallow bedrock in the southwest portion of the study area is towards the north-northeast. In the northwest corner of the existing landfill site, the topographic high present in the bedrock appears to influence shallow groundwater flow and induces an area of localized northwesterly flow toward the northwest corner of the site. Across the majority of the study



area, the direction of groundwater flow in the overburden-shallow bedrock is towards the northeast. Comparison of the groundwater head contours between different periods of the year illustrates that although there are seasonal variations in the groundwater elevations, the general characterization of the flow directions and gradients remains consistent.

2.3 ISSUES OF CONSIDERATION FOR GROUNDWATER PROTECTION

The characteristics of the hydrogeologic environment on the WCEC property make it susceptible to groundwater contamination from point and non-point sources. The Best Management Practices described in this document are intended to prevent or mitigate impacts to groundwater by means of source and structural controls, and operational procedures.

The relevant hydrogeologic characteristics include the following:

Shallow unconfined aquifer – The water table occurs at a relatively shallow depth in the overburden deposits, and there is no protective confining layer of fine-grained soil deposits near the surface.

Hydraulic conductivity – The unconfined aquifer consists of coarse-grained soil deposits (sand, gravel, etc.) and shallow fractured limestone with relatively high hydraulic conductivity (K) values. This results in relatively rapid movement of groundwater across the site.

Recharge area – A proportion of the precipitation that falls on the WCEC property will infiltrate through the unsaturated soil horizons to reach the water table in the unconfined aquifer. The permeable soil deposits and downward hydraulic gradients promote recharge across most of the WCEC property.

Water supply wells – The area surrounding the WCEC property is not serviced by a municipal water supply, and properties rely on the groundwater resource for a supply of water for potable or other uses. Residences and businesses use private water supply wells to access the groundwater resource.

Surface water drainage – The WCEC property is situated within the subwatersheds of two creeks: Huntley Creek and Feedmill Creek. Both creeks flow into the Carp River east of WCEC property. The creeks support aquatic life and habitat, and are susceptible to nutrient or contaminant inputs.

Potential Source Areas and Activities

The various areas of the WCEC facility and proposed activities that could potentially contribute to contaminants entering the groundwater regime or surface watercourses are outlined in Table 1.



A description of the type of contaminants and potential mechanisms for entry in the groundwater or surface water environments is also presented in the table.

Table 1: Potential Source Areas and Activities

Source Area/Activity	Description (contaminant, mechanism)
Landfill construction: - excavation and grading - imported fill - equipment spills	Runoff from disturbed areas (bare soil with no topsoil or vegetation) or stockpiles of imported fill may contain higher suspended solids loadings that can enter surface watercourses; petroleum products (fuels, oils, lubricants, etc.) from equipment spills may enter surface water or groundwater environments.
Chemical storage, handling & use: - petroleum products (POLs) - solvents (degreasers) - waste chemicals - pesticides, rodenticides, etc.	Hydrocarbon chemical spills from storage in tanks (above-ground or underground); spills from storage of solvent inventories; handling of chemicals during and after use; releases from hydraulic oils contained in scales, hoists and vehicles; improper storage or use of other chemicals.
Wastewater: - leachate containment, collection & treatment system - sewage systems - stormwater management - road & parking area drainage - maintenance activities	Leachate from decomposing waste can enter the surface water or groundwater environments through seeps or infiltration; leachate and gas condensate is pumped from the landfill footprint to other areas where it is treated and discharged from the site; septic systems service the buildings on the site and discharge to tile beds; stormwater from the landfill and other areas is routed to sedimentation & infiltration ponds; washwater from vehicles and other equipment can infiltrate to groundwater or flow to drainage ditches.
Solid waste acceptance & handling: - scales, roads & tipping face - waste transfer & processing facility - public drop-off bins	Solid waste is transported around the site in trucks, from acceptance at the weigh scales to various transfer, processing or disposal areas; waste being transported or stored outdoors is subjected to wind (litter) and precipitation (leaching).
Road & parking area maintenance: - dust control - snow removal - de-icing	Water used to control dust on roads can runoff into ditches, with elevated levels of suspended solids; stockpiles of snow removed from roads and parking areas may contain elevated concentrations of salts and metals; de-icing products typically used on roads and parking areas can contain high levels of chloride salts and sand.
Imported fill: - storage and stockpiling	Clean fill may be imported during landfill construction for re-grading purposes; contaminated soil may be accepted at the landfill, stockpiled and used as cover over disposed waste; the soil may contain petroleum products or other contaminants; runoff from soil stockpiles may contain elevated suspended solids loadings.
Wells: - water supply wells - monitoring wells	A water supply well is in use at the waste transfer & processing facility; monitoring wells are located around the site to observe groundwater conditions; the wells can potentially act as conduits for contaminants to enter the groundwater.
Fires: - runoff - fire retardant chemicals	Water used to control fires at the landfill can impact groundwater or surface water because the water becomes contaminated on contact with burning materials; chemicals stored or in use at the location of the fire could potentially leak and enter the groundwater or surface water environments.



