WATERFRONToronto

Waterfront Toronto
Environmental Management Plan
for Project-Related Activities

August 2022

EXECUTIVE SUMMARY

This **Environmental Management Plan** (EMP) describes processes and procedures designed to mitigate environmental effects that might result from project-related activities in the Waterfront Toronto (WT) Designated Waterfront Area (DWA). It supports WT's *Sustainability Framework* (2005) and *Resilience and Innovation Framework for Sustainability* (2017) through the establishment of measures to prevent pollution and environmental impairment, preserve cultural and natural resources, protect wildlife habitat and ensure compliance with applicable legislation, regulations, policies and guidelines.

A key component of this EMP is the series of **Environmental Protection Plans** (EPPs) included within it. EPPs are included for:

- Air Quality and Dust Management
- Archaeological and Built Heritage Resources Management
- Contaminated Soils Management
- Erosion and Sediment Control
- Fuel and Lubricants Management
- Groundwater Management
- Methane Control
- Noise and Vibration Management
- Project-related Waste Management
- Stormwater / Surface Water Management
- Traffic Management
- Vegetation Management
- Wildlife Management

The EPPs should be tailored by the construction manager and / or contractor for each project where necessary, to meet site specific conditions, as required. The EPPs may include some general measures for works such as:

- Works In or Adjacent to Water
- Infrastructure Servicing and Utilities
- Development of Parks and Open Spaces, and
- Site Development Works.

The EMP contains information on each EPP, including:

- A description of the environmental concerns and regulatory framework
- An outline of the activities or conditions that would cause the EPP to be invoked
- Details of planning and design considerations, and
- Maintenance, monitoring, and documentation programs.

A description of **Contingency and Emergency Response Plans** (CERPs) required for projects is also included in this EMP. These plans are necessary to address and ameliorate any consequences of unintended occurrences such as operational upsets and malfunctions. These contingencies are critical and are to be put in place before proceeding with WT projects.

All WT projects must comply with applicable regulatory requirements set out in legislation, regulations, policies, guidelines, bylaws and codes that are administered through various agencies/public bodies at the federal, provincial and municipal levels. Applicable requirements for WT projects are identified and discussed in this EMP and the specific EPPs set out in Section 7. While an effort has been made to provide a comprehensive summary of current regulatory requirements that may apply to WT project-related activities, these rules may be deleted, amended or replaced at any point. It is the full responsibility of construction managers and / or contractors and their on-site personnel to be aware of applicable requirements or changes that may occur and to comply with these requirements. WT recommends that a review of current regulatory requirements be conducted prior to project initiation for compliance purposes and to ensure that sound management and practices are in place.

EPPs and CERPs are tracked by Waterfront Toronto. Applicable general and site-specific EPPs should be identified at the design and tender stages of contracts. Each EPP and CERP applicable to the project must be submitted by the construction manager and / or contractor to Waterfront Toronto prior to the commencement of any on-site work and must be put in place before proceeding with the project. On an ongoing basis, the construction manager and / or contractor must submit Quarterly Update Reports which summarize EPP activity and project performance.

The implementation of this EMP and the EPPs outlined within is the responsibility of all parties involved in WT project-related activities. Construction managers and / or contractors must implement EPPs as part of their responsibility for ensuring sound environmental practices and safeguards, good housekeeping on-site, training employees in their responsibilities and keeping good records. Note that documentation provided to Waterfront Toronto is not done for the purpose of regulatory compliance. For a summary of documentation requirements, see Table 2.

LIST OF ACRONYMS

ACMS	Archaeological Conservation and Management Strategy
AHT	Aquatic Habitat Toronto
C of A	Certificate of Approval
CEPA	Canadian Environmental Protection Plan
CERP	Contingency and Emergency Response Plan
DFO	Department of Fisheries and Oceans
DWA	Designated Waterfront Area
EC	Environment Canada
EMP	Environmental Management Plan
EPA	*Environmental Protection Act*
EPP	Environmental Protection Plan
HADD	Harmful alteration, disruption or destruction
LEED NC	Leadership in Energy and Environmental Design for New Construction
LEED ND	Leadership in Energy and Environmental Design for Neighbourhood Development
MECP	Ontario Ministry of the Environment, Conservation and Parks
MNR	Ontario Ministry of Natural Resources
MSDS	Material Safety Data Sheet
OWRA	*Ontario Water Resources Act*
QP	Qualified Person
QUR	Quarterly Update Reports
TPH	Toronto Public Health
TRCA	Toronto and Region Conservation Authority
WHMIS	Workplace Hazardous Material Information System
WT	Waterfront Toronto

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1.0 PURPOSE AND SCOPE OF THE EMP

This **Environmental Management Plan** (EMP) describes processes and procedures designed to mitigate environmental effects that might result from project-related activities in the Waterfront Toronto (WT) Designated Waterfront Area (DWA). It provides the framework for establishing environmental priorities, identifying potential risks, complying with industry and regulatory standards and it defines responsibilities of the various parties in WT project-related activities.

This EMP supports WT's *Sustainability Framework* (2005) and *Resilience and Innovation Framework for Sustainability* (2017) through the establishment of measures to prevent pollution and environmental impairment, preserve cultural and natural resources, protect wildlife habitat and ensure compliance with applicable legislation, regulations, policies and guidelines.

A key component of this EMP is the series of **Environmental Protection Plans** (EPPs) included in Section 7. Each EPP should be tailored to be site-specific, if required, particularly in sensitive areas with specific or unique conditions. The EPPs may also contain some general information on the approach for managing the project.

A description of **Contingency and Emergency Response Plans** (CERPs) (Section 8) which must be in place for each project is also included in this EMP. These plans are necessary to address and ameliorate any consequences of unintended occurrences such as operational upsets and malfunctions. Such contingencies are crucial to effective environmental management and are to be put into place by the identified responsible parties before proceeding with WT projects.

2.0 PROJECTS AND ACTIVITIES SUBJECT TO THE EMP

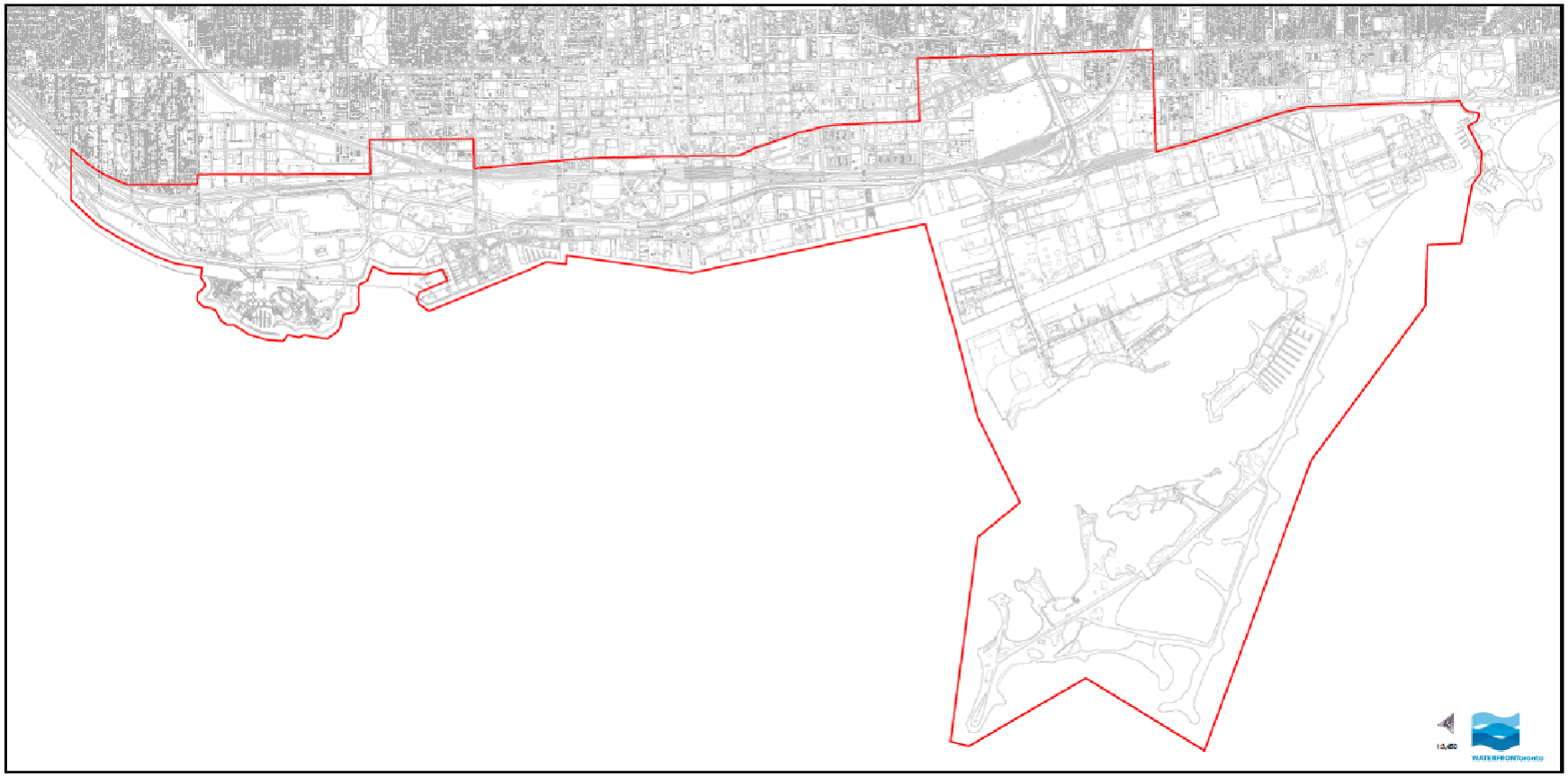
Projects and activities subject to this EMP are located in the **DWA** (Figure 1) which is comprised of the following lands or activities:

- **West Don Lands** – north of the rail corridor and south of King Street East, between Parliament Street (west side) and the Don Valley Parkway (east side)
- **East Bayfront Lands** – from Lake Ontario to the rail corridor, between Jarvis Street (west side) and Parliament Street (east side)
- **Central Waterfront Lands** – from Lake Ontario north to Queen's Quay Boulevard and from Bathurst Street (west side) to Jarvis Street (east side) and projects beyond these boundaries associated with the Martin Goodman trail
- **Lower Don Lands** – from the rail corridor (north side) to the ship channel (south side) and from Parliament slip / Inner Harbour (west side) to the Don Roadway (east side)
- **Port Lands Flood Protection Project** – from the proposed Sediment and Debris Management Area north of the Keating Channel south to the Ship Channel, and from the Toronto inner harbour (west side) to Saulter Street (east side).
- **Broadview Eastern Flood Protection Project** – from east side of the Don River located between Eastern Avenue and the Metrolinx railway embankment.
- **Lake Ontario Park** – from Unwin Avenue (north side) to the outer harbour (south side) and from the inner harbour (west side) to Leslie Street (east side), and
- **Beautification Projects or Activities** – throughout the DWA.

The project categories anticipated in the DWA include:

- **Works In or Adjacent to Water** that may include dock wall repair in the Central Waterfront Lands, trail construction through the East Bay Front Lands and earthworks at Lake Ontario Park
- **Infrastructure Servicing and Utilities** that may include installation of underground services, construction of stormwater management facilities, tunnelling for the district energy project and transit improvements, extension of the LRT and road construction
- **Development of Parks and Open Spaces** that may include trail construction, landscaping, and stormwater management, and
- **Site Development Works** that may include buildings, public spaces, park structures and infrastructure.

Figure 1.



Waterfront Toronto Designated Waterfront Area

3.0 SUSTAINABLE WATERFRONT REVITALIZATION

WT's central mandate is to oversee, lead, and implement the revitalization of 800 hectares (2,000 acres) of Toronto's waterfront, transforming the area into mixed-use, sustainable communities. As a key public policy objective, sustainability has been core to WT since its inception.

In 2005, WT released the *Sustainability Framework*, which provides the overarching corporate policy on sustainability and presents a roadmap to guide the transformation of the waterfront into green, liveable and prosperous communities.

The *Sustainability Framework* (2005) describes 11 interrelated themes that focus sustainable actions for WT projects:

1. Energy
2. Land Use
3. Transportation
4. Sustainable Buildings
5. Air Quality
6. Human Communities
7. Cultural Resources
8. Natural Heritage
9. Water
10. Materials and Waste
11. Innovation

Each theme is accompanied by objectives, actions and targets to achieve WT's sustainability mandate. The objectives of each theme may be applicable at any stage of development however three themes are of particular relevance to the construction and implementation stages of WT projects: Air Quality, Water, and Materials and Waste. Each is profiled in the sub- sections that follow. In this respect, this EMP includes specific measures to reduce environmental impacts associated with these themes.

One of the ways that Waterfront Toronto is implementing its Sustainability Framework on the building-scale is through our Green Building Requirements, which are mandatory performance standards for all waterfront building projects. First developed in 2005 and updated in 2021, the Green Building Requirements support advanced, high performing buildings and sustainable lifestyle choices. This involves, among other requirements, the achievement of Tier 3 under the Toronto Green Standard (TGS) version 3.

3.1 Air Quality

According to a study completed by Toronto Public Health, air pollutants deriving from traffic contribute to an estimated 1,300 premature deaths and 3,550 hospitalizations per year in Toronto[1]. The EPP relating to Air Quality and Dust Management (Section 7.1) provides measures intended to control the generation of airborne particulates at project sites in the DWA. The Fuel and Lubricants Management EPP (Section 7.5) and Project-Related Waste Management EPP (Section 7.9) describe means to reduce the release of other potentially harmful pollutants into the atmosphere.

3.2 Water

The EPP for Erosion and Sediment Control (Section 7.4) provides protection against the transport of soil and particulates to water bodies that may occur during project-related activities. The Fuel and Lubricants Management EPP (Section 7.5) also provides means for control of spills and leaks which could result in impacts to groundwater and adjacent water bodies.

In some situations, past industrial activities on the waterfront lands have contributed to the degradation of groundwater quality. The EPPs for Contaminated Soils Management (Section 7.3) and for Groundwater Management (Section 7.6) are intended to reduce the potential for further degradation of the groundwater as well as to minimize potential migration of contaminated groundwater.

Further to this, the reduction and prevention of negative impacts on water in the EPPs for Erosion and Sediment Control, Contaminated Soils Management, and Stormwater/Surface Water Management (Section 7.10) must comply with the Toronto and Region Conservation Authority's Erosion and Sediment Control Guide for Urban Construction. Specifics regarding the requirements are discussed in each EPP.

3.3 Material and Waste

The EPP for Project-Related Waste Management (Section 7.9) requires that an integrated **Waste Management Plan** be prepared for demolition and construction projects. The measures incorporated into the Waste Management Plan are intended to minimize waste generation and to ensure the proper handling and disposal of waste from projects.

Further to this, construction waste management must comply with the prevailing version of the Toronto Green Standard's *Construction Waste Management* performance measure. Specifics regarding the requirements are discussed in the EPP for Project-Related Waste Management.

Waterfront Toronto tracks performance with respect to materials used in construction, including materials that are: salvaged, refurbished or reused; Forest Stewardship Council certified (applies to wood products); recycled and/or renewable; locally extracted, harvested, recovered, processed and manufactured; and low emitting (low VOCs). These objectives should be

[1] Toronto Public Health, 2014. *Toronto Air Pollution Burden of Illness Update*.

considered in the development of tender and contract documents and where applicable on a project-by-project basis. Specifically, projects must include five (5) out of seven (7) of the following sustainability requirements in the project product specifications:

- Concrete Mix: Minimum 25% supplementary cementous material (SCM)
- Rebar / Structural Steel / Metal Decks: Minimum 50% recycled content
- Flooring: Meet FloorScore or USGBC equivalent program
- Paints / Coatings / Adhesives / Sealants: Meet SCAQMD rule 1113 and 1168 Low VOC content thresholds
- Plywood / Lumber: FSC certified
- Plywood: No added formaldehyde (NAF) or ultra-low-emitting formaldehyde (ULEF)
- Red List Materials: Do not use any materials from the International Living Future Institute's Red List

4.0 APPLICABLE REGULATORY REQUIREMENTS

In addition to the WT requirements for sustainability and LEED® compliance, all WT projects must comply with the applicable requirements of legislation, regulations, policies and guidelines administered through federal, provincial and municipal jurisdictions. Appendix A presents a compilation of applicable environmental regulatory requirements for WT projects and identifies the EPPs relevant to each. Although this represents a comprehensive summary of current environmental regulations, it may be that other regulations also apply to WT project-related activities and the cited requirements may change. It is the full responsibility of the construction manager and / or contractor to be aware of applicable requirements and any changes that may occur.

The Toronto Green Standard (TGS) is not mandatory through this EMP but are applicable when city planning, or other approvals trigger them. References in this document encourage best practice and coordination where the TGS is applicable. Accordingly, it is important that responsible parties, designers, consultants, construction managers and / or contractors review project-related requirements at the start of and during WT projects to ensure that the regulatory requirements, including any project-specific permits, are considered throughout the implementation of the project.

5.0 ROLES AND RESPONSIBILITIES

Waterfront Toronto, a development partner, or an eligible recipient organization, such as TTC or TRCA are responsible for communicating the requirements of the EMP to involved parties throughout the life of the project. This will involve monitoring implementation through the collection of EPPs and Quarterly Update Reports and ensuring that EMP requirements are incorporated in tender and contract documents as well as project specifications. For those projects where WT is not the directly responsible party, implementation of the EMP will be monitored by those that are.

To ensure the EMP is implemented, EPPs are to be identified and developed at the design and tender stages of projects and incorporated into project specifications. The EPPs should be tailored for each project to meet site specific conditions, as required.

Project managers for the responsible party will retain necessary technical expertise and implement a compliance tracking system that includes key components such as:

- monitoring and documentation;
- where appropriate, third party oversight;
- regular inspections; and
- reporting compliance to WT.

Construction managers and / or contractors retained by Waterfront Toronto, a developer partner, or an eligible recipient are required to develop and implement EPPs as part of their responsibilities, while technical experts such as the designers and consultants must incorporate them into relevant tender packages, contracts documents, project specifications, and plans / designs.

Table 1 sets out the basic roles of WT, development partners, eligible recipients, designers, consultants, construction managers and contractors. Some of these roles may vary, depending on land ownership and/or who controls the project and its activities.

Table 2 provides a summary of all documentation that must be provided to WT as part of EMP obligations. All EPPs must be provided to WT prior to the commencement of work on site. WT monitors implementation of each EPP through Quarterly Update Reports (QURs). QURs are submitted to Waterfront Toronto throughout the year on a schedule as determined by the project team and Waterfront Toronto.

Table 1. Basic Roles and Responsibilities

Party	General Role and Responsibility	Stages of Development		
		Planning and Design	Implementation	Documentation
Waterfront Toronto	Communicate the requirements of the EMP to involved parties and ensure that the EMP is considered at all stages of development for all projects in the DWA. Monitor implementation of EMP by reviewing Environmental Protection Plans and Quarterly Update Reports.	Assist the project team in identifying EPPs that may apply to each project. Assist the project team in identifying who is responsible for producing EPPs and providing relevant documentation. Include references to EPP requirements in direct tender and consulting contract documents, as well as project specifications. Assist the project team in identifying sensitive projects that require project-specific mitigation measures in the EPPs.	Ensure construction managers / contractors are complying with implementation and documentation requirements. Where appropriate, identify successes and deficiencies to improve implementation of the EMP and EPPs.	Prepare project closure documentation recording compliance with EPP maintenance and monitoring requirements as well as recommended improvements going forward
Development Partners and Eligible Recipients	Communicate the requirements of the EMP to involved parties and ensure that the EMP is considered at all stages of development for all projects in the DWA. Monitor implementation of EMP by reviewing Environmental Protection Plans and Quarterly Update Reports. Coordinate implementation of the EMP on joint projects. Ensure that all hired construction manager and contractors communicate EMP compliance to WT.	Assist the project team in identifying EPPs that may apply to each project. Assist the project team in identifying who is responsible for producing EPPs and providing relevant documentation. Include references to EPP requirements in tender and construction contract documents as well as project specifications. Assist the project team in identifying sensitive projects that require project-specific mitigation measures in the EPPs.	Maintain communication with WT for the tracking of compliance. Ensure construction managers / contractors are complying with implementation and documentation requirements. Where appropriate, identify successes and deficiencies to improve implementation of the EMP and EPPs.	Prepare project closure documentation recording compliance with EPP maintenance and monitoring requirements as well as recommended improvements going forward
Designers, and Consultants	Consider and incorporate the EMP / EPPs in the preparation of all relevant tender packages, contract documents, project specifications, and plans/designs.	Identify and incorporate all EPP requirements into scopes of work for investigations and in technical specifications. Assign qualified staff to prepare and implement project-specific EPPs and monitoring programs (where	Where appropriate, identify successes and deficiencies to improve implementation of the EMP and EPPs.	Prepare project closure documentation recording lessons learned and recommended improvements going forward.

Party	General Role and Responsibility	Stages of Development		
		Planning and Design	Implementation	Documentation
	Consider the requirements of the EMP / EPPs in the design and implementation of project-related activities.	applicable). Consider the requirements of the EMP / EPPs in the project design.		
Construction Managers and/or Construction Contractor	Prepare all applicable EPPs and Quarterly Update Reports and submit to WT prior to the commencement of any work on site. Implement, monitor, and modify each applicable EPP throughout the project. Provide necessary training and education.	Prepare all applicable EPPs and submit to WT. Include EPP requirements in sub-trade contracts.	Assign qualified staff to implement all EPPs applicable to the project.	Submit all applicable EPPs and Quarterly Update Reports to WT for compliance monitoring purposes.

Table 2. Environmental Management Plan Documentation Requirements

Environmental Management Plan Documentation Requirements	
Environmental Protection Plan	**Documentation Requirements**
Air Quality and Dust Management	• An Air Quality and Dust Control Plan for all project sites or associated areas where causative activities or conditions may occur • As part of each Quarterly Update Report, submit a summary of dust control monitoring logs, any issues encountered, and mitigation measures implemented
Archaeological and Building Heritage Resource Management	• An Archaeological Monitoring Protocol, if required. • As part of each Quarterly Update Report, provide details of any unexpected archaeological resource discovered including evaluation of significance
Contaminated Soils Management	• A Soil Management Plan including but not limited to protocols for ensuring contaminated soils are not tracked to uncontaminated areas of the site (applies to any development project involving the excavation or handling of soils) • As part of each Quarterly Update Report, summarize Soil Management Plan activities undertaken, issues encountered, and mitigation measures implemented • As part of each Quarterly Update Report, summarize quantity and percentage of excavated soil sent to the Waterfront Green Soils Treatment Facility and materials used from the Waterfront Green Soils Treatment Facility, as per section 7.3.6
Erosion and Sediment Control	• An Erosion and Sedimentation Control Plan for any project site or associated area where causative activities or conditions may occur • As part of each Quarterly Update Report, summarize Erosion and Sedimentation Control Plan activities undertaken, issues encountered, and mitigation measures implemented • Copies of photographs or drawings to document the ESC measures implemented on the site, or a representative sample thereof
Fuel and Lubricants Management	• A Fuel and Lubricants Management Plan including but not limited to a plan for training all on-site personnel on the handling of fuels and lubricants • As part of each Quarterly Update Report, summarize Fuel and Lubricants Management activities undertaken, issues encountered, and mitigation measures implemented • Any use of alternative vehicles (such as electric of biodiesel fuel) must be noted in the Quarterly Update Reports.
Groundwater Management	• A Groundwater Management Plan for any project site where there are possibilities for impacting groundwater • As part of each Quarterly Update Report, summarize Groundwater Management Plan activities undertaken, issues encountered, and mitigation measures implemented
Methane Control	• A Methane Monitoring and Control Plan for any project site or associated area where causative activities or conditions may occur • As part of each Quarterly Update Report, summarize Methane Control activities undertaken, issues encountered, and mitigation measures implemented
Noise and Vibration Management	• A Noise and Vibration Management Plan • As part of each Quarterly Update Report, summarize Noise and Vibration Management activities undertaken, issues encountered, and mitigation measures implemented

Environmental Management Plan Documentation Requirements	
Environmental Protection Plan	**Documentation Requirements**
Project-Related Waste Management	• A Waste Management Plan and a Waste Reduction Work Plan with the aim of reducing and recycling waste generated during the project • As part of each Quarterly Update Report, summarize daily maintenance and monitoring of project waste management including a record of the quantity, material type, and final destination of all waste generated or disposed of at the site • As part of each Quarterly Update Report, provide percentage of recycled content used for asphalt pavement, aggregate bases and sub-base
Stormwater / Surface Water Management	• A Stormwater and Surface Water Management Plan • As part of each Quarterly Update Report, summarize stormwater and surface water management measures implemented, issues encountered, and mitigation measures implemented. • As part of each Quarterly Update Report, submit any changes / modifications to the Stormwater and Surface Water Management Plan as they occur (as necessary throughout all phases of the project to address changing conditions).
Traffic Management	• A Traffic Management Plan including but not limited to procedures for complaint filing and management of traffic-related complaints • As part of each Quarterly Update Report, summarize traffic management measures used to minimize disruption to local residents and businesses, any traffic and parking complaints, and mitigation measures implemented
Vegetation Management	• A Vegetation Management Plan (if applicable) • As part of each Quarterly Update Report, summarize Vegetation Management activities undertaken, issues encountered, and mitigation measures implemented
Wildlife Management	• A Wildlife Management Plan (if applicable) • As part of each Quarterly Update Report, summarize Wildlife Management activities undertaken, issues encountered, and mitigation measures implemented
Contingency and Emergency Response Plans	• A Spill Prevention and Contingency Plan and an Emergency Response Plan

It is expected that management plans for each EPP be tailored to reflect site-specific conditions, as required, in addition to the considerations and measures outlined in the Environmental Management Plan.

Plans are to be provided to WT prior to the commencement of any work on site, while Quarterly Update Reports are to be submitted to Waterfront Toronto throughout the year on a schedule as determined by the project team and Waterfront Toronto.

6.0 EMP COMPLIANCE ASSESSMENT

Compliance with the EMP and regulatory requirements is the full responsibility of the construction manager and / or contractor. The following information is provided to WT development partners and eligible recipients to assist in compliance monitoring and documentation.

Where appropriate, quantitative markers representing actual measurements or observations are defined in the EPPs. Where quantitative measurements are not feasible (e.g., real-time measurement of airborne particulate at a construction site), qualitative markers (e.g., visual evidence of dust) are used. It is preferred to record compliance with real-time measurements or observations rather than documenting non-compliance, after the fact.

The EPPs describe recommended maintenance and monitoring measures for the purpose of tracking compliance with the relevant legislation, regulations, standards, by-laws, and policies. It is intended that the EMP be included in tender packages and contract specifications and be implemented by the construction manager and / or contractor for the duration of the contract. Compliance tracking will be undertaken by the responsible parties and their consultants to ensure that contract requirements are being met. Construction managers and / or contractors are responsible for retaining staff qualified in the appropriate form of monitoring at the site and for ensuring compliance with contract requirements.

For example, Ontario regulations prohibit the release of air pollutants that may affect or damage adjacent properties. This could include odorous emissions or excessive dust during demolition, excavation or construction. The Air Quality and Dust Management EPP requires construction managers and / or contractors to monitor air quality at the site on a regular basis and implement dust control measures to prevent unacceptable emissions. Depending on the sensitivity of the surrounding area and the types of contaminants that may be anticipated during the works, regular monitoring may consist of hourly or daily site inspections or perimeter sampling. In addition, the contract administrator would monitor air quality compliance through a review of reports prepared by the construction manager and / or contractor and periodic site observations.

For works at some sites, more aggressive monitoring may be needed (e.g., sensitive environmental conditions on adjacent lands). In these circumstances, EPPs focused on the issues at hand are to be prepared to reflect site-specific conditions. The site-specific EPPs would typically be prepared by the construction manager and would form part of the technical specification package on which the contract is based. For very sensitive sites, a dedicated Environmental Monitor may be assigned to a project. Provisions for this added monitoring are included in the EPPs.

An effective tracking system for EPP compliance includes a requirement to demonstrate and document that a project is not contributing to adverse environmental effects. The tracking system will draw on the monitoring and maintenance requirements for each of the EPPs that apply to active projects. Components of a tracking system include:

- **Compliance monitoring and documentation** by construction managers and / or contractors to record waste diversion measurements, compliance with air quality, erosion control and noise emission requirements, and records of spills. Although these observations

are compiled in Quarterly Update Reports, observations and record keeping are typically conducted on a daily or weekly basis.

- **Oversight (third-party) compliance monitoring and reporting** for issues such as archaeological and heritage resource management, groundwater management, soil management and hazardous materials management. Typical reports consist of a single report for each project, at the start of the project, to document project closure, or both. On- going monitoring may be conducted throughout the project, to support the preparation of a project closure report.
- **Quarterly Update Reports** to document compliance with the EMP. Please refer to Table 2 for all documentation requirements.

7.0 ENVIRONMENTAL PROTECTION PLANS

EPPs are designed to eliminate or reduce the effects of project-related activities on the environment. The EPPs included in this section are tailored to the types of activities likely to be carried out in the DWA. They are described to an appropriate level of generalized application and form the basic conditions from which more project-specific EPPs can be developed as unique conditions may require.

EPPs in this section address:

7.1 Air Quality and Dust Management
7.2 Archaeological and Built Heritage Resources Management
7.3 Contaminated Soils Management
7.4 Erosion and Sediment Control
7.5 Fuel and Lubricants Management
7.6 Groundwater Management
7.7 Methane Control
7.8 Noise and Vibration Management
7.9 Project-related Waste Management
7.10 Stormwater / Surface Water Management
7.11 Traffic Management
7.12 Vegetation Management
7.13 Wildlife Management

Each EPP section includes:

- A description of the environmental concerns and regulatory framework associated with the subject;
- An outline of the activities or conditions that would cause the EPP to be invoked and how the EPP is to be applied;
- Details of design and implementation considerations; and
- Maintenance and monitoring programs.

The development of EPPs and subsequent implementation, monitoring, and mitigation is the responsibility of the construction manager and / or contractor. The party responsible for this work must be defined by WT and/or the Development Partner/Eligible Recipient early in the process at the design stage of the project. WT and/or the Development Partner/Eligible Recipient must also assist the project team in identifying EPPs that apply to each project and whether project-specific mitigation measures and implementation considerations are required.

Appendix A presents a summary of applicable regulatory requirements for WT projects and identifies the EPPs relevant to each while **Appendix B** presents a summary of applicable

regulatory agency contacts for WT projects along with associated EPPs where these contacts may be applicable. As regulations and contact information can change, all parties should review the appended information and ensure up-to-date information is included in project documentation.

7.1 Air Quality and Dust Management

7.1.1 Environmental Concerns

Environmental effects on air quality associated with airborne particulate typically correlate with periods of dry weather and windy atmospheric conditions. Dust emissions result from the handling of soils or aggregates, vehicle traffic on roadways and cutting, sanding and grinding associated with construction. Engine exhaust emissions may also contribute to atmospheric degradation in the vicinity of construction projects, especially in terms of very fine particulate associated with internal combustion.

Dust and other contaminants that degrade air quality can be irritants for occupants or users both on the site and on adjacent properties. Project-related dust can include contaminants such as metals and organic contaminants that bind to soil particles. These airborne emissions may contribute to adverse health effects, particularly for those individuals susceptible to breathing ailments. Dust and other airborne contaminants can be mitigated through good management practices and standard dust control measures such as misting, sweeping and tarping of materials and control of traffic routes and speeds. The effectiveness of dust control measures can be monitored visually or through air sampling.

7.1.2 Regulatory Framework

Most project-related activities are governed by provincial and municipal regulations and by-laws. No federal legislation specifically addresses air quality and dust management on project sites, but mitigation measures identified in project-related Environmental Assessments, both federal and provincial, may apply to air quality and dust management.

Construction projects are exempt from the provincial requirement under the *Environmental Protection Act (EPA)* to obtain a Certificate of Approval (C of A) for air and noise emissions. However, the requirements of Ontario Regulation 419/05 Air Pollution – Local Air Quality do apply. This regulation requires that emissions to the atmosphere be controlled to prevent discomfort to persons, loss of enjoyment of normal use of property, interference with normal business operations or damage to property. For construction projects, airborne contaminants including chemicals and particulate must not be dispersed beyond the limits of the property unless every step necessary to control the emission of the contaminant is implemented.

