DESIGN AND OPERATIONS PLAN

McDOUGALL LANDFILL SITE
MUNICIPALITY OF McDOUGALL, ONTARIO

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1.0 INTRODUCTION

1.1 BACKGROUND

Conestoga-Rovers & Associates (CRA) on behalf of the Corporation of the Municipality of McDougall has prepared the following Design and Operations Plan (D&O) in support of the Municipal Landfill Expansion at the McDougall Landfill Site, Township of McDougall, Ontario.

The McDougall Landfill Site (Site) is a municipal waste management facility owned by the Corporation of the Municipality of McDougall. The Site is located on Part Lots 11 and 12, Concession 4 in the Township of McDougall, District of Parry Sound.

The Site serves as a solid non-hazardous waste disposal facility for the Municipality of McDougall, and surrounding municipalities. The Site service area includes Municipality of McDougall, Town of Parry Sound, Township of the Archipelago, Township of Seguin, Township of McKeller, and Township of Carling.

Landfilling at the Site commenced in 1976. The Site was originally owned and operated by a private company. The Ministry of the Environment (MOE) required that the Municipality of McDougall (Municipality) assume ownership of the Site and subsequently issued an Emergency C of A No. A522101 to the Municipality on September 25, 1989, which came into force on October 1, 1989. This C of A provided for the continued operation of the Site for a period of 2 years, ending September 28, 1991, and was subsequently extended to November 30, 1991. The MOE further amended the C of A on November 29, 1991, to allow for continued use of the Site up to the Site's originally approved capacity and a requirement for the submission of a plan to construct a containment cell and move the existing landfilled waste to the containment cell. The November 29, 1991 C of A amendment revoked all previous C of A's issued for the Site. The November 29, 1991 C of A (Appendix A) has been amended as follows:

- on February 21, 1992, a Notice was issued amending the C of A to provide additional time to submit the required plan;
- on June 29, 1992, a Notice was issued amending the C of A to provide additional time to submit the required plan;
- on January 25, 1993, a Notice was issued amending the C of A to include conditions detailing the leachate recovery and recirculation program, the waste excavation and screening procedure, and requiring a long-term leachate disposal strategy;

- on April 21, 1994, a Notice was issued amending the C of A to include conditions detailing the design of the containment cell, and the Site closure date (June 30, 2000);
- on November 21, 1996, a Notice was issued amending the C of A to include conditions detailing groundwater and surface water monitoring programs;
- on December 23, 1996, a Notice was issued amending the C of A to allow continued use of the Site to the revised final contours; and
- on November 16, 2005, a Notice was issued amending the C of A to permit landfilling on an emergency basis up to a revised Site capacity of 329,000 cubic metres (m^3) and to include a requirement for the submission of a progress report with respect to the long-term disposal options by December 31, 2006.

On March 1, 2006, the Ontario Ministry of the Environment gave approval of an Environmental Assessment of the proposed expansion of the McDougall Landfill Site by Order in Council 523/2006. This approval enables the Municipality to proceed with the preparation of the technical studies and application under the Environment Protection Act (EPA) for the expansion of the Landfill Site. The Design and Operations Plan (D&O) presented herein is one of the technical documents prepared in support of the EPA Application.

A copy of the Order in Council 523/2006 is provided in Appendix B.

1.2 SITE DESCRIPTION

The McDougall Landfill Site is currently approved for the use and operation of a 7.0 hectare municipal waste disposal Landfill within a total Site area of 77.56 hectares. The Site is located on Part Lots 11 and 12, Concession 4 in the Township of McDougall, District of Parry Sound and consist of Part 1 as per Registered Plan 150379, Parts 1 and 2 as per Registered Plan 42R-2573 and Parts 1 and 4 as per Registered Plan 42R-13880. A copy of the legal plans are provided in Appendix C. Additionally, the contaminate attenuation zone (CAZ) extends easterly onto the Oxley Wet Land. The CAZ is approximately 56.65 ha. in size.

The Site was originally designed and operated as a natural attenuation landfill. In 1994, the landfill was mined and the waste remaining after exhumation was placed in a lined landfill with a footprint of approximately 3.3 hectares and approved capacity of 312,710 m^3. This approved capacity was increased to 329,600 m^3 through the development of a Short-term Landfill Capacity Increase, as detailed in CRA October 2005 Report and approved in a C of A Amendment dated November 2005. With the

Short-term Landfill Capacity Increase, the existing Landfill is expected to reach capacity by January 2008.

In March 2006, the Environmental Assessment for the proposed expansion of the Site was approved. This approval sought expansion of the landfill capacity by approximately 678,738 m^3.
Concurrent and independent of approvals for expansion of the Landfill footprint and increased waste capacity, a Compliance Plan was developed for the Site in May 2005 to continue to address historical environmental concerns with the existing Site observed prior to ownership by the Municipality in 1989. These concerns are primarily related to stockpiled fines generated when the waste was mined and exhumed as a remedial activity by the Municipality in 1994, performance of the purge well to address residual groundwater impacts, and surface water and groundwater compliance locations and monitoring program.

In May 2006, the final Compliance Plan Summary Report (Compliance Plan) prepared by CRA was submitted to MOE. The Compliance Plan addressed the environmental concerns at the Site through:

- use of fines for daily and interim cover soil;
- modification to the existing groundwater and surface water monitoring programs;
- expansion of Site buffer zones to include additional lands owned by the Municipality;
- expansion of the Contaminant Attenuation Zone (CAZ) onto the Oxley Wetland;
- modification to the Landfill development sequence along the west side of the existing landfill;
- modification to the surface water ditches and ponds; and
- implementation of an iron-reduction groundwater extraction and treatment system.

A amendment to the CofA to allow implementation of the Compliance Plan works was issued by the MOE on September 26, 2006.
The Site limits and contaminant attenuation zone are shown on Drawing No. C-02 (Appendix L).

The Site abuts an aggregate pit to the west, undeveloped land to the north and a mixture of undeveloped land and residential properties to the east and south. McDougall Road is adjacent to the south portion of the Site and transects the southeast portion of the Site. Beyond the Site limits, McDougall road is adjacent to the north side to the CAZ. Access

to the Site is gained via McDougall Road. The landfill footprint is set back approximately 170 metres northwest of McDougall Road and is well screened by local topography and vegetation. A weigh scale, office, and equipment shed are located along the Site access road to the landfill. An area referred to as the "Front Pit" is located east of the Landfill within the developed area of the Site. The "Front Pit" is low-lying area, which is remnant of historic aggregate extraction operations at the Site.

The existing conditions at the Site in November 2004 are shown on drawing C-01 (Appendix L).

1.3 OBJECTIVE OF REPORT

The following report has been prepared in support of a Part V Application made under the Environmental Protection Act (EPA) to amend Provisional C of A No. A522101 to accommodate additional capacity in the McDougall Landfill. This report is also prepared in support of an amendment of Certificate of Approval for a Sewage Number 3-0178-94-006 issued under Section 53 of the Ontario Water Resources Act for implementation of the surface water management works.

1.3.1 ENVIRONMENTAL ASSESSMENT ACT

The Terms of Reference for completion of an individual Environmental Assessment (EA) for the proposed Municipal Landfill Expansion were completed and approved by the Minister of the Environment on June 30, 2004.

The Environmental Assessment for One or More Waste Disposal Solutions for the Municipality of McDougall and Other Area Municipalities (EA Report) was submitted by CRA to the Ministry of the Environment (MOE) in final in June 2005. The EA Report was prepared in accordance with the requirements of the Environmental Assessment Act (EAA) to enable the Municipality of McDougall to proceed with the landfill expansion being considered.

On March 1, 2006, the proposed Expansion of the McDougall Landfill was designated under the EAA under Order in Council 523/2006.

1.3.2 ENVIRONMENTAL PROTECTION ACT

In addition to this D&O Plan, an Expansion Cell Incremental Impact Assessment Report is being submitted to the MOE to form part of the supporting documentation to the Part V EPA Application. The Expansion Cell Incremental Impact Assessment (Incremental Impact Assessment) and the D&O have been prepared to meet the requirements of Ontario Regulation 232/98. The Incremental Impact Assessment was built on the current hydrogeologic knowledge of the Site and presents how the Expansion Cell will fit into and react within the existing groundwater regime at the Site. The D&O presents the design and operational procedures for the Site.

The Part V EPA Application is subject to application fees as stipulated in Ontario Regulation 363/98.

1.3.3 ONTARIO WATER RESOURCES ACT

An Application to amend the existing Certificate of Approval for Sewage Number 3-0178-94-006 issued under Section 53 of the Ontario Water Resources Act (OWRA) is being prepared and will be submitted in the Fall of 2006 to obtain approval for implementation of the surface water management works and the groundwater treatment and leachate treatment systems proposed for the Site. Section 8.0 of this D&O will form part of the supporting documentation for the Section 53 OWRA Approval Application and provides details on the surface water management works proposed for the Site. Supporting documentation for sewage works related to groundwater and leachate treatment will be submitted under separate cover in support of the Application.

The OWRA Section 53 Application is subject to application fees as stipulated in Ontario Regulation 364/98.

1.3.4 PUBLIC CONSULTATION

In accordance with Condition 8 of the EAA Approval , the Draft D&O Plan was made available for public viewing for a period of not less than 30 days before submission to the Ministry of the Environment. The Draft D&O Plan was made available from June 10, 2006 to July 10, 2006, at the McDougall Municipal Office, #5 Fire Route 113, Nobel, Ontario and from June 19, 2006 to July 10, 2006 on the Municipalities website at http://www.municipalityofmcdougall.com/

To facilitate public review of the Draft D&O Plan, the Municipality of McDougall held a Public Information Open House on Saturday June 10, 2006, at the McDougall Municipal Offices. A Notice of Invitation to comment on the D&O and a Public Information Open House (PIOH) was advertised in the Beacon Star on May 20, 2006 and the Parry Sound North Star on Wednesday June 7, 2006. Copies of these notices are provided in Appendix D. In addition to general notices, a letter providing notice of the availability of the D&O and PIOH was distributed to the seven First Nations and five residential properties located in the vicinity of the Site. In accordance with Condition 6 of the EAA Approval, this letter also invited interested parties to join the Public Liaison Committee, which would serve as a focus point for disseminations; review and exchange of information and monitoring results relevant to the operation of the Landfill. The distribution list for the letter of notice and a copy of the letter is provided in Appendix D.

A summary of the Public Consultation activities and public comments received are summarized in Appendix D.

1.4 REPORT ORGANIZATION

This Design and Operations Plan is organized into the following sections:

- Section 1.0 Introduction;
- Section 2.0 Design Considerations;
- Section 3.0 Site Design;
- Section 4.0 Landfill Volumes;
- Section 5.0 Site Life;
- Section 6.0 Site Development;
- Section 7.0 Groundwater/Leachate Management Plan;
- Section 8.0 Surface Water Management Plan;
- Section 9.0 Landfill Gas Assessment and Management Plan;
- Section 10.0 Site Facilities;
- Section 11.0 Site Operation; and
- Section 12.0 Site Monitoring.

1.5 OTHER REPORTS

A list of reports referenced throughout the D&O are provided at the end of the report.

2.0 DESIGN CONSIDERATIONS

2.1 OFFICIAL PLAN DESIGINATION

The Official Plan (OP) governing the Site is the Municipality of McDougall Official Plan dated December 2004. Section 15.02 of the OP, "Landfill Impact Area", recognizes that some lands near the existing McDougall Landfill Site may be impacted by leachate-impacted groundwater migrating from the Site. Lands within the Landfill Impacted Area are designated as "Rural" and "Environmentally Sensitive". The policy further states that lands within the Landfill Impacted Area have been placed in a "Holding Zone" pending the outcome of investigations to assess any environmental impacts and the lands will remain designated as Holding Zone until the Municipality is satisfied that water quality issues have been properly addressed.

Official Plan Amendment 55 passed by Municipal By-law 2001-26 provided that certain lands within the vicinity of the McDougall Landfill Site also be placed in the "Holding Zone" pending the outcome of investigations to assess any environmental impacts.

2.2 ZONING DESIGINATION

The Zoning By-law governing the Site is the Municipality of McDougall By-law 2004-50. The McDougall Landfill Site is zoned "Waste Disposal (M5) Zone". The Waste Disposal (M5) Zone allows for a solid waste collection, sorting, processing and disposal area, a waste transfer station, a recycling facility, and accessory structures.

As previously noted Municipal By-law 2001-26 placed a Holding Zone on the Site and all lands around the Site. The Holding Zone (H) is applied in addition to other existing zoning and flags the presence of the landfill site. The Landfill Site is therefore zoned as M5-H.

2.3 SUMMARY OF SITE SETTING

The following section summarizes the Site setting with respect to topography, surface water, geology, and hydrogeology. Additional information on the physical Site setting is provided in detail in the Compliance Plan Summary Report (CRA, 2006) and the Expansion Cell Incremental Impact Assessment (CRA, 2006).

2.3.1 TOPOGRAPHY

The topography in the vicinity of the Site is hummocky and irregular. The Site is located in the Canadian Shield geographic region of Canada, characterized by rugged topography with low hills, many lakes, and many bedrock exposures of granite or other igneous or metamorphic rocks. Ground elevation ranges from 207 to 260 m above mean sea level (m AMSL), and hills have up to 50 m of relief. The topography is strongly controlled by bedrock features: folding, structural trends and faults. Many small lakes or wetlands occupy bedrock depressions near the Site. The Landfill is located at a regional topographic high point, where the ground has an elevation of between 245 and 255 m AMSL, up to 50 m higher than lakes and rivers in the vicinity. The majority of the land surrounding the Site is forested; other land uses include recreational uses (cottages, campgrounds, and golf courses), private residences, and aggregate extraction.

2.3.2 SURFACE WATER

The Site is part of the Parry Sound Watershed. All surface water in the area of the Site eventually discharges to the Seguin River, which is the largest regional drainage feature. The Seguin River flows west to Mountain Basin and Mill Lake eventually discharging to Parry Sound and Georgian Bay.

There are no natural surface water bodies or drainage features identified on the Site. Several small lakes, creeks and wetlands are located within one kilometre of the Site boundaries, including Agnes Lake, Cramadog Lake, a wetland and small pond between Agnes and Cramadog Lakes that will be referred to as Little Cramadog Lake, and a wetland located on the property owned by Oxley (Oxley Wetland), all of which ultimately discharge to the Seguin River.