3. COMMITMENTS & EA CONDITIONS

The commitments made by WM during EA consultations in relation to groundwater protection and management are summarized in Table 2, along with the specific conditions issued in the Minister of Environment's approval of the EA.



Table 2: Groundwater Commitments & EA Conditions

EA Report Section	Commitment Made in the EA	EA Approval Condition No.	Minister of the Environment's EA Condition
Section 7.9	Consult with stakeholders regarding ECAs, EMP(s) and BMPs, Contingency Plans, and End-Use/Closure Plan for the undertaking and other WCEC facilities prior to submission of the formal applications to the MOE. Consultation will include opportunities to review ECAs, EMP(s) and BMPs, Contingency Plans, and End-Use/Closure Plan for the undertaking and other WCEC facilities. Give notice of availability of draft documents on the project website for review for a 30-day period (e.g., local newspapers, project website, stakeholder email). Conduct consultation events on draft documents, if needed (e.g., Open Houses). Post final documents submitted to the MOE on the project website, including the results of the consultation process. Stakeholders will include the Carp Landfill Community Liaison Committee (CLCLC), the City of Ottawa, government agencies, and the public.	8	2. The proponent shall post the draft Groundwater and Surface Water Monitoring Plan on the proponent's website for the undertaking for a period of thirty days for review and public comment. The proponent shall take any comments received into consideration prior to finalizing the plan. Once finalized, the proponent shall implement the plan. 3. Any monitoring reports prepared by the proponent in accordance with the Groundwater and Surface Water Monitoring Plan shall be made publicly available on the proponent's website for the undertaking.
Section 7.9	Consult with First Nations and Aboriginal communities regarding the ECAs, EMP(s) and BMPs, Contingency Plans, and End-Use/Closure Plan for the undertaking and other WCEC facilities prior to submission of the formal applications to the MOE. Consultation will include opportunities to review ECAs, EMP(s) and BMPs, Contingency Plans, and End-Use/Closure Plan for the undertaking and other WCEC facilities. Give notice of availability of draft documents on the project website for review for a 30-day period (e.g., mail/email/fax, phone, project website). Conduct consultation events on draft documents, if needed (e.g., meetings). Post final documents submitted to the MOE on the project website, including the results of the consultation process.	8	2. The proponent shall post the draft Groundwater and Surface Water Monitoring Plan on the proponent's website for the undertaking for a period of thirty days for review and public comment. The proponent shall take any comments received into consideration prior to finalizing the plan. Once finalized, the proponent shall implement the plan. 3. Any monitoring reports prepared by the proponent in accordance with the Groundwater and Surface Water Monitoring Plan shall be made publicly available on the proponent's website for the undertaking.
Chapter 6	Prepare EMP(s) and BMPs following approval of the undertaking by the Minister of the Environment and prior to construction. The EMP(s) and BMPs will include a description of proposed mitigation measures, monitoring requirements, and commitments, as stated in Chapter 6 of the WCEC EA Report. The EMP(s) and BMPs will ensure these mitigation measures, monitoring requirements, and commitments are implemented during construction, operation, closure, and post-closure of the undertaking and other WCEC facilities.		