7.1.3 Causative Activities and Conditions

Demolition, earthworks, and construction activities (including blasting or mechanical demolition activities, excavation, transport and placement and grading of soil and similar materials, and cutting, sanding or grinding during construction) are the main activities that can contribute to poor air quality and dust generation.

In addition, during the warmer months of the year, the heat and sunlight can react with gases and fine particles in the air around the downtown waterfront area which may lead to a smog alert issued by the City of Toronto. Smog can worsen heart conditions, asthma, bronchitis, and other lung problems. It reduces lung function in healthy people and can also be an irritation for eyes, nose and throat. During smog alerts, added controls may be necessary for the management of air quality and dust generation.

7.1.4 Application

Air quality and dust control measures are to be applied at all project sites and associated areas (e.g., transport route) where causative activities or conditions can occur. Adequate dust control measures are to be in place prior to the initiation of work in order to prevent the uncontrolled generation of dust, to lessen the project's effect on the creation of smog and to minimize impacts or disruptions to the surrounding population.

7.1.5 Design and Implementation Considerations

For most sites, dust controls put in place also address the potential for release of other air pollutants. Toronto Public Health may be consulted during the preparation of dust control plans to ensure methods adequately mitigate the potential for health effects from the generation of dust during demolition and construction activities. To prevent the emission of dust and other pollutants into the atmosphere, the following environmental control measures are to be implemented where applicable:

- On-site vehicle and equipment idling is to be discouraged and where practical, limited;
- Dust generation from construction and demolition activities, storage piles and exposed soils/surfaces is to be controlled through the use of water sprays or similar techniques;
- Tracking of earth or soil from the site on trucks is to be minimized through the use of mud mats (e.g., granular pads located at site entrance). Where a mud mat is not effective in controlling the tracking of earth or soil onto adjacent roads, the physical removal of earth from vehicles is to be implemented;
- Vehicles hauling soil, aggregates or fine or dusty material are to be covered to minimize the generation of dust;
- Construction activities are to be scheduled and planned to limit areas of soil exposed at any given time;
- Exposed soil areas and adjacent roads are to be monitored for dust generation potential, with attention paid to areas used for pedestrian walkways and vehicle traffic;
- On-site (including roadways) flushing, sweeping and cleaning are to be performed on a regular basis, with consideration for the containment and management of any wash water;
- Exposed fill/stockpiles that may be a source of fugitive dust are to be covered with tarpaulins, soil binders or other appropriate means, where practical;
- Soil surfaces are to be restored and re-vegetated as soon as possible;
- Construction activities such as cutting and grinding are to be scheduled and planned to limit the release of dust and noise to adjacent properties;
- Transportation and delivery of construction materials are to be scheduled to minimize the amount of bulk construction materials stored on-site at a given time; and
- Speed limits within the site are to be 20 km/h to control dust generation.

If workers experience symptoms such as coughing, wheezing, chest tightness and/or difficulty breathing, in particular on smog alert days, they should:

- Reduce their activity level and check the Air Quality Health Index (http://www.weatheroffice.gc.ca/airquality/pages/onaq-001_e.html) to find out how best to

protect their health;

- Drink plenty of water and take breaks preferably in the shade or in an air-conditioned area; and
- Contact their physician or go to the nearest hospital if further concerns arise.

7.1.6 Maintenance, Monitoring, and Documentation

Dust control is to be monitored regularly by the construction manager and / or contractor who is responsible for compliance with project specifications. At a minimum, observations of compliance with air quality and dust control objectives are to be recorded in daily logs for the site.

Where there is a potential for impacts to air quality, a site-specific EPP may prescribe that an Environmental Monitor be assigned to evaluate, audit, and monitor the control measures and report any measures that are being improperly implemented or that are ineffective. For example, project sites that involve the handling of severely contaminated soils may require additional monitoring, including the collection and analysis of air samples at the property boundary, to quantitatively demonstrate compliance. Measurement parameters such as the frequency of sampling or monitoring and the device used for measurements (e.g., Hi-Vol samplers) are to be determined on a project-specific basis and detailed in consultation with an air quality specialist.

Where air quality and dust management mitigation measures are ineffective or if the construction manager / contractor is not in compliance with prescribed control measures, work on the project is to be suspended until a review of mitigation measures is completed and issues are resolved.

Construction managers and / or contractors and susceptible individuals should check the Air Quality Health Index (https://weather.gc.ca/airquality/pages/provincial_summary/on_e.html), which provides current and forecasted measures of air quality in terms of health.

The construction manager and / or contractor must submit an Air Quality and Dust Control Plan to WT prior to the commencement of any work on site. In addition (as part of each Quarterly Update Report), a summary of dust control monitoring logs must be provided, along with any issues encountered, and mitigation measures implemented.

7.1.7 References

City of Toronto Public Health: Air Quality. https://www.toronto.ca/community-people/health-wellness-care/health-programs-advice/air-quality/

City of Toronto. 2010. *The Toronto Green Standard.*

Canada Green Building Council. 2010. *LEED® Canada for New Construction 2009*

Health Canada. 2004. *Canadian Handbook on Health Impact Assessment – Volume 4: Health Impacts By Industry Sector, Section 3.1.3 Pollution Caused by Vehicle Traffic*

Ontario Regulation 419/05 Air Pollution – Local Air Quality of the *EPA*

7.2 Archaeological and Built Heritage Resource Management

7.2.1 Environmental Concerns

The history of Toronto's waterfront is rich and varied and presents a unique opportunity for the presence of archaeological and built heritage resources. Although the majority of the lands that constitute the DWA have been comprised from decades of infilling, industrial or marine resources (i.e., wharf features and structures) may be found as deeply buried deposits when carrying out project-related activities. Any evidence of pre-contact (aboriginal) occupation along the original shoreline has likely been destroyed or submerged through the shifting water levels of Lake Ontario, combined with the intensity of nineteenth and twentieth-century land use. However, these deposits may still exist in a deeply buried context. Above-ground cultural heritage resources may also be present in the form of historically significant buildings and cultural landscapes.

7.2.2 Regulatory Framework

Archaeological Resources

Under the *Ontario Heritage Act*, the Ministry of Tourism, Culture and Sport regulates the protection and conservation of cultural heritage including archaeological resources, while the Ontario *Planning Act* requires municipalities to address archaeological resource concerns through planning processes and land-use control. The *Environmental Assessment Act* applies to public sector projects and requires the preparation of an environmental assessment document containing inventories, alternatives, evaluations, and mitigation strategies to address archaeological concerns. The provincial government, through the Ministry of Tourism, Culture and Sport has a regulatory and licensing responsibility for archaeology under the *Ontario Heritage Act*, however, municipal governments assume the day-to-day responsibility for ensuring that archaeological assessments are completed on lands which hold archaeological potential prior to any soil disturbance activity. The City of Toronto requires an archaeological assessment as a condition of development approval where warranted.

The archaeological review procedure developed as part of the larger "City of Toronto's Archaeological Management Plan" is the means through which the City is addressing its responsibility. Working with the City of Toronto, WT has developed an Archaeological Conservation and Management Strategy (ACMS) which contains an inventory of all known archaeological features within the DWA. The ACMS has evaluated the archaeological significance of potential resources, assigned a significance rating, and provided recommendations for mitigating any impacts to potential archaeological resources. The plan includes a funding provision for contingency planning in the event that an unexpected archaeological resource is encountered during the construction process.

Built Heritage Resources

Under the *Ontario Heritage Act*, a site can either be designated under Part IV (single building) or Part V (Conservation District) or be listed by a municipality as a heritage building.

Listed properties are those that City Council has recommended for inclusion in the City of Toronto's Inventory of Heritage Buildings. The recommendations are based on criteria that

relate to architecture, history, and neighbourhood context. Inclusion on the inventory signifies that the City would like to see the heritage attributes of the property preserved.

Listing a property on the Inventory of Heritage Properties allows Heritage Preservation Services to review development and building applications affecting those properties. It also requires the owner of a listed property to give the City 60-day notice of their intention to demolish the property.

Designated properties are those that have been designated under Part IV or Part V of the Ontario Heritage Act by the passing of a by-law. Designation gives Council the legal authority to refuse an application that will adversely affect the property's heritage attributes.

7.2.3 Causative Activities and Conditions

The Heritage Preservation Services section of the City of Toronto Planning Division must be consulted for any project-related activities such as alterations and demolitions that could directly or indirectly impact built heritage resources. Heritage Preservation Services is responsible for advising and assisting City Council, the Toronto Preservation Board, the community, and property owners on the conservation of the City's heritage resources. This involves advising on matters stipulated in the *Ontario Heritage Act*, reviewing, and advising on development proposals, and the monitoring and the maintenance of heritage sites.

All development plans within the DWA are to be reviewed against the ACMS inventory to determine if the proposed undertakings have the potential to impact an identified archaeological resource. This is to be done prior to submitting a development application. Upon submission of a development application, City Planning – Heritage Preservation Services will provide formal comment on the archaeological monitoring requirement as a condition of development approval.

The ACMS assigns a significance rating to individual features and the associated recommendation falls in to one of four basic categories:

Grade 1: Historically significant feature for which field work (e.g., archaeological test excavations, possible mitigation) is recommended.

Grade 2: Historically important feature for which limited archaeological fieldwork, typically monitoring, is recommended. This grade also applies to sites that would otherwise be ranked as Grade 1 but cannot be mitigated as such for technical reasons or because of economic constraints.

Grade 3: Feature of little historical significance, or for which the significance is not apparent; no form of mitigation or monitoring is necessary.

Grade 4: Lake fill within Toronto Harbour – no further action required.

On January 1, 2011, the Ministry of Tourism, Culture and Sport released *Standards and Guidelines for Consultant Archaeologists*. Compliance with the 2011 Standards and Guidelines is mandatory for all consultant archaeologists licensed by the ministry, who carry out archaeology in Ontario.

The Standards set out the basic technical, process and reporting requirements for conducting archaeological fieldwork, while the guidelines give advice on good practice beyond the requirements of the standards.

7.2.4 Maintenance, Monitoring, and Documentation

While every effort has been made to ensure that the inventory is comprehensive, it is recognized that unexpected heritage resources of interest or value may be encountered when carrying out project-related activities.

When an unexpected resource is found, work must stop in the immediate vicinity of the discovery. The resource is to be evaluated by a licensed archaeologist. Its significance is to be evaluated using the ACMS and reviewed with the City of Toronto Heritage Preservation Services and will form the basis of a final recommendation.

No potential archaeological resources within the DWA have been ranked as a Grade 1 resource, that is, a feature of such high significance that archaeological assessment in the form of test excavations and possible mitigation efforts (salvage excavation or preservation in situ) needs to be undertaken in advance of development.

Twenty-one inventoried features or combinations of features within the DWA have been ranked as Grade 2 resources. These are regarded as exhibiting moderate archaeological significance. Limited archaeological fieldwork, in the form of monitoring during construction excavations, is recommended for 18 of these sites. Please refer to Waterfront Toronto's ACMS for further details.

An **Archaeological Monitoring Protocol** is to be undertaken once large-scale excavations commence on a site. The site is visited on a daily basis, or as is deemed necessary based on consultation with the archaeological consultants, the City of Toronto Heritage Preservation Services, WT or other responsible parties, and on-site supervisory staff. The archaeological monitoring ceases once it has been determined that there is to be no further construction or excavation within areas of archaeological potential. The monitoring protocol will be developed on a site-specific basis and ensures that all parties including the consulting archaeologist and City Planning – Heritage Preservation Services are aware of the parameters and conditions of the monitoring process.

The purpose of monitoring is to document, through photography and the preparation of measured drawings, any significant exposed features that exhibit notable design or construction attributes. Artefact recovery is at the discretion of the monitoring archaeologist. The **Archaeological Monitoring Protocol** ensures that heavy equipment operators are to be instructed in on-site protocols, in advance of excavation activities. Equipment protocols may include:

- Notifying site supervisors when equipment operators encounter any intact structural features such as wharf cribs, structure foundations, etc.;
- Assisting archaeological staff in exposing archaeological features for documentation purposes; and

- Ensuring that significant archaeological features are preserved for a period of 24 to 48 hours to allow the archaeologist to visit the site, record its salient attributes and carry out any other activities that may be necessary.

In the event that suspected human remains are discovered or unearthed, the construction manager and / or contractor is to take appropriate measures including:

- Halting all work in the vicinity and ensuring the area surrounding the human remains is protected from further disturbance;
- Contacting the Toronto Police Service (416-808-2222); and
- Advising the archaeological consultant and WT (or developer partner or eligible recipient) immediately.

The construction manager and / or contractor must provide documentation to WT to demonstrate compliance with this EPP, including an Archaeological Monitoring Protocol (if required) and Quarterly Update Reports. The Quarterly Update Reports must document details, including photographs and narratives of any unexpected archaeological resource(s) discovered, an evaluation of its significance, and mitigation measures implemented.

7.2.5 References

Archaeological Services Incorporated. 2008. *Waterfront Toronto Archaeological Conservation and Management Strategy (ACMS)*

Archaeological Services Incorporated. 2003. *The Archaeological Master Plan of the Central Waterfront, Toronto, Ontario*

Ministry of Tourism, Culture and Sport, September 2006. The Discovery of Human Remains – Best Practices, Unit 5 in Standards and Guidelines for Consultant Archaeologists – Final Draft.

Ministry of Tourism, Culture, and Sport, January 2011. Standards and Guidelines for Consultant Archaeologists.

7.3 Contaminated Soils Management

7.3.1 Environmental Concerns

Much of the land in the DWA was formed through the infilling of Lake Ontario using soil and other fill materials from a variety of sources, some of which included contaminated materials. Industrial uses in the area also introduced contaminants such as polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), petroleum hydrocarbons, polychlorinated biphenyls (PCBs) and inorganic substances (e.g., metals).

7.3.2 Regulatory Framework

Federal legislation requires that management of contaminated soils comply with the applicable Regulations made under the *Fisheries Act* and the *Canadian Environmental Protection Act* (CEPA) to ensure the protection of fish, aquatic habitat, the environment, and human health.

The identification and management of contaminated soils or suspect materials is more directly governed by Ontario Regulation 153/04 - Record of Site Condition under the Ontario *EPA*. This Regulation outlines acceptable standards for soil, groundwater, and sediment quality, depending on the actual or proposed use(s) of land. To ensure the protection of groundwater supplies on adjacent lands, investigation and management of contaminated soils are to be in compliance with Ontario Regulation 169/03 under the *Safe Drinking Water Act.* In addition, if site personnel are at risk of being exposed to airborne contaminants originating from contaminated soils, respiratory protection is to be provided in compliance with the Ontario *Occupational Health and Safety Act* and Canadian Standards Association Standard Z94.4-18.

When soil is removed from a project site, it is to be managed according to Ontario Regulation 347; General – Waste Management under the *EPA*. This regulation designates excess soil as a waste unless specific conditions apply as set out in Ontario Regulation 406/19 – On Site and Excess Soil Management.

If excess soil is designated as a waste under Ontario Regulation 347, then it is required that contaminated materials be transported by licensed carriers and that receiving sites hold appropriate approvals to accept the types of materials being deposited.

In order for excess soil not to be designated a waste, the following conditions must be satisfied:

- The excess soil is transported directly to a reuse site from a project area, or to a permitted soil management site.
- The owner or operator of the reuse site must provide written consent for the deposit of the excess soil on the reuse site (if soil is being moved from one Waterfront Toronto project site to another Waterfront Toronto project site, Waterfront Toronto must provide written consent for the transfer).
- The excess soil is dry soil (i.e., passes a slump test as set out in Ontario Regulation 347) and remains so until the time of deposit.

- The reuse site is governed by one of a specified number of instruments as set out in Ontario Regulation 406/19, or otherwise meets the requirements of Ontario Regulation 406/19.

Soil intended for reuse must meet specific environmental quality criteria as set out in Ontario Regulation 406/19.

In order for soil not to be designated as a waste, soil reuse is required to be for a beneficial purpose such as:

- Backfill for an excavation carried out for the purposes of any form of development;
- Final grading for the purposes of any form of development;
- Achieving grades necessary for:
    - Any development;
    - An undertaking related to infrastructure;
    - Landscaping; or
    - Another project governed by an instrument issued by a public body.
- The placement of fill to assist in the rehabilitation of the reuse site (e.g., preloading or surcharging).

Final placement of the soil to fulfil one of these beneficial purposes must occur within two years of its initial deposit on the receiving site.

Waterfront Toronto's construction managers and / or contractors must follow the requirement of Ontario Regulation 153/04, Ontario Regulation 347 and Ontario Regulation 406/19, along with the requirements of any site-specific instruments that govern the quality or quantity of excess soil placement on a site.

7.3.3 Causative Activities and Conditions

Carrying out project-related activities in the DWA includes the inherent risk that contaminated soils may be encountered. These soils may be exposed during general grading or excavation for foundations, sewers or utilities in areas of known or suspected contamination.

7.3.4 Application

Waterfront Toronto has developed a Soil Management Program. This program requires that each development project involving the excavation or handling of soils be governed by a site- specific **Soil Management Plan** developed by an environmental consultant retained by the construction manager and / or contractor. These plans are prepared at the design stage of a project before the implementation of any site activities and provides details concerning the characterization of soil quality and the management and treatment of contaminated soils.

7.3.5 Design and Implementation Considerations

The potential for contaminated soil to be present at a project site is to be assessed through soil testing by WT's environmental consultant prior to the initiation of construction works. The Soil Management Plan developed at the design stage will characterize existing subsurface conditions including potential contaminants, proposed activities that are likely to disturb the soil, and provide direction on the management of excess soils (whether contaminated or not). For contaminated sites, site-specific monitoring programs for air quality and containment of contaminants within the site boundaries may be incorporated into the Soil Management Plan. Toronto Public Health may be consulted to ensure soil management protocols mitigate the potential for health effects from contaminated soil.

Construction managers and / or contractors must adhere to the site-specific Soil Management Plan for each project and incorporate it along with provisions for Spill Response (Section 8.2.2), Air Quality and Dust Management (Section 7.1), Groundwater Management (Section 7.6), Stormwater/Surface Water Management (Section 7.10) and worker health and safety, into an overall site-specific program.

7.3.6 Maintenance, Monitoring, and Documentation

Any work at a contaminated site must include the input and direction of WT's environmental consultant. Site supervision by WT or its environmental consultant will be undertaken when excavations into or around suspected contaminated soils take place. Where soil excavation is required, advance soil sampling is to be conducted within the proposed project area to determine the presence and concentrations of potential contaminants.

An environmental consultant (under the direction of a Qualified Person), either retained directly by WT or by the Construction Manager/General Contractor, will maintain records on the identification and management of contaminated soils. Site supervision will include direction on the segregation of contaminated soil and non-contaminated materials, field monitoring, procedural controls to prevent the spread of contamination from the excavation areas, screening, and verification sampling to establish the limits of contamination, and the maintenance of appropriate records relevant to the treatment or disposal of contaminated soil.

The Soil Management Plan must be in place prior to initiating any earthworks to ensure effective management of contamination and to minimize risk to human health and safety through exposure to contaminants. Effective management of suspect contamination will also reduce the risk of delays to project schedules. The Soil Management Plan may incorporate or be supplemented with the relevant Planning Documents as required by Ontario Regulation 406/19.

While project sites are to be adequately characterized in advance of construction activities, contaminated soil may be encountered unexpectedly during excavation. Suspect soil may be

identified through visual or olfactory clues such as colouration or staining, unusual odours, or as a result of field screening using combustible gas detectors or photo-ionization detectors. If suspect soil is unexpectedly encountered, the construction manager and / or contractor is required to notify WT and its environmental consultant immediately. All works in the affected area must be suspended and the zone of contamination must be controlled until the soil has been thoroughly evaluated.

Excavated soil is to be managed to prevent sediment accumulation in stormwater runoff (Section 7.10). Excavated soil that is suspected of or known to be contaminated is to be placed in covered bins or other sealed containers or stockpiled and covered with plastic sheeting anchored in place (Sections 7.1 Air Quality and Dust Management and 7.4 Erosion and Sediment Control). Site protocols are to be established to ensure contaminated soils are not tracked to uncontaminated areas of the site. These will include mud mats, truck washing and equipment scheduling that minimizes equipment movement between contaminant zones.

The construction manager and / or contractor must submit a Soil Management Plan to WT prior to the commencement of any work on site, as well as Quarterly Update Reports, which summarize Soil Management Plan activities undertaken, issues encountered, and the mitigation measures implemented. The construction manager and / or contractor must also provide the following data to Waterfront Toronto as part of the Quarterly Update Reports:

- Quantity of excavated soil sent to landfill (m^3)
- Quantity of excavated soil sent to beneficial reuse sites in accordance with O. Reg. 406/19
- Quantity of virgin aggregate / unshrinkable backfill used on site (m2)
- Quantity of suitable backfill material imported under the beneficial use provisions of O. Reg. 406/19

7.3.7 References

Center for Environmental Excellence by AASHTO. 2008. *Chapter 4: Construction Practices for Environmental Stewardship - Section 4.11: Soil Management in Construction*

Canada Green Building Council. 2010. *LEED® Canada for New Construction 2009*

Ontario Ministry of the Environment. 2004. *Records of Site Condition: A Guide on Site Assessment, the Cleanup of Brownfield Sites and the Filing of Records of Site Condition*

Ontario Regulation 153/04: Records of Site Condition - Part XV.1 of the Act. Accessed at: https://www.ontario.ca/laws/regulation/040153

Ontario Regulation 347: General – Waste Management

Ontario Regulation 406/19 – On-Site and Excess Soil Management. Accessed at: https://www.ontario.ca/laws/regulation/190406

Ontario Ministry of the Environment, Conservation and Parks. 2020. *Rules for Soil Management and Excess Soil Quality Standards*.

7.4 Erosion and Sediment Control

7.4.1 Environmental Concerns

Erosion is generally defined as the destabilization of the ground surface and the transfer of surface soils from one location to another. It commonly occurs when precipitation (rain or snowmelt) flows over the ground surface. The extent and severity of erosion depends on the type of soil, the type and condition of soil cover (e.g., vegetation), local climate and site topography. Site disturbance increases the risk of erosion unless controls are in place to manage erosion and sediment runoff. Erosion concerns are typically relevant during construction or related project activities.

If soil enters a watercourse (either directly or through a storm sewer) the sediment can impair water quality and have an adverse effect on aquatic habitat. Suspended sediment can directly affect aquatic biota as it may impair respiration. Indirectly, sedimentation can inhibit plant productivity and damage spawning areas. Deposited sediments can also reduce the capacity of a watercourse and potentially increase flood risk.

7.4.2 Regulatory Framework

Legislation, regulations, codes, and standards under the jurisdiction of the three levels of government (federal, provincial and municipal) may influence project-related requirements in the DWA. Each is described in the following sections.

7.4.2.1 Federal Regulations

The federal *Fisheries Act* establishes protections to fish and fish habitat in all waters frequented by fish. Subsection 36(3) prohibits the deposit of deleterious substances into the water frequented by fish, or to any place, under any conditions, where they may enter waters frequented by fish. The Act also protects against the 'death of fish, other than by fishing' and the harmful alteration, disruption, or destruction of fish habitat. Projects that potentially involve disruption to fish or fish habitat requires authorization and determination of appropriate mitigation and/or compensation. To avoid disruptions or damage to fish habitat, activities undertaken near a watercourse must implement erosion and sediment controls. Part 8 of the *CEPA* outlines the requirements for environmental emergency plans for unplanned or accidental releases of a substance into the environment.

7.4.2.2 Provincial Regulations

The Ontario *EPA* and the *Ontario Water Resources Act (OWRA)* both aim to protect and manage the quality and quantity of surface water and groundwater. Discharging or depositing material in any water or on any bank that may degrade the quality of surface water such as rivers, streams or lakes is prohibited. Sediment released from a site could also result in a discharge to a water body and subsequent quality degradation. Provincial approvals through a C of A, with demonstrated erosion and sediment control for stormwater management, are required for projects that may contribute to erosion in the DWA.

7.4.2.3 Municipal Requirements

Municipalities must ensure that discharges from storm sewer systems meet provincial requirements. Projects that may release suspended solids to a storm sewer must have an erosion and sediment control plan and comply with City of Toronto Municipal Code Part II,

Chapter 681 (By-law 457-2000) to regulate the discharge of sewage and land drainage. The City of Toronto reviews this requirement as part of its site plan review and approval process (*Planning Act*).

In addition, the Toronto Green Standard Version 4 (effective May 1, 2022) provides an integrated set of targets, principles, and practices to support sustainable development and site design. The standards are designed to work with the regular development approvals and inspections process. A completed Toronto Green Standard checklist is required as part of the planning approval process. With respect to this EPP, it ensures the protection of water quality during construction and demolition through adherence to the Erosion and Sediment Control Guide for Urban Construction (Toronto and Region Conservation Authority, 2019). The EPP also promotes the prevention of erosion through the retention and reuse of all uncontaminated on-site soil in areas not covered by buildings or hard surfaces. Where this cannot be achieved, the soil should be replaced with soil of equal or better quality to encourage revegetation and minimize future erosion potential.

7.4.3 Causative Activities and Conditions

Many project-related activities (e.g., demolition and construction) can cause or contribute to erosion or sediment migration. The physical or environmental conditions likely to contribute or cause situations requiring intervention to manage erosion and sediment transport include:

- Erosion caused by rain and runoff, and
- Erosion through project-related works (e.g., excavation, transport and placement of materials, site development and infrastructure-related works) disrupting existing water bodies.

7.4.4 Application

Erosion and sediment control measures must be applied at any project site or associated area (e.g., transport routes) where causative activities or conditions may occur. These measures must be in place prior to the initiation of work in order to prevent soil erosion, rather than manage erosion that has already begun to take place.

7.4.5 Design and Implementation Considerations

The hierarchy for erosion and sediment control is first to control erosion at its source and then to provide controls against potential off-site migration of sediment. To reduce the need for controls for off-site sediment migration, the following procedures are to be implemented:

- Design site layouts to minimize vehicle movement that can cause soil compaction and subsequent erosion;
- Limit both the gradient and the length of exposed slopes (faster moving water associated with steeper slopes accelerates erosion);
- Minimize the area and duration of exposed soil; and
- Maintain and regenerate vegetative cover as a natural erosion control feature.

TRCA's *Erosion and Sediment Control Guide for Urban Construction* includes requirements for the early stages of planning and design, intermediate stages of planning and design, and detailed design stages of planning and design.

During the early stages of planning and design, the focus of the erosion and sediment control

works should coincide with the overall planning stage: high level conceptualization, strategizing, and an effort to understand the works to be conducted during subsequent design stages. In this manner, the efforts provided during this stage will feed into further studies, helping guide the Erosion and Sediment Control (ESC) strategy to minimize impacts on the downstream receiving systems. It is understood that not all details of the proposed works will be known, and that only general guidance is requested at this point.

During the intermediate stages of planning and design, the focus of the erosion and sediment control works is on preparing site level strategies. The appropriateness of strategies prepared during previous planning and design stages will be verified based on consideration of advanced information available related to the site layout and grading requirements. Further, the works at this level will provide greater insight to the level of effort required in preparing the final ESC plans and reports during the final planning and design stages.

During the detailed design stage, a comprehensive ESC report and drawings are prepared using the strategies from previous design stages. The reports and plans need to clearly demonstrate the preferred strategy, including ESC measures in relation to construction phasing.

Design teams must reference and comply with the full list of requirements advanced in the *Erosion and Sediment Control Guide for Urban Construction* and report on completion status as required.

7.4.5.1 Assessing Existing Conditions and Erosion Risk

The *Erosion and Sediment Control Guide for Urban Construction Projects* outlines procedures to collect pertinent site information in order to analyze and assess the level of erosion risk associated with the proposed construction. The Guide informs projects when and how erosion risk assessments should be undertaken, and denotes the process involved with selecting Best Management Practices (BMPs) specific for the site. Construction Managers and contractors should apply the current version of the *Erosion and Sediment Control Guide for Urban Construction* regardless of whether the project falls under TRCA's jurisdiction.

7.4.5.2 ESC Plan Design Process

Following the identification of BMPs to address the site-specific erosion hazards anticipated throughout the construction program, proponents are to develop an effective ESC plan that first seeks to prevent erosion and then seeks to remove sediment from runoff before it leaves the site. The ESC should provide protection strategies for the entire construction period, from the initial site stripping to the final stabilization and decommissioning of ESC measures.

ESC planning process should be comprehensive, collaborative, strategic and dynamic. Conventional ESC planning relied of sediment fences, check dams and temporary ponds in a static ESC plan. Current approaches focus on better tailoring of ESC measures specific to the site and various stages of the work program, and able to respond due to changing conditions as observed through the application of a regular inspections, monitoring, and maintenance program.

The Guide provides information in the development of a staged ESC plan reflecting the various stages of construction, and even includes consideration of sediment management controls associated with dewatering activities, and construction projects located near water and in-water. Construction Managers and contractors engaged in WT projects should consider the information presented in the guide and prioritize erosion controls and sediment controls over in-water controls.

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7.4.5.3 Considerations for ESC Plan Implementation

As all Waterfront Toronto projects incorporate intrinsic sustainability elements, including the incorporation of Low Impact Development, the Guide also outlines additional considerations for Construction Managers to ensure construction activities and phasing does not impact the functionality of completed LID elements. For example, LID should be constructed near the end of a project, to avoid having construction run-off from impairing the features prior to hand-over.

7.1.1 Inspections, Monitoring, Maintenance, and Documentation

Other critical considerations in ESC planning and implementation include the development of Spill Response and Control Plans, in order to quickly mobilize forces in the event of a breach in the ESC measures. Central to the Spill Response and Control Plan is to develop detailed spills prevention considerations to mitigate risk. The Spills Response program should be the last resort to be implemented when all other mitigation and planning measures fail. Spill responses can be measured based on whether an event is considered a minor event or a significant event. The Guide provides details on the information required to address all aspects of a Spills Response and Control Plan.

The inspection, monitoring and maintenance program is critical to ensure the effective implementation of the ESC measures. The Guide outlines the need for a qualified inspector that is responsible for undertaking regular inspections of the ESC measures and to ensure that all ESC measures are maintained in a state of good repair.

- In addition to the inspection and maintenance role, inspectors are to initiate ongoing or periodic assessments of the quality of site discharges leaving the site and downstream at receiving waterways to assess the overall effectiveness of the ESC measures. The inspector is to provide recommendations for improvements in the ESC system, if it is deemed that the existing measures are deemed deficient in their effectiveness of preventing the release of excessive sediment and other deleterious substances into nearby watercourses. The monitoring program will identify what parameters will be monitored, how and where they will be monitored and at which frequency. In addition, turbidity targets will be selected on the specific conditions of the nearby and downstream watercourses, to reflect the nuances and sensitivities specific to the receiving waterbody.

The construction manager and / or contractor is to implement the *Erosion and Sediment Control Guide for Urban Projects* and work with WT to receive applicable approvals, prior to the commencement of any work on site. In addition, Quarterly Update Reports must be submitted, summarizing ESC activities undertaken, issues encountered, and mitigation measures implemented. Copies of photographs or drawings to document the ESC measures implemented on the site, or a representative sample thereof must also be provided.

7.1.2 References

City of Toronto. 2010. *The Toronto Green Standard.*

Toronto and Region Conservation Authority. 2019. *Erosion and Sediment Control Guide for*

Urban Construction

Transportation Association of Canada (TAC). 2005. *National Guide to Erosion and Sediment Control on Roadway Projects*, Ottawa, Ontario

Canada Green Building Council. 2010. *LEED® Canada for New Construction and Major Renovations 2009*

Department of Fisheries and Oceans (DFO). *Federal Fisheries Act, June 21, 2019.*

7.2 Fuel and Lubricants Management

7.2.1 Environmental Concerns

Fuels and lubricants are used in mechanical equipment and machinery. Improper management of these fluids may cause environmental impacts through:

- Spills and leaks into the soil, surface water, and/or groundwater; and
- Fires at the site.

Inadvertent release of these fluids may adversely impact the environment and may also affect the project through the diversion of resources to remediate the release.