As previously noted, the Landfill is located at a regional topographic high point. This highpoint comprises a surface watershed divide, and surface water runoff drains radially out from the lined landfill area in all directions. There are four surface water catchment areas that include surface water drainage from the Site. These catchment areas include the Seguin Lake, Front Pit, Cramadog Lake, and Oxley Wetland Catchment Areas. The Catchment Areas are illustrated on Figure 2.1 and are described in detail in the Compliance Plan Summary Report (CRA, 2006).

2.3.3 SITE GEOLOGY

2.3.3.1 OVERBURDEN GEOLOGY

The Site is situated in a glaciolacustrine deposit of silt to medium sand, with some gravely lenses. This deposit is found throughout the Site with the exception of the hilltop northeast of the existing Landfill and the hilltop southwest of the existing Landfill. These hilltops consist of shallow glacial till deposits, less than 1 m thick, overlying bedrock. The heterogeneous deposit of primarily sand and gravel overlies bedrock and has been described as a subsequatic outwash fan (Kor, 1991). The thickness of the deposit varies due to the uneven bedrock surface below, and thickness ranges from 0 to 25 m on the Site. It is deepest 50-100 m southeast of the existing Landfill where a bedrock trough is located. The deposit ranges from 2-20 m thick beneath the Existing Landfill, and in most areas, is greater than 10 m thick. Beneath the area of the Expansion Cell, the glaciofluvial deposit generally ranges from 2-10 m thick such that it is thinnest in the north and thickest in the south. Where recovered fines have been stockpiled, bedrock is up to 15 m below ground surface because of the additional height of the stockpiles. In the southwest corner of the expansion area, the overburden locally attains a maximum thickness of 20 m where a buried bedrock valley is present.

2.3.3.2 BEDROCK GEOLOGY

The bedrock underlying the Site has been described as massive mafic/gneissic metamorphic rock. This bedrock is part of the Grenville geologic province of the Canadian Shield; a region defined by hard crystalline bedrock and rugged topography with numerous small lakes. Bedrock exposure is common in the area along the many lakes, or at hilltops where soil and glacial drift cover is thin. Hewitt (1967) mapped the bedrock of this region and describes all bedrock within 1 kilometre of the Site as metasedimentary, containing amphibolite, hornblende, gneiss and schist. These rocks have been folded into large structural features, which control topography and drainage in the area, as described by Hewitt (1967). The amphibolites are medium grained equigranular rocks composed primarily of hornblende and plagioclase, with accessory minerals of biotite, quartz, ortho and clino-pyroxenes, scapolite and garnet. Minor accessories of carbonate, epidote, pyrite and magnetite have also been found in the bedrock of this region.

Beneath the Site, the bedrock surface is uneven, with bedrock ridges and valleys that do not mimic surficial topography. Bedrock contours have been mapped using borehole logs (Gartner Lee, 1986) and geophysical methods (Henderson Paddon, 1995) in the

central and southwestern portion of the Site, and are depicted on Figure 2.2. The existing Landfill lies atop a saddle point between two bedrock highs; one northeast of the existing Landfill and a second which is southwest, on the Parry Sound Sand and Gravel property. A prominent bedrock valley has been identified starting at the southeast corner of the existing Landfill and extending in a southeast direction towards McDougall Road. A second bedrock valley has been identified to the northwest of the existing Landfill, extending onto the Parry Sound Sand and Gravel Property.

The bedrock topography beneath the Expansion Cell slopes gently towards the south and southeast. The depth to bedrock beneath the Expansion Cell varies from 0 to 6 m below the bottom of the liner, such that the overburden is thinnest in the northwest and thickest in the southwest and east portions of the Expansion Cell. Blasting/excavation of bedrock will be required beneath the Expansion Cell in order to accommodate construction of the liner system to the proposed grades presented on Drawing No. C-04 (Appendix L).

2.3.4 SITE HYDROGEOLOGY

The large glaciolacustrine overburden deposit underneath the Site comprises an unconfined aquifer, with a reported hydraulic conductivity ranging from 1×10^{-4} to 3×10^{-7} metres/second (Ince, 2005). The groundwater flow directions in this overburden aquifer appear to be controlled by bedrock topography, as the bedrock unit is considerably less permeable to bulk groundwater flow. Mean linear groundwater flow velocity in the overburden aquifer is reported to be approximately 100 metres/year (Ince, 2005). Following review of the hydraulic gradients (Ince, 2005) and the range of hydraulic conductivities (Henderson-Paddon, 1995) determined in the vicinity of the Site, CRA has established that the groundwater velocity beneath, and in the vicinity of the Site may be as low as 10 metres/year. The bedrock has a low hydraulic conductivity and is generally not heavily fractured.

All residential wells in the vicinity of the Site draw water from the unconfined overburden aquifer except for one: the former Butler residence well (W12), which is a bedrock well.

A groundwater flow divide is located under the existing Landfill, controlled by the presence of the underlying bedrock saddle. Bedrock topography and water level measurements indicate that there are three primary groundwater flow paths originating from the Site: the Seguin Lake flow path, the Little Cramadog Lake flow path, and the Oxley Wetland flow path. These are presented on Figure 2.2, and are descried further in

the Compliance Plan Summary Report (CRA, 2006). In the vicinity of PW-1, the Little Cramadog Lake and Oxley Wetland flow paths appear to converge in the bedrock trough, but are again separated by a subsurface bedrock ridge in the vicinity of monitoring well BHP. Groundwater flow from beneath the existing Landfill and the Expansion Cell contribute to the Little Cramadog Lake and the Oxley Wetland flow paths.

Under most surrounding regions, the overburden aquifer is absent (less than 1 m thick) due to the presence of bedrock subcrops. However, water level contours reported by Ince (2005) indicate an overburden aquifer is present beneath the southwest corner of the Expansion Cell in the vicinity of well BHA-2. The surface water table in 2004 was approximately 5 m below the proposed Expansion Cell liner elevation at this location. Therefore an unsaturated zone may be present beneath the Expansion Cell. Figure 2.2 presents the groundwater flow and well locations and Figure 2.3 presents the groundwater and surface water flow directions at the Site.

2.4 WASTE CHARACTERISTICS

The characteristics of the waste that will be disposed of in the Expansion Cell are considered to be the same as that historically disposed of at the Site. The McDougall Landfill is currently approved to accept domestic waste and solid non-hazardous wastes as defined by General Waste Management Regulation R.R.O. 1990, Ontario Regulation O. Reg. 347 of the Environmental Protection Act.

The Site service area is not stipulated for the current C of A, however wastes received at the Site are typically generated by sources within the Municipality of McDougall, Township of the Archipelago, Township of Carling, Township of Seguin, Township of McKellar, and Town of Parry Sound.

All municipalities that use the Site currently operate recycling programs including paper, plastic, tin and glass (Refer to Section 2.7). As such, recycling at the Site is limited to scrap metal, wood, white goods, and tires. Scrap metal is stockpiled and removed from the Site by a recycling contractor as required. Wood and brush is stockpiled and chipped as required, for use as daily cover and road stabilization material.

Tires have been stockpiled on-Site since 1999. Tires were removed in 2004 and 2005 by a tire recycler and less than 5,000 tires currently remain stockpiled on–Site (Ince, 2006).

2.5 REFUSE DENSITY

Refuse density is the weight of refuse per volume of refuse and daily cover soil disposed at a landfill. Modern landfill compaction equipment and techniques employed at well operated landfill sites can typically attain an average minimum refuse density of at least 0.6 tonnes of refuse into each cubic metre of air space consumed.

Given the nature of the refuse and the landfilling equipment and placement techniques currently employed at the McDougall Landfill Site, a refuse density of 0.6 tonnes/m^3 has been assumed to be a typical refuse density that will be attained at the Site.

2.6 POPULATION FORECAST

The population forecast for the Municipality of McDougall and surrounding Townships was evaluated in the Engineering/Planning Evaluation and Cost Assessment – McDougall Landfill Site (CRA, 2003). This report identified permanent, seasonal, and total population projections based on rates of increase from municipal directories and Statistics Canada. The annual total population growth rate for all the Municipalities using the McDougall Landfill Site is estimated at 0.9%.

2.7 WASTE DIVERSION ACTIVITIES

All of the Municipalities that use the Site encourage permanent and seasonal residents and visitors to divert waste through the placement and use of recycling bins in the area. Diversion is also achieved through backyard and municipal collection composting activities. The Town of Parry Sound offers a green box curbside organics collection program for its residents, where the compostable materials are collected, sorted and shipped to Bracebridge for further processing.

The following indicates the overall reported diversion rates for each of the evaluated Municipalities[1].

[1] Information on diversion rates was collected through short surveys to each of the evaluated Municipalities during conduct of the EA Report.

Municipality	2003 Diversion Rate
Town of Parry Sound	48%
Township of The Archipelago	44%
Township of Carling	13%
Municipality of McDougall	86%[2]
Township of McKellar	8%
Township of Seguin	24%

The Municipality of McDougall supports the Province's overall diversion goal of 60% and is doing its part as a northern municipality. When comparing diversion efforts of other northern Ontario municipalities, the Municipality of McDougall, has a higher than average diversion rate. The median diversion rate for northern municipalities with populations less than 5,000 was 4.0% in 2003, whereas McDougall's diversion rate (not including scrap metals, wood and tires) was 14.1% in the same period.

There are several solid waste transfer stations/recycling depots located throughout the service area. Municipalities with curb-side collection, such as the Town of Parry Sound, also have a blue-box system in place.

As part of the Environmental Assessment, the Municipalities were surveyed in order to determine current diversion efforts. The following is a list of responses received from each of the participating municipalities:

Municipality	2003 Tonnes Recycled (approximate)
Town of Parry Sound	680 tonnes/year
Township of the Archipelago	400 tonnes/year
Township of Carling	63 tonnes/year
Township of McDougall	236 tonnes/year + over 4,000 tires
Township of McKellar	62 tonnes/year
Township of Seguin	486 tonnes/year

The McDougall Landfill has restricted public access and the bulk of McDougall residents take their household refuse to a transfer station where recycling occurs. All municipalities that use the Landfill operate recycling programs and waste is segregated

[2] This number includes scrap metal, tires, and wood separated at the Landfill. Not including these numbers reduces the overall diversion rate to 14.1%

before arrival at the Site. The McDougall Landfill does not currently accept any blue box recyclable materials for separation and off-site disposal. At the Landfill, the Municipality separates white goods/metals, wood, and tires from the waste stream. White goods and tires are shipped off-Site for recycling, while clean wood is chipped for use on-Site or sold for off-Site uses. Any hazardous waste is diverted to the Town of Parry Sound hazardous waste depot or other licensed hazardous waste facilities.

During the Expansion period, waste diversion rates are expected to increase and may include diversion of shingles, drywall and cardboard from the waste stream. The Municipality is also considering the development of a composting facility at the Site. Prior to implementation of composting at the Site, approval from the MOE will be sought.

2.8 ALLOWABLE FILL RATE

An allowable fill rate for the Site is not specified in the C of A. Given seasonal fluctuations in waste disposed and the acceptance of clean/inert fill at the Site, the design of the Site has been undertaken to accommodate a fill rate of up to 500 tonnes/day.

2.9 END USE

There is presently no End Use Plan formalized for the Site. It is anticipated that most of the area will have no active land use taking place upon it. Use of the Site will likely consist of enhanced regeneration/restoration of the Site. The final contours presented in the D&O will allow for a revegetated passive land use area.

A detailed End Use and Site Closure Plan will be prepared 2 years prior to the Site reaching the approved final contours as may be amended over time. The End Use and Closure Plan will be prepared with regards to the requirements outlined in the "Landfill Standards, A Guideline on the Regulatory and Approval Requirements for New and Expanding Landfill Sites (MOE 1998)" and will include but not be limited to the following:

- proposed end use;
- final contour configuration;
- design and construction of final cover;

- landscaping;
- site facilities (if any);
- closure schedule;
- rodent control;
- surface water control; and
- post-closure inspection, maintenance, and monitoring.

The End Use and Site Closure Plan will be submitted to the MOE for approval prior to implementation.

2.10 DESIGN CONCEPT

The design requirements for the Expansion Cell are based on the design requirements of Ontario Regulation (O. Reg.) 232/98. The supporting document "Landfill Standards, A Guideline on the Regulatory and Approval Requirements for New and Expanding Landfill Sites (MOE 1998)" was used as a reference document in evaluating and establishing the design constraints and requirements for the Site. The design constraints and requirements include the following:

- the establishment of adequate buffer zones;
- an assessment of the hydrogeological performance of the design within the hydrogeologic conditions of the Site;
- a defined maximum refuse volume (air space);
- a design that is protective of groundwater quality;
- a design that provides for on-Site soil balance or surplus;
- a design that provides for leachate collection and management;
- a design that provides for groundwater management;
- a design that provides for surface water management;
- an assessment of landfill gas production and potential for subsurface migration;
- ancillary features to prevent nuisance impacts associated with landfilling activities including odour, dust, noise, and traffic;
- adequate Site facilities and operations;
- long-term monitoring, inspection, maintenance, and reporting plan; and
- contingency plan for the contaminating life span of the Site.

A hydrogeological performance assessment for the existing landfill was completed independent of the proposed expansion and is presented in the Compliance Plan Summary Report (CRA, amended May 2006). The hydrogeological performance assessment for the Expansion Cell was completed in conjunction with this D&O and is documented in the Expansion Cell Incremental Impact Assessment Report (CRA, 2006). The hydrogeological assessments established the suitability of the design, monitoring and contingency plans for expansion of the Site. A summary of the hydrogeological assessment activities is presented in Section 7.4.

Buffer zones were established as part of the Compliance Plan and meet the requirements of O.Reg. 232/98 for the Expansion Cell.

The Expansion Cell design consists of a Site-specific design as specified in O.Reg. 232/98 based on the MOE's Reasonable Use Guideline for Groundwater Protection. Details of the Site-specific design are presented in Section 3.0.

A construction quality control and quality assurance (CQC&QA) plan has been developed for implementation during construction of the Expansion Cell. The CQC&QA plan is provided in Appendix E.

The final contours for the Expansion Cell were designed to provide the required volumetric capacity for the Site and to ensure that the final waste contours were consistent with current landfill standards and existing Site features. Details of the final contours are presented in Section 3.4.