Chapter 6	<p>Prepare Contingency Plans related to groundwater, surface water, and atmosphere (i.e., odour, dust, noise, landfill gas) following approval of the undertaking by the Minister of the Environment and prior to construction. The Contingency Plans will include a description of proposed contingency measures, monitoring requirements, and commitments, as stated in Chapter 6 of the WCEC EA Report. The Contingency Plans will ensure these contingency measures, monitoring requirements, and commitments are implemented, if required, during construction, operation, closure, and post-closure of the undertaking and other WCEC facilities.</p>		
<p><i>SD #5 – Geology and Hydrogeology DIA, Section 6.2.1, Section 6.2.2 and Section 8.2</i></p>	<p>Develop a Groundwater BMP Plan that may include the following mitigation measures for groundwater quality:</p> <ul style="list-style-type: none"> • Establish concentration limits on the effluent infiltrating to the groundwater from the unlined pond stages; • Prepare an implementation plan for the design and construction of a purge well system (or other approved mitigation measure) in order to control leachate migration from the existing unlined (closed) landfill, if necessary. The implementation plan will be prepared and submitted to MOE concurrent with the application for approval under the Environmental Protection Act for the new WCEC landfill facility; • Install a series of purge wells along the northern toe of the existing landfill, between the existing unlined (closed) landfill and the new landfill in accordance with the implementation plan; and • Continue to operate and maintain the existing purge well system on the existing unlined (closed) landfill site to ensure that groundwater quality impacts from former operations remain within the boundaries of the CAZs. The purge well system will continue to be operated until such time as it can be demonstrated that the system is no longer required in order to maintain groundwater impacts within the CAZs. 	8	<ol style="list-style-type: none"> 1. The proponent shall prepare and submit to the Regional Director a draft Groundwater and Surface Water Monitoring Plan for review and comment prior to the commencement of construction of the undertaking. The Regional Director may require the proponent to amend the plan. 2. The proponent shall post the draft Groundwater and Surface Water Monitoring Plan on the proponent's website for the undertaking for a period of thirty days for review and public comment. The proponent shall take any comments received into consideration prior to finalizing the plan. Once finalized, the proponent shall implement the plan.



<p><i>SD #5 – Geology and Hydrogeology DIA, Section 8.1.1</i></p>	<p>Develop a Groundwater BMP Plan that may include the following monitoring measures for groundwater flow:</p> <ul style="list-style-type: none"> • Monitor groundwater flow on-site and within the site-vicinity by measuring water levels in monitoring wells; • Monitor water levels in the SWM ponds; and • Use the collected data to map and interpret the groundwater flow orientations. 	<p>8</p>	<p>1. The proponent shall prepare and submit to the Regional Director a draft Groundwater and Surface Water Monitoring Plan for review and comment prior to the commencement of construction of the undertaking. The Regional Director may require the proponent to amend the plan. 2. The proponent shall post the draft Groundwater and Surface Water Monitoring Plan on the proponent’s website for the undertaking for a period of thirty days for review and public comment. The proponent shall take any comments received into consideration prior to finalizing the plan. Once finalized, the proponent shall implement the plan.</p>
<p><i>SD #5 – Geology and Hydrogeology DIA, Section 8.1.1 and Section 8.2</i></p>	<p>Develop a Groundwater BMP Plan that may include the following monitoring measures for groundwater quality:</p> <ul style="list-style-type: none"> • Collect groundwater samples from selected monitoring wells located on-site and within the site-vicinity and analyze the samples for an appropriate site-specific indicator list; • Collect effluent samples from the unlined stages of the SWM Ponds to measure water quality in effluent infiltrating to the groundwater table; • Use the collected data to interpret groundwater quality conditions upgradient, between the landfill footprints, and downgradient from the new landfill facilities; and • Continue to monitor the existing purge well system on the existing landfill site to ensure that groundwater quality impacts from the existing unlined landfill remain controlled by the existing purge well system and natural attenuation across the CAZ. The purge well system will continue to be operated until such time as it can be demonstrated that the system is no longer required in order to maintain groundwater impacts within the CAZs 	<p>8</p>	<p>1. The proponent shall prepare and submit to the Regional Director a draft Groundwater and Surface Water Monitoring Plan for review and comment prior to the commencement of construction of the undertaking. The Regional Director may require the proponent to amend the plan. 2. The proponent shall post the draft Groundwater and Surface Water Monitoring Plan on the proponent’s website for the undertaking for a period of thirty days for review and public comment. The proponent shall take any comments received into consideration prior to finalizing the plan. Once finalized, the proponent shall implement the plan.</p>
<p><i>SD #5 – Geology and Hydrogeology DIA, Section 8.1.1</i></p>	<p>Submit groundwater monitoring results to MOE for review in an annual report for the WCEC.</p>		