Risks from spills and leakage of harmful fluids is reduced through the development and implementation of sound management plans for vehicles, machinery (including fueling and operation), imported materials (including hazardous materials) and materials generated from project-related activities.

Contingency and Emergency Response Plans (Section 8.0) prepared and implemented by construction managers and / or contractors will minimize the impacts from inadvertent spills.

7.2.2 Regulatory Framework

7.2.2.1 Federal Regulations

Projects are to be carried out in compliance with Parts 5 and 8 of the *CEPA* which relate to the regulation and release of toxic substances, and include requirements for environmental emergency plans, regulations, and remedial actions for an uncontrolled, unplanned or accidental release of a substance into the environment.

In addition, project activities involving fuels and lubricants must ensure the protection of fish habitat and prevention of pollution through the federal *Fisheries Act*.

7.2.2.2 Provincial Regulations

Part V of the Ontario *EPA* prohibits the disposal of wastes to any sewage or other works which are governed by the *OWRA*. In the event that a spill does occur, Part X of the *EPA* provides direction on the management and reporting of spills.

To ensure the protection of groundwater, the management of fuels and lubricants are to be in compliance with Ontario Regulation 169/03 under the *Safe Drinking Water Act.*

Vehicle handling, fueling and fuel storage are to be conducted in accordance with the *Technical Standards and Safety Act* (Ontario Regulation 217/01) which is administered by the Ontario Technical Standard and Safety Authority (TSSA).

All project activities that involve the storage and use of lubricants and fuels on-site shall follow the *Occupational Health and Safety Act*, Workplace Hazardous Material Information System (WHMIS) regulation (Ontario Regulation 860). This ensures cautionary labelling of containers of

WHMIS "controlled products", the provision of material safety data sheets (MSDSs) and the implementation of worker education programs.

Part 4 of the *Fire Protection and Prevention Act* (O.Reg. 388/97) and *Ontario Fire Code*, which provides guidelines for storing and handling of flammable and combustible liquids, should also be adhered to for all projects.

7.2.2.3 Municipal Requirements

The City of Toronto regulates the discharge of fluids to stormwater, sanitary and combined sewer systems under Part II, Chapter 681 of the Toronto Municipal Code. Management of fuels and lubricants will ensure that release of materials to the sewer system does not violate the requirements laid out in the code.

7.2.3 Causative Activities and Conditions

Activities associated with fueling of on-site machinery and use of lubricants in the operation and maintenance of machinery can lead to spills or leaks resulting in contamination and migration of contaminants into the soils, groundwater and watercourses.

7.2.4 Application

A **Fuel and Lubricants Management Plan** is to be prepared and implemented by construction managers and / or contractors involved in the fueling or maintenance of construction equipment. The Plan is to be completed prior to the start of any on-site work. Construction managers and / or contractors are responsible for ensuring that all on-site personnel are aware of and trained in the handling of fuels and lubricants.

7.2.5 Design and Implementation Considerations

Good housekeeping practices during project-related activities reduce the potential for spills or leakages of fuels and lubricants into the environment. In addition to project guidelines on workplace fuels and lubricant, the following measures are to be implemented:

- Equipment refueling is to be performed only at a designated refueling station;
- Equipment maintenance and refueling are to be controlled to prevent any inadvertent discharge of petroleum products;
- Fuels and lubricants are to be properly labelled and stored in a designated storage area;
- Vehicle maintenance and refueling is to be conducted at least 30 metres away from any sensitive watercourse (i.e., Don River, Lake Ontario, etc.) and special care is to be taken near municipal storm sewers (i.e., cover sewers during fueling);
- Fuel storage and pumps, if installed, are to be placed where access to fuel trucks and construction equipment is easiest and in accordance with provincial fuel tank storage and dispensing regulations;
- All personnel working with fuels and lubricants are to be trained in the proper handling of such materials;

- Access to fuels/lubricant storage area is to be restricted to personnel qualified and designated to handle such materials;
- First aid kits and emergency response equipment (spill kits) are to be available near storage areas and on re-fueling vehicles;
- All vehicles on-site are to be equipped with spill kits;
- Fire protection equipment is to be maintained on-site and all personnel are to be trained to respond to emergencies in accordance with the site plan provided by the construction manager and / or contractor;
- MSDS for all hazardous substances are to be accessible on-site; and
- A Spill Prevention and Contingency Plan (Section 8.1) and an Emergency Response Plan (Section 8.2) are to be developed and implemented as required.

It is expected that alternative vehicles such as electric vehicles or those run-on biodiesel fuel be used whenever possible for project-related activities, to satisfy objectives set out in Waterfront Toronto's Sustainability Framework.

7.2.6 Maintenance, Monitoring, and Documentation

Mechanical equipment is to be in good working repair and free of oil, hydraulic fluid, grease and fuel leaks. A daily inspection of all machines is to be conducted by the construction manager and / or contractor before start-up to ensure that no potential exists for contamination of soils and watercourses. Operators are responsible for ensuring that no potential exists for oil, grease or other deleterious substances to enter into the environment.

Buffer zones are to be established around all sensitive environmental features to avoid environmental impacts that may be caused by equipment. Equipment is to be stored in a stable location away from sensitive areas and outside the established buffer zones. Contract administrators and site supervisors are responsible for ensuring that these measures are effectively implemented by the construction manager and / or contractor.

Fuel and lubricant storage control measures are to be in place to protect the project site. Where the size of the project or types of materials present warrant additional oversight, an Environmental Monitor may be retained to evaluate, audit and monitor the control measures and report any measures that are ineffective or not being implemented properly. The Environmental Monitor or contract administrator is to complete daily field reports.

Pollutants spilled or discharged into the environment are to be reported to the **Spill Action Centre** of the Ontario Ministry of the Environment (MOE) (1-800-268-6060), as well as to the City of Toronto (416-338-8888). Further information on procedures and contacts in the event of a spill or discharge can be found in Section 8.1 and Appendix B respectively and are to be followed immediately upon discovery of an incident.

The construction manager and / or contractor must submit a Fuel and Lubricants Management Plan (including but not limited to a plan for training all on-site personnel on the handling of fuels and lubricants) to WT prior to the commencement of any work on site. In addition (as part of each Quarterly Update Report), a summary of Fuel and Lubricants Management activities undertaken must be provided, along with a description of any issues that were encountered and

the mitigation measures implemented. In addition, any use of alternative vehicles must be noted in the Quarterly Update Reports.

7.2.7 References

Center for Environmental Excellence by AASHTO. 2008. *Chapter 4: Construction Practices for Environmental Stewardship - Section 4.6: Vehicle Fluid, Fuel and Washwater Control*

U.S. Environmental Protection Agency. Construction Site Chemical Control. Last updated on January 13, 2010. *http://www.epa.gov/owow/NPS/MMGI/Chapter4/ch4-3b.html*

Ontario Provincial Standard Specification. 2010*. OPSS 182: General Specification for Environmental Protection for Construction in Waterbodies and on Waterbody Banks.*

7.3 Groundwater Management

7.3.1 Environmental Concern

The majority of the lands across the DWA can be classified as Brownfields (i.e., underutilized lands that are or are perceived to be contaminated). As such, these lands generally pose a higher risk of contamination because of past land uses (e.g., industrial). Adverse impacts to groundwater quality through contamination from on-site activities or from past uses can impair the future use of the site and adjacent sites. Impacts to the groundwater are to be avoided or minimized.

Excavation works and construction of foundations may impact groundwater flows if large quantities of groundwater are removed during dewatering or if recharge areas or flow patterns are disrupted. Proper management of groundwater ensures that minimal impacts occur to the environment as well as wildlife and their habitat.

7.3.2 Regulatory Requirements

Contaminated groundwater represents a potential for adverse effects on nearby water courses and discharge areas. All project activities are to be carried out in a manner that will not adversely affect fish habitat (unless an appropriate approval under the *Fisheries Act is obtained)* and will preserve the environment and human health as required under the *CEPA.*

The extraction and management of groundwater is governed provincially by the *EPA* (Part X) and the *OWRA.* These Acts aim to protect and manage the quality and quantity of surface water and groundwater. Ontario Regulation 153/04 outlines acceptable standards for groundwater quality for a site and is to be followed.

For any works where more than 50,000 L of groundwater will be extracted per day during dewatering, a Permit to Take Water issued under the *OWRA* (section 34) is required.

Should an abandoned well be discovered or should existing wells no longer be required, the decommissioning of the wells is governed by the *Safe Drinking Water Act* and Ontario Regulation 903 - Wells.

The City of Toronto provides requirements for discharge of fluids to stormwater, sanitary and combined sewer systems under Part II, Chapter 681 of the Toronto Municipal Code. Should dewatering works be required for a project, discharges of groundwater to the sewer system are to comply with the requirements laid out in the code and are subject to a sewer discharge agreement.

7.3.3 Causative Activities and Conditions

Activities that could lead to impacts to the groundwater include groundwater pumping, flow attenuation, groundwater recharge, spills and leaks from refueling of machinery, improper storage and handling of lubricants and fuels, poor stormwater and surface water management and ineffective sediment and erosion controls. Seepage of contaminants into soil may eventually reach the underlying groundwater and migrate off-site. Contamination of the

groundwater may eventually impact nearby sensitive watercourses or intrude into buildings through the vapour phase.

7.3.4 Application

Groundwater management is to be undertaken for any project requiring dewatering, whether or not a Permit to Take Water is required and is to be done in concert with Contaminated Soils Management (Section 7.3), Erosion and Sediment Controls (Section 7.4), Fuels and Lubricant Management (Section 7.5) and Stormwater/Surface Water Management (Section 7.10). A Groundwater Management Plan is to be applied at any project site or associated area (e.g., transport route) where there are possibilities for impacting groundwater. These measures are to be in place prior to the initiation of work.

7.3.5 Design and Implementation Considerations

In addition to the planning and implementation considerations outlined in the Contaminated Soils Management (Section 7.3), Erosion and Sediment Control Management (Section 7.4), the Fuels and Lubricant Management (Section 7.5), and the Stormwater/Surface Water Management (Section 7.10) Plans, the following groundwater management guidelines are to be implemented:

- Site plans are to be reviewed by a qualified groundwater professional retained by the construction manager and / or contractor for the subject project activity regardless of vulnerability. The groundwater professional should prepare a **Groundwater Management Plan** that considers the quality and quantity of groundwater to be managed; and
- Where an abandoned well is discovered, site personnel must inform the project's environmental consultant and WT to obtain direction on whether the well has contributed or has the potential to contribute to soil and/or groundwater contamination and measures that are to be taken to decommission the well.

For sites with contaminated groundwater, site-specific monitoring, and sampling programs to control off-site migration may be incorporated into the Groundwater Management Plan. Toronto Public Health may be consulted to ensure groundwater management protocols mitigate the potential for health effects from contamination.

7.3.6 Maintenance, Monitoring, and Documentation

If project-related activities can impact groundwater, if there is known groundwater contamination, or if an activity is in the vicinity of a sensitive watercourse or wildlife habitat, monitoring wells must be installed on-site and on adjacent properties to monitor migration of contaminants in groundwater. The groundwater professional retained by the construction manager and / or contractor will evaluate the need for construction monitoring wells and will include requirements for these in the project specifications. Where monitoring wells are installed, regular monitoring of groundwater quality and elevation is to be conducted by the groundwater professional or as directed by them before, during, and after the activity.

Should seepage or pooling of groundwater occur during excavation works, sufficient pumps or sumps with the capacity to remove the water that accumulates must be provided and used by the construction manager and / or contractor. In addition, proper mitigation measures such as

retention ponds and drainage ditches are to be constructed in order to prevent the discharge of groundwater onto the surface. An inspection of retention ponds, drainage ditches, and/or catch basins must be performed by the construction manager and / or contractor and the groundwater professional prior to dewatering to ensure that capacity to handle dewatered groundwater is adequate. If the groundwater is considered to be non-turbid and/or uncontaminated (i.e. meets the specific site condition standards for groundwater under O.Reg 153/04), it can be either recycled/reused or discharged to the storm sewer (as long as it complies with the requirements laid out in Part II, Chapter 681 of the Toronto Municipal Code). Erosion and sediment control measures (Section 7.4) must be implemented by the construction manager and / or contractor at, in and around all retention ponds, drainage ditches, and/or catch basins.

The construction manager and / or contractor must submit a Groundwater Management Plan to WT prior to the commencement of any work on site. In addition (as part of each Quarterly Update Report), a summary of Groundwater Management Plan activities undertaken must be provided, along with any issues encountered throughout the project and the mitigation measures implemented.

7.3.7 References

City of Toronto Municipal Code, Chapter 681 – Sewers.

Ontario Ministry of the Environment. 2004. *Groundwater Studies in Ontario: Mapping a Hidden Treasure*

Ontario Ministry of the Environment. 2001. *Stormwater Pollution Prevention Handbook*, *Part III: Ontario Case Studies - Watershed Infrastructure Ecology Program (WIEP)-Toronto*

7.4 Methane Control

7.4.1 Safety and Environmental Concerns

Given that the DWA has a history of infilling lands over existing peat layers using waste and sewage material, there is a higher potential and risk for encountering methane on-site through activities that require excavation and subsurface investigations. As such, more care must be taken to ensure that human health and safety is addressed where there exists the potential for encountering methane.

At room temperature and standard pressure, methane is a colourless, odourless gas. In ambient conditions methane gas is lighter than air and dissipates with time. Methane is not toxic but it is highly flammable and may form explosive mixtures. It is violently reactive with oxidizers, halogens, and some halogen-containing compounds.

Methane is also an asphyxiant and may displace oxygen in an enclosed space. Asphyxia may result if the oxygen concentration is reduced to below 19.5% by displacement with methane or other gas. The concentrations at which flammable or explosive mixtures form are much lower than the concentration at which asphyxiation risk is significant. When structures are built on or near methane-generating materials (e.g., landfills, peat or high organic soils), methane off-gas may be required to inhibit penetration into building interiors and to prevent occupants from being exposed to accumulating methane.

Methane is a greenhouse gas that may be present at low aggregate volumes at any project. As such, capture and re-use of methane is not likely feasible at most sites.

7.4.2 Regulatory Framework

Methane control is not directly regulated. However, because of its inherent health and safety hazards, the following regulations may apply:

- Regulation 213 made under the Ontario *Health and Safety Act*: Construction Projects, and
- CSA Z94.4-18: Selection, Use and Care of Respirators, Canadian Standards Association (2018).

Certificates of Approval (Air) may be required for gas interception and venting systems that are typically installed to control methane gas migration at a site.

7.4.3 Causative Activities and Conditions

The following WT project-related activities and physical or environmental conditions may contribute or cause situations that require intervention to manage methane hazards:

- Project-related activities involving excavation of methane-generating materials (e.g., organic matter, waste materials) that may form a conduit for methane release; and
- Construction of facilities that may create areas where methane accumulates or redirects methane to enclosed areas (e.g., underground vaults, granular bedding for underground services or impermeable surface coverings).

7.4.4 Application

Methane monitoring and control measures are to be applied at any project site or associated area (e.g., transport route) where causative activities or conditions may occur. These measures are to be in place prior to the initiation of work to prevent methane exposure and migration.

7.4.5 Methane Mitigation Design and Implementation Considerations

To reduce the need for methane monitoring and control measures, the following procedures are to be followed when possible:

- Maximize excavation surface areas to the extent practicable to allow methane gas to dissipate and minimize low surface area to depth ratio excavations (e.g., test pits). Erosion control measures (Section 7.4) are to be balanced with methane control if exposed surfaces will be maximized;
- Monitor methane and oxygen levels in any area suspected of containing methane (e.g., confined spaces, basements, caissons, monitoring wells) using a portable combustible gas vapour detector (e.g., RKI Eagle, RKI GX-2003) prior to entry and during occupation;
- Design constructed features to prevent methane migration and build up; and
- Include passive or active venting systems in areas where gas pressure differences can build up in the ground, resulting in uncontrolled methane migration.

7.7.5.1 Methane Monitoring Measures

In order to minimize the need for methane control measures, the following procedures are to be implemented for all projects across the DWA where methane may be present:

- Use personal protective equipment including flame-resistant protective clothing (coveralls, gloves, footwear, headgear) in areas of possible methane accumulation;
- Extinguish sources of ignition, such as smoking and open flames;
- Prohibit eating, smoking or drinking as methane can be swallowed;
- Wash hands carefully before eating, drinking, applying cosmetics, smoking or using the toilet;
- Use only non-sparking tools and equipment and ground and bond all metal containers and piping;
- Calibrate combustible vapour detectors to detect methane and use them before entering areas where methane may be present (e.g., confined spaces, basements, caissons, monitoring wells) to ensure that explosive concentrations do not exist; and
- **Use only NIOSH approved self-contained breathing apparatus with a full face piece (operated in the positive pressure mode) in oxygen-deficient environments**. Any work conducted with respirators must include a written respirator use and care program in accordance with Canadian Standards Association standard Z94.4-18. The program must be administered by the employer of the worker wearing the respirator.

7.7.5.2 Methane Control Measures

To reduce overall risks where methane is assumed or confirmed to be present, the following measures are to be implemented for all projects in the DWA:

- Enclose operations and use local exhaust ventilation at the site of chemical release, where possible. If local exhaust ventilation or enclosure is not used, NIOSH approved self- contained breathing apparatus with a full face piece operated in the positive pressure mode must be used;
- Install permanent vapour detection units calibrated to detect and monitor methane concentrations and connect an audible and visual alarm system to the vapour detection units to alert occupants of possible safety hazards;
- Post hazard and warning information at all entry points and accesses in work areas and as part of an ongoing training effort, communicate all information on the health and safety hazards of methane to personnel; and
- Install a passive or active soil venting system for in-situ methane gas generating substances to prevent methane build-up and to control methane migration.

7.4.6 Maintenance, Monitoring, and Documentation

Areas where methane may be present are to be monitored on a regular basis at a frequency commensurate with the potential for exposure.

Soil gas measurements can be made using several techniques. However, active whole-air sampling methods and active or passive sorbent sampling methods are usually employed. Typically, a whole-air sampling method is used in which a non-reactive sampling probe is inserted into the soil to a prescribed depth. This can be accomplished manually using a "slam bar", a percussion power drill or inserted into the ground with a drill rig. Soil gas samples can be withdrawn directly from the probe or through flexible tubing connected to the probe. The collection and concentration of soil gas contaminants can be greatly affected by the components of the sampling system. It is imperative to use materials that are inert to the contaminants of concern.

Whole-air sampling is typically accomplished using an evacuated Summa or equivalent canister, or by evacuation to a Tedlar bag. Normal operation includes the use of an in-line flow controller and a sintered stainless-steel filter to minimize particles becoming entrained in the sample atmosphere. The sampling rate must not be so high as to allow for ambient air leakage between the annulus of the probe and the surrounding soils.

Passive sorbent sampling involves burial of solid sorbent sampling devices called cartridges or cassettes to a depth of normally 5 feet or less and are typically left in-ground for 72 to 120 hours or longer. During this time, the vapour-phase soil gas contaminants pass through the cassette and are adsorbed as the soil gas moves toward the soil surface by diffusion and/or convection.

The construction manager and / or contractor must submit a Methane Monitoring and Control Plan to WT prior to the commencement of any work on site. In addition (as part of each Quarterly Update Report), a summary of Methane Monitoring and Control activities undertaken

must be provided, along with a description of any issues that were encountered, and mitigation measures implemented.

7.4.7 References

Canadian Standards Association. 2018. *CSA Z94.4-18: Selection, Use and Care of Respirators*

Ontario Regulation 213/91 made under the *Ontario Health and Safety Act*: Construction Projects

7.5 Noise and Vibration Management

7.5.1 Environmental Concerns

Project-generated noise can disturb the community and impact wildlife. Project-generated vibrations can damage nearby roads, buildings and municipal infrastructure and can cause erosion of stream banks, or lead to instability of soil piles and excavated faces.

A **Noise and Vibration Management Plan** establishes a set of protocols to control noise emissions, monitor vibration generation, minimize community and wildlife impacts, and promote community acceptance of unavoidable noise.

7.5.2 Regulatory Framework

No federal legislation specifically governs noise and vibration management on construction sites.

Provincially, noise is governed by Section 14 of the *EPA* which prohibits the discharge of noise that may cause an adverse effect.

Noise is also enforced through the City of Toronto Municipal Code on Noise (Chapter 591), specifically 591-2.3 and 591-3 which outlines restrictions on noise as a result of construction-related activities. The construction manager and / or contractor must adhere to, at all times during construction, the provisions set forth in the code and that relate to the associated and applicable activities that have the potential for generating noise.

Should blasting be required for a project, it is to be carried out in accordance with the MOE *Guideline NPC-119* regulating the noise and vibration produced during blasting.

Work associated with construction vibration, such as pile driving, is governed by the City of Toronto Municipal Code on Building, Construction and Demolition (Chapter 363), specifically 363-3.6 which outlines vibration restrictions and vibration monitoring protocols. Building permit applicants must provide details relating to the potential for construction vibrations.

7.5.3 Causative Activities and Conditions

Activities such as movement of heavy equipment, pile driving for foundations, blasting, soil excavation and construction of buildings can lead to noise and vibration levels in excess of the provincial and municipal guidelines.

7.5.4 Application

Noise and vibration monitoring and control measures are to be applied on the project site by the construction manager and / or contractor, in order to minimize nuisance effects on residents, businesses and nearby neighbourhoods.

7.5.5 Design and Implementation Considerations

Where the noise impact exceeds the applicable criteria, mitigation will be necessary. Mitigation measures may be implemented on the site of the noise-sensitive land use or at the source. The preferred and normally the most economical option is to implement noise control measures at the source. These measures include:

- Ensuring that all equipment is well maintained and in good condition;
- Using mufflers on vehicles and equipment in accordance with manufacturer's guidelines; and
- Scheduling material delivery and transportation at appropriate times.

Project-related works must not emit sound from any operation of construction equipment (such as jackhammers, concrete saws and/or pneumatic drills), if it is clearly audible at a point of reception in:

- A quiet zone or residential area within the prohibited period of 7:00 p.m. one day to 7:00 a.m. the next day, 9:00 a.m. on Saturdays, and all day Sunday and statutory holidays, or
- In any other area within the prohibited period of all day Sunday and statutory holidays.

This does not apply to the continuous pouring of concrete, large crane work and necessary municipal and emergency work that cannot be performed during regular business hours (City of Toronto Municipal Code on Noise). The City of Toronto (416-392-7539) must be notified and approval must be obtained for these exceptional circumstances.

Required control measures for transportation and stationary sources are to be evaluated separately for day time (between 07:00 and 23:00 hours) and night time (between 23:00 and 07:00 hours) periods. The final selection of control measures should ensure the compliance with the applicable sound level criteria of the provincial *Noise Assessment Criteria in Land Use Planning*.

Where vibrations are anticipated, the construction manager and / or contractor will:

- Retain an engineer specializing in vibration monitoring who must determine the zone surrounding the project site at which vibrations could reach 1.5 to 2.0 mm/sec and undertake a survey documenting the existing condition of structures within the zone of influence;
- Establish a vibration monitoring program before activity begins, including number of seismographs, location, frequency of monitoring and transmittal of results protocol;
- Conduct test measurements to develop site specific vibration attenuation curves to identify the significant vibration causing project activities; and
- Install sensors to monitor ground vibration during piling.

In these conditions, the construction manager and / or contractor must monitor areas identified by the engineer that are considered to be susceptible to vibration damage in order to avoid impacts (City of Toronto, 2007).

If generation of noise and vibration is anticipated and likely to affect the neighbourhood, efforts must be made to notify the potential residences and businesses that may be impacted at least one week in advance and to provide measures to minimize the effects.

7.5.6 Maintenance, Monitoring, and Documentation

The construction manager and / or contractor must ensure that all construction noise and vibration control measures as specified are maintained throughout the project. As appropriate, the construction manager and / or contractor is required to monitor vibration and noise to ensure that levels comply with the MOE sound level criteria for construction equipment and that disruption to residents and the community are kept at a minimum. Any noise complaint received from the public is to be investigated and, where required, mitigated by the construction manager and / or contractor. Construction managers and / or contractors must also keep a record of complaints and document actions taken to mitigate against future disturbances. WT must be notified of the complaints and may take further action, should noise complaints persist. If project-related activities result in damage to adjacent properties, the construction manager and / or contractor must notify WT and take the necessary steps to address the issue.

Persistent noise complaints may require the construction manager and / or contractor to modify the existing mitigation measures and employ alternative solutions. These measures are to be designed in consultation with a noise expert retained by the construction manager and / or contractor. The MOE Regional Office duty officer may be contacted (416-326-6700) to request input when persistent noise complaints occur even with noise controls in place. If noise levels for a project cannot be mitigated, a permit for an exemption from a noise prohibition or noise limitation provision with the City of Toronto (416-392-7539) may have to be obtained.

The construction manager and / or contractor must submit a Noise and Vibration Management Plan to WT prior to the commencement of any work on site. In addition (as part of each Quarterly Update Report), a summary of Noise and Vibration Management activities undertaken must be provided, along with any issues encountered and a description of mitigation measures implemented.

7.5.7 References

City of Toronto. Toronto Municipal Code: *Building Construction and Demolition, Chapter 363. Article 5 – Construction Vibrations*

City of Toronto. *Toronto Municipal Code: Noise, Chapter 591*

Ontario Ministry of the Environment, Conservation and Parks. *Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning (NPC-300).* August 2013.

7.6 Project-Related Waste Management

7.6.1 Environmental Concerns

During project-related activities, both hazardous and non-hazardous wastes may be generated. Improper handling and management of waste such as contaminated soils or lubricant wastes could lead to the contamination of soils, groundwater and watercourses as well as the attraction of nuisance vectors which could lead to health and safety risks.

7.6.2 Regulatory Framework

The management of wastes generated at construction and development projects is regulated in some form by the three levels of government (federal, provincial, and municipal).

7.6.2.1 Federal Regulations

Projects are to be implemented in a manner such that the management of waste is in compliance with Part 5 and 8 of the *CEPA* which provides for the regulation and release of toxic substances. This section of the *CEPA* also includes requirements for environmental emergency plans, regulations, and remedial actions for an uncontrolled, unplanned, or accidental release of a substance into the environment (Section 8).

7.6.2.2 Provincial Regulations

Part V, section 26 of the Ontario *EPA* prohibits the storage or disposal of wastes likely to create a nuisance. Section 86 of the Act prohibits the abandonment of any material in a place, manner, receptacle or wrapping such that it is reasonably likely that the material will become litter. Project activities are to ensure compliance with these sections of the Act. Part X of the Ontario EPA provides direction on the disposal of pollutants, which are also to be considered in waste management activities.

Regulations outlined in the MOE *Waste Diversion Act* and Ontario Regulations 102/94 and 103/94 pertain to the development and implementation of waste diversion and reduction plans. All projects of a size and type governed by the Act are to incorporate waste management protocols to reduce, reuse, and recycle waste.

Registration as a waste generator, as stipulated in the *EPA* (Ontario Regulation 347), may be required for a project should hazardous waste be generated during construction. A waste audit will be conducted for each project to determine whether a waste generator number is required as stipulated by MOE Waste Audits and Waste Reduction Work Plans, and Source Separation Programs (Ontario Regulation 102/94 and Ontario Regulation 103/94).

Should portable toilets be required on-site, the construction manager and / or contractor is to employ an MECP-licensed waste hauler to dispose of the waste. Disposal of waste will also be in accordance with the *OWRA* which regulates the discharge of polluting material and sewage.

Part 5 of the *Fire Protection and Prevention Act* and Ontario Fire Code (O.Reg. 213/07), which provides guidelines for storing, handling, and use of hazardous materials, should also be adhered to for all projects.

7.6.2.3 Municipal Requirements

Each project is to be conducted in accordance with the City of Toronto Solid Waste Management Services (416-338-2010) for the transfer and disposal of generated waste and the promotion of reducing, reusing and recycling non-hazardous material. This would be in accordance with the Toronto Municipal Code Part II, Chapter 548 which pertains to the littering and dumping of refuse and includes a list of recyclable materials and prohibited waste.

In addition, the Toronto Green Standard provides an integrated set of targets, principles, and practices to support sustainable development and site design. The standards are designed to work with the regular development approvals and inspections process. A completed Toronto Green Standard checklist is required as part of the planning approval process. With respect to this EPP, it ensures the reduction of waste going to landfill and reduces the demand for new materials. This standard has been integrated into this EPP.

7.6.3 Causative Activities and Conditions

Projects generate waste products through excavation of soil, maintenance of machinery and vehicles and routine construction and demolition activities. These wastes are composed of a variety of materials such as glass, wood and metal waste products. Waste generated from on-site personnel can include food and septic wastes which can attract nuisance vectors if not managed properly. Portable toilet waste is classified as “septage”, an untreated waste that can cause impacts to groundwater and aquatic life if released into the environment.

7.6.4 Application

Project-related **Waste Management Plans** must be developed by the construction manager and / or contractor, and include the management of general waste, hazardous waste, and non-hazardous waste. The Waste Management Plan must be in place prior to the initiation of any on-site works. Project waste management is to be maintained by the construction manager and / or contractor and monitored daily to ensure that waste for the project is handled and disposed of properly.

7.6.5 General Waste Design and Implementation

Waste management is to be carried out in a manner that maximizes the opportunity for the reduction, re-use and recycling of solid waste and, as appropriate, to ensure proper management and disposal of waste that cannot be diverted. Waste generated at project sites are to be managed through containment and regular removal in order to minimize impacts from litter and the attraction of vectors.

Portable toilet facilities are to be provided on sites where required by the City of Toronto and situated a minimum of 30 metres away from sensitive environmental features. These facilities are to be maintained and emptied by a commercial MOE-licensed waste contractor for the duration of project activities.

All on-site personnel are to have valid WHMIS training appropriate to their job description in order to raise awareness and knowledge for the proper safety and handling of waste materials.

Project-related Waste Management initiatives must also adhere to the requirements of the prevailing version of the Toronto Green Standard. Specifically, construction managers, and / or contractors are to ensure that all WT projects:

- Manage construction and demolition waste in accordance with O. Reg 103/94: Industrial, Commercial and Institutional Source Separation Programs
- Develop and implement a construction and demolition waste management plan, and
- Divert at least 75% of the total construction and demolition material from landfill. Diverted materials must include at least four material streams.

7.6.5.1 Hazardous Waste Design and Implementation

If hazardous waste is generated, construction managers and / or contractors must ensure that the waste is handled in a manner that protects workers and the environment.

Where required by the MECP, a Waste Generator Number must be obtained by WT, the development partner, or eligible recipient for hazardous wastes removed from the project site. Registration with the Resource Productivity and Recovery Authority (www.rpra.ca) is required. The wastes must be disposed of through an MECP-approved hazardous waste hauler and sent to a MECP-approved waste disposal site. While on-site, waste is to be stored in a secure container in an area that minimizes risks to the environment. The choice of containment location depends on the activity and materials involved. Proper waste storage and recognition that some wastes are incompatible with others is critical to avoiding violent, explosive reactions and/or the creation of toxic fumes. Personnel responsible for dealing with hazardous waste generated on-site must be properly trained in these duties. Storage of hazardous waste, or any other Subject Waste as defined under O. Reg. 347, for a period longer than 90 days is not permitted on WT's project sites without WT's written consent and requires submission of the appropriate notifications to MECP or on the Resource Productivity and Recovery Authority registry.

Potential environmental impacts resulting from waste generation include soil and groundwater contamination from spills or environmental accidents. In these cases, refer to the Spill Prevention and Contingency Plan (Section 8.1) when waste is being moved from or throughout the site.

7.6.5.2 Non-hazardous Waste Design and Implementation

On-site personnel should be encouraged to minimize the generation of non-hazardous waste through reduction, reuse, and recycling. Non-hazardous waste generated on-site is to be managed according to the following procedures:

- Provide appropriate waste storage containers;
- Provide separate containers for each category of waste (e.g., concrete, cardboard, drywall, steel and wood) for sorting purposes or based on their end-use (e.g., recyclable or green) in accordance with Ontario Regulation 103/94;
- Label containers and keep them in good condition, sealed, closed/covered at all times to prevent wildlife attraction, ensure safety and to comply with proper handling requirements;

- Transfer waste regularly from points of waste generation to central consolidation or transfer points;
- Store waste until quantities are adequate to be transported for recycling, treatment and disposal as per municipal regulations;
- Transport waste according to provincial and municipal requirements;
- Dispose of excess construction material and debris in accordance with the project site requirements;
- Place waste to be transported from the site into containers with proper labelling to ensure safety and prevent loss of materials in surrounding environments;
- Equip waste transport vehicles with spill response kits and train drivers in proper procedures in the event of a spill; and
- Reuse/recycle materials from structures slated for decommissioning or demolition, where possible.