Landfill and soil volumes were estimated based on the proposed base and final contours for the Expansion Cell. A soil balance was completed comparing soil available from site development versus soil required for site development. Details of the soil volume calculations for the Expansion Cell are presented in Section 4.3.

The Expansion Cell has been designed for a fill rate of 500 tonnes/day, as previously discussed in Section 2.8.

The development sequence plan for the Expansion Cell was designed to minimize nuisance impacts, simplify management of surface water, leachate and construction and to provide progressive closure of the Site throughout the operating period. The development sequence plan is presented in Section 6.0.

A leachate management plan was designed for the Site to detail the collection and disposal of collected leachate. The Long-term Leachate Management Plan is to provide on-Site treatment. Details of the leachate management plan are presented in Section 7.0.

A surface water management plan has been designed to control surface water runoff from the Site in order to ensure drainage onto or leaving the Site does not adversely affect Site operations or on-Site and/or off-Site surface water quality. Details of the surface water management design are presented in Section 8.0.

A landfill gas assessment was performed to assess landfill gas production and the potential for subsurface migration of landfill gas from the Site. Details of the landfill gas assessment are included in Section 9.0.

Ancillary features have been designed to minimize the impacts associated with odour, dust, noise, and traffic. Engineered facilities at the Site have been designed to ensure adequate service life. Site facilities are presented in Section 10.0.

Operation and maintenance procedures have been developed for the Site to ensure the environmental control and monitoring works continue to function as designed for as long as they are needed. Site operations are presented in Section 11.0.

Monitoring, inspection, maintenance, and reporting requirements for the Site are presented in Section 12.0.

The contingency plans for potential leachate and groundwater management and landfill gas management are presented in Sections 7.0 and 9.0 respectively.

3.0 SITE DESIGN

3.1 EXPANSION AREA

In February 2003 CRA, on behalf of the Corporation of the Municipality of McDougall, completed an evaluation of the suitability of continued use of the Municipal Landfill for long-term waste management purposes. This evaluation considered various expansion alternatives adapted to the physical and environmental limitations of the Site and of the adjacent properties. The evaluation concluded that an expansion of the Landfill vertically and towards the east was the preferred Landfill Expansion alternative for the McDougall Landfill Site.

The Expansion Cell footprint is approximately 3.7 ha. in size and forms a quadrilateral shape. The size of the Expansion Cell footprint measures approximately 229 m, 139 m, 195 m and 221 m along the north, east, south, and west segments respectively. The Expansion Cell abuts the east side of the existing landfill and extends west over the side slope of the existing Landfill Cell. The proposed limits of the Expansion Cell are presented on Drawing No. C-02 (Appendix L).

3.2 BUFFER ZONES

The Site encompasses 77.56 ha. consisting of 7.0 ha. of waste disposal area and 70.56 ha. combined buffer zone and CAZ. Additionally, the CAZ extends onto the Oxley Wetland where the municipality has established a groundwater easement. The extended CAZ encompasses approximately 56.65 ha.

The primary purposes of buffer zones are to allow the implementation of environmental controls, to provide sufficient land to locate operating facilities, and to buffer adjacent lands from landfilling operations. In addition, the subsurface soil of the buffer area can serve to provide natural attenuation of impacted groundwater.

The proposed buffer zones for the Site vary from a minimum of 167.3 m wide adjacent to the south side of the Expansion Cell to a maximum of 543.4 m wide adjacent to the north side of the Expansion Cell. The proposed buffer zones for the Site are shown on Drawing No. C-02. As previously noted, the west side of the Expansion Cell abuts the existing Landfill. The buffer zone provided along the west side of the existing Landfill Cell is approximately 25 m.

The northern buffer zone is primarily used for the control and management of groundwater and surface water, and contains a perimeter surface water drainage ditch, perimeter access road, CAZ, and a surface water infiltration pond.

The western and eastern buffer zones are primarily used for the control and management of groundwater and surface water, and contain perimeter surface water drainage ditches, perimeter access roads, and CAZ.

The southern buffer zone is used for the control and management of groundwater and surface water and for support facilities for Site operations. The southern buffer zone contains a perimeter surface water drainage ditch and perimeter access road, Site entrance and main access road, vehicle parking, leachate holding tanks, and segregated metal and wood waste stockpile areas, surface water management pond, CAZ, groundwater purge well, office/maintenance building, weigh scale, and recycling bins. The future Iron Reduction and Leachate Treatment System(s) will also be located within the southern buffer zone.

3.3 BASE DESIGN

The design of the Expansion Cell was based on the design requirements of O. Reg. 232/98. This Regulation provides several options for the design of the landfill base including a site-specific design option and two generic design options.

The Expansion Cell design for the McDougall Landfill is a site-specific design based on the geological and hydrogeologic conditions present at the Site. A performance assessment for the Expansion Cell is provided in the Expansion Cell Incremental Impact Assessment (CRA, 2006).

The landfill base design is a single composite liner design consisting of a 1.5 mm thick high-density polyethylene (HDPE) liner overlying a 900 mm thick engineered clay liner. The clay liner will be constructed to achieve a hydraulic conductivity of 6.8 x 10^{-9} metres/second or less.

The top of the landfill liner will extend to a depth of approximately 5.8 metres below ground surface (m bgs) along the northern limit of the Expansion Cell and to approximately 12.6 m bgs in the southwest corner of the Expansion Cell. The base is sloped in a north to south direction at 5%. The side slopes of the base are designed at a slope of 2 horizontal to 1 vertical (2H:1V). The base grades range in elevation from 243.42 to 251.43 m AMSL.

The contouring of the base has been designed to facilitate the leachate collection system overlying the composite liner. The base contours divide the base into three cells in a north-south direction axis by permanent berms. The top of the berms will be a minimum of 0.5 m high at the northern end of the Expansion Cell and increase 3 to 3.5 m above the base at the southern end of the Expansion Cell. The berms will provide for separation of clean and impacted water between the landfilled and non-landfilled cells and will provide a capacity for storage of clean surface water accumulation in the non-landfilled cells. The height of the berms have been designed to permit storage of clean water in Cells 2 and 3 equal to ½ of the historical average precipitation at the Site, such that the accumulated water will only need to be removed two to three times per year on average.

Within each cell the base is further divided into two parts on a north-south axis. In each part the base slopes diagonally at approximately 7% to a 1.05 m deep swale. The swales slope at 5% from north to south and are joined to a common header swale at the toe of the south side slope.

The HDPE liner is designed and will be installed in accordance with the requirements stipulated in Schedule 3 of O. Reg. 232/98 to provide for an assumed 150 year service life for the geomembrane liner. The engineered clay liner is designed and will be installed in accordance with the requirements stipulated in Schedule 4 of O.Reg. 232/98 to provide for an assumed unlimited service life for the compacted clay liner.

The landfill base is designed with a leachate collection system that overlays the composite liner. The leachate collection system consists of collection laterals and header and a granular drainage media. The leachate collection laterals/header will consist of 200 mm diameter HDPE piping with perforations 12 mm in diameter located along and around the bottom of the pipe. Where the header pipe passes through the separation berm between cells, the header pipe will be solid. The laterals will be spaced at a maximum of 42 m intervals and connected to the header at the south end of the base. The stone drainage media will be placed over the base of the landfill at a minimum thickness of 0.3 m on the base and base side slopes and a minimum thickness of 0.6 m on the leachate collection pipes. Non-woven geotextile will be installed between the stone layer and the underlying liner to protect the HDPE liner. Woven geotextile will be installed on top of the stone layer to provide separation from the overlying waste.

The contouring of the base and the layout of the leachate collection pipes have been designed such that the drainage path before leachate can intercept a pipe is generally less than 30 m. The collection system pipes will be accessed for maintenance through

cleanout piping that will extend from the landfill base up the base side slopes to access chambers located between the landfill and the perimeter access road. A main leachate pump riser pipe will be installed in the drainage media at the end of the collection header at the southwest corner of the Expansion Cell (Cell 1) from which collected leachate will be removed as detailed further in Section 7.2.2. Pump riser pipes will also be installed at the southwest corner of Cells 2 and 3 which will be used to remove the accumulated clean water prior to these cells receiving refuse and to remove leachate from these cells once refuse placement commences in these cells.

The header pipe will be fitted with a valve at the southwest corner of both Cell 2 and Cell 3 of the Expansion Cell. The valves will remain closed until the cells commence receiving waste. The valves will be opened or removed when landfilling begins in Cell 2 and subsequently in Cell 3 to allow for leachate collection from all cells by the primary leachate collection sump riser pipe in Cell 1.

The leachate collection system is designed and will be installed in accordance with the requirements stipulated in Schedule 1 of O.Reg. 232/98 to provide for an assumed 75 year service life for the leachate collection system.

A CQC&QA plan has been developed to be implemented during the construction of the Site. The CQC&QA plan is provided in Appendix E.

The proposed base contours for the Expansion Cell are shown on Drawing No. C-04 (Appendix L).

3.4 FINAL CONTOURS

As specified in O.Reg. 232/98, a maximum slope of 4H:1V and a minimum slope of 20H:1V have been used for the final contours. The maximum elevation of the Landfill (i.e. top of final cover) will be 275.75 m AMSL, being approximately 19.5 m above surrounding ground elevations (nominal ground elevation of 256 m AMSL). The top of the final cover around the perimeter of the Expansion Cell will vary from elevation 254.39 m AMSL at the southeast edge of the Expansion Cell to elevation 256.95 m AMSL in the northwest corner of the Expansion Cell. This represents a 0.55 to 0.86% grade around the perimeter of the landfill, which will facilitate the incorporation of perimeter surface water drainage ditches in the final cover construction.

The maximum side slope of 4H:1V promotes surface water runoff while minimizing soil erosion during surface water runoff events and facilitates equipment access for final

cover construction and maintenance. The minimum slope of 20H:1V is the minimum slope required to maintain surface water runoff.

The final cover will consist of a 0.6 m thick soil cover overlaid with a 0.15 m topsoil layer and a vegetative cover. The soil cover will consist of imported material to provide a cover that will allow a minimum infiltration rate of 0.15 m year in accordance with O.Reg. 232/98 for an engineered Site. The topsoil used in the final cover construction will be imported and suitable to sustain vegetation growth. The proposed final contours are presented on Drawing No. C-03 (Appendix L).

3.5 DAILY COVER

At landfills accepting municipal solid waste, daily cover fulfills a number of functions including: minimizing erosion of landfilled waste, minimizing blowing litter, reducing odours, discouraging vector and vermin activity, and improving vehicular access to the active disposal area.

As specified in O.Reg. 232/98, daily cover will be placed on the working face of the landfill at the end of each working day to cover exposed refuse. Daily cover will typically consist of a 0.15 m thick layer of soil.

The fines material recovered from historical waste extraction activities and wood chips will be used for daily cover in addition to native sand and gravel. The fines material is stockpiled in several locations surrounding the landfill area and is readily available for cover at the end of each operating day. Clean or inert fill brought to the landfill for disposal, will be segregated and stockpiled for use as daily cover soil if the material is suitable for this purpose. As defined by the General Waste Management Regulation R.R.O. 1990, O.Reg. 347 of the Environmental Protection Act, inert fill means "earth or rock fill or waste of a similar nature that contains no putrescible materials or soluble or decomposable chemical substances".

Tarps may also be used to temporarily cover the active face of the landfill, with soil being placed on a weekly basis. For the purposes of soil volume calculations, a design ratio of volume of refuse to volume of daily cover soil equal to 4:1 was assumed for the Site.

3.6 INTERIM COVER

During development of the landfill, areas which are not part of the active disposal area but are scheduled to receive additional lifts of waste at some time in the future will be temporarily completed with interim cover soil. The application of interim cover will help promote surface water runoff and limit the exposure of waste at the Site. Interim cover will consist of a 0.3 m thick layer of soil. On-Site native material, recovered fines and wood chips will be used as interim cover.

Interim cover will be placed on disposal areas as practical, after which landfilling will resume until final contours are reached. Prior to resuming landfilling in an area completed with interim cover, the interim cover will be removed to promote hydraulic connection between the waste lifts and allow leachate to infiltrate readily to the leachate collection system at the base of the landfill.

4.0 LANDFILL VOLUMES

4.1 GENERAL

Expansion of the Landfill is anticipated to enable the Municipality of McDougall and other municipalities in the area to have continued access to an environmentally sound and economically feasible non-hazardous solid waste disposal facility for a period of approximately 25 years.

Landfill volumes for the Expansion Cell were calculated using the computer program Land Desktop 2006 by AutoDesk. This program calculates the change in volume between two topographic surfaces using the grid method. A grid spacing of 1.0 m was used for the volume calculations.

4.2 SITE VOLUMES

4.2.1 TOTAL SITE VOLUME

For the purposes of determining volumes for the Expansion Cell, it was assumed that the north slope of the existing Landfill was completed to the final approved contours detailed in the Short-Term Landfill Capacity Increase Provisional Certificate of Approval No. A522101 Report (CRA, 2005) representing a Site capacity of 329,600 m^3 (waste and daily cover soil). The footprint and final contours of the Expansion Cell were then determined based on the design criteria (base grades, side slopes, final cover, capacity required, etc.). Using 4H:1V side slopes and a top slope of 20H:1V, the elevation of the transition from 20H:1V to 4H:1V slopes is approximately 275 m and the maximum center ridge elevation of the landfill is 275.75 m AMSL.

The total volume (air space) for the Expansion Cell is calculated to be 739,275 m^3 and includes waste and daily cover soil.

4.2.2 VOLUME LANDFILL

The landfill volume for the disposal of waste and daily cover soil was determined by calculating the difference between top of the final refuse contours and the base contours. The volume of air space available for the disposal of refuse and daily cover soil within the Expansion Cell is calculated to be 700,719 m^3. As previously noted, the approved

capacity of the existing Landfill is 329,600 m^3 for a total site capacity of 1,030,319 m^3 (refuse and daily cover soil).

4.2.3 REFUSE VOLUME

The volume of refuse to be disposed of within the Expansion Cell was determined by subtracting the volume of daily cover soil from the volume of air space available for the disposal of refuse and daily cover soil. For the purposes of refuse volume calculations, it is assumed that the ratio of volume of refuse to volume of daily cover soil will be 4:1. Based on this assumption, the volume of air space for the disposal of refuse within the Expansion Cell is 560,575 m^3 (700,719 m^3 – 140,144 m^3).