<p><i>SD #5 – Geology and Hydrogeology DIA, Section 8.1.1 and Section 8.2</i></p>	<p>An EMP for groundwater flow and quality monitoring will be developed as part of the application for approval under the Environmental Protection Act for the new WCEC landfill facility. Details of the groundwater monitoring program, including specific sampling locations, physical/chemical parameters, and sampling frequencies, as well as trigger/compliance locations and parameter concentrations, will be developed as part of the EMP for the proposed undertaking.</p>	<p>8</p>	<p>1. The proponent shall prepare and submit to the Regional Director a draft Groundwater and Surface Water Monitoring Plan for review and comment prior to the commencement of construction of the undertaking. The Regional Director may require the proponent to amend the plan. 2. The proponent shall post the draft Groundwater and Surface Water Monitoring Plan on the proponent's website for the undertaking for a period of thirty days for review and public comment. The proponent shall take any comments received into consideration prior to finalizing the plan. Once finalized, the proponent shall implement the plan.</p>
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4. BEST MANAGEMENT PRACTICES

Groundwater protection Best Management Practices (BMPs) are specific measures taken or procedures followed to prevent or reduce contaminants from entering the groundwater environment. The sources of contamination may be from discrete (point) sources, or from more widespread (non-point) sources. The practices may involve structural or non-structural controls, or operational/maintenance procedures. The overall objective of the BMPs is to operate the WCEC facility as efficiently as possible, in a manner that prevents or reduces contaminant impacts to groundwater.

The groundwater protection BMPs for the WCEC facility are presented in Table 3.



Table 3: Groundwater Best Management Practices

No.	Potential Effect	Groundwater BMP	Implementation Timing (i.e. date, stage of process, season)	Responsibility
A. Landfill Construction				
A1.	High suspended solids in runoff	a) Minimize extent of disturbed areas prior to vegetating or covering with liners. b) Use erosion and sedimentation controls along drainage routes and around soil stockpiles (i.e., covers, silt fences, berms, check dams, etc.).	All stages of landfill construction and development.	Waste Management, Construction Contractor(s)
A2.	Vehicle and equipment spills	a) Ensure adequate spill clean-up materials are kept available at the facility. Clean up spills promptly, and dispose spilled materials properly.		
B. Chemical storage, handling & use				
B1.	Release of chemicals from storage	a) Prepare a Spill Prevention and Contingency Plan (SPCP) to include provisions to prevent and mitigate spills during storage, handling and transfer activities. The SPCP should be reviewed and updated annually. b) Avoid use of underground storage tanks where possible on the facility. c) Provide secondary containment of liquid storage tanks to include 110% of the volume of the largest storage container, by double-walled structures, concrete vaults, permanent dikes or other means. d) Equip liquid storage tanks with automatic shutoffs and high level alarms. Personnel should be trained to respond to shutoffs and alarms. e) Label all storage containers to identify products and according to WHMIS requirements. f) Ensure all containers and piping are secure and resistant to corrosion, and available for visual inspection. g) Protect all storage containers/structures from collision with vehicles and equipment. h) Store all bulk, drummed or bagged chemicals under cover, and on impervious working surfaces without floor drains. i) Inspect all storage areas at least weekly, and maintain an inventory of chemicals being stored. j) Remove all used/waste chemicals from the site on a regular basis.	B.1.(a) – Prior to construction of the WCEC facilities. Remaining BMPs – Throughout all stages of WCEC facility operations.	Waste Management