7.6.6 Maintenance, Monitoring, and Documentation

The construction manager and / or contractor is to conduct an audit of construction waste generated and address the extent to which materials or products used consist of recycled or reused materials (Ontario Regulation 102/94). Based on the results of the audit, the construction manager and / or contractor is to develop and implement a Waste Reduction Work Plan to reduce, reuse and recycle waste generated during a project and will include measures for communicating the plan to on-site workers.

The construction manager and / or contractor must submit a Project-Related Waste Management Plan and a Waste Reduction Work Plan (with the aim of reducing and recycling as much of the waste generated during the project as possible) to WT prior to the commencement of any on-site work. The Plan must also record quantities, material type and final destination of all waste, recyclable and reusable materials managed off site.

In addition (as part of each Quarterly Update Report), the construction manager and / or contractor must submit documentation on the daily maintenance and monitoring of project waste management including the following:

- Identification of materials that will be diverted and/or stored on-site or commingled.
- A table of the construction and demolition debris, including a general description of each category of waste generated, the quantity in tons or cubic yards, and the location of receiving agent (recycler / landfill) for waste.
- A calculation showing the total percentage of material diverted from landfill disposal.
- Relevant backup documentation.

Documentation must also be provided on the volume and percentage of recycled content used in asphalt pavement, granular bases, and granular sub-bases.

7.6.7 References

City of Toronto. 2010. *The Toronto Green Standard.*

Government of Canada. 1992. *Hazardous Waste Management: Canadian Directions.* *http://dsp-psd.tpsgc.gc.ca/Collection-R/LoPBdP/BP/bp323-e.htm#C.%20Storage(txt)*

Ontario Ministry of the Environment, Conservation and Parks. *Strategy for a Waste-Free Ontario: Building the Circular Economy.* February 2017.

7.7 Stormwater / Surface Water Management

7.7.1 Environmental Concerns

Stormwater and surface water affected by construction activities can cause environmental impacts during project-related activities. These include general runoff with erosion and the formation of ruts or puddles on-site than can contain sediment-laden water. This can also create excessive mud to build up on tires, which can then be transported onto local roads and dispersed into the environment with stormwater or as dust. Improper management of stormwater and surface water is a pathway for potentially contaminated soil and/or groundwater to move off site and into the environment.

Vehicle and equipment cleaning procedures and practices are typically used to minimize or eliminate the discharge of pollutants from vehicle and equipment cleaning operations to storm drain systems or watercourses. On-site vehicle and equipment washing is discouraged to minimize water usage and runoff effects; however, when necessary to control the migration of contaminants from the site, capture and management of wash water will be required. Where necessary, these activities must be conducted at dedicated vehicle washing sites where wash water can be collected and controlled.

Impacts to surface water could also be a primary concern if activities associated with a project required in-water works. All works within water must mitigate impacts to the surface water and lakebed and prevent spills/the spread of spills in the surface water.

7.7.2 Regulatory Framework

Project-related stormwater and surface water is to be managed in a manner that does not adversely affect fish habitat and considers associated requirements of the federal *Fisheries Act*.

All works are to comply with the *EPA* (Part V) and the *OWRA* (section 29), which are intended to protect and manage the quality and quantity of surface water and groundwater.

A MOE C of A for Industrial Sewage Wastewater Discharge may be required as stipulated by the *OWRA* (sections 33 and 53) to regulate effluent discharge directly to surface water bodies during construction and other project-related works.

The requirements laid out in the City of Toronto Municipal Code on Sewers (Chapter 681-4) are to be followed with respect to the discharge or deposit of matter of any type into a storm sewer, watercourse, and municipal or private sewer connection to any storm sewer.

In addition, the Toronto Green Standard provides an integrated set of targets, principles, and practices to support sustainable development and site design. The standards are designed to work with the regular development approvals and inspections process. A completed Toronto Green Standard checklist is required as part of the planning approval process. With respect to this EPP, it ensures the protection of water quality during construction and demolition through adherence to the Greater Golden Horseshoe Authorities' onsite erosion and sediment control guidelines and the implementation of an erosion and sediment control plan. An Erosion and Sediment Control EPP for Waterfront Toronto projects can be found in Section 7.4.

7.7.2.1 Aquatic Habitat Toronto

Waterfront Toronto is a founding member of Aquatic Habitat Toronto (AHT). AHT is a consensus-based partnership between agencies with a vested interest in the improvement of aquatic habitat on Toronto's waterfront. AHT uses an integrated resource planning approach to achieve a cumulative net gain in aquatic habitat.

Waterfront Toronto projects should meet with AHT early in the concept through design stages on all activities that may affect aquatic habitat, including any project involving in-water works. AHT coordinates all approvals such as federal fisheries and navigable water authorizations. AHT also helps projects direct and design suitable aquatic habitat in appropriate locations where there are potential project-related impacts.

7.7.3 Causative Activities and Conditions

Surface water and stormwater that can be of concern during construction projects include melting of snow and pooling/seepage of water either from storm events or from excavated pits that are below the water table. If the volume of collected water exceeds the capacity of the on- site management features, overflows and runoff leaving the site could result in environmental impacts to adjacent properties.

Activities resulting from in-water works have the potential for altering surface water conditions, impacting the lakebed and introducing contaminants as a result of spills and generation of debris.

7.7.4 Application

Where potential impacts may occur to areas adjacent to a project site, stormwater and surface water management measures must be applied on-site prior to the start of any works. These measures must be maintained and modified as necessary throughout all phases of the project to address changing conditions.

7.7.5 Design and Implementation Considerations

In addition to the mitigation measures discussed in the Erosion and Sediment Control EPP (Section 7.4), temporary stormwater works described in a project-specific Environmental Compliance Approval must also be implemented, where applicable. To control the quality and quantity of runoff while project-related activities are taking place, the following measures are to be implemented:

- Install silt fences, blankets, and berms around construction areas, including the laydown area, and across sloping terrain/areas to prevent surface runoff from carrying sediment off- site and into any sewer;
- Install sub-drains/catch basins in areas of excavations/trenches or areas sensitive to erosion in order to trap runoff;
- Trap sediment using silt traps once sub-drains/catch basins have been installed;
- Design and size ditches and stormwater management ponds appropriately to remove sediment before the water is discharged from the site; and

- Discourage the on-site washing of equipment and vehicles. Where necessary to control the migration of contaminated soil, an area for the washing of vehicles, including containment and treatment of wash water, is to be designated and located away from sensitive receivers.

For in-water works, the following measures are to be implemented, based on EC's guidance document[2] for work in and around water:

- All work involving the use of concrete, cement, mortars and other Portland cement or lime-containing construction materials shall be conducted so as to ensure that sediments, debris, concrete, and concrete fines are not deposited, either directly or indirectly into the aquatic environment. Any water contacting uncured or partly cured concrete or Portland cement or lime-containing construction materials, such as the water that may be used for exposed aggregate wash-off, wet curing, equipment and truck washing, etc. shall be prevented from entering, directly or indirectly, to the aquatic environment unless this water has been tested and found to have a pH of between 6.5 and 9.0 and a turbidity of less than 25 NTU. Containment facilities shall be provided at the site for wash-down water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment as required;
- Sediment or sediment laden waters or other deleterious substances shall not be allowed to enter the aquatic environment during the proposed work. Work should be conducted in accordance with best management practices, for example the sediment and erosion provisions of the *Land Development Guidelines for the Protection of Aquatic Habitat* (Fisheries and Oceans Canada, 1993);
- An appropriate spill prevention, containment, and clean up contingency plan for hydrocarbon products (e.g. fuel, oil, hydraulic fluid, etc.), and other deleterious substances shall be put in place prior to work commencing, and appropriate spill containment and cleanup supplies shall be kept available on-site whenever the works are occurring. Further, all personnel working on the project should be familiar with implementing the spill clean-up plan and the deployment of spill response materials, as indicated in Section 8;
- If land-based equipment or machinery is used to conduct the proposed works, the equipment/machinery should operate upland of the proposed works. Impacts outside the footprint of the proposed works must be prevented;
- All machinery used on-site should be in good repair and free of excess oil and grease. Any fueling or maintenance of such equipment should occur on the upland well away from the foreshore;
- If steel piles are to be used, they must be capped to prevent the entry of wildlife;
- All demolition materials are to be disposed of upland in an authorized manner. Whenever possible, recycling of materials is encouraged; and

[2] Environment Canada – Pacific and Yukon. 2008. *Interim Guidance for Addressing Water Quality for Work In and Around Water*

- Only clean, uncontaminated material, as approved by TRCA may be used as fill.

7.7.6 Maintenance, Monitoring, and Documentation

A thorough check of the measures to manage stormwater and surface water must be conducted by the construction manager and / or contractor on a daily basis, especially before and after a forecast storm/rain event. The construction manager and / or contractor must be aware of upcoming weather conditions and modify/implement appropriate measures in order to prevent off-site migration of sediment or contaminated water. Any deficiencies in the mitigation measures must be addressed and/or repaired immediately. It is best to inspect the stormwater and surface water mitigation measures within 24 hours of a rain event. Inspection should include information relating to:

- The hydraulic operation of the facility (detention time, evidence or occurrence of overflows);
- Obstructions at the inlet and outlet and removal of objects;
- Verification that dumpsters, paints and chemicals are covered;
- Evidence of spills and oil/grease contamination; and
- Trash build-up.

Should any evidence of spills, contamination or trash build-up be identified, the construction manager and / or contractor must address the source of the issue and remediate or remove the contamination or trash.

The construction manager and / or contractor must submit a Stormwater and Surface Water Management Plan to WT prior to the commencement of any work on site. In addition (as part of each Quarterly Update Report), a summary of stormwater and surface water management measures implemented must be provided, along with any issues that are encountered, and mitigation measures implemented. In addition, the construction manager and / or contractor must submit changes/modifications to the Stormwater and Surface Water Management Plan as they occur (as necessary throughout all phases of the project to address changing conditions).

7.7.7 References

Environment Canada – Pacific and Yukon. 2008. *Interim Guidance for Addressing Water Quality for Work in and around Water*

Center for Environmental Excellence by AASHTO. 2008. *Chapter 4: Construction Practices for Environmental Stewardship - Section 4.6: Vehicle Fluid, Fuel and Washwater Control*

City of Toronto. 2010. *The Toronto Green Standard.*

Canada Green Building Council. 2010. *LEED® Canada for New Construction 2009*

U.S. Environmental Protection Agency. 2006. *Construction Site Operator BMP Inspection and Maintenance*

Ontario Ministry of the Environment. 2003. *Stormwater Management Planning and Design Manual*

7.8 Traffic Management

7.8.1 Environmental Concerns

Traffic to and from project sites include a variety of vehicles and equipment that have the potential for causing environmental impacts including traffic delays/congestion, detours, damage to roads from heavy/tracked equipment, and an increase in dust, exhaust emissions and noise.

7.8.2 Regulatory Framework

All motor vehicles used for project activities are to be in compliance with the Ontario *EPA*, Part III, section 23 which regulates motor and motor vehicle operations.

Project-related works represent significant changes to the local environment. As such, site plan control review and approval (*Planning Act*) may require that a Traffic Operations Assessment be submitted to the City of Toronto and that an approved **Traffic Protection Plan** be obtained from the City.

Zoning amendments, occupancy permits, heavy haul traffic arrangements, and other parking by-laws and ordinances are to be considered, in accordance with the *Toronto Municipal Code, Part II and III Traffic and Parking By-laws*. Available resources from the Ontario Provincial Police, Toronto Police Service and/or the Ontario Ministry of Transportation may be used for project-related activities. The need for these resources is to be identified in the Traffic Protection Plan.

7.8.3 Causative Activities and Conditions

Project-related traffic volumes can vary and may cause disruptions to nearby residences and businesses. This can include disruptions from heavy trucks, construction equipment, employee parking and traffic delays as well as from congestion, detours, damage to roads, or an increase in dust, exhaust emissions and noise.

7.8.4 Application

Traffic management measures will be evaluated before a project begins and implemented throughout a project. All personnel associated with the project must be aware of the traffic management issues and are to conduct project-related activities in accordance with the approved Traffic Protection Plan, where applicable. Continual updates and modifications in traffic management are to be performed based on the effectiveness in minimizing traffic-related disruptions. Air Quality and Dust Management (Section 7.1) and Noise and Vibration Management (Section 7.8) EPPs are to be consulted in the preparation of project specifications to ensure implementation of appropriate mitigation measures.

7.8.5 Design and Implementation Considerations

Construction activities are to be staged to minimize and avoid (where possible) traffic delays and related effects to local residents, business owners and facility owners/users, as well as motorists, cyclists and pedestrians traveling through the area. The prevailing site conditions, including an overview of existing traffic conditions adjacent to the site with respect to traffic

volumes, lane markings, on-street parking, and pedestrian/cycle routes, are to be documented in order to develop a traffic management strategy.

Traffic management planning is to consider the following:

- Maximum number and tonnage of construction vehicles arriving and departing the site at any one time (hourly or daily rate in peak);
- Vehicle entry and exit points considering the evolving stages of construction;
- Routes between the site and major arterial roads for construction vehicles that minimize use of residential streets;
- Queuing locations for arriving vehicles if not solely on-site (engines are to be switched off when using these queuing locations);
- Work zones for any area of public land to be occupied including plans of the affected area and the duration of occupation;
- Information concerning oversized vehicles including their location and duration of stay, is to be provided to the proper authorities (municipal authorities, Toronto Police Service, local OPP office, fire and emergency services) (all oversize vehicles must obtain permits from the City of Toronto, Ontario Provincial Police, Toronto Police 72 hours prior to arrival at the site);
- Arrival times for construction vehicles (arrival of construction vehicles other than oversize vehicles must not take place prior to 6:30 in the morning in residential areas);
- Method of loading and unloading of construction vehicles; and
- Routes to be used by construction personnel including suitable and sufficient parking facilities on or near the construction site.

7.8.6 Maintenance, Monitoring, and Documentation

Construction managers and / or contractors must ensure the effectiveness of traffic management for the project and take the necessary steps to implement or improve measures that minimize disruption to local residents and businesses. These may include:

- Providing authorities with any updates or changes to planned traffic events and obtain permits as required (including closures, duration, detours and alternative routes);
- Providing prior notice to residents of potential traffic impacts through the use of an appropriate medium (newspaper, mail drop, local media announcement, etc.), where necessary;
- Providing on-site traffic signage and traffic conductors (automated or flag-person) for heavy haul traffic with the use of traffic lights, where practical;
- Maintaining access for emergency vehicles and school buses at all times on designated routes;
- Providing temporary access for residents at all times during the length of construction, where necessary; and
- Installing adequate night-time accident-prevention measures (lights, flashers, road markings etc.) throughout the construction period.

Construction managers and / or contractors must ensure that all roads used by construction-related traffic are free of debris and that dirt and dust is kept to an acceptable level. Regular road sweeping and cleaning are to be implemented at a frequency that effectively maintains the off-site roads in a condition that would not result in dust generation, sediment transport or nuisance effects in the community.

The Air Quality and Dust Management (Section 7.1) and Noise and Vibration Management (Section 7.8) EPPs provide guidelines for ensuring effective transportation management for the project.

Any traffic/parking complaints received from the public are to be addressed in accordance with **complaint filing and management procedures** developed by the construction manager and / or contractor.

The construction manager and / or contractor must submit a Traffic Management Plan including but not limited to complaint filing and management procedures to WT prior to the commencement of any work on site. In addition (as part of each Quarterly Update Report), a summary of all traffic management measures used to minimize disruption to local residents and businesses must be provided, along with a summary of all traffic/parking complaints including mitigation measures undertaken.

7.8.7 References

City of Toronto. Traffic Control Policy. https://www.toronto.ca/city-government/accountability-operations-customer-service/city-administration/corporate-policies/people-equity-policies/traffic-control/

7.9 Vegetation Management

7.9.1 Environmental Concerns

General construction activities give rise to a number of environmental concerns that can be addressed through management of vegetation at the site, including:

- Protection of existing vegetation;
- General weed prevention and invasive species control;
- Control of vegetative debris; and
- Minimizing erosion and disturbance of soils.

Vegetation management is to be considered at the planning and design stage of a project to ensure that intermittent stream channels, shorelines and drainage swales are kept in a free-to-grow, low-maintenance condition and that the potential for invasive plants to become established from construction activities is minimized as much as possible. LEED® NC, Sustainable Sites Credit 5.1 (Site Development: Protect or Restore Habitat) provides direction on achieving conservation of existing natural areas and restoration of damaged areas.

7.9.2 Regulatory Requirements

Management of vegetation is to be carried out in a manner that does not adversely affect fish habitat and considers associated requirements of the federal *Fisheries Act*.

The requirements outlined in the *Migratory Birds Conservation Act* stipulates that any removal of vegetation should be carried out at the appropriate time of year to protect migratory birds. All projects must adhere to this Act.

With respect to vegetative debris, Part V, section 26 of the *EPA* prohibits the storage or disposal of wastes that are likely to create a nuisance. Section 86 of the Act prohibits the abandonment of any material that may become litter. Part X of the *EPA* provides direction on the disposal of pollutants and is to be followed. Project activities which generate vegetative debris are to ensure compliance with these sections of the EPA.

Should a project require weed control with compliance stipulated under the *Weed Control Act* and require the use of pesticides, the Ontario *Pesticide Act* (O. Reg. 63/09) as well as the Toronto Municipal Code Chapter 612 are to be considered. In all other circumstances, the application of pesticides is not permitted.

A Natural Heritage Impact Study may be required as part of the planning approvals process for projects in or near natural heritage systems as identified on Map 9 of the Official Plan or areas defined as municipal Environmentally Significant Areas. A Natural Heritage Impact Study is required for any undertaking within a designated Environmentally Sensitive Area under Official Plan Policy 3.4.13.

A permit may be required under the Ravine and Natural Feature Protection by-law (Toronto Municipal Code Chapter 658), which regulates activities that may injure or destroy a tree or alter the grade of the land.

The Toronto Municipal Code Chapter 813, Article III is commonly referred to as the City's "Private Tree By-law". This by-law regulates injury or removal of privately owned trees which measure 30 cm in diameter or more as measured at 1.4 m above ground level. All construction activities are to adhere to the regulations outlined in this by-law to ensure protected trees are not damaged or harmed.

In addition, the Toronto Green Standard provides an integrated set of targets, principles, and practices to support sustainable development and site design. The standards are designed to work with the regular development approvals and inspections process. A completed Toronto Green Standard checklist is required as part of the planning approval process. With respect to this EPP, the Toronto Green Standard provides policies and guidance for ensuring the protection of urban trees and should be referred to if a Tree Protection Plan is required.

All trees situated on City streets are protected under Article II, Chapter 813 of the City of Toronto Municipal Code and trees located on private property that have a diameter of 30 cm or more are protected under Article III, Chapter 813 of the City of Toronto Municipal Code. Should there be any trees on site that are protected under the City of Toronto Municipal Code, a tree care professional should be consulted prior to the commencement of any construction activity to determine the type and condition of the trees on the property and surrounding properties. Anyone failing to adhere to the tree protection policies and specifications will be financially responsible for any resulting damage to trees and may be charged under the provisions of the applicable City of Toronto tree by-law.

7.9.3 Causative Activities and Conditions

Project-related activities such as excavation, grading and movement of heavy equipment and vehicles can damage trees, wetlands and riparian areas.

If clearing and grubbing activities are required for a project, vegetative debris including brush, trees, and stumps will be generated.

Significant environmental damage can also result through the invasion of fugitive and exotic plants that could potentially compete with, or otherwise disrupt, native/adapted plant habitats when these habitats are disturbed through project-related activities.

7.9.4 Application

The need for vegetation management is to be evaluated by the construction manager and / or contractor in consultation with WT and technical experts prior to the start of a project. Where project conditions warrant it, a **Vegetation Management Plan** that may include such components as a **Tree Protection Plan** or an **Integrated Pesticide Management Pan**, will be developed by an ecological specialist retained by the construction manager and / or contractor. The construction manager and / or contractor must implement identified measures during the project to manage vegetation appropriately. The Vegetation Management Plan can be modified as necessary to mitigate against adverse impacts from project-related activities.

7.9.5 Design and Implementation Considerations

The level of vegetation management planning required is based on the site location and surrounding area. The evaluation, which must be conducted at the design stage and may require the involvement of an ecological specialist, should include:

- An inventory (to "vegetation type" level) of the vegetation on the project site, described in accordance with the Ecological Land Classification System, including a species list;
- Identification of existing tree and other vegetation protection measures;
- Preparation of a Tree Protection Plan by a qualified arborist or approved tree professional retained by the construction manager and / or contractor working in consultation with City of Toronto Urban Forestry Services where required by City of Toronto by-laws. Each construction project will have its own unique requirements for tree protection depending on the type and size of trees located at or near the site;
- The Toronto Green Standard requires that trees 30 cm or more DBH (diameter at breast height) are retained in accordance with the City of Toronto Private Tree Protection Bylaw. Where applicable, trees of all diameters adjacent to City of Toronto streets and roadways and City-owned Parkland must be retained and protected in accordance with the Trees on City Streets and Parkland Bylaws;
- Identification of areas of the site that are to be maintained or returned to a natural self-sustaining vegetated state as well as those that are to be converted to a non-vegetated surface, i.e., buildings, roads, parking areas, lined ponds. The Toronto Green Standard requires the retention and reuse of all uncontaminated on-site soil in areas not covered by the building, parking footprint or hard surfaces. Where this cannot be achieved, the soil should be replaced with soil of equal or better quality to encourage revegetation and minimize future erosion potential;
- Proposed treatment and buffers from development for areas where site alteration is prohibited and for intermittent stream channels and treatment of drainage swales that results in free-to-grow, low-maintenance management;
- Temporary designated storage locations for vegetative debris and mitigation of impacts to watercourses and soil erosion; and
- Preparation of an Integrated Pesticide Management Plan (IPM) in accordance with Landscape Ontario IPM practice requirements, as warranted by site conditions. The IPM may include watering regimens, biocide and fertilizer applications and controls/restrictions, including targets for reducing water, biocide and fertilizer use.

For general weed prevention practices and invasive species control, the construction manager and / or contractor is to ensure that:

- Seeds and straw material are certified as weed-free; and
- Areas of noxious weeds are identified and treated, as determined by an ecological specialist prior to the start of project-related activities.

If projects are located near extremely sensitive or protected areas, added prevention practices, such as equipment inspections and cleaning may be required.

7.9.6 Maintenance, Monitoring, and Documentation

Tree protection barriers and zones are to remain until all site activities, including landscaping, are complete. Construction managers and / or contractors are to inspect all tree protection barriers and zones daily and ensure that they are properly maintained (i.e., upright, no rips or holes, etc.). The arborist retained by the construction manager and / or contractor will provide written notice to the City of Toronto Urban Forestry Services prior to the removal of the tree protection barriers.

Any roots or branches extending beyond the tree protection zones are to be pruned by a qualified arborist or other tree professional as approved by the City of Toronto Urban Forestry Services. Pruning of tree roots and branches will be in accordance with good arboricultural standards. The arborist or tree professional will contact Urban Forestry Services no less than 48 hours prior to conducting any work.

Construction managers and / or contractors are to ensure that vegetation debris is properly managed. This includes storing all vegetative debris in designated areas, ensuring that vegetative debris is covered, and transporting vegetative debris off site in trucks with covers or caps to contain the debris. Transport of vegetative debris to an appropriate disposal location is determined by the construction manager and / or contractor.

Due to the rapid spread of invasive plants in areas of disturbed soil, soil disturbance and vegetative removal should be minimized. Vehicles that have entered weed-infested areas are to be cleaned and inspected before entering into non-infested areas.

As soon as possible following construction, the construction manager and / or contractor will re-vegetate or otherwise prevent the establishment of weeds in applicable areas of the project site. Re-vegetation must use plant types that have a high likelihood of survival and are native to the area.

The construction manager and / or contractor must submit a Vegetation Management Plan (if applicable) to Waterfront Toronto prior to the commencement of any work on site. In addition (as part of each Quarterly Update Report), a summary of Vegetation Management activities undertaken must be provided, along with any issues encountered and mitigation measures implemented.

7.9.7 References

Center for Environmental Excellence by AASHTO. 2008. *Chapter 4: Construction Practices for Environmental Stewardship - Section 4.10: Vegetation Management in Construction*

City of Toronto. 2010. *The Toronto Green Standard.*

City of Toronto Urban Forestry Services. 2016. *Tree Protection Policy and Specifications for Construction Near Trees.*

7.10 Wildlife Management

7.10.1 Environmental Concerns

The DWA includes areas that have both aquatic and terrestrial wildlife habitats. Project-related activities that are conducted near these habitats may impact both the habitats and associated wildlife species. The incorporation of wildlife management protocols in project-related activities can protect wildlife species and their habitat.

7.10.2 Regulatory Requirements

7.10.2.1 Federal Regulations

The *Canada Wildlife Act* provides for the protection of marine areas and wildlife in danger of extinction and also prescribes measures for the conservation of wildlife. The *Species at Risk Act* is a key federal government commitment to prevent wildlife species from becoming extinct and secure the necessary actions for their recovery. It provides for the legal protection of wildlife species and the conservation of their biological diversity. Activities associated with WT projects are to be in compliance with these Acts.

To ensure that WT projects do not result in harmful alteration, disruption or destruction (HADD) of nearby sensitive watercourses, compliance with sections 35 to 43 of the *Fisheries Act* is required. This requirement will apply to proposed projects or work near water and fish habitat.

The *Migratory Birds Convention Act* provides conventions for protecting and conserving migratory birds and their nests. It is enforced by Environment Canada (Canadian Wildlife Service) and must be followed if project-related activities can potentially impact or disrupt migratory birds and their nests.

7.10.2.2 Provincial Regulations

Ontario Regulation 166/06 of the *Conservation Authorities Act* requires a permit from the Toronto and Region Conservation Authority (TRCA) for development and interference with wetlands and alterations to shorelines and watercourses.

As well, all project activities must adhere to the *Ontario Endangered Species Act*, which provides for the protection of species at risk and their habitat.

7.10.3 Causative Activities and Conditions

Construction activities such as tree and vegetation removal, excavation, and movement of heavy equipment and vehicles have the potential to impact, disrupt, and potentially harm aquatic and terrestrial wildlife and their habitats. Some terrestrial wildlife can also pose a threat to human safety. Generally, however, wildlife will not bother humans unless they are surprised or threatened.

7.10.4 Application

At the project planning stages, WT, the developer partner, or eligible recipient must consider the need for a **Wildlife Management Plan** depending on the proximity to wildlife habitats or the potential for encountering and/or impacting wildlife species. Wildlife experts and biologists may need to be consulted in areas where a project will encroach upon sensitive and/or protected wetlands, vegetated valleys, and water bodies. Where project conditions warrant the preparation of such a plan, a wildlife consultant retained by the construction manager and / or contractor is to prepare the plan in consultation with the TRCA. This consultation will also identify any permitting required by the project, particularly in relation to alterations to aquatic and terrestrial habitats. The plan is to be included in the project specifications, which will be implemented by the construction manager and / or contractor.

Measures for the management and protection of wildlife including reduction of mortalities associated with vehicle collisions, wildlife habitat fragmentation, impacts to amphibians/aquatic habitats, and exclusion periods during construction are to be addressed in the Wildlife Management Plan.

Projects must minimize disruption to wildlife habitats as much as possible. All necessary precautions are to be taken by project personnel to avoid creating situations that attract wildlife.

7.10.5 Design and Implementation Considerations

The Wildlife Management Plan will be prepared through field assessments by the ecological consultant to confirm the presence of sensitive species and their habitats. The plan will identify wildlife mitigation activities and strategies including:

- Field assessments to confirm that impacts of the specific design features and construction methods proposed in the project specifications do not exceed those assumed in the Environmental Assessment or other applicable environmental guiding document for the project;
- The identification of construction mitigation measures (general and site specific) including timing restrictions, wildlife salvage, prevention of barriers to wildlife movement, and buffer retention;
- Specific mitigation measures identified through consultation with the Aquatic Habitat Toronto working group; and
- The inclusion of wildlife enhancement considerations in site rehabilitation and restoration planning.

Wildlife protection measures are to address the specific types of terrestrial and aquatic species and communities that are identified to occur in the habitat areas and that could be affected by the proposed works. For projects that may impact wildlife, a wildlife specialist will provide monitoring during key animal activity periods and/or where wildlife may impact or be impacted by construction activities.

Noise and vibration mitigation measures, as outlined in the EPP in Section 7.8, should be consulted in order to minimize effect on wildlife and their habitats.

7.10.6 Maintenance, Monitoring, and Documentation

Aquatic Wildlife

General procedures for the maintenance and monitoring of the aquatic environment will:

- Consider and incorporate (where applicable) the recommendations made for protection of the aquatic environment in an Environmental Assessment that may have been conducted for the project;
- Minimize disturbance to all wetlands when activities are carried out through or adjacent to these areas;
- Where possible conduct activities in the vicinity of aquatic habitats during winter months to reduce impacts to the aquatic environment;
- Fence the entire construction site and install silt fencing along all protected aquatic wildlife habitats and water bodies within 30 m of the construction site;
- Organic and mineral soils that are excavated from wetlands may be used as berms to isolate the construction area from the adjacent wetland or aquatic wildlife habitat; and
- When monitoring of watercourses in the vicinity of the project suggest that the aquatic environment may be affected by the work, (e.g., transport of sediment), implement mitigation measures to address the concern.

Where avoidance of construction activities in or near wetlands or water bodies is not possible, the construction manager and / or contractor is to implement habitat enhancements as identified by the wildlife expert. These enhancements may include rip rap and vegetation plantings to provide a greater in-water habitat diversity and improve riparian vegetation.

Terrestrial Wildlife

General procedures for the maintenance and monitoring of terrestrial wildlife are to include:

- A survey of the construction site to identify terrestrial wildlife, nesting birds, amphibians using vernal pools, reptile nest activity, and movement between habitat areas as well as general mammal movement;
- Appropriate actions must be taken should sensitive species be identified;
- Clear vegetation during winter to reduce impacts to species that use the areas as corridors and nest sites (where possible);
- Fence construction areas to prevent wildlife access; and
- Avoid unnecessarily removing or destroying terrestrial wildlife habitat.

All construction personnel must report wildlife observations that may impact or be impacted by project-related activities to the wildlife consultant. Should terrestrial wildlife be encountered on the project site, personnel are to move a safe distance away from the animal and wait for the animal to move off the project site. Should an animal persist on-site, an appropriate response plan is to be developed by the wildlife consultant in consultation with the construction manager and / or contractor, TRCA and Ontario MNR.

The construction manager and / or contractor must submit a Wildlife Management Plan (if applicable) to Waterfront Toronto prior to the commencement of any work on site. In addition (as part of each Quarterly Update Report), a summary of Wildlife Management activities undertaken must be provided, along with issues encountered and mitigation measures implemented.

7.10.7 References

Species at Risk Public Registry. 2011. *http://www.sararegistry.gc.ca/default_e.cfm*

Department of Fisheries and Oceans. Projects Near Water. *https://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html*

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8.0 CONTINGENCY AND EMERGENCY RESPONSE PLANS

EPPs are intended to address normal operations at project sites. Regardless of planning and precautions implemented to avoid upset conditions, unexpected events may still occur. Contingency plans for spill control and emergency response plans for unexpected situations provide the means to mitigate or otherwise manage environmental consequences that may result.

Typically, construction managers and / or contractors maintain corporate spill prevention and contingency plans and emergency response plans tailored to the nature of the work being undertaken.

All construction managers and / or contractors working in the DWA are required to develop and implement a **Spill Prevention and Contingency Plan** and an **Emergency Response Plan** that consider the project-related activities being undertaken as part of their contract.