4.3 SOIL VOLUME

4.3.1 SOIL REQUIREMENTS

The soils required for construction of the Expansion Cell include clay material that will form part of composite liner system, soil and topsoil for final cover, daily cover, soil for perimeter roads and ditches and soil for surface water management works. The individual volume associated with each is discussed below. The soil requirements for the construction and operation of the Expansion Cell are summarized on Table 4.1. In addition, miscellaneous soils are required on a temporary basis for the construction of surface water control berms and interim cover soils. However, soil required for these temporary uses have not been included in the soil requirement calculations since the soils will be removed prior to advancement of landfilling, the soils will be reused for other applications, and the soils will not consume a portion of the Expansion Cell volume.

Clay for Composite Liner System

The composite liner will consist of 0.9 m engineered clay liner. The total volume of low permeable soil (clay) required for construction of the composite liner system is approximately 38,619 m^3. The low impermeable soil will be obtained from suitable off-Site sources, as a source for this material is not available on-Site.

Final Cover

Final cover will consist of 0.6 m layer of soil overlaid by a 0.15 m layer of topsoil. The total volume of final cover soil required for the Expansion Cell is approximately 38,556 m^3, of which 30,845 m^3 is cover soil and 7,711 m^3 is topsoil. Soil and topsoil will

be obtained from suitable off-Site sources, as a source for this material is not available on-Site.

Daily Cover

Daily cover soil will be placed on the working face of the landfill at the end of each day, as previously discussed in Section 3.5. Using a volume of refuse to volume of daily cover ratio of 4:1, the volume of daily cover soil required for the Expansion Cell is approximately 140,144 m^3. Native material, recovered fines and wood chips will be used for daily cover soil and will be obtained from on-Site stockpiles and native material excavated to construct the Expansion Cell base. Tarps may also be used to temporarily cover the active area reducing the volume of daily cover soil required.

Access Roads and Surface Water Management Works

The main access road and perimeter roads will be elevated to provide appropriate surface water drainage and to create the perimeter ditches between the landfill and perimeter roads. Surface water ponds will be constructed to control and infiltrate collected surface water.

The roads, perimeter ditches and surface water management ponds will be constructed using sand and gravel from on-Site and off-Site sources. The side slopes of the perimeter ditches and ponds will be overlaid with 0.15 m of topsoil. The total volume of soil required for the construction of the access roads, perimeter roads and ditches, and surface water management works is approximately 26,513 m^3, of which 24,463 m^3 is sand and gravel and 2,050 m^3 is topsoil.

4.3.2 SOIL AVAILABILITY AND BALANCE

The total volume of soil available as a result of construction of the Expansion Cell base is estimated to be approximately 262,097 m^3 of sand and gravel. An additional 27,000 m^3 of recovered fines are available from the on-Site stockpiles for use as daily cover soils.

In comparing the volume of available sand and gravel to the volume of sand and gravel required for construction and operation of the Expansion Cell, a sand and gravel surplus of approximately 124,490 m^3 is predicted.

Low permeable soil is not available on-Site, as such; a deficit of 69,464 m^3 is predicted. The low permeable soil required for construction will be obtained or imported from suitable off-Site sources.

Topsoil is not available on-Site, as such; a deficit of 9,761 m^3 is predicted. The topsoil required for construction will be imported from suitable off-Site sources.

5.0 SITE LIFE

The Expansion Cell was designed to provide a 25 year Site life. Based on waste generation rates determined as part of the Engineering/Planning Evaluation and Cost Assessment (CRA, 2003) for Alternative 4, approximately 407,243 tonnes of capacity was required to provide the 25 year Site life. Using a refuse density of 0.6 tonnes/m^3 (previously discussed in Section 2.5), the total air space required for the disposal of refuse and daily cover soil over the 25 year planning period is calculated to be 678,738 m^3. As previously noted in Section 4.2.1 the air space available for the disposal of refuse and daily cover soil within the Expansion Cell is 700,719 m^3, which provides for an estimated 25 year Site life.

6.0 SITE DEVELOPMENT

The Expansion Cell, perimeter roads and ditches and surface water management works will be constructed in one stage. Once constructed, landfilling within the Expansion Cell will be advanced in three stages (Cells 1 through 3) to adequately control environmental impacts. The conceptual cell layout is provided on Drawing No. C-06 (Appendix L). The cell sizes were developed based on similar sized base areas and the berm heights were designed to provide a storage capacity for accumulated surface water (prior to waste placement) for Cell 2 and 3 equal to one half of the annual historical precipitation for the area.

Landfilling will commence in Cell 1 and waste will be landfilled using the area method in two general phases being the lower portion of the disposal area and the upper portion of the disposal area. Landfilling will progress from north to south within the cell and will be completed in a phased manner as landfilling progresses vertically, The east side slope of the cell will be shaped to provide for a 3:1 side slope from the base of the cell to the top of refuse. Once Cell 1 is completed landfilling will commence in Cell 2.

The first 1-2 metres of waste placed over the composite liner system will be select waste (waste free of demolition debris and other large sharp material) to protect the composite liner system from damage. The first lift of waste will be placed within the first season to provide frost protection.

Simultaneous with landfilling in the lower portion of Cell 1, and within the first season, a minimum of 1.0 m of native sand will be placed over the base of Cells 2 and 3 to provide frost protection for the composite liner system in Cells 2 and 3. To the extent feasible, the native sand will be removed prior to commencing landfilling in these areas.

Temporary surface water diversion berms will be constructed using low permeable soil to a height of approximately 1.0 m in each area, as landfilling progresses above the elevation of the liner system, to prevent surface water within the landfill area, which has contacted refuse, from leaving the disposal area. Diversion berms will also be constructed to divert surface water runoff from entering the active disposal area as required. All surface water that has contacted landfill refuse will be treated as leachate and allowed to infiltrate to leachate collection system at the base of the landfill.

Interim cover will be placed on disposal areas which will remain inactive for more than 90 days, after which landfilling will resume until final contours are reached. Interim cover will be removed for reuse prior to resumption of landfilling in order to promote hydraulic connection between the refuse lifts. The timely placement of interim and final

cover will reduce leachate generation by promoting surface water runoff and minimizing infiltration into the landfill.

Final cover will be placed on areas of the landfill which have reached final contours.

7.0 LEACHATE AND GROUNDWATER MANAGEMENT PLAN

7.1 IMPACTED GROUNDWATER MANAGEMENT

7.1.1 RESIDUAL GROUNDWATER IMPACT

As detailed in the Compliance Plan Summary Report (CRA, 2006), residual leachate derived impacts are present in the groundwater beneath and downgradient of the existing Landfill. The groundwater flow from this area contributes to two flow paths designated as the Little Cramadog Lake (southeast) and Oxley Wetland (east) flow paths. The groundwater and surface water flow paths are illustrated on Figure 2.3.

The conclusions presented in recent annual monitoring reports and the results of the Compliance Plan sampling program indicate that iron and manganese are the primary contaminants of concern within the groundwater in exceedance of the regulatory criteria.

Based on the results of the Compliance Plan, implementation of active on-Site iron reduction measures was chosen as the preferred alternative to achieve groundwater and surface water compliance criteria for the contaminants of concern along the Little Cramadog Lake and Oxley Wetland flow paths.

7.1.2 ON-SITE IRON REDUCTION MEASURES

As part of the Compliance Plan activities, groundwater recovery from historic groundwater extraction wells was tested. Based on the recovery test results and historic work completed by Henderson Paddon (1995), groundwater extraction from PW1 is an efficient means for mass reduction of iron and manganese in groundwater to achieve groundwater compliance along the southern site boundary.

As detailed in the Compliance Plan Summary Report (CRA, 2006), an extraction rate of 45 litres per minute was achievable at PW1. The capture area of this extraction well at this rate would include the majority of the source area and would extend northwesterly beneath the existing lined Landfill cell.

The objective of the groundwater treatment system is to reduce iron and manganese concentrations in the extracted groundwater and to re-infiltrate the treated water into the Oxley Wetland groundwater regime. The recharged groundwater would then undergo further treatment by natural attenuation along a defined groundwater flow

path (Oxley Wetland Flow Path) for further reduction of other residual leachate impacts in order to achieve the regulatory criteria at the compliance locations. The conceptual iron reduction treatment system is shown on Figure 7.1 consistent with the approved Compliance Plan.

Details on the Iron Reduction Treatment System are presented in the Technical Design Brief – Iron Reduction Treatment System provided in Appendix F.

As noted in Section 1.3.3, an application and supporting documentation to amend the existing C of A for Sewage No. 3-0178-94-006 issued under Section 53 of the OWRA is being prepared and will be submitted in Fall 2006 to obtain approval for implementation of the proposed on-Site iron reduction treatment system. The iron reduction treatment system is proposed to be combined with the leachate treatment system as discussed in Section 7.2 below.

7.2 LEACHATE MANAGEMENT AND DISPOSAL

7.2.1 EXISTING LEACHATE CONTROLS

The existing Landfill Cell was constructed with a Leachate Collection System (LCS). The LCS consists of perforated and solid HDPE collection pipes and header and drainage media that carry the leachate to the pumping station located in the southwest corner of the existing Landfill Cell. The leachate collected in the existing Landfill Cell is removed from the pumping station on a continuous basis through pumping. The leachate is pumped via forcemain to a tank truck loading facility located off the main access road west of the Site office/weigh scale. The loading facility consists of three holding tanks and piping to facilitate the transfer of leachate from the holding tanks to tank truck for subsequent off-Site disposal. The capacity of the holding tanks is approximately 400 m^3. The approximate configuration of the existing LCS and leachate pumping station is shown on Drawing C-01 (Appendix L).

7.2.2 LEACHATE COLLECTION SYSTEM – EXPANSION CELL

As discussed in Section 3.3, the landfill base of the Expansion Cell is designed with a LCS that overlays the composite liner and consists of drainage media and collection piping. The LCS is designed to ultimately direct leachate to a low point at the southwest corner of the Expansion Cell, where pump riser pipe will be located from which collected leachate will be removed through pumping. A pump riser pipe will also be

installed at the low points in both Cells 2 and 3 for removal of accumulated surface water prior to commencement of waste placement in these cells.

7.2.3 LEACHATE HANDLING – EXPANSION CELL

The leachate collected by the LCS will be removed from the low point in the LCS on a continuous basis through pumping. A pumping system will be installed in the pump riser pipe to pump the collected leachate via a buried forcemain to the existing tank truck loading facility.

The pumping system will consist of a commercially available leachate pump configured with dolly wheels to facilitate installation and removal through the sloping pumping system riser pipe.

As previously noted, the capacity of the existing holding tanks of approximately 400 m^3 (400,000/litres), provides adequate storage capacity at the maximum anticipated average daily leachate generation rate.

The leachate pumping systems will be, and the tank truck loading facility is, automated with fail safe high level monitoring to ensure the capacity of the holding tank will not be exceeded due to pumping from the existing Landfill Cell and Expansion Cell LCS's.

7.2.4 LEACHATE DISPOSAL

The leachate from the Site will continue to be hauled by tank truck for disposal at a licensed liquid waste disposal facility in the short-term (1 to 3 years).

The long-term solution for Leachate Management is to develop an on-Site leachate treatment system as outlined in Section 7.2.5.

7.2.5 LONG-TERM LEACHATE MANAGEMENT SOLUTION (ON-SITE LEACHATE TREATMENT)

Leachate is currently stored on-Site in three leachate holding tanks and transported off-Site for treatment, as previously detailed. In December 2003, CRA on behalf of the Municipality completed a Leachate Treatment System Conceptual Design Report (CRA, 2003) to evaluate treatment alternatives and costs for the development and operation of

an on-Site leachate treatment system for the treatment of leachate from the existing Landfill Cell and the expansion Cell. Based on the results of the evaluation, it was concluded that on-Site treatment of leachate is both technically and economically feasible.

The selection of an appropriate treatment process sequence was considered based on leachate characteristics, effluent criteria, site characteristics and costing. Additionally the capacity of a treatment process to adapt to changes in leachate quality and quantity that occur over time with changing landfill conditions was considered in selection of an appropriate treatment method. The recommended treatment method was a biological nutrient removal process (anoxic/oxic).

The proposed anoxic/oxic treatment process would consist of an anoxic tank, an oxic tank, and a clarifier enclosed in a building and a sludge storage lagoons, polishing pond, and an infiltration pond. The iron-reduction groundwater treatment system and the leachate treatment system will be combined into one system. The treated groundwater and leachate will be recharged into the groundwater for further management.

As noted in Section 1.3.3 and Section 7.1.2, an application and supporting documentation to amend the C of A Sewage will be prepared and submitted to the MOE for approval prior to implementation of the combined iron-reduction/leachate treatment system.

A detailed design of the groundwater/leachate treatment system will be prepared and submitted to the MOE in support of OWRA Section 53 Amendment once the Municipality is in a position to move from off-Site disposal to on-Site treatment.

7.2.6 LEACHATE GENERATION

The leachate generation rate within the existing Landfill Cell and the Expansion Cell is detailed in the Leachate Treatment System Conceptual Design Report (CRA, 2003).

Leachate generation is dependent on a number of factors including the amount of precipitation, the landfill area, and the various stages and durations of landfill development (e.g., areas of cells, areas of exposed refuse, areas completed with final cover, etc.).

As specified in the Leachate Treatment System Conceptual Design Report (CRA, 2003), the calculated leachate generation rate for the existing Landfill area is 5,825 m^3/year or

11 litres per minute (L/min.). The leachate generation rate for the Expansion Cell was calculated to be a maximum of 18,5000 m^3/year (35 L/min.). Following closure of the Expansion Cell, the leachate generation rate is expected to be 11,100 m^3/year (21 L/min.).

7.2.7 LEACHATE CHARACTERIZATION

The chemical composition of leachate is highly variable, changing over both space and time, with site conditions. Leachate quality is affected by a number of factors including the site setting, waste characteristics, landfilling operations, climate, to name a few. As leachate is dependent on site conditions, it is unique to each landfill site. As such, site-specific leachate quality data is required to evaluate future contaminant loadings.