B2.	Chemical spills during use	<ul style="list-style-type: none"> a) Use non-hazardous, non-toxic alternatives for chemical products wherever possible. b) Pesticides, herbicides, rodenticides, etc. should only be used by trained personnel in accordance with government regulations. Limit the use of such chemicals to the minimum necessary for control. c) Refuel vehicles on an impermeable surface or provide spill containment under refueling equipment. d) Perform vehicle and equipment maintenance on an impermeable surface or provide spill containment beneath equipment being maintained. e) Use portable drip pans when draining oils or fluids from vehicles or other equipment (hydraulic hoists, etc.) to prevent spills on the ground. Drain fluids over an impermeable surface where possible. f) Ensure adequate spill clean-up materials are kept available at the facility. Clean up spills promptly, and dispose spilled materials properly. 	Throughout all stages of WCEC facility operations.	
C. Wastewater				
C1.	Release of leachate to surface water or groundwater	<ul style="list-style-type: none"> a) Prepare and implement a Construction Quality Assurance Plan (CQA Plan) for the construction of the leachate containment & collections system (i.e., grade control, natural & synthetic liners, collection piping, natural & synthetic collection layers, attenuation & protection layers, etc.). Ensure that the leachate containment & collection system construction is supervised and inspected by certified technicians experienced in the use of the various construction materials. b) Pressure test all forcemains used to convey leachate from the landfill footprint to treatment or discharge points prior to use. c) Conduct waste transfer, processing and disposal activities in accordance with an approved Development & Operations (D&O) report. d) Limit the size of the tipping face and the amount of exposed waste to the minimum practical. Cover disposed wastes daily with soil or alternate cover material, and cover any areas not to be used for disposal within the next six months with 600mm of fine-grained interim soil cover. 	<p>C.1.(a) – Prior to construction of the WCEC landfill.</p> <p>C.1.(b) – As soon as practical following construction.</p> <p>C.1.(g) – Prior to operation of the WCEC facilities.</p> <p>Remaining BMPs – Throughout all stages of WCEC facility operations.</p>	Waste Management



		<ul style="list-style-type: none"> e) Inspect and clean primary and secondary leachate collection pipes and leachate forcemains at the frequencies specified in Schedules 1 and 2 of O. Reg. 232/98, as amended. f) Repair any leachate seeps promptly following the procedures described in the approved D&O report. g) Prepare and implement a groundwater and surface water monitoring program to observe whether there are any changes to water quality and quantity conditions during facility operation. 		
C2.	Sewage system discharges to groundwater	<ul style="list-style-type: none"> a) Restrict all discharges to on-site septic sewage systems to domestic sewage only (kitchens, lunch rooms, bathrooms). b) Pump out septic tanks to remove accumulated sludge and scum at least every five years, or as necessary to maintain proper operation. 	Throughout all stages of WCEC facility operations.	
C3.	Stormwater runoff & infiltration	<ul style="list-style-type: none"> a) Prepare and implement a CQA Plan for the construction of the lined stormwater management ponds and infiltration basins (i.e., grade control, synthetic liners, granular infiltration layers, berms, piped connections, etc.). b) Maintain ditches, ponds, erosion and sedimentation controls, etc. as specified in the approved D&O report to ensure proper operation. c) Use vegetated buffers in stormwater drainage routes leading from impervious surfaces such as parking areas, soil pads, paved roads, etc. d) Prepare and implement a monitoring program to ensure stormwater collected in the lined ponds meets the criteria established for discharge to the infiltration basins. 	<p>C.3.(a) – Prior to construction of the stormwater management ponds.</p> <p>C.3.(d) – Prior to operation of the WCEC facilities.</p> <p>Remaining BMPs – Throughout all stages of WCEC facility operations.</p>	
C4.	Vehicle and equipment washing and maintenance activities	<ul style="list-style-type: none"> a) Perform vehicle and equipment washing on an impermeable surface that drains to a lined containment area where washwater can be evaporated or collected for treatment. 	Throughout all stages of WCEC facility operations.	
D. Solid waste acceptance & handling				
D1.	Litter from waste being transported on-site	<ul style="list-style-type: none"> a) All waste loads arriving at the site in open containers (e.g., roll-off boxes, etc.) should remain tarped or enclosed until the truck reaches the tipping face. This minimizes blowing litter escaping from waste trucks. b) Use portable litter fences to contain wind-blown litter at the tipping face. 	Throughout all stages of WCEC facility operations.	Waste Management



		c) Conduct daily litter inspections and pick-up to ensure that landfill sideslopes and surface water drainage routes remain free of litter which can prevent proper drainage.		
D2.	Runoff from stored waste & recyclable materials	a) Limit the stockpiling of any uncovered waste before being processed or disposed, and limit the quantity of recyclable materials or wastes stored outside in open containers. Place all waste stockpiles within the lined landfill footprint or on an impermeable surface. b) Control and contain runoff from any stored waste or recyclables off the landfill footprint. Remove any accumulated water for treatment or off-site disposal.	Throughout all stages of WCEC facility operations.	
E. Road & parking area maintenance				
E1.	Runoff from dust control activities	a) Maintain paved roads in good condition with regular sweeping to remove fine-grained soils. b) Re-apply granular surfaces to unpaved roads as necessary to prevent contamination of the road surface by fine-grained soils. c) Use only water for dust control applications on access roads.	Throughout all stages of WCEC facility operations.	
E2.	Runoff and infiltration from snow removal stockpiles	a) Stockpiles of excess snow removed from roads and parking areas should be placed in flat upland areas where sand and other accumulated debris can be removed and disposed after snowmelt. b) Snow stockpiles should not be placed in areas where there is direct runoff toward monitoring wells, into existing ponds or infiltration basins, or where meltwater will infiltrate directly into active or closed waste disposal areas.	Throughout all stages of WCEC facility operations.	Waste Management
E3.	Runoff of de-icing materials	a) Minimize the quantities of de-icing materials (i.e., road salt, sand, etc.) stored on-site. b) Cover all stockpiles of de-icing materials or store materials in covered structures. Place stockpiles on an impermeable surface.	Throughout all stages of WCEC facility operations.	
F. Imported fill				
F1.	High suspended solids in runoff	a) Restrict the quantities of clean imported fill stored on-site to the minimum practical. b) Use erosion and sedimentation controls around fill stockpiles (i.e., covers, silt fences, berms, check dams, etc.).	Throughout all stages of WCEC facility operations.	Waste Management



F2.	Releases from contaminated soil stockpiles	<ul style="list-style-type: none"> a) Control and contain runoff from uncovered, contaminated soil stockpiles for treatment or removal from site. b) Use erosion and sedimentation controls around contaminated soil stockpiles (i.e., covers, silt fences, berms, check dams, etc.). 	Throughout all stages of WCEC facility operations.	
G. Wells				
G1.	Contaminant movement to water table along wellbores	<ul style="list-style-type: none"> a) Monitoring wells and water supply wells should be constructed by a licensed well driller, in accordance with the requirements of O. Reg. 903, as amended. b) Inspect monitoring wells at least once annually to ensure surface seals that prevent surface water infiltration along the wellbore remain intact. Maintain, repair or replace any wells as necessary. c) Any wells that are no longer needed for monitoring or water supply purposes should be plugged with impermeable materials (bentonite, grout, etc.) and decommissioned in accordance with the requirements of O.Reg. 903, as amended. 	Throughout all stages of WCEC facility operations.	Waste Management, Drilling Contractor
H. Fires				
H1.	Runoff from fire suppression water and chemicals	<ul style="list-style-type: none"> a) Prepare a Fire Prevention and Emergency Response Plan to describe prevention and fire suppression activities at the facility. The plan should be specific to the unique conditions and materials stored at a waste disposal site, and designed to limit groundwater contamination in the event of fire. The Plan should be reviewed and updated annually. b) Meet with local fire officials to discuss the Plan so that all parties are knowledgeable of the conditions on-site and the measures to be taken in the event of fire. 	Prior to construction of the WCEC facilities.	Waste Management



5. RESPONSIBILITIES AND TRAINING

WM is to be responsible for ensuring that the best management practices described in this plan are followed and the necessary inspections and monitoring activities are completed. To accomplish this, employees should be properly trained to be familiar with the plan requirements.

The groundwater monitoring requirements are presented in Environmental Monitoring Plan (EMP), prepared by WESA (2014b).

The WM Site Manager will be responsible for:

- Providing training to staff;
- Providing guidance on practices to be followed to prevent groundwater impacts;
- Maintaining this plan.

Designated WM employees will have responsibilities for conducting inspections and performing maintenance activities in accordance with the groundwater BMPs. The list of individuals with these responsibilities as well as the date(s) of any training should be maintained in a Groundwater BMP Inspection Log.

WM staff should also be trained in the recordkeeping procedures as required below.

6. RECORD-KEEPING

Information collected as part of this Groundwater BMP program should be maintained in a log, specifically designated for that purpose.

The log should contain a copy of this document, as well as copies of all other documents required by the Groundwater BMPs (e.g., Spill Prevention and Contingency Plan, Fire Prevention and Emergency Response Plan, etc.). The log should also contain the records from all inspections, clean-up and repair activities, general notes, and recommended changes to the plan. The log should also maintain a record of all training activities, dates, personnel involved, etc.

7. MONITORING REQUIREMENTS

The requirements for monitoring groundwater flow and quality at the WCEC facility are presented in the Environmental Monitoring Plan (EMP) for the site (WESA, 2014b). These are consistent with the EA commitments and the EA approval conditions.



The groundwater monitoring program includes the following elements:

- Monitor groundwater flow on-site and within the site-vicinity by measuring water levels in monitoring wells;
- Monitor water levels in the SWM ponds;
- Use the collected data to map and interpret the groundwater flow orientations;
- Collect groundwater samples from selected monitoring wells located on-site and within the site-vicinity and analyze the samples for an appropriate site-specific indicator list;
- Collect effluent samples from the unlined stages of the SWM Ponds to measure water quality in effluent infiltrating to the groundwater table;
- Use the collected data to interpret groundwater quality conditions upgradient, between the landfill footprints, and downgradient from the new landfill facilities;
- Continue to monitor the existing purge well system on the existing landfill site to ensure that groundwater quality impacts from the existing unlined landfill remain controlled by the existing purge well system and natural attenuation across the CAZ;
- Establish trigger/compliance locations and parameter concentrations at property boundaries to determine whether any potential groundwater impacts exceed the appropriate limits;
- Describe contingency plans for mitigating potential groundwater impacts if necessary.



8. CONTINGENCY MEASURES

Possible contingency measures for potential groundwater impacts are presented in the Groundwater and Surface Water EMP (WESA, 2014b). Contingency measures are defined as potential remedial activities that could be implemented in the event that observed groundwater impacts exceed established trigger values at designated monitoring locations. Contingency measures are implemented within the context of an overall Contingency Plan, which typically involves the following stages:

- Assessment of the nature and extent of a potential problem;
- Further investigations to determine more precisely the extent of the problem;
- Feasibility assessment of possible remedial alternatives (i.e., “contingency measures”);
- Selection of a preferred remedial method to address the problem;
- Implementation of the preferred remedial action;
- Continued monitoring to assess the performance of the remedial action to fully address the problem.

Respectfully Submitted,



David Harding, M.Sc., P.Eng.
Senior Consulting Engineer



9. REFERENCES

Mississippi-Rideau Source Protection Region. 2011. *Assessment Report, Mississippi Valley Source Protection Area*. August 4, 2011.

Waterloo Hydrogeologic Inc. and CH2M Hill Canada Ltd., 2001. *Preliminary Evaluation of Relative Aquifer Vulnerability: City of Ottawa (formerly the Region of Ottawa-Carleton)*. Report prepared for City of Ottawa.