8.1 Spill Prevention and Contingency Plan

A Spill Prevention and Contingency Plan provides on-site personnel with information relating to the prevention of spill events involving liquid chemicals or fuels and response procedures should a spill occur. Appropriately trained personnel can react to spills in a proactive manner so that adverse impacts from such releases are reduced. The Plan may be incorporated into a construction manager and / or contractor's health, safety and environmental manual that is prepared for the contract.

Spill Prevention and Contingency Plans are to include:

Spill Prevention

- Identification of type and location of fuels or chemicals that are to be stored and used during project-related activities;
- Requirement for all containers to be identified according to the WHMIS standard;
- Proactive methods and procedures for material storage and use to prevent spills, including containment, fueling inspections and training;
- Requirement for the maintenance of spill response materials (shovels, absorbents, etc.) in a designated area on-site;
- A monitoring program to document condition of materials and compliance with use and storage standards; and
- Provision for employee training on the storage and use of materials and prevention of spills.

Spill Response

- Spill response procedures for each material that may be spilled with appropriate responses for the potential risk associated with a release;
- Provision for the appropriate delegation of responsibility to specific on-site staff;
- Provision for the assessment of reportable spills;

- Requirements for internal (e.g., WT, contractor management) and external (e.g., MOE Spills Action Centre, Toronto Public Health and City of Toronto Works and Emergency Services) reporting, including follow-up reporting after the response;
- Information on emergency services contacts for spill response;
- Requirements for documentation of the spill and response through photographs of the spill incident; and
- Requirements for the documentation of remediation of the spill area and disposal of spill clean-up materials in accordance with Ontario Regulation 347 under the *EPA*.

8.2 Emergency Response Plan

An Emergency Response Plan describes, in detail, a construction manager and / or contractor's policy and procedures for handling and responding to an emergency situation on-site. These policies and procedures must define how the construction manager and / or contractor will protect people and property at the site during an emergency. For the purposes of projects in the DWA, the emergency response plan should be compatible with the City of Toronto's emergency response plan.

As part of an Emergency Response Plan, these measures must include:

- Preparations for reasonably anticipated emergencies (i.e., storms) that provide for the protection of the site and surrounding area from the anticipated emergency;
- Communication protocol in the event of emergencies (i.e., fire, flood, storms, power outages, explosions, etc.);
- Identification of emergency muster stations and the types of materials and documentation that will be maintained at the muster stations (e.g., emergency contacts, first aid kit, site map, evacuation location, fire extinguisher, MSDSs, spill kit and an air horn); and
- Emergency contact information, including fire, medical, security, and evacuation.

APPENDIX A

Applicable Regulatory Requirements

(**Note:** Changes in the regulatory environment may occur at any time. Construction managers and / or contractors are responsible for confirming that the cited regulations are current)

Legend: Acronyms			
CCME	Canadian Council of Ministers of the Environment	**EAA**	Environmental Assessment Act
CEAA	Canadian Environmental Assessment Act	**HADD**	Harmful alternation, disruption, or destruction
CEPA	Canadian Environmental Protection Act	**MECP**	Ontario Ministry of the Environment, Conservation and Parks
CEQG	Canadian Environmental Quality Guidelines	**MOLITSD**	Ontario Ministry of Labour, Immigration, Training and Skills Development
CSA	Canadian Standards Association	**OWRA**	Ontario Water Resources Act
DFO	Department of Fisheries and Oceans Canada	**SARA**	Species At Risk Act
EC	Environment Canada	**TSSA**	Technical Standards and Safety Authority
EC (CWS)	Environment Canada (Canadian Wildlife Service)	**TRCA**	Toronto and Region Conservation Authority

Regulatory Component	Agency or Administrator[1]	Part and/or Section	Regulated Activity/Element	Applicable Project Components
Federal Jurisdiction				
Fisheries Act (R.S. 1985, c. F-14).	DFO	s. 35 to 43	Address fish habitat protection and pollution prevention and are intended to ensure activities do not result in harmful alteration, disruption, or destruction (HADD) of fish habitat (i.e., Don River, Lake Ontario). The *Act* prohibits the deposit (by discharge, spraying, releasing, dumping, leaking, or otherwise) of deleterious substances into waters frequented by fish, including lakes and rivers and including storm drains that may lead to such waters. Facilities and activities regulated under this *Act* are required to conduct environmental effects monitoring as part of a program to assess effectiveness of their activities in terms of legislative and regulatory compliance. Section 37 requires that a proponent receive approval from the Minister or designated person before proceeding with any activity that may result in the HADD of fish habitat or the deposit of any deleterious substance in fish habitat.	Contaminated Soils Management; Erosion and Sediment Control; Fuels and Lubricants Management; Groundwater Management; Stormwater/Surface Water Management; Vegetation Management; Wildlife Management
Canadian Environmental Protection Act (1999, c. 33)	EC	Part 5	CEPA governs pollution prevention and the protection of the environment and human health in order to contribute to sustainable development. Part 5 pertains to controlling toxic substances and provides for the regulation and release of toxic substances.	Contaminated Soils Management; Fuels and Lubricants Management; Groundwater Management; Project-Related Waste Management
		Part 8	Part 8 pertains to environmental matters associated with emergencies and provides requirements for environmental emergency plans, regulations and, remedial actions for an uncontrolled, unplanned, or accidental release of a substance into the environment.	Air Quality and Dust Management; Contaminated Soils Management; Erosion and Sediment Control; Fuels and Lubricants Management; Groundwater Management; Project-Related Waste Management; Spill Prevention and Contingency Plan; Emergency Response Plan
Canadian Environmental Assessment Act, 2012	EC and the Canadian Environmental Assessment Agency		Canadian environmental assessment legislation has been updated in 2012 to provide an improved federal environmental assessment process that focuses on large projects that have a greater potential for significant adverse environmental effects. CEAA 2012 applies to projects described in the *Regulations Designating Physical Activities* and to projects designated by the Minister of the Environment.	General – will apply to projects outlined in the regulation that are within a wildlife area or migratory bird sanctuary.
Canadian Environmental Quality Guidelines	CCME		Provides nationally endorsed science-based goals for the quality of atmospheric, aquatic, and terrestrial ecosystems and • document chemical-specific fact sheets that summarize the key scientific information and rationale for each substance • detailed summary tables of recommended guidelines for the different media and resource uses, and • protocols used in developing the CEQG, along with their associated implementation guidance.	General – applies to all WT projects and activities.
Migratory Birds Convention Act, 1994 (1994, c.22)	EC (CWS)		Implements a Convention for protecting and conserving migratory birds — as populations and individual birds — and their nests.	Vegetation Management; Wildlife Management
Species at Risk Act	Minister of Canadian Heritage; DFO;		SARA aims to prevent species, subspecies, and distinct populations of wildlife from becoming extirpated or extinct; to provide for the recovery of endangered or threatened species; and to encourage the management of other species to prevent them from becoming at risk.	Wildlife Management

Regulatory Component	Agency or Administrator[1]	Part and/or Section	Regulated Activity/Element	Applicable Project Components
	MECP; TRCA			
Canada Wildlife Act	EC (CWS)		The Act provides protection of marine areas and wildlife in danger of extinction and prescribes measures for the conservation of wildlife.	Wildlife Management
CSA Z94.4-02 Selection, Use and Care of Respirators	CSA		Guidance document for the selection, use and care of respirators should methane or other contaminants be present on a project site.	Contaminated Soils Management; Methane Control; Project-Related Waste Management
Provincial Jurisdiction				
Environmental Protection Act (R.S.O. 1990, c. E-19).	MECP	Part II, s. 6 and 14	This Act provides for the protection and conservation of the natural environment. These provisions address general provisions for contamination and discharge and prohibits the discharge of any contaminant into the natural environment, if the discharge causes or may cause an adverse effect.	General – applies to all WT projects and activities.
		Part II, s. 9 9.2, 9.6-11 Repealed. May need to revisit	This section regulates air emissions and the issuance of Cs of A for Air and Noise. This pertains specifically to projects that require the installation of gas interception and venting systems for methane gas control.	Methane Control
		Part III, s. 23	This section addresses motor and motor vehicles and prohibits the operation of a motor or motor vehicle that does not comply with the regulations.	Traffic Management
		Part V, s. 26 and Part IX, s. 86	This section addresses waste management and litter. Section 26 includes the prohibition of storage or disposal of wastes that are likely to create a nuisance, or that may violate the *Ontario Water Resources Act*. Section 86 of the Act prohibits the abandonment of any material in a place, manner, receptacle or wrapping such that it is reasonably likely that the material will become litter.	Erosion and Sediment Control; Fuels and Lubricants Management; Project-Related Waste Management; Stormwater/Surface Water Management; Vegetation Management
		Part V, s. 27	This section regulates waste management systems and the issuance of Certificate of Approvals. This pertains specifically to the removal and treatment of contaminated soils and management of project-related wastes.	Contaminated Soils Management; Project-Related Waste Management
		Part X	This Part addresses spills and includes provisions for spill prevention and spill contingency plans, notice of spills, duty to mitigate and restore, and disposal of pollutants.	Fuels and Lubricants Management; Groundwater Management; Project-Related Waste Management; Vegetation Management; Spill Prevention and Contingency Plan; Emergency Response Plan
Environmental Assessment Act (R.S.O. 1990, c. E.18	MECP	Part II	The EAA provides for the protection, conservation, and wise management of the environment, including the social, economic and cultural aspects of the environment. Major public and designated private undertakings must conduct an EA prior to obtaining permits. Regardless of the undertaking size, type and proponency (e.g., private sector), it may be designated as subject to the EAA by the Minister.	General – applies to all WT projects and activities.
Ontario Water Resources Act (R.S.O. 1990, c. 0.40)	MECP	s. 29 to 34, 53	The OWRA provides for the conservation, protection, and management of Ontario's waters and for their efficient and sustainable use, to promote long-term environmental, social and economic well-being. The Act governs the release of contaminants to waters, such that the water must not be impaired. Sections 29 to 33 pertain to the supervision of all surface waters and groundwaters and prohibits or regulates the discharge of polluting material and sewage. Section 34 provides for the taking of water while section 53 pertains to the issuance of a C of A for industrial sewage wastewater discharge.	Erosion and Sediment Control; Fuels and Lubricants Management; Groundwater Management; Project-Related Waste Management; Stormwater/Surface Water Management
Planning Act (R.S.O. 1990, c. P.13)	City of Toronto	Part V	This Act relates to land use controls and related administration, including zoning by-laws and site-plan control. If any zoning amendments and site plan approvals/agreements are required, this Act must be followed.	General – applies to all WT projects and activities.
Health Protection and Promotion Act	Ministry of Health		Establishes a role for TPH in aspects of a project that relates to the protection of the health of people of Ontario.	Air Quality and Dust Management; Contaminated Soils Management; Erosion and Sediment Control; Fuels and Lubricants Management; Groundwater

Regulatory Component	Agency or Administrator[1]	Part and/or Section	Regulated Activity/Element	Applicable Project Components
				Management; Project-Related Waste Management; Spill Prevention and Contingency Plan; Emergency Response Plan
Building Code Act, 1992 (S.O. 1992, c. 23)	City of Toronto	s. 8 to 14	These sections pertain to construction and demolition and includes the issuance of building permits. Required for the demolition and/or construction of buildings and structures associated with WT projects.	General – applies to all WT projects and activities.
Waste Diversion Act, 2002 (S.O. 2002, c. 6)	Waste Diversion Ontario and MECP	s. 25	This Act promotes the reduction, reuse and recycling of waste and provides for the development, implementation, and operation of waste diversion programs.	Project-Related Waste Management
O. Reg. 347 (R.R.O. 1990) General - Waste Management	MECP	s. 17.1 to 23	Reg. 347 addresses the management, handling and disposal of waste. Under this regulation, waste generators and waste carriers are required to obtain identification numbers for any waste generation facility that is involved in the production, collection, handling or storage of subject waste which includes solid and hazardous waste.	Contaminated Soils Management; Project-Related Waste Management
O. Reg. 102/94 and O.Reg 103/94 – Waste Audits and Waste Reduction Work Plans & Industrial, Commercial, and Institutional Source Separation Programs	MECP	Part IV and V	These Parts pertain to the requirements for waste audits, waste reduction and waste work plans for large construction and demolition projects.	Project-Related Waste Management
O. Reg. 169/03- Ontario Drinking Water Quality under the *Safe Drinking Water Act*	MECP	s. 1& 2	To ensure that construction projects protect groundwater supplies on adjacent lands.	Contaminated Soils Management; Fuels and Lubricants Management; Groundwater Management
Pesticide Act (R.S.O. 1990, c. P.11)	MECP	s. 4	This Act must be adhered to when undertaking landscaping activities.	Vegetation Management
MOE Guideline NPC-119	MECP		NPC-119 regulates the amount of noise and vibration produced during blasting operations associated with construction activities.	Noise and Vibration Management
MOE Noise Assessment Criteria in Land Use Planning	MECP		Outlines the requirements for feasibility and detailed noise impact studies should a project generate sound levels exceeding the requirements outlined in the document.	Noise and Vibration Management
Weed Control Act (R.S.O. 1990, c. W.5)	Ministry of Agriculture Food and Rural Affairs		This Act provides for reducing the infestation of noxious weeds and to reduce plant diseases by eliminating plant disease hosts.	Vegetation Management
Ontario Heritage Act (R.S.O. 1990, c. O.18)	Ontario Ministry of Heritage, Sport, Tourism and Culture	Part IV & VI	This Act provides for the protection and conservation of cultural heritage and archaeological resources. Archaeological clearance must be obtained prior to construction and authorization is required for design. This Act must be adhered to in case there is the discovery of archaeological resources (handling, excavation, and reporting of find) during construction.	Archaeological and Heritage Resources Management
O. Reg. 217/01- Liquid Fuels, *Technical Standards and Safety Act* & *WHMIS Regulation*. (R.R.O. 1990, Reg. 860, s. 26.)	TSSA		This Act is to ensure that vehicle handling, fueling and fuel storage during construction are in accordance with the TSSA.	Fuels and Lubricants Management
Fire Protection and Prevention Act (O.Reg. 213/07) and Ontario Fire Code	The Office of the Fire Marshal	Part 4	This part of the Act provides guidelines for storing and handling of flammable and combustible liquids.	Fuels and Lubricants Management
		Part 5	This part of the Act provides guidelines for the storage, handling, and use of hazardous materials.	Project-Related Waste Management
O. Reg. 166/06, under the *Conservation Authorities Act*	TRCA		This regulation ensures that planning, construction, and operation activities are undertaken in accordance with the guidelines of the TRCA, which grants permission for development in or on the areas near shorelines, streams and rivers, and wetlands if, in its opinion, the control of flooding, erosion, dynamic beaches, pollution or the conservation of land will not be affected by the development.	General – applies to all WT projects and activities

Regulatory Component	Agency or Administrator[1]	Part and/or Section	Regulated Activity/Element	Applicable Project Components
Erosion and Sediment Control Guidelines for Urban Construction	TRCA		This guideline ensures the protection of water quality during construction and demolition activities	General – applies to all WT projects and activities.
O. Reg. 213/91 – Construction Projects, *Occupational Health and Safety Act*	Ontario Ministry of Labour	Part II to III	This regulation is to ensure that the construction manager and / or contractor adheres to the MOL labour codes outlined for general construction and excavation practices for all works on a project.	General – applies to all WT projects and activities.
O. Reg. 419/05 – Air Pollution – Local Air Quality	Clean Air Partnership; and MECP	Part III, s. 49	Ensures regulation of emission of contaminants to the air through construction and sandblasting works.	Air Quality and Dust Management
Endangered Species Act, 2007 (S.O. 2007, c. 6)	MECP		Identifies Species at Risk list in Ontario and stipulates the protection and recovery of species and includes prohibition on damage to habitat.	Wildlife Management
O. Reg. 153/04 – Record of Site Condition	MECP		This regulation outlines acceptable standards for soil, groundwater, and sediment quality for a site, depending on its land use.	Contaminated Soils Management; Groundwater Management
O. Reg. 406/19 – On-Site and Excess Soil Management	MECP		This regulation outlines procedures and applicable standards for the beneficial reuse of soil at a receiving site.	Contaminated Soils Management
O. Reg. 903 (R.R.O. 1990) – Wells	MECP		This regulation under the *Safe Drinking Water Act* ensures the proper construction, decommissioning and abandonment of wells. The standards outlined must be followed should works involving wells be required.	Groundwater Management
Municipal Jurisdiction				
Toronto Municipal Code	City of Toronto	Part II, Ch.363 and 415	Pertain to approvals and permits for building construction, demolition, and site development.	General – applies to all WT projects and activities.
		Part II, Ch. 517 and Part III Ch. 950	Pertain to the restrictions on idling of vehicles and traffic and parking provisions and regulations for the city.	Traffic Management
		Part II, Ch. 548	Pertains to littering and dumping of refuse including recyclable materials and prohibited waste.	Project-Related Waste Management
		Part II, Ch. 591	General provisions and limitations for sound levels.	Noise and Vibration Management
		Part II, Ch. 612 and Ch. 813	Restrictions on the use of pesticides (612) and the protection of trees (813).	Vegetation Management
		Part II, Ch. 681	Pertains to stormwater, sanitary and combined sewer discharge requirements.	Erosion and Sediment Control; Fuels and Lubricants Management; Groundwater Management; Stormwater/Surface Water Management
		Part II, Ch. 851-9	Pertains to water supply and in particular permit for a water service connection for the supply of water to the property for construction purposes.	General – dependent on type and requirements of the project
		Ch.658	Pertains to the injury or destruction of vegetation in the ravine and natural feature area	Vegetation Management
Archaeological Master Plan of the Central Waterfront	City of Toronto		Provides guidelines for the management, development review and conservation of known and potential archaeological resources.	Archaeological and Built Heritage Resources Management
The Toronto Green Development Standard 2007	City of Toronto		Provides an integrated set of targets, principles, and practices to encourage sustainable development.	Air Quality and Dust Management; Erosion and Sediment Control; Project-Related Waste Management Stormwater/Surface Water Management; Vegetation Management

APPENDIX B

Applicable Regulatory Agency Contacts for Projects in the Waterfront Toronto Development Area

(**Note:** Contact information may change over time. It is the responsibility of all parties to maintain updated information.)

Agency or Administrator	Department	Description	Applicable Project Components	Phone Number
Federal Agency Contact Numbers				
Department of Fisheries and Oceans (DFO)	General	Any activity that may result in the harmful alteration, disruption, or destruction (HADD) of fish habitat or the deposit of any deleterious substance in fish habitat must contact the DFO.	Contaminated Soils Management; Erosion and Sediment Control; Fuels and Lubricants Management; Groundwater Management; Project-Related Waste Management; Stormwater/Surface Water Management; Vegetation Management; Wildlife Management	613-993-0999
Environment Canada (EC)	Ontario Regional Office	Governs pollution prevention and the protection of the environment. Should an uncontrolled, unplanned, or accidental release of a substance into the environment occur, EC must be contacted.	Air Quality and Dust Management; Contaminated Soils Management; Erosion and Sediment Control; Fuels and Lubricants Management; Groundwater Management; Project-Related Waste Management; Spill Prevention and Contingency Plan; Emergency Response Plan	416-739-4734 Alternate: 1 800 661-7785
	Canadian Wildlife Service	Any activity that could lead to impacts on the protection and management of migratory birds, nationally significant habitat and endangered species.	Wildlife Management	867-393-6700
Provincial Agency Contact Numbers				
Ontario Ministry of the Environment, Conservation and Parks (MECP)	Spill Action Centre (SAC)	All spills or other emergencies must be reported to the SAC as soon as possible. This is a 24/7 service.	Fuels and Lubricants Management	1-800-268-6060 Alternate: 416-325-3000
	Toronto Regional Office Duty Officer –	Projects that may require approval and licenses for discharge of contaminants to the air, surface, and ground water; management of wastes; and the use of pesticides must contact this department of the	All applicable EPPs that may require an MECP approval or license for project related activities.	(416) 314-6378

Agency or Administrator	Department	Description	Applicable Project Components	Phone Number
	Operations Division	MECP to ensure compliance with environmental laws.		
	Toronto Regional Office Duty Officer – Investigations and Enforcement Branch	Activities that may violate the Environmental Protection Act, Ontario Water Resources Act, Environmental Assessment Act, and/or Pesticides Act must contact this department of the MECP.	Air Quality and Dust Management; Contaminated Soils Management; Erosion and Sediment Control; Fuels and Lubricants Management; Groundwater Management; Project-Related Waste Management; Spill Prevention and Contingency Plan; Emergency Response Plan	(416) 326-6700
Ontario Ministry of Natural Resources and Forestry (MNRF)	Greater Toronto Area Regional Office	Provides for the protection of fish and wildlife. Any activity that may impact wildlife including their habitat or works in the vicinity of water must contact MNRF for consultation on applicable permits/licenses that may be required.	Wildlife Management	(905) 713-7400 Alternate: 1-800-667-1940
Ontario Technical Standard and Safety Authority (TSSA)	General	TSSA must be contacted should a fuels related incident such as carbon monoxide poisoning, pipeline strikes, explosions, spills, leaks, fires, and/or the discovery of petroleum product occur.	Fuels and Lubricant Management; Spill Prevention and Contingency Plan; Emergency Response Plan	416-734-3300 Alternate: 1-877-682-TSSA (8772)
Ontario Provincial Police (OPP)	General	OPP must be informed for activities that require the movement of oversized vehicles on provincial highways and may result in the requirement for a permit.	Traffic Management (Highways)	1-888-310-1122
Municipal Contact Numbers				
City of Toronto	Heritage Preservation	Consultation with Heritage Preservation Services is required prior to activities that involve work on or near a structure on the Inventory of Heritage	Archaeological and Heritage Resources Management	416-338-1076 Alternate: 416-392-1975 or 416-338-1096 for specific inquiries related to

Agency or Administrator	Department	Description	Applicable Project Components	Phone Number
	Services	Properties, or prior to any soil disturbance activities.		archaeology
	Toronto Water's 24-hour spill reporting line (Water Services)	Any spill that results in the release of contaminants into catchbasins, stormwater sewers, or watercourses must report the incident to the 24-hour reporting line.	Erosion and Sediment Control; Fuels and Lubricants Management; Spill Prevention and Contingency Plan	311
	Air Quality Information Line	Provides daily information on the smog alert status for the City.	Air Quality and Dust Management	416-338-SMOG (7664)
	Toronto Building Customer Service	Provides formal permission from the City of Toronto to begin construction, demolition, addition, or renovation on a property.	Building Permits	416-392-7539
	Solid Waste Management Services	Should be notified and consulted for handling the transfer and disposal of garbage onsite as well as the processing of recyclable materials.	Project-Related Waste Management	311
	Transportation Services	Projects that require road and sidewalk maintenance; street cleaning, snow clearing and road salting; permits for on-street parking; construction events; traffic signs and pavement markings; and/or traffic signals and traffic safety construction planning must contact this department.	Air quality and Dust Management; Traffic Management	311
	Urban Forestry	Projects that require maintenance and protection of private and city owned trees must inform this	Vegetation Management	311 or 416-392-CITY (2489)

Agency or Administrator	Department	Description	Applicable Project Components	Phone Number
	Services	department.		
Toronto Police Service	General	Any activity that may or will compromise the safety of the public or individuals on or near site (i.e. injuries, fire, explosions, vehicle collisions, spills, etc.)	Emergency Response	In an Emergency: 911 Non-Emergency: 416-808-2222
	Traffic Services	Toronto Police must be informed for activities that require the movement of oversized vehicles; local traffic signs/management; and any other construction or design that may impact the safety of the general public.	Traffic Management	416-808-1900
Toronto Fire Service	Fire Prevention South (Toronto) District	Any activity that may or will compromise the safety of the public or individuals on or near site (i.e. injuries, fire, explosions, vehicle collisions, spills, etc.)	Traffic Management; Spill Prevention; Emergency Response	In an Emergency: 911 Non-Emergency: 416-338-9350
Toronto Emergency Medical Service (EMS)	General	Any activity that may or will compromise the safety of the public or individuals on or near site (i.e. injuries, fire, explosions, vehicle collisions, spills, etc.)	Emergency Response	In an Emergency: 911 Non-Emergency: 416-392-2000
Toronto and Region Conservation Authority (TRCA)	Planning and Permits	Any activity within or adjacent to natural areas that may or will cause impacts to stream corridors, wetlands, and along the Lake Ontario shoreline.	Wildlife Management;	416-661-6600 Extension 5271 or 5221

APPENDIX C

Recommended Procedures for Methane Management During Construction Activities Across the Designated Waterfront Area

March 16, 2010

CELEBRATING 50 YEARS in 2010

RECOMMENDED PROCEDURES FOR METHANE MANAGEMENT DURING CONSTRUCTION ACTIVITIES ACROSS THE DESIGNATED WATERFRONT AREA

Submitted to:
Waterfront Toronto
20 Bay Street, Suite 1310
Toronto, Ontario
M5J 2N8

REPORT

Report Number: 09-1113-0101 Version 2

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Table of Contents

1.0 INTRODUCTION

This document has been prepared by Golder Associates Ltd., at the request of the Toronto Waterfront Revitalization Corporation (Waterfront Toronto). It presents an approach that may be considered for methane management during the construction of buildings and facilities in the Designated Waterfront Area (DWA) of Toronto. It describes procedures that would typically be used for monitoring and managing methane and related gases during construction activities.

The responsibility for developing Health and Safety Plans at construction sites, remains the responsibility of the individuals (usually contractors) responsible for the construction activities. At sites in the DWA where methane has been identified in the subsurface through previous investigation, the Health and Safety Plans should also address potential safety hazards due to methane. The methane management approach described in this document may be used as guidance in developing such site-specific Health and Safety Plans.

Methane in the DWA is generated from buried naturally occuring former lake bottom sediments and peat. Some methane may also be generated from the historical fill present in this area. For example, in the East Bayfront Precinct, located south of Lakeshore Boulevard between Jarvis and Parliament Streets, methane has been identified in the subsurface at levels that could pose explosion hazards if the methane accumulates in enclosed spaces. Due to the known occurrence of methane in the DWA, it is recommended that methane monitoring be routinely undertaken in boreholes or monitoring wells installed for environmental or geotechnical purposes at sites where construction activities would occur.

This document applies only to the construction phases of projects, and not post-construction phases once site development is complete. A post-construction methane management approach is described in a separate document entitled "*Methane Management Approach for Permanent Building Structures across the Designated Waterfront Area",* March 16, 2010, prepared by Golder Associates Ltd., for Waterfront Toronto.

Golder understands that this document will be incorporated in Waterfront Toronto's overall environmental management planning document for project-related activities.

This document meets the objectives of Waterfront Toronto's "Environmental Management Plan for Project-Related Activities (January 2009)".

2.0 PURPOSE AND SCOPE

This document describes a methane management approach that may be typically used to address potential safety hazards during construction. The methane management approach outlined in this document may be used as guidance for the development of Health and Safety Plans to address safety hazards at sites in the

DWA where methane has been identified in the subsurface through previous investigation. This is in addition to Health and Safety Plans normally required for construction activities.

The document provides background information and typical methane management procedures as general guidelines. These guidelines may be considered by the contractor in the context of the specific work to be conducted and all applicable regulatory requirements. The contractor should prepare and implement their own Health and Safety Plan that addresses all construction hazards, including potential hazards from methane and other soil gases that may be encountered during construction activities. Potential health and safety concerns due to other volatile gases are not addressed in this document. Copies of letters to Waterfront Toronto by Dillon Consulting Limited addressing health and safety requirements for volatile organic compounds are included in Appendix A.

3.0 OVERVIEW OF METHANE ISSUES IN THE DESIGNATED WATERFRONT AREA

Recent subsurface studies completed in the East Bayfront Precinct of the DWA help to gain an understanding of methane generation in the subsurface in this area of the Toronto waterfront. The studies included Phase I and II Environmental Site Assessments (ESAs) completed by Dillon Consulting Limited in 2007 and 2008, and methane monitoring undertaken by Terraprobe Consulting Engineers during construction activities at Sherbourne Park and Sugar Beach in 2009.

A summary of the Dillon Phase I and II ESAs and the Terraprobe data for the East Bayfront Precinct is provided below.

Phase I ESA (Dillon, 2007).

The Phase I ESA identified the potential for methane gas generation within subsurface soils and fill, most likely due to anaerobic decomposition of organics associated with the organic-rich soils. Subsurface soils in the East Bayfront area include sediments dredged from Lake Ontario as well as surplus and/or poor quality fill (containing brick, glass, tree stumps, other woody materials, metal, concrete, cinder, and coal).

Summarizing the findings of a report titled "*Geotechnical Investigation Update, 125 Queens Quay East"*, Trow Associates Inc., 2007", the Phase I ESA indicated that methane was measured by Trow in open boreholes, and that all concentrations were below the lower explosive limit (LEL) for methane, which is 5 percent in air.

The Phase I ESA also refers to a letter from the City of Toronto Health Department in response to a building permit request at 215 Lakeshore Blvd. The letter

recommended the installation of a passive gas extraction system below the building floor slab due to the presence of methane in the subsurface.

Phase II ESA (Dillon, 2008)

The Dillon Phase II ESA reported the presence of methane in various monitoring wells, predominantly those installed in either fill materials or the native lake bottom sediments underlying the fill between 7 and 12 metres below grade. The average methane concentrations were 38% in wells installed in the fill deposits and 67% in the lake bottom deposits. These methane concentrations were measured in an area with approximately 7 metres of fill overlying approximately 4 to 6 metres of native former lake bottom sediments comprised of organic silt deposits, which in turn are underlain by shale bedrock. Soil gas monitoring at most wells was limited to two events. Some wells tested were screened below the water table. The data for these locations is uncertain given that it is not possible to obtain a representative soil gas sample from these wells.

The report indicates that control measures for methane are required to address migration to outdoor air during construction activities and future development of the site where combustible gases have the potential for accumulating in enclosed spaces.

Terraprobe Construction Monitoring (2009)

Terraprobe Consulting Engineers (Terraprobe) conducted monitoring of gases inside holes excavated for caissons at the Sherbourne Park pavilion and ice rink site at 255 Queens Quay. The majority of the monitoring was conducted between August and November 2009.

The results of monitoring indicated that the combustible gas concentrations were typically between approximately 1% and 15% of the lower explosive limit (LEL) of methane in air. The maximum combustible gas concentration was 46% of the LEL measured near the base of a caisson excavation.

The context and significance of these readings is uncertain because the magnitude of the ventilation and dilution inside the excavation is unknown. Nevertheless, these readings confirm that combustible gases (inferred to be methane) are being generated and also suggest the potential for methane to accumulate in enclosed spaces at concentrations above explosive levels.

4.0 POTENTIAL HAZARDS DUE TO METHANE AND OTHER BIOGENIC GASES

An overview of the potential hazards associated with methane and other biogenic gases in the context of the planned development is presented in this section of the document.

Methane and carbon dioxide may be generated through the biological breakdown of organic matter present in fill or native soil deposits (e.g., peat, wood, soil with high organic content) and petroleum hydrocarbon impacted soil, and could be present across various parts of the DWA. Methane is a flammable gas and can form explosive mixtures with air. For an explosion to occur, there must be a source of flammable gas (methane), an ignition source and sufficient oxygen for combustion. Methane is violently reactive with oxidizers, halogens and some halogen-containing compounds. Combustible vapours may also be associated with petroleum fuels.

The Lower Explosive Limit (LEL) of a gas or a vapour is its minimum concentration in air needed for the gas to explode if an ignition source is present. The LEL of methane is approximately 5% by volume in air (gasoline vapours have a lower LEL of approximately 1.4% in air). The Upper Explosive Limit (UEL) is the highest concentration of a gas or a vapour in air capable of producing an explosion if an ignition source is present. The UEL of methane is approximately 15 % by volume in air. A methane concentration above 15% is still hazardous as dilution in air can still reduce concentrations within flammable limits. This is summarized in Table 1. The occupational exposure limits for selected gases are summarized in Table 2.There is also the potential for oxygen deficiency or asphyxiation when methane or carbon dioxide displaces or dilutes air in confined spaces, and creates oxygen deficient conditions that could lead to coma, convulsions or death.