Historical leachate quality data for the Site is limited in terms of the amount of data and number of compounds analyzed. The leachate quality has also been affected by the exhumation and containment of landfilled waste at the Site. In addition, recent analytical results for leachate from the temporary storage tanks are not representative of Site leachate since the leachate is diluted with impacted groundwater from extraction well BHA-2.

A leachate quality assessment was undertaken as part of the Leachate Treatment System Conceptual Design Report (CRA, 2003). This assessment considered leachate quality up to the end of 1999, leachate quality from 2000 to 2002, which represents a mixture of leachate and impacted groundwater, quality of the impacted groundwater at BHA-2, and a single leachate sample collected in September 2003. Comparing leachate quality data at the Site to leachate quality data from other selected landfill sites and typical leachate data made up the assessment of the leachate quality. The data comparison is presented in Table 7.1.

Leachate quality at the Site appears to be relatively stable and of generally low strength when compared to other landfills. The current leachate has a low to moderate nitrogen (ammonia) load, a low organic load, a low inorganic load and low phenol concentrations.

The future leachate quality is anticipated to be similar to the current leachate up until the commissioning of the Expansion Cell. As the Expansion Cell becomes active and produces leachate, the leachate can be expected to be of much higher strength, in particular, the stronger leachate will exhibit increased organic and nutrient loads.

7.3 EVALUATION OF SITE PERFORMANCE

7.3.1 TRIGGER LEVEL ASSESSMENT PLAN

A Trigger Level Assessment Plan has been developed to ensure water quality moving off-Site meets or exceeds all applicable MOE water quality standards, including Ontario Drinking Water Standards (ODWS), Provincial Water Quality Objectives (PWQO) and the Reasonable Use Concept (RUC). Trigger Level parameters were chosen by comparing the leachate quality to the ODWS and PWQO criteria to determine those leachate constituents that are of potential concern.

The natural attenuation compliance for all flow paths (Seguin Lake, Little Cramadog Lake and Oxley Wetland flow paths) is addressed through comparison of the compliance location quality data to background surface water quality and PWQO as all surface water flows discharge to surface water. Where groundwater exits the Site before reaching the surface water, compliance is also addressed through the comparison of compliance location quality data to RUC criteria. Five trigger locations have been established to evaluate Site performance. A list of the compliance monitoring locations and the flow path that they represent is presented in Table 7.2 and the list of chosen trigger parameters is provided in Table 7.3.

The trigger level assessment program has been developed in accordance with the MOE Guideline 232/98. The key components of the three-tier evaluation program are provided below:

Tier I – Routine Monitoring

Ground and surface water monitoring at the Site will take place twice per year for an extended list of parameters, and twice per year for a reduced list of parameters, as discussed further in Section 12.0. The annual monitoring program is part of the Tier I trigger program and is considered to be an Alert Level of monitoring. At Tier I monitoring, trigger level parameters will be defined by the PWQO or as the corresponding mean background concentration at SW26, whichever is greater, as well as by RUC where applicable. At present, a one-year mean background concentration (2004 monitoring events) has been utilized in the assessment to calculate the trigger level concentrations. As data becomes available, a five-year mean background concentration of all indicator parameters will be calculated.

Tier II – Confirmation Monitoring

If during a single quarter-annual monitoring event, two or more trigger parameter concentrations exceed the Tier I trigger concentrations at a single compliance location, the Tier II Confirmation Monitoring program would be implemented. The Tier II Confirmation Monitoring program consists of collecting water quality samples in duplicate from the location exhibiting the Tier I exceedance during the next scheduled monitoring event in order to confirm the Tier I exceedances of the trigger parameters. If the duplicate samples indicate that Tier I trigger concentrations are no longer being exceeded then Tier I monitoring will resume.

If the Tier I exceedance is confirmed, then the next step in the Tier II Confirmation Monitoring program will be to evaluate the degree, nature, and potential source(s) of trigger level impact identified in Tier I. As a first step, the trigger parameter concentrations will be compared to the established trigger level concentrations, calculated as per Tier I monitoring. The comparison and compliance with established trigger level concentrations is to be utilized as an indicator of the timing and urgency of response. The comparison will also include parameter trend analysis over time with emphasis on seasonal variations, if any, for trigger parameters and an evaluation of the need to increase monitoring frequency or expand the trigger level parameter list. If the Tier II Confirmation Monitoring program indicates the Site is out of compliance then the need to implement contingency measures will be evaluated and implemented, through consultation with MOE staff.

Tier III – Compliance Monitoring

The Tier III Compliance Monitoring is a program designed to assess the effectiveness of the contingency measures. The Tier III Compliance Monitoring program details would be determined in conjunction with the development and implementation of the preferred remedial measure. The compliance performance trigger parameters, concentrations, locations and monitoring frequency would be determined at such time.

7.4 CONTINGENCY MEASURES

Modelling undertaken for the Landfill Expansion indicates no anticipated off-Site adverse impacts to the groundwater as a result of the Expansion Cell, as detailed in the Incremental Impact Assessment (CRA, 2006). Nonetheless, a series of contingency measures have been identified and developed to mitigate any adverse groundwater conditions during and subsequent to the operation of the Expansion Cell.

The contingency measures developed for the Site are summarized in the following sections and are hydrogeologically feasible and consistent with the groundwater management approach at the Site.

7.4.1 GROUNDWATER CONTINGENCY PLANS

In the event of confirmation of an exceedance as per the Trigger Level Assessment Program outlined above, the need for contingency measures to bring the water quality back to within regulatory compliance will be evaluated at such time. If it is determined that contingency measures are necessary, a preferred strategy will be chosen, and implemented, under the direction of MOE staff. Possible contingency measures may include, but are not limited to, expansion of the Groundwater Treatment System through construction of an additional groundwater extraction well, or construction of a subsurface cut-off wall to redirect leachate-impacted groundwater to the existing groundwater extraction well, PW1.

7.4.2 LEACHATE CONTROL CONTINGENCY

As discussed in Section 7.3, the Site has been designed to minimize potential leachate build-up. The Site will be constructed with a LCS extending beneath the entire Expansion Cell including the bottom and side slopes of the base.

Should leachate mounding occur in specific areas of the Site due to failure of the LCS, the affected portion of the LCS will be investigated and cleaned as required.

Should a leachate mound continue to rise within the refuse to such an elevation that leachate seeps may occur at surface, a toe drain collection system and/or leachate extraction wells would be installed within the refuse.

7.5 CONTAMINATING LIFE SPAN

Under normal conditions the source concentration of landfill leachate will diminish with time through various processes, eventually reaching levels that are no longer a source of contamination for the Site. The contaminating life span of a landfill is the time required for the leachate concentration to decrease to regulatory defined quality objectives. The time requirements to reach those objectives will depend on the initial source

concentration of the leachate and the half-life of the various parameters within the leachate.

8.0 SURFACE WATER MANAGEMENT PLAN

8.1 GENERAL

The Surface Water Management Plan (SWMP) for the Site has been developed in accordance with the design requirements of O. Reg. 232/98. The primary objectives of the SWMP are to:

- convey and direct surface water runoff from the landfill area;
- provide storage capacity within the storm water management facilities;
- promote groundwater recharge;
- preserve the natural hydrologic cycle;
- control surface water runoff from the Site into the active disposal areas in order to minimize surface water contacting refuse; and
- minimize potential for on-Site erosion and sediment loading to down stream water courses.

The SWMP will be used in support for of the Application to amend the existing C of A Sewage No. 3-0178-94-006 issued under Section 53 of the OWRA to obtain approval for implementation of the surface water management works.

The SWMP hydrologic analysis was completed to calculate peak flows and runoff volumes from the Site under various storm event conditions. The computer model MIDUSS 4.72 (Smith, 1993) was used to complete the hydrologic modelling. The modelling was used to provide a basis for identifying and sizing appropriate surface water management features. Model input parameters include design storms, topographic features (drainage area, flow length, slope, roughness), soil parameters (antecedent moisture conditions, infiltration capacity), ground cover conditions, and drainage paths.

The 2, 5, 10, 25 and 100-year storm events were considered in the hydrologic modelling to provide a design basis for on-Site surface water management features. The a, b, and c parameters for each of these storm events are summarized in Table 8.1. Two infiltration ponds are proposed to handle surface runoff from the landfill site. In keeping with standard engineering practice, the basins were designed to have capacity for the surface runoff from the 100-year storm. The peak runoff flows associated with the 100-year storm will be conveyed on Site within the existing and proposed ditches. Only under

extreme storm events beyond the 100-Year storm event will surface runoff be discharged from either pond via emergency overflow weirs.

8.2 EXISTING CONDITIONS

8.2.1 EXISTING DRAINAGE PATTERNS

The Site is part of the Parry Sound Watershed. All surface water in the area of the Site eventually discharges to the Seguin River, which is the largest regional drainage feature. The Seguin River flows west to Mountain Basin and Mill Lake eventually discharging to Parry Sound and Georgian Bay.

There are no natural surface water bodies or drainage features identified on the Site. Several small lakes, creeks and wetlands are located within one kilometre of the Site boundaries, including Agnes Lake, Cramadog Lake, Little Cramadog Lake, and the Oxley Wetland, all of which ultimately discharge to the Seguin River.

The Landfill is located at a regional topographic high point. This highpoint comprises a surface watershed divide, and surface water runoff drains radially out from the lined landfill area in all directions as shown on Figure 2.3. There are four surface water catchment areas that include surface water drainage from the original landfill footprint and the approved lined landfill. The four catchment areas that include surface water drainage from the Site are the Seguin Lake, Front Pit, Cramadog Lake, and Oxley Wetland Catchment Areas as shown on Figure 2.1.

The surface water generated from the final covered portion of the Existing Landfill is collected by a perimeter ditch and piping system and conveyed to an infiltration pond located northwest of the lined landfill. Surface water conveyed to the pond is allowed to infiltrate into the groundwater regime or during storm events overflow into a naturally occurring swale that eventually discharges to the Seguin Lake.

Surface water from the southeastern portion of the Site is conveyed to the Front Pit by a combination of overland flow and surface water ditches. Due to historic aggregate extraction there is no outlet for surface water in this catchment area, and as such all surface water in this area infiltrates into the groundwater regime. As shown on Figure 3 groundwater flow beneath the Front Pit contributes to the Little Cramadog Lake and the Oxley Wetland flow paths, eventually discharging to the Seguin River.

Surface water from the eastern portion of the Site and the Sherwin Property is conveyed by overland flow and natural drainage swales to the roadside ditch on the north side of McDougall Road. Surface water from the north roadside ditch is conveyed by four culverts under the road into the Oxley Wetland. Water from the Oxley Wetland is conveyed to the Seguin River by a culvert under McDougall road at the north end of the wetland. Water also flows via a combination of man-made and natural ditches and swales across a portion of the Sherwin Property to the Seguin River.

8.3 PROPOSED CONDITIONS

The following sections describe the storm water management measures proposed to manage surface runoff from the Site.

The post closure conditions hydrologic model was developed to calculate the runoff conditions that will prevail following closure of the Site and design the surface water management features necessary to compensate for these changes in the hydrologic regime. The internal ditch located along the perimeter of the landfill area at the toe of the slopes will direct runoff to the ponds. Under post closure conditions two infiltration basins are proposed one at the southeast portion of the Site within the Front Pit and Oxley Wetland flow path and one in the northwest portion of the Site replacing the existing infiltration pond in the Seguin Lake Catchment Area. The proposed infiltration ponds will have sufficient storage capacity to retain and infiltrate the surface runoff associated with the 100-Year storm event. An armoured overflow weir and outlet channel is proposed in each pond to prevent erosion in the event of overtopping.

As presented in Figure 8.1, seven catchment areas were delineated to represent the drainage from the landfill under Post-Closure conditions. A flow schematic representing the post closure conditions hydrologic model is presented on Figure 8.2. The post closure conditions subcatchment parameters used in the hydrologic model are summarized in Table 8.2. A copy of the post closure conditions hydrologic modelling output is provided in Appendix G.

8.3.1 PROPOSED CONDITIONS HYDROLOGIC MODEL

The hydrologic model was used to calculate peak flow rates and runoff volumes for the 2, 5, 10, 25 and 100-Year design storm events. The 2 and 5-Year storms were used to calculate the response of the stormwater management system to minor storm events. The 25 and 100-Year storms were used to calculate the response of the stormwater

management system to major storm events. Tables 8.3 and 8.4 provide a summary of the calculated peak flows from the Site and summaries of the calculated runoff volumes from the Landfill catchment areas respectively. The proposed design will retain all surface runoff associated with the considered design storm events and therefore meets the MOE criteria.

Using the flows calculated in the post closure conditions hydrologic model, the perimeter ditches and on Site culverts were designed accordingly. A copy of the design calculations supporting these drainage features is provided in Appendix G.

8.3.2 PROPOSED STORMWATER MANAGEMENT SYSTEM

Drawing No. C-07 (Appendix L) presents the proposed storm water management plan features. The expanded stormwater management system is proposed to consist of one drainage culvert 14.2 m in length and 1050 mm diameter, 600 m of ditches and two infiltration basins having a total capacity of 3,112 m^3. Design parameters for existing and proposed ditches are presented in Table 8.5. Hydraulic calculations for the conveyance system and infiltration ponds are presented in Appendix G.

8.3.2.1 EXPANSION CELL STORMWATER MANAGEMENT

The series of eastern perimeter ditches representing a length of 600 m will convey surface runoff from the Expansion Cell to a 1050 mm diameter corrugated metal pipe culvert, where it will be conveyed to the infiltration pond (Pond 1) located in the Front Pit catchment within the Oxley Wetland flow path. The proposed drainage swales will be constructed with 3H:1V side slopes, a minimum depth of 0.8 m, and a longitudinal slope of 0.55 to 0.86%.

The infiltration pond (Pond 1) is proposed to be approximately 75 m in length by 25 m in width with 3H:1V side slopes. The minimum infiltration area is 1,817 m^2 with 0.6 m of normal operation depth and a design depth of 1.2 m providing approximately 1,774 m^3 of temporary retention storage. Overflow from the Pond 1 will discharge via an overflow weir to the Front Pit and infiltrate into the groundwater regime. Groundwater flow beneath the Front Pit contributes to the Little Cramadog Lake and the Oxley Wetland flow paths, eventually discharging to the Seguin River.