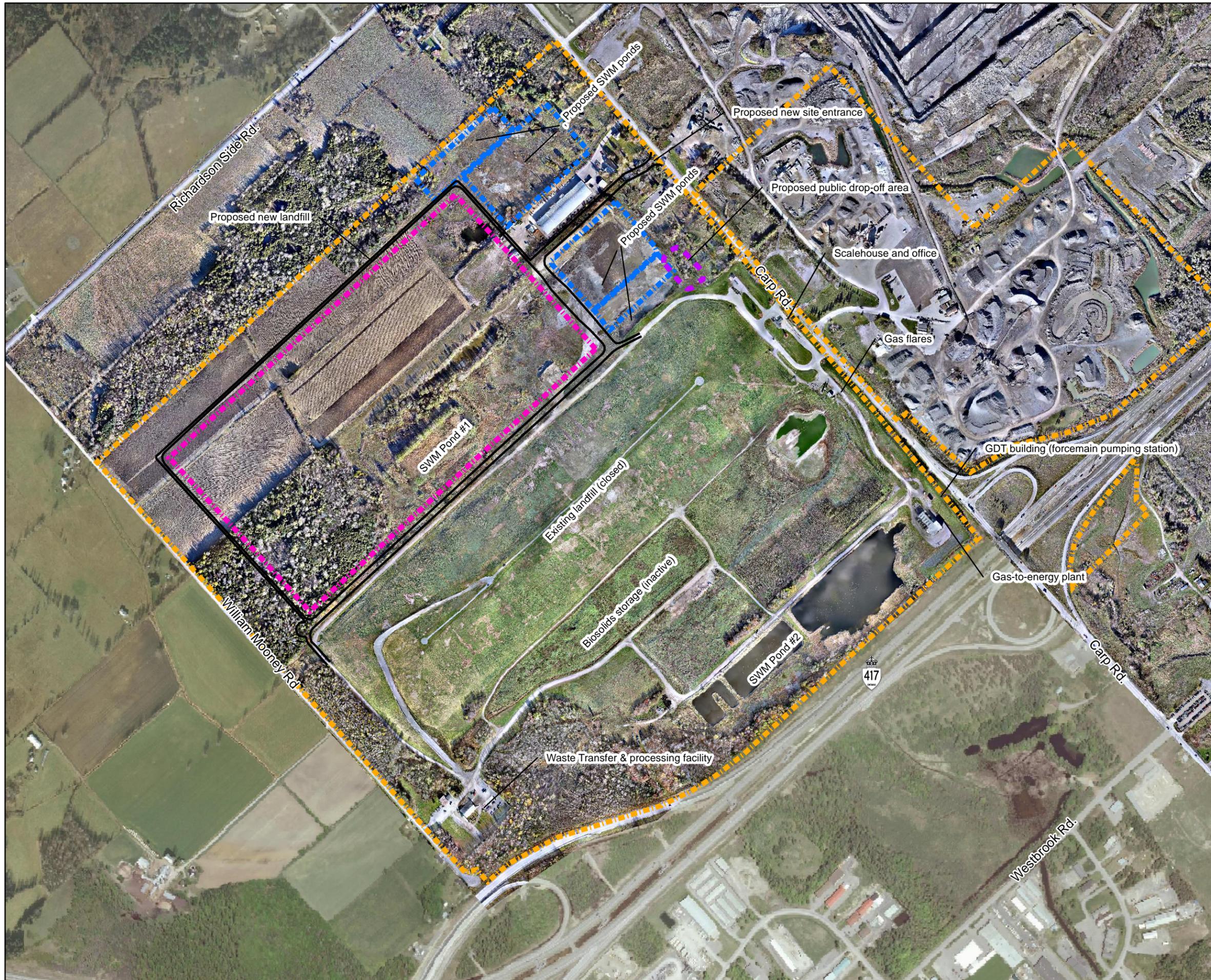
WESA, 2014a. *Hydrogeologic Assessment Report*. Proposed West Carleton Environmental Centre Landfill, Ottawa, Ontario. Prepared by WESA, a division of BluMetric Environmental Inc. July 2014.

WESA, 2014b. *Environmental Monitoring Plan, Groundwater, Surface Water, Leachate and Subsurface Gas Components*. West Carleton Environmental Centre, Ottawa, Ontario. Prepared by WESA, a division of BluMetric Environmental Inc. July 2014.



FIGURES





LEGEND

- Proposed Access Roads
- WCEC Site Boundary
- Proposed WCEC Landfill Footprint
- Proposed Stormwater Management Ponds
- Proposed Public Drop-Off Area

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REFERENCES

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CLIENT

WASTE MANAGEMENT

PROJECT

**WASTE MANAGEMENT
WEST CARLETON ENVIRONMENTAL CENTRE**

TITLE

SITE PLAN

WESA, a division of BluMetric Environmental Inc.

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