Methane and/or carbon dioxide may accumulate or build-up below buildings or structures since concrete slabs and asphalt pavement surfaces are a low permeability barrier to methane migration. A low permeability slab may promote lateral migration of methane, although foundation designs with deeper foundations or grade beams along the perimeter of the building may “trap” methane because lateral movement of methane is restricted. The migration of methane and related gases into the building or smaller enclosed spaces associated with the building (e.g., wet wells, sumps, etc.) represents a potential safety hazard. Another potential soil gas entry point is an elevator shaft pit, which is often the deepest point of the building and may have a drain.

Methane may enter utilities (manholes, vaults, catchbasins, ducts, sumps) and may also move along high permeability utility backfill when there is a permeability contrast between the utility backfill and surrounding soils. In particular, methane may accumulate in below-grade utility boxes or vaults that have a sealed cover, but open bottom.

In areas with soft landscaping (i.e., grass areas) or with pavers (with many openings), methane will more readily migrate through the surface cover and consequently there is less potential for accumulation or elevated concentrations of methane in localized areas.

Table 1: Methane concentrations in air by volume expressed in percentage and parts per million

	Concentration of methane in air by volume Expressed as percentage (%)	Concentration of methane in air by volume Expressed as parts per million (ppm)
Lower Explosive Limit (LEL)	5	50,000
Upper Explosive Limit (UEL)	15	150,000
20% (i.e. 1/5) of LEL	1	10,000

If a highly concentrated emission of methane is diluted with air, explosive mixtures of methane and air can be formed. Such mixtures may have the greatest potential to be present in subsurface excavations, in confined spaces at a construction site (for example manholes, pits, trenches) and in subsurface utilities (within the utility conduit and backfill). There may also be the potential for methane build-up below temporary construction buildings or enclosures placed directly on soil without ventilation, if present. There is also the potential for oxygen deficiency or asphyxiation when methane or carbon dioxide displaces or dilutes air confined spaces, and creates oxygen deficient conditions that could lead to coma, convulsions or death.

Occupational exposure limits for methane and related gases, carbon dioxide and oxygen, are presented in Table 2.

Table 2: Occupational Exposure Limits for Selected Gases

Substance	Ontario OEL TWAEV[1]	Ontario OEL STEV[2]	Ontario OEL Ceiling[3]
Methane	1,000 ppm (0.1%)	N/A	N/A
Carbon Dioxide	5,000 ppm (0.5%)	30,000 ppm (3%)	N/A
Oxygen	N/A	N/A	N/A

[1] TWAEV = time weighted average exposure limit (8 hour).
[2] STEV = Short-term exposure value (15 minute).
[3] Ceiling = maximum not to be exceeded at any time

Methane and carbon dioxide are considered simple asphyxiants, and methane is also flammable and combustible. The OSHA limits for oxygen-deficient and oxygen-enriched environments are 19.5 % and 23.5%, respectively (29CFR 1910.146). Ontario Regulation 632 sets the oxygen limits as between 19.5 % and 23 %.

5.0 BACKGROUND INFORMATION ON REGULATORY PROCEDURES, CODES AND GUIDANCE

This section of the report provides a summary of regulatory requirements regarding methane, including: the Ontario Ministry of Environment procedures for assessing methane hazards; methane mitigation requirements in building codes in Canada and Ontario; and requirements and best practice from selected other jurisdictions. It is not intended to be an exhaustive review but provides an overview of selected guidance for illustrative purposes.

Ontario Ministry of Environment

The Ontario Ministry of Environment (MOE) has specified the requirements for addressing methane hazards at landfill sites through Ontario Regulation 232/98 (amended as O.Reg 216/08), and Guideline D-4-1 "*Assessing Methane Hazards from Landfill Sites*".

Although the MOE requirements are specific to landfill sites, they could also generally apply to fill sites where methane is present.

Guideline D-4-1 provides a decision tree that recommends monitoring when methane is detected at concentrations between 10% and 20% of the LEL, methane mitigation or controls when the methane concentration is greater than 20% of the LEL, and monitoring and alarm devices to ensure that the methane concentration remains less than 20% of the LEL

Regulation 232/98 (as amended) addresses potential combustion or explosion concern with methane by requiring an assessment of the potential for subsurface migration and by setting concentration limits for methane. The specified concentration limits are:

- Less than 2.5 percent methane gas (50% of the LEL) in the subsurface at the property boundary,
- Less than 1.0 percent methane (20 % of the LEL) in an on-site building, or the area immediately outside its foundation or floor, and

- Less than 0.05 percent methane (i.e., not present) in a building, or area immediately outside its foundation or floor, which is located off-site.

If active methane control systems are installed to meet the specified limits, a MOE Certificate of Approval (C of A) issued under Part IX (Air) of the Environmental Protection Act specifying the design, operation and monitoring requirements may be required.

5.1 Federal Regulations

Because Waterfront Toronto and components of the redevelopment of the waterfront are under federal jurisdiction, the Canada Labour Code Part II, and the Canada Occupational Health and Safety Regulations (SOR/86-304) also apply. Specific elements of SOR/86-304 that must be addressed at the Site as appropriate include health and safety requirements for Temporary Structures and Excavations, Hazardous Substances, Confined Spaces, and Hazard Prevention Program.

For regulatory compliance, the more stringent confined space flammable gas management requirements of the Ontario regulations should be followed for all construction projects.

National and Ontario Building Code

Section 9.13 of the National Building Code (NBC) of Canada (2005) describes requirements for soil gas controls. The NBC requirements do not specifically address methane, but are focussed on mitigation of radon gas. Where soil gas controls are required, the NBC indicates a soil gas barrier shall be installed, excluding single family dwellings where a sub-slab depressurization system may be installed instead of a barrier below the building floor. The NBC indicates materials used to provide a barrier to soil gas ingress shall conform to CAN/CGSB-51.34-M, "*Vapour Barrier, Polyethylene Sheet for Use in Building Construction*" and all penetrations of the barrier are to be sealed. The Ontario building code Supplementary Standard SB-9 Requirements for Soil Gas Control (August 15, 2006) has similar requirements to the NBC of Canada (2005).

Los Angeles County Code

The Los Angeles County Municipal Code Ordinance No. 175790 ("Los Angeles Code") provides a matrix to determine when methane mitigation is warranted and provides detailed requirements. The Los Angeles Code matrix defines five categories or "levels" ranging from Level 1: 0-100 ppm; Level 2: 101-1,000 ppm, Level 3: 1,001-5,000 ppm; Level 4: 5,001-12,500 ppm, and Level 5: > 12,500 ppm, with sub-categories based on design methane pressures (greater and less than 2

inches water column). For a passive venting system, an impervious membrane is required for all levels (Levels 1 to 5) within certain designated areas with known methane generation potential. Active sub-slab venting is identified as an option for Level 5 conditions. While the methane triggers for passive venting are considered unnecessarily conservative, the Los Angeles Code provides useful information on design concepts, including specifications and details for venting pipes, venting fill layers, impervious liners, alarms, soil gas monitoring ports, dewatering systems and trench dams.

UK CIRIA Report C665

In 2007, the UK Construction Industry Research and Information Association (CIRIA) published "*Assessing risks posed by hazardous ground gases to buildings*" (C665). A step-wise approach to risk assessment and mitigation for gas contaminated land is described in this document. Semi-quantitative methods are set out for two different development types utilizing a concept of "traffic lights" to identify levels of risk based on a combination of concentrations and borehole gas flow measurements. Based on the level of risk, a mitigation matrix is provided that incorporates two different types of membrane (a thinner damp proofing membrane and a thicker gas barrier), a range of venting requirements (none, passive venting of underfloor sub-space, active venting of underfloor sub-space) and ancillary measures (e.g., monitoring, sealing of cracks, voids). This document reflects the relatively extensive UK experience with gas contaminated lands and construction practices, where buildings on gassy ground are often constructed with sub-floor voids that through their open area facilitate efficient venting.

6.0 PROPOSED CONSTRUCTION AND DEVELOPMENT

It is understood that the site development activities could include the following:

- Shallow excavation and shallow trenches (less than 2 m to maximum of 3 m);
- Deeper excavations of varying widths (3 to 6 m deep), and
- Caisson drilling (greater than 6 m depth).

7.0 METHANE MONITORING AND MANAGEMENT PLAN

The recommended procedures for methane management described below do not constitute a health and safety plan, but may be used as guidelines for contractors to develop their own requirements, which should be documented in a project-specific

Health and Safety Plan. If there are changes to the project scope of work or new information is obtained on soil gases, the recommendations below should be updated.

7.1 General Requirements

General requirements for the methane monitoring and management plan that should be addressed in the contractor's Health and Safety Plan include:

- The roles and responsibilities for all contractors and persons entering the site should be defined prior to the onset of the work in the contractors Health and Safety Plan. This should include designation of the Site Safety Officer and persons responsible for soil gas monitoring.
    - Gas monitoring should be conducted by trained and competent individuals. Individuals using equipment should undergo supplier product orientation for specific instrument or specific confined space training with focus on instrumentation and interpretation.
- A safety briefing should be held as a minimum daily or more frequently prior to beginning any new work task. Information and data obtained during gas monitoring should be discussed and recorded, and health and safety incidents and resolutions or actions taken should be documented.

The implementation of the project-specific Health and Safety Plan should be audited and corrective action taken if there are deficiencies noted.

7.2 Safe Work Procedures and Prohibited Activities

The contractor should develop safe work procedures and develop a list of prohibited activities based on hazards identified in Section 6 and the work to be performed. Safe work procedures should include consideration of construction methods, personnel protective equipment (PPE), ventilation, confined space entry, control of ignition sources, use of electronic devices and smoking.

A site exclusion or work zone should be established where gas monitoring and management applies, and as needed, signage and site security (e.g., fencing) should be provided.

The contractor should develop procedures for confined space entry, if confined space entry is required. Ontario Regulation 213/91, as amended, defines a confined space as "a fully or partially enclosed space, that is not both designed and constructed for continuous human occupancy, and in which atmospheric hazards may occur because of its construction, location or contents, or because of work that is done in it".

It is important to note that both of the above conditions must apply in order for the space to meet the definition of a confined space. Ontario Regulation 632 defines a "hazardous atmosphere "as:

1) the accumulation of flammable, combustible or explosive agents;

2) an oxygen content that is less than 19.5% or more than 23%; or

3) the accumulation of atmospheric contaminants that could result in acute health effects that pose an immediate threat to life or interfere with a person's ability to escape unaided from a confined space.

Entry to and work in confined spaces is limited as follows:

- Inspection only to less than 20% Lower Explosive Limit (1% methane by volume)
- Cold work (not capable of producing ignition sources) to less than 10% Lower Explosive Limit (0.05% methane by volume); and
- Hot work (capable of producing ignition sources) to less than 5% Lower Explosive Limit (0.025% methane by volume) and with additional controls such as fans and ventilation.

Further guidance on confined spaces is beyond the scope of this document.

Gas concentrations may be higher wherever gases can accumulate and are not readily dispersed into the ambient air. Such conditions are most likely to occur in poorly ventilated areas and confined, enclosed, or partially enclosed spaces, such as:

- Trenches, excavations (partially enclosed spaces);
- Enclosed spaces such as caissons, manhole, pits; and
- Poorly ventilated spaces below man-made temporary (e.g., raised construction trailer with "skirt") or permanent structures.

Entry to above areas should be avoided to the extent practical. If lateral gas migration occurs, high gas concentrations may also be encountered in buildings on or in the vicinity of the excavation, especially in basements, enclosed areas, and service entry points.

Measures for safe work are further described below:

- **Communication, Access Requirements and Signage:** Designate an exclusion or work zone where soil gas monitoring and management apply. Post hazard and warning information at all entry points and accesses in work area; communicate all information on the health and safety hazards.

- **Ventilation.** It may be possible to enhance natural ventilation through design (e.g., sloping) of excavations and positioning of soil piles and equipment relative to prevailing winds. To the extent practicable, minimize the depth to width ratio of excavation (e.g., test pits). Mechanical ventilation may also be a good strategy to reduce the potential for hazardous gas concentrations to develop. Where possible, position personnel and equipment up-wind of gas sources.

- **Personal Protective Equipment.** In addition to standard PPE (i.e. hi-visibility clothing, hard hat, eye protection, gloves and overalls), gas detectors may be warranted under certain conditions (see sections below).

- **Ignition Sources.** Methane gas and combustible petroleum vapours are extremely flammable. Sparks, cigarette, naked flames and other sources of ignition should be kept well away from sources of this and other combustible (e.g., gasoline or diesel) vapours. In addition, all works and operations should be undertaken in a manner compliant with Ontario Regulation 851/90 as amended for Industrial Establishments, as applicable.

- **Use of Mobile Phones**: Reporting periodically by mobile phone to an office contact person is a widely used lone-working procedure. Ideally, no uncertified electrical equipment should be taken into any hazardous areas.
  However, it is a greater risk for the worker to leave an uncertified mobile phone outside of a suspect area than to have it with him/her for the phone to be within easy reach in case of an injury. Uncertified mobile phones without a metal case can be used in certain areas. Mobile phones with metal cases may produce a sufficiently strong electrostatic discharge to ignite methane gas; therefore, such phones should not be brought into a suspect area.

- **Electronic Equipment**: No personal electronic equipment (radio, I-pods, etc.) should be taken into work areas.

- **Smoking**: Should be prohibited in work areas.

7.3 Methane Monitoring

The following monitoring procedure is recommended:

1) Continuous monitoring at the commencement and during excavation activity, and during work in or near to trenches, caissons, boreholes, subsurface utilities and other subsurface confined, enclosed or below-grade spaces (Table 3).

2) Gas concentrations should be measured at multiple locations including close to (within 10 centimetres) of the ground surface (or other gas emitting surface), within the breathing zone, in areas where equipment is used, and other

locations. Under windy conditions, measurement locations should include the leeward side of excavation. A reduced frequency of monitoring (at start of shift and re-entry into excavation and ½ hourly spot checks thereafter at a minimum) of soil gases is acceptable in shallow bulk excavations (less than 3 m depth) after the excavation is complete (soil is no longer being removed), providing initial set of measurements indicate that there is a stable and safe trend of gas concentrations indicated.

3) A combustible gas detector calibrated to methane should be used to measure combustible gas concentrations and % LEL. When the gas detected is methane, a combustible gas detector measures the methane concentration and %LEL of methane. For carbon dioxide and oxygen, appropriate instrumentation should be used. The required detection limits are as follows:

   a) Combustible gases: 0.05% (500 ppm)

   b) Oxygen: 0.1 % (1,000 ppm)

   c) Carbon dioxide: 0.1 % (1,000 ppm)

4) Acceptable monitoring equipment includes RAE Systems Entry RAE or Industrial Scientific TMX412 or equivalent, or higher, grade with data logging capability. Logged data should be downloaded at the end of each shift.

5) If working in areas susceptible to explosive, oxygen deficient, and/or toxic environments, a personal monitoring device (i.e., attached to the worker at chest height) that is capable of measuring the above gases is required.

6) Only intrinsically safe and approved equipment should be used for gas monitoring (such equipment is typically marked to indicate where it is safe to use). The equipment should be approved for the type of use in accordance with applicable codes and regulations, and as specified by the Ontario Fire Marshall's office.

7) Calibration should be current to no less than 30 days prior to each use (not just prior to project start up), and the instrument should be 'bump tested' daily at start of shift, and records maintained for each piece of equipment used. All equipment should be appropriately maintained.

Table 3: Soil Gas Monitoring Requirements

Area	Monitoring Requirements
Shallow Excavation < 3m	Continuous soil gas monitoring, reduced frequency of monitoring may be considered after stable and safe trend is observed
Deeper Excavation >3m	Continuous monitoring
Caisson Excavation	Continuous monitoring

7.4 Action Levels and Contingent Measures

The contractors should set action levels that meet applicable regulations based on the work being conducted. Action limits should address the average or daily, short term and maximum or ceiling concentrations. For monitoring of gases at construction sites, it is typically considered good practice to set an initial action level that is half of the 8-hour time-weighted average. Thus, for carbon dioxide, the initial action level would be 2,500 ppm, while for methane, the initial action level based on the TWAEV is 500 ppm. The threshold indicating potential significant (explosive) safety concern for methane is 20 % of the LEL, thus, an initial action level of 10% of the LEL (or 0.5 % or 5,000 ppm) is calculated. This level is higher than the TWAEV so the value based on the TWAEV takes precedence. Table 4, below, provides recommended action levels.

Table 4: Recommended Action Levels

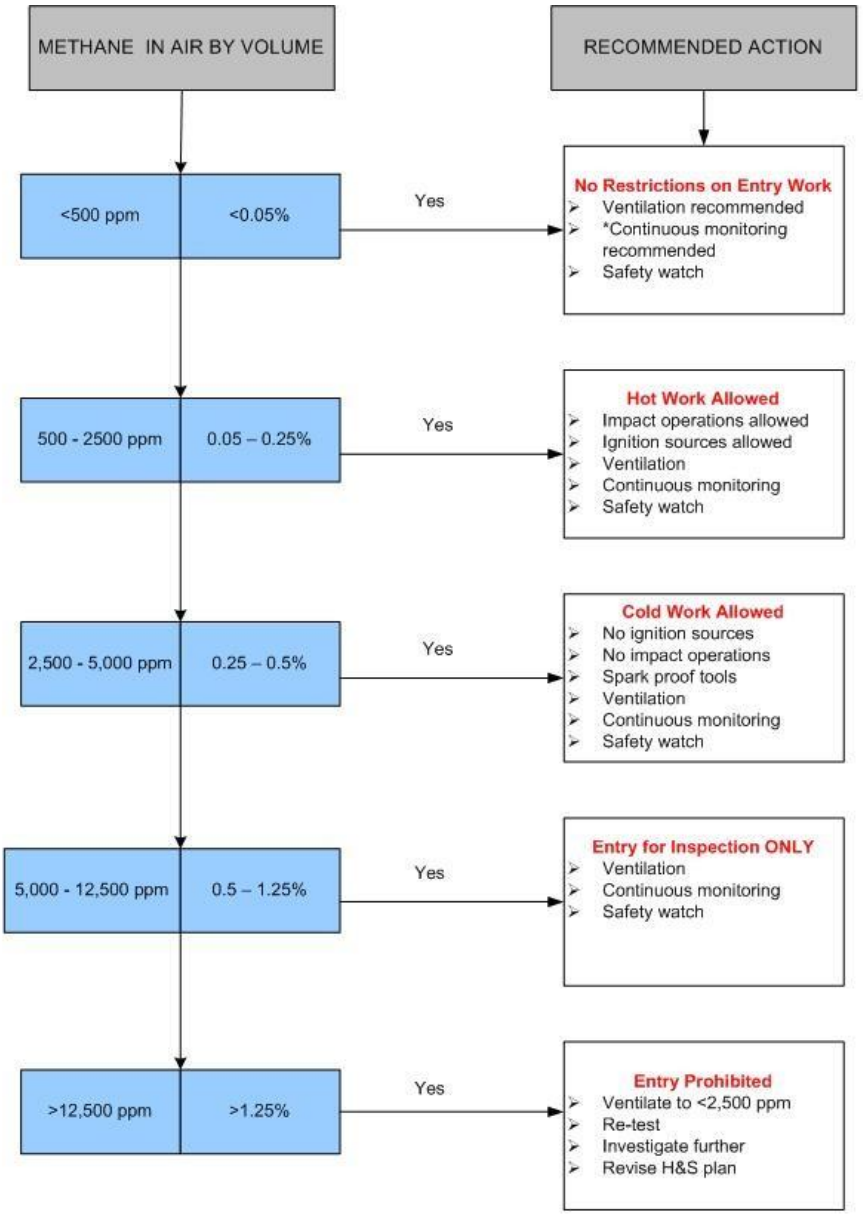
Soil gas	Initial Action Level	Action Level
Carbon dioxide	0.25% (2,500 ppm)	0.5% (5000 ppm)
Methane	0.05% (500 ppm)	0.1% (1000 ppm)
Oxygen	19.5%	19.5%

If the initial action level is exceeded, appropriate actions must be taken, which may depend on the gases detected. Equipment should be stopped, the immediate area should be safely evacuated immediately, preferably in an upwind direction. Monitoring should be conducted to demonstrate safe conditions before entering the area where action levels were exceeded. Mitigation measures such as forced-air ventilation (i.e., fans) may be considered, designed and installed by qualified persons. After safely evacuated, the work area should be carefully approached while continuously monitoring gases. The work area should only be re-entered if conditions are safe.

The decision chart (Section 8.0) provides a recommended approach for methane gas monitoring at construction sites..

(*Note: carbon dioxide concentrations and oxygen depletion are to be measured as part of standard atmospheric monitoring protocol for confined or enclosed spaces which is not addressed in this guidance document*).

8.0 METHANE CONCENTRATION / CONTROL DECISION MATRIX



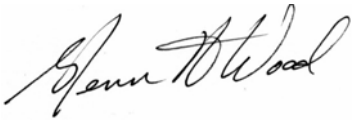
Notes:
* Continuous Monitoring – Frequency of measurements to be determined on site specific basis but should include at a minimum measurements immediately prior to ground breaking and at various times during the specific construction activity
5% methane = lower explosive limit (LEL)
1% methane = 20% of LEL

9.0 LIMITATION

The recommendations in this report are limited to guidelines to address the potential for unsafe or hazardous working conditions associated with the accumulation of methane during the construction phase of the project. Golder is not responsible for ensuring in any manner that these guidelines are appropriately applied and is not liable for any property damage, injury or loss of revenue associated with misapplication of these recommendations or a failure to implement safe working conditions where and when appropriate.

Report Signature Page

Ian Hers, P. Eng.
Associate, Senior Specialist Engineer



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IH/GW/ER/sa

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APPENDIX A

Dillon Health and Safety Letters

May 13, 2009

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Andrew Grey
Vice President, Development
WATERFRONToronto
20 Bay Street, Suite 1310
Toronto, Ontario, M5J 2N8

Re: East Bayfront Dockside Redevelopment
Evaluation of Worker Risks During Site Redevelopment Activities

Dear Andrew:

Dillon Consulting Limited (Dillon) is providing this brief submission at the request of WATERFRONToronto to clarify the extent to which subsurface environmental contamination within the Dockside Redevelopment (exclusive of the Corus Development) may present a risk to construction workers during the site redevelopment, implementation of risk management measures, and remedial activities.

The subsurface environmental quality across the site has been thoroughly investigated and evaluated as part of ongoing environmental investigations and risk assessments for the Dockside Roadways and Parks, completed in accordance with Ontario Regulation 153/04 (O.Reg. 153).

As required under 0. Reg. 153, exposures for construction workers to surface and subsurface soil and groundwater were examined, including during excavation activities. The risk assessments conservatively assume that construction workers would be consistently exposed to the maximum reported concentrations of contaminants across the whole site, excluding one localized area within the proposed Sherbourne Park that requires remediation through soil excavation and off-site disposal. The results of the risk assessments clearly show that:

- subsurface materials (excluding the hot-spot area) do not pose a health risk to construction workers engaged in remediation activities.

The localized remediation of the area within the proposed Sherbourne Park will be subject to the requirements of a site-specific health and safety plan, which will be clearly outlined in construction contract documents.

Although the risk assessment results do not indicate potential concerns relative to construction worker exposure, these do not obviate any of the Contractor's health and safety requirements/responsibilities under the Ontario Occupational Health and

...cont'd

Safety Act (OHSA), as well as any contingency plan(s) to address potentially variable site conditions.

Should you have any questions or comments, please contact the undersigned at (905) 901-2912.

Yours sincerely,

DILLON CONSULTING LIMITED

Bryan Leece, Ph.D.

... cont'd

November 25, 2008

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WATERFRONToronto
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Attention: Mr. David Kusturin
VP - Program Management

Re: East Bayfront District Energy Plant
Evaluation of Worker Risks

Dear Mr. Kusturin

Dillon Consulting Limited (Dillon) has prepared this submission in reference to a request from WATERFRONToronto (WT) to provide comment on potential risks associated with exposure by workers to existing soils at the above noted site within the East Bayfront Redevelopment. This request was directed to Dillon since we are currently completing human health and ecological risk assessments for other portions of the East Bayfront Redevelopment in order to meet the requirements of Ontario Regulation (O.Reg.) 153/04 (Brownfields regulation), administered by the Ontario Ministry of the Environment (MOE).

The information presented herein is provided for information purposes only in order to provide general guidance to the Contractor engaged in soil excavation and related activities at the site (Aecon Buildings). This information does not obviate any of the Contractor's health and safety requirements/responsibilities under the Ontario Occupational Health and Safety Act (OHSA).

We further note that the site in question has been identified as 'contaminated' relative to soil and/or groundwater standards referenced by 0. Reg. 153/04[1]. These standards are based upon chronic (long-term) exposure by the general population (including sensitive receptors such as children) and would generally be considered overly conservative when applied to the types of shorter duration exposures more typical of the sort of construction activities contemplated for the site (and otherwise regulated by the OHSA). Nevertheless, there are contaminants in the soil in excess of the established site conditions standards, therefore efforts to limit exposure to the soil should be encouraged.

SITE DESCRIPTION

The site in question comprises Block 2 of the East Bayfront Redevelopment. It consists of portions of the lands formerly identified as 125 and 175 Queen's Quay East. The site will consist of the entirety of one future city block, being bounded to the north by Queen's Quay East, and to the east, south and west by future roadways associated with the East Bayfront Dockside Redevelopment.

[1] Soil, Ground Water and Sediment Standards for Use Under Part XV.I of the Environmental Protection Act, March 9, 2004.

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The property constitutes reclaimed land via filling of Lake Ontario during the 1950s. The lands were mainly created through placement of fill from lake dredging and surplus fill from other parts of Toronto. Considering the diverse sources of lakefill material utilized, and given that environmental quality considerations were not a significant concern during that era, it can be expected that some po1tion of the fill material emplaced was impacted with various contaminants. These would include contaminants present in harbour sediments used as dredgeate fill due to the long history of industrial activities in and around the harbour, as well as contaminants in fill derived from land-based sources due to past activities at those sources. Superimposed over this is the potential for contaminant input from industrial activities that have occurred since the property was initially developed.

Extensive environmental characterization work has been completed at the East Bayfront Redevelopment in the context of O.Reg. 153/04. This has included sampling of soils and groundwater at Block 2 and adjoining lands. Soil and groundwater quality data from t[2]hese areas was recently evaluated by Dillon in support of the completion of a human health and ecological risk assessment for the Dockside Redevelopment Roadways. Contaminants that have been identified at the site and on the immediately surrounding lands as being present in soil and/or groundwater at concentrations in excess of the O.Reg. 153/04 standards include various metals, volatile organic compounds (VOCs), petroleum hydrocarbons (PHCs) and polycyclic aromatic hydrocarbons (PAHs). It is noted that the maximum concentrations in all cases were measured on adjoining lands rather than Block 2 per se.

CONTAMINANTS OF CONCERN FOR WORKER EXPOSURE

The O.Reg. 153/04 Standards applied to the site are based upon consideration of potential adverse effects to both human health and the environment. Since this evaluation is focussed on potential human health effects only, the site data was subjected to an additional screening against the relevant human health criteria components only3.

The results of this additional screening indicated that the following chemical constituents of concern (COCs) required further assessment for the purposes of this risk evaluation:

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[2] Soil and groundwater data from Block 2 and adjacent locations on Queen's Quay East has previously been provided to the Contractor. Additional sampling data has been considered herein from locations to the east, west and south of Block 2.

[3] Generally the MOE S2 criteria for soil contact, or applicable substitute criteria from the MOE or the Canadian Council of Ministers of the Environment (CCME). Criteria components based on drinking water consumption and the inhalation of volatile constituents via migration to indoor air were not considered as these exposure pathways are not considered to be applicable in the context of this assessment.

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Metals
- Antimony
- Arsenic
- Beryllium
- Lead

PAHs
- Benzo[a]pyrene
- Benzo[b,j]fluoranthene
- Dibenz[a,h]anthracene
- Indeno[1,2,3-cd]pyrene
- Phenanthrene

It is reiterated that this contaminant screening is based on review of data from Block 2 and adjoining lands and includes higher COC concentrations than have been observed on Block 2 alone.

RISK EVALUATION

As noted previously, data from the site in question (i.e. Block 2) as well as adjoining lands was recently evaluated by Dillon in support of the completion of a risk assessment for the Dockside Redevelopment Roadways[4]. That risk assessment included evaluation of a construction/maintenance worker exposure scenario that is considered to be applicable to the current risk evaluation. Consideration was given to worker exposure to COCs in site soils via incidental ingestion of soil, dermal contact with soil, and inhalation of wind-blown particulates. Exposure was assumed to occur over a 6 month construction period, 5 days per week. Other exposure factors, such as physical/physiological parameters and soil dermal loading factors, were adopted from those endorsed by the MOE and Health Canada.

The risk assessment was used to predict theoretical levels of hazard (in the case of non-carcinogenic COCs) and risk (in the case of carcinogenic COCs) for the construction/maintenance workers. It was also used to calculate Property Specific Standards (PSS) for the COCs. The results indicated that none of the predicted hazard or risk levels for these receptors exceeded target levels. Furthermore, the calculated PSS for all COCs were higher than the maximum concentrations observed at the site. Of note, the risk assessment also evaluated exposures to these receptors via inhalation of volatile COCs in outdoor air and contact with COCs in groundwater (e.g. within excavations), with similar results obtained.

As such, it can be concluded that the COC concentrations that have been measured at the site and adjoining lands do not pose an exposure risk to workers at the site.

RISK MANAGEMENT

Although the risk evaluation results did not indicate potential concerns relative to worker exposure, COC concentrations at the site are variable and it is possible that zones of previously unknown contamination could be present. For this reason, the implementation of risk management precautions is recommended. These could include measures such as the following:

[4] East Bayfront - Dockside Redevelopment Roadways, Quantitative Human Health and Ecological Risk Assessment (Dillon, 2008) . Please note that this work is complete but has not yet been submitted to, or reviewed by the MOE.

...cont'd

- Measures to reduce potential incidental ingestion of contaminated soils (e.g. reducing hand to mouth contact through washing hands prior to eating and drinking, no eating or smoking in work area);
- Measures to reduce potential skin contact with contaminated soils (e.g. wearing gloves, keeping other skin smfaces covered);
- Measures to reduce potential inhalation of airborne particulate/dust (e.g. practicing good dust control techniques, donning particulate masks as needed); and
- Avoiding/minimizing direct contact with groundwater.

Please note that risk management measures of this nature are standard practice for work at contaminated sites. Other measures may be necessary if previously unknown conditions are encountered, as indicated by observations such as extensive staining of soils, petroleum or other chemical smells.

We understand that the Contractor will be preparing a site-specific health and safety plan for this work. Further, pursuant to Change Directive No. 1, it is understood that the Contractor will be obtaining representative soil samples of the materials to be excavated. Any such additional data obtained should also be considered in the formulation of health and safety measures for the work.

CLOSURE

This submission has been provided for information purposes only in order to help inform decisions concerning health and safety requirements for workers at the site in question. The information and guidance provided does not obviate any of the Contractor's requirements pursuant to the OHSA. The evaluation herein has consisted of a further review of data and risk assessment activities previously completed for the East Bayfront Dockside Redevelopment Roadways and is subject to the same limitations referred to therein.

This submission was prepared by Dillon for the sole benefit and use of WATERFRONToronto and the City of Toronto. The material in it reflects Dillon's best judgement in light of the information available to it at the time of preparation. Any use that a third party makes of this submission, or any reliance on or decision made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this submission.

...cont'd

Should you have any questions or comments, please contact the undersigned at (416) 229 4647, ext. 2313

Yours sincerely,

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CBL/DJB:mrb
Our File: 08-8884

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APPENDIX D

Methane Management Approach for Permanent Building Structures Across the Designated Waterfront Area

March 16, 2010

CELEBRATING 50 YEARS in 2010

METHANE MANAGEMENT APPROACH FOR PERMANENT BUILDING STRUCTURES ACROSS THE DESIGNATED WATERFRONT AREA

Submitted to:
Waterfront Toronto
20 Bay Street Suite 1310
Toronto, Ontario
M5J 2N8

REPORT

Report Number: 09-1113-0101 Version 2

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1.0 INTRODUCTION

This document has been prepared by Golder Associates Ltd., at the request of the Toronto Waterfront Revitalization Corporation (Waterfront Toronto). The purpose of this document is to provide a conceptual methane management approach to be considered for permanent building structures proposed for construction in the Designated Waterfront Area (DWA) of Toronto.