8.3.2.2 EXISTING LANDFILL STORMWATER MANAGEMENT

The existing perimeter ditches surround the entire existing Landfill and drain to a set of storm sewer culverts and eventually to the existing infiltration pond (Pond 2) located in the northwest portion of the Site within the Seguin Lake flow path. The drainage swales are triangular and have a total length of 500 m. The drainage swales are riprap lined to minimize the potential for erosion to occur as calculated velocities in the ditches under various storm events exceed 1.5 m/s. The remaining ditches have a vegetative cover to prevent erosion and enhance infiltration and sediment control. The drainage swales have 3H:1V side slopes, a minimum depth of 1.0 m, and a longitudinal slope of 0.75%.

Pond 2 will be reconstructed to be approximately 65 m in length by 25 m in width with 3H:1V side slopes. The minimum area required to facilitate infiltration is 1,425 m^2 with a normal operating depth of 0.6 m and a 1.2 m design depth. At 0.6 m depth, the basin provides approximately 1,368 m^3 of retention storage. Overflow from the Pond 2 will discharge via an overflow weir to the natural drainage swale eventually discharging to Seguin Lake.

8.3.2.3 INFILTRATION BASINS

Infiltration basins are stormwater runoff impoundments designed to capture and retain surface runoff and subsequently infiltrate it into the ground over a period of time. The infiltration basins will provide peak discharge, volume, and water quality control for all surface runoff from storm events up to the 100-year storm. The infiltration basins will reduce the volume of runoff, remove many pollutants and provide stream base flow and regional groundwater recharge. The advantages of the use of infiltration basins include:

- reduction of surface runoff volume from landfill site;
- effective removal of fine sediment, trace metals and bacteria;
- reduction of downstream flooding risk; and
- groundwater recharge to support base flow in nearby streams.

8.3.2.4 PRE-TREATMENT OF STORMWATER RUNOFF

Infiltration basins are susceptible to high failure rates due to clogging from sediments and therefore pre-treatment of surface runoff draining to the basins is required to remove as much suspended sediment from the runoff as possible prior to discharge to

the basin. Rock check dams will be installed in the perimeter ditches to pre-treat surface runoff. The check dams will capture larger sediment particles and be easier to maintain than the basin itself thereby increasing the time required between maintenance events in the infiltration basins.

8.3.2.5 INFLOW AND OVERFLOW

To prevent incoming flow velocities from reaching erosive levels, which can scour the basin floor, inlet pipes and culverts to the basin will be stabilized. Culverts draining to the basin are proposed to terminate in broad rip rap aprons, which will disperse the runoff more evenly over the basin surface to promote better infiltration. Detailed design calculations for the riprap aprons are presented in Appendix G.

Emergency overflow weirs are proposed to convey runoff from large storms without damage to the structure.

8.3.2.6 INFILTRATION BASIN MAINTENANCE

Routine and non-routine maintenance is required to keep infiltration basins operating effectively. Pre-treatment devices associated with basins should be inspected and cleaned at least twice a year or when the sediment capture capacity is reduced by one third, whichever occurs more frequently. The infiltration basins should be inspected following major storms, especially in the first few months after construction. Maintenance is necessary if stormwater remains in the system beyond the design drawdown time (24 hours). Periodic maintenance includes removal of debris, mowing the sides, and re-vegetating eroded or barren areas. If mowed, grass clippings should be removed to prevent clogging of the surface. The basins were designed to have 3H:1V side slopes to help sustain vegetation, permit access for maintenance, and ensure public safety and ease of mowing.

Occasionally, non-routine maintenance or basin rehabilitation may be required. This may include removal of accumulated sediment and scarification of the basin floor. Sediment removal should be performed only when the soil surface is very dry to avoid compaction of the basin bottom. It is important to avoid the use of herbicides and fertilizers on grassed portions of the infiltration basin since these applications can directly contribute undesirable pollutants in nearby waterways.

8.3.2.7 EROSION AND SEDIMENT CONTROL PLAN

The purpose of erosion and sediment controls are to minimize the potential release of pollutants and specifically sediments directly or indirectly into the receiving waters. To achieve this objective, an erosion and sediment control plan will be established and implemented during construction. These controls may include but not be limited to temporary detention basins, rock check dams, straw bale check dams, and filter media.

During construction activities, visual monitoring will be conducted regularly and within 24 hours of any rainfall event of 12 mm or more. Monitoring shall consist of visual observation for the effectiveness of the sediment and erosion controls and sediment migration off-Site. Sediment traps shall be inspected to ensure that they have been properly installed and continue to function as designed. Any observed releases of sediment into receiving waters or adjacent lands shall be removed and returned to the Site prior to significant impact to those areas. Accumulated sediments in any capture measures shall be removed once the control's capture capacity has been reduced by one third and used on the landfill as daily cover. Following closure of the Site, sediment captured in the sediment controls shall continue to be removed as specified, however, the removed material shall be used as final cover material and seeded immediately upon placement on the landfill cap.

Construction inspections shall be conducted until such time as the ponds and ditches have been constructed and vegetation has established itself to a density equivalent to 70 percent of the background native vegetation density. It is anticipated that the plantings will require one full growing season to fully grow in. An additional two growing seasons are anticipated to be required to achieve 100 percent density as native seed stock will be used to stabilize the Site and two seasons of renewal will be required to fully vegetate and facilitate complete stabilization of the Site.

Permanent monitoring at the Site shall be consistent with the existing monitoring program.

8.4 FLOOD RISK

The main concerns with respect to flood risk are related to safety and damage. All surface water runoff is redirected away from the landfill footprint, therefore there is minimal risk of impact from the landfill to the surrounding area. As the landfill is the topographic high region in this area, there is only minimal risk for flooding in the vicinity of the Landfill.

The proposed infiltration ponds will assist in reducing the flood risk to off-Site areas. Additionally, all proposed storm water management facilities have been designed to convey and store the total volume of runoff associated with the 100-Year storm event.

8.5 WATER QUANTITY

Limited infiltration will be available in areas where a final cover is proposed and runoff from these areas is high. Proposed conditions incorporate one additional pond and relocation and upgrading of the existing pond. Pond 2 will service the Existing Landfill. The proposed infiltration pond, Pond 1, will serve the Expansion Cell. The ponds will have sufficient storage capacity to retain the surface runoff from a 100-Year storm event.

8.6 WATER QUALITY

The SWMP design presents measures to control surface water such that there is no detrimental impact to the off Site environment. Effective control of storm water during the operational life of the landfill is important due to the high erosion and sediment loading associated with bare soil conditions and the potential risk of water contamination from site operations.

Sediment removal will be performed as required to remove sediments from the surface runoff that may reduce the infiltration capacity of the ponds. When operational, the infiltration ponds will function to filter water that will recharge the groundwater aquifer.

The two ponds will remain following closure of the Site. These ponds will provide a total storage capacity of approximately 3,112 m^3.

8.7 CONCLUSION

The storm water management measures presented are sufficient to meet the objectives to control the water quantity and quality discharged from the Site.

All on-Site ditches around the perimeter of the landfill are designed to convey the flow associated with the 100-Year storm. Grass and rip rap channel linings are proposed to enhance sediment and erosion control.

The proposed storm water management system incorporates two infiltration basins. The Pond 1 located in the Oxley Wetland flow path will be utilized to capture and treat surface runoff from the eastern portion of the site and Expansion Cell. Pond 2 located in the Seguin Lake flow path will be utilized to capture and treat surface runoff from the western portions of the Site, and the Existing Landfill. Ponds 1 and 2 will infiltrate/detain flows to provide sediment control and groundwater recharge. The existing Pond is proposed to be decommissioned and replaced with Pond 2.

Each pond is designed to retain and infiltrate flow from the 100-Year storm event. Only under extreme storm events beyond the 100-Year storm event, however, will surface runoff be discharged from either pond via emergency overflow weirs. The process of infiltration from the two ponds will improve the quality of the surface runoff before recharging the groundwater aquifer. Therefore it is anticipated that receiving waters will not be adversely impacted by the changes proposed for the Site.

9.0 LANDFILL GAS ASSESSMENT AND MANAGEMENT PLAN

9.1 LANDFILL GAS ASSESSMENT

9.1.1 LANDFILL GAS

Landfill gas (LFG) is produced by the biological decomposition of wastes placed in a landfill. LFG composition is highly variable and depends upon a number of site-specific conditions including solid waste composition, density, moisture content, and age. The specific composition of LFG varies significantly from landfill to landfill and even from place to place within a single landfill. However, LFG is typically comprised of methane (approximately 50 percent by volume) and carbon dioxide (approximately 50 percent by volume). LFG may also contain nitrogen (N_2), oxygen (O_2), and trace quantities of other gases (such as hydrogen sulfide (H_2S), mercaptans, etc.). In addition to the above methane-related LFG constituents, non-methane organic compounds (NMOCs) such as vinyl chloride, may also be generated and emitted at a landfill.

Due to its composition, the presence of LFG may create explosive, suffocating, and toxic conditions. LFG management may be required to control potential impacts relating to the release of LFG to the atmosphere and migration of LFG through the soil surrounding the Site.

The release of LFG into the air may contribute to odours in the vicinity of the Site and addition of "greenhouse gases" into the atmosphere. LFG odours are primarily a result of the presence of hydrogen sulfide and mercaptans. These compounds may be detected by sense of smell at very low concentrations (0.005 and 0.001 parts per million for hydrogen sulfide and mercaptans, respectively). It is generally recognized that the impacts related to these compounds are nuisance odours.

Migration of LFG through the soil poses two primary concerns that are related to the build-up of gases within or below structures near the landfill site. Firstly, accumulation of LFG in a subsurface structure (i.e., basement, buried chambers, etc.) may expose those required to enter the structure, to an oxygen deficient environment, which may be created by the presence of LFG. Secondly, accumulation of LFG in low-lying areas or within buildings introduces the risk of an explosion if a source of ignition is present.

9.1.2 LANDFILL GAS PRODUCTION

The production rate and the total volume of LFG that will be generated in a landfill, depends primarily on mass of refuse with several other factors including organic content, age of refuse, and moisture content influencing the production process. Landfill operations affecting production of LFG include:

- changes in waste composition accepted at the landfill over time, primarily due to changes in biodegradable content;
- landfill operations that change the quantity of moisture in the waste mass; and
- significant changes in total waste tonnage accepted at the landfill over the life of the site.

The evaluation of potential LFG emissions from the Site was conducted in accordance with the MOE guidance document entitled "Interim Guide to Estimate and Assess Landfill Air Impacts", October 1992 (Interim Guide).

There are numerous models available for estimating rates of production of LFG. Accepted industry standard models for estimating rates of LFG production are generally first order kinetic models, which rely on a number of basic assumptions regarding site-specific conditions. These models are used to predict the variation of LFG generation rates with a time for a typical unit mass of solid waste. The general rate curve is then applied to records (or projections) of solid waste filling at a site to produce an estimate of the site's LFG production over time.

A first order decay model (Scholl Canyon) was adopted by the United States Environmental Protection Agency (USEPA) under New Source Performance Standards and Emission Guidelines (NSPS) for Municipal Solid Waste (MSW) landfills. The Tier 1 approach of the NSPS model utilizes mathematical modelling with conservatively high default input parameters to estimate the non-methanogenic organic compound (NMOC) emissions from MSW landfills.

The NSPS model has several input parameters to estimate LFG emissions. The model uses the decay constant (k = 0.04 /year), the methane generation potential (LoCH4 = 125 m^3/tonnes), and waste tonnage as input parameters to estimate LFG production rates.

The Site has two landfill areas: the existing Landfill and the Expansion Cell. The LFG production rates from these areas were considered individually due to the varying operating parameters of each area.

The model was run for the Existing Landfill utilizing the following assumptions:

- daily fill rate of up to 17 tonnes of typical municipal solid waste;
- total site landfill capacity (including daily cover) of 329,600 m^3; and
- estimated waste disposal quantities of 6,254 tonnes per year and 187,626 tonnes total.

As shown on Figure 9.1, the estimated peak LFG production from the existing Landfill at the assumed scenario is approximately 124.0 m^3/hr (73 cubic feet per minute [cfm]) in the year 2006.

The model was run for the Expansion Cell utilizing the following assumptions:

- daily fill rate of up to 45 tonnes of typical municipal solid waste;
- total site landfill capacity (including daily cover) of 678,738 m^3; and
- estimated waste disposal quantities of 16,290 tonnes per year and 407,243 tonnes total.

As shown on Figure 9.2, the estimated peak LFG production for the proposed landfill expansion at the assumed scenario is approximately 293.9 m^3/hr (173 cfm) in the year 2031.

Therefore, the cumulative effect of the two landfilled areas at the assumed scenario is estimated to peak at approximately 339.8 m^3/hr (200 cfm) in the year 2031 as shown on Figure 9.3.

Generally, the peak LFG production occurs within a couple of years after Site closure. Based on the factors affecting the production of LFG at the McDougall Landfill Site discussed previously, it is not expected that LFG production will be higher than that presented above.

9.1.3 ATMOSPHERIC EMISSIONS OF LANDFILL GAS

Potential LFG emissions of particular interest include NMOCs and odours. The LFG emission estimate provided in Section 9.1.2 was used to assess potential NMOCs and odour emissions from the Site.

9.1.3.1 ESTIMATED NMOC EMISSION RATES

NMOCs are typically found in LFG in trace quantities and their concentrations vary from site to site. Composition data is not available for the McDougall Landfill Site, however, LFG data typical of that found in landfills in Ontario is suitable for use in this application. Data was obtained from several Ontario and selected USEPA landfills and the 95% upper confidence limit of mean value (UCL) concentrations of the NMOCs were used. The landfills selected for the characterization of the LFG are Bensfort Road Landfill, Cambridge Landfill, Greenlane Landfill, Keele Valley Landfill, Vaughan Landfill, Waterloo Landfill, and selected USEPA landfills. The concentration data is summarized in Tables 9.1, 9.2, and 9.3 for the existing cells, the proposed cells, and the total landfill area respectively.

9.1.3.2 ODOURS

Odour at the Site may originate from the following sources:

- the placement of freshly collected waste;
- the emission of LFG; and
- small cracks in the cover.

In order for odour to be noticed by a person, odour must be present at a sufficient concentration and for a finite period of time. An odour unit (OU) is the quantity of an odourous substance which, when dispersed in one m^3 of clean air, becomes detectable by 50 percent of a population of 'normal' human observations. The Interim Guide recommends a default LFG odour concentration of 10,000 (OU/m^3) and suggests an odour detection limit of 1 OU/m^3 over 10 minutes at the point of reception.

An odour impact assessment will be prepared if odours become problematic at the Site.

9.1.4 SUBSURFACE MIGRATION OF LANDFILL GAS

The assessment of the LFG migration potential requires a basic understanding of the fundamentals and processes involved in the decomposition of solid waste. Depending upon the proportions of the two major constituents of LFG (CO_2 and CH_4), it can either be lighter or heavier than air and therefore may accumulate in structures or low-lying areas. Should there be a continuous source of LFG, the hazard may be significant given

that methane is explosive in the range between approximately 5 to 15 percent by volume in air.

Medium to coarse-grained soils tend to act as preferential pathways for migration of LFG while fine grained, clayey or water bearing soils tend to impede the movement of LFG. Granular bedding materials and pipelines in underground service corridors may also provide preferential pathways for LFG migration.

In the context of LFG migration, trigger levels are established based on an exceedance of a specified concentration of combustible gas. The following migration trigger levels are based on O.Reg. 232/98 (under part V of the Environmental Protection Act). The criteria require that the following be met:

- less than 2.5 percent methane gas in the subsurface at the property boundary;
- less than 1.0 percent methane in an on-site building, or its foundation; and
- less than 0.05 percent methane (i.e., not present) in a building, or its foundation, which is located off-site.

Subsurface migration potential of LFG at the Site are low due to:

- low LFG production indicating minimal quantities of gas available to migrate and minimal in-refuse gas pressures which provide the driving force for migrating LFG; and
- base and side slopes of the landfill consisting of an engineered composite liner that will inhibit LFG migration.

The Site geology, hydrogeology, and the proposed engineering features demonstrate low potential for migration of landfill gas below land surface to adjacent or off-Site properties or into buildings or enclosed structures located on-Site or off-Site.

9.2 LANDFILL GAS MANAGMENT

9.2.1 LANDFILL GAS COLLECTION

O.Reg. 232/98 requires mandatory collection of LFG for sites exceeding 3,000,000 m^3 waste disposal capacity. As such, active LFG collection at the McDougall Landfill Site is not considered necessary as:

- the total solid waste capacity of the Site is set at 1,008,493 m^3, which is significantly below the threshold of 3,000,000 m^3 set out in the MOE Landfill Standards;
- LFG emissions are estimated to be low based on the production assessment described in Section 9.1.2; and
- anticipated landfill operational practices will not significantly enhance atmospheric emissions of LFG.

Based on the landfill gas production assessment presented in Section 9.1.2, and the age and relative small size of the Site, it is CRA's opinion that emissions to the atmosphere are not an issue for further consideration.

It is noted that this does not preclude the landfill operator from voluntarily pursuing active LFG collection for the purpose of obtaining "greenhouse gas" credits or utilizing the energy content of the LFG, should it become economically feasible in the future.

9.2.2 LANDFILL GAS MIGRATION MONITORING

As discussed above, it is not anticipated that there will be a potential for migration of landfill gas. Since there is no significant potential for landfill gas to migrate, a LFG migration monitoring program is not proposed at this time.

However, the potential for migration of LFG through buried utility or service lines in the area of the leachate collection system at the Site is of concern. Based on this concern, it is recommended that LFG monitoring be implemented in on-site buildings. To monitor for the potential presence of combustible gas within each building envelope, an ambient combustible gas detection system is recommended.

9.2.3 SAFETY PRECAUTIONS

To avoid the hazards posed by LFG all personnel must exercise extreme care. Due to the potential explosion hazard, no smoking, open flames, or potentially sparking activity should be permitted in areas where LFG may be present. Due to the potentially harmful compounds which may be present in LFG and condensate (moisture condensed from LFG), care should be taken to avoid inhalation of raw LFG and to avoid contact of skin or mucous membranes with condensate.

On-Site buildings will be provided with methane gas monitoring devices with detection alarms tied to the building ventilation system, and confined space protocols will be implemented for potential confined spaces. Additionally, all on-Site structures and chambers including leachate collection system access chambers will be signed for potential LFG hazards.

9.2.4 CONTINGENCY MEASURES

The contingency measures outlined are presented in the event of detection of methane at one or more of the on-Site building monitoring locations. Prior to implementation of a contingency measure a detailed trigger level assessment of the landfill gas migration will be conducted.

Based on the results of the trigger level assessment, the need for installation of a passive barrier system would be determined.

A passive barrier system would include:

- installation of geomembrane "keyed" into the groundwater table to prevent migration of gas beyond the barrier;
- installation of a granular trench to provide a collection gallery for passive venting to the atmosphere; and
- installation of gas vent stacks to provide a conduit for passive landfill gas venting.

The installation of passive gas vents through the final cover soils, once installed, may also be required. The installation of passive gas vents will:

- maintain the integrity of the final cover soils;
- reduce the potential for subsurface horizontal migration; and
- allow for additional monitoring to evaluate the status of gas generation within the landfill.

The passive gas vents would be installed along the top center ridge of the final contours proposed for the Site where the final cover could become compromised from the uncontrolled discharge of LFG.

Passive venting systems rely on slightly positive (relative to atmospheric) pressure of gas migrating through the soil/refuse to induce exhaust or gas to the atmosphere. If post-construction LFG monitoring indicates the need for enhanced LFG extraction, gas vent wind turbines will be installed on each gas vent.

9.2.5 CONTAMINATING LIFE SPAN

Generally, the peak LFG production occurs within a couple of years after Site closure and can continue for approximately 50 years, depending on the site–specific conditions including solid waste composition, density, moisture content, and age. Based on the factors affecting the production of LFG at the McDougall Landfill Site discussed previously, LFG production is expected to peak in 2031, at the time of Site Closure.

10.0 SITE FACILITIES

10.1 SITE FENCING

Site access is controlled via a main access road off of McDougall Road as shown on Drawing No. C-01. The main entrance gate is currently locked outside of normal operating hours to prohibit vehicle entrance and uncontrolled disposal when the Site is closed. A 1.2 m high post and wire fence exists along a portion of the southern property boundary adjacent to McDougall Road. With the existing fencing and vertical grade change along McDougall Road and the Site, additional fencing for Site security along McDougall Road is not required. Additional fencing and/or guardrails are provided along a portion of the western property boundary and northwest of the Existing Landfill.

10.2 GATE HOUSE

An existing office trailer (gate house) is located on the southern portion of the Site off of the main access road as shown on Drawing No. C-01. With construction of the Expansion Cell a new scale house will be constructed along the Site perimeter road as presented on Drawing C-03. The building will also house the iron-reduction and leachate treatment system facility.

10.3 WEIGH SCALE

The existing weigh scale is located opposite the existing gatehouse as shown on Drawing C-01. The weigh scale will be relocated opposite the new scale house once constructed. The weigh scale will be used to measure the weight of all waste haulage vehicles entering and leaving the Site.

10.4 MATERIAL RECYCING AREA

All waste received at the Site is currently examined for materials which may be diverted from the landfill. Items currently diverted from the landfill include scrap metal, white goods, clean wood waste, propane tanks, and tires. As previously discussed in Section 2.7, waste diversion activities including blue box recycling are carried out prior to waste arriving at the Site. As such blue box recycling is not carried out at the Site.

Scrap metal, white goods and propane tank collection areas are located along the western portion of the site, south of the existing Landfill. Wood and brush are currently stockpiled north of the existing Landfill as shown on Drawing C-01. With construction of the Expansion Cell the wood and brush stockpile area will be relocated to the southwest portion of the Site and the existing wood/brush area will be used for stockpiling of soils for use in landfill operations. Wood and brush is chipped and used in landfilling operations.

Bins may also be established in the vicinity of the scale house to accommodate receipt of small quantities of recycling and/or waste by the public as shown on Drawing C-03.

10.5 SITE ROADS

The existing Site access road network is shown on Drawing No. C-01. Access to the Site is via the main access road off of McDougall Road. The Site entrance road leads to the scale house and connects to the perimeter roads providing access to the active areas of the landfill, material recycling area, and material stockpile area.

Under long-term operation of the Site, three types of roadways will be utilized. The roadway types are described as follows:

- Site access road;
- perimeter Site maintenance road; and
- secondary haul road.

The existing Site access road will continue to be utilized and will continue to provide access to the entire Site under long-term operation of the Site. This road will continue to be maintained with a granular surface.

The combination of the main Site access road and extension of the perimeter Site maintenance roads will allow for complete access around the landfill area. The perimeter Site roads will also allow for access to the storm water management ponds for maintenance. A typical cross-section of the perimeter Site maintenance road is provided on Drawing No. C-10 (Appendix L).

Secondary haul roads will be constructed as required to access the working face(s) and working area(s) of the landfill. Secondary haul roads will provide for hauling refuse and daily cover soil to the active disposal face.

10.6 SIGNS

A sign is posted at the main entrance to the Site, which displays prominently the following:

- name of the Site;
- operating authority;
- Site Provisional Certificate of Approval Number;
- hours of operation; and
- phone number for reporting emergencies during non-operating hours.

Miscellaneous signs including Stop, All Vehicles Report to Office, and No Dumping or Littering are posted in appropriate locations throughout the Site.

Under the long-term operation of the Site, the need for additional signage will be reviewed from time to time by landfill staff for adequacy and implementation as required.

10.7 SITE EQUIPMENT

Adequate equipment will be maintained at the Site to ensure that operational requirements will be met. The equipment currently used at the Site, which will continue to be used during long-term operation of the Site is summarized below.

Equipment	*Operations*
Caterpillar 816B Landfill Compactor	• spreading and compacting of landfill materials and cover soils
Case 721C Loader	• construction of roads and SWM works • snow removal • hauling of material used for cover soils and miscellaneous construction works
D3x1 Caterpillar Bulldozer	• grading of cover soils • construction of roads and SWM works
John Deere Gator HPX 4x4	• litter control and Site inspections
Ford L8000 Tandem Tanker	• leachate pumping and haulage

Equipment used for Site construction activities is typically provided by a third party retained through tendering process. The existing Site equipment will be adequate for the proposed landfill expansion at the estimated landfilling rates. The need for additional or replacement equipment will be assessed on an as required basis.

10.8 SCREENING AND LANDSCAPING

A Visual Impact Assessment of the Site was conducted to provide an assessment of potential visual impacts that may result from the operation of the Landfill. The assessment was undertaken in accordance with the O. Reg. 232/98, Item 6, (2) (c)(xv).

As previously noted, the Site abuts an aggregate pit to the west, undeveloped land to the north and a mixture of undeveloped land and residential properties to the east and south, with McDougall road parallel to the southern property boundary as shown on Drawing C-02. As such, the visual impact assessment involved a visual evaluation of the Site from the quarry west of the Site and five locations along McDougall Road.

The Visual Impact Assessment notes that high visibility exists from the quarry adjacent to the west of the Site. Visibility from McDougall Road was noted as low at all five locations.

Although the landfill is visually seen from the adjacent quarry, due to the nature of the quarry operations, the landfill does not provide a visual impact on the property that would require measures to be undertaken to mitigate the visual impact.

As such requirements for visual screening along McDougall Road are not required. Requirements for further landscaping will be assessed as part of the End Use and Site Closure Plan to be prepared for the Site as discussed in Section 2.9.

A copy of the technical memorandum documenting the Visual Impact Assessment is provided in Appendix H.

11.0 SITE OPERATION

11.1 SITE SUPERVISION

The McDougall Landfill Site is operated by the Municipality of McDougall. Adequate manpower will continue to be maintained at the Site to ensure that operational requirements are satisfactorily met. Two full-time employees are on Site from April 1st to November 1st and one full-time employee is on Site for the remainder of the year. Additionally one to two students work at the Site from May to August. In general, these employees are responsible for accepting and recording waste loads, rejecting and recording waste loads rejected, segregation, stockpiling and placement of waste, placement of waste cover, record keeping, and site inspection and house keeping including collection of wind blown litter along McDougall Road.

Site personnel are also responsible for maintaining environmental controls including dust, litter, odour, and noise control measures on an as required basis.

The Site operator will ensure that all landfill employees are adequately trained with respect to the technical requirements for the operation of the landfill. Employees are trained in Workplace Hazardous Materials Information System (WHMIS) and in daily operation of the landfill, including how to safely operate all landfilling equipment.

11.2 HOURS OF OPERATION

At the present time, the Site operates from 9:00 AM to 4:00 PM Monday through Friday and Saturday from 9:00 AM to 1:00 PM from May 1st to Labour Day Weekend and one Saturday per month for the rest of the year. Equipment normally operates at the Site up to two hours before and after the hours of operation to complete the required maintenance and cover soil placement operations. Leachate haulage occurs between 7:00 am and 7:00 pm, with provisions for emergency haulage 24 hours per day 7 days per week.

11.3 SITE SECURITY

As discussed in Section 11.1, one to two dedicated employees are present at the Site during operating hours, depending on the time of year. These dedicated employees maintain Site security and ensure that all persons entering the Site are authorized to do so.

The main access gate will be locked outside of normal operating hours to prohibit vehicle entrance and uncontrolled disposal when the Site is closed.

11.4 INSPECTION, COMPLAINTS, AND RECORD KEEPING

Inspection of the Site conditions and operations are conducted by landfill personnel to verify that nuisance factors associated with housekeeping procedures, such as dust, litter, odour, and noise are under control, thereby preventing routine operational nuisances from developing into more serious environmental problems. If any housekeeping or nuisance problems are observed, the need for and type of corrective action(s) required to resolve the problems will be implemented as soon as possible after identification.

Operation complaints received by landfill personnel will be documented on a Landfill Complaint Form, which records the information pertaining to the complaint, a description of the complaint, and the appropriate response/action undertaken or carried out to address the complaint. The landfill personnel will undertake corrective action(s) as soon as possible after identification of need. A copy of the Landfill Complaint Form is provided in Appendix I.

In addition to the above, the landfill personnel will ensure that all material entering the Site is weighed and recorded. The quantity and type of waste accepted at the site is recorded electronically.

11.5 DUST CONTROL

Dust generation is common at most landfill sites due to the handling of soils and movement of vehicles along gravel and dirt roads. Dust impacts typically result from landfill traffic, landfill operations, soil borrow operations, and wind erosion. Dust in the vicinity of a landfill site should not be problematic under normal conditions and is usually controllable under extreme conditions.

Dust on Site will be controlled by applying water or calcium chloride to the travelled areas to ensure dust is kept to a bare minimum. No complaints of dust nuisances have been received by landfill personnel.

Dust impacts will be managed by utilizing suitable road construction materials and completing routine road maintenance.

Should dust become problematic at the Site, the following control measures will be implemented:

- lower vehicle speeds;
- reduce landfill activities during periods of high wind;
- curtail soil hauling activities during periods of high wind; and
- apply dust suppressant(s) (i.e. water or calcium chloride) more frequently to Site roadways, soil borrow areas, and if required, to the active disposal area.

11.6 LITTER CONTROL

Preventative litter control measures are taken to minimize the blowing of debris from the active area of the landfill. Any litter, which is observed around the Site, is picked up on a regular basis to prevent litter from becoming problematic. Additional staff is hired to keep the site and surrounding area clean, particularly in the spring and summer.

To ensure that litter does not become problematic at the Site during normal or extremely windy conditions, the following control measures will be implemented:

- all vehicular traffic transporting refuse to and around the Site will be adequately loaded and tarped, as necessary, to prevent litter from blowing out of the vehicle;
- daily cover soils will be placed over the working face of the landfill in order to minimize the blowing of debris; and
- the active face of the landfill will be kept to a minimum. This may be accomplished by placing daily cover soils over a portion of the active face, should windy conditions warrant this action.

11.7 NOISE CONTROL

A Noise Impact Assessment was prepared in accordance with the MOE October 1998 Noise Guidelines for Landfill Sites (Landfill Standards). A copy of the technical memorandum documenting the assessment is provided in Appendix J.

The Landfill Standards provide the following sound level limits for a point of reception:

- 45 dBA in any hour of the night, 7:00 PM. to 7:00 AM.; and
- 55 dBA in any hour of the day, 7:00 AM. to 7:00 PM., or less than or equal to background if background is greater than 55 dBA.

The nearest residential receptor is the Stage/Sherwin property located southwest of the landfill. However, since this property is blocked visually by existing topography of more than 10 m in elevation change and by dense vegetation, the noise assessment was undertaken for the next closest resident (Oxley property) located east of the Site.

Off-Site noise impacts at the Oxley residential receptor was evaluated for the operation of Site equipment. The predicted noise levels at the Oxley residential receptor was calculated using reference sound levels and estimated distances to the residential receptor.

The worst case noise impact for the operation of Site equipment is anticipated to occur when all equipment is being operated and the leachate pumping facility is active. Should this situation occur the worst case noise level at the residential receptor will be 53.3 dBA which is below the MOE's daytime noise level criteria of 55 dBA. Even with the very conservative modelling assumptions, the Site equipment is not anticipated to have any noise impacts at residential receptors.

Based on the results of the noise assessment no noise control measures are required for the long-term operation of the Site.

11.8 ODOUR CONTROL

In general, landfills have the potential to emit two types of odours: refuse odours and landfill gas odours. Refuse odour is generated by recently disposed waste and is controllable by the application of daily cover soil. Landfill gas odour is generated during the anaerobic decomposition of organic waste material.

Waste odours will be managed by minimizing the active working face and applying daily cover. Landfill gas odours will be managed by utilizing interim cover on inactive areas of the landfill that have not reached final contours and progressively closing

portions of the landfill as they reach final contours. Closing areas will include construction of final cover and the establishment of vegetation.

The 2003 Annual Report (Ince, 2004) noted that some complaints concerning nuisance odours from the Site were received by the Municipality during 2003. These complaints were usually related to the burning of wood waste. The Municipality ceased burning wood and is now chipping this material for on-Site use (Ince, 2005).

Should odours become a problem at the Site an investigation into the problem will be required. The investigation will address such items as gas generation rates, odour problem areas around the Site, and potential methods to reduce odours, such as gas collection systems.

11.9 TRAFFIC CONTROL AND IMPACT

The low volume of vehicular traffic at the Site has not resulted in significant traffic impacts. The Existing Site is located in a relatively unpopulated area of the Municipality and the total Site related traffic represents a small percent of total traffic using McDougall Road. Under long-term operation of the Site, it is anticipated that there will be no significant increase in the volume of truck traffic historically experienced to the Site.

Access to the Site will continue to be via the main entrance off of McDougall Road. All vehicular entrance to the Site is controlled at the main access gate.

McDougall Road has an asphalt surface and provides good access to the Site. The main Site access road is granular surface and therefore minimizes the tracking of mud from vehicles leaving the Site, during wet weather operations, onto McDougall Road. However, should conditions warrant, then the landfill operator will arrange for McDougall Road to be cleaned in the vicinity of the Site entrance, on an as required basis.

Traffic control signs including Stop and All Vehicle Report to Office are posted in appropriate locations throughout the Site. The need for additional signage will be reviewed from time to time by landfill staff for adequacy and implementation as required.

11.10 VECTOR AND VERMIN CONTROL

The terms vector and vermin refer to objectionable insects, rodents, and birds that may establish a habitat at the landfill. Common vector and vermin include flies, rats, and gulls. The impact of these species is of concern from both a health and aesthetic perspective. Landfill operations are required to control vector and vermin on the Site.

According to landfill personnel, vector and vermin is not problematic at the landfill. Additionally, no complaints have been received by landfill personnel, with respect to the control of vector and vermin.

However, should vector and vermin become problematic then the following control measures will be taken:

- should an outbreak of flies occur at the Site, an insect exterminator will be contracted to control the population on an as required basis;
- should rodents come to inhabit the Site, then extermination will be conducted by a licensed exterminator on an as required basis; and
- should the presence of gulls become problematic at the Site, measures would undertaken to control and discourage them. The more frequent application of waste cover soil will assist in mitigating the presence of gulls.

11.11 SCAVENGING

Scavenging of deposited and stockpiled waste is prohibited at the Site. Segregation of recyclable and recoverable materials from the incoming waste stream will be conducted by landfill personnel. These materials will be removed off-Site for subsequent recycling on an as required basis.

11.12 WINTER AND WET WEATHER OPERATION

Winter operations require advance planning for Site preparation, snow removal, and the stockpiling and storage of cover material.

Many operational problems occur as a direct result of failure to prepare an adequate disposal area in advance of winter. An area sufficient to hold more than the expected volume of waste will be prepared in advance. In addition, stockpiles of cover material

and areas for stockpiling snow will be provided and placed prior to the onset of winter. Snow fences to minimize and control snow drifting will be installed on an as required basis.

Under extremely wet weather conditions, the disposal operations may be temporarily relocated to a drier working area to accommodate vehicular traffic at the working face.

On-Site equipment required to be used for continued landfill operations during rainfall events, will be provided with closed cabs.

Site roadways will be maintained in a passable condition during wet weather conditions. Secondary haul roads to the active landfill area will be located so as to ensure continuous access to the active face during wet weather conditions. Should washouts of the Site roadways occur due to rainfall events, then the roadways will be reconstructed in a timely fashion and in a manner consistent with the design presented in this report.

11.13 RECEIPT, HANDLING, AND DISPOSAL OF ASBESTOS

Asbestos may be accepted at the Site for disposal in accordance with Section 17 of the General - Waste Management Regulation, R.R.O. 1990, Reg. 347. The protocols for the handling and disposal of asbestos waste at the Site are summarized below.

Receipt

Asbestos waste will not be accepted for disposal at the Site unless the landfill operator has received prior notification as to its anticipated time of arrival. The asbestos waste is to be transported to the Site in rigid, impermeable, sealed containers of sufficient strength to accommodate the weight and nature of the waste. Where the container is in a cardboard box, the waste shall be sealed in a 6-mil polyethylene bag placed within the box. Every container received at the Site will be free from punctures, tears, or leaks, and the exterior surface of the container free from asbestos waste, or it will not be accepted for disposal.

Asbestos waste will only be accepted at the Site if the container is displayed with large, legible letters that contrast in colour with the background, the word "CAUTION" in letters not less than 10 centimetres in height and the words:

"CONTAINS ASBESTOS FIBRES
Avoid Creating Dust and Spillage
Asbestos May be Harmful to Your Health
Wear Approved Protective Equipment"

Unloading

During unloading, any asbestos waste that is loose or in a container that is punctured, broken, or leaking shall be packaged, immediately on discovery, in a 6-mil polyethylene bag. All unloading activities will be carried out in such a manner to prevent the airborne discharge of asbestos and so that no loose asbestos or punctured, broken, or leaking containers of asbestos waste are landfilled.

Disposal

Asbestos waste will only be deposited at locations in the landfill area which have been adapted for the purpose of receiving asbestos waste. Disposal of asbestos waste will only be conducted under direct supervision by the landfill operator or a person designated by the operator for that purpose and the person supervising is not also operating machinery or the truck involved.

Where asbestos waste is deposited, a minimum depth of 1.25 metres of waste or cover material will be placed over the deposited asbestos waste in such a manner that direct contact with compaction equipment or other equipment operating on Site is prevented.

All personnel involved in the supervision, handling, and disposal of asbestos waste at the Site will have the appropriate WHMIS training and will wear suitable protective clothing and personal respiratory equipment while so doing. Protective clothing that has been or is suspected of having been in contact with asbestos waste will be changed at the location of the exposure and either property disposed of as an asbestos waste or washed at the end of the working day. Disposable protective clothing will not be reused.

Disposal activities will incorporate all precautions necessary to prevent asbestos waste from becoming airborne.

The landfill operator will document and maintain records of the disposal locations of all asbestos waste received at the Site. This documentation will include the approximate elevation and location of disposal, referenced to permanent Site features, and the approximate quantity of asbestos that was disposed.

11.14 CLEAN OR INERT FILL ACCEPTANCE

Prior to acceptance of any clean/inert fill, the landfill operator will screen the materials to determine and record its source, type, quantity, and historical land use. In addition, the landfill operator will conduct a visual and olfactory inspection of the material to determine if contaminants are present.

Should clean/inert fill received at the Site be suspected as being contaminated, then the generator will be requested to complete a soil analysis on a representative sample(s) of the material prior to acceptance. The sample(s) will be required to be analyzed at an accredited laboratory for selected parameters as determined from review of the source and historical land use associated with the material. As a minimum, the analysis will be completed for selected metals and petroleum hydrocarbons (Fractions F1 to F4). The analytical results will be compared to the applicable soil criteria set forth in the Soil, Groundwater and Sediment Standards for Use under Part XV.1 of the EPA (MOE, March 2004) for industrial/commercial/community land use in a potable groundwater condition (Table 2). Soil containing parameters in excess of these criteria will not be accepted as clean or inert fill. However, the waste material may be redirected for disposal in the landfill area as waste cover soil, should the material conform to the requirements of the General – Waste Management Regulation, R.R.O 1990, Regulation 347 of the Environmental Protection Act.

12.0 SITE MONITORING

12.1 WATER QUALITY MONITORING

Water quality is monitored as outlined in Schedules B and C of the Provisional September 26, 2006 Amendment to Certificate of Approval No. A522101. The Expansion Cell Incremental Impact Assessment Report (CRA, May 2006) also proposed additional monitoring locations in the vicinity of the Expansion Cell.

As such, the proposed monitoring program for the Site will include 27 groundwater monitoring locations, 4 private well monitoring locations, 10 surface water locations, one leachate sample, and two groundwater treatment samples. All locations will be sampled on a semi-annual or quarterly basis with the exception of one residential well, which is sampled annually. The collected samples are analysed for a variety of general chemistry, metal and volatile organic compounds (VOCs).

In additional to water quality samples, hydraulic monitoring (water level) and quality assurance/quality control (QA/QC) sample collection and analysis are also carried out at each sampling event. A list of all the monitoring locations, sampling frequency of sample collection and parameter list for sample analysis is provided on Table 12.1. A list of the specific parameters analyzed for each list of parameters is provided in Table 12.2.

12.2 WATER QUALITY SAMPLING PROTOCOLS

In order to ensure that representative water quality samples are obtained from the Site and that no contamination of the samples occurs, strict sampling protocols should be followed during the monitoring events. These protocols are summarized in Appendix K.

12.3 QUALITY ASSURANCE / QUALITY CONTROL PROGRAM

All monitoring wells should be fully developed prior to sampling using dedicated Waterra™ foot valve and polyethylene tubing until generally a minimum of three standing water volumes in each well is purged. Following recovery of the wells, samples should be collected with the dedicated valves and tubing. Water quality sampling protocols should be followed during sampling.

A Quality Assurance/Quality Control (QA/QC) Program involving the collection and analysis of field duplicates and field blanks, as well as the evaluation of standard laboratory quality control samples and procedures, will be conducted for the surface water and groundwater samples collected as part of the monitoring program.

12.4 ANNUAL MONITORING AND PROGRESS REPORTING

An Annual Monitoring and Progress Report will be prepared for the Site and submitted to the District Office of the MOE. The operations and monitoring information will be prepared by a qualified consultant, retained for the duration of the reporting year. The consultant will oversee the development of the Site and provide guidance with regard to the overall operation of the Site.

The annual progress reports will discuss, at a minimum, the following:

- the results and interpretive analysis of the all leachate, groundwater, surface water, monitoring, including an assessment of the need to amend the monitoring program;
- an assessment of the operation and performance of all engineered facilities, the need to amend the design or operation of the Site, and the adequacy of and need to implement the contingency plans;
- Site plans showing the existing contours of the Site, areas of landfilling operations during the reporting period, areas of intended operation during the next reporting period, areas of excavations during the reporting period, the progress of final cover and intermediate cover application, previously existing Site facilities, facilities installed during the reporting period, and Site preparations and facilities planned for installation during the next reporting period;
- calculations of volume of waste, daily and intermediate cover, and final cover deposited or placed at the Site during the reporting period and a calculation of the total volume of Site capacity used during the reporting period;
- a calculation of the remaining capacity of the Site and an estimate of the remaining Site life;
- a summary of the quantity of any leachate removed, or treated and discharged, from the Site during each operating week;
- a summary of the monthly, maximum daily and total annual tonnage of waste received at the Site;
- a summary of any public complaints received by the owner and the responses made; and

- a discussion of any operational problems encountered at the Site and corrective actions taken.

All of Which is Respectfully Submitted,
CONESTOGA-ROVERS & ASSOCIATES

Christine Robertson, C.E.T.

Gregory D. Ferraro, P. Eng.

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