The document is intended as general guidance only. It is up to the building design engineers to assess the site-specific methane data in relation to the proposed building construction, and based on this assessment to decide on the need for the implementation of an appropriate methane mitigation strategy.

Methane in the DWA is generated from buried naturally occurring former lake bottom sediments and peat. Some methane may also be generated from the historical fill present in this area. For example, in the East Bayfront Precinct, located south of Lakeshore Boulevard between Jarvis and Parliament Streets, methane has been identified in the subsurface at levels that may pose an explosion hazard if the methane accumulates within enclosed structures.

The scope of the methane management approach addressed in this document is limited to methane and related gases (carbon dioxide) originating from the breakdown of organic matter in fills and underlying native soils. The document describes an approach that may be considered to address potential explosion, combustion and asphyxiation hazards associated with methane and related soil gases. This document does not address management of soil gas or vapour impacts from other potential sources, if present, such as volatile contaminants in soil or groundwater.

The methane management approach described herein does not address methane-related health and safety issues and monitoring that may be warranted during construction. These issues are addressed in separate documents prepared by Golder Associates Ltd., for Waterfront Toronto entitled "*Recommended Procedures for Methane Management at the East Bayfront Precinct",* dated July 14, 2009, and "*Recommended Procedures for Methane Management during Construction Activities across the Designated Waterfront Area",* dated March 16, 2010. The Methane Decision Matrix for construction projects excerpted from these documents is provided in Appendix A for reference.

Golder understands that this document will be incorporated in Waterfront Toronto's overall environmental management planning document for project-related activities.

2.0 GENERAL DEVELOPMENT PLAN

A mix of commercial, institutional, parkland and recreational facilities will be constructed in the DWA. The construction is scheduled to occur in phases. In the East Bayfront Precinct, the development includes the CORUS building which is nearing completion, the Sherbourne Park and Sugar Beach sites currently under construction, while other parcels remain to be developed.

The proposed building construction ranges from smaller buildings to large multi-storey buildings. The buildings are anticipated to include both slab-at-grade and basement construction, with basements extending below the water table in some areas. Other subsurface structures at the site include vaults, manholes, and various utilities.

3.0 OVERVIEW OF METHANE ISSUES IN THE DESIGNATED WATERFRONT AREA

Recent subsurface studies completed in the East Bayfront Precinct of the DWA help to gain an understanding of methane generation in the subsurface in this area of the Toronto waterfront. The studies included Phase I and II Environmental Site Assessments (ESAs) completed by Dillon Consulting Limited in 2007 and 2008, and methane monitoring undertaken by Terraprobe Consulting Engineers during construction activities at Sherbourne Park and Sugar Beach in 2009.

A summary of the Dillon Phase I and II ESAs and the Terraprobe data for the East Bayfront Precinct is provided below.

Phase I ESA (Dillon, 2007).

The Phase I ESA identified the potential for methane gas generation within subsurface soils and fill, most likely due to anaerobic decomposition of organics associated with the organic-rich soils. Subsurface soils in the East Bayfront area include sediments dredged from Lake Ontario as well as surplus and/or poor quality fill (containing brick, glass, tree stumps, other woody materials, metal, concrete, cinder, and coal).

Summarizing the findings of a report titled "*Geotechnical Investigation Update, 125 Queens Quay East"*, Trow Associates Inc., 2007, the Phase I ESA indicated that methane was measured by Trow in open boreholes, and that all concentrations were below the lower explosive limit (LEL) for methane, which is 5 percent in air.

The Phase I ESA also refers to a letter from the City of Toronto Health Department in response to a building permit request at 215 Lakeshore Blvd. The letter

recommended the installation of a passive gas extraction system below the building floor slab due to the presence of methane in the subsurface.

Phase II ESA (Dillon, 2008)

The Dillon Phase II ESA reported high levels of methane in various monitoring wells, predominantly those installed in either fill materials or the native lake bottom sediments underlying the fill between 7 and 12 metres below grade. The average methane concentrations were 38% in wells installed in the fill deposits and 67% in the lake bottom deposits. These methane concentrations were measured in an area with approximately 7 metres of fill overlying approximately 4 to 6 metres of native former lake bottom sediments comprised of organic silt deposits, which in turn are underlain by shale bedrock. Soil gas monitoring at most wells was limited to two events. Some wells tested were screened below the water table. The data for these locations is uncertain given that it is not possible to obtain a representative soil gas sample from these wells.

The report indicates that control measures for methane are required to address migration to outdoor air during construction activities and future development of the site where combustible gases have the potential for accumulating in enclosed spaces.

Terraprobe Construction Monitoring (2009)

Terraprobe Consulting Engineers (Terraprobe) conducted monitoring of gases inside holes excavated for caissons at the Sherbourne Park pavilion and ice rink site at 255 Queens Quay. The majority of the monitoring was conducted between August and November 2009.

The results of monitoring indicated that the combustible gas concentrations were typically between approximately 1% and 15% of the lower explosive limit (LEL) of methane in air. The maximum combustible gas concentration was 46% of the LEL measured near the base of a caisson excavation.

The context and significance of these readings is uncertain because the magnitude of the ventilation and dilution inside the excavation is unknown. Nevertheless, these readings confirm that combustible gases (inferred to be methane) are being generated and also suggest the potential for methane to accumulate in enclosed spaces at concentrations above explosive levels.

4.0 POTENTIAL HAZARDS DUE TO METHANE AND OTHER BIOGENIC GASES

An overview of the potential hazards associated with methane and other biogenic gases in the context of the planned development is presented in this section of the report.

Methane and carbon dioxide may be generated through the biological breakdown of organic matter present in fill or native soil deposits (e.g., peat, wood, soil with high organic content) and petroleum hydrocarbon impacted soil, if present. Methane is a flammable gas and can form explosive mixtures with air. For an explosion to occur, there must be a source of flammable gas (methane), an ignition source and sufficient oxygen for combustion. Methane is violently reactive with oxidizers, halogens and some halogen-containing compounds. Combustible vapours may also be associated with petroleum fuels.

The Lower Explosive Limit (LEL) of a gas or a vapour is its minimum concentration in air needed for the gas to explode if an ignition source is present. The LEL of methane is approximately 5% by volume in air (gasoline vapours have a lower LEL of approximately 1.4% in air). The Upper Explosive Limit (UEL) is the highest concentration of a gas or a vapour in air capable of producing an explosion if an ignition source is present. The UEL of methane is approximately 15 % by volume in air. A methane concentration above 15% is still hazardous as dilution in air can reduce concentrations within flammable limits.

There is also the potential for oxygen deficiency or asphyxiation when methane or carbon dioxide displaces or dilutes air in confined spaces, and creates oxygen deficient conditions that could lead to coma, convulsions or death.

Methane is lighter than air while carbon dioxide is heavier than air. The density of soil gas containing primarily methane and carbon dioxide will depend on the relative proportions of these gases. Methane and carbon dioxide both readily diffuse within soil gas and are not attenuated through sorption to soil particles, although methane is relatively quickly aerobically biodegraded in the vadose zone. Soil gas can readily move through coarse-grained permeable deposits if there are pressure gradients.

Methane may accumulate or build-up below buildings or structures since concrete slabs and asphalt pavement surfaces are a low permeability barrier to methane migration. A low permeability slab may promote lateral migration of methane, although foundation designs with deeper foundations or grade beams along the perimeter of the building may “trap” methane because lateral movement of methane is restricted. The migration of methane and related gases into the building or smaller enclosed spaces associated with the building (e.g., wet wells, sumps, etc.) represents a potential safety hazard. Another potential soil gas entry point is an

elevator shaft pit, which is often the deepest point of the building and may have a drain.

Methane may enter utilities (manholes, vaults, catchbasins, ducts, sumps) and may also move along high permeability utility backfill when there is a permeability contrast between the utility backfill and surrounding soils. In particular, methane may accumulate in below-grade utility boxes or vaults that have a sealed cover, but open bottom.

In areas with soft landscaping (i.e., grass areas) or with pavers (with many openings), methane will more readily migrate through the surface cover and consequently there is less potential for accumulation or elevated concentrations of methane in localized areas.

5.0 BACKGROUND INFORMATION ON REGULATORY PROCEDURES, CODES AND GUIDANCE

This section of the report provides a summary of regulatory requirements regarding methane, including: the Ontario Ministry of Environment procedures for assessing methane hazards; methane mitigation requirements in building codes in Canada and Ontario; and requirements and best practice from selected other jurisdictions. It is not intended to be an exhaustive review but provides an overview of selected guidance for illustrative purposes.

Ontario Ministry of Environment

The Ontario Ministry of Environment (MOE) has specified the requirements for addressing methane hazards at landfill sites through Ontario Regulation 232/98 (amended as O.Reg 216/08), and Guideline D-4-1 "*Assessing Methane Hazards from Landfill Sites*".

Although the MOE requirements are specific to landfill sites, they could also generally apply to fill sites where methane is present.

Guideline D-4-1 provides a decision tree that recommends monitoring when methane is detected at concentrations between 10% and 20% of the LEL, methane mitigation or controls when the methane concentration is greater than 20% of the LEL, and monitoring and alarm devices to ensure that the methane concentration remains less than 20% of the LEL.

Regulation 232/98 (as amended) addresses potential combustion or explosion concern with methane by requiring an assessment of the potential for subsurface

migration and by setting concentration limits for methane. The specified concentration limits are:

- Less than 2.5 percent methane gas (50% of the LEL) in the subsurface at the property boundary,
- Less than 1.0 percent methane (20 % of the LEL) in an on-site building, or the area immediately outside its foundation or floor, and
- Less than 0.05 percent methane (i.e., not present) in a building, or area immediately outside its foundation or floor, which is located off-site.

If active methane control systems are installed to meet the specified limits, a MOE Certificate of Approval (C of A) issued under Part IX (Air) of the Environmental Protection Act specifying the design, operation and monitoring requirements may be required.

National and Ontario Building Code

Section 9.13 of the National Building Code (NBC) of Canada (2005) describes requirements for soil gas controls. The NBC requirements do not specifically address methane, but are focussed on mitigation of radon gas. Where soil gas controls are required, the NBC indicates a soil gas barrier shall be installed, excluding single family dwellings where a sub-slab depressurization system may be installed instead of a barrier below the building floor. The NBC indicates materials used to provide a barrier to soil gas ingress shall conform to CAN/CGSB-51.34-M, "*Vapour Barrier, Polyethylene Sheet for Use in Building Construction*" and all penetrations of the barrier are to be sealed. The Ontario building code Supplementary Standard SB-9 Requirements for Soil Gas Control (August 15, 2006) has similar requirements to the NBC of Canada (2005).

Los Angeles County Code

The Los Angeles County Municipal Code Ordinance No. 175790 ("Los Angeles Code") provides a matrix to determine when methane mitigation is warranted and provides detailed requirements. The Los Angeles Code matrix defines five categories or "levels" ranging from Level 1: 0-100 ppm; Level 2: 101-1000 ppm, Level 3: 1,001-5,000 ppm; Level 4: 5001-12,500 ppm, and Level 5: > 12,500 ppm, with sub-categories based on design methane pressures (greater and less than 2 inches water column). For a passive venting system, an impervious membrane is required for all levels (Levels 1 to 5) within certain designated areas with known methane generation potential. Active sub-slab venting is identified as an option for Level 5 conditions. While the methane triggers for passive venting are considered unnecessarily conservative, the Los Angeles Code provides useful information on

design concepts, including specifications and details for venting pipes, venting fill layers, impervious liners, alarms, soil gas monitoring ports, dewatering systems and trench dams.

UK CIRIA Report C665

In 2007, the UK Construction Industry Research and Information Association (CIRIA) published "*Assessing risks posed by hazardous ground gases to buildings*" (CIRIA, 2007). A step-wise approach to risk assessment and mitigation for gas contaminated land is described in this document. Semi-quantitative methods are set out for two different development types utilizing a concept of "traffic lights" to identify levels of risk based on a combination of concentrations and borehole gas flow measurements. Based on the level of risk, a mitigation matrix is provided that incorporates two different types of membrane (a thinner damp proofing membrane and a thicker gas barrier), a range of venting requirements (none, passive venting of underfloor sub-space, active venting of underfloor sub-space) and ancillary measures (e.g., monitoring, sealing of cracks, voids). This document reflects the relatively extensive UK experience with gas contaminated lands and construction practices, where buildings on gassy ground are often constructed with sub-floor voids that through their open area facilitate efficient venting.

6.0 METHANE MANAGEMENT APPROACH

A methane management approach is provided below to assist in the planning and implementation of methane mitigation and monitoring that may be warranted as part of the development in the DWA.

The document is not intended to be a prescriptive protocol, but instead provides guidance on the methane management approach and concepts that may be considered. It is the responsibility of the site developers and their building design engineers to conduct their own in-depth analysis of methane management requirements and to prepare designs and plans that are specific to the site and building conditions.

The essential elements of a methane management approach are:

- Site investigation to assess the presence and concentration of methane in the subsurface prior to construction;
- Design and implementation of methane mitigation systems based on methane concentrations, subsurface characteristics, geotechnical parameters, and building configuration;
- Operation and monitoring protocols; and

- Contingency plan.

Each of the essential elements of the methane management approach is described in the following sections.

6.1 Site Investigation

This section provides guidance in conducting site investigation to assess the presence and concentration of methane in the subsurface. It is up to the professional conducting the site investigation to determine the scope of the investigation based on site-specific considerations.

The primary subsurface data considered in design is methane concentration, although methane pressure and methane flow at monitoring wells may also be considered when evaluating mitigation requirements.

The methane data should be obtained from a properly designed monitoring network using appropriate methods, as described below. The descriptions provided below refer to soil gas, but they are equally applicable to methane. Additional information is provided in Health Canada (2009) and CIRIA (2007). Factors for investigation design and data interpretation are summarized in Table 1.

Soil gas Probe Construction

The preferred construction is a permanent soil gas probe constructed within a borehole advanced using a drill rig or direct push technology. The soil gas probe should be screened over the zone of interest and sealed above the filter pack to ground surface to prevent atmospheric air leakage. The soil gas probe should be completed with a gas-tight valve or fitting. Driven “punch-bar” probes may also be used for soil gas investigations, although there may be depth limitations with driven probes and possible short-circuiting depending on the probe design and installation method. It is recommended that soil gas probes be subjected to a leak tracer test to evaluate possible leakage of atmospheric air.

Design of Monitoring Network

Groundwater monitoring wells screened across the water table and above the capillary fringe or soil gas probes screened within the vadose zone may be used for methane monitoring.

The lateral spacing of the probes will depend on site specific conditions and preferably should be sufficient to contour methane concentrations. The probe depth should take into consideration the source of the methane, geologic conditions

and potential for aerobic biodegradation of methane. Shallow probes above the zone of methane degradation are not suitable for methane characterization.

Depending on the site conditions and depth to the water table, the vertical profiling of methane concentrations through multiple depth probes may be valuable. The collection of a methane sample in a monitoring well screened below the water table is not possible, although air evacuated from the standpipe provides an indication of the potential for methane to partition from groundwater into air.

Methane Field Testing

Field methane monitoring programs at sites where biogenic generation of methane and carbon dioxide is the primary concern should consist of the testing of methane, carbon dioxide, oxygen, and optionally hydrogen sulphide when conditions warrant (e.g., using a Landtec GEM-2000 Plus). The measurement of methane requires an infrared detector, which is subject to interference and potential bias when other hydrocarbon vapours are present at significant concentrations. Other types of detectors that may be employed are combustible gas detectors, which either work on a catalytic oxidation or thermal conductivity principle, or flame ionization detectors. These detectors measure total combustible gas concentrations including methane, and should be calibrated to methane. Catalytic type detectors should only be used when methane concentrations are relatively low and below the lower explosive limit (at high concentrations this type of sensor can be subject to erroneous readings, see CIRIA (2007)). All detectors have different characteristics that must be understood by the operator. Equipment should be regularly calibrated in accordance with manufacturer's instructions.

Laboratory Analysis

Generally it is good practice to submit a subset of soil gas samples for laboratory analysis for methane, carbon dioxide, oxygen, and other light gases as warranted (e.g., ASTM D1945-03 or ASTM D1946-90 (2000) analysis).

Soil Gas Pressure

The methane pressure can be readily measured using a hand-held manometer. Some gas detectors also have a built-in pressure sensor. The recommended pressure sensitivity is 0.01 inches of water. Conceptually, elevated positive soil gas pressures would indicate greater potential for methane migration and intrusion into buildings, although there is no widely accepted design basis for using pressure data. It is important to recognize that soil gas pressures will vary temporally and spatially within the subsurface.

Well Soil Gas Flow Rate or Surface Soil Gas Flux

The measurement of soil gas flow rate at wells or surface emissions using flux chambers are considered optional tests for design. Some gas detectors (e.g., Landtec GEM-2000) have an external flow pod that may be attached to the detector to provide for gas flow measurements out of or into wells. Conceptually, soil gas flow out of the well would indicate greater potential for methane migration and intrusion into buildings. With soil gas flow or flux measurements, the effect of the development on the gassing environment should be considered. Changes to the ground surface (e.g., pavement or building) will change the flow pattern, as will the installation of piles or venting layers. Such changes may also change the methane biodegradation.

Monitoring Frequency

A minimum of two monitoring events is recommended to provide data on soil gas concentration variability. Additional monitoring events may be warranted to provide data on seasonal variability and to assess the persistence of the methane generation.

Depth to Water Table

Since the water table may fluctuate seasonally, data on the high water table condition should be obtained. Water table data is used to interpret soil gas data and also may influence soil gas mitigation design.

Geotechnical Data

Geotechnical information including the expected ground deformation or settlement may be required for design purposes. Of particular importance is the expected differential vertical movement between pipes in soil that settles at the point where pipes enter structures that are founded on piles or caissons (i.e., that do not settle). Depending on the design and construction requirements, collection of geotechnical data and geotechnical analysis of soil strength, pipe strength, and soil stability may be warranted. Geotechnical analysis should be performed by a geotechnical engineer.

Table 1: Factors to Consider in Investigation Design and Interpretation

Geological conditions	Methane movement through coarser-grained, drier soils will be much faster than through finer-grained, wetter soils.
Biogeochemical conditions	Aerobic biodegradation of methane results in reduced methane concentrations and increased carbon dioxide concentrations.
Paved areas:	Can cause near-surface methane concentrations to be significantly higher than in non-paved areas since emissions to atmosphere are restricted
Utility Corridors:	Can represent preferential migration pathways for methane because they are typically backfilled with coarse-grained soils.
Frozen ground	Can act in a similar manner to paved surfaces in that soil gas concentrations may be higher below the frozen ground, and may change migration pathways.
Rainfall	Near-surface, wet soil may temporarily reduce methane emissions from surface and cause lateral migration of methane. A downward moving wetting front may push soil gas ahead of it.
Barometric pressure:	Increasing barometric pressure pushes atmospheric air into soil reducing near-surface methane concentrations and emissions, while conversely, during decreasing barometric pressure, there is greater movement of methane to surface increasing near-surface methane concentrations.

Note: Table refers to methane concentrations; more generically soil gas is subject to the majority of same processes

6.2 Conceptual Methane Mitigation Approaches

Soil Gas Mitigation Options

There are a range of conceptual approaches or options for methane mitigation. The approach chosen will depend on the site specific subsurface conditions (primarily the methane concentration, but also potentially the methane pressure and flux) and the site development characteristics (primarily the building size, type and

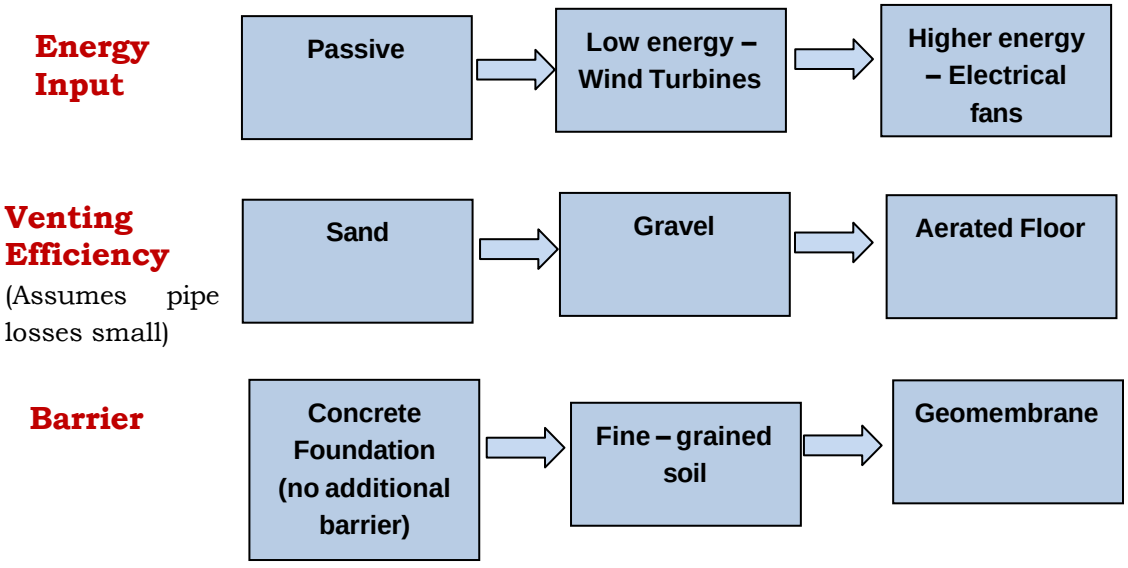
foundation), which are further described in Section 6.2 of this report. At a "high level", soil gas mitigation options may be categorized as:

- Building-based measures such as sealing of openings in the subsurface building envelope (i.e., walls and base), increased building ventilation or building pressurization;
- Near-building measures to intercept and vent soil gases, consisting of a passive or active (depressurized) sub-slab venting system that often includes a below-building gas barrier; and
- Deeper near-source measures to extract or control soil gases (i.e., implemented at some distance away from the building).

For methane mitigation at sites typical of the Toronto waterfront (i.e., with relatively shallow methane sources), near-building venting combined with a below-building gas barrier is considered the most appropriate and effective measure.

Soil Gas Mitigation Matrix

Near-building methane mitigation systems may be evaluated using the matrix shown below that describes options in terms of energy input, venting efficiency and type of barrier.



The energy input reflects the type of ventilation system used. A passive system relies on natural density differences (*i.e.*, stack effect) and natural pressure gradients for methane venting. Pipe vent risers connected to wind turbines are low energy systems but provide for an increased rate of venting relative to passive

systems when there is sufficient wind. A mechanical system utilizing electrical fans or blowers is a higher energy and thus more efficient system.

The ventilation efficiency refers to the ability for soil gas to be extracted from within venting layers below buildings, which will depend on the permeability of the venting layer. Sand and gravel are conventional materials that are commonly used for methane venting systems, although depending on gradation, sand may provide for insufficient gas flow for venting. A recent development in North America is the construction of aerated floors where concrete slabs are constructed on top of plastic domework (e.g., Cupolex) that has a high open area. Such systems are designed with connections to ground surface (air brick or vent pipes) such that wind forces provide for cross-flow of air below the slab, which provides for dilution of gases that may be present. A similar concept commonly employed in the United Kingdom are pre-formed polystyrene venting slabs that which also act as formwork for the construction of the overlying floor (e.g. Cordek Ventform).

Barriers for soil gas protection may consist of a concrete foundation (i.e., no additional barrier), a fine-grained soil layer (clay), or impervious geomembrane. When a concrete foundation is utilized, it should be recognized that depending on the construction (e.g., openings, cracks), there may be limited protection to methane intrusion via diffusive and advective gradients. Clay barriers are typically not practical for soil gas protection systems but in some cases could be considered as a secondary protection layer. Where possible, the geomembrane should be attached to the concrete foundation since the performance of a composite barrier (i.e., geomembrane and concrete sealed together) is enhanced, compared to the sum of the components acting individually.

Geomembrane Barriers

Geomembrane barriers may consist of sheet-type membranes or spray-applied membranes (e.g., Liquid Boot, GeoSeal). Both sheet-type and spray-applied membranes have advantages and disadvantages with respect to constructability, performance and cost. The selection of the liner will depend on soil gas protection objectives, types of soil gases present (e.g., methane, petroleum vapours, chlorinated solvent vapours) and site specific factors. Where buildings are tanked and where water-proofing of foundations is required, an acceptable solution for gas protection may be a material that has a dual function as a water and gas barrier (e.g., CETCO Coreflex 60 or equivalent).

Design criteria for the selection of a geomembrane include chemical compatibility and resistance, gas transmission rate through the barrier, mechanical properties such as strength and ductility (i.e., ability to deform), thermal properties and long- term degradation (e.g., oxidation, stress-cracking).

The constructability and ability to connect geomembranes to foundations and utilities is an important consideration and sealing of service entries is particularly important. Spray-applied barriers can be advantageous in terms of sealing around multiple penetrations. There is a substantial loss in effectiveness when there are gaps and openings at geomembrane connections.

Damage during construction is of significant potential concern. Geomembrane barrier systems may require base or top protection layers consisting of geotextiles.

A quality assurance/quality control (QA/QC) program should be implemented to verify acceptable installation and performance.

Summary

The selection of the methane mitigation option will depend on the subsurface conditions and site development characteristics. There is a matrix for soil gas protection and a range of design combinations that are possible. Passive and wind-turbine methane protection systems will typically require a barrier to maintain acceptable performance, although if the methane concentration, flux and pressure are relatively low, a passive system without a barrier may be acceptable, provided that there is a high efficiency venting layer and well-sealed foundation slab. A passive system is typically a more desirable approach to mitigation since an active system requires on-going operation and maintenance. Nevertheless, it is considered good practice to design the passive venting system such that it could be readily converted to an active system, if required based on monitoring results.

Mitigation requirements may also depend on the sensitivity of the building to methane risk. For example, a large open warehouse building with a slab-at-grade foundation may warrant different measures than a building with below-grade enclosed spaces.

6.3 Overview of Design and Construction Issues

The main site development characteristics considered in design are the building size, type and foundations, with general information requirements listed in Table 2. Important considerations are whether the building has a basement, slab-at-grade construction or crawlspace, the complexity of the building design (e.g., is the basement slab at different elevations) and below-grade enclosed or confined spaces (e.g., sumps, vaults, etc.). The type of foundation is also important in that sealing of a geomembrane barrier is more challenging when buildings are constructed on caissons or piles, or when the ground floor slab includes grade beams or thickened edge slabs. Piles may also represent preferential pathways for upward migration of methane. Grade beams or variations in foundation elevations

also have implications for construction of subsurface piping systems. The details of the construction of the ground floor slab and utility penetrations will also be important. For example, separation cracks between a floating slab and wall, or voids surrounding service ducts entering the building should generally be sealed with caulk or expanding foam to prevent methane ingress.

Subsurface vent piping systems are connected to headers, which in turn are connected to vertical risers that typically are situated within the building (there is a greater stack effect when pipes are inside a heated building) and that extend to a roof-top vent or wind turbine. For active ventilation systems, an electrical-powered blower or fan is connected in-line to the riser pipes. For piping systems within buildings, there are code requirements that must be considered when specifying the pipe type and strength (typically steel) and pipe enclosures that may be required (i.e., a chaise for vertical pipe runs and soffit for horizontal pipe runs). There are design considerations for sealing of penetrations to prevent water ingress (e.g., roof). The design of piping systems within buildings should be conducted by mechanical and structural engineers, in conjunction with the architect. If blowers or other electrical components are to be installed, an electrical engineer should be part of the design team.

Other site development information that may be considered in the design is the surface cover and subsurface utilities. Surface cover that consists of asphaltic pavement or concrete will act as a cap and thus methane concentrations may build-up in areas with this type of cover. The potential capping effect will generally be much less significant in vegetated or landscaped areas.

For sites with higher methane concentrations and pressures, an active venting system may be warranted. An active venting system may or may not require a methane barrier depending on site conditions and venting design.

Table 2: Information Requirements for Methane Mitigation Design

	Required	Optional
Methane concentration	✓	
Methane pressure		✓
Methane flux		✓
Soil properties to evaluate pipe corrosion for applicable pipe construction (e.g., resistivity, pH)	✓	
Settlement	✓	
Depth to water table	✓	
Surface water drainage	✓	
Building use (residential, commercial, institutional, industrial)	✓	
Building size and height	✓	
Building details (basement, slab-at-grade, crawlspace)	✓	
Building foundation (piles, caissons, floor slab details)	✓	
Surface cover outside building footprint	✓	
Subsurface utilities (sumps, drains, sewers, vaults, etc.)	✓	

6.4 Conceptual Designs for Methane Mitigation Measures

This section provides a description of conceptual designs for methane mitigation at sites where methane has been identified to be present at levels that could pose explosion hazards in permanent structures.

The conceptual designs are provided in this document to illustrate typical design measures that are used for methane mitigation. As stated in Section 1.0 (page 1) of this document, it is the responsibility of the building design engineers to decide whether there is a need for methane mitigation based on their own evaluation of the site-specific methane data and the type of building construction, and, if so, to design an implement an appropriate methane mitigation strategy.

The minimum methane mitigation strategy for sites in the Toronto waterfront is considered to be a passive, provisionally active, venting system with an impervious barrier. A sheet geomembrane, spray-applied geomembrane (Liquid Boot or GeoSeal) or combination water and gas barrier (CETCO Coreflex 60 or equivalent) are considered to be acceptable options.

Conceptual design elements are described below assuming either basement or slab-at-grade construction (the design is not applicable to a crawlspace). As part of detailed design, these conceptual measures should be reviewed and revised, as warranted. Conceptual soil gas measures are illustrated in Figures 1 – 3 (Appendix B).

Methane Barrier Considerations

1) A continuous impervious geomembrane should be installed along the outside of below-grade walls and below the ground floor slab.

2) The impervious geomembrane should extend below elevator pits and sumps. Sump lids should be equipped with a gasketed seal.

3) Cracks, openings and utility penetrations (cables, conduits, pipes, etc.) in the subsurface foundation walls and base should be sealed with approved elastomeric sealant material.

4) The impervious geomembrane system should be designed to take into consideration possible total and differential settlement. Of particular importance are mechanical connections to structures that do not settle (e.g., pile caps).

Venting Pipe Considerations

5) The vent pipes may be constructed of perforated pipes or geocomposites (e.g., a polyethylene core wrapped with geotextile). Vent pipe layout and spacing will depend on project specific conditions.

6) The vent pipes should be placed within a permeable sand or gravel venting layer, or alternately, a plastic domework aerated sub-floor should be installed.

7) Depending on possible settlement, vent pipes may need to be hung from the underside of the slab using pipe hangers. Keeping vent pipes tight below the concrete slab provides for more efficient venting of the void space that is created. Penetrations of the geomembrane by pipe hangers should be sealed.

8) Vent pipe laterals should be connected to headers, which in turn should be connected to risers. Often multiple pipe laterals are connected to a header and riser. Good design practice is to specify a larger diameter for pipe headers than pipe laterals.

9) Clean-outs should generally be installed at low points in the piping system.

10) Solid non-perforated portions of the vent pipe should slope downwards to the perforated section of the pipe at a continuous grade of typically 1% or greater to enable the pipe to drain.

11) Condensate traps or drains may be required depending on the design.

12) Subsurface piping may require consideration of corrosion based on soil properties depending on pipe construction (e.g., soil resistivity, pH).

13) Risers on building roofs should terminate a minimum of 0.6 m above roof eaves, and a minimum of 3 m from windows, doors, air intakes or other openings to the building. The pipe should be appropriately secured to walls and supported in accordance with applicable codes. Risers in outdoor areas should be terminated a minimum of 4 m above ground level. Risers may be secured to lamp-posts or other structures.

14) Risers should be terminated to prevent rainwater ingress (*i.e.*, rain cap or goose-necked), unless connected to a wind-turbine.

15) The piping system should be designed to take into consideration possible total and differential settlement. Where warranted, flexible expansion joints or connectors should be installed.

16) Depending on the design objectives, a permanent de-watering system consisting of perforated pipes, gravel, sump pumps and pits may be required. The de-watering system should be designed to permanently maintain the groundwater level 30 centimetres below the sub-slab vent system.

Monitoring Considerations

17) A soil gas sampling port should be installed on each riser pipe in an accessible location. The need for additional soil gas sampling ports installed below the building slab should be considered. Each riser pipe should be labelled as methane collection pipe and given a unique identifier.

18) All buildings and structures should generally be equipped with one or more sensors that, in the occupied space of the building, measures methane for detection and early warning to occupants when gas concentrations exceed a threshold of concern. The warning should be through an audible and visible signal.

19) Soil gas pressure sensors may be considered as an optional measure.

Utilities

20) Trench dams should be installed within utility trenches to minimize the lateral movement of methane within trenches. Trench dams are typically constructed using a soil-bentonite mixture.

21) Subsurface utilities such as manholes, sumps and vaults in areas outside of the building footprint should be designed to minimize the ingress of methane. Where warranted, utilities should be vented. Confined space procedures should be followed where such procedures apply (specification of confined space procedures is beyond the scope of this document). There should be appropriate labelling of confined spaces and venting mitigation works to indicate potential hazardous soil gas conditions.

Miscellaneous

22) Sufficient space should be set aside and electrical power should be roughed in such that an active extraction blower system could be readily installed, if required.

23) Paved areas may require methane mitigation measures depending on the size of the area. Methane mitigation is warranted to prevent build-up and lateral migration of methane, potentially to below buildings or other possibly sensitive areas (e.g., parks).

Diagrams illustrating a conceptual methane mitigation design are included in Appendix B.

6.5 Construction Monitoring and Quality Control Testing

Construction monitoring and quality control testing are important aspects of a methane mitigation project. The scope of such monitoring will depend on the system design, but generally will include verification of materials to ensure compliance with specifications and conduct of tests to verify system performance. For geomembrane barriers, this will typically include the testing of barrier thickness, strength, and integrity, through for example smoke tests. Monitoring and quality control testing should be conducted by qualified personnel.

6.6 Monitoring Measures Post Installation

Site owners and their consultants may need to prepare a monitoring and contingency plan for soil gas mitigation measures. The scope of such plans will

depend on the site specific conditions (e.g., methane concentrations), the type of development and building details, and type of mitigation system (e.g., passive versus active).

Passive Systems

An initial post-construction, pre-occupancy inspection and testing program should be conducted. Typically, follow-up monitoring is conducted over a duration that is sufficiently long to establish trends and confirm acceptable performance (e.g., half a year to year). If monitoring results indicate acceptable conditions, monitoring may be discontinued. The monitoring frequency is often quarterly, but more or less frequent monitoring may be justified based on site specific conditions.

The scope of the monitoring program will depend on site specific conditions and system details, but should typically include the following:

1) Concentrations of combustible gas (catalytic type detector calibrated to methane) or methane (infrared detector), carbon dioxide, oxygen (and other gases, as applicable) in soil gas vent pipes, monitoring ports and spot measurements inside buildings, accessible utilities, sumps and clean-outs.

2) The condition of visible components of the methane mitigation system (e.g., wind turbines, vent pipes, monitoring ports). Note whether wind turbines are rotating during the monitoring event, if applicable.

3) Differential pressure between the interior of the building and soil gas at monitoring ports (manometer with 0.01 inches water column resolution), if applicable.

4) Weather data from the nearest Environment Canada weather station (Toronto Island) should be obtained because weather conditions (e.g., barometric pressure, wind) could affect monitoring results.

Active Systems

Active systems require commissioning followed by on-going maintenance and inspection, as required. The monitoring scope will be similar to a passive system, except that data on operating parameters (e.g., flow rate, vacuum, etc.) is also obtained.

Methane Monitoring and Alarm Devices

Consideration may be given to the installation of methane sensors in buildings and enclosed structures (e.g., mechanical vaults). Sensor types may be either combustible gas (catalytic bead) or methane (infrared diffusion) and the range should be 0 to 100% LEL (calibrated to methane). The warning should be through an audible and visible signal. The set-points will depend on project specific conditions, but typically when 10% of the LEL is exceeded in buildings, the auto- dialler alerts maintenance personnel, and when 20% is exceeded, a strobe and audible alarm is activated for evacuation. Combustible gas sensors should be maintained and calibrated in accordance with manufacturer's recommendations.

Contingency Plan

The monitoring plan should establish a threshold for contingent actions based on methane concentrations and pressures (as applicable) in soil gas vents and subslab monitoring ports. If the threshold is exceeded, more frequent monitoring, and as warranted, modifications to the venting system including possible conversion to an active venting may be considered. If damage to the mitigation system is noted during site visits, the system should be repaired. Any intrusive activities at the site such as excavation should take into consideration subsurface soil gas mitigation components (as well all other utilities and structures).

Regulatory Considerations

Methane mitigation systems relying on vent pipes to discharge methane from the subsurface to the atmosphere may require a MOE Certificate of Approval issued under Section IX (Air) of the Environmental Protection Act. Owners and installers of such systems should confirm this requirement and ensure that the conditions of the C of A, if required, are followed.

7.0 LIMITATIONS AND USE OF REPORT

The recommendations in this report are limited to recommended mitigation design to address potential safety hazards associated with methane for planned construction in the DWA. Golder is not responsible for ensuring in any manner that these recommendations are appropriately applied and is not liable for any property damage, injury or loss of revenue associated with an individual's or a company's misapplication of these recommendations or a failure to implement safe working and occupancy conditions where and when appropriate.

8.0 REFERENCES

- Dillon, 2007. Phase I Environmental Site Assessment City of Toronto Economic Development Corporation (TEDCO) Lands - East Bayfront, dated July 27, 2007.
- Dillon, 2008. Phase II Environmental Site Assessment (May 2008 Update), TEDCO Lands - East Bayfront, May 2008.
- UK Construction Industry Research and Information Association (CIRIA), 2007 - "Assessing risks posed by hazardous ground gases to buildings" (C665).
- Health Canada, 2009. Protocols for soil gas measurement.

Report Signature Page

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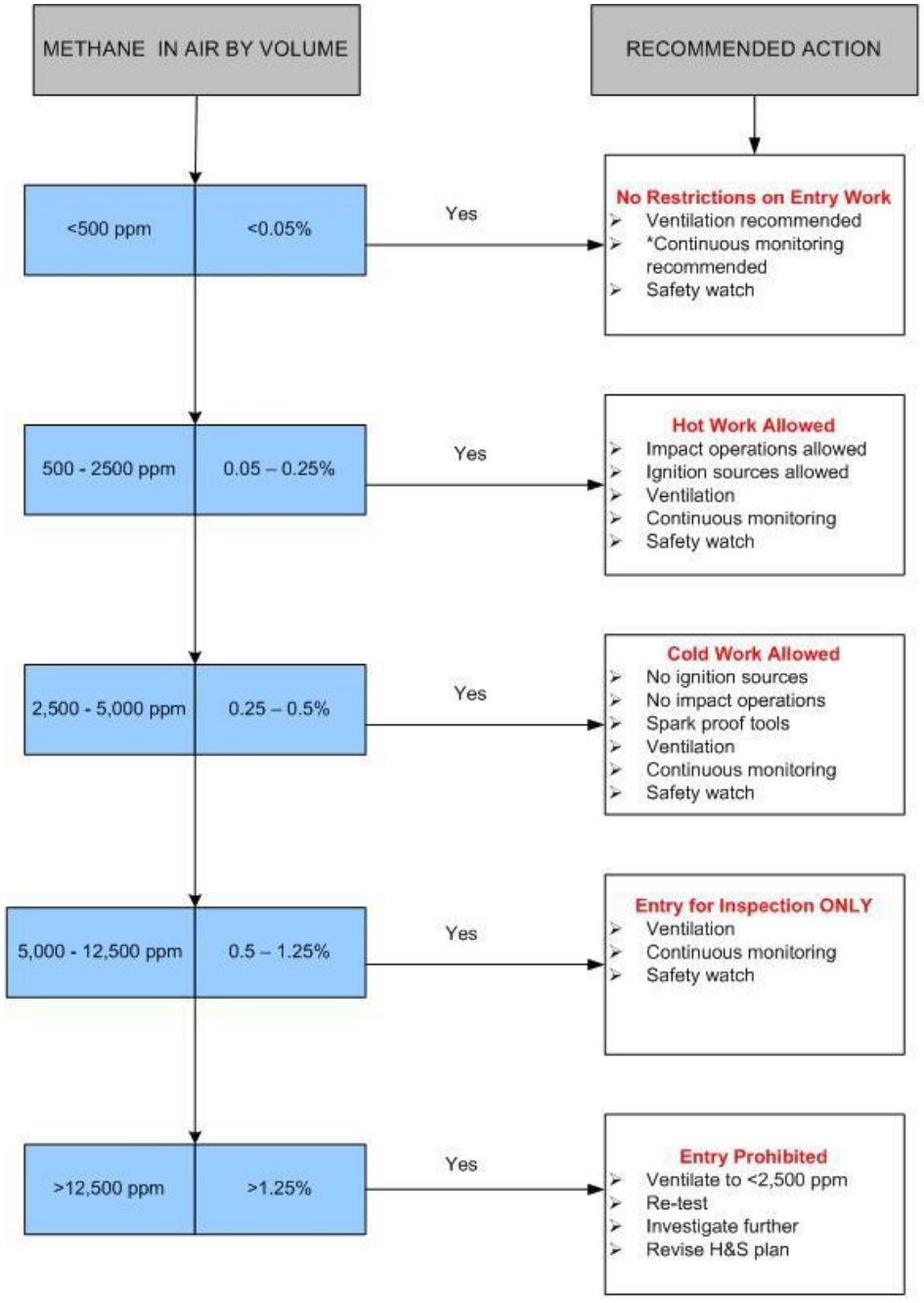
APPENDIX A

Methane Decision Matrix during Construction Activity

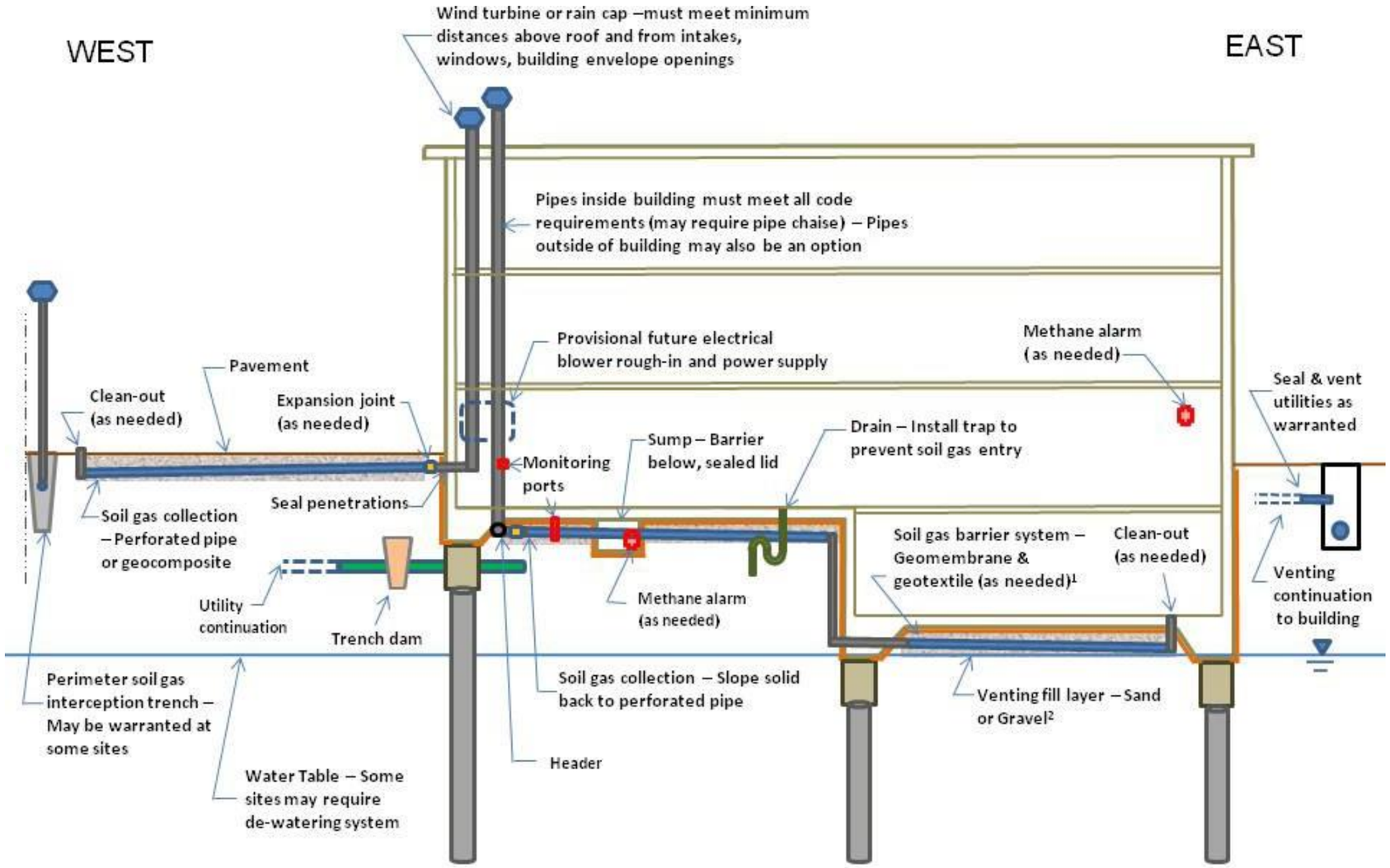
Methane Decision Matrix during Construction Activity



Notes:
* Continuous Monitoring – Frequency of measurements to be determined on site specific basis but should include at a minimum measurements immediately prior to ground breaking and at various times during the specific construction activity
5% methane = lower explosive limit (LEL)
1% methane = 20% of LEL

APPENDIX B

Conceptual Methane Mitigation Design



Notes:
[1] For tanked buildings, a combination of water and gas barrier may be an option
[2] Depending on water table fluctuations and building drainage, venting below water table may not be required

Figure 1. Conceptual Soil Gas Mitigation Measures East West Cross Section View

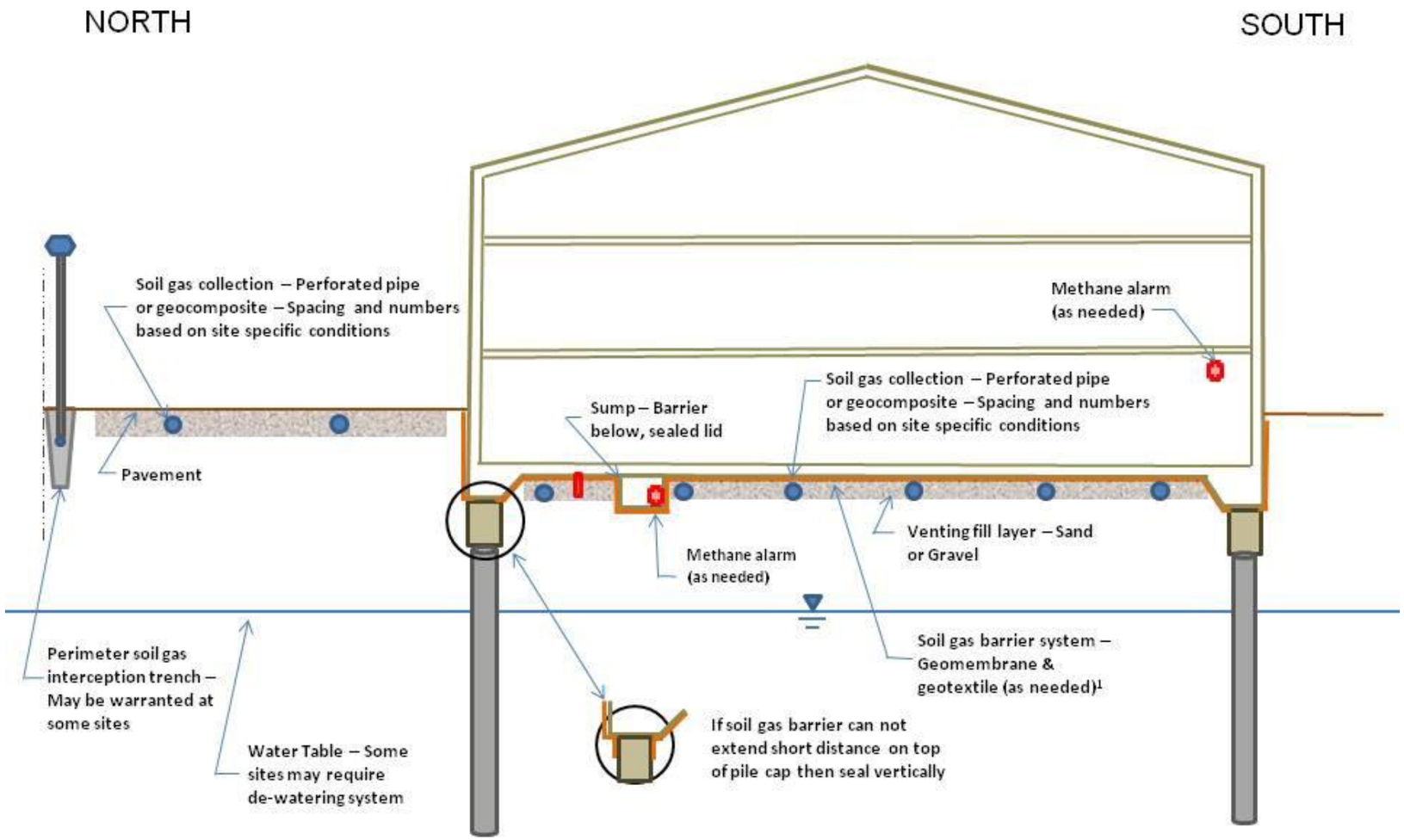


Figure 2. Conceptual Soil Gas Mitigation Measures North-South Cross Section View

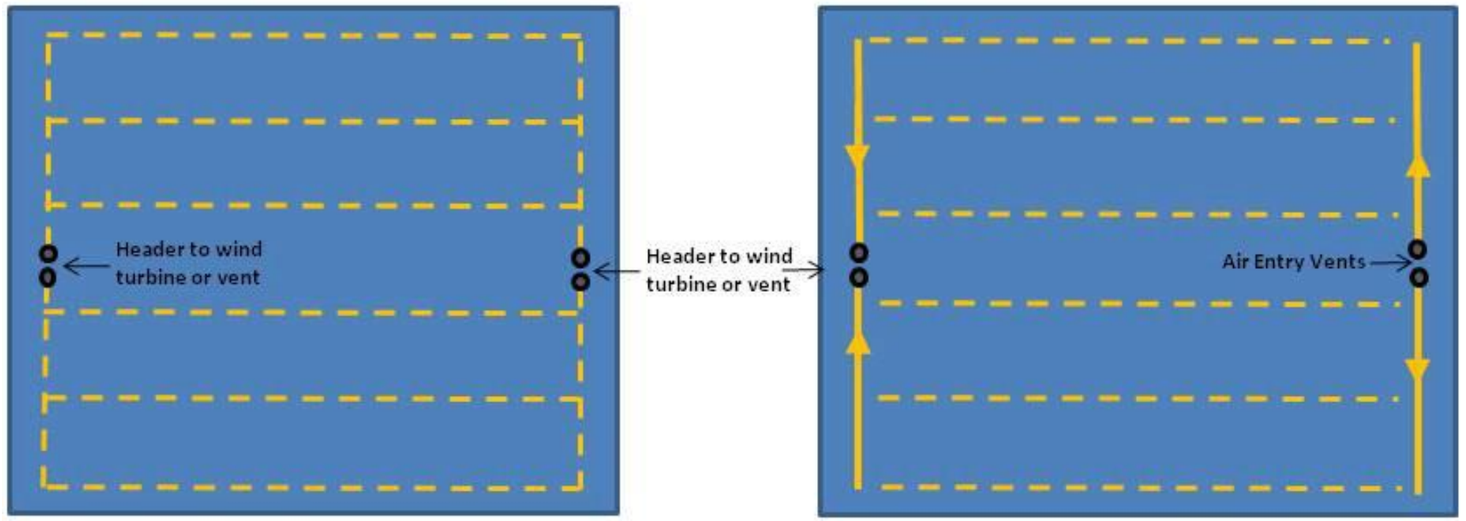


Figure 3. Conceptual Soil Gas Mitigation Possible Vent Pipe Layout Plan View

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

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Golder Associates

APPENDIX E

Waterfront Toronto
Environmental Management Plan
Quarterly Update Documentation Requirements

Waterfront Toronto
Environmental Management Plan
Quarterly Update Documentation Requirements

Per section 5 of Waterfront Toronto's Environmental Management Plan (EMP), we are requesting Quarterly Update Reports about your project. Please complete the following:

1. Complete page 1 with basic contact information;
2. Review page 2 "Checklist for Submission" to identify which Quarterly Update Reports we require from your company;
3. Complete the required Quarterly Update Report forms provided to you below starting at page 3.

Please fill out the following information,

Responsible CM: _____

Site/Project: _____

Submitted by: (name) _____

Company: _____

Date Submitted: _____

Reporting Period: _____

Please see page 2 for full submission checklist.

Checklist for Submission

Applicable	Attached	Environmental Protection Plan
☐	☐	**Air Quality and Dust Control Plan** Quarterly Update Report, including: Summary of Dust Control Monitoring Logs
☐	☐	**Archaeological Monitoring Protocol** Quarterly Update Report
☐	☐	**Soil Management Plan** Quarterly Update Report, including: Quantity and Percentage of Soil sent to Recycling Facility Materials used from Treatment Facility
☐	☐	**Sediment Control Plan** Quarterly Update Report, including: Copies of Photographs or drawings to document the ESC measures implemented on site
☐	☐	**Fuel and Lubricant Management Plan** Quarterly Update Report, including: Use of Alternative Vehicles
☐	☐	**Groundwater Management Plan** Quarterly Update Report
☐	☐	**Methane Monitoring and Control Plan** Quarterly Update Report
☐	☐	**Noise and Vibration Management Plan** Quarterly Update Report
☐	☐	**Waste Management and Waste Reduction Work Plan** Quarterly Update Report, including: Percentage of recycled content used for asphalt pavement, aggregate base and sub base
☐	☐	**A Stormwater and Surface Water Management Plan** Quarterly Update Report, including: Submit any changes/modifications to the Stormwater and Surface Management Plan
☐	☐	**Traffic Management Plan** Quarterly Update Report
☐	☐	**Vegetation Management Plan** Quarterly Update Report
☐	☐	**Wildlife Management Plan** Quarterly Update Report
☐	☐	**Spill Prevention and Contingency Plan** Emergency Response Plan

WATERFRONToronto

Air Quality and Dust Management Quarterly Update Report

☐ **Check here if contact information is same as page 1**

Contractor: _____ **Date Submitted:** _____

Submitted by: (name) _____ **Reporting Period:** _____

Company: _____

Checklist

☐ Summary of Dust Control Monitoring logs
☐ Issues encountered
☐ Mitigation measures implemented

Please provide a summary of the dust monitoring logs including any issues encountered and mitigation measures implemented.

Dust monitoring logs:

For Waterfront Toronto Use only:	
Received by:	
Received on:	

Issues encountered:

Mitigation measures implemented:

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Archaeological and Building Heritage Resource Management Quarterly Update Report

☐ **Check here if contact information is same as page 1**

Contractor: _____ **Date Submitted:** _____

Submitted by: (name) _____ **Reporting Period:** _____

Company: _____

Were any unexpected archaeological resources discovered?

☐ Yes (Please provide details below)

☐ No

If unexpected archaeological resources were discovered, please provide details including evaluation of significance.

For Waterfront Toronto Use only:	
Received by:	
Received on:	

WATERFRONToronto

Contaminated Soils Management Quarterly Update Report

☐ **Check here if contact information is same as page 1**

Contractor: _____ **Date Submitted:** _____

Submitted by: (name) _____ **Reporting Period:** _____

Company: _____

Checklist

☐ Summary of Soil Management Plan activities
☐ Issues encountered
☐ Mitigation measures implemented
☐ Summary of excavated soils quantities and percentages

Please provide a summary of Soil Management Plan activities undertaken, issues encountered, and mitigation measures implemented

Soil Management Plan activities:

For Waterfront Toronto Use only:	
Received by:	
Received on:	

Issues encountered:

Mitigation measures implemented:

Please fill in the following information, as per section 7.3.6 of the EMP

Quantity of excavated soil sent to landfill

_____ m^3

Quantity of excavated soil sent to the Waterfront Green Soils Treatment Facility

_____ m^3

Percentage of excavated soil sent to the Waterfront Green Soils Treatment Facility

_____ %

Quantity of soil left on-site through RA / RM

_____ m^3

Quantity of virgin aggregate / unshrinkable backfill used on site

_____ m^2

Quantity of suitable backfill material from the Waterfront Green Soils Treatment Facility used on site

_____ m^3

Percentage of backfill material used from the Waterfront Green Soils Treatment Facility

_____ %

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Erosion and Sediment Control Quarterly Update Report

☐ **Check here if contact information is same as page 1**

Contractor: _____ **Date Submitted:** _____

Submitted by: (name) _____ **Reporting Period:** _____

Company: _____

Checklist

☐ Summary of Erosion and Sedimentation Control Plan activities
☐ Issues encountered
☐ Mitigation measures implemented
☐ Copies of photographs or drawings to document the ESC measures

---

Please provide a summary of Sedimentation Control Plan activities undertaken, issues encountered, and mitigation measures implemented

Sedimentation Control Plan activities:

For Waterfront Toronto Use only:	
Received by:	
Received on:	

Issues encountered:

Mitigation measures implemented:

Please indicate if copies of photographs or drawings to document the ESC measures implemented on the site, or a representative sample thereof, are attached to this Quarterly Update Report. If not, please let us know how we can access such photographs or drawings

WATERFRONTToronto

Fuel and Lubricants Management Quarterly Update Report

☐ **Check here if contact information is same as page 1**

Contractor: _____ **Date Submitted:** _____

Submitted by: (name) _____ **Reporting Period:** _____

Company: _____

Checklist

☐ Summary of fuel and lubricant management activities
☐ Issues encountered
☐ Mitigation measures implemented
☐ Provide information on use of alternative vehicles (such as electric or biodiesel)

Please provide a summary of Fuel and Lubricant Management activities undertaken, any issues encountered and mitigation measures implemented

Fuel and Lubricant Management activities:

For Waterfront Toronto Use only:	
Received by:	
Received on:	

Issues encountered:

Mitigation measures implemented:

Please provide information on the use of alternative vehicles

Were alternative vehicles used on site?

☐ *Yes*

☐ *No*

If yes, please provide details regarding the type of alternative vehicle used (electric, biodiesel, hybrid, etc.)

WATERFRONToronto

Groundwater Management Quarterly Update Report

☐ **Check here if contact information is same as page 1**

Contractor: _____ **Date Submitted:** _____

Submitted by: (name) _____ **Reporting Period:** _____

Company: _____

Checklist

☐ Summary of Groundwater Management Plan activities
☐ Issues encountered
☐ Mitigation measures implemented

Please provide a summary of the Groundwater Management Plan activities undertaken, issues encountered and mitigation measures implemented

Groundwater Management Plan activities:

For Waterfront Toronto Use only:	
Received by:	
Received on:	

Issues encountered:

Mitigation measures implemented:

WATERFRONTToronto

Methane Control
Quarterly Update Report

☐ **Check here if contact information is same as page 1**

Contractor: _____ **Date Submitted:** _____

Submitted by: (name) _____ **Reporting Period:** _____

Company: _____

Checklist

☐ Summary of methane monitoring and control plan activities
☐ Issues encountered
☐ Mitigation measures implemented

Please provide a summary of Methane Monitoring and Control Plan activities undertaken, issues encountered and mitigation measures implemented

Methane Monitoring and Control Plan activities:

For Waterfront Toronto Use only:	
Received by:	
Received on:	

Issues encountered:

Mitigation measures implemented:

Noise and Vibration Management
Quarterly Update Report

☐ **Check here if contact information is same as page 1**

Contractor: _____ **Date Submitted:** _____

Submitted by: (name) _____ **Reporting Period:** _____

Company: _____

Checklist

☐ Summary of noise and vibration management
☐ Issues encountered
☐ Mitigation measures implemented

Please provide a summary of Noise and Vibration Management activities undertaken, issues encountered and mitigation measures implemented

Noise and Vibration Management activities:

For Waterfront Toronto Use only:	
Received by:	
Received on:	

Issues encountered:

Mitigation measures implemented:

Project-Related Waste Management Quarterly Update Report

☐ **Check here if contact information is same as page 1**

Contractor: _____ **Date Submitted:** _____

Submitted by: (name) _____ **Reporting Period:** _____

Company: _____

Checklist

☐ Summary of daily maintenance and monitoring of project waste management
☐ Percentage of recycled content

Please provide a summary of the daily maintenance and monitoring of project waste management as per section 7.9.6 of the Waterfront Toronto EMP

Identification of materials that will be diverted and/or stored on-site or commingled:

For Waterfront Toronto Use only:	
Received by:	
Received on:	

Please complete the following:

A table of the construction and demolition debris, including a general description of each category of waste generated, the quantity in tons or cubic yards, and the location of receiving agent (recycler / landfill) for waste.

Categories of waste generated	*Quantity (in tons or cubic yards)*	*Location of receiving agent for waste*

Please calculate the total percentage of material diverted from landfill disposal.

Type of material	*% diverted from landfill*

Please refer us to any relevant backup documentation by listing it here:

Please provide the percentage of recycled content used for asphalt pavement, aggregate bases, and sub base.

Asphalt Pavement _____ %

Aggregate Bases _____ %

Sub Base __ %

WATERFRONToronto

Stormwater/Surface Water Management
Quarterly Update Report

☐ **Check here if contact information is same as page 1**

Contractor: _____ **Date Submitted:** _____

Submitted by: (name) _____ **Reporting Period:** _____

Company: _____

Checklist

☐ Summary of Stormwater and Surface Water Management activities
☐ Issues encountered
☐ Mitigation measures implemented
☐ Changes to the Stormwater and Surface Water Management Plan

---

Please provide a summary of stormwater and surface water management measures implemented, issues encountered, and mitigation measures implemented.

Stormwater and Surface Water Management measures:

For Waterfront Toronto Use only:	
Received by:	
Received on:	

Issues encountered:

Mitigation measures implemented:

Please submit any changes / modifications to the Stormwater and Surface Water Management plan as they occur (as necessary throughout all phases of the project to address changing conditions).

Were there any changes to the Stormwater and Surface Water Management Plan?

☐ Yes
☐ No

If yes, please describe any changes

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Traffic Management Quarterly Update Report

☐ **Check here if contact information is same as page 1**

Contractor: _____ **Date Submitted:** _____

Submitted by: (name) _____ **Reporting Period:** _____

Company: _____

Checklist

☐ Summary of Traffic Management Measures
☐ Traffic and Parking complaints
☐ Mitigation measures implemented

Please provide a summary of traffic management measures used to minimize disruption to local residents and businesses, any traffic and parking complaints, and mitigation measures implemented.

Traffic management measures used to minimize disruption to local residents and businesses

Were there any traffic and parking complaints?

☐ Yes
☐ No

For Waterfront Toronto Use only:	
Received by:	
Received on:	

If yes, please provide details below:

Mitigation measures implemented:

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Vegetation Management Quarterly Update Report

☐ **Check here if contact information is same as page 1**

Contractor: _____ **Date Submitted:** _____

Submitted by: (name) _____ **Reporting Period:** _____

Company: _____

Checklist

☐ Summary of vegetation management activities
☐ Issues encountered
☐ Mitigation measures implemented

Please provide a summary of vegetation management activities undertaken, issues encountered, and mitigation measures implemented.

Vegetation management activities:

For Waterfront Toronto Use only:	
Received by:	
Received on:	

Issues encountered:

Mitigation measures implemented:

WATERFRONToronto

Wildlife Management
Quarterly Update Report

☐ **Check here if contact information is same as page 1**

Contractor: _____ **Date Submitted:** _____

Submitted by: (name) _____ **Reporting Period:** _____

Company: _____

Checklist

☐ Summary of wildlife management activities
☐ Issues encountered
☐ Mitigation measures implemented

Please provide a summary of wildlife management activities undertaken, issues encountered, and mitigation measures implemented.

Wildlife Management activities

For Waterfront Toronto Use only:	
Received by:	
Received on:	

Issues encountered:

Mitigation measures implemented:
