LANDFILL FEASIBILITY STUDY
(CONCEPTUAL ASSESSMENT)
EXPANSION OF EXISTING LANDFILL SITES

Submitted to:

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1.0 INTRODUCTION

1.1 Project Description

AMEC Earth and Environmental, a division of AMEC Americas Ltd. (AMEC), was retained by the City of Temiskaming Shores (the City) to complete a Feasibility Study to assess alternatives for long-term solid waste management (i.e., landfill disposal). The City has two existing landfill sites, the New Liskeard Landfill and the Haileybury Landfill. The New Liskeard Landfill is currently at capacity and landfill activities have ceased as of June 2009. The Haileybury Landfill is currently in operation, but is anticipated to reach capacity in 2016; under the current waste generation rates (see Section 3.3.2). The City initiated the process to identify the most feasible option for establishing new capacity for long-term solid waste disposal. AMEC was retained to assess the feasibility of providing new solid waste disposal capacity by means of a) expansion of one or both of the existing municipal landfill sites; b) the development of a new site; or c) a combination of both strategies.

Once a preferred waste management strategy (i.e., expansion of an existing landfill and/or establishment of a new landfill) is determined to be feasible, the development of this amount of landfill capacity will require a full environmental assessment (EA) under Part II of the Ontario Environmental Assessment Act. The Feasibility Study does not replace such an EA. Instead, it aims at identifying potentially feasible alternatives on the basis of existing information, visual site inspections, and preliminary engineering concepts. It also intends to involve stakeholders and the general public early on in the City's planning process for new solid waste disposal capacity. It is envisaged that a future EA on this subject would build on the results of the Feasibility Study, consider stakeholder and public input obtained during the process and supplement the information base with field surveys, refined engineering concepts and further consultation.

1.2 Project Tasks and Approach

The scope of work for preparation of the Feasibility Study is arranged into the following key tasks:

Task 1: Project Initiation and Information Gathering (Completed)

- Attend kick-off meeting with the City's Technical Advisory Committee (TAC) to identify waste management/landfill requirements, and possible new landfill sites;
- Secure and review background documentation including landfill operating manuals and annual reports; and,
- Prepare meeting minutes for the project kick-off meeting.

Task 2: Preliminary Assessment of the Feasibility of Expansion of an Existing Landfill

- Conduct inspections of existing landfill sites by AMEC's project team and meet with City representatives and landfill operators;

- Prepare a draft Landfill Feasibility Study (Conceptual Assessment) report discussing the feasibility of expansion for the New Liskeard and Haileybury Landfills and outlining the following:
    - landfill inspection observations preliminary evaluation of landfill operations against relevant legislation;
    - determine remaining Site life of existing landfills, projected waste generation quantities during proposed 30-year planning period, and projected disposal capacity for future landfill operations;
    - identify opportunities for operational improvements and existing landfills;
    - conceptual design alternatives of landfill expansion;
    - evaluation of conceptual design alternatives and ranking to identify a preferred alternative;
- Submit draft report to the City for review and convene a meeting with the City to discuss comments; and,
- Finalize the report and submit to the City for reference/use.

Task 3: Preliminary Assessment of the Feasibility of Establishing a New Landfill

- Perform desktop review of three (3) sites outside the City [within 10 kilometers (km) of City boundaries] in areas chosen by City and TAC;
- Perform desktop review of three (3) sites inside the City in areas chosen by City and TAC;
- Prepare a draft Landfill Feasibility (Conceptual Assessment) report discussing the feasibility of establishing four new landfill sites, two (2) sites within, and two (2) sites outside the City;
- Submit draft report to the City for review and convene a meeting with the City to discuss comments; and,
- Finalize the report and submit to the City for their reference/use.

Task 4: Consultation Meeting with the Technical Advisory Committee (TAC)

- Prepare TAC presentation outlining findings of Tasks 2 and 3;
- Conduct consultation meeting with TAC and prepare meeting minutes; and,
- TAC to select either preferred alternative for landfill expansion or outline new landfill site(s) for further, more detailed assessment.

Task 5: Technical Assessment of Preferred Waste Management Alternative

- Perform technical assessment of TAC preferred alternative site(s);
- Consultation with relevant stakeholders (land owner, public, City, regulatory agency, etc.);
- Public consultation meeting (i.e., one open house session) introducing preferred landfill alternative;
- Prepare draft Feasibility Study (Preliminary Assessment) report providing technical information as well as a business case for the TAC preferred alternative site(s);

- Prepare an executive summary of the technical report for Council and the general public; and,
- Submit draft report to City and TAC for review and comment.

Task 6: Consultation Meeting with TAC

- Prepare TAC presentation outlining the results of Task 5
- Conduct consultation meeting with TAC and prepare meeting minutes; and,
- Record TAC comments for incorporation in the final Feasibility Study Report.

Task 7: Draft Feasibility Study (Final Assessment) Report

- Prepare three (3) copies of draft Feasibility Study (Final Assessment) incorporating the findings and comments from the Task 2, Task 3 and Task 5 reports;
- Submit draft Feasibility Study to the TAC review and comment; and,
- Conduct a conference call with the TAC to discuss comments for incorporation in the final report.

Task 8: Final Feasibility Study Submission

- Prepare and conduct final Feasibility Study presentation to Council; and,
- Prepare and submit final Feasibility Study (including executive summary) to the City for reference and use.

The scope of work is structured to allow the review of background information and initial visits at the existing landfill sites (i.e., Task 1) as well as independent preliminary assessments of the feasibility of expanding existing sites and the development a new landfill site, as represented by Tasks 2 and 3. Task 4 represents the TAC's review of the Feasibility Study (Conceptual Assessment) reports, to be submitted as part of, Tasks 2 and 3. The TAC preferred alternative for expansion of an existing Site and/or the development of a new site are compared and evaluated as part of Task 5, in order to establish an overall preferred feasible long-term solid waste management strategy (i.e., landfill disposal). Task 5 also includes the incorporation of a public consultation meeting to introduce the TAC preferred alternatives to relevant internal and external stakeholders and agencies. Further refinement of the preferred strategy will take place as part of Tasks 6 and 7, with the preparation and submission of the final Feasibility Study to the City occurring at the end of Task 8.

This report represents the fulfillment of Task 2 – Preliminary Assessment of the Feasibility of Expanding an Existing Landfill.

1.3 Report Objectives

The objectives of this report are as follows:

a) to identify the long-term solid waste management (i.e., landfill disposal) needs of the City of Temiskaming Shores;
b) to provide a review of the current environmental and operational conditions of the existing New Liskeard and Haileybury Landfill sites;
c) to provide conceptual alternatives for expansion of the existing landfill sites; and,
d) to assess the feasibility of expanding an existing landfill to facilitate long-term waste management needs.

In order to achieve the report objectives, AMEC has outlined the report as follows:

- Section 1 - Outline project and report specific goals;
- Section 2 - Review and evaluate historic/projected waste generation and determine the City's needs for future disposal capacity during a 30-year planning period;
- Section 3 – Provide descriptions of the existing landfill sites as well as descriptions of adjacent land use, geology and physical site setting, hydrogeological condition, hydrological condition, remaining site capacity, current operational condition, and operational deficiencies/improvements;
- Section 4 – Establish and discuss landfill siting criteria and preliminary feasibility assessment criteria for expansion of the existing landfill sites;
- Section 5 – Present two (2) conceptual design alternatives for expansion of each existing landfill site;
- Section 6 – Ranking and evaluation of each landfill expansion alternative against the preliminary feasibility assessment criteria;
- Section 7 – Selection and presentation of a preferred landfill expansion alternative; and,
- Section 8 – Outline the report conclusions as well as recommendations for the subsequent project tasks.

2.0 HISTORY OF SOLID WASTE MANAGEMENT IN THE CITY OF TEMISKAMING SHORES

AMEC's understanding of the history of solid waste management in the City of Temiskaming Shores is based on the 2 September 2009 project kick-off meeting between AMEC and City representatives, as well as a review of the following background documents, provided to AMEC by the City:

- Provisional Certificate of Approval No. A571505 (New Liskeard Landfill Site), dated 9 May 2000, amended 27 April 2005 and 17 April 2007;
- Provisional Certificate of Approval No. A570402 (Haileybury Landfill Site), dated 10 November 1998, amended 27 April 2005;
- *Corporation of the Town of Haileybury, Landfill Site Approval Report, Project No. E9100*8, revised July 1997, prepared by Sutcliffe Engineers & Surveyors (Sutcliffe, July 1997);
- *Municipal Groundwater Study, Central Temiskaming Area,* dated June 2003, prepared by Knight Piesold Consulting (KPC, June 2003);
- *City of Temiskaming Shores, New Liskeard Landfill, Operation and Maintenance Manual*, dated May 2004, prepared by Sutcliffe Rody Quesnel Inc. (SRQ, May 2004);
- *New Liskeard Landfill Site, Annual Monitoring Report 2004,* dated February 2005, prepared by Sutcliffe Rody Quesnel Inc. (SRQ, February 2005);
- *New Liskeard Landfill Site, 2007 Annual Groundwater Monitoring Report,* dated May 2008, prepared by Jagger Hims Limited (JHL, May 2008);
- *Corporation of the City of Temiskaming Shores, Leachate Plume Delineation and Contaminant Attenuation Zone Calculations, Haileybury Landfill Site,* dated May 2008, prepared by Story Environmental Services (SES, May 2008);
- *City of Temiskaming Shores, Application to Amend Provisional Certificate of Approval Waste Disposal Site No. A570402,* dated June 2008, prepared by Story Environmental Services (SES, June 2008);
- *City of Temiskaming Shores, 2008 Annual Monitoring Report, Haileybury Landfill Site,* dated April 2009, prepared by Story Environmental Services (SES, April 2009); and,
- *Draft Solid Waste Management Master Plan*, dated August 2009, prepared by Earth Tech Canada Inc. (Earth Tech, August 2009).

Certificate Approvals No. A571505 and A570404 are provided in Appendices A and B, respectively.

2.1 Solid Waste Management Facilities

The City of Temiskaming Shores is located in north-eastern Ontario, near the Quebec border, at the head of Lake Temiskaming (Earth Tech, August 2009). The City has a current population of approximately 10,600, and was formed in January 2004 through the amalgamation of the former Town of Haileybury, former Town of New Liskeard and the former Township of Dymond into a single tier municipality (Earth Tech, August 2009). The City has two existing landfill sites: the New Liskeard Landfill (formally the Town of New Liskeard Landfill) and the Haileybury Landfill

(formally the Town of Haileybury Landfill). These sites will be henceforth referred to as the New Liskeard Landfill and the Haileybury Landfill, respectively.

The New Liskeard Landfill, located approximately 3 kilometres (km) west of the former Town of New Liskeard off of Rockley Road, has been used for a landfill site since 1916 (Earth Tech, August 2009). The New Liskeard Landfill currently operates under Certificate of Approval (C of A) No. A571505, dated 9 May 2000, as amended, which approves of the disposal of domestic, commercial and non-hazardous solid industrial waste in a 2.02 hectare (ha) landfilling area (i.e., waste footprint) within a total property area of 32 ha. C of A No. A571505 is provided in Appendix A.

The Haileybury Landfill, located approximately 9 km southwest of the former Town of Haileybury off of Highway 11 along Dump Road, has been in operation since 1975 (Earth Tech, August 2009). The Haileybury Landfill currently operates under C of A No. A570420, dated 10 November 1998, as amended, which approves the disposal of municipal waste in a 5.8 ha landfilling area within a total property area of 32.4 ha. C of A No. A570402 is provided in Appendix B.

The City also administers a recycling program through the operation of a material resource facility (MRF) through the Cochrane Temiskaming Waste Management Board (Earth Tech, August 2009). The recycling program includes the collection of paper fibres, aluminium and steel cans, container glass, and No. 1 polyethylene terephthalate (PET) plastic which are deposited at eight drop-off depots located throughout the City (Earth Tech, August 2009).

Figure 1 (see Schedule 1) presents the locations of the communities that form the City of Temiskaming Shores, as well as the locations of the existing landfill properties.

2.2 Solid Waste Management Practices

For the purposes of this report, the discussion of City's waste management practices will focus on the provision of three main services: 1) solid waste collection; 2) solid waste disposal; and 3) recycling/waste diversion.

2.2.1 Solid Waste Collection

The collection of solid waste within the City is governed by the various policies, by-laws and programs established by the former Towns of Haileybury, New Liskeard and Dymond prior to the January 2004 amalgamation. These policies focus on the collection of waste materials from residential, industrial, commercial and institutional sources. In general, residential waste is collected on a weekly basis in the summer months and bi-weekly in the winter months for all towns located within the City. Industrial, commercial and institutional solid waste is collected on a weekly basis in the summer months and on a bi-weekly basis in the winter months in the former Towns of Haileybury and Dymond, while waste collection in the former Town of New Liskeard occurs twice weekly (Earth Tech, August 2009). Earth Tech reports that the City's

various residential collection by-laws allow for the collection of solid waste with the exception of the following “non-collective wastes”:

- Manufacture waste, including wire;
- Oil/gasoline soaked absorbent material or any explosive or highly combustible material;
- Broken plaster, lumber or other waste or residue resulting from the construction alteration, repair, demolition or removal of any building or structure;
- Sawdust and/or shavings;
- Organic matter not properly drained or wrapped;
- Liquid waste;
- Bandages, poultices, dressings and other such waste;
- Hay, straw, manure;
- Night soil;
- Carcass of any animal;
- Live animals or birds;
- Furniture;
- Stock or any wholesaler which shall be regarded as manufacturing waste;
- Discarded truck and automobile tires;
- Tree branches or roots exceeding three (3) inches in diameter;
- Ashes (except in Haileybury);
- Old corrugated cardboard (OCC); and,
- Other materials may, from time to time, be designated by the City as non-collectible waste.

The City operates various special waste collection programs, such as the annual Christmas tree, Spring Clean-Up and Bulky programs where residents can deposit “non-collective waste” such as furniture, large diameter branches, white goods (i.e., stoves and furnaces), fencing, mattresses, bed springs and other general household items at the curbside for collection. The City also operates a limited Hazardous Waste Program for the collection of old/used paint, oils, propane tanks and batteries. Additionally, residents and contractors are able to bring solid waste to the City’s landfill sites for disposal (Earth Tech, August 2009).

As reported in Draft Solid Waste Management Master Plan, the City’s current reliance on the various solid waste collection policies have resulted in inconsistencies between the collection services offered to the various towns with respect to the schedule/frequency of waste collection, bag limits, bag fees, container sizes, bans on various waste materials, composting, bulk item collection and hazardous waste collection/disposal (Earth Tech, August 2009). As such, the provision of a uniform solid waste collection by-law/policy is identified as the first key objective in developing a more efficient solid waste management program for the City of Temiskaming Shores (Earth Tech, August 2009).

2.2.2 Solid Waste Disposal

Prior to amalgamation, the New Liskeard Landfill received waste only from the former Town of New Liskeard, while the Haileybury Landfill received waste from the former Town of Haileybury, the former Town of Dymond, the Town of Cobalt, and from residents of Firstbrook and Lorrain

Townships (Earth Tech, August 2009). Upon amalgamation, all waste from the various towns comprising the City of Temiskaming Shores was diverted to the New Liskeard Landfill. As such, the New Liskeard Landfill reached its approved landfill capacity in June 2009, and is currently no longer accepting waste. Currently, The Haileybury Landfill accepts landfill waste from the entire City, as well as the Town of Cobalt. It should be noted that based on waste generation projections, as discussed in Section 3.3.2, the Haileybury Landfill is expected to reach its approved landfill capacity by mid-2016. As such, the provision of additional landfill capacity to facilitate long-term waste disposal is identified as the second key objective in establishing a sustainable solid waste management program for the City of Temiskaming Shores (Earth Tech, August 2009). As stated in Section 1.3, this preliminary assessment report will focus on evaluating the feasibility of fulfilling the objective of providing additional landfill capacity through the expansion of an existing landfill site.

2.2.3 Recycling/Waste Diversion

As stated in Section 2.1, the City operates an MRF facility for the collection of recyclable materials. Earth Tech reports that the current MRF facility does not have the capacity to accommodate the additional volume of recyclable materials resulting from amalgamation and the location of the MRF limits the possibility of expansion (Earth Tech, August 2009). As such, the City's ability to divert recyclable materials from the waste stream is restricted. Additionally, the City currently is in contract with Phippen Waste Management (Phippen) to manage and operate the Haileybury Landfill (Earth Tech, August 2009). It should be noted that Phippen was also in contract to manage and operate the now closed New Liskeard Landfill. Phippen continues to separate bulk items such as white goods (i.e., disposed appliances), waste tires, glass, inert construction fill and reclaimed asphalt, from the landfilled solid waste at the open Haileybury Landfill. These bulk items are generally stockpiled on-Site for removal on a sporadic, as needed basis. As such, the provision of additional capacity for long-term recycling and waste diversion is identified as the third key objective in establishing a sustainable solid waste management program for the City of Temiskaming Shores (Earth Tech, August 2009).

2.3 Historical Quantity of Disposed Solid Waste

There are currently no weigh scales at either the New Liskeard or Haileybury Landfill sites, therefore amount of waste disposed per year at each site is based on the following:

- visual pre-disposal waste volume estimates recorded by Phippen, as provided to AMEC by the City; and,
- quantities reported in the background documents listed in Section 2.0.

The summary quantity of waste disposed of at the New Liskeard Landfill from 2000 through 2006 is reported in the Section 5.1.1. of the Draft Solid Waste Management Master Plan, and is presented on Table 2.1 (embedded below). The quantity of waste disposed in 2007 is currently not known, although the amount of waste disposed in 2008 was provided by the City as approximately 25,447 cubic yards, or 19,456 cubic meters (m^3). Table 1 (see Schedule 2) presents a detailed accounting of the quantity of waste disposed of at the Haileybury Landfill

from 1997 to 2008, based on pre-disposal waste volume estimates provided to AMEC by the City. Although a similar detailed accounting for the waste disposed at the New Liskeard Landfill was not provided to AMEC, a summary of the annual quantity waste disposed at the both the New Liskeard and Haileybury Landfills from 1997 to 2009 is provided on Table 2.1 (embedded below):

Table 2.1
Waste Quantities Disposed of at City Landfills

Year	New Liskeard Landfill (m^3/year)	Haileybury Landfill (m^3/year)
1997	NA	17,309
1998	NA	16,449
1999	NA	15,901
2000	16,806	16,578
2001	14,769	21,009
2002	13,844	22,562
2003	11,667	20,431
2004	10,102	17,982
2005	12,032	17,176
2006	18,554	20,078
2007	20,335	18,217
2008	19,456	18,954

Note:
NA = data not available

It should be noted that these estimates of historical waste volumes were recorded prior to disposal and compaction by the landfill operators.

2.4 Project Needs – Planning Period, Waste Densities and Long-Term Solid Waste Disposal Volume

As stated in Section 1.1., the overall goal of this project is to identify the most feasible option for establishing new landfill capacity for long-term solid waste disposal. Based on AMEC's discussions with the City, a long-term solid waste disposal planning period of 30-years was chosen. For the purposes of this report, the 30-year planning period begins in January 2009 and extends to December 2038. This planning period provides the basis for the calculation of projected long-term waste disposal quantities.

Tables 2a and 2b (see Schedule 2) present estimates of the amount of uncompacted waste projected to be generated by the communities of Haileybury, Dymond, Cobalt and New Liskeard over the 30-year planning period. The projections were based on the following:

- Linear extrapolations of population growth calculated from 1991, 1996, 2001 and 2006 census data, as provided by Statistics Canada for the City of Temiskaming Shores and the Town of Cobalt;
- Uncompacted waste quantity estimates for 2008, as presented above in Section 2.3; and
- Uncompacted waste generation estimates of 2.6 m^3 per capita for the communities of Haileybury, Cobalt and Dymond (combined) and 3.9 m^3 per capita for the former Town of New Liskeard.

Table 2c (see Schedule 2) presents projections for the generation of uncompacted residential solid waste for the City of Temiskaming Shores, representing the sum of the projected waste generation estimates from Tables 2a and 2b (see Schedule 2). McBean, et. al. (1995) indicates that the density of uncompacted residential solid waste generally ranges from 90 kilograms per cubic meter (90 kg/m^3) to 180 kg/m^3, with a typical value of 150 kg/m^3. For the purposes of this report, it is assumed that the uncompacted residential waste generated by the City will have a density of 150 kg/m^3. As such, Table 2c presents the calculation of the tonnage of projected waste generated per year by multiplying the volume of uncompacted solid waste by a density of 150 kg/m^3 and dividing the result by a factor of 1 tonne to 1,000 kilograms.

As discussed below in Section 3.4.2, AMEC observed that waste disposed at the Haileybury Landfill was subjected to compaction using a HL760 front end loader. Although the actual densities of the compacted waste material at the New Liskeard and Haileybury Landfills are not known, McBean, et. al., (1995) indicates that the density of residential solid waste after landfill compaction generally ranges from 445 kg/m^3 to 505 kg/m^3. For the purposes of this report, the in-place density of residential solid waste after landfilling and compaction will be conservatively estimated at 300 kg/m^3, representing an increase from the uncompacted residential waste density by a factor of two. Thus, on Table 2c the volume of compacted residential waste is calculated by multiplying the tonnage of projected waste generated by a factor of 1,000 kg to 1 tonne and dividing the result by an in-place density of 300 kg/m^3.

The results presented on Table 2c (see Schedule 2) indicate that the City of Temiskaming Shores (including the Township of Cobalt) is projected to cumulatively generate approximately 699,073 m^3 of compacted solid waste during the 30-year planning period. As stated in Section 2.2.3., although the City does administer the operation of an MRF for the management of recyclable waste, the MRF has limited capacity to accommodate the increased volume of recycled material generated by the City due to amalgamation. As such, this report conservatively assumes that, based on the current condition of the MRF, the volume of residential waste diverted by collection of recycle materials will be negligible throughout the planning period. Therefore any long-term solid waste management alternative developed by the City will have to accommodate a long-term solid waste disposal volume of approximately 699,073 m^3 of compacted residential waste.

It should be noted that typically, landfill operations in Ontario require that daily cover soil be applied on solid waste at a ratio of 4:1 (waste to daily cover soil), representing approximately 20% of typical landfill capacity. Given a projected long-term solid waste disposal volume of

approximately 699,073 m^3, the total landfill capacity of waste and daily cover soil is calculated as follows:

$$TC = 699,073\ m^3 \times R_{TOTAL}/R_{WASTE}$$
$$= 699,073\ m^3 \times [(4+1)/4]$$
$$= 699,073\ m^3 \times 5/4$$
$$= 873,841\ m^3$$

Where: TC = Total Capacity of projected solid waste generated;
R_{TOTAL} = Total Ratio of solid waste and daily cover soil; and
R_{WASTE} = Ratio of solid waste.

As such, the overall project needs are summarized in Table 2.2 (embedded below):

Table 2.2
Project Needs

Project Planning Criteria	Value
Planning Period	30 years (2009 to 2038)
Uncompacted Waste Density (Typ.)	150 kg/m^3
In-place Compacted Waste Density	300 kg/m^3
Long-term Solid Waste Disposal Volume Requirement	699,073 m^3 (landfilled and compacted)
Long-term Landfill (Waste & Cover Soil) Capacity Requirement	873,841 m^3
Long-term Daily Cover Soil Volume Requirement	174,768 m^3

Therefore any long-term solid waste management alternative developed by the City will be required to accommodate approximately 874,000 m^3 (rounded value) of landfill volume, including waste and daily cover soil quantities.

3.0 DESCRIPTION OF EXISTING LANDFILL SITES

AMEC's understanding of the condition of the New Liskeard and Haileybury Landfills are based on the record review of the documents listed in Section 2.0. Additionally, AMEC conducted visual inspections of the New Liskeard and Haileybury Landfill sites on 17 and 18 September 2009.

3.1 New Liskeard Landfill

3.1.1 Site Description

The New Liskeard Landfill is situated approximately 1 km west of Highway 11 along the north side of Rockley Road. The legal description of the landfill location, as presented on C of A No. A571505, is the west half of Lot 5, Concession 2 in the Corporation of the Town of New Liskeard. This site is located approximately 3 km west of the former Town of New Liskeard, as shown on Figure 1 (see Schedule 1). The total property area consists of 32 ha, of which 2.02 ha are designated for landfill operations. The New Liskeard Landfill is located on Rockley Road in Dymond Township.

As shown on Figure 2 (see Schedule 2), the landfill area is located centrally within the property. The landfill property access is from the south gate located along Rockley Road. A series of granular haul roads have been constructed on the site, one running from the gate adjacent to the west property boundary, one running south and east of the landfill and one running over the capped landfill area towards the most recent active disposal area. Stock piles of waste tires, white goods, inert construction rubble (steel and concrete), clay, Wabi slag and sand are found to the west and northwest of the landfill area. Stockpiles of recycled glass and reclaimed asphalt are located towards the southwest near the entrance gate. A bedrock outcrop is located north of the landfill area. Photos of the New Liskeard Landfill are presented in Appendix C.

3.1.2 History of Site Approvals

The New Liskeard Landfill was purchased by the former Town of New Liskeard in 1916 and the land was used for waste deposition soon thereafter (SRQ, May 2004). The landfill's original Certificate of Approval expired in 1976, prompting new investigations at the landfill to facilitate the application for a new Provisional Certificate of Approval (SRQ, May 2004). There is limited information available on the operation of the landfill between the years 1976 and 1978. SRQ, May 2004 reports that in 1978 the Ministry of Environment (MOE) threatened to issue a formal order regarding the operation of the New Liskeard Landfill, although, in a letter dated 10 November 1978 the MOE agreed to withhold the order if the following conditions to landfill operations were met:

- Municipality to commission an "in-depth" study to determine the extent of leachate migration within and outside of the landfill boundary;
- Prohibition of all on-site burning activities;
- Maintain a minimum 25 yard (23 m) "working face";

- Municipality to purchase any property affected by landfill leachate; and,
- Municipality to investigate the use of bentonite cut-off walls to control leachate migration.

In 1979, the former Town of New Liskeard commissioned a phased hydrogeological investigation of the landfill site, which was completed in 1980 (SRQ, May 2004). The results of the investigation indicated that leachate was detected approximately 300 m to 400 m north east from the toe of the landfill; however the report indicated that the leachate was not threatening any down-gradient groundwater users (SRQ, May 2004). The resulting report recommended that the Town of New Liskeard purchase of property within 500 m of the north and east landfill boundary, an area designated as the "contaminant attenuation zone" (CAZ). The extent of the CAZ is shown of Figure 1 (see Schedule 1).

Between 1979 and 1980, the former Town of New Liskeard commissioned the preparation of landfill operation documentation, which was submitted to the MOE to secure the issuance of Provisional C of A No. A571501, dated 11 December 1980. It should be noted that although a topographic survey was completed in 1980 is support of the C of A application, the information available at that time provides no indication of the limits of the 2.02 ha area designated for landfill operations (SRQ, May 2004). In 1999, the MOE conducted an inspection of the New Liskeard landfill. The MOE's inspection report indicated that the landfill was operating beyond the approved limits, estimating that landfilled waste was deposited in an area of approximately 4 ha rather than the approved 2.02 ha. The MOE report also indicated that groundwater monitoring had not been conducted since 1983 and that the recommended CAZ had not been purchased by the Town of New Liskeard. The MOE recommended that an Emergency C of A and Environmental Assessment were required.

In order to comply with the MOE's recommendations, the former Town of New Liskeard commissioned a new hydrogeological investigation, as well as topographic surveys to delineate the extent of the approved 2.02 ha landfill area, delineate the limit of the of the waste deposited outside of the approved area; and to determine the amount of waste was deposited at the landfill. Figure 2 (see Schedule 1) presents the limits of the approved 2.02 ha landfill area, as well as the extent of the waste deposited beyond the approved landfill area. The estimate of the Total Site Capacity quantity for the New Liskeard Landfill was not provided in any of the background documentation provided to AMEC by the City, although SRQ reports that in 2004 the Total Remaining Site Capacity of the New Liskeard Landfill Site was approximately 49,580 m^3, including waste and waste cover soil (SRQ, May 2004).

Subsequently, the former Town of New Liskeard purchased the land adjacent to the east landfill property boundary for use as a CAZ. A revised C of A No. A571505 was issued on May 9, 2000 (SRQ, May 2004) outlining of the disposal of domestic, commercial and non-hazardous solid industrial waste at the New Liskeard Landfill within an approved 2.02 ha landfill area. C of A No. A571505 was amended on 27 April 2005, after amalgamation. This amendment changed the name of the landfill owner from "The Corporation of the Municipality of New Liskeard" to "The Corporation of the City of Temiskaming Shores", as well as revised the landfill's service area to the municipal boundary of the City of Temiskaming Shores which includes the communities of New Liskeard, Haileybury and Dymond, as well as the Town of Cobalt. C of A

No. A571505 was again amended on 17 April 2007 to include the November 2005 application for Provisional C of A and a figure showing the CAZ in the Schedule "A" list of landfill operating documents.

3.1.3 Adjacent Land Use

Land use

The New Liskeard Landfill property is bordered by undeveloped forest lands to the north, northwest and west. HydroOne electric transmission power line right-of-ways are located along the north and west boundary. Lands used for agricultural purposes are located to the southwest, south and southeast, with single family residences, farm buildings and pasture lands located on either side of Rockley Road. An Ontario Ministry of Transportation equipment building is located to the southeast of the landfill property. The land directly to the east of the landfill property is unused forested lands owned by the City, which is designated as the contaminant attenuation zone (CAZ).

A bedrock outcrop is located adjacent to the northern portion of the landfill, and is presumed to run to the south, directly beneath the fill area. Landfill operations early on in the history of the site involved depositing landfill waste on the east side of the bedrock ridge (SRQ, May 2004) As discussed in Section 3.1.5, it is presumed that the bedrock ridge forms a divide between subsurface flows on the west side of the landfill.

Sensitive Land Uses

Within 500 m of the New Liskeard Landfill property, there are several domestic water supply wells located along Rockley Road southeast of the landfill. Additional domestic water supply wells are located along Highway 65 just beyond the 500 m distance from the landfill. There are no surface water features or any known natural sensitive areas within 500 m of the site (JHL, May 2008).

Transportation/ Access

The New Liskeard Landfill property is accessed from Rockley Road located to the south of the property. A granular haul road extends to the north from the site entrance gate to a loop located adjacent to waste material (i.e., tires, white goods, inert construction debris) stockpiles placed immediately south of the bedrock outcrop. A granular site haul road is also located immediately south of the landfill limit, running towards the east and then turning north along the east property boundary. As shown on Figure 1 (see Schedule 1), the New Liskeard Landfill is located approximately 3 km to the west of the former Town of New Liskeard, approximately 4 km to the southwest of the former Town of Dymond, approximately 9 km to the north west of the former Town of Haileybury, and approximately 20 km to the north of the Town of Cobalt.

Ecology (Habitat and Species)

With the exception of agricultural lands south of the site, the surrounding area comprises undeveloped natural flora with mostly forested areas containing immature to mature vegetation.

Observations during the September 2009 Landfill Inspections indicate that the fauna in these natural areas represented by species commonly found in undeveloped lands in Northern Ontario in close proximity to a human settlement.

3.1.4 Physical Site Setting and Geology

The Temiskaming Shores area is known as the Little Clay Belt, a large glaciolacustrine clay plain deposited by Lake Barlow during the Late Pleistocene within the Temiskaming Rift Valley created by a series of faults. Surrounded and bounded at depth by igneous and metamorphic rocks of the Precambrian Shield, the deposits of the rift valley include dolostones, limestones, shales and sandstones up to 310 m thick overlying the Precambrian rocks and Quaternary overburden overlying the sedimentary rocks. The Quaternary units include a basal diamicton overlain by glaciofluvial sand and gravel, and glaciolacustrine varved clay. The sand and gravel deposits form important regional aquifers with thicknesses of up to 30 m or more (KPC, June 2003).

The New Liskeard Landfill is located at the south edge of the rift valley on top of a bedrock ridge. A groundwater divide is presumed to be present at the top of the ridge. The waste is located just east of this groundwater divide along the northeast portion of the bedrock ridge and sits directly on top of limestone bedrock or very thin overburden of silt till to sandy gravel (JHL, May 2008). The land topography from the waste slopes down to the northeast and the overburden thickness gradually increases towards the fault running northwest-southeast near Highway 65. The overburden thickness ranges approximately from 0 to 2 m below ground surface (BGS) near the landfill and gradually increases towards the northeast with a significant increase in thickness on the other side of the fault up to approximately 23 m BGS with a sand and gravel aquifer at depth used by numerous water supply wells along Highway 65.

3.1.5 Hydrogeology

Jagger Hims Limited (JHL) reported that the groundwater table in the plains area of the CAZ ranged from 0.4 m BGS to 3.2 m BGS (JHL, May 2008). In 2007, the average depth to static water level at the bedrock ridge was 4.2 m BGS in shallow bedrock and 8.8 m BGS in deep bedrock. Source area observation well OW-18, which is located at the highest point within the landfill and is constructed to approximately 15.2 m BGS, has consistently been observed to be dry. Immediately downgradient of the landfill footprint to the northeast, the water table is approximately 3.5 m BGS.

Groundwater flows through the overburden and through the upper bedrock from the landfill to the northeast. JHL reported that highly fractured bedrock extended to 10 m BGS at OW-1R (northeast edge of waste footprint), which corresponds to approximately the upper 7 m of the limestone bedrock (JHL, May 2008). Other boreholes indicated more fractured bedrock in the upper 1 to 2 m of bedrock relative to deeper bedrock. Strong downward hydraulic gradients have been reported on the bedrock ridge and below the landfill, indicating that the landfill is located in a groundwater recharge area. This is to be expected since the site is located just east of the presumed groundwater divide at the top of the bedrock ridge. The vertical hydraulic

gradients level out to nearly horizontal downgradient of the landfill. At the eastern boundary of the CAZ, upward vertical hydraulic gradients were observed, towards the intermediate overburden (JHL, May 2008).

The CAZ, owned by the City, extends approximately 500 m downgradient of the northeast edge of the waste footprint. Average groundwater flow velocity in the plains area northeast of the landfill was reported by JHL to be approximately 1.9 m/year in overburden and ranging from 0.6 to 5.7 m/year in shallow bedrock (JHL, May 2008).

3.1.6 Hydrology

The New Liskeard Landfill is situated on a well-drained, limestone ridge, which forms a drainage divide separating the South Wabi Creek catchment to the west and the Wabi River catchment to the east. The current waste fill zone lies within the Wabi River watershed, however, no significant surface water bodies are located within 500 m of the New Liskeard Landfill. JHL reported one or two intermittent, poorly defined channels at the northeast corner of the CAZ (JHL, May 2008). The nearest surface water bodies to the New Liskeard Landfill are South Wabi Creek located approximately 900 m to the west and Wabi River located approximately 2 km northeast.

3.1.7 Monitoring Program

An extensive groundwater monitoring network of observation wells has been established at the New Liskeard Landfill. Some of the observation wells have been reported to be damaged. There are no surface water monitoring stations because there is no surface water body to monitor in the vicinity of the landfill. The monitoring program is conducted three times per year and includes the measurement of groundwater levels and collection of groundwater samples for analysis of general chemistry and metal parameters (JHL, May 2008). Groundwater samples are also collected once a year at 8 domestic wells along Highway 65.

The groundwater monitoring network was first established at the landfill in 1980 by the installation of 23 observation wells, each in a separate borehole. The wells were constructed with 40-mm inside diameter Schedule 40 ABS pipes, with screening reported as being in the “bottom few meters” (JHL, May 2008). These wells were designated with A for shallow, B for intermediate and C for deep installations. Additional wells were installed from 2000 to 2007 and were designated with "I" for deep, "II" for intermediate and "III" for shallow installations. The historical groundwater monitoring network is summarized on Table 3.1 (embedded below):

Table 3.1
New Liskeard Landfill
Groundwater Monitoring Well Network

Overburden		Shallow Bedrock	Deep Bedrock	Source
OW-1A/OW-1R-III	OW-16-III	OW-1B/OW-1R-II	OW-1C/OW-1R-I	OW-18
OW-2A	OW-17-I	OW-2B	OW-2C	
OW-3A	OW-17-II	OW-3B	OW-7C	
OW-4A	OW-17-III	OW-8B		
OW-5A	OW-19-I	OW-9B		
OW-6A	OW-19-II	OW-10-I		
OW-7A	OW-20-I	OW-11-I		
OW-8A	OW-20-II	OW-12-I		
OW-9A	OW-21-I			
OW-10-II	OW-22-I			
OW-10-II	OW-23-I			
OW-11-II	OW-23-II			
OW-12-II	OW-24-I			

Selected groundwater monitoring well locations are shown on Figure 2 (see Schedule 1). Figures showing the full known groundwater monitoring networks are provided in Appendix E.

3.1.8 Groundwater Quality

JHL reports that a leachate-affected groundwater plume extends from the New Liskeard Landfill to the northeast. Shallow groundwater quality in 2007 was affected by leachate at monitor wells OW-11 and OW-12 located at the property boundary between the landfill and the CAZ. The leachate plume did not appear to extend to monitor wells OW-16, OW-17, OW-24 and OW-25 at the northeast boundary of the CAZ, although potentially intermittent and negligible effects were noted for some parameters, suggesting these monitors are located just beyond the fringe of a “compliance boundary” (JHL, May 2008).

In 2004, water quality samples were last collected from private water supply wells located along Rockley Road southeast of the landfill property. Sample results indicated that these wells were not impacted by leachate (JHL, May 2008). Given that groundwater flow on the landfill property flows away from these private wells to the north east, no leachate impacts to these wells are expected in the future. The private water supply wells along Highway 65, approximately 900 m downgradient from the landfill and beyond the CAZ, were reported not to be impacted by leachate in 2007 (JHL, May 2008).

Concentrations of leachate indicator parameters (boron, chloride, DOC, potassium, sodium, sulphate and TDS) in samples collected from the landfill’s monitoring wells have remained steady over time from 2000 to 2007, indicating that the subsurface groundwater chemistry has attained steady state (JHL, May 2008).

3.1.9 Preliminary Conceptual Groundwater Model

Based on the presence of numerous fractures in the subsurface, the presence of fault zones, and the absence of a significant low permeability confining layer overlying the bedrock, as reported by JHL, there is a high susceptibility for leachate migration to the bedrock aquifer. Leachate infiltration into the deeper bedrock from beneath the landfill can also be attributed to the high vertical hydraulic gradients reported by JHL, as indicated by high concentrations of indicator parameters (boron, chloride, DOC, potassium, sodium, sulphate and TDS) in samples collected from deep bedrock well OW-1R. JHL reports that the concentration of chloride in a sample collected from OW-1R was measured at 350 milligrams per Liter (mg/L) (JHL, May 2008). Monitoring well OW-1R extends to approximately 20 m BGS into deep bedrock. In downgradient monitor wells, higher concentrations of indicator parameters are usually found in the shallow overburden or bedrock than in the deeper overburden or bedrock. This indicates that although the leachate plume may extend to the deep bedrock beneath the landfill, horizontal and upward hydraulic gradients farther downgradient of the landfill results in groundwater flowing progressively more horizontally and then upward from deeper to intermediate layers of overburden and shallow bedrock. The majority of groundwater flow occurs in the overburden and shallow bedrock.

3.1.10 Contaminant Attenuation Zone Assessment

As reported in Section 3.1.8, the presence of leachate indicator parameters were not observed in samples collected from monitoring wells located at the northeastern boundary of the CAZ. JHL reports that the existing CAZ is currently sufficient for the existing volume of solid waste landfilled at New Liskeard (JHL, May 2008). This conclusion is based on the following observations:

- steady concentration trends of indicator parameters were observed in the groundwater monitoring samples from 2000 to 2007, and

- no leachate impacts have been reported in the groundwater samples collected downgradient of the CAZ.

In order to confirm JHL's conclusion that the CAZ is sufficient for the natural attenuation of the existing condition of the landfill's leachate plume, AMEC conducted a preliminary assessment of the dilution capacity of the CAZ using the concentrations of the leachate indicator, chloride. The assessment is based on the following factors:

- Existing Footprint Area – Measurements from Figure 3 of JHL's 2007 Annual Monitoring Report (see Appendix E) indicated that the surface area of the existing New Liskeard Landfill footprint is approximately as 33,900 m^2.

- Downgradient Recharge Area - Based on the available distance from the northeast edge of the landfill to the northeast edge of the CAZ as shown on Figure 2 of JHL's 2007 Annual

Monitoring Report (see Appendix E), the surface area of the available attenuation zone downgradient of the landfill was measured as approximately 210,000 m^2. and

- Downgradient Infiltration Rates - Climate data from the Earlton A Climatological Station near Temiskaming Shores indicate a 30-year (1971 to 2000) mean annual precipitation in the area of 785 millimeters per annum (mm/a) and a mean evapotranspiration rate of 505 mm/a. This yields a mean water surplus of 280 mm/a available for runoff and groundwater recharge. Assuming a conservative infiltration factor of 0.8, based on typical rates observed in similar environments, the resultant surface water infiltration rate would be 224 mm/a (280 mm/a x 0.8). This infiltration rate, I_{CAZ}, is applied at the CAZ downgradient of the landfill.

- Source Area Infiltration Rates - The New Liskeard Landfill has been largely covered with an interim (soil and clay) cover. An infiltration rate (I_L) of 150 mm/a is assumed for the landfill footprint based on typically observed rates at other clay capped landfills.

- Upgradient Infiltration Rates – Field observations indicated that the New Liskeard Landfill is located just east of a groundwater divide. Historical data indicates that the majority of the first groundwater recharging the subsurface is from beneath the landfill. Therefore it is assumed that there is negligible dilution of the leachate plume beneath the landfill due to upgradient surface water infiltration.

The assessment of the existing CAZ begins with the calculation of the downgradient and source area groundwater recharge rates from the above noted factors. For example the downgradient CAZ recharge rate is calculated as follows

$$Q_{CAZ} = A_{CAZ} \times I_{CAZ}$$
$$= 210{,}000\ m^2 \times 0.224\ m/a$$
$$= 47{,}040\ m^3/a$$

Where: Q_{CAZ} = Downgradient CAZ recharge rate;
A_{CAZ} = Downgradient CAZ surface area; and
I_{CAZ} = Downgradient CAZ infiltration rate.

Similarly, the source area (i.e., landfill area) recharge rate is calculated as follows:

$$Q_L = A_L \times I_L$$
$$= 33{,}900\ m^2 \times 0.15\ m/a$$
$$= 5{,}085\ m^3/a$$

Where: Q_L = Landfill recharge rate;
A_L = Landfill footprint surface area; and
I_L = Landfill footprint infiltration rate

As reported in Section 3.1.5, groundwater/leachate from the source (i.e. landfill) area generally flows downgradient to the north east, thorough the CAZ. As such, any groundwater recharge located downgradient of the landfill will serve to dilute the leachate generated within the landfill footprint. The dilution factor of the downgradient groundwater recharge can be calculated as follows:

Dilution Factor, DF $= Q_{CAZ} / Q_L$
$= 47{,}040\ m^3/a\ /\ 5{,}085\ m^3/a$
$= 9.3$

Expected vs. Actual Downgradient Chloride Concentrations

In 2003, a leachate sample was collected from well OW-18, located within the landfill footprint. The concentration of chloride in the leachate sample was reported as 1,220 mg/L (JHL, May 2008). Using a dilution factor of 9.3, as calculated above, the expected chloride concentration at the northeast boundary of the CAZ is calculated as approximately 131 mg/L (i.e. 1,220 mg/L divided 9.3). It should be noted that the reasonable use concept (RUC) criterion for chloride used by JHL for the Site is 127.9 mg/L (JHL, May 2008), which is numerically close to the expected chloride concentration of 131 mg/L, which was calculated using the infiltration approach. The Ontario Drinking Water Standard (ODWS) for chloride is 250 mg/L.

Analytical data from the Site indicates that the chloride concentrations at the northeast boundary of the CAZ range from 3 mg/L in deep overburden to 26 mg/L in shallow overburden (JHL, May 2008). These analytical concentrations are reportedly similar to the concentrations found in the background/upgradient monitoring wells, and are significantly less than the expected chloride concentration of 131 mg/L. For the purposes of this report, the background concentration of chloride will be conservatively assumed to be 20 mg/L

JHL reports that in 2007, the chloride was detected at a concentration of 100 mg/L in a sample collected from OW-12 located approximately 175 m downgradient of OW-18 (JHL, May 2008). At that time, this is the highest detected chloride concentration in a downgradient monitoring well, representing a reduction from the leachate chloride concentration of 1,220 mg/L in the landfill. Based on the observed data and the fact that groundwater chemistry from 2000 to 2007 has remained at steady state at the Site, an attenuation factor, AF, can be calculated as follows:

AF $= (Cl_{SOURCE} - Cl_{DOWN}) / D_{ATT}$
$= (1{,}220\ mg/L - 100\ mg/L) / 175\ m$
$= 6.4\ mg/L/m$

Where: Cl_{SOURCE} = Chloride concentration from source monitoring well;
Cl_{DOWN} = Maximum chloride concentration from a downgradient well; and
D_{ATT} = Attenuation distance between source area and downgradient well.

Based on the above attenuation factor, the required attenuation distance, D_{ATT}, for chloride, and by extension, the leachate plume, to be attenuated from the source area chloride concentration

of 1,220 mg/L to an assumed background chloride concentration of 20 mg/L is calculated as follows:

$$D_{ATT} = (Cl_{SOURCE} – Cl_{DOWN}) / AF$$
$$= (1{,}220 \text{ mg/L} – 20 \text{ mg/L}) / 6.4 \text{ m}$$
$$= 187.5 \text{ m}$$

The current CAZ extends approximately 500 m downgradient of the northeast edge of the landfill, which is over two and a half times greater than the calculated required attenuation distance of 187.5 m.

Therefore, given that the chloride concentrations from downgradient monitoring wells is significantly less that the expected chloride concentration of 131 mg/L, and the downgradient distance of the existing CAZ is greater than the calculated required attenuation distance of 187.5 m, it can be concluded that the existing CAZ is sufficient to address current leachate impacts and will likely continue to be sufficient for the existing waste footprint.

3.2 Haileybury Landfill

3.2.1 Site Description

The Haileybury Landfill is located approximately 9 km southwest of the former Town of Haileybury off of Highway 11 along the north side of Dump Road. The legal description of the landfill location, as presented on C of A No. A570402 is the south half of Lot 1, Concession 2, Town of Haileybury, District of Temiskaming, Ontario. The landfill's location is shown on Figure 1 (see Schedule 1). The total property area consists of 32.4 ha of forested land, of which 5.8 ha are designated for landfill operations. The Site is accessed from Dump Road located along the south property boundary. C of A No. A570402 indicates that the service area for the Haileybury Site includes all towns located within the municipal boundary of the City of Temiskaming Shores, which includes the former Towns of New Liskeard, Haileybury and Dymond and the Town of Cobalt.

Figure 3 (see Schedule 1) presents the plan view of the Haileybury Landfill. Waste deposition has occurred within three distinct areas within the landfill limits. A historic stock pile of waste tires, inert construction rubble (steel and concrete) and waste recyclables (i.e., fridges, metal objects, stoves, etc.) is located along the east portion of the designated landfill area. A currently inactive construction material landfill area is located within the south and southwest portions of the designated landfill area. The currently active municipal waste landfill is located within north and northwest portions of the designated landfill area. The central portion of the designated landfill area is currently used for the placement of access/haul roads, although future landfill activities are planned for this area. Access/haul roads lead to the top of the active municipal landfill, and is utilized by public dumpers to deposit their waste.

The west portion of the active municipal landfill area is capped, presumably with interim soil cover placed at approximately 300 mm thickness (source). The east portion of the landfill contains the active waste tipping face, which is constructed is a large mound of uncovered waste material. Photographs of the Haileybury Landfill are presented in Appendix D.

3.2.2 History of Site Approvals

Landfill operations at the Haileybury Landfill began in the early 1970's, in response to urgent solid waste management needs. The former Town of Haileybury's landfill at that time was rapidly filling, and was experiencing problems with respect to burning fill, and the municipality required new disposal area 1997 (Sutcliffe, July 1997). The former Town of Haileybury applied to the MOE for an Emergency Certificate of Approval to continue landfill operations, which was granted in 1975 (Sutcliffe, July 1997).

Landfill operations continued under the Emergency C of A until 1986. At that time the MOE initiated a legal review of the landfill, which cumulated in a request that the former Town of Haileybury prepare a landfill operations report in support of an application for a C of A (Sutcliffe, July 1997). The report was commissioned in 1991 and revised in 1997. A draft certificate of approval was issued in April of 1998 and C of A No. A570402 was finalized and issued on 10 November 1998 (Sutcliffe, July 1997). C of A No. A570402 approved the "use and operation of a 5.8 ha landfill site within a 32.4 ha Total Site Area". The conditions of the C of A outlined the implementation of landfill improvements including, but not limited to; the following:

- the implementation of stormwater management controls (swales, diversion ditches, sedimentation ponds, etc.) around the perimeter of the landfill and the submission for an application for approval under the Ontario Water Resources Act (OWRA) (Condition 6);
- that the Town of Haileybury acquire or obtain an easement of the water rights for Parcel 904 NND, Part of the South Half of Lot 1, Concession 2 in the Township of Firstbrook for use as a proposed contaminant attenuation zone (CAZ), within 12 months of the issuance of the C of A (Condition 7);
- delineation of the waste disposal area (Condition 9);
- installation of a perimeter fence (Condition 11);
- implementation of a water quality monitoring program (Condition 22); and,
- installation of a battery-operated methane gas meter in the landfill structures.

Upon receipt of the C of A, The Town of Haileybury initiated the implementation of the above noted improvements.

C of A No. A570402 was amended on 27 April 2005, after amalgamation. The April 2005 amendment changed the name of the landfill owner from "The Corporation of the Municipality of

Haileybury" to "The Corporation of the City of Temiskaming Shores", as well as revised the landfill's service area to the municipal boundary of the City of Temiskaming Shores which includes the former Towns of New Liskeard, Haileybury and Dymond and the Town of Cobalt.

In June 2008, the City of Temiskaming Shores applied for an application to amend C of A No. A570402, in order to redefine the extent of the proposed CAZ (SES, June 2008). The re-delineation of the proposed CAZ was a result of on-going hydrogeological studies performed at the landfill and within adjacent areas from 1973 to 2007, and determination of leachate impacts as reported by Story Environmental Services (SES) in May 2008. The SES report outlined a reduction in the original CAZ of approximately 400 m from the north boundary and approximately 100 m from the west boundary. Essentially the CAZ was reduced from approximately 64 ha to approximately 28 ha. The original proposed CAZ boundary and the revised SES proposed CAZ boundary are shown on Figure 1 (see Schedule 1).

The City indicates that the MOE has recently issued a new amendment to C of A No. A570402 recognizing the revised limits of the CAZ as outlined by SES to the west of the existing landfill footprint. This amendment also requires that the City obtain the water rights within the CAZ.

3.2.3 Adjacent Land Use

Land use

Figure 3 (see Schedule 1) presents the plan view of the Haileybury Landfill. The landfill is located within the west portion of the City owned property, with swampy, forested areas located on the central and eastern portion of the property. The Haileybury Landfill property is surrounded by vacant forested land to the north, east and south. Granular aggregate pits are located to the west and southwest of the property, within the proposed CAZ area. A TransCanada natural gas pipeline right of way and a small creek are also located to the west of the property.

Sensitive Land Uses

Two sensitive natural areas are located in close proximity to the Haileybury Landfill. A wetland is located on the site property immediately east and southeast of the landfill. An intermittent channel drains the wetland. It runs along the south boundary of the site property and joins an unnamed Creek immediately southwest of the site property boundary. The Creek contains water, which flows to the northwest.

Transportation/ Access

The Haileybury Landfill property is accessed from the south, along Dump Road. A granular access/haul road extends to the north from the site entrance gate to the active disposal area. The access/haul haul road also runs towards the east, where stockpiles of various waste materials (i.e., white goods, spare tires, scrap metal and construction fill) are located. As shown on Figure 1, the Haileybury Landfill is located approximately 15 km to the southwest of Dymond, approximately 12 km to the southwest of New Liskeard, approximately 12 km to the west of Haileybury, and approximately 10 to the northwest of Cobalt.

Ecology (Habitat and Species)

With the exception of the two aggregate pits south and southwest of the landfill property, and the cleared TransCanada pipeline right of way, the surrounding area comprises a natural mixed forest with deciduous and coniferous trees. Observations made during the September 2009 Landfill Inspections indicate that the fauna in this forest is represented by species commonly found in the forests of Northern Ontario, including black bears, which occasionally come to the landfill to feed.

3.2.4 Physical Site Setting and Geology

The Haileybury Landfill is located in a forested area at the northeast corner of the intersection of Dump Road and Firstbrook Line Road. The waste is located directly on top of an outwash sand and gravel deposit, which is underlain by Precambrian bedrock. The ground surface in the vicinity of the landfill slopes gradually from the northeast to the southwest towards the Creek located approximately 120 m from the site at its closest approach. The bedrock also slopes down towards the southwest with a sudden drop west of the landfill where it was not detected in the boreholes at depth. Bedrock outcrops were reported along ridges north and east of the landfill (SES 2008). The thickness of the sand overburden increases from the northeast to the southwest. A privately-owned aggregate pit is located southwest of the landfill, and a City-owned aggregate pit is located directly south of the landfill on the other side of Dump Road.

3.2.5 Hydrogeology

According to the 2008 Annual Monitoring report, prepared by SES in April 2009, the groundwater table generally ranges from approximately 1 m BGS at monitoring well TW8, upgradient of the landfill, to 20 m BGS downgradient of the landfill, beneath the pipeline and Creek (SES, April 2009). The water table beneath the landfill footprint was approximately 7 m BGS at TW1 and 11 m BGS at TW3 (SES, April 2009).

SES reports that groundwater flows through a sand and gravel water table aquifer to the west towards the TransCanada pipeline and the Creek beyond (SES, April 2009). The groundwater levels in the vicinity of the pipeline are below the pipeline and therefore the groundwater flow direction is not affected by the pipeline (SES, April 2009). As discussed above in Section 3.2.2., SES proposed a revised contaminant attenuation zone (CAZ) measuring approximately 700 m by 400 m, to be established west of the landfill. The latest amendment to C of A No. A570402 requires the City to negotiate with the adjacent property owner to acquire the required water rights within the SES revised CAZ limits.

3.2.6 Hydrology

A wetland is present immediately east and southeast of the landfill and is likely drained partially by infiltration into the ground and by an intermittent channel running along the north side of Dump Road along the south site boundary to the west where it drains to the Creek. During the September 2009 Landfill Inspections, AMEC observed that this channel was dry. Additionally, the Creek did contain water, although there are signs that it drains west towards the South Wabi Creek.

3.2.7 Monitoring Program

SES reports that a monitoring network of observation wells and surface water stations has been established at the Haileybury Landfill (SES, April 2009). The groundwater monitoring program is conducted three times per year and the surface water monitoring program is conducted semi-annually, in accordance with C of A No. A570402. The monitoring program includes the measurement of groundwater levels in the wells and collection of groundwater and surface water samples for analysis of general chemistry and metal parameters (SES, April 2009).

There are 16 observation wells and 5 surface water stations in the monitoring network. The current monitoring network is summarized on Table 3.2 (embedded below):

Table 3.2
Haileybury Landfill
Water Quality Monitoring Network

Groundwater Monitoring Wells				Surface Water Stations
TW1	TW7	TW12	TW17	SW1
TW3	TW8	TW13		SW2
TW4	TW9	TW14		SW3
TW5	TW10	TW15		SW4
TW6	TW11	TW16		SW5

Selected groundwater monitoring well locations are shown on Figure 3 (see Schedule 1). A figure showing the full known groundwater and surface water monitoring network is provided in Appendix F.

3.2.8 Groundwater Quality

SES reports that water quality monitoring results from the 2008 reporting period indicate that leachate-impacted groundwater migrates off-site to downgradient wells TW12 and TW15 (SES, April 2009). The edge of the plume may be somewhere between monitoring wells TW12, TW15, TW14 and TW16. No Reasonable Use Concept (RUC) criteria were exceeded at TW14 (SES, April 2009). Sample results from downgradient monitoring wells located farthest to the southwest (i.e., TW10, TW14, TW16 and TW17), indicate that this area is considered to be outside the impact of the leachate plume, although potentially at the very leading edge of the leachate plume at TW16 (SES, April 2009).

Background concentrations at upgradient monitoring well TW8 have remained low and steady over time (SES, April 2009). Leachate indicator parameter (alkalinity, ammonia, chloride, DOC, iron, manganese, potassium, sodium, sulphate and TDS) concentrations indicated generally steady conditions for most monitor wells, with the exception of increasing concentration trends

of most indicator parameters at downgradient impacted monitor wells TW4, TW9, TW11 and TW13.

3.2.9 Surface Water Quality

SES reports that the water chemistry in the Creek differs from that of the groundwater (SES, April 2009). Surface water sampling station SW4 is located in the Creek upstream of the landfill. The Creek water level is well above the groundwater elevation and is likely draining water into the subsurface. The groundwater chemistry at monitor well TW10 has similarities to that of the Creek water and may be influenced by infiltrating Creek water into the ground.

Leachate impacts were only observed in samples collected from surface water monitoring stations SW5, which is located in the intermittent channel at the southeast corner of the Site. Visual observations made during the September 2009 Landfill Inspections indicated that this channel was impacted by litter and refuse.

3.2.10 Preliminary Conceptual Groundwater Model

The groundwater flow system at the Haileybury Landfill Site produces a groundwater plume that flows to the west within an unconfined coarse-grained aquifer. As shown on Figure 1 (see Schedule 1), the proposed CAZ required to attenuate these impacts to within acceptable levels is located outside the municipally owned lands and onto private property. Acquisition of this land and the formal acceptance of a CAZ would be required in order to facilitate leachate management at the existing landfill.

3.2.11 Contaminant Attenuation Zone Assessment

As discussed in Section 3.2.2, in May 2008, SES prepared a report outlining the limits of a revised proposed CAZ for the Haileybury Landfill, in support of an application for amendment of C of A No. A570402. Using dilution models and an empirical approach based on actual contaminant concentrations of leachate indicator parameters chloride, sulphate and TDS, SES estimated that the revised limits of the CAZ would extend the west of the Haileybury Landfill in an area measuring approximately 700 m (to the west) by 400 m (to the north) (SES, May 2008).

As discussed in Section 3.2.5, groundwater generally flows to the west from the landfill footprint. SES's dilution model yielded CAZ downgradient attenuation distances of approximately 91 m for chloride, 162 m for sulphate and 631 m for TDS to attenuate the contaminants to acceptable concentrations below the reasonable use criterion (RUC). The mean CAZ distance was 295 m.

The empirical model was based on actual parameter concentrations. Monitoring well TW9, located immediately west of the main landfill area, was used as the representative source area well Historical analysis indicate that samples collected from well TW9 had the highest concentrations of leachate indicator parameters.. Using the progressively lower parameter concentrations in groundwater observed in wells downgradient from TW9, SES was able to calculate an attenuation rate for each indicator parameter. The attenuation rate was used to calculate the required attenuation distances to reduce each leachate indicator parameter to

below the RUC. Calculated attenuation distances were 355 m, 289 m and 474 m for chloride, sulphate and TDS, respectively. The mean attenuation distance is 373 m (SES, May 2008).

Based on these two approaches, SES recommended a length of 700 m for the CAZ west of the Site property boundary (SES, May 2008). The reason for this conservative length were the slightly increasing concentrations of some indicator parameters, including TDS and sulphate, observed at the most impacted monitor wells TW9, TW11 and TW13. These gradually increasing concentrations are attributed to on-going waste disposal activities at the Haileybury Landfill, and are expected to increase with continued landfilling. In should be noted that, chloride concentrations have generally been steady at most wells and even decreasing at some boundary wells such as TW4 and TW5 (SES, May 2008).

In order to confirm SES's conclusion that the revised proposed CAZ would be sufficient for the natural attenuation of the existing condition of the landfill's leachate plume, AMEC conducted a preliminary assessment of the dilution capacity of the CAZ using the concentrations of the leachate indicator, chloride. The assessment is based on the following factors:

- Existing Footprint Area - The surface area of the existing Haileybury Landfill footprint was estimated by SES to be 58 000 m^2 (SES, May 2008).

- Downgradient Recharge Area - Based on the available distance from the western edge of the landfill to the western edge of the proposed CAZ as shown on Figure 6 of the SES May 2008 Leachate Plume Delineation and CAZ Calculation report (see Appendix F), the surface area of the available attenuation zone downgradient of the landfill would be 280,000 m^2 (SES, May 2008).

- Downgradient Infiltration Rate - Climate data from the Earlton A Climatological Station near Temiskaming Shores indicate a 30-year (1971 to 2000) mean annual precipitation in the area of 785 mm/a (a = annum = year) and a mean evapotranspiration of 505 mm/a. This yields a mean water surplus of 280 mm/a available for runoff and groundwater recharge. Assuming a conservative infiltration factor of 0.8, based on typical rates observed in similar environments, the resultant groundwater infiltration rate would be 224 mm/a (280 mm/a x 0.8). This infiltration rate, I_{CAZ}, is applied at the CAZ downgradient of the landfill.

- Source Area Infiltration Rate - The Haileybury Landfill is generally capped with a daily soil cover with the exception of the active disposal area. For the purposes of this report and infiltration rate (I_L) of 224 mm/a is assumed for the landfill footprint, similar to the downgradient area.

- Upgradient Infiltration Rate – Surface water infiltration is assumed to occur upgradient of the landfill footprint, resulting in dilution of the leachate and infiltrated water passes beneath the landfill. For the purposes of this report, dilution calculations will be based on the high chloride concentrations measured in monitoring well TW9, which is located immediately downgradient of the landfill footprint. It is assumed that the water quality at this location will represent the diluted leachate concentrations after upgradient infiltration.

The assessment of the proposed CAZ begins with the calculation of the downgradient and source area groundwater recharge rates from the above noted factors, as follows:

The downgradient CAZ recharge rate is estimated to be

$$Q_{CAZ} = A_{CAZ} \times I_{CAZ}$$
$$= 280{,}000\ m^2 \times 0.224\ m/a$$
$$= 62{,}720\ m^3/a$$

Where: Q_{CAZ} = Downgradient CAZ recharge rate;
A_{CAZ} = Downgradient CAZ surface area; and
I_{CAZ} = Downgradient CAZ infiltration rate

The landfill footprint recharge rate is estimated to be:

$$Q_L = A_L \times I_L$$
$$= 58{,}000\ m^2 \times 0.224\ m/a$$
$$= 12{,}992\ m^3/a$$

Where: Q_L = Landfill area recharge rate;
A_L = Landfill footprint surface area;
I_L = Landfill footprint infiltration rate.

As reported in Section 3.2.5, groundwater/leachate from the source area generally flows to the west, towards the area of the proposed CAZ. As such, any groundwater recharge occurring downgradient of the landfill in the area of the proposed CAZ will dilute the leachate generated within the landfill footprint. The dilution factor of the downgradient recharge can be calculated as follows:

$$\text{Dilution Factor, DF} = Q_{CAZ} / Q_L$$
$$= 62{,}720\ m^3/a \ / \ 12{,}992\ m^3/a$$
$$= 4.8$$

Expected vs. Actual Downgradient Chloride Concentration

For the purposes of this report, the chloride concentration of the leachate-impacted groundwater is assumed to be 204 mg/L based on the highest concentration detected at TW9 over the past 10 years (SES, April 2009). Using the dilution factor of 4.8, as calculated above, the expected chloride concentration at the western boundary of the proposed CAZ would be calculated at approximately 42.5 mg/L (i.e., 204 mg/L divided by 4.8). The RUC criterion for chloride used by SES for the Site is 126 mg/L (SES, April 2009), while the OWDS for chloride is 250 mg/L. Therefore, the expected downgradient chloride concentration at the western boundary of the proposed CAZ is below both the RUC criterion and the ODWS.

Analytical data collected during the 2008 reporting year indicates that the chloride concentration at monitor well TW16, located approximately 280 m downgradient of TW9, ranged between 6 mg/L and 25 mg/L in 2008 (SES, April 2009), which is significantly less than the expected chloride based on the above noted dilution calculations. The chloride concentrations at background/upgradient monitoring well TW8 have been measured at 1 mg/L in recent years (SES, April 2009), which may indicate that there is an upgradient recharge area closer to the northern bedrock ridge with thin overburden overlying bedrock.

Therefore, given that the chloride concentrations at the monitoring wells 280 m downgradient of TW9 is less than the expected chloride concentration at the west border of the proposed CAZ located over 700 m downgradient of TW9, it can be concluded that the proposed CAZ would be sufficient for the existing waste footprint.

3.3 Remaining Site Capacity

3.3.1 New Liskeard Landfill

C of A No. A571501 for the New Liskeard Landfill approves the disposal of waste in a 2.02 ha area (i.e. Fill Area) within a 32 ha Total Site Area. As stated above in Section 3.1.2., solid waste has been deposited beyond the approved Fill Area, as shown on Figure 2 (see Schedule 1). The estimate of the Total Site Capacity for the New Liskeard Landfill was not provided in any of the background documentation provided to AMEC by the City, although SRQ reports that in 2004 the Remaining Site Capacity of the New Liskeard Landfill Site was approximately 49,580 m^3, including waste and waste cover soil (SRQ, May 2004). It is presumed that this Remaining Site Capacity value refers to the volume remaining within the approved 2.02 ha Fill Area. Figure 4 (see Schedule 1) shows the proposed Final Contours of the New Liskeard Landfill.

The Remaining Site Capacity of waste and cover soil at the New Liskeard Landfill was consumed in 2009, and landfill operations were indefinitely halted in June of that year. The majority of the landfill area outside the approved Fill Area has been graded and capped with cover soils. Observations recorded during the AMEC's September 2009 site inspection indicate that topsoil and vegetated cover has been established on the northern portion of the landfill. Representatives of the City reported to AMEC that the cap material used included foundry sands and excavated construction fill with unknown clay content. The thickness of the cap is unknown, but generally ranges from 150 mm to over 300 mm in some areas. As of September 2009, the most recently deposited landfill material, located within the approved Fill area, was exposed although the City arranged for the progressive deposition and application of excavated construction fill on the exposed face as cover material.

3.3.2 Haileybury Landfill

As stated above in Section 3.2.2., C of A No. A570402 for the Haileybury Landfill approved the use and operation of a 5.8 ha landfill site within a 32.4 ha Total Site Area. The supporting documentation for the Emergency C of A application indicated that the original Total Site

Capacity of the Haileybury Landfill Site (including waste and daily cover soil) was estimated as 475,644 m^3 (Sutcliffe, July 1997). The Total Site Capacity was revised in 1997 Landfill Site Approval Report to 452,221 m^3, based on revised per capita waste projection values.

Based on landfill quantities provided by the City, presented on Table 1 (see Schedule 2), between 1997 and 2008, approximately 222,617 m^3 of waste material was landfilled at the Haileybury Landfill. The 2008 Annual Monitoring Report, prepared in April 2008 by Story Environmental Services (SES), indicates that the volume of compacted solid waste deposited at the Haileybury Landfill through to the 2008 reporting period is approximately 263,530 m^3 (SES, 2009). The more conservative estimate was used to calculate the Remaining Landfill Capacity, although it will be assumed that the volume of 263,530 m^3 consumed includes daily cover as well as landfill waste.

The Remaining Landfill Capacity of the Haileybury Landfill is calculated in Table 3.3 (embedded below):

Table 3.3
Haileybury Landfill
Remaining Site (Waste & Daily Cover Soil) Capacity

Item	Volume
Total Site Capacity	452,221 m^3
Estimated Volume of Landfill Waste Deposited as of 2008	263,530 m^3
Estimated Remaining Landfill Capacity	188,691 m^3

Therefore the Remaining Landfill Capacity at the Site, including waste and daily cover soil, is approximately 188,691 m^3, as of the end of 2008.

The estimated Remaining Landfill Capacity of 188,691 m^3 includes both waste and waste cover soil. SES reports that due to historical site practices and the limited availability of cover soil, approximately 3% to 5% of the consumed landfill capacity consisted of daily cover soils. Typically, landfill operations in Ontario require that daily cover soil be applied in a ratio of 4:1 (waste to daily cover soil), representing approximately 20% of typical landfill capacity. Therefore the Remaining Site Capacity is itemized on Table 3.4 (embedded below) as follows:

Table 3.4
Haileybury Landfill
Remaining Landfill Waste Capacity

Item	Volume

Item	Volume
Estimated Remaining Landfill Capacity	188,691 m^3
Estimated Cover Soil Capacity (at a 4:1 ratio)	37,738 m^3
Estimated Remaining Waste Capacity	150,953 m^3

The projections for waste generation by the City of Temiskaming Shores, including the Town of Cobalt, are presented in Table 2c (see Schedule 2). Table 2c (see Schedule 2) also provides a projection of the total volume of compacted waste to be landfilled for each year starting in 2009, based on the assumption that landfill waste generated can be compacted to an in-place density of 300 kg/m^3 (as discussed in Section 2.1). Given the estimate of Remaining Waste Capacity and the projections of the quantity of compacted landfill waste, an estimate of the Remaining Site Life for the Haileybury Landfill is provided on Table 3.5 (embedded below):

Table 3.5
Haileybury Landfill
Remaining Site Life

Year	Annual Volume of Compacted Waste (m^3)	Remaining Waste Capacity (m^3)
		150,953 (as of 2008)
2009	19,373	131,580
2010	19,587	111,993
2011	19,797	92,196
2012	20,010	72,186
2013	20,220	51,966
2014	20,433	31,533
2015	20,647	10,886
2016	20,857	Haileybury Waste Capacity consumed

Based on the conservative estimates presented above it is anticipated that the Remaining Waste Capacity for the Haileybury Landfill will be consumed in mid-2016.

3.4 Current Landfill Operations

The following discussion on landfill operations are based on AMEC's review of Provisional C of A No. A571505 for the New Liskeard Landfill, Provisional C of A No. A570402 for the Haileybury Landfill Site, and observations made during the landfill inspections conducted by AMEC on 17 and 18 September 2009.

3.4.1 New Liskeard Landfill

The requirements for landfill operations at the New Liskeard Landfill are outlined in Provisional C of A No. A571505, dated 9 May 2000 and amended 27 April 2005 and 17 April 2007. The conditions outlining day-to-day landfill operations are summarized as follows:

- The landfill is approved for the processing and disposal of domestic, commercial and non-hazardous solid industrial waste;
- Condition 14 outlines the training requirements of all landfill attendants and operators;
- Condition 15 requires that the landfill boundaries be permanently marked in accordance with the Site plan [as shown on Figure 4 (see Schedule 1)] within 90 days of the issuance of C of A No. A57150;
- Condition 16 prohibits the burning of waste;
- Condition 17 requires that waste is deposited within the 2.02 ha landfill area shown on Figure 4 (see Schedule 1);
- Condition 18 requires that the landfill be closed when the final landfill contours have been achieved;
- Condition 19 prohibits the receipt or disposal of liquid industrial waste or hazardous waste, as defined by Ontario Regulation 347;
- Condition 20 outlines the parameters of a litter maintenance program, including the collection and proper disposal of wind blown/vector borne litter from off-site locations;
- Conditions 23 and 24 outlines the parameters for a Site Operations and Maintenance Plan, and requires that the landfill be operated in accordance with the Plan
- Conditions 27 outlines procedures for the logging and response to complaints received regarding the operation of the landfill; and,
- Condition III of the 25 April 2005 amendment outlines landfill's hours of operation from 8:00 am to 12:00 pm, Tuesday through Saturday.

AMEC representatives performed an inspection of the New Liskeard Landfill on 17 September 2009. Inspection activities included a visual review of the current conditions, inspections at the landfill perimeter and landfill buffer zones and participating in discussions with representatives of the City of Temiskaming Shores.

Representatives of the City indicated that the New Liskeard Landfill is currently inactive due to reaching its approved landfill capacity, and has not received waste since 1 June 2009. The landfill is accessed by the entrance gate located off of Rockley Road, and is secured by padlock. Official access is controlled by employees of the City and is granted to approved subcontractors for the purposes of depositing clay material for use as cover soil.

At the time of the Site inspection, AMEC observed the importing and delivery of clay cover material in triaxle dump trucks at the top southeast corner of the landfill, the location of the most recent landfilling activities. City representatives indicate that the most recent activities on-site included grading and covering of the waste at this section of the landfill. AMEC also observed that the majority of the landfill is covered with an interim, clay and soil mixed, cover layer of an undetermined thickness. City representatives that this cover generally ranges from 150 mm to over 300 mm in thickness. The majority of the cover is currently unvegetated. AMEC also observed that the side slope and top plateau grades in the southeast corner of the landfill, within the approved 2.02 ha fill area will require re-grading in order to achieve the proposed final contours.

The existing on-site buildings include a combination garage for housing landfill equipment, and office for the Site attendant. AMEC did not observe the presence of any scales on-Site, and was informed by City personnel that, historically, tipping fees were based on a visual volume inspection by the Site attendant. AMEC observed stockpiles of waste tires, scrap metal, white goods and inert construction rubble to the north and west, and a stockpile of recycled glass existing to the south, near the Site building.

A granular haul road runs parallel to the western face of the landfill, extending from the entrance gate to a loop adjacent to the waste tire stockpile. A connecting road runs perpendicular to the haul road, leading to the top of the landfill. The granular haul roads were observed to be well maintained and available to provide adequate transport to all required areas of the landfill. During the inspection AMEC did not observe any nuisance animals or vermin, although it should be noted that much of the recent landfill waste in the southern end of the landfill (i.e., the approved Fill Area) remains exposed and uncovered.

It was noted during the landfill inspection that evidence of illegal dumping was observed on a trail located outside the western property boundary. The waste deposited did not look recent and it was observed that some effort was taken to barricade the access point to the trail from Rockley Road. Litter and wind spread debris from the landfill were noted in this area as well as the vegetated areas around the landfill.

3.4.2 Haileybury Landfill

The requirements for landfill operations at the Haileybury Landfill are outlined in Provisional C of A No. A570402, dated 10 November 1998 and amended 9 May 2005. The conditions outlining day-today landfill operations are summarized as follows:

- Condition 9 outlines the waste disposal Fill Area [as shown on Figure 2 (see Schedule 1)], describes the methodology of above-ground and below-ground landfilling and limits disposal of further waste in the Bulk Material Storage Area [i.e., Historical Building Demolition Waste Area identified in Figure 2 (see Schedule 1)];

- Condition 10 outlines that only municipal waste, as defined in Ontario Regulation 347, may be disposed of at the Site;

- Condition 11 outlines the installation of a perimeter fence within 18 months of the issuance of C of A A570402;

- Condition 12 outlines the landfill's operating hours and the requirements for security and access. The operating hours are revised in the 9 May 2005 amendment to 1:00 pm to 5:00 pm, Tuesday through Saturday. Condition 12 requires that the access gate remain locked during non-operating hours, and that an attendant must supervise all waste disposal activities within the landfill;

- Condition 13 outlines the training requirements of all landfill attendants and operators;

- Condition 14 requires that the working face of the Fill Area be minimized, and that waste materials be compacted prior to the application of cover material;

- Condition 15 outlines the depths for waste cover soil (i.e., 15 cm for daily cover, 30 cm for interim cover);

- Condition 16 outlines how to obtain approval for alternative cover soil materials;

- Condition 17 outlines the timing of the application of vegetative seed on final cover and the application of interim cover during the landfilling of bedrock trenches;

- Condition 20 outlines the visual inspection and management of landfill litter on nearby public roadways and within the landfill's buffer zone;

- Condition 21 requires that the capped areas and buffer zones be graded to direct surface water from the active working face; and,

- Condition 24 requires that daily records of landfill operations be maintained to record the type of waste, name of hauler, vehicle license number, time of arrival, public complaints, litter collection/landfill inspection activities and application of interim/daily cover.

AMEC representatives performed an inspection of the Haileybury Landfill Site on 18 September 2009. Site inspection activities included a visual review of the daily operations, disposal at the active working face and inspections at the landfill perimeter and buffer zones. AMEC also participated in discussions with landfill operators and representatives of the City of Temiskaming Shores.

AMEC observed that the landfill's hours of operation are 8:30 am to 4:30 pm on Tuesdays to Saturdays. The Site is accessed by the entrance gate located off of Dump road, and is secured by padlock during off-hours. Official access is controlled by employees of the City and approved waste management contractors. A second gate is located at the northeast corner of the perimeter fence, which is presumably used by landfill personnel and designated staff to access a series of monitoring wells located in that area.

During operating hours, the landfill is staffed by one attendant, who monitors access and collects tipping fees, and one operator who is responsible for compacting and covering newly deposited landfill waste. The City contracts with Phippen Waste Management (Phippen), who is responsible for the day-to-day landfill activities. A single kiosk building is located near the entrance gate which is utilized by the attendant. During the inspection, AMEC observed the attendant collecting tipping fees from local residents wishing to dispose of their waste at the landfill. Tipping fees are based on a visual volume inspection by the attendant and do not include the use of scales. AMEC observed that the attendant maintains a log recording incoming waste haulers and volumes. The attendant then directs public dumpers to the appropriate active disposal areas. Actual disposal activities at the active working face are supervised by the operator.

AMEC observed that the active landfill working face is located near the north limit of the Fill Area as shown on Figure 2 (see Schedule 1), well within the disposal area delineated by chain link perimeter fencing. AMEC observed that the active working face encompasses a large uncovered mound of solid waste material located in the northeast portion of the landfill. The landfill operators use an HL760 front end loader to compact waste.. Reports from landfill operators and City representatives indicated that there are limited sources of cover soil available for application on the active face. The northwest portion of the landfill area is covered with a vegetated interim cover of an undetermined thickness. There are two other disposal areas located on-site, designated for the disposal of construction materials and historic disposal of building demolition waste, as shown on Figure 2 (see Schedule 1). AMEC observed that these two areas were inactive, although stockpiles of vehicle tires, scrap metal, and white good (i.e., household appliances) were observed adjacent to the east historic disposal area. The area immediately east of the designated Fill Area was observed to be undeveloped swamp, muskeg and forested land.

During the inspection AMEC observed that the active disposal working face (area of waste piling) was relatively wide, with a significant portion of the area exposed without daily cover. Phippen reported to AMEC that this area of waste was being brought up to its maximum elevation for final grading purposes, and that there was a limited volume of soil available for covering the waste. As a result, the AMEC observed significant litter and debris along the perimeter fencing, and within the north buffer zone. It was observed that this litter was spread by wind, as well as by large and small animal vectors (seagulls and black bears). Phippen reported that black bears regularly breach the perimeter fencing, and are a common nuisance at the Haileybury Landfill, as well as other Northern Ontario landfills.

Surface water drainage was observed to be managed by the installation of perimeter drainage piping along the north border of the Fill Area, just within the perimeter fenceline. AMEC observed that there was a corrugated stand pipe, approximately 6-inches to 8-inches in diameter, located at the north perimeter fenceline. City personnel indicated that this stand pipe was constructed to collect and direct surface water drainage along the northern perimeter through sub-surface drainage piping running towards the west property boundary. The surface run-off was then discharged to drainage ditches located adjacent to the nearby public road. City personnel also indicated that this standpipe was prone to clogging caused by winter icing, litter deposition, or by damage from large animals, resulting in the pooling of surface runoff along the north perimeter fence.

3.5 Operational Deficiencies and Improvements

3.5.1 New Liskeard Landfill

Deficiencies

The following list outlines AMEC's observations of operational deficiencies at the New Liskeard Landfill Site:

- areas of exposed waste disposal area in southeastern portion of the landfill;
- current cover material is of an undetermined composition and thickness;
- current cover material is unvegetated;
- side slopes and top plateau within the approved 2.02 ha fill area require re-grading to achieve proposed final contours;
- unauthorized litter/waste dumping observed along the west property boundary;
- stockpiles of waste tires, white goods, scrap metal, recycled glass etc., remain on-Site for long periods of time; and,
- limited perimeter surface water drainage controls.

Improvements

The following list outlines AMEC's suggestions for operational improvements at the New Liskeard Landfill Site:

- prioritize the application of interim/final cover on areas of exposed waste;
- re-grade within the approved 2.02 ha fill area to achieve final contours;
- verify thickness and composition of landfill cover material;
- secure an on-Site stockpile of soil/clay to ensure final cover can be placed on the exposed waste disposal area and current covered area, as required, to limit leachate generation;
- apply topsoil and grass seed on final cover to limit soil erosion and sediment transport;
- prepare and implement a litter maintenance program to clean and collect illegally dumped waste observed along the west property boundary; and,
- arrange for the recycling/disposal of stockpiles of waste tires, white goods, scrap metal, etc.

3.5.2 Haileybury Landfill

Deficiencies

The following list outlines AMEC's observations of operational deficiencies at the Haileybury Landfill Site:

- active working face for waste disposal is too large;
- limited application of daily cover on active waste disposal area;
- damage to perimeter fencing facilitates access by large animals;
- excess litter observed along the north and west landfill perimeter;
- estimates for logging landfill waste is subjective and based on visual observations;
- stockpiles of waste tires, white goods, scrap metal, etc., remain on-Site for long periods of time; and,
- perimeter surface drainage facilities are prone to damage and clogging.

Improvements

The following list outlines AMEC's suggestions for operational improvements at the Haileybury Landfill Site:

- reduce the area of the active working face to approximately 15 m wide by 3 m depth to limit surface water infiltration and leachate generation;
- secure an on-Site stockpile of soil to ensure daily cover can be placed on the active waste disposal area;
- secure an on-Site stockpile of soil/clay to ensure final cover can be progressively placed on the inactive/closed waste disposal areas, as required, to limit leachate generation;
- progressively apply topsoil and grass seed on final cover to limit soil erosion and sediment transport;
- install a weigh scale to facilitate an accurate accounting of incoming waste and cover soil;
- continue annual topographic surveys to facilitate estimates of amount of landfill capacity consumed;
- repair damage to Site perimeter fencing and install barb wire at the top to limit unauthorized access;
- prepare and implement a litter maintenance program to clean and collect litter observed along the north and west landfill perimeter;
- prepare and implement a large animal vector management program; and,
- arrange for the recycling/disposal of stockpiles of waste tires, white goods, scrap metal, etc.

3.5.3 Compliance with Operational Guidelines from Legislation/Industry Sources

The operations at the New Liskeard and Haileybury Landfills are both currently regulated by the Environmental Protection Act, Regulation 347, General Waste Management. Table 3.6 (embedded below) presents an outline of the Standards for Waste Disposal Sites set out by Ontario Regulation 347, Section 11.0, applicable to the operations of the New Liskeard and Haileybury Landfill Site. During the September 2009 Site inspections, observations were recorded in order to evaluate Site operations against the applicable Standards for Waste

Disposal Sites. Table 3.6 (embedded below) also presents a summary of the criteria and the evaluation based on visual inspections at both Sites. Table 3.6 (embedded below) presents information on both sites to facilitate direct comparison.

Table 3.6
Evaluation of Haileybury and New Liskeard Landfill Sites
to the Standards for Waste Disposal Sites

Ontario Regulation 347 Standards for Waste Disposal Sites	New Liskeard Landfill	Haileybury Landfill
Access roads and on-Site roads shall be provided so that vehicles hauling waste to and on the site may travel readily on any day under all normal weather conditions (S. 11.0, 1)	Yes	Yes
Access to the site shall be limited to such times as an attendant is on duty and the site shall be restricted to use by persons authorized to deposit waste in the fill area (S. 11.0, 2).	Yes	Yes
Drainage passing over or through the site shall not adversely affect adjoining property and natural drainage shall not be obstructed (S. 11.0, 3)	Re-grade landfill side slopes and top plateau and apply final cover.	Re-grade landfill side slopes and top plateau and progressively apply final cover.
Drainage that may cause pollution shall not, without adequate treatment, be discharged into watercourses (S. 11.0, 4).	Re-grade landfill side slopes and top plateau and apply final cover.	Re-grade landfill side slopes and top plateau and progressively apply final cover.
Waste shall be placed sufficiently above or isolated from the maximum water table at the site in such manner that impairment of groundwater in aquifers is prevented and sufficiently distant from sources of potable water supplies so as to prevent contamination of the water, unless adequate provision is made for the collection and treatment of leachate. (S. 11.0, 5)	Natural attenuation landfill.	Natural attenuation landfill.
Where necessary to isolate a landfilling site and effectively prevent the egress of contaminants, adequate measures to prevent water pollution shall be taken by the construction of berms and dykes of low permeability (S. 11.0, 6).	Yes	Yes

Ontario Regulation 347 Standards for Waste Disposal Sites	New Liskeard Landfill	Haileybury Landfill
Where there is a possibility of water pollution resulting from the operation of a landfilling site, samples shall be taken and tests made by the owner of the site to measure the extent of egress of contaminants and, if necessary, measures shall be taken for the collection and treatment of contaminants and for the prevention of water pollution (S. 11.0, 7).	Yes	Yes
Adequate and proper equipment shall be provided for the compaction of waste into cells and the covering of the cells with cover material (S. 11.0, 9).	Exposed waste to be compacted and covered.	Exposed waste to be compacted and covered.
Where climatic conditions may prevent the use of the site at all times, provisions shall be made for another waste disposal site which can be used during such periods (S. 11.0, 10).	Yes	Yes
Where required for accurate determination of input of all wastes by weight, scales shall be provided at the site or shall be readily available for use (S. 11.0, 11).	Site inactive (N/A)	No
All waste disposal operations at the site shall be adequately and continually supervised (S. 11.0, 12).	Site Inactive (N/A)	Yes
Waste shall be deposited in an orderly manner in the fill area, compacted adequately and covered by cover material by a proper landfilling operation (S. 11.0, 13).	Site Inactive (N/A)	Reduce size of active fill area and apply daily cover.
Procedures shall be established for the control of rodents or other animals and insects at the site (S. 11.0, 14).	Develop vector/vermin management plan, as required.	Observed evidence of animals breaching perimeter fencing. Develop and implement vector/vermin management plan.
Procedures shall be established, signs posted, and safeguards maintained for the prevention of accidents at the site (S. 11.0, 15).	Yes	Yes
The waste disposal area shall be enclosed to prevent entry by unauthorized persons and access to the property shall be by roadway closed by a gate capable of being locked (S. 11.0, 16).	Yes	Yes
A green belt or neutral zone shall be provided around the site and the site shall be adequately screened from public view (S. 11.0, 17).	Site topography limits screening landfill from public view	Yes

Ontario Regulation 347 Standards for Waste Disposal Sites	New Liskeard Landfill	Haileybury Landfill
Whenever any part of a fill area has reached its limit of fill, a final cover of cover material shall be placed on the completed fill and such cover shall be inspected at regular intervals over the next ensuing period of two years and where necessary action shall be taken to maintain the integrity and continuity of the cover materials (S. 11.0, 18).	Exposed waste to be covered and inspected at regular intervals.	Exposed waste to be covered and inspected at regular intervals.
Scavenging shall not be permitted (S. 11.0, 19).	Yes	Yes

4.0 PRELIMINARY FEASIBILITY ASSESSMENT CRITERIA

The process of assessing the feasibility of the conceptual landfill expansion alternatives will be conducted in two steps. Step one is a review of the potential opportunities for and constraints to the siting (i.e., location) of the two existing landfill properties, to determine if expansion is principally feasible. Step two will be the evaluation and ranking of each conceptual landfill expansion against a set list of feasibility criteria to determine a preferred expansion scenario (i.e., the most feasible alternative). The criteria used for both steps are derived from the following sources:

- Environmental Protection Act, Regulation 347 General-Waste Management (Reg. 347);
- Ontario Regulation 232/98 (O.Reg. 232/98) for new and expanding landfill sites
- Town of Haileybury Zoning By-law No. 85-27, November 1985;
- Township of Dymond By-law No. 1041, March 1986;
- Official Plan for the Town of Haileybury, March 1989;
- Official Plan for the Town of New Liskeard, March 1989; and,
- Town of New Liskeard Zoning By-law No. 2233, June 1989.

The following discussion outlines the criteria to be used for both steps.

4.1 Criteria for Site Constraint/Opportunities Mapping

Site constraint/opportunity mapping is an exercise that is typically applied to the screening of new landfill sites. The exercise involves incorporating a series of setbacks from sensitive areas or land uses, which are determined by provincial regulation or local bylaws, onto a map of the project property generated by Geographical Information System (GIS) software. The pictorial representation of these setbacks on the project site provides a preliminary guideline to determine if the proposed landfill site, or in this case, the proposed landfill expansion, will be constrained by the regulatory setbacks, and/or if the location of the project site will present any potential opportunities for the municipality with respect to locations to nearby highways, roads and sources of waste generation. Although, Site constraint/opportunity mapping is typically used for the siting of new landfills, the exercise was carried out for the existing New Liskeard and Haileybury Landfills in order to alert the City of Temiskaming Shores to any potential existing siting constraints or opportunities.

Table 4.1 (embedded below) presents a summary of the landfill constraints/opportunity mapping criteria used for this report.

Table 4.1
Site Constraint/Opportunity Mapping Criteria

Site Constraint/Opportunity	Criteria
Distance to Existing Infrastructure	Landfill located within 1000 m of an existing roadway.
Distance from Water Supply Wells	Landfill located more than 500 m from an existing water well.
Elevation above Flood Zone	Landfill located above an elevation of 182 meters above sea level.
Distance from Railway	Landfill located more than 50 m from a railway
Limit Preferential Contaminant Pathway	Landfill located more than 60 m from a fault zone.
Distance from Surface Water	Landfill located more than 30 m from a surface water body.
Distance from Existing Roadways	Landfill located more than 50 m from the existing roadway.
Conflicting Land Use	Landfill located outside of agricultural lands, Areas of Natural or Scientific Interest (ANSI), Ministry of Natural Resources (MNR) designated wetlands, and Significant Ecological Areas.

Figures 6 and 7 (see Schedule 1) present the results of the constraint/opportunity mapping for the New Liskeard and Haileybury Landfills, respectively. In general, both of the existing landfill Sites satisfy the criteria with the exception of the suggested setbacks from the water supply wells at the New Liskeard Landfill, and the suggested setback from existing roadways for the west landfill footprint at the Haileybury Landfill.

Although there are some constraints to the locations of the existing landfills, they should not be considered absolute barriers to landfill expansion. Further study should be performed to evaluate the impacts, if any; the locations of these landfill have to the nearby land features. For example, the locations of these water supply wells shown adjacent to the New Liskeard Landfill on Figure 6 (see Schedule 1) are based on the MOE's Water Well Records. These records have been known to be inaccurate with respect to the location of water supply wells. Observations recorded during the September 2009 Landfill Investigations indicated there is a discrepancy with the locations of some of these wells. Additionally, as discussed in Section 3.1.5, groundwater at the New Liskeard Site flows to the northeast, indicating that the water supply wells nearest to the New Liskeard Landfill are either upgradient or cross-gradient of the landfill footprint, thus it is likely that these receptors have little to no exposure to landfill derived groundwater impacts. With respect to the Haileybury Landfill, Figure 7 (see Schedule 1) shows that there is a potential conflict between the road setback and the landfill area. It should be noted that the landfill area shown on Figure 7 (see Schedule 1) includes the regulated 30 m buffer zone around the waste disposal area. It is likely that the recommended 50 m setback distance from an existing roadway to the landfill footprint is satisfied. Although, further study,

such as performing an inventory and monitoring of the water supply wells adjacent to the New Liskeard Landfill and/or measuring and assessing the distance of the limits of the landfill waste to the centerline of the west county road, is recommended to determine the overall impact, if any, the location of the existing landfills have on the nearby siting features, expansion of the existing New Liskeard and Haileybury Landfills is considered to be principally feasible.

4.2 Conceptual Landfill Expansion Alternative Feasibility Assessment Criteria

AMEC generated a list of key criteria for the assessment of the feasibility of the conceptual landfill expansion alternatives based on a review of the documentation listed in Section 4.0. The purpose of the feasibility criteria is to assess the overall impact of the conceptual landfill expansion alternatives to the members of the community, the surrounding environment and the municipality. The key criteria are:

- Public Health, Safety and Socioeconomic Factors;
- Natural Environment;
- Conceptual Technical Considerations; and,
- Conceptual Cost Estimates.

The following presents a discussion of each of these key criteria as well as the sub-criteria which will be ranked to assess a preferred conceptual landfill expansion alternative.

4.2.1 Public Health & Safety and Socioeconomic Factors

This key criterion mainly addresses the potential impact the conceptual landfill expansion alternatives will have on the nearby community. The alternatives will be ranked based on the assessment of the following sub-criteria:

- Distance to Residential Areas;
- Distance to Sensitive Land Uses;
- Distance to Drinking Water Supply Wells; and,
- Distance to Waste Generation Source and Road/Transport Access.

Distance to Residential Areas

The distance between a landfill footprint and adjacent residential areas are referenced in several regulatory sources. Section 13 of Reg. 347 requires that a landfill fill area be at least 0.25 mile (400 m) from any existing residence. Section 5.3 of the MOE's *Guideline D-4 Land Use On or Near Landfills and Dumps* (Guideline D-4), dated April 1994 recommends that a 500 m study area be established around landfill areas to evaluate the presence and impact of any adverse effects or risks to health and safety. However, Sections 5.3 and 4.4 or Guideline D-4 does consider that the actual perimeter distance of the study area may be set at less than or greater than 500 m based on the determination of the limit of the environmental impacts. Section 7, of O. Reg. 232/98 (for new or expanding landfill sites) outlines the requirement of a 100 m buffer area around the waste fill area of the landfill site or a minimum of 30 m at every point of the buffer area if there is adequate space for site access, parking, surface water

management facilities structures and that the buffer area is sufficient to ensure that potential impacts of the landfill operation to the outside are minimal.

The various municipal by-laws for the various towns that form the City of Temiskaming Shores also reference distances between waste disposal facilities and residential areas. These references are summarized as follows:

Town of Haileybury, Zoning By-law No. 85-27, November 1985

- Article 2.23 - Setbacks from Waste Disposal Sites requires that no building or structure shall be constructed or expanded closer than 30 meters to the perimeter of an operational waste disposal site.

Town of Haileybury Zoning By-law No. 85-27 Nov 1985

- Article 2.23 requires that no building or structure shall be constructed or expanded closer than 30 m to the perimeter of the area which is to be landfilled on an operational waste disposal site.

Township of Dymond By-law No. 1041, March 1986

- The by-law requires that landfills cannot be located in Environmental Protection (EP) zones.

As a result, each conceptual landfill expansion alternative will be evaluated based on the distance between the landfill and the closest residence.

Distance to Sensitive Land Uses

Section 13 of Reg. 347 references the following restrictions to locating landfill sites near sensitive land uses:

- Section 13(1) - The fill area shall not be subject to flooding and shall be so located that no direct drainage leads to a watercourse;
- Section 13(2) - The landfill shall be at least one-quarter of a mile (400 m) from the nearest dwelling;
- Section 13(3) - The landfill shall be at least two hundred yards (182 m) from the nearest public road;
- Section 13(4) - The site shall be at least 100 feet (30 m) from any watercourse, lake or pond; and,
- Section 13(5) - The site shall not be on land covered by water.

The following excerpts from the City's municipal by-laws and official plans further define limitations to development of sensitive lands:

Township of Dymond By-law No. 1041, March 1986

- Section 14(1) outlines that the only allowed non-residential uses for EP (Environmental Protection) zones are for an archaeological site; conservation use; farm, other that a

building; flood control and erosion use; forestry use; marine facility; and outdoor recreational use, other than a building; a wildlife and fish management use; and

- Section 16(5)(n) requires that where a non-agricultural land use is establishing or expanding in close proximity to existing livestock buildings; or where livestock facilities are being constructed, enlarged or remodeled near an existing non-agricultural use the separation distance between the existing use and proposed use shall be the distance prescribed by the Minimum distance Separation formula of the Agricultural Code of Practice as revised from time to time.

Township of Dymond Official Plan Amendment No. 2, November 1996, Section 1- General Provisions:

- Agriculture 1.4.1 - Class 2 and 3 soils as defined by the Canada Land Inventory of soil Capability for Agriculture are considered to be of prime importance and will be protected. Non-farm development in areas of good agricultural capability will not be permitted; and,
- 1.10 Hazard Land and Sensitive Areas – It is the intent of this Plan to prevent development from occurring on lands having an inherent environmental hazards such as poor drainage, flood susceptibility, erosion, steep slopes or any other physical condition which could endanger human life and property.

In order to evaluate potential conflicts of the proposed landfill expansions, the feasibility of each alternative will be assessed by the number of residences within 400 m of the center of the landfill, the distance to the nearest agricultural land, distance to the nearest EP Zone, and the distance to hazard lands and sensitive areas.

Distance to Drinking Water Supply

There are no restrictions to the placement of water supply wells around established landfill sites in Reg. 347 or O. Reg. 232/98, as groundwater impacts are to be managed within the designed buffer area and attenuation zone. In September 1986, the MOE introduced a policy to assist in the evaluation of groundwater impacts, especially for the case of landfill and/or lagoon operations. The policy was entitled “The Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities” and is referred to now as Guideline B-7 (formerly Policy 15-08) or the “Reasonable Use” policy. Simply stated, the policy sets groundwater contaminant discharge criteria for landfills and/or lagoons that may impair local water quality; the criteria are based on maintaining the protection of groundwater resources on the adjacent lands or properties.

Guideline B-7 requires that contaminant discharge criteria, representing the maximum acceptable levels of contaminants that should not be exceeded, be established using a simple mathematical relationship that incorporates background (existing) water quality and the highest provincial water quality standards for the adjacent land use. Under Guideline B-7, water quality impacts will not be allowed to exceed the maximum calculated discharge criteria at the landfill (or Site) property boundaries.

In order to apply Guideline B-7, the appropriate resource use of the adjacent properties must be selected. At both the New Liskeard and Haileybury Waste Disposal Sites, the highest end use for groundwater on the adjacent properties is for drinking water purposes, for which the Ontario Drinking Water Standards (ODWS) - Table 1 through Table 4 have been established. The

purpose of the ODWS is to protect public health through the provision of safe drinking water. Water intended for human consumption shall not contain unsafe concentrations of toxic chemicals (health related parameters). Health related standards are established for parameters that, when present above a certain concentration, have known or suspected adverse health effects. At the same time, water should also be aesthetically acceptable. Colour, odour and turbidity are parameters that, when controlled, result in water that is clear, colourless and without objectionable or unpleasant taste or odour (non-health related parameters). In addition, operational guidelines have been established for non-health related parameters that need to be controlled to ensure efficient and effective treatment and distribution of the water. As well, Guideline B-7 requires the identification of background water quality conditions in the underlying aquifer.

In order to establish the background geochemical profile, the geometric mean of the valid concentrations of each applicable ODWS parameter would have to be calculated, and the resultant values applied along with the ODWS, to complete a Guideline B-7 analysis for all of the on-Site groundwater monitoring wells for various landfill indicator parameters.

As each conceptual landfill expansion alternative may potentially be developed as a natural attenuation site, the feasibility of the expansion alternatives will be compared to the water well related criteria, specifically pertaining to the presence of any designated drinking water supply areas (i.e., Wellhead Protection Areas) and distance to the nearest drinking water supply well.

Distance to Waste Generation Source and Road/Transport Access

The Official Plans for the City of Temiskaming Shores do not contain any special provisions to protect rural areas. The rural area covers areas within the City where no further urban development is contemplated by the Plan and where further municipal services will be restricted to those needed to deal with emergencies. Land designated as Rural Use is intended primarily for agriculture, forestry, recreational or conservation purposes. The purpose of the Rural Use designations to prevent uncontrolled and scattered development. Further in order to prevent the conflicts that may result when development occurs in areas that are not adequately supplied with services and other public works and to avoid excessive costs for such works in the future, it is the intent of Council to maintain the rural area at a similar level to the now prevailing and to restrict further development to a minimum.

As such, the distance to waste centroid/waste generation source and the distance to nearest existing road will be used to evaluate the feasibility of future landfilling at each Site.

4.2.2 Natural Environment

This key criterion mainly addresses the potential impact the conceptual landfill expansion alternatives may have on the surrounding natural environment. The alternatives will be ranked based on the assessment of the following sub-criteria:

- Distance to Terrestrial Habitat;
- Distance to Aquatic Habitat;

- Distance to Species at Risk; and,
- Hydrogeological Conditions (i.e. Overall Condition of Site Setting).

Distance to Terrestrial Habitat

Expansion of an existing site may be limited or prevented due to its proximity to certain land use designations; however, there are no specific regulatory requirements or municipal by-laws that outline setbacks from natural areas.

However, in order to avoid potential interference the distance to the nearest wetland (swamp, bog, marsh, and fen) and the distance to the nearest potentially significant terrestrial habitat (e.g., old growth forest) will be used as ranking criteria to evaluate the feasibility of potential landfill expansion alternatives.

Distance to Aquatic Habitat

Aquatic habitat includes lakes, rivers or other water bodies. As discussed in Section 4.1, Section 13 of Reg. 347 requires that landfill sites be at least 100 feet (30 m) from any watercourse, lake or pond. In addition, the Municipal Bylaws place further restrictions on land use in EP zones, including agricultural, rural areas, hazard land and sensitive areas (as described previously in Section 4.2.1. As a result, the distance to the nearest aquatic habitat will be used to evaluate the expansion potential of each of the Sites.

Distance to Species at Risk

Section 14 of the Township of Dymond By-law No. 1041 requires that landfills must not be located in Environmental Protection (EP) zones. There are no regulatory requirements or by-laws for setbacks from Areas of Natural or Scientific Interest (ANSI).

Expansion of landfills may be limited due to proximity to species at risk or their potential habitat. The Ontario Ministry of Natural Resources (MNR) maintains a “species at risk” database through the Natural Heritage Information Centre (NHIC). The NHIC compiles, maintains and distributes information on natural species, plant communities and spaces of conservation concern in Ontario. This information is stored in a spatial database used for tracking this information. The Centre also has a library with conservation-related literature, reports, books, and maps, which are accessible for conservation applications, land use planning, and natural resource management.

The NHIC web-site can be accesses at http://nhic.mnr.gov.on.ca/MNR/nhic/nhic_.cfm. Natural heritage information can be checked directly on-line using an interactive map or database information can be downloaded in GIS file format. Distance to nearest known or potential species at risk or its critical habitat will be used as criteria to evaluate the feasibility of expansion potential at each Site.

Hydrogeological Conditions

The environmental impact of newly established landfill expansion is dependent on the hydrogeological condition of the landfill property. As stated in Section 4.1, Reg. 347 requires that a landfill shall be at least 100 feet (30 m) from any watercourse, lake or pond. The

conceptual landfill expansion alternatives will be ranked and evaluated based on distance to the nearest surface water feature.

Although regulations and by-laws do not specifically address the overall hydrogeological condition of the landfill property, for the purposes of this report the conceptual landfill expansion alternatives will be ranked based on the hydrogeological condition of each site. The ranking will be based on factors such as the presence of a groundwater recharge area near the Site, the degree of existing groundwater contamination, the presence of a significant confining layer, and the number of and distance to potentially impacted aquifers.

4.2.3 Conceptual Technical Considerations

This key criterion addresses recommended technical features of each conceptual landfill expansion alternative. The alternatives will be ranked based on the assessment of the following sub-criteria:

- Site Size;
- Leachate Management Strategy;
- Surface Water Management Strategy; and
- Landfill Gas Management Strategy.

Site Size

The first technical consideration that must be evaluated for each conceptual landfill expansion alternative is the size of the proposed expansion, and how it relates to the effort required to implement (i.e., construct) the alternative. As discussed in Section 2.4, this study is to evaluate the feasibility of each conceptual landfill expansion alternative to address the City's long term waste management requirements. It is anticipated that the City will generate approximately 874,000 m^3 of solid waste over a 30-year planning period. As a result, each conceptual landfill expansion alternative will be assessed to ensure that it can satisfy the required landfill capacity requirements while meeting the MOE design criteria for buffer areas, side slopes, top elevation and regulatory setbacks (as described earlier). Each alternative will also be assessed on the size of the footprint of the potential expansion, as that is a key indicator of the required construction effort.

Leachate Management

Both of the existing landfill Sites are currently operated as natural attenuation type facilities. To date, the primary control for minimizing leachate impacts to groundwater is the establishment of a CAZ downgradient of each landfill to protect potential receptors. Although natural attenuation will be considered as the primary leachate management strategy for each conceptual landfill expansion alternative, the condition of the existing landfill property, as it relates to site setting factors may require alternative methods for leachate management.

As a result, the feasibility of each conceptual landfill expansion alternative will be evaluated and ranked based on the leachate management strategy. The assessment will consider factors

such as the size, complexity and effort required to implement the leachate management strategy.

Surface Water Management

Currently, the surface water management at both the Haileybury and New Liskeard Landfills is achieved though the establishment of perimeter drainage ditching around the landfill footprint. Perimeter drainage systems direct surface water runoff falling on the lands surrounding landfill away from the active tipping face, thus limiting impacts to nearby creeks and surface water bodies. Surface water runoff from within the landfill footprint is managed through the grading of landfill side slopes and top plateaus, and the application of interim cover on inactive landfill areas, and final cover on closed landfill areas. The feasibility of the conceptual landfill expansion alternatives will be evaluated against the size and complexity of any surface water management features, including length of ditching, number of stormwater management ponds, treatment requirements, and water course alteration requirements.

Landfill Gas Management

Landfill gas (LFG) is generated by methanogenic bacteria during decomposition of organic material under anaerobic conditions. The rate of LFG production in a landfill depends on the interrelationship of many factors. The principal factors include waste composition and age, temperature, moisture content, pH, and quantity and quality of available nutrients and microbial populations. The length of time that a landfill may generate LFG can be in excess of 50 years.

Landfill gas is composed of a variety of chemical compounds, which reflects the types of waste that are placed at the landfill site. In general, landfill gas is composed of approximately 50% to 55% methane by volume, 40% to 45% carbon dioxide by volume, and less than 1% other gases such as sulphur species and volatile organic compounds. The concerns with LFG are that the methane gas creates an explosive hazard under certain conditions (between 5% to 15% by volume in air); that LFG will reduce or replace the percentage of the natural atmosphere in enclosed structures, thus creating an oxygen deficient environment; and that there is a potential for health effects depending on the trace gas compounds and levels.

The generated LFG can migrate from a landfill site in two ways. These two methods are emission of the LFG to the atmosphere either under controlled released conditions (designed venting and/or collection structures) or uncontrolled conditions (venting through the landfill cover), and/or the migration of the LFG within the surrounding subsurface until a venting location is encountered.

Gas migration in the subsurface soil is governed by the same general principles as water flow. The subsurface migration of landfill gas is dependent on soil conditions at the landfill site, the landfill gas generation rate, the landfill site design and weather conditions throughout the year. Potential migration of landfill gas will be greatest in the higher permeable soil stratigraphic units that are present around the landfill site. The landfill gas generation rate will govern the amount of gas available to migrate and impact the extent of landfill gas migration, since landfill gas will usually rise. A perched water table or frost layer will influence the distance of landfill gas

migration, since the boundary layer will create a reduced exfiltration area for the gas and create the conditions for potential lateral migration.

In June 2008, the Ministry of Environment amended Reg. 347 and O.Reg. 232/98 to present requirements for landfill gas collection and management for new, expanding and operating landfills. The amendments are presented in the MOE's *Landfill Gas Capture: A Guideline on the Regulatory and Approval Requirements for Landfill Gas Capture Facilities*, dated September 2008 (Landfill Gas Guideline). The Landfill Gas Guideline states systems to control the atmospheric emission of landfill gas are required for landfills with capacities larger than 1.5 million cubic meters.

The conceptual design of each landfill expansion alternative will be evaluated and ranked based on whether the proposed expansion will increase the overall landfill capacity to over 1.5 million cubic meters, which will require the establishment of a landfill gas collection and management system.

4.2.4 Conceptual Cost Estimates

This key criterion addresses projected cost of each conceptual landfill expansion alternative, which will be based on conceptual estimates. The alternatives will be ranked based on the assessment of the following sub-criteria:

- Land Acquisition Cost Estimate;
- Capital/Construction Cost Estimate; and,
- Cost Estimate for Regulatory Approvals.

It should be noted that the cost estimates provided in this report are preliminary, based on the conceptual design parameters provided for each landfill expansion alternative. The costs presented herein are intended to provide an order of magnitude estimate for the purposes of a feasibility assessment. They are not intended to be used for budgetary purposes. It is recommended that after the selection of a preferred long-term solid waste management strategy, that the City commission a detailed design, upon which one can provide cost estimates suitable for capital budget projections.

Conceptual Land Acquisition Cost Estimate

The acquisition of land adjacent to the existing landfill may be required depending on the parameters and scope of each conceptual landfill expansion alternative. The acquired land may be needed for various reasons, including but not limited to the establishment of proposed contaminant attenuation zones, to facilitate the increased footprint of the expanded landfill, ,for the siting of regulatory required buffer zones or to provide sufficient lands for the installation of leachate, surface water and/or landfill gas management facilities.

Each conceptual landfill expansion alternative will be evaluated and ranked based on the project estimated cost of acquiring new lands adjacent to the existing landfill property. The

lower cost estimate will be ranked as the most feasible while the higher cost will be ranked as least feasible.

Conceptual Capital/Construction Cost Estimate

The conceptual capital/construction cost estimates presented herein are based on the key features that are identified for each conceptual landfill expansion alternative. These key features include projected conceptual cost estimates to perform various construction activities such as:

- Excavation and earthworks;
- Installation of a leachate management system;
- Installation of a surface water management system;
- Application of a final cover system; and,
- Installation of a landfill gas management system.

Each conceptual landfill expansion alternative will be evaluated and ranked based on the projected conceptual estimated capital costs. Lower cost estimates will be ranked as the most feasible while the higher cost will be ranked as least feasible.

Conceptual Cost Estimate for Regulatory Approvals

As discussed in Section 1.0, once a preferred waste management strategy (i.e., expansion of an existing landfill and/or establishment of a new landfill) is determined to be feasible, the development of the required landfill capacity will require a full environmental assessment (EA) under Part II of the Ontario Environmental Assessment Act. Obtaining an operating license for the preferred waste management strategy will require obtaining approval of the landfill design under the Environmental Protection Act and approval of the required leachate/surface water management system under Ontario Water Resources Act. The conceptual costs estimates for Regulatory Approvals presented herein includes the projected engineering/consulting costs and administrative fees anticipated in order to obtain regulatory approval for each of the for each conceptual landfill expansion alternative. Each expansion alternative will be compared against the other and the lowest total cost over the planning period would be considered the most feasible and the highest cost would be considered the least.

4.3 Summary of Feasibility Assessment Criteria

Table 4.2 (embedded below) presents a summary of the key criteria and sub-criteria to be employed for the evaluation of each conceptual landfill design alternative, as well as a summary of the indicators which will provide the basis for the ranking.

Table 4.2
Feasibility Assessment Criteria
for the Conceptual Expansion of Existing Landfills

Criteria	Indicator

	Criteria	Indicator
1	**Public Health, Safety and Socioeconomic Factors**	
	Residential Areas	Distance to nearest residence
	Sensitive Land Uses	Number of residences within 400 m and 1000 m of landfill Distance to nearest agricultural lands Distance to nearest Environmental Protection (EP) Zone Distance to nearest designated Hazard Lands and Sensitive Areas
	Drinking Water Supply	Distance to nearest designated drinking water supply area Distance to nearest drinking water supply well
	Road Transport	Distance to waste centroid/waste generation source Distance to nearest existing road
2	**Natural Environment**	
	Terrestrial Habitat	Distance to nearest wetland, swamp, bog, marsh or fen Distance to nearest potentially significant terrestrial habitat (e.g., old growth forest)
	Aquatic Habitat	Distance to nearest water course, creek, ponds or lake
	Species at Risk	Distance to nearest known or potential Species At Risk or its critical habitat
	Hydrogeological Conditions	Presence of on-site groundwater recharge area Existing and degree of groundwater contamination Degree of natural containment at site Number of aquifers Distance to aquifer
3	**Technical Considerations**	
	Site Size	Size of conceptual landfill expansion
	Leachate Management	Size of proposed contaminant attenuation zone Complexity of alternative leachate management system
	Surface Water Management	Size and complexity of surface water management features
	Landfill Gas Management	Requirement for landfill gas collection and management
4	**Conceptual Cost Estimate**	
	Land Acquisition	Cost of acquiring new lands adjacent to the existing landfill property
	Capital/Construction Cost	Cost estimate to construct the landfill expansion
	Cost for Regulatory Approval	Cost to obtain regulatory approvals for landfill expansion

5.0 CONCEPTUAL LANDFILL EXPANSION ALTERNATIVES

This section includes a description of a total of four conceptual design alternatives for the expansion of the existing City of Temiskaming Shores landfills (i.e., two alternatives for each landfill) as well a discussion on the basis for the conceptual alternatives. It should be noted that for the purposes of this report, the designs for the landfill expansions are prepared at a preliminary, conceptual level to facilitate evaluation of overall feasibility of the alternatives. The landfill alternatives presented herein are not intended to provide details on the implementation or construction of the landfill expansion. The preparation of more detailed designs would be initiated subsequent to the submission of the Final Feasibility Study and the preparation and approval of an Environmental Assessment of a preferred long-term solid waste management (i.e., landfill disposal) strategy for the City.

5.1 Conceptual Landfill Expansion Capacity

The volumetric capacity for the conceptual landfill expansion is determined by the following two parameters:

1. the total volume of solid waste projected to be generated during the 30-year planning period; and,
2. the available remaining landfill waste capacity at the existing landfill sites.

Section 2.3 presents a discussion of solid waste generation projections for the City during a 30-year planning period (i.e., 2009 to 2038). Based on these projections, it is anticipated that the City will generate approximately 874,000 m^3 of solid waste, including waste and daily cover soil quantities.

It is understood that any long-term solid waste management strategy would include the use of any remaining landfill capacity at the existing landfills. As discussed in Section 3.3.2, the Haileybury Landfill is the only existing site within the City with a remaining landfill capacity. The Remaining Site Capacity at the Haileybury Landfill is estimated as approximately 188,691 m^3, including waste and daily cover soil.

As such the estimated capacity of the required landfill expansion would be calculated by the subtraction of the Remaining Site Capacity at Haileybury Landfill from the Long-term Landfill (Waste & Cover Soil) Volume Requirement. Therefore the Conceptual Landfill Expansion Capacity is 685,309 cubic meters (874,000 m^3 - 188,691 m^3), which is rounded to approximately 685,000 m^3 for the purposes of this report.

AMEC has developed four conceptual landfill expansion alternatives, two for each existing landfill site. Alternatives No. 1 and No. 2 outline the expansion of the New Liskeard Landfill within available land to the east and west of the existing landfill footprint, respectively. Alternatives No. 3 and No. 4 outline the expansion of the Haileybury Landfill within available land to the east of the existing landfill footprint, with each alternative containing different

footprint areas. Each conceptual landfill expansion alternative is described by the following key conceptual design parameters:

- footprint area;
- base elevation;
- top elevation; and,
- volumetric capacity.

As stated above, the landfill expansion alternatives are prepared on a conceptual basis to facilitate the assessment of socioeconomic, environmental, technical, cost and regulatory feasibility. The preparation of refined conceptual design outlining landfill buffer zones, base contours, side slope grades and landfill plateau grades and other design criteria would proceed upon the identification and selection of a preferred feasible conceptual alternative.

5.2 New Liskeard Landfill Conceptual Expansion Alternatives

During the September 2009 Landfill Inspections, AMEC observed that the New Liskeard Landfill property had open areas to the east and to the west of the existing landfill footprint which would be available to potential expansion. Expansion to the north of the landfill footprint was limited on the basis that it would be difficult to develop land adjacent to the limestone escarpment located in that area. Additionally, AMEC observed that there were clear, long sightlines to and from the former Town of New Liskeard and the surrounding lands from the limestone escarpment, thus recognizing the potential future value property as a setting for a recreational/parkland once the landfill was closed. The limited availability of land to the south of the landfill footprint minimized the possibility of expansion in that direction.

As shown on Figure 2 (see Schedule 1), the lands to the east of the New Liskeard Landfill are generally open with grasses and low lying vegetation covering the surface. The land generally slopes downward toward the northeast with surface elevations ranging from 254 meters above sea level (masl) to 245 masl. AMEC observed stockpiles of foundry sands and wood debris (i.e., brush and branches) in that area. A granular access road runs from the north to the south, adjacent to the east property boundary.

The lands to the west of the New Liskeard landfill are generally forested. Stockpiles of reclaimed asphalt, recycled glass, foundry sands, scrapped spare tires, white goods and concrete debris are stored along the west granular haul road. The land is generally level with elevations ranging from 270 masl to 271 masl. As noted in Section 3.4.1, AMEC observed evidence of illegal dumping on a trail located outside the west property boundary

Summary descriptions of each of the conceptual landfill alternative for the New Liskeard Landfill are provided below.

5.2.1 Alternative No. 1 – New Liskeard Landfill

Conceptual Landfill Expansion Alternative No. 1 involves the construction of the landfill expansion to the east of the current footprint of the New Liskeard Landfill and west of the established contaminant attenuation zone (CAZ). Figure 8 (see Schedule 1) presents a schematic of Alternative No. 1. The key parameters of this alternative are presented on Table 5.1 (embedded below):

Table 5.1
Key Parameters
New Liskeard Landfill Conceptual Landfill Expansion Alternative No. 1

Parameter	Value
Footprint Area	2.61 ha
Base Elevation	254 masl
Top Elevation	280 masl
Landfill Capacity (inc. waste & daily cover)	687,600 m^3

5.2.2 Alternative No. 2 – New Liskeard Landfill

Conceptual Landfill Expansion Alternative No. 2 involves the construction of the landfill expansion to the west of the current footprint of the New Liskeard Landfill. Figure 9 (see Schedule 1) presents a schematic of Alternative No. 2. The key parameters of this alternative are presented on Table 5.2 (embedded below):

Table 5.2
Key Parameters
New Liskeard Landfill Conceptual Landfill Expansion Alternative No. 2

Parameter	Value
Footprint Area	3.60 ha
Base Elevation	266.0 masl
Top Elevation	285.5 masl

Parameter	Value
Landfill Capacity (inc. waste & daily cover)	702,000 m^3

5.3 Haileybury Landfill Conceptual Expansion Alternatives

During the September 2009 Landfill Inspections, AMEC observed that the Haileybury Landfill property was positioned in the west portion of the landfill property, along the west property boundary, within 50 m of the north property boundary, 70 m of the south property boundary and 460 m of the east property boundary. The lands to the north and west of the existing landfill footprint are located outside of the existing City owned property. As such, the only land considered for the potential expansion was located to the east of the existing landfill footprint.

During the September 2009 Landfill Inspections, AMEC observed that stockpiles of scrap spare tires, scrap metal, white goods and historical building demolition waste were all located within the lands immediately to the east of the Haileybury Landfill, inside the perimeter fence. The land in this area is generally hilly with bedrock outcrops. The surface elevation ranges from 294 masl to 300 masl. The lands beyond the perimeter fence are generally forested, with low lying wetland areas. AMEC observed several groundwater monitoring wells in that area, including MW-TW8 and other unidentified wells. GIS mapping information indicates that the surface elevation generally rises towards the east, ranging from 300 masl to 320 masl.

Summary descriptions of each of the conceptual landfill alternative for the Haileybury Landfill are provided below.

5.3.1 Alternative No. 3 – Haileybury Landfill

Conceptual Landfill Expansion Alternative No. 3 involves the construction of the landfill expansion to the east of the current footprint of the Haileybury Landfill, while maintaining a maximum top elevation of 303 masl, to match the proposed final contours of the existing landfill area. A schematic of Alternative No. 3 is presented in Figure 10 (see Schedule 1). The key parameters of this alternative are presented on Table 5.3 (embedded below):

Table 5.3
Key Parameters
Haileybury Landfill Conceptual Landfill Expansion Alternative No. 3

Parameter	Value
Footprint Area	8.20 ha
Base Elevation	295 masl

Parameter	Value
Top Elevation	303.5 masl
Landfill Capacity (inc. waste & daily cover)	697,000 m^3

5.3.2 Alternative No. 4 – Haileybury Landfill

Conceptual Landfill Expansion Alternative No. 4 involves the construction of the landfill expansion to the east of the Haileybury Landfill with a reduced landfill expansion footprint area compared to Alternative No. 3. As such, the top elevation of the proposed conceptual expansion will increase to compensate for the volume restrictions presented by a reduced footprint. A schematic of Alternative No. 4 is presented in Figure 11 (see Schedule 1). The key parameters of this alternative are presented on Table 5.4 (embedded) below:

Table 5.4
Key Parameters
Haileybury Landfill Conceptual Landfill Expansion Alternative No. 4

Parameter	Value
Footprint Area	4.40 ha
Base Elevation	295 masl
Top Elevation	311 masl
Landfill Capacity (inc. waste & daily cover)	704,000 m^3

The discussion of the evaluation and selection of the preferred conceptual landfill expansion alternative is presented in Sections 6.0 and 7.0, respectively.

Other potential landfill expansion alternatives may exist but are considered a sub-set of the above principal conceptual landfill expansion alternatives. This feasibility assessment focuses on the discussion and evaluation of these four conceptual alternatives. The further refinement of these concepts should be conducted as part of the environmental assessment stage of the solid waste management planning process, which will provide the basis of detailed design alternatives for the implementation of the preferred feasible alternative.

6.0 EVALUATION OF LANDFILL EXPANSION ALTERNATIVES

6.1 Assignment of Ranking Scores

The ranking of each feasibility assessment criteria will be based on the level of concern and/or the potential for adverse impact presented by each conceptual landfill alternative. The determination of the level of concern and potential for adverse impact will be based on how each alternative affects the criteria's indicator. For example, evaluating a conceptual landfill alternative under the criteria for Public Health, Safety and Socioeconomic Factors will include determining the distance of the proposed landfill expansion to the nearest residence. For the purposes of this feasibility assessment the closer the distance between the proposed expansion and the nearest residence, the greater the level of concern and/or potential adverse impact to the environment.

The rating of the level of concern and/or potential for adverse environmental effects was determined in consultation with City's Technical Advisory Committee. For those criteria where a concern or potential for environmental effect was identified, one of the following ratings was assigned:

- **High** – Where the expansion may affect the environmental component so as to seriously disturb the integrity, distribution, operation, or abundance of the component and is expected to raise serious concern with government reviewers and / or the public.

- **Medium** - Where the expansion may affect the environmental component so as to bring about a disturbance but does not threaten the integrity, distribution, operation, or abundance of the component as determined by government reviewers and the public. Short-term effects associated with construction and operation of facilities also constitute a potential for moderate effects/concerns.

- **Low** – Where the expansion may affect the environmental component in such a way that only a portion of the component is disturbed for a short period of time.

- **None** – The expansion causes little or no affect to the environmental component and causes no concern among government reviewers and/or the public.

To assist with the identification of the overall most feasible (preferred) alternative the following ranking system was applied:

Table 6.1
Feasibility Assessment Ranking System

Level of Concern/Potential Impact Rating	Ranking Value
None	0
Low	1
Low to medium	2
Medium	3
Medium to high	4
High	5

The scores are introduced to summarize the quantitative and qualitative evaluation using the individual feasibility assessment sub-criteria and indicators into a numeric score. To arrive at an overall score for each of the conceptual landfill expansion alternative, the individual scores for each sub-criterion will be tallied in order to asses the overall feasibility.

The following sections will present discussions on how each conceptual landfill expansion alternative is assessed for each individual feasibility assessment sub-criteria, as well as summary rankings for the main key criteria.

6.2 Public Health, Safety and Socioeconomic Factors

6.2.1 Residential Areas

During the September 2009 Landfill Inspections, AMEC observed that there are two residences located within a 400 m radius of the New Liskeard Landfill. As stated in Section 4.2.1, Reg. 347, requires that a landfill be placed at least 400 m from an existing residence, therefore the location of the residences present a potential conflict with the applicable regulation. However, it should be noted that AMEC is unaware of any complaints issued by the nearby property owners with respect to landfill operations. Additionally, no residences, buildings or structures (other than the landfill operations buildings) are constructed within 30 m of the perimeter of the landfill property, thus the existing New Liskeard Landfill satisfies the requirements of O.Reg. 232/989 and various City by-laws.

Conceptual Landfill Expansion Alternative No. 1 involves expanding the New Liskeard Landfill by constructing waste disposal cells on the east side of the existing landfill. Although the environmental impact is low, AMEC observed that due to the location of the existing landfill on the high point of the limestone escarpment, the east side of the existing landfill is readily visible to the population of the Town of New Liskeard. Any landfill operations conducted on the east side of the existing landfill will have a visual impact to the local community. Conceptual Landfill

Expansion Alternative No. 2 involves the expansion of the landfill to the west of the existing landfill footprint. As such, the existing landfill acting as a visual screen to landfill operations conducted on the west. Therefore, for the purposes of this report Alternative No. 1 will be ranked with a level of concern/potential impact rating of 3-medium, while Alternative No. 2 will be ranked with a rating of 2-low to medium.

There is one existing residences located within 1 km of the Haileybury Landfill Site. As such, Conceptual Landfill Expansion Alternatives No. 3 and 4 will be ranked with a level of concern/potential impact rating of 1-low.

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Residential Area sub-criterion.

6.2.2 Sensitive Land Uses

As discussed in Section 6.2.1, there are two residences located within a 400 m radius of the New Liskeard Landfill, and one residence located within a 1 km radius of the Haileybury Landfill. The closest residences are located to the east and south of the existing landfill footprint, closest to the proposed location of Alternative No. 1, which is located on the east side of the landfill. The New Liskeard Landfill is located adjacent to agricultural properties, although no Environmental Protection (EP) Zones, Hazard Zones or Sensitive Areas are located within 500 m of the New Liskeard Landfill. As discussed in Section 3.2.3, the Haileybury Landfill is located adjacent to a sensitive natural wetland area, which is located immediately east of the landfill footprint, within the property boundary. In addition, a sensitive natural intermittent surface water channel is located along the north boundary of the landfill property, before connecting with the creek located adjacent southwest property boundary.

Based on the above noted information Conceptual Landfill Expansion Alternative No. 1 is ranked with a level of concern/potential impact rating of 3-medium and Alternative No. 2 is ranked with a level of concern/potential impact rating of 2-low to medium, to address the potential impacts to nearby residences and adjacent agricultural lands at the New Liskeard Landfill. Alternatives No. 3 and 4 for the Haileybury Landfill will be ranked with a rating of 5-high, since the available land for potential expansion within the property boundary will require construction within an established wetland.

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Sensitive Land Use sub-criterion.

6.2.3 Drinking Water

As discussed in Section 4.1, there are 5 drinking water wells within 500 m of the New Liskeard Landfill property, as shown on Figure 6 (see Schedule 1). Based on a review of the historical annual water quality monitoring reports for the Site it appears that these wells are either upgradient or crossgradient of the predominant groundwater flow direction indicating low potential impacts by any landfill derived leachate plume. In addition, there are a number of private water supply wells along Highway 65, approximately 900 m downgradient from the New

Liskeard Landfill located east of the established CAZ. As discussed in Section 3.2.8, the historical water quality monitoring of these wells indicated that these wells were not impacted by leachate.

Based on the above noted findings, Conceptual Landfill Expansion Alternative No. 1 and No. 2 will be ranked with a level of concern/potential impact rating of 2-low to medium. As stated in Section 4.1, although the presence of drinking water supply wells are not anticipated to present a significant constraint to the construction of an expansion of New Liskeard Landfill, further study is recommended to verify the location of the of the water supply wells shown on Figure 6 (see Schedule 1), as well as to confirm that there are no impacts to the inventoried water supply wells.

As shown on Figure 7 (see Schedule 1), there are no drinking water wells within 500 m of the Haileybury Landfill Site. As such Conceptual Landfill Expansion Alternatives will be ranked with a level of concern/potential impact rating of 0-none.

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Drinking Water sub-criterion.

6.2.4 Accessibility and Driving Distance

The New Liskeard Landfill is located approximately 3 km from the Town of New Liskeard and 9 km from Town of Haileybury, the two main areas of waste generation within the City. The Haileybury Landfill is located approximately 12 km from Town of New Liskeard and 12 km from Town of Haileybury. As such it is more advantageous to construct landfill expansions at the New Liskeard Landfill since it is closer to both major waste generation centers.

Both the New Liskeard Landfill and Haileybury Landfill are readily accessed by county roads located immediately south of the property boundary.

Based on the above noted information, Conceptual Landfill Expansion Alternatives No. 1 and No. 2 will be ranked with a level of concern/potential impact rating of 0-none, while Alternatives No. 2 and 3 will be ranked with a rating of 2-low to medium due to the required driving distance from waste generation areas.

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Accessibility and Driving Distance sub-criterion.

6.3 Natural Environment

6.3.1 Terrestrial Habitat

During the September 2009 Landfill Inspections, AMEC observed that there were no indicators that a significant terrestrial habitat (i.e., wetlands, old growth forest) in the vicinity of the New Liskeard Landfill. This observation was confirmed during the Site Constraint/Opportunity Mapping exercise, as no significant terrestrial habitats were located within the vicinity of the New Liskeard Landfill property.

As previously discussed, the Haileybury Landfill is constructed adjacent to a significant wetlands area to the east of the landfill footprint. Since the existing landfill is surrounded by property boundaries to the north, west and south, the only available area for potential expansion is located to the east of the existing footprint, within the wetlands area.

Based on the above noted information, Conceptual Landfill Expansion Alternatives No. 1 and No. 2 will be ranked with a level of concern/potential impact rating of 0-none, while Alternatives No. 2 and 3 will be ranked with a rating of 5-high.

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Terrestrial Habitat sub-criterion.

6.3.2 Aquatic Habitat

Field observations recorded during the September 2009 Landfill Inspections indicate that there are no indicators that aquatic habitats are located within the vicinity of the New Liskeard Landfill. These observations were confirmed during the performance of Site Constraint/Opportunities GIS Mapping of the New Liskeard Landfill. As such, Conceptual Landfill Expansion Alternatives No. 1 and No. 2 will be ranked with a level of concern/potential impact rating of 0-none.

Field observations recorded during the September 2009 Landfill Inspections indicated the presence of an intermittent surface water drainage channel within the northeast of the Haileybury Landfill. The intermittent channel drains the adjacent wetlands into a creek located to the southwest and south of the existing landfill. Although any proposed expansions to the Haileybury Landfill will be located outside of the 30 m setback from any surface water bodies, the location of the potential landfill expansions may directly impact downstream surface water bodies through the intermittent drainage channel. As such, Conceptual Landfill Expansion Alternatives No. 3 and No. 4 will be ranked with a level of concern/potential impact rating of 4-medium to high.

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Aquatic Habitat sub-criterion.

6.3.3 Species at Risk

Field observations recorded during the September 2009 Landfill Inspections indicate that the lands surrounding the New Liskeard and Haileybury Landfills are surrounded by natural mixed forests containing flora and fauna species commonly found in Northern Ontario. Site

Constraint/Opportunity Mapping indicates that there are not indicators that species at risk (SAR) or Areas on Natural or Scientific Interest (ANSI) located within the vicinity either landfill. As such, Conceptual Landfill Expansion Alternatives No. 1 through No. 4 will be ranked with a level of concern/potential impact rating of 0-none.

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Species at Risk sub-criterion.

6.3.4 Hydrogeological Conditions

Conceptual Landfill Expansion Alternative No. 1 – New Liskeard Landfill

As stated in 3.1.5, the New Liskeard Landfill is located in a groundwater recharge area, based on the downward hydraulic gradients reported in the nested wells close to the landfill site, as well as, the location of the site on a topographically elevated, exposed (i.e., little to no overburden) limestone, bedrock ridge. In addition, a number of documented fault zones are present in the vicinity of the site and within the downgradient area. Geological investigations in this area indicate a presence of some overburden to the east of the landfill limits, with depths ranging from 0 to 2 m below ground surface. The absence of a significant low permeability confirming layer overlying the bedrock means that there is a high susceptibility to contaminant migration to the bedrock aquifer and the faults. Historical monitoring results indicate that there is a leachate-impacted groundwater plume, indicated by impacts to monitoring wells located approximately 300 to 350 m downgradient of the landfill. As previously discussed, these impacts are managed though the establishment of a leachate CAZ located immediately downgradient to the east of the landfill property boundary.

A preliminary assessment was performed to assess if the existing CAZ would be sufficient to manage any additional impacts introduced by the construction of Conceptual Landfill Alternative No. 1. The assessment was based the procedures outlined in Section 3.1.10, and include the following factors:

- Expanded Footprint Area - The surface area of the additional waste footprint of Alternative No. 1 was estimated to be 2.61 ha (26,100 m^2). As such, the total landfill footprint for the existing New Liskeard Landfill, including Conceptual landfill Expansion Alternative No. 1 would be increased to approximately is 60,000 m^2.

- Reduced Downgradient Recharge Area - Since the expansion occurs onto the downgradient side of the landfill, the downgradient recharge area is reduced to 183 900 m^2 (i.e., 210,000 m^2 minus 26,100 m^2).

Assuming that the downgradient infiltration rate (I_{CAZ}=224 mm/a) and the source area infiltration rate (I_L=150 mm/a) remains the same as in Section 3.1.10, the recharge rate for the downgradient area is calculated as follows:

$$Q_{CAZ\ EXP} = A_{CAZ\ EXP} \times I_{CAZ}$$

= 183,900 m^2 x 0.224 m/a
= 41,194 m^3/a

Where: $Q_{CAZ\ EXP}$ = Downgradient CAZ recharge rate;
$A_{CAZ\ EXP}$ = Downgradient CAZ surface area; and
I_{CAZ} = Downgradient CAZ infiltration rate.

Similarly, the expanded landfill footprint (i.e., source area) recharge rate is calculated as follows:

$Q_{L\ EXP}$ = $A_{L\ EXP}$ x I_L
= 60 000 m^2 x 0.15 m/a
= 9 000 m^3/a

Where: $Q_{L\ EXP}$ = Recharge rate within the expanded landfill footprint;
$A_{L\ EXP}$ = Total landfill footprint surface area; and
I_L = Landfill footprint infiltration rate.

Assuming that the groundwater recharges downgradient of the landfill in the CAZ and dilutes the migrating leachate plume. The expanded dilution factor is:

Dilution Factor, DF_{EXP} = $Q_{CAZ\ EXP}$ / $Q_{L\ EXP}$
= 41,194 m^3/a / 9,000 m^3/a
= 4.6

As stated in Section 3.1.10, the chloride concentration of the leachate is 1,220 mg/L as measured in source area well OW-18. Using the dilution factor of 4.6, the expected chloride concentration at the northeast boundary of the CAZ for the expanded landfill would be 265 mg/L (1,220 mg/L divided by 4.6). The reasonable use concept (RUC) criterion for chloride used by Jagger Hims (2008) for the Site is 127.9 mg/L. The Ontario Drinking Water Standard (ODWS) for chloride is 250 mg/L. Therefore, using the infiltration approach, the expected downgradient chloride concentration at the expanded Site would exceed the RUC and ODWS at the northeast CAZ compliance boundary.

However, as previously indicated for the existing landfill, this approach significantly overestimated the degree and extent of groundwater impact downgradient of the landfill. As shown in Section 3.1.10, and based on actual historical data it was estimated that a distance of approximately 187.5 m from the edge of the landfill is required to attenuate the leachate plume to background concentrations (based on chloride concentrations). The infiltration calculations, although overestimating the observed impact, did indicate that the degree and extent of downgradient impact for the expanded landfill may be twice that of the existing landfill at steady state (i.e., expected downgradient chloride concentration of 265 mg/L for the expanded landfill vs. expected downgradient chloride concentration 131 mg/L for the existing landfill). Therefore,

if it is conservatively assumed that the attenuation distance for the leachate plume from the edge of the landfill will also double as a result of the additional waste, the required distance for attenuation of the leachate plume in the subsurface would be 2 x 188 m = 376 m. This is still within the 400 m of the CAZ downgradient of the east property boundary, although it would likely extend beyond the north side of the existing CAZ.

In summary, the configuration of the existing CAZ would likely need to be expanded to the north by approximately 50 m, resulting in the requirement to obtain approximately 20,000 m^2 of additional land to ensure a minimum 400 m attenuation distance. Based on the above noted data, Conceptual Landfill Expansion Alternative No. 1 will be ranked with a level of concern/potential impact rating of 3-medium.

It is noted that this preliminary assessment of the existing CAZ was based on waste volumes but only surface area of the footprint. A more detailed assessment of the existing CAZ is recommended upon selection of a preferred landfill expansion alternative.

Conceptual Landfill Expansion Alternative No. 2 – New Liskeard Landfill

Assessing the hydrogeological impact of Conceptual Landfill Expansion Alternative No. 2 is difficult due to the limited historical data of groundwater conditions to the west of the existing landfill footprint. Field observations indicate that the existing landfill is located on top of a bedrock ridge. As stated in Section 3.1.4, the presence of this ridge presupposes that a groundwater divide likely exists between the east and west portion of the property. As such, it is possible that establishing Conceptual Landfill Expansion Alternative No. 2 on the west side of the existing landfill would result in the creation of a new leachate plume migrating towards the west, which may impact the South Wabi Creek sub-watershed. The creation of this new plume would likely necessitate the installation of a new monitoring network and establishment of a new CAZ west of the landfill property. For the purposes of this report, the newly required CAZ for Alternative No. 2 will be assumed to be similar in size (i.e., approximately 30 ha) to the existing CAZ.

As such, Conceptual Landfill Expansion Alternative No. 2 will be ranked with a level of concern/potential impact rating of 4-medium to high.

Conceptual Landfill Expansion Alternatives No. 3 and No. 4 – Haileybury Landfill

As stated in Section 3.2.8, the available historical groundwater quality data for the Haileybury Landfill indicates that there is a leachate-impacted groundwater plume flowing downgradient to the to the west of the landfill foot print. Historical hydrogeological data also indicates that the Haileybury Landfill property consists of a sand and gravel aquifer with low hydraulic gradients, high hydraulic conductivities and high groundwater velocities. The absence of a low permeability confining layer allows impacted water to rapidly reach the underlying groundwater. Groundwater mounding effects within the existing waste deposits have the potential to result in a significant alteration to the currently observed groundwater elevations. SES indicates that these impacts would likely be addressed by establishing a 30 ha CAZ, which would be sufficient to attenuate the landfill derived impacts to within acceptable levels (SES, May 2008). As stated

in Section 3.2.2, the City is currently in negotiations with the adjacent property owner to purchase the water rights for the SES revised CAZ.

Based on the available information, it is likely that the placement of additional waste east of the existing Haileybury Landfill footprint, currently considered the upgradient recharge area, will potentially increase the observed groundwater quality impacts and alter the localized groundwater flows resulting potential discharges to the adjacent creek and wetland system. As such, Conceptual Landfill Expansion Alternatives No. 3 and No. 4 will be ranked with a level of concern/potential impact rating of 4-medium to high.

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Hydrogeological Conditions sub-criterion.

6.4 Technical Considerations

6.4.1 Site Size

The key conceptual technical parameters for each of the Conceptual Landfill Expansion Alternatives are presented in Section 5.0 on Tables 5.1 through 5.4 (embedded above), as well as on Figures 8 though 11 (see Schedule 1). Each conceptual expansion alternative was developed to ensure that the proposed expansions would be able to fit within the limits of the representative landfill property boundary to ensure that the City does not need to acquire any of the adjacent property to accommodate the additional landfill volume. Each Conceptual Landfill Expansion Alternative is ranked as follows, with respect to the level of concern/potential impact based on the area of existing landfill property required to facilitate the expansion:

- Alternative No. 1 – New Liskeard, Footprint Area = 2.61 ha (rank = 1-low);
- Alternative No. 2 – New Liskeard Footprint Area = 3.62 ha (rank = 2-low to medium);
- Alternative No. 3 – Haileybury Footprint Area = 8.2 ha (rank = 4-medium to high); and,
- Alternative No. 4 – Haileybury Footprint Area = 4.4 ha (rank = 3-medium).

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Site Size sub-criterion.

6.4.2 Leachate Management

Leachate management at the existing New Liskeard Landfill is currently completed through natural attenuation processes within the established CAZ. As discussed in Section 6.3.4, leachate management for Conceptual Landfill Expansion Alternatives No. 1 and No. 2 will also be accomplished though natural attenuation. For Conceptual Landfill Expansion Alternative No. 1 it is anticipated that expanding the existing CAZ by 2 ha to the north and using the existing groundwater monitoring network will be sufficient to achieve leachate management goals. As such, Alternative No. 1 will be ranked with a level of concern/potential impact rating of 1-low. As discussed in Section 6.3.4, the establishment of a new CAZ to the west of the existing landfill footprint and the installation of a new groundwater monitoring network will be required to

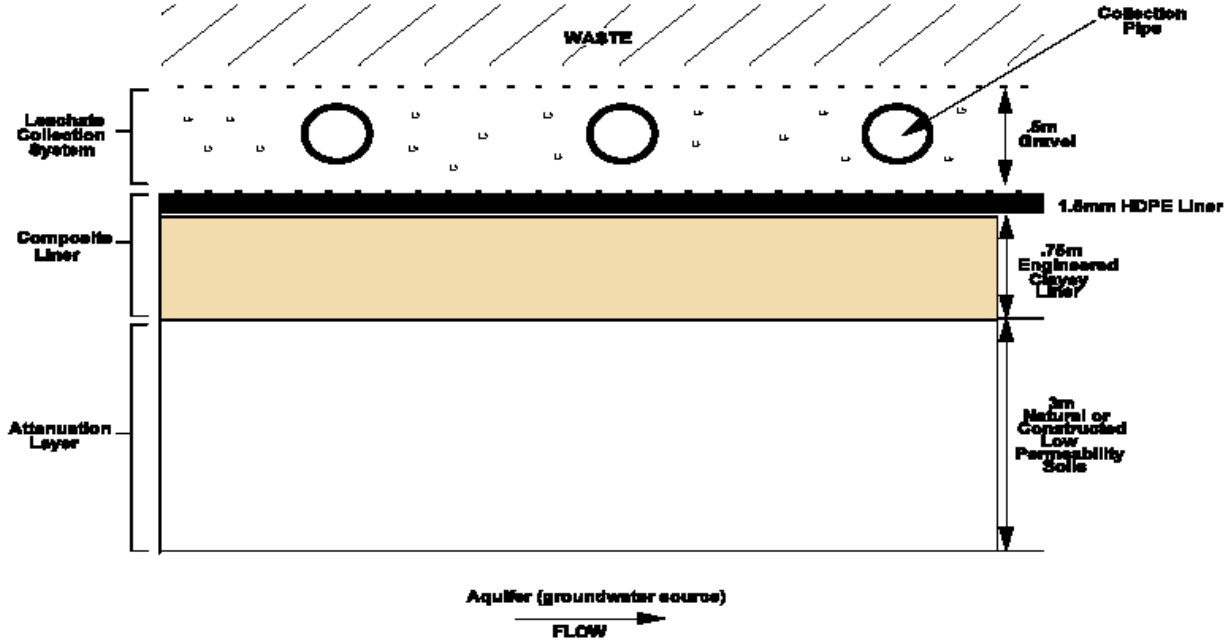
manage leachate generated by Conceptual Landfill Expansion Alternative No. 2. Therefore, Alternative No. 2 will be ranked with a level of concern/potential impact rating of 3-medium.

It is anticipated that the existing Haileybury Landfill Site will continue to operate as a natural attenuation landfill, assuming that the City can obtain the necessary water rights for the SES revised CAZ. As discussed in Section 6.3.4, any proposed expansion of the Haileybury Landfill will by necessity include expansion in the wetlands located to the east of the existing landfill footprint, as well as potential expansion of the SES revised CAZ. Development of any expansion alternative could potentially result in an impact to the local groundwater and adjacent surface water bodies. Given the relative difficulty in obtaining the necessary water rights for the existing SES revised CAZ, and anticipating similar difficulties to acquiring land and obtaining rights for an expansion to the CAZ, it is conservatively assumed that leachate management for the proposed expansion of the Haileybury Landfill will be achieved through the installation of a generic single base liner and leachate collection system.

The design of a generic single base liner and leachate collection system is outlined in O.Reg. 232/98 and the Ministry of Environment's *Landfill Standards: A Guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites*, dated May 1998 (Landfill Standards Guideline). The design consists of the following components:

- landfill base sub-grade consisting of a natural or constructed layer of low permeability soils approximately 3 m in thickness;
- installation of a 0.75 m thick compacted clay liner, or alternatively, installation of a layer of geosynthetic clay liner;
- application of a 1.5 millimeter (mm) thick layer of high-density polyethylene geomembrane; and,
- installation of a leachate collection system layer consisting of non-woven geotextile underlying a network of perforated leachate collection pipe headers and laterals surrounded by a clear stone drainage layer.

The schematic of the generic single base liner and leachate system from O.Reg. 232/98 is presented below:



Conceptual Landfill Expansion Alternative No. 3 and 4 also includes the installation of a leachate piping network to facilitate the collection of leachate and a concrete manhole/pump station to facilitate the pumping and removal of leachate. The ultimate leachate treatment option may include transport and disposal at the City's waste water treatment facility. It should be noted that any proposed leachate treatment/collection system will require approval by the MOE under the Section 53 of the Ontario Water Resources Act (OWRA) as part of the detailed design process.

Conceptual Landfill Expansion Alternatives No. 3 and No. 4 will be ranked with a level of concern/potential impact rating of 5-high, due to the size and complexity of the proposed generic single liner leachate management and collection system.

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Leachate Management sub-criterion.

6.4.3 Surface Water Management

Due to the minimal historical surface water impacts observed at the New Liskeard and Haileybury Landfills, the proposed Conceptual Landfill Expansion Alternatives will include the use of perimeter drainage systems and best management practices as primary components of the surface water management system. Although the extent of the proposed perimeter drainage systems is dependent on the overall configuration of the Conceptual Landfill Expansion Alternative, it is anticipated that the required ditching will be relatively minor and will have minimal overall impact to the environment. As such, Conceptual Landfill Expansion Alternatives No. 1 and No. 2 will be ranked with a level of concern/potential impact rating of 1-low. Conceptual Landfill Expansion Alternatives No. 3 and No. 4 will be ranked with a level of

concern/potential impact rating of 2-low to medium, to address potential surface water impacts to the nearby wetlands and aquatic habitats.

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Surface Water Management sub-criterion.

6.4.4 Landfill Gas Management

As discussed in Section 4.2.3, MOE amended Reg. 347 and O.Reg. 232/98 to require that landfill gas management systems be installed for landfills with capacities larger than 1.5 million cubic meters. As discussed in Section 3.3, the Total Site Capacity of the existing New Liskeard Landfill is not currently known. Conceptual level cross-section calculations performed on the existing landfill footprint indicates that the current Site Capacity is approximately 392,000 m^3. Therefore, for the purposes of this report, it is assumed that landfill gas collection or management systems will not be required. As such, As such, Conceptual Landfill Expansion Alternatives No. 1 and No. 2 will be ranked with a level of concern/potential impact rating of 0-none.

As discussed in Section 3.3, the Total Site Capacity of the Haileybury Landfill is estimated as 452,221 m^3A quick review of the projected waste capacities for Conceptual Landfill Expansion Alternatives No. 3 and No. 4 indicates that neither expansion will increase the Total Site Capacity of the Haileybury Landfill in excess of 1.5 million cubic meters. It is not anticipated that landfill gas collection or management will be required at the Haileybury Landfill. As such, Conceptual Landfill Expansion Alternatives No. 3 and No. 4 will be ranked with a level of concern/potential impact rating of 0-none.

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Landfill Gas Management sub-criterion.

6.5 Conceptual Cost Estimates

The projected conceptual cost estimates for Conceptual Landfill Alternatives No. 1, No. 2, No. 3 and No. 4 are presented on Tables 3, 4, 5 and 6 (see Schedule 2), respectively. The conceptual cost estimates are itemized by the following sub-criteria: land acquisition costs, capital/construction costs; and costs to obtain regulatory approval. Discussions on the basis of each estimate are provided below.

6.5.1 Land Acquisition Cost Estimates

As previously mentioned in Section 6.4.2, it is anticipated that the natural attenuation will be primary method of leachate management for Conceptual Landfill Expansion Alternatives No. 1 and No. 2 for the New Liskeard Landfill. Alternative No. 1 will require the acquisition of adjacent land to expand the existing CAZ while Alternative No. 2 will require the acquisition of adjacent land for the establishment of a new CAZ. Tables 3a and 4a (see Schedule 2) present the proposed cost for land acquisition for Alternative No. 1 and No. 2, respectively. A unit cost of $1,000 per ha is assumed based on typical land prices observed in Northern Ontario. As

discussed in Section 6.3.4, Conceptual Landfill Expansion Alternative No. 1 will require the acquisition of approximately 2 ha of adjacent land resulting in an estimated cost of $2,000, while Conceptual Landfill Expansion Alternative No. 2 will require the acquisition of approximately 30 ha of adjacent land resulting in an estimated cost of $30,000. As such, Conceptual Landfill Expansion Alternative No. 1 will be ranked with a level of concern/potential impact rating of 1-low, while Conceptual Landfill Expansion Alternative No. 2 will be ranked with a level of concern/potential impact rating of 3-medium.

For the purposes of this report, the land acquisition costs for Conceptual Landfill Expansion Alternatives No. 3 and No. 4 are based on the anticipated cost to obtain the water rights to adjacent land within the limits of the SES revised CAZ. Currently, the status of the City's current negotiations with the property owner, as well as the current offer price for the water rights are not known. Yet, given the importance of obtaining water rights as a condition of establishing the SES revised CAZ, Conceptual Landfill Expansion Alternatives No. 3 and No. 4 will be ranked with a level of concern/potential impact rating of 4-medium to high.

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Land Acquisition Cost Estimate sub-criterion.

6.5.2 Capital/Construction Cost Estimate

Tables 3b, 4b, 5b and 6b (see Schedule 2) present the projected conceptual capital/construction cost estimates for Conceptual Landfill Expansion Alternatives No. 1, No. 2, No. 3 and No. 4, respectively. As discussed in Section 4.2.4, the cost estimates on the following key construction activities

- excavation of the proposed base elevation of the landfill expansion;
- installation of a leachate management system;
- installation of a surface water management system;
- application of a final cover system; and,
- installation of a landfill gas management system.

The unit costs used for Table 3b through 6b (see Schedule 2) are derived from AMEC experience with the construction of municipal landfills in Ontario. They are based on average unit costs for similar construction activities for municipal landfill expansions in Waterloo, Cambridge and Brighton, Ontario. The quantities used for each table are derived from the key expansion parameters for each alternative listed in Section 5.0 and presented on Figures 8 though 11 (see Schedule 1).

Each Conceptual Landfill Expansion Alternative is ranked with respect to the level of concern/potential impact based on the overall capital/construction cost estimates as follows:

- Alternative No. 1 – New Liskeard Landfill Capital/Construction Cost Estimate = $681,100 (rank = 1-low);

- Alternative No. 2 – New Liskeard Landfill Capital/Construction Cost Estimate = $$1,839,000 (rank = 2-low to medium);
- Alternative No. 3 – Haileybury Landfill Capital/Construction Cost Estimate = $8,122,000 (rank = 4-medium to high); and,
- Alternative No. 4 – Haileybury Landfill Capital/Construction Cost Estimate = $4,359,200 (rank = 3-medium).

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Capital/Construction Cost Estimate sub-criterion.

6.5.3 Cost Estimates for Regulatory Approvals

Tables 3c, 4c, 5c and 6c (see Schedule 2) present the projected conceptual cost estimates for obtaining regulatory approval of Conceptual Landfill Expansion Alternatives No. 1, No. 2, No. 3 and No. 4, respectively. As discussed in Section 4.2.4, the conceptual cost estimates provided included the engineering, consulting and administrative fees required to obtain approval of each alternative under the Environmental Assessment Act, the Environmental Protection Act and the Ontario Water Resources Act. The cost estimates also include conceptual projections of the tender/contract administration and construction inspection costs for each conceptual alternative.

For the purposes of this feasibility assessment, the projected approval cost estimates are derived as a percentage of the preliminary capital/construction estimates. The percentages are developed based on AMEC experience with preparing budgets to obtain approval of various landfills sites across Southern and Northern Ontario. The percentages are also adjusted based on the scope of the capital/construction activities. As such, the conceptual cost estimates for regulatory approvals for all of the Conceptual Landfill Expansion Alternatives are based on the following:

- Approval under the Environmental Assessment Act = 15% of Capital/Construction Costs;
- Approval under the Environmental Protection Act and Ontario Water Resources Act = 15% of Capital/Construction Costs; and,
- Tender/Contract Administration and Construction Inspection = 15% of Capital/Construction Costs.

Each Conceptual Landfill Expansion Alternative is ranked with respect to the level of concern/potential impact based on the overall cost estimate to obtain regulatory approval as follows:

- Alternative No. 1 – New Liskeard Landfill Cost Estimate for Regulatory Approval = $300,000 (rank = 1-low);
- Alternative No. 2 – New Liskeard Landfill Cost Estimate for Regulatory Approval = $1.500,000 (rank = 2-low to medium);
- Alternative No. 3 – Haileybury Landfill Cost Estimate for Regulatory Approval = $3,660,000 (rank = 4-medium to high); and

- Alternative No. 4 – Haileybury Landfill Cost Estimate for Regulatory Approval = $2,100,000 (rank = 3-medium).

Table 7 (see Schedule 2) presents a summary of the ranking and scores with respect to the Regulatory Approval Cost Estimate sub-criterion.

6.6 Evaluation & Ranking

Table 7 (see Schedule 2) presents the detailed ranking of each criteria to assess the overall feasibility of the Conceptual Landfill Expansion Alternatives. The ranking for each sub-criterion was tallied in order to calculate the score for each feasibility assessment criteria. The score for each criterion was then totaled in order to calculate the overall score for each Conceptual Landfill Expansion Alternative. A summary of the feasibility assessment scores are presented on Table 6.2 (embedded below):

Table 6.2
Summary of Feasibility Assessment Evaluation
Ranking Scores for the Conceptual Landfill Expansion Alternatives

Feasibility Assessment Criteria	New Liskeard Landfill		Haileybury Landfill	
	Expansion Alternative No. 1 (East Side)	Expansion Alternative No. 2 (West Side)	Expansion Alternative No. 3 (East Side with Large Footprint)	Expansion Alternative No. 4 (East Side with Smaller Footprint)
Public Health, Safety and Socioeconomic Factors	8	6	8	8
Natural Environment	2	4	13	13
Conceptual Technical Considerations	3	6	11	10
Conceptual Cost Estimates.	3	7	12	10
TOTAL	**16**	**23**	**44**	**41**

7.0 CONCLUSION

Based on the results of the discussion and ranking provided above in Section 6.0 and on Table 7 (see Schedule 2) the preferred landfill expansion alternative for the existing New Liskeard and Haileybury Landfills is Conceptual Landfill Expansion Alternative No. 1, the construction of landfill expansion cell at the New Liskeard Landfill to the east of the current waste boundary. Conceptual Landfill Expansion Alternative No. 1 includes the following features:

- Footprint Area = 2.61 ha;
- Base Elevation = 254.0 masl;
- Top Elevation = 280.0 masl;
- Landfill Capacity = 687,600 m^3;
- Leachate Management Strategy = Natural Attenuation
- Required Extension of established CAZ = 2 ha to the north;
- Surface Water Management Strategy = approximately 600 linear meter of perimeter ditching;
- Landfill Gas Management Strategy = not required and,
- Preliminary Total Cost Estimate (including Land Acquisition, Capital/Construction and Regulator Approvals = $983,100

The solid waste management strategy proposed herein includes the closure of the existing New Liskeard Landfill as well as the continued operation Haileybury Landfill through 2016 until the landfill has reached its proposed final contours and has achieved its approved Total Site Capacity of 452,221 m^3. Once the Haileybury Landfill is closed, the City can subsequently implement its long-term waste management strategy, which may include the expansion of the New Liskeard Landfill in accordance with Conceptual Landfill Expansion Alternative No. 1.

8.0 RECOMMENDATIONS

Upon acceptance and approval of the findings this report, it is recommended that the City of Temiskaming Shores undertake the following steps in order to continue and finalize the feasibility assessment process

1. Prepare a Landfill Feasibility Study (Conceptual Assessment) for establishing new landfills on "Greenfield" properties. The study should include a Site Constraint/Opportunity GIS Mapping of Greenfield properties located within and outside a 10 km radius of the City boundaries, followed by the preparation of a Conceptual Landfill Alternatives for the properties that successfully satisfy the Site Constraint/Opportunity GIS Mapping criteria.

2. Schedule a consultation meeting the between AMEC and City's Technical Advisory Committee (TAC) to review the both Landfill Feasibility Study (Conceptual Assessment) report for expanding existing landfills and establishing new Greenfield landfills. The purpose of the meeting should be the a) refinement of the waste generation projections and estimates of the remaining capacity at Haileybury Landfill; b) verifying historical information and technical assumptions; c) development of criteria for the technical assessment of the alternatives; d) refinement of the conceptual waste management designs; and e) discussion of a preferred long-term waste management (i.e., landfill disposal) strategy.

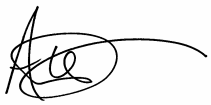
The overall projected work plan following the submission of the Feasibility Study (Conceptual Assessment) reports for the existing and new landfill site will be dependent on the outcome of the AMEC/TAC consultation meeting outlined in Item 2. Any changes to the overall work program will be re-assessed based on the City's requirements at that time, and outlined under separate cover in the *Landfill Feasibility Study (Conceptual Assessment) Development of a New Landfill Site* report.

9.0 CLOSURE

This report was prepared exclusively for the City of Temiskaming Shores for specific application to the existing New Liskeard and Haileybury Landfills. The conceptual feasibility assessment provided herein was completed in accordance with the verbal and written requests from the City of Temiskaming Shores and generally accepted engineering practices. No other warranty, express or implied, is made. The limitations of this report are presented in Appendix G.

Respectfully submitted,
AMEC Earth & Environmental,
A Division of AMEC Americas Limited

Prepared By:



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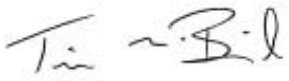
Landfill Engineer

Tomas Cihula, B.Sc., P.Geo.
Landfill Hydrogeologist

Reviewed By:



Tim McBride, B.Sc., P.Geo.
Project Manager/Senior Hydrogeologist

Wayne Cooley, B.Sc., P.Eng.
Senior Landfill Engineer

10.0 REFERENCES

Town of Haileybury Zoning By-law No. 85-27, November 1985.

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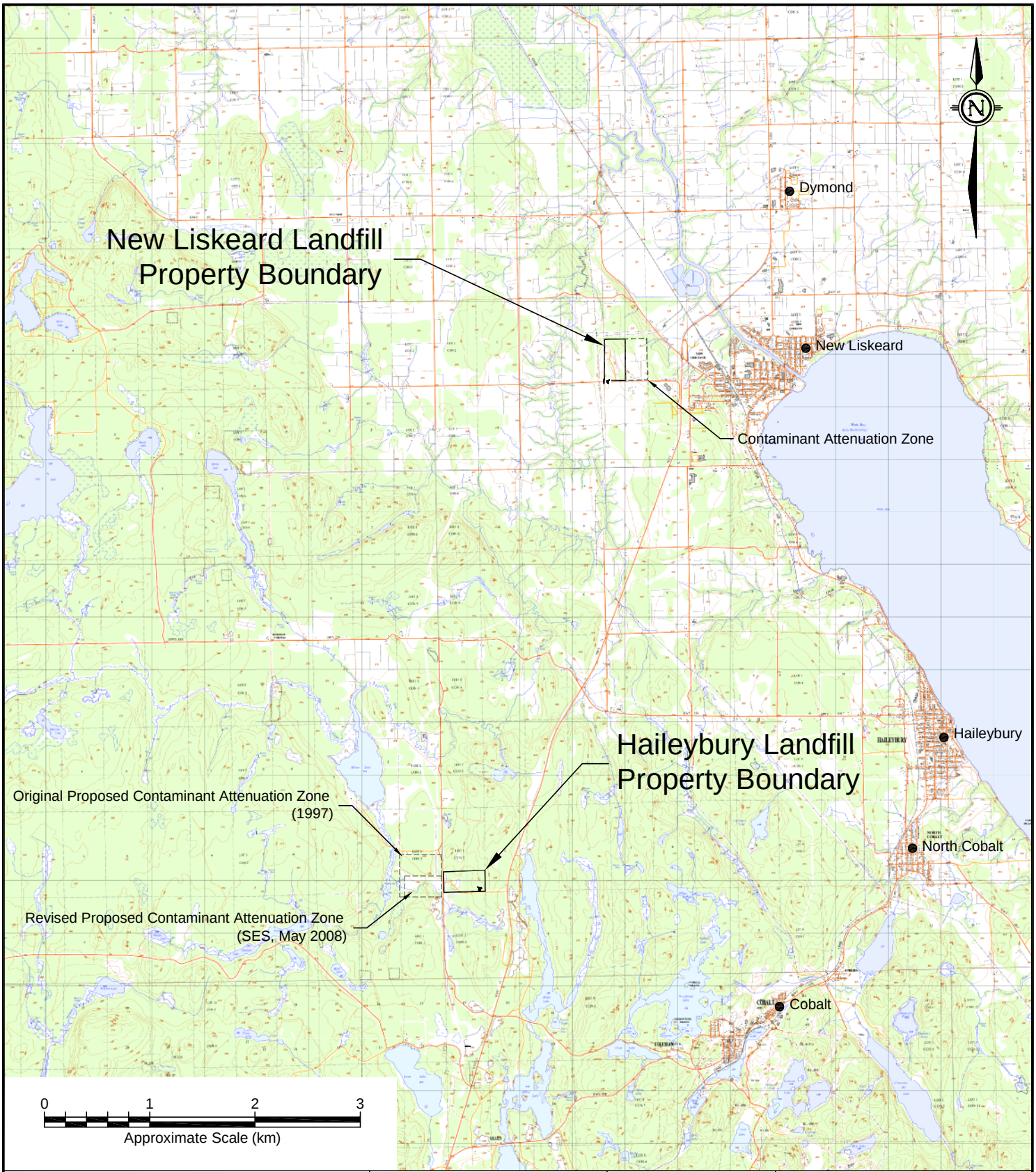
SCHEDULE 1

FIGURES



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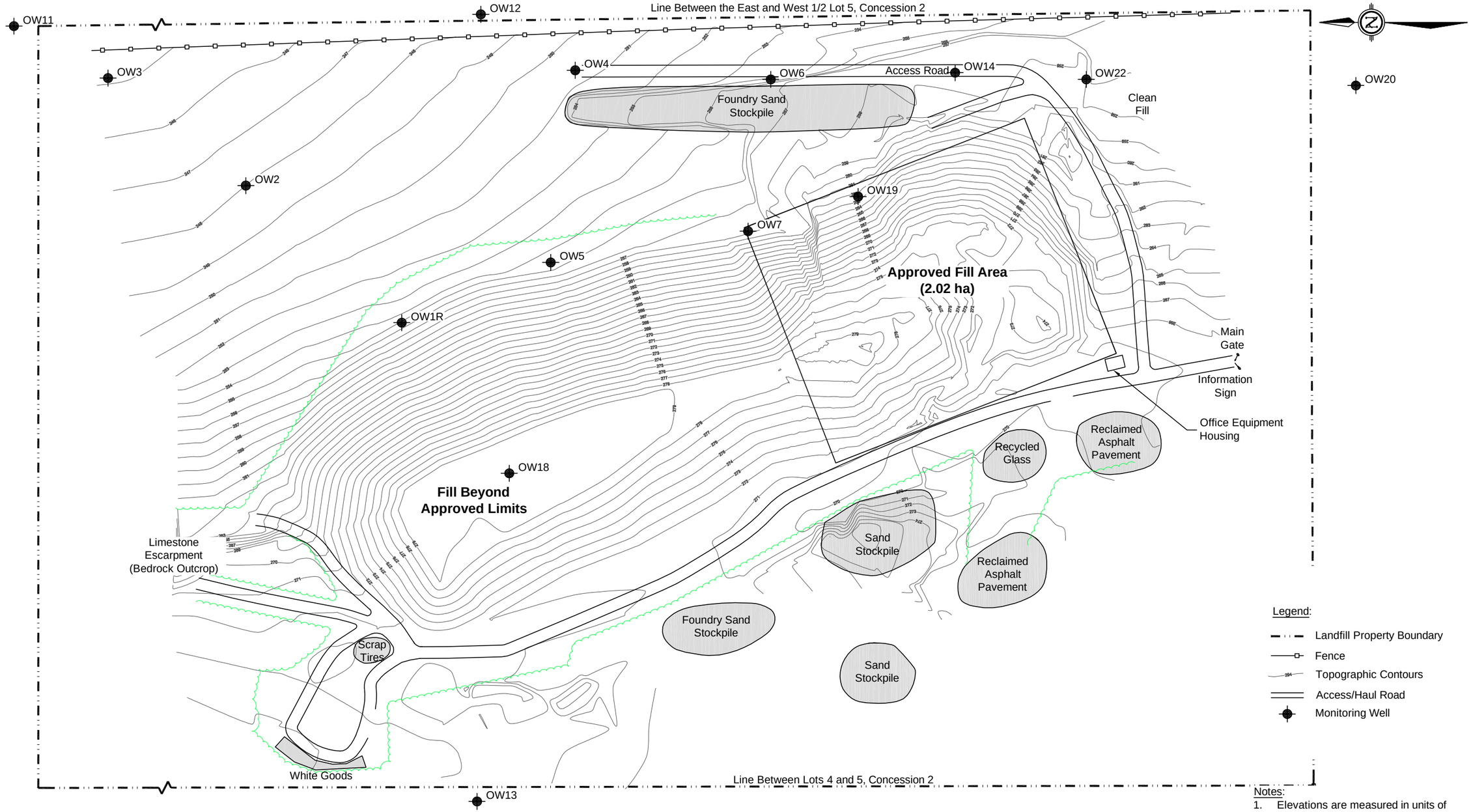
City of Temiskaming Shores

PROJECT: Landfill Feasibility Study (Conceptual Assessment) Expansion of Existing Landfill Sites	DWN BY: KKJ	CHK'D BY: A.K.W.	DATE: March 2010
			PROJECT NO: TY91049
TITLE: Site Location Map	REV. NO.: 1	SCALE: 1:100,000	FIGURE NO. 1



Notes:

1. Elevations are measured in units of metres above sea level (masl).

0 20 40 60 80 100

Approximate Scale (m)

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DWN BY:	KKJ
CHK'D BY:	A.K.W.
SCALE:	1:2000

PROJECT: Landfill Feasibility Study (Conceptual Assessment) Expansion of Existing Landfill Sites

TITLE: New Liskeard Landfill Site Plan (2007 Topographic Contours)

DATE	March 2010
PROJECT No.	TY91049
REV. No.	1
FIGURE No.	2

Legend:

- Landfill Property Boundary
- Approved Limit of Waste
- Perimeter Chain Link Fence
- Minimum Buffer Limit
- Contour Lines
- Access/Haul Road
- Monitoring Well

Notes:

1. Elevations are measured in units of meters above sea level.
2. Drawing based on Sutcliffe Rody Quesnel Inc. drawing.

0 20 40 60 80 100
Approximate Scale (m)

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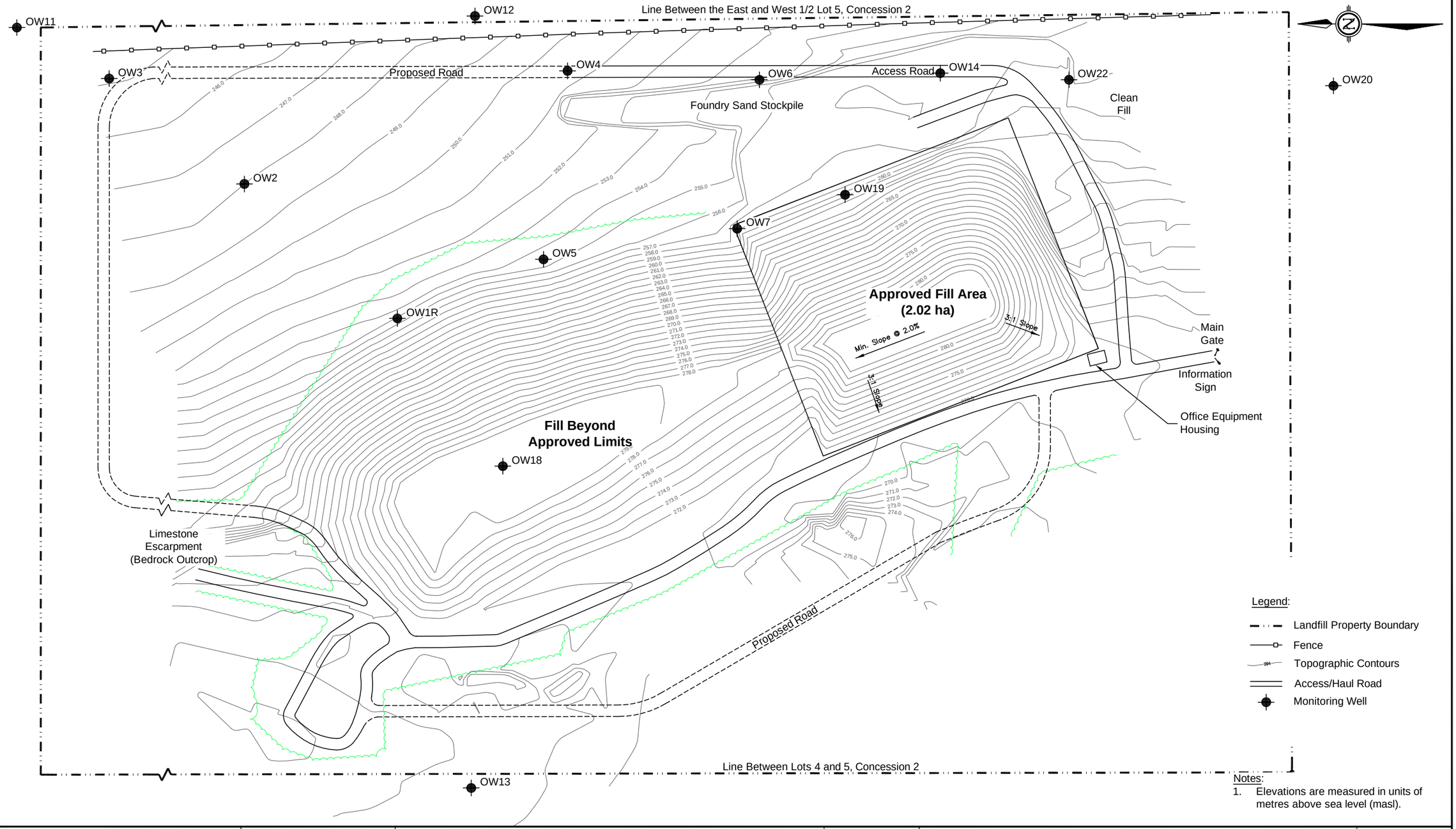
CHK'D BY: A.K.W.
SCALE: 1:2000

PROJECT: Landfill Feasibility Study (Conceptual Assessment) Expansion of Existing Landfill Sites

TITLE: Haileybury Landfill Site Plan (2008 Topographic Contours)

DATE: March 2010
PROJECT No.: TY91049
REV. No.: 1
FIGURE No.: 3



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SCALE:	1:2000
PROJECT	Landfill Feasibility Study (Conceptual Assessment) Expansion of Existing Landfill Sites
DATE	March 2010
PROJECT No.	TY91049
TITLE	New Liskeard Landfill Proposed Final Contours
REV. No.	1
FIGURE No.	4

Notes:
1. Elevations are measured in units of meters above sea level.
2. Drawing based on Sutcliffe Rody Quesnel Inc. drawing.

0 20 40 60 80 100
Approximate Scale (m)

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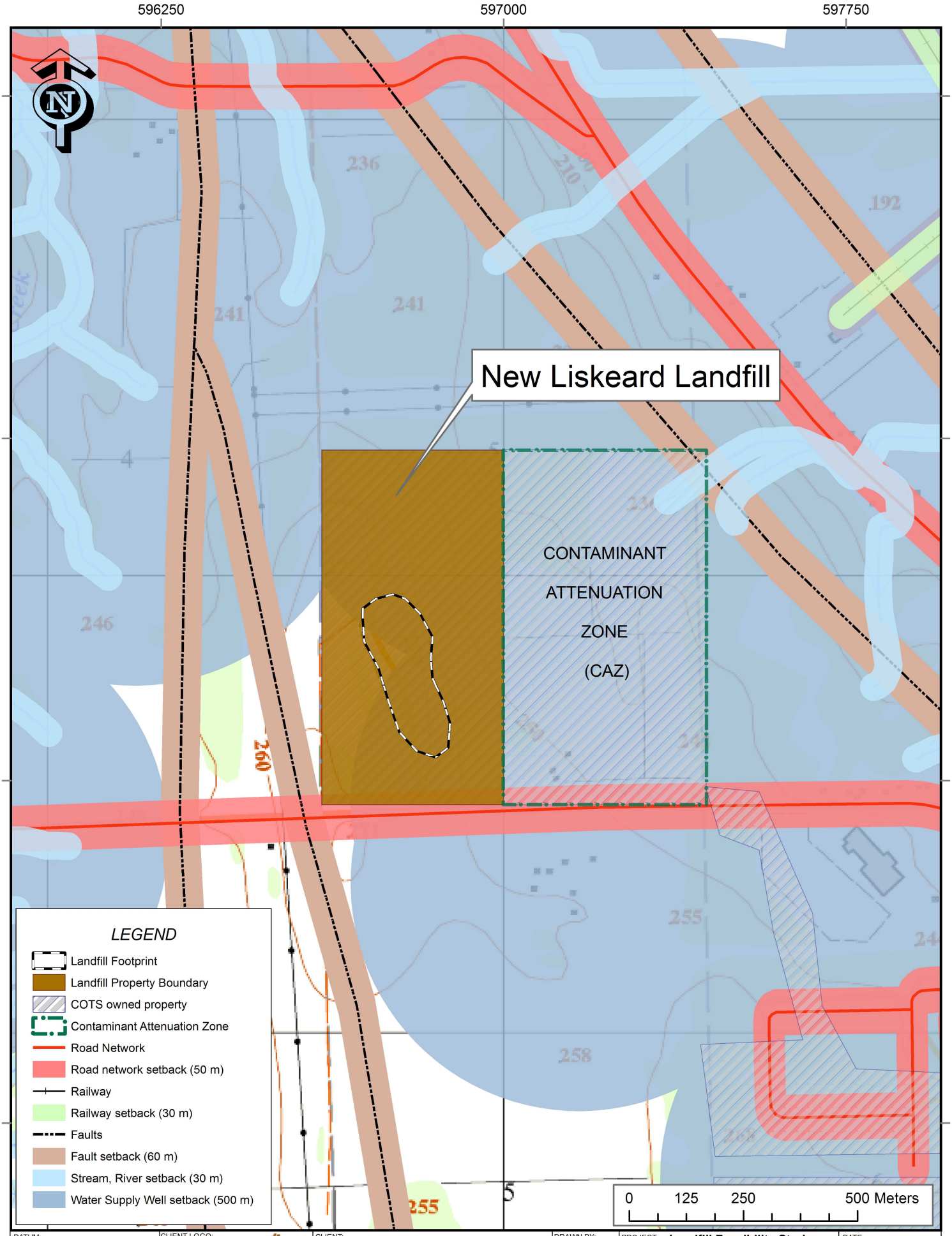
CHK'D BY: A.K.W.
SCALE: 1:2000

PROJECT: Landfill Feasibility Study (Conceptual Assessment) Expansion of Existing Landfill Sites

TITLE: Haileybury Landfill Proposed Final Contours

DATE: March 2010
PROJECT No.: TY91049
REV. No.: 1
FIGURE No.: 5



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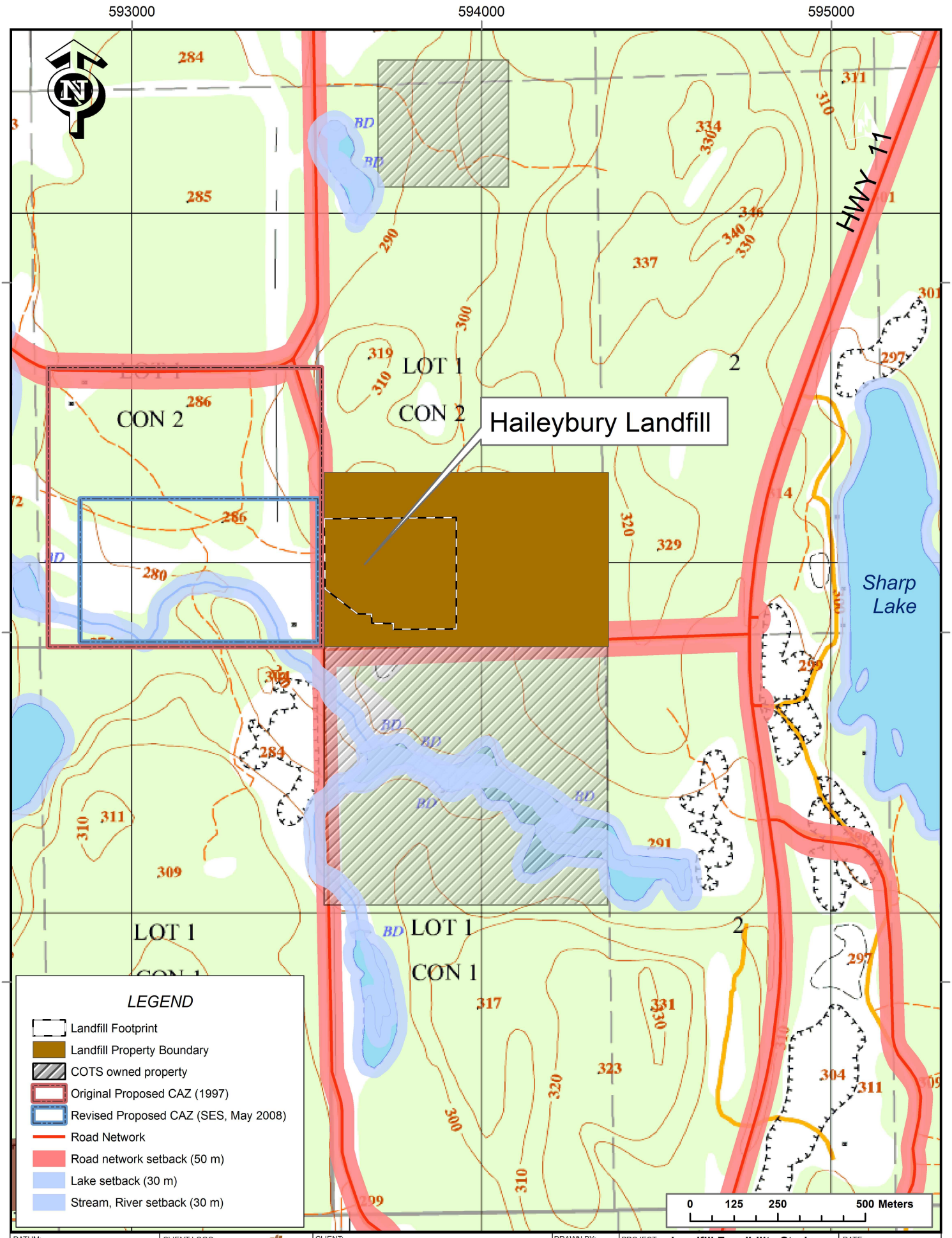

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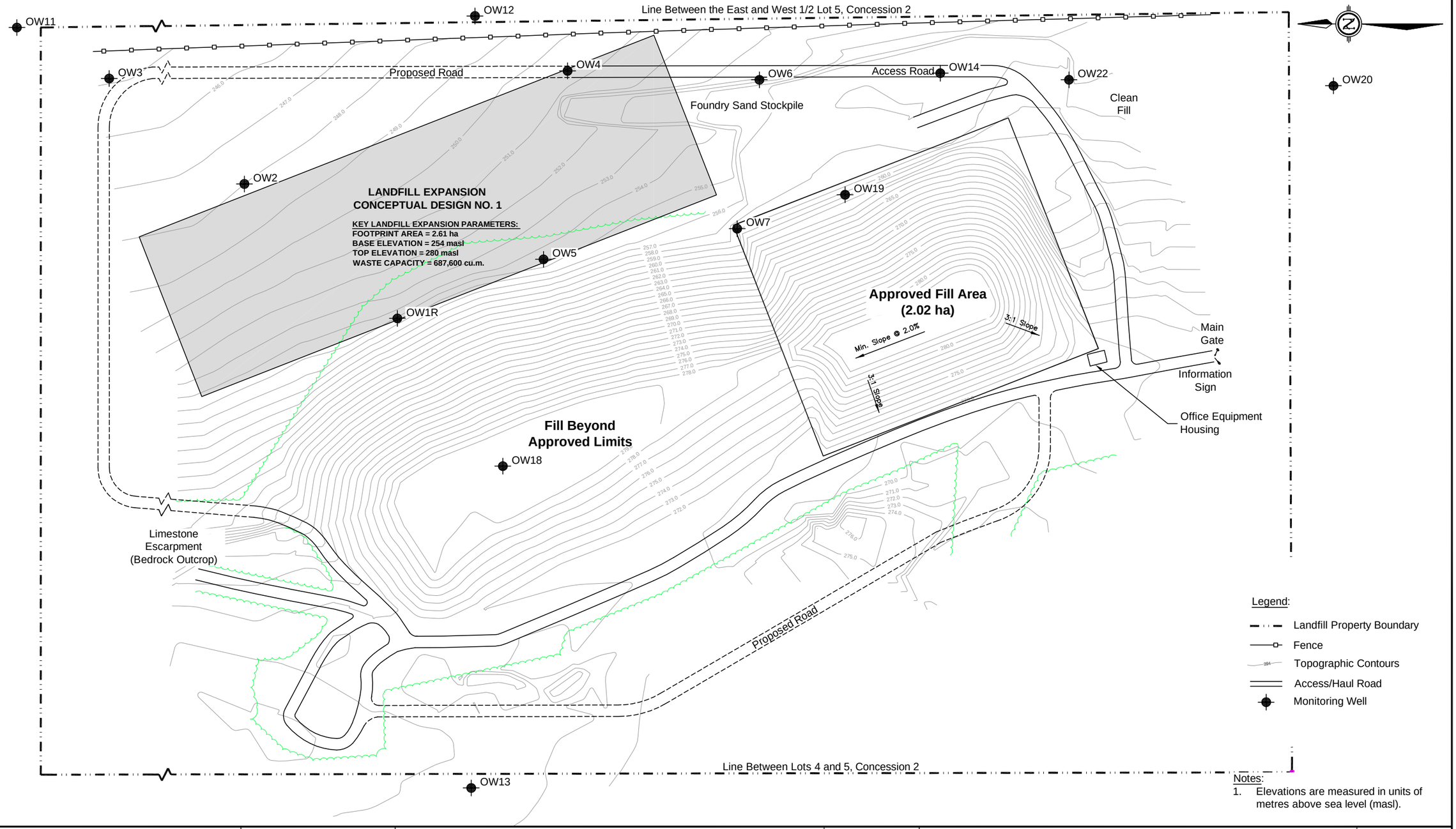

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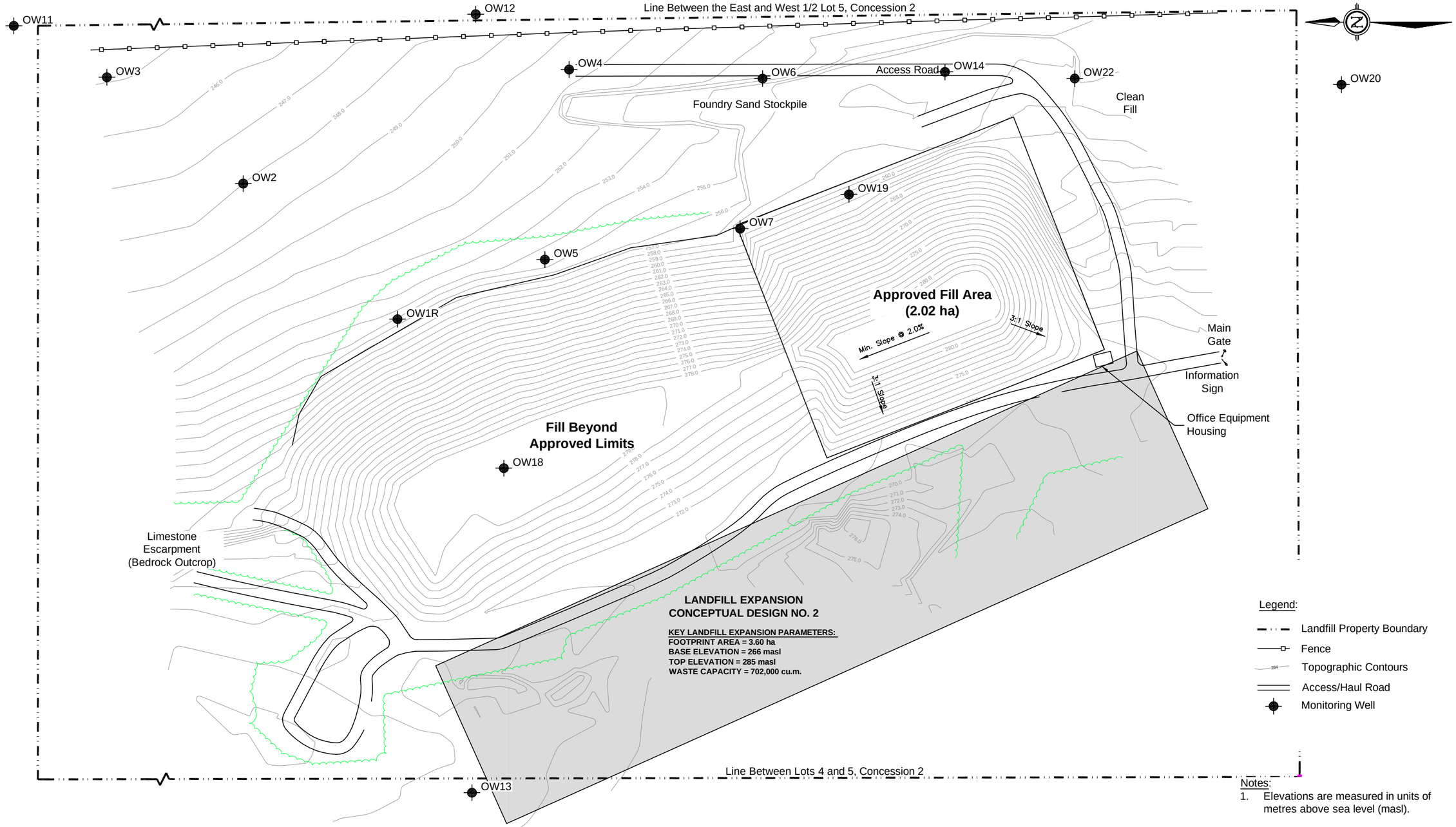
CHK'D BY:	A.K.W.
SCALE:	1:2000
PROJECT	Landfill Feasibility Study (Conceptual Assessment) Expansion of Existing Landfill Sites
TITLE	Conceptual Landfill Expansion Alternative No. 1 (New Liskeard Landfill)
DATE	March 2010
PROJECT No.	TY91049
REV. No.	1
FIGURE No.	8



0 20 40 60 80 100
Approximate Scale (m)

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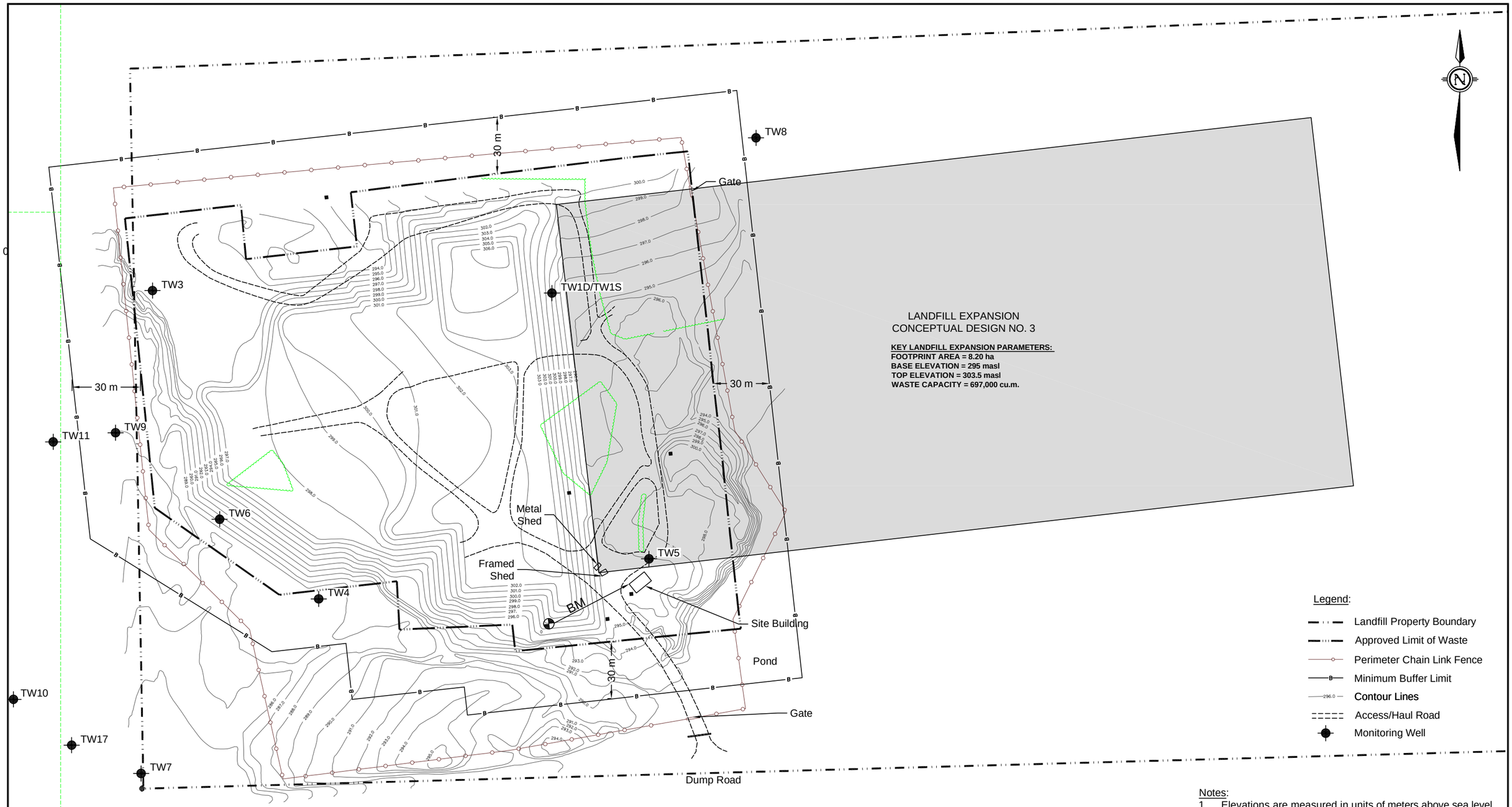
CHK'D BY: A.K.W.
SCALE: 1:2000

PROJECT
Landfill Feasibility Study (Conceptual Assessment)
Expansion of Existing Landfill Sites

TITLE
Conceptual Landfill Expansion Alternative No. 2
(New Liskeard Landfill)

DATE: March 2010
PROJECT No.: TY91049
REV. No.: 1
FIGURE No.: 9



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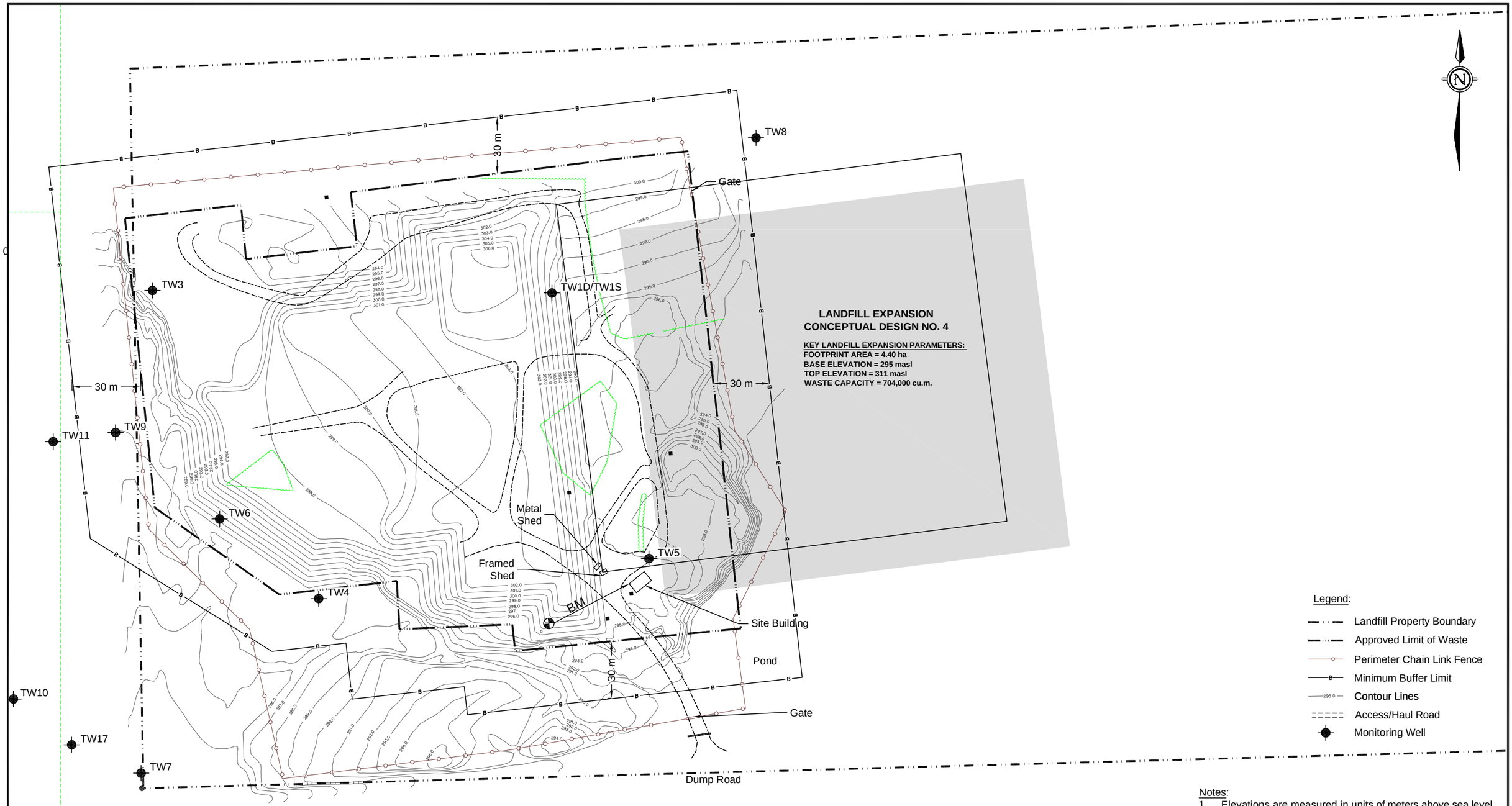
CHK'D BY: A.K.W.
SCALE: 1:2000

PROJECT
Landfill Feasibility Study (Conceptual Assessment)
Expansion of Existing Landfill Sites

TITLE
Conceptual Landfill Expansion Alternative No. 3
(New Haileybury Landfill)

DATE: March 2010
PROJECT No.: TY91049
REV. No.: 1
FIGURE No.: 10



Notes:
1. Elevations are measured in units of meters above sea level.
2. Drawing based on Sutcliffe Rody Quesnel Inc. drawing.

0 20 40 60 80 100
Approximate Scale (m)

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CHK'D BY: A.K.W.
SCALE: 1:2000

PROJECT: Landfill Feasibility Study (Conceptual Assessment)
Expansion of Existing Landfill Sites

TITLE: Conceptual Landfill Expansion Alternative No. 4
(Haileybury Landfill)

DATE: March 2010
PROJECT No.: TY91049
REV. No.: 1
FIGURE No.: 11

SCHEDULE 2

TABLES

TABLE 1

WASTE QUANTITIES DEPOSITED AT HAILEYBURY LANDFILL
FROM 1997 TO 2008[1]
LANDFILL FEASIBILITY STUDY (CONCEPTUAL ASSESSMENT)
EXPANSION OF EXISTING LANDFILL SITES

MONTH	Waste from Town of Haileybury (m^3)											
	1997	1998	1999	2000	2001	2002	2003[2]	2004	2005	2006	2007	2008
JANUARY	638	562	459	497	651	776	755					
FEBRUARY	387	415	445	590	537	782	633					
MARCH	473	493	555	641	657	459	613					
APRIL	834	736	658	594	763	1,753	1,187					
MAY	943	1,096	1,471	789	2,123	2,123	2,198					
JUNE	775	684	755	677	840	1,412	154	Beginning 2004, waste volumes combined with the City of Temiskaming Shores due to Amalgamation				
JULY	790	612	616	624	868	861	1,207					
AUGUST	1,326	551	787	971	761	1,507	825					
SEPTEMBER	959	856	680	624	1,111	843	1,000					
OCTOBER	1,068	642	613	989	1,520	1,283	869					
NOVEMBER	543	1,089	474	632	1,610	880	1,211					
DECEMBER	579	668	546	564	815	973	870					
TOTAL	9,315	8,404	8,059	8,192	12,256	13,652	11,522					

MONTH	Volume of Waste from Town of Dymond (m^3)											
	1997	1998	1999	2000	2001	2002	2003[2]	2004	2005	2006	2007	2008
JANUARY	488	389	467	417	507	477	483					
FEBRUARY	367	363	378	489	450	449	481					
MARCH	475	427	477	526	499	532	488					
APRIL	393	574	435	489	515	530	526					
MAY	766	802	447	521	717	806	1,084					
JUNE	626	469	621	573	493	565	80	Beginning 2004, waste volumes combined with the City of Temiskaming Shores due to Amalgamation				
JULY	600	569	539	661	630	495	598					
AUGUST	473	622	499	561	501	542	732					
SEPTEMBER	511	473	514	965	536	465	553					
OCTOBER	543	456	458	517	578	496	535					
NOVEMBER	504	467	496	515	505	520	1,014					
DECEMBER	422	458	548	504	563	1,091	530					
TOTAL	6,168	6,069	5,879	6,738	6,494	6,968	7,104					

MONTH	Town of Cobalt											
	1997	1998	1999	2000	2001	2002	2003[2]	2004	2005	2006	2007	2008
JANUARY	177	157	150	115	130	119	163	117	117	114	142	134
FEBRUARY	114	121	139	97	113	92	208	117	67	119	119	109
MARCH	113	139	133	121	112	167	125	158	158	15	110	107
APRIL	137	231	176	165	115	138	152	128	146	11	123	331
MAY	195	167	156	118	166	164	177	157	121	15	151	108
JUNE	151	172	154	140	108	143	109	122	117	8	125	112
JULY	168	187	233	138	165	161	157	135	118	602	132	103
AUGUST	166	185	187	118	841	287	151	156	147	164	153	116
SEPTEMBER	158	163	184	332	131	271	135	212	125	112	120	111
OCTOBER	168	192	184	99	104	161	150	258	119	129	162	179
NOVEMBER	118	137	110	97	144	118	119	158	127	131	108	115
DECEMBER	161	125	157	108	130	121	159	115	112	103	107	143
TOTAL	1,826	1,976	1,963	1,648	2,259	1,942	1,805	1,833	1,474	1,523	1,552	1,668

MONTH	Waste from Towns of Haileybury and Dymond (m^3)											
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
JANUARY								1,052	1,066	992	1,057	891
FEBRUARY								1,028	957	1,158	900	667
MARCH								1,187	1,237	942	976	891
APRIL								1,613	1,106	3,194	1,297	1,402
MAY								1,346	1,263	1,168	1,492	3,639
JUNE				Pre-Amalgamation				1,282	1,108	1,138	1,787	2,002
JULY								1,391	826	2,961	1,517	1,680
AUGUST								1,608	1,002	1,661	3,191	1,206
SEPTEMBER								1,718	888	1,315	1,230	1,476
OCTOBER								1,041	1,448	1,219	906	1,576
NOVEMBER								1,274	3,454	1,651	1,703	952
DECEMBER								1,580	1,347	1,156	609	904
TOTAL								16,120	15,702	18,555	16,665	17,286

TOTAL (m^3)	**17,309**	**16,449**	**15,901**	**16,578**	**21,009**	**22,562**	**20,431**	**17,953**	**17,176**	**20,078**	**18,217**	**18,954**

Notes:

All units are cubic meters

1. Waste volume estimates presented herein were provided by the City of Temiskaming Shores and were recorded by landfill operators prior to disposal and compaction activities.
2. The June 2003 monthly refuse volumes are artificially low since some of the refuse for June was entered for the month of May, hence the higher than normal May monthly refuse volumes.

TABLE 2

CITY OF TEMISKAMING SHORES
30-YEAR PROJECTED WASTE GENERATION
LANDFILL FEASIBILITY STUDY (CONCEPTUAL ASSESSMENT)
EXPANSION OF EXISTING LANDFILL SITES

Table 2a: Projected Waste Generation for the Towns of Haileybury, Dymond and Cobalt

Planning Year	Population Growth Estimate[1]	Per Capita Waste Generation Estimate (m^3/capita)	Estimated Volume of Uncompacted Waste Generated (A) (m^3)
2008[2]	7,214	2.6	18,954
2009	7,294	2.6	18,964
2010	7,374	2.6	19,172
2011	7,454	2.6	19,380
2012	7,534	2.6	19,588
2013	7,613	2.6	19,794
2014	7,693	2.6	20,002
2015	7,773	2.6	20,210
2016	7,853	2.6	20,418
2017	7,933	2.6	20,626
2018	8,013	2.6	20,834
2019	8,092	2.6	21,039
2020	8,172	2.6	21,247
2021	8,252	2.6	21,455
2022	8,332	2.6	21,663
2023	8,412	2.6	21,871
2024	8,492	2.6	22,079
2025	8,571	2.6	22,285
2026	8,651	2.6	22,493
2027	8,731	2.6	22,701
2028	8,811	2.6	22,909
2029	8,891	2.6	23,117
2030	8,971	2.6	23,325
2031	9,051	2.6	23,533
2032	9,130	2.6	23,738
2033	9,210	2.6	23,946
2034	9,290	2.6	24,154
2035	9,370	2.6	24,362
2036	9,450	2.6	24,570
2037	9,530	2.6	24,778
2038	9,609	2.6	24,983
2039	9,689	2.6	25,191

Table 2b: Projected Waste Generation for the Town of New Liskeard

Planning Year	Population Growth Estimate[1]	Per Capita Waste Generation Estimate (m^3/capita)	Estimated Volume of Uncompacted Waste Generated (B) (m^3)
2008[2]	5,017	3.9	19,456
2009	5,073	3.9	19,785
2010	5,128	3.9	19,999
2011	5,183	3.9	20,214
2012	5,239	3.9	20,432
2013	5,294	3.9	20,647
2014	5,350	3.9	20,865
2015	5,405	3.9	21,080
2016	5,460	3.9	21,294
2017	5,516	3.9	21,512
2018	5,571	3.9	21,727
2019	5,626	3.9	21,941
2020	5,682	3.9	22,160
2021	5,737	3.9	22,374
2022	5,793	3.9	22,593
2023	5,848	3.9	22,807
2024	5,903	3.9	23,022
2025	5,959	3.9	23,240
2026	6,014	3.9	23,455
2027	6,069	3.9	23,669
2028	6,125	3.9	23,888
2029	6,180	3.9	24,102
2030	6,236	3.9	24,320
2031	6,291	3.9	24,535
2032	6,346	3.9	24,749
2033	6,402	3.9	24,968
2034	6,457	3.9	25,182
2035	6,512	3.9	25,397
2036	6,568	3.9	25,615
2037	6,623	3.9	25,830
2038	6,679	3.9	26,048
2039	6,734	3.9	26,263

Table 2c: Total Projected Waste Generation for the City of Temiskaming Shores

Planning Year	Total Volume of Uncompacted Waste (A+B) (m^3)	Calculated Tonnage of Uncompacted Waste[3] (tonne)	Calculated Volume of Compacted Waste[4] (m^3)	Cumulative Volume of Compacted Waste (m^3)
2009	38,749	5,812	19,373	19,373
2010	39,171	5,876	19,587	38,960
2011	39,594	5,939	19,797	58,757
2012	40,020	6,003	20,010	78,767
2013	40,441	6,066	20,220	98,987
2014	40,867	6,130	20,433	119,420
2015	41,290	6,194	20,647	140,067
2016	41,712	6,257	20,857	160,924
2017	42,138	6,321	21,070	181,994
2018	42,561	6,384	21,280	203,274
2019	42,980	6,447	21,490	224,764
2020	43,407	6,511	21,703	246,467
2021	43,829	6,574	21,913	268,380
2022	44,256	6,638	22,127	290,507
2023	44,678	6,702	22,340	312,847
2024	45,101	6,765	22,550	335,397
2025	45,525	6,829	22,763	358,160
2026	45,948	6,892	22,973	381,133
2027	46,370	6,956	23,187	404,320
2028	46,797	7,020	23,400	427,720
2029	47,219	7,083	23,610	451,330
2030	47,645	7,147	23,823	475,153
2031	48,068	7,210	24,033	499,186
2032	48,487	7,273	24,243	523,429
2033	48,914	7,337	24,457	547,886
2034	49,336	7,400	24,667	572,553
2035	49,759	7,464	24,880	597,433
2036	50,185	7,528	25,093	622,526
2037	50,608	7,591	25,303	647,829
2038	51,031	7,655	25,517	673,346
2039	51,454	7,718	25,727	699,073

Notes:

1. Population estimated based on linear extrapolations of population growth calculated from 1991, 1996, 2001 and 2006 census data, as provided by Statistics Canada for the City of Temiskaming Shores and the Town of Cobalt
2. Uncompacted (i.e., pre-landfilled) waste quantity estimates for 2008 provided by the City of Temiskaming Shores
3. Tonnage based a typical density value of 150 kg/m^3 for uncompacted residential solid waste (McBean et. al., 1995).
4. Volume based on an the conservative assumption that landfilled and compacted residential solid waste has an in-place density of 300 kg/m^3.

TABLE 3

PRELIMINARY COST ESTIMATE
NEW LISKEARD LANDFILL
CONCEPTUAL LANDFILL EXPANSION ALTERNATIVE NO. 1 - NEW LISKEARD LANDFILL
FEASIBILITY STUDY (CONCEPTUAL ASSESSMENT)
EXPANSION OF EXISTING LANDFILL SITES

Table 3a: Conceptual Land Acquisition Cost Estimate

Item	Activity	Unit	Unit Cost[(1)]	Quantity	Estimated Cost[1] (2009 $CAD)
1	Purchase land for an Extension of the Current Contaminant Attenuation Zone	ha	$ 1,000.00	2	$ 2,000
				Total Land Acquisition Cost Estimate	***$ 2,000***

Note:
1. Based on typical price per hectare for land in Northern Ontario.

Table 3b: Conceptual Capital Cost Estimate

Item	Activity	Unit	Unit Cost[(1)]	Quantity	Estimated Cost (2009 $CAD)
2	Earthworks/excavation	cu.m	$ 5	0	$ -
	Sub-total				***$ -***
3	Surface Water Management System				
3.1	Perimeter Diversion Ditches (excavation)	cu.m.	$ 5	500	$ 2,500
	Sub-total				***$ 2,500***
4	Final Cover Application				
4.1	Compacted Clay Layer (750 mm thick)	sq.m.	$ 15	26,100	$ 391,500
4.2	Topsoil Layer (150 mm thick)	sq.m.	$ 9	26,100	$ 234,900
4.3	Hydroseed	sq.m.	$ 2	26,100	$ 52,200
	Sub-total				***$ 678,600***
				Total Capital Cost Estimate	***$ 681,100***

Note:
Unit cost estimates based on AMEC's database of average unit costs for similar construction activities.

Table 3c: Conceptual Cost Estimate for Regulatory Approvals

Item	Activity	Cost Determination	Estimated Cost (2009 $CAD)
5	Approval under the Environmental Assessment Act		
5.1	Develop Terms of Reference	Equivalent to 15% of the Capital Cost Estimate	$ 100,000
5.2	Public/Stakeholder Consultation		
5.3	Environmental Assessment and Reporting		
	Sub-total		***$ 100,000***
6	Approval under the Environmental Protection Act and Ontario Water Resources Act		
6.1	Prepare/submit Hydrogeological Assessment		
6.2	Prepare/submit Final Landfill Expansion Design and Operations Plan		
6.3	Prepare/submit Application for Provisional Certificate of Approval of Waste Disposal Site	Equivalent to 15% of the Capital Cost Estimate	$ 100,000
6.4	Prepare/submit Stormwater Design and Operations Documents		
6.5	Prepare/submit Application for Provisional Certificate of Approval of Industrial Sewage Works		
6.6	Prepare/submit Financial Assurance Plan		
	Sub-total		***$ 100,000***
7	Tender/Contract Administration and Construction Inspection		
7.1	Develop Construction Specifications and Construction Drawings		
7.2	Tender Administration	Equivalent to 15% of the Capital Cost Estimate	$ 100,000
7.3	Construction Inspection & Contract Administration		
7.4	Construction Reporting		
	Sub-total		***$ 100,000***
		Total Regulatory Approval Cost Estimate	***$ 300,000***

Note:
Conceptual Alternative No. 1 involves the extension of the New Liskeard Landfill to the east of the existing landfill footprint (Footprint Area = 2.61 ha; Base Elevation = 254 masl; Top elevation = 280 masl; and Landfill Expansion Capacity = 687,600 m^3). See Figure 8.

TABLE 4

PRELIMINARY COST ESTIMATE
NEW LISKEARD LANDFILL
CONCEPTUAL LANDFILL EXPANSION ALTERNATIVE NO. 2 - NEW LISKEARD LANDFILL
FEASIBILITY STUDY (CONCEPTUAL ASSESSMENT)
EXPANSION OF EXISTING LANDFILL SITES

Table 4a: Conceptual Land Acquisition Cost Estimate

Item	Activity	Unit	Unit Cost(1)	Quantity	Estimated Cost[1] (2009 $CAD)
1	Purchase land for Establishing a new Contaminant Attenuation Zone	ha	$ 1,000.00	30	$ 30,000
				Total Land Acquisition Cost Estimate	***$ 30,000***

Note:
1. Based on typical price per hectare for land in Northern Ontario.

Table 4b: Conceptual Capital Cost Estimate

Item	Activity	Unit	Unit Cost(1)	Quantity	Estimated Cost (2009 $CAD)
2	Earthworks/excavation	cu.m	$ 5	180,000	$ 900,000
	Sub-total				***$ 900,000***
3	Surface Water Management System				
3.1	Perimeter Diversion Ditches (excavation)	cu.m.	$ 5	600	$ 3,000
	Sub-total				***$ 3,000***
4	Final Cover Application				
4.1	Compacted Clay Layer (750 mm thick)	sq.m.	$ 15	36,000	$ 540,000
4.2	Topsoil Layer (150 mm thick)	sq.m.	$ 9	36,000	$ 324,000
4.3	Hydroseed	sq.m.	$ 2	36,000	$ 72,000
	Sub-total				***$ 936,000***
				Total Capital Cost Estimate	***$ 1,839,000***

Note:
Unit cost estimates based on AMEC's database of average unit costs for similar construction activities.

Table 4c: Conceptual Cost Estimate for Regulatory Approvals

Item	Activity	Cost Determination	Estimated Cost (2009 $CAD)
5	Approval under the Environmental Assessment Act		
5.1	Develop Terms of Reference		
5.2	Public/Stakeholder Consultation	Equivalent to 15% of the Capital Cost Estimate	$ 280,000
5.3	Environmental Assessment and Reporting		
	Sub-total		***$ 280,000***
6	Approval under the Environmental Protection Act and Ontario Water Resources Act		
6.1	Prepare/submit Hydrogeological Assessment		
6.2	Prepare/submit Final Landfill Expansion Design and Operations Plan		
6.3	Prepare/submit Application for Provisional Certificate of Approval of Waste Disposal Site	Equivalent to 15% of the Capital Cost Estimate	$ 280,000
6.4	Prepare/submit Stormwater Design and Operations Documents		
6.5	Prepare/submit Application for Provisional Certificate of Approval of Industrial Sewage Works		
6.6	Prepare/submit Financial Assurance Plan		
	Sub-total		***$ 280,000***
7	Tender/Contract Administration and Construction Inspection		
7.1	Develop Construction Specifications and Construction Drawings		
7.2	Tender Administration	Equivalent to 15% of the Capital Cost Estimate	$ 940,000
7.3	Construction Inspection & Contract Administration		
7.4	Construction Reporting		
	Sub-total		***$ 940,000***
		Total Regulatory Approval Cost Estimate	***$ 1,500,000***

Note:
Conceptual Alternative No. 2 involves the extension of the New Liskeard Landfill to the west of the existing landfill footprint (Footprint Area = 3.60 ha; Base Elevation = 266 masl; Top elevation = 285.5 masl; and Landfill Expansion Capacity = 702,000 m^3). See Figure 9.

TABLE 5

PRELIMINARY COST ESTIMATE
HAILEYBURY LANDFILL
CONCEPTUAL LANDFILL EXPANSION ALTERNATIVE NO. 3 - HAILEYBURY LANDFILL
FEASIBILITY STUDY (CONCEPTUAL ASSESSMENT)
EXPANSION OF EXISTING LANDFILL SITES

Table 5a: Conceptual Land Acquisition Cost Estimate

Item	Activity	Cost Determination	Estimated Cost[1] (2009 $CAD)
1	Obtain Water Rights for SES Revised Contaminant Attenuation Zone (SES, May 2008)	Currently under negotiation	TBD
		Total Land Acquisition Cost Estimate	***TBD***

Note:
1. Estimated Cost represents the most recent quoted price from current property owner to purchase the property delineated by the limits of the Original Proposed Contaminant

Table 5b: Conceptual Capital Cost Estimate

Item	Activity	Unit	Unit Cost[(1)]	Quantity	Estimated Cost (2009 $CAD)
2	Earthworks/excavation	cu.m	$ 5	410,000	$ 2,050,000
	Sub-total				***$ 2,050,000***
3	Base Liner Installation				
3.1	Clay Liner (GCL)	sq.m.	$ 9	82,000	$ 738,000
3.2	HDPE Liner	sq.m.	$ 8	82,000	$ 656,000
3.3	Geotextile	sq.m.	$ 3	82,000	$ 246,000
3.4	Clear Stone Layer	cu.m.	$ 80	25,000	$ 2,000,000
	Sub-total				***$ 3,640,000***
4	Leachate Collection System				
4.1	Piping	lin.m.	$ 90	2,000	$ 180,000
4.2	Manholes	ea.	$ 10,000	8	$ 80,000
4.3	Pump Station	ea.	$ 35,000	1	$ 35,000
	Sub-total				***$ 295,000***
5	Surface Water Management System				
5.1	Perimeter Diversion Ditches (excavation)	cu.m.	$ 5	1000	$ 5,000
	Sub-total				***$ 5,000***
6	Final Cover Application				
6.1	Compacted Clay Layer (750 mm thick)	sq.m.	$ 15	82,000	$ 1,230,000
6.2	Topsoil Layer (150 mm thick)	sq.m.	$ 9	82,000	$ 738,000
6.3	Hydroseed	sq.m.	$ 2	82,000	$ 164,000
	Sub-total				***$ 2,132,000***
7	Landfill Gas Management System				
7.1	Not required; total capacity below 1.5 million cubic meters	lump sum	$ -	0	$ -
	Sub-total				***$ -***
				Total Capital Cost Estimate	***$ 8,122,000***

Note:
1. Unit cost estimates based on AMEC's database of average unit costs for similar construction activities.

Table 5c: Conceptual Cost Estimate for Regulatory Approvals

Item	Activity	Cost Determination	Estimated Cost (2009 $CAD)
8	Approval under the Environmental Assessment Act		
8.1	Develop Terms of Reference		
8.2	Public/Stakeholder Consultation	Equivalent to 15% of the Capital Cost Estimate	$ 1,220,000
8.3	Environmental Assessment and Reporting		
	Sub-total		***$ 1,220,000***
9	Approval under the Environmental Protection Act and Ontario Water Resources Act		
9.1	Prepare/submit Hydrogeological Assessment		
9.2	Prepare/submit Final Landfill Expansion Design and Operations Plan		
9.3	Prepare/submit Application for Provisional Certificate of Approval of Waste Disposal Site	Equivalent to 15% of the Capital Cost Estimate	$ 1,220,000
9.4	Prepare/submit Leachate/Stormwater Design and Operations Documents		
9.5	Prepare/submit Application for Provisional Certificate of Approval of Industrial Sewage Works		
9.6	Prepare/submit Financial Assurance Plan		
	Sub-total		***$ 1,220,000***
10	Tender/Contract Administration and Construction Inspection		
10.1	Develop Construction Specifications and Construction Drawings		
10.2	Tender Administration	Equivalent to 15% of the Capital Cost Estimate	$ 1,220,000
10.3	Construction Inspection & Contract Administration		
10.4	Construction Reporting		
	Sub-total		***$ 1,220,000***
		Total Regulatory Approval Cost Estimate	***$ 3,660,000***

Note:
Conceptual Alternative No. 3 involves the extension of the Haileybury Landfill to the east of the existing landfill footprint (Footprint Area = 8.20 ha; Base Elevation = 295 masl; Top elevation = 303.5 masl; and Landfill Expansion Capacity = 697,000 m^3). See Figure 10.

TABLE 5

PRELIMINARY COST ESTIMATE
HAILEYBURY LANDFILL
CONCEPTUAL LANDFILL EXPANSION ALTERNATIVE NO. 4 - HAILEYBURY LANDFILL
FEASIBILITY STUDY (CONCEPTUAL ASSESSMENT)
EXPANSION OF EXISTING LANDFILL SITES

Table 6a: Conceptual Land Acquisition Cost Estimate

Item	Activity	Cost Determination	Estimated Cost[1] (2009 $CAD)
1	Obtain Water Rights for SES Revised Contaminant Attenuation Zone (SES, May 2008)	Currently under negotiation	TBD
		Total Land Acquisition Cost Estimate	***TBD***

Note:
1. Estimated Cost represents the most recent quoted price from current property owner to purchase the property delineated by the limits of the Original Proposed Contaminant Attenuation Zone

Table 6b: Conceptual Capital Cost Estimate

Item	Activity	Unit	Unit Cost[(1)]	Quantity	Estimated Cost (2009 $CAD)
2	Earthworks/excavation	cu.m	$ 5	220,000	$ 1,100,000
	Sub-total				***$ 1,100,000***
3	Base Liner Installation				
3.1	Clay Liner (GCL)	sq.m.	$ 9	44,000	$ 396,000
3.2	HDPE Liner	sq.m.	$ 8	44,000	$ 352,000
3.3	Geotextile	sq.m.	$ 3	44,000	$ 132,000
3.4	Clear Stone Layer	cu.m.	$ 80	13,000	$ 1,040,000
	Sub-total				***$ 1,920,000***
4	Leachate Collection System				
4.1	Piping	lin.m.	$ 90	1,300	$ 117,000
4.2	Manholes	ea.	$ 10,000	4	$ 40,000
4.3	Pump Station	ea.	$ 35,000	1	$ 35,000
	Sub-total				***$ 192,000***
5	Surface Water Management System				
5.1	Perimeter Diversion Ditches (excavation)	cu.m.	$ 5	640	$ 3,200
	Sub-total				***$ 3,200***
6	Final Cover Application				
6.1	Compacted Clay Layer (750 mm thick)	sq.m.	$ 15	44,000	$ 660,000
6.2	Topsoil Layer (150 mm thick)	sq.m.	$ 9	44,000	$ 396,000
6.3	Hydroseed	sq.m.	$ 2	44,000	$ 88,000
	Sub-total				***$ 1,144,000***
7	Landfill Gas Management System				
7.1	Not required; total capacity below 1.5 million cubic meters	lump sum	$ -	0	$ -
	Sub-total				***$ -***
			Total Capital Cost Estimate		***$ 4,359,200***

Note:
1. Unit cost estimates based on AMEC's database of average unit costs for similar construction activities.

Table 6c: Conceptual Cost Estimate for Regulatory Approvals

Item	Activity	Cost Determination	Estimated Cost (2009 $CAD)
8	Approval under the Environmental Assessment Act		
8.1	Develop Terms of Reference	Equivalent to 15% of the Capital Cost Estimate	$ 700,000
8.2	Public/Stakeholder Consultation		
8.3	Environmental Assessment and Reporting		
	Sub-total		***$ 700,000***
9	Approval under the Environmental Protection Act and Ontario Water Resources Act		
9.1	Prepare/submit Hydrogeological Assessment		
9.2	Prepare/submit Final Landfill Expansion Design and Operations Plan		
9.3	Prepare/submit Application for Provisional Certificate of Approval of Waste Disposal Site	Equivalent to 15% of the Capital Cost Estimate	$ 700,000
9.4	Prepare/submit Leachate/Stormwater Design and Operations Documents		
9.5	Prepare/submit Application for Provisional Certificate of Approval of Industrial Sewage Works		
9.6	Prepare/submit Financial Assurance Plan		
	Sub-total		***$ 700,000***
10	Tender/Contract Administration and Construction Inspection		
10.1	Develop Construction Specifications and Construction Drawings		
10.2	Tender Administration	Equivalent to 15% of the Capital Cost Estimate	$ 700,000
10.3	Construction Inspection & Contract Administration		
10.4	Construction Reporting		
	Sub-total		***$ 700,000***
		Total Regulatory Approval Cost Estimate	***$ 2,100,000***

Note:
Conceptual Alternative No. 4 involves the extension of the Haileybury Landfill to the east of the existing landfill footprint (Footprint Area = 4.40 ha; Base Elevation = 295 masl; Top elevation = 311 masl; and Landfill Expansion Capacity = 704,000 m^3). See Figure 11.

TABLE 7

FEASIBILITY ASSESSMENT EVALUATION
OF CONCEPTUAL LANDFILL EXPANSION ALTERNATIVES
LANDFILL FEASIBILITY STUDY (CONCEPTUAL ASSESSMENT)
EXPANSION OF EXISTING LANDFILL SITES

		New Liskeard Landfill		Haileybury Landfill	
Criteria	**Indicator**	**Alternative No. 1**	**Alternative No. 2**	**Alternative No. 3**	**Alternative No. 4**
Public Health, Safety and Socioeconomic Factors					
Residential Areas	Distance to nearest residence	3	2	1	1
Sensitive Land Uses	Number of residences within 400 m and 1000 m of landfill	3	2	5	5
	Distance to nearest agricultural lands				
	Distance to nearest Environmental Protection (EP) Zone				
	Distance to nearest designated Hazard Lands and Sensitive Areas				
Drinking Water Supply	Distance to nearest designated drinking water supply area	2	2	0	0
	Distance to nearest drinking water supply well				
Road Transport	Distance to waste centroid/waste generation source	0	0	2	2
	Distance to nearest existing road				
	Sub-Total	***8***	***6***	***8***	***8***
Natural Environment					
Terrestrial Habitat	Distance to nearest wetland, swamp, bog, marsh or fen	0	0	5	5
	Distance to nearest potentially significant terrestrial habitat (e.g., old growth forest)				
Aquatic Habitat	Distance to nearest water course, creek, ponds or lake	0	0	4	4
Species at Risk	Distance to nearest known or potential Species At Risk or its critical habitat	0	0	0	0
Hydrogeological Conditions	Presence of on-site groundwater recharge area	2	4	4	4
	Existing and degree of groundwater contamination				
	Degree of natural containment at site				
	Number of aquifers				
	Distance to aquifer				
	Sub-Total	***2***	***4***	***13***	***13***
Technical Considerations					
Site Size	Size of conceptual landfill expansion	1	2	4	3
Leachate Management	Size of proposed contaminant attenuation zone	1	3	5	5
	Complexity of alternative leachate management system				
Surface Water Management	Size and complexity of surface water management features	1	1	2	2
Landfill Gas Management	Requirement for landfill gas collection and management	0	0	0	0
	Sub-Total	***3***	***6***	***11***	***10***
Conceptual Cost Estimate					
Land Acquisition	Cost of acquiring new lands adjacent to the existing landfill property	1	3	4	4
Capital/Construction Cost	Cost estimate to construct the landfill expansion	1	2	4	3
Cost for Regulatory Approval	Cost to obtain regulatory approvals for landfill expansion	1	2	4	3
	Sub-Total	***3***	***7***	***12***	***10***
	Total	***16***	***23***	***44***	***41***

Notes:

Ranking scores for each Feasibility Assessment Sub-Criteria is based on the following Level of Concern/Potential Impact Rating: 0-none, 1-low, 2-low to medium, 3-medium, 4-medium to high, 5-high.
See Section 6.0 for the full rationale behind each score.

Conceptual Alternative No. 1 involves the extension of the New Liskeard Landfill to the east of the existing landfill footprint (Footprint Area = 2.61 ha; Base Elevation = 254 masl; Top elevation = 280 masl; and Landfill Expansion Capacity = 687,600 m^3). See Figure 8.

Conceptual Alternative No. 2 involves the extension of the New Liskeard Landfill to the west of the existing landfill footprint (Footprint Area = 3.60 ha; Base Elevation = 266 masl; Top elevation = 285.5 masl; and Landfill Expansion Capacity = 702,000 m^3). See Figure 9.

Conceptual Alternative No. 3 involves the extension of the Haileybury Landfill to the east of the existing landfill footprint (Footprint Area = 8.20 ha; Base Elevation = 295 masl; Top elevation = 303.5 masl; and Landfill Expansion Capacity = 697,000 m^3). See Figure 10.

Conceptual Alternative No. 4 involves the extension of the Haileybury Landfill to the east of the existing landfill footprint (Footprint Area = 4.40 ha; Base Elevation = 295 masl; Top elevation = 311 masl; and Landfill Expansion Capacity = 704,000 m^3). See Figure 11.

APPENDIX A

CERTIFICATE OF APPROVAL NO. A571505
NEW LISKEARD LANDFILL
DATED NOVEMBER 10, 1998
AMENDED APRIL 27, 2005+

Location: N.L. LANDFILL
C of A #: A571505 Issue Date: MAY 9/00
Revokes/Repeals: _____

Ministry of the Environment

Environmental Assessment and Approvals Branch
2 St. Clair Ave. W., 12A Floor
Toronto ON M4V 1L5

Ministère de l'Environnement

Direction des évaluations environnementales et des autorisations
2, avenue St. Clair W., 12A étage
Toronto ON M4V 1L5

Tel/Tél (416) 314-6979
Fax/Téléc (416) 314-8452

Ontario

1

May 9, 2000

1) ACCESS TO SITE ?
2) NO BURNING OF WASTE ?
3) NO HAZARDOUS WASTE ?
4) HYDROGEOLOGICAL REPORT
5) O/M PLAN
6) CLOSURE PLAN
7) ANNUAL REPORT

Mr. Kenneth D.N. Boal, AMCT, CMC
Chief Administrative Officer
The Corporation of the Town of New Liskeard
P.O. Box 730, 90 Whitewood Avenue
New Liskeard, Ontario
P0J 1P0

Dear Sir:

Re: Certificate of Approval No. A 571505
Corporation of the Town of New Liskeard

Please find enclosed the new Provisional Certificate of Approval for the New Liskeard Landfill Site.

If you have any questions regarding this matter, please call Mr. E. Zaltsberg of my staff at (416)314-8342.

Sincerely,

A. Dominski, P. Eng.
Supervisor, Waste Unit

Encl.
EZ/nb
c.: District Manager, Timmins

Copied to Dan.
June 9/00

Under the Environmental Protection Act and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

The Corporation of the Town of New Liskeard
P.O. Box 730, 90 Whitewood Avenue
New Liskeard, Ontario
P0J 1P0

for the use and operation of a 2.02 hectare landfilling area within a 32 hectare total site area.

all in accordance with the following plans and specifications:

as listed in Schedule "A"

Located: West ½ of Lot 5, Concession 2
Corporation of the Town of New Liskeard

which includes the use of the site only for the Processing and Disposal *of the following categories of waste (Note: Use of the site or additional categories of wastes requires a new application and amendments to the Provisional Certificate of Approval)* domestic, commercial and non-hazardous solid industrial waste

and subject to the following conditions:

For the purpose of this Provisional Certificate of Approval:

(a) "Certificate" means this Provisional Certificate of Approval including its schedules, if any, issued in accordance with the Environmental Protection Act;

(b) "Director" means a Director of the Environmental Assessment and Approvals Branch of the Ministry;

(c) "Regoinal Director" means the Director, Thunder Bay Regional Office of the Northern Region of the Ministry;

(d) "District Manager" means the District Manager of the Timmins District Office of the Northern Region of the Ministry;

(d) "Ministry" means the Ontario Ministry of the Environment, unless specific reference is made to another Ministry;

(e) "Town" means the Corporation of the Town of New Liskeard;

(g) "Provincial Officer" means a person who is designated by the Ministry of Environment as a Provincial Officer for the purposes of the Environmental Protection Act, the Ontario Water Resources Act, the Pesticides Act, and their respective regulations;

(h) "Site" means the facility described in the application for this Provisional Certificate of Approval and in the supporting documentation referred to herein;

(i) "ODWO" means the Ontario Drinking Water Objectives; and

(j) "RUP" means the Ministry's Reasonable Use Policy (Policy 15-08).

GENERAL

(1) Except as otherwise provided by these conditions, the Site shall be designed, developed, used, maintained and operated, and all facilities, equipment and fixtures shall be built and installed, in accordance with the Application for a Certificate Approval for a Waste Disposal Site dated April 12, 2000 and supporting documentation, and plans and specifications listed in Schedule "A".

(2) The requirements specified in this Provisional Certificate of Approval are the requirements under the Environmental Protection Act, R.S.O. 1990. The issuance of this Provisional Certificate of Approval in no way abrogates the Town's legal obligations to take all reasonable steps to avoid violating other applicable provisions of this legislation and other legislation and regulations.

(3) The requirements of this Provisional Certificate of Approval are severable. If any requirement of this Provisional Certificate of Approval, or the application of any requirement of this Provisional Certificate of Approval to any circumstance, is held invalid, the application of such requirement to other circumstances and the remainder of this Provisional Certificate of Approval shall not be affected in any way.

(4) The Town shall ensure compliance with all the terms and conditions of this Provisional Certificate of Approval. Any non-compliance constitutes a violation of the Environmental Protection Act, R.S.O. 1990 and is grounds for enforcement.

(5) (a) The Town shall, forthwith upon request of the Director, District Manager, or Provincial Officer (as defined in the Act), furnish any information requested by such persons with respect to compliance with this Provisional Certificate of Approval, including but not limited to, any records required to be kept under this Provisional Certificate of Approval; and

(b) In the event the Town provides the Ministry with information, records, documentation or notification in accordance with this Provisional Certificate of Approval (for the purposes of this condition referred to as "Information"),

(i) the receipt of Information by the Ministry;
(ii) the acceptance by the Ministry of the Information's completeness or accuracy; or
(iii) the failure of the Ministry to prosecute the Town, or to require the Town to take any action, under this Provisional Certificate of Approval or any statute or regulation in relation to the Information

shall not be construed as an approval, excuse or justification by the Ministry of any act or omission of the Town relating to the Information, amounting to non-compliance with this Provisional Certificate of Approval or any statute or regulation.

(6) The Town shall allow Ministry personnel, or a Ministry authorized representative(s), upon presentation of credentials, to:

(a) carry out any and all inspections authorized by Section 156, 157 or 158 of the Environmental Protection Act, R.S.O. 1990, Section 15, 16 or 17 of the Ontario Water Resources Act, R.S.O. 1990, or Section 19 or 20 of the Pesticides Act, R.S.O. 1990, as amended from time to time, of any place to which this Provisional Certificate of Approval relates; and,

without restricting the generality of the foregoing, to:

(b) (i) enter upon the premises where the records required by the conditions of this Provisional Certificate of Approval are kept;
(ii) have access to and copy, at reasonable times, any records required by the conditions of this Provisional Certificate of Approval;
(iii) inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations required by the conditions of this Provisional Certificate of Approval; and
(iv) sample and monitor at reasonable times for the purposes of assuring compliance with the conditions of this Provisional Certificate of Approval.

(7) (a) Where there is a conflict between a provision of any document referred to in Schedule "A", and the conditions of this Provisional Certificate of Approval, the conditions in this Provisional Certificate of Approval shall take precedence; and

(b) Where there is a conflict between documents listed in Schedule "A", the document bearing the most recent date shall prevail.

(8) The Town shall ensure that all communications/correspondence made pursuant to this Provisional Certificate of Approval includes reference to the Provisional Certificate of Approval No. A 571505.

(9) The Town shall notify the Director in writing of any of the following changes within thirty (30) days of the change occurring:

(a) change of Town or Owner of the Site or both;
(b) change of address or address of the new Town;
(c) change of partners where the Operator or Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act, 1991 shall be included in the notification to the Director;

(d) any change of name of the corporation where the Operator or Owner is or at any time becomes a corporation, and a copy of the most current "Initial Notice or Notice of Change" (form 1 or 2 of O. Reg. 182, Chapter C-39, R.R.O. 1990 as amended from time to time), filed under the Corporations Information Act shall be included in the notification to the Director; and

(e) change in directors or officers of the corporation where the Operator or Owner is or at any time becomes a corporation, and a copy of the most current "Initial Notice or Notice of Change" as referred to in 9(d), supra.

(10) In the event of any change in ownership of the Site, the Town shall notify, in writing, the succeeding owner of the existence of this Provisional Certificate of Approval, and a copy of such notice shall be forwarded to the Director.

(11) Any information relating to this Provisional Certificate of Approval and contained in Ministry files may be made available to the public in accordance with the provisions of the Freedom of Information and Protection of Privacy Act, R.S.O. 1990, C. F-31.

(12) All records and monitoring data required by the conditions of this Provisional Certificate of Approval must be kept on the Town's premises for a minimum period of two (2) years from the date of their creation.

OPERATIONAL

(13) This Certificate revokes all previously issued Certificates for this Site.

(14) The Town shall ensure that the Site is operated by trained personnel in a safe and secure manner, and that the wastes are properly handled, so as not to pose any threat to the general public, Site personnel or the environment, and that access to the Site is limited to the Town and his staff.

(15) Within ninety (90) days of the issuance of this Certificate, the Town shall mark the Site boundaries, as identified in the site plan included with the application and supporting documents, with permanent markers, that shall be erected so as to be visible throughout the year for the life of the Site.

(16) The Town shall ensure that no burning of waste shall take place at the Site.

(17) All waste received at the Site under the authority of this Certificate shall be deposited within a 2.02 hectare landfilling area shown on Sheets A and B, provided with the Application for the Certificate.

(18) The Site shall be closed when final contours shown on Sheet B and reduced by 0.9m for final cover, have been reached.

(19) Liquid industrial waste or hazardous waste as defined in Ont. Reg. 347 shall not be received or deposited at the Site.

(20) The Town shall operate a litter maintenance program, which will include the collection and proper disposal of any wind blown or vector borne litter, from off-site deposition locations and from those areas of the Site that are not being actively landfilled.

(21) (a) The Town shall:

i) Within 60 days of the date of this Certificate, submit to the Director, for the Director's signature, two copies of a completed Certificate of Prohibition containing a registrable description of the Property, in accordance with Forms 4 & 5 of O. Reg. 14/92; and

ii) Within 10 calendar days of receiving the Certificates of Prohibition signed by the Director, register the Certificate of Prohibition in the appropriate Land Registry Office on title to the Property and submit to the Director the duplicate registered copy immediately following registration; and

(b) Pursuant to Section 197 of the Environmental Protection Act, neither the Owner nor any person having an interest in the Property shall deal with the Property in any way without first giving a copy of this Certificate to each person acquiring an interest in the Property as a result of the dealing.

(22) Within 18 (eighteen) months of the issuance of this Certificate, the Town shall submit for the Director's approval a hydrogeological report. This report shall include but not limited to the following issues:

(a) groundwater regime evaluation (hydraulic gradients, direction of groundwater flow, groundwater flow velocity);
(b) the extent of the existing groundwater contaminant plume;
(c) monitoring requirements; and
(d) contaminant attenuation zone requirements.

(23) Within two years of the issuance of this Certificate, the Town shall submit for the Director's approval an Operation and Maintenance Plan. This Plan shall include but not be limited to the following issues:

(a) the Site capacity approved in accordance with the Ministry's protocol;
(b) total in situ waste volume;
(c) the remaining life of the Site;
(d) new final contours reflecting the capacity defined in (a);
(e) the final cover installation in the Fill Beyond Approved Limit (FBAL) areas and its schedule;
(f) Site operations including daily and final cover;
(g) the groundwater monitoring program; and
(h) the closure plan.

(24) The Site shall be operated, maintained and monitored in accordance with the approved Operation & Maintenance Plan required by Condition 23.

(25) Two years before the Site is expected to stop receiving waste, the Town shall submit for the Director's approval an updated Closure Plan. This Plan shall include, but not be limited to the following issues:

(a) the choice of final cover material;
(b) changes to the final contour plan that may be previously identified in the annual reports, or recommended in the Closure Plan;
(c) the sequence and schedule for final cover installation;
(d) post-closure and end-use plans which reflect an after-use of conservation and passive recreation;
(e) schedules for Site inspections;
(f) plans and schedules for post-closure groundwater and surface water monitoring programs; and
(g) plans and schedules for the routine monitoring and maintenance of the final cover.

(26) The Town shall prepare and submit an annual report to the Regional Director by June 1st of the year following the calendar year covered by the report which shall include as a minimum, the following:

(a) a summary of total annual quantities of waste received at the Site;
(b) a drawing(s) of the Site indicating all groundwater monitoring locations;
(c) tables outlining monitor locations, analytical parameters sampled, and frequency of sampling;
(d) an analysis and interpretation of groundwater monitoring data; a review of the adequacy of the monitoring program; conclusions of the monitoring data; and recommendations for any changes in monitoring program that may be necessary;
(e) an assessment of groundwater quality in relation to the RUP and ODWO;
(f) an assessment of the efficiency of the Contaminant Attenuation Zone established;
(g) an update of changes in operations, equipment, or procedures made or produced at the Site, and any operating difficulties encountered;
(h) drawings showing areas of fill, buffer areas, current Site contours, maximum final Site contours, any recommended changes of the final contours of the Site, percentage of available space utilized, and an estimate of the remaining disposal capacity and Site life;
(i) a statement as to compliance with all Conditions and with the inspection and reporting requirements of the Conditions;
(j) summary of any complaints made regarding Site operation and the Town's response and action taken; and
(k) recommendations respecting any proposed changes in the operation of the Site.

COMPLAINT PROCEDURES

(27) If at any time, the Town receives complaints regarding the operation of the Site, the Town shall respond to these complaints according to the following procedures:

(a) The Town shall record each complaint on a formal complaint form entered in a sequentially numbered log book. The information recorded shall include the nature of the complaint, the name, address and the telephone number of the complainant and the time and date of the complaint;

(b) The Town, upon notification of the complaint shall initiate appropriate steps to determine all possible causes of the complaint, proceed to take the necessary actions to eliminate the cause of the complaint and forward a formal reply to the complainant; and

(c) The Town shall retain on-site a report written within one (1) week of the complaint date, listing the actions taken to resolve the complaint and any recommendations for remedial measures, and managerial or operational changes to reasonably avoid the re-occurrence of similar incidents.

SCHEDULE "A"

This Schedule "A" forms part of this Provisional Certificate of Approval:

1. The updated Application for a Certificate of Approval for a Waste Disposal Site dated April 12, 2000;
2. Letters from Sutcliffe Rody Quesnel Inc. to the MOE dated February 4, 2000, March 14, 2000 and April 12, 2000;
3. Site Plan Approved Area (Sheet A) and Site Plan Final Contours (Sheet B) prepared by Sutcliffe Rody Quesnel Inc. and dated February 2000;

The reasons for the imposition of these Conditions are as follows:

(1) The reason for Condition (1) is to ensure that the Site is operated in accordance with the application and supporting documentation submitted by the Town, and not in a manner which the Director has not been asked to consider.

(2) The reason for Conditions (2), (3), (4), (5), (7), (8), (9), (10), (11) and (12) is to clarify the legal rights and responsibilities of the Town.

(3) The reason for Condition (6) is to ensure that the appropriate Ministry staff have ready access to information and the operations of the Site which are approved under this Provisional Certificate of Approval. Condition (6) is supplementary to the powers of entry afforded a Provincial Officer pursuant to the Environmental Protection Act, the Ontario Water Resources Act, and the Pesticides Act, as amended.

(4) The reason for Condition (13) is to ensure that this Certificate revokes all previously issued Certificates for this Site.

(5) The reason for Conditions (14) and (20) is to ensure that the Site is operated in an environmentally safe manner.

(6) The reason for Condition (15) is to allow a viable on-site inspection to realize the limits of the Site during any season.

(7) The reason for Condition (16) is to reduce potential damage and environmental effects due to fire.

(8) The reason for Conditions (17), (18), (19) and (24) is to ensure that this Site is operated in accordance with the application and submitted documentation listed in Schedule A.

(9) The reason for Condition (21) requiring registration of the Provisional Certificate of Approval is that Section 46 of the Environmental Protection Act, R.S.O. 1990, prohibits any use being made of the lands after they cease to be used for waste disposal purposes within a period of twenty-five years from the year in which such land ceased to be used for waste disposal, unless the approval of the Minister for the proposed use has been given. The purpose of this prohibition is to protect future users of the Site and the environment from any hazards which might occur as a result of waste being disposed of on the Site. This prohibition and potential hazard should be drawn to the attention of future owners and users of the Site by the Provisional Certificate of Approval being registered on title.

(10) Condition (22) is to ensure that the Town shall conduct and submit for the Director's approval a hydrogeological report.

(11) The reason for Condition (23) is to ensure that the Town shall develop and submit for the Director's approval an Operation and Maintenance Plan.

(12) The reason for Condition (25) is to ensure that two years before the Site is closed, the Town shall submit for the Director's approval an updated Closure Plan.

(13) The reason for Condition (26) is to ensure that the Town shall prepare and submit an annual report to the Regional Director by June 1st of the year following the calendar year covered by the report.

(14) The reason for Condition (27) is to ensure that the complaints are responded to in a systematic manner to protect the health and safety of the public and the environment.

You may by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. Section 142 of the Environmental Protection Act, R.S.O. 1990 c. E-19, as amended, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

In addition to these legal requirements, the Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary,*
Environmental Appeal Board,
2300 Yonge St., 12th Floor,
P.O. Box 2382
Toronto, Ontario.
M4P 1E4

AND

The Director,
Section 39, Environmental Protection Act,
Ministry of the Environment,
250 Davisville Avenue, 3rd Floor,
Toronto, Ontario.
M4S 1H2

*Further information on the Environmental Appeal Board's requirements for an appeal can be obtained directly from the Board by: Tel: (416) 314-4600, Fax: (416) 314-4506 or e-mail: www.ert.gov.on.ca.

DATED AT TORONTO this 9th *day of* May, 2000.

A. Dominski, P. Eng.,
Director,
Section 39,
Environmental Protection Act

EZ/nb
c.: District Manager, Timmins District Office

Location: N.L. LANDFILL
C of A #: A571505 Issue Date: APR 25/05
Revokes/Repeals: AMENDS A571505

600-20-07

Ministry of the Environment / Ministère de l'Environnement

Ontario

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A571505
Notice No. 1

cc: [redacted]
Ken P. Burley
Dave Treen

The Corporation of the City of Temiskaming Shores
PO Box 2050
Haileybury, Ontario
P0J 1K0

Site Location: New Liskeard Landfill
West 1/2 of Lot 5, Concession 2, Dymond Twp
Temiskaming Shores City, District of Timiskaming

You are hereby notified that I have amended Provisional Certificate of Approval No. A571505 issued on May 9, 2000 for a waste disposal site (landfill), as follows:

I. The name of the Owner has changed:

From: **The Corporation of the Municipality of New Liskeard**

To: **The Corporation of the City of Temiskaming Shores**

II. The service area for this site is hereby changed to the municipal boundary of the City of Temiskaming Shores.

III. The hours of operation are hereby changed to 8:00am-12:00pm, Tuesday through Saturday.

All in accordance with the Application for a Provisional Certificate of Approval for a Waste Disposal Site dated November 19, 2004, signed by Dan Harvey, Director of Public Works, City of Temiskaming Shores, including all supporting documentation.

The reason for this amendment to the Certificate of Approval is as follows:

1. To approve the Owner's requests.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A571505 dated May 9, 2000

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as

amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

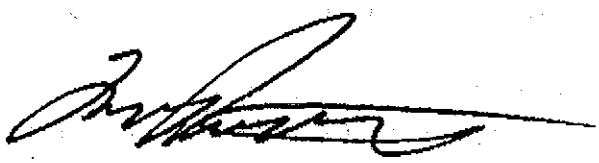
AND

The Director
Section 39, *Environmental Protection Act*
Ministry of Environment and Energy
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this 27th day of April, 2005



Ian Parrott, P.Eng.
Director
Section 39, *Environmental Protection Act*

AN/

c: District Manager, MOE North Bay
H. James Hawken, P.Eng., Sutcliffe Rody Quesnel Inc.

Location: N.L. LANDFILL
C of A #: A571505 Issue Date: APR 17/07
Revokes/Repeals: NOTICE #2

Ontario

Ministry of the Environment | Ministère de l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A571505
Notice No. 2
Issue Date: April 17, 2007

APR 2 6 2007

To: Dave Treen.
April 30, 2007.
CWQ

The Corporation of the City of Temiskaming Shores
PO Box 2050
Haileybury, Ontario
P0J 1K0

Site Location: New Liskeard Landfill
West 1/2 of Lot 5, Concession 2, Dymond Twp
Temiskaming Shores City, District of Temiskaming

You are hereby notified that I have amended Provisional Certificate of Approval No. A571505 issued on May 9, 2000 and amended April 27, 2005 for a waste disposal site (landfill), as follows:

I. This Certificate is hereby amended to recognize the addition of a contaminant attenuation zone.

II. The following Item is hereby added to Schedule "A":

4. Application for a Provisional Certificate of Approval for a Waste Disposal Site dated November 14, 2005 and signed by Dave Treen, Manager of Environmental Services, City of Temiskaming Shores, including the attached drawing entitled "New Liskeard Landfill Site Figure 1" showing the attenuation zone.

The reason for this amendment to the Certificate of Approval is as follows:

1. To recognize the addition of the contaminant attenuation zone as required by Provincial Officer's Order No. 7026-6GQLJY.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A571505 dated May 9, 2000, as amended.

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to eachportion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., Suite 1700
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 39, *Environmental Protection Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this 17th day of April, 2007

Tesfaye Gebrezghi, P.Eng.
Director
Section 39, *Environmental Protection Act*

AN/

c: District Manager, MOE North Bay
H. James Hawken, Sutcliffe Rody Quesnel Inc.

APPENDIX B

CERTIFICATE OF APPROVAL NO. A570402
HAILEYBURY LANDFILL
DATED NOVEMBER 10, 1998
AMENDED APRIL 27, 2005

Location: HAIL. LANDFILL
C of A #: A570402 Issue Date: NOV 10/98
Revokes/Repeals: A570402 (MAR 5/92)

Ministry of the Environment
250 Davisville Avenue
Toronto ON M4S 1H2

Ministère de l'Environnement
250, avenue Davisville
Toronto ON M4S 1H2

Ontario

ENVIRONMENTAL ASSESSMENT AND APPROVALS BRANCH
3RD FLOOR
Tel. (416) 314-7967
Fax (416) 314-8452

November 10, 1998

Mr. G. Douglas Walsh, CET
Director of Public Works
Town of Haileybury
Postal Bag "D", 451 Meridian Avenue
Haileybury, Ontario
P0J 1K0

Dear Mr. Walsh:

Re: Amended Provisional Certificate of Approval for a Waste Disposal Site No. A 570402 for a Landfill Site Located on S ½ Lot 1, Concession 2, in the Town of Haileybury

Please find attached the Amended Provisional Certificate of Approval for a Waste Disposal Site No. A 570402.

The draft Certificate of Approval presented to the Environmental Assessment Board, (Board), during the hearing under Part V of the Environmental Assessment Act, has been adopted by the Board with a number of conditions added upon the request from the Board. In addition, we have made some clarifying changes to the wording. All of the changes from the draft dated April 24, 1998, (Exhibit No.11) are listed below:

1. Definition No. 1(3) has been changed to correct the name of the local district office.

2. Definition No. 1(4) has been added to define the Drainage Act, since its use is required in the condition required by the Board. The remaining definitions have been re-numbered.

3. Definition No. 1(6) has been expanded to clarify the extend of the Fill Area.

4. Condition No. 4(1) has been changed to fully define the Pesticides Act.

5. Condition No. 6 has been changed to incorporate the recommendation from the Board, to require a construction of the stormwater management works within a 12-month time frame.

.../2

6. Condition No. 11 has been added to incorporate the recommendation from the Board, to require an installation of a perimeter fence. The remaining conditions have been re-numbered.

7. Condition No.15 has been changed to clarify the units used to describe the depth of the cover material.

8. Condition No. 17 has been changed to clarify the units used to describe the depth of the cover material.

9. Condition No. 18 has been added to require a submission of a clean wood handling plan, to further investigate the need for an installation of a pit incinerator suggested by the Board.

10. Sub-condition No. 22(2) has been changed to incorporate the recommendation from the Board, by adding lead to the groundwater testing parameters.

11. Sub-condition No. 22(3) has been changed to incorporate the recommendation from the Board, by adding suspended solids to the surface water testing parameters and by requiring another surface water testing location.

12. Sub-condition No. 22(4) has been added to describe the location of the additional monitoring station required by the Board. The remaining sub-conditions have been re-numbered.

13. Condition No. 23 has been changed to incorporate the recommendation from the Board, to require an installation of methane monitors at the garage, operator's office and other permanent structures at the site within a 3-month deadline.

14. Condition No. 27 has been changed, by replacing "Item 2" to "Item 3", to correct a typographical error.

15. Condition No. 27 has been changed, to correct the title of Guideline B-7.

16. Document No. 5 has been added to Schedule "A", since it provided clarification to the definition of the Fill Area. The remaining documents have been re-numbered.

If you have any questions on the above, please call Margaret Wojcik, P.Eng., Senior Review Engineer, Waste Section, at (416) 314-7993.

Yours truly,

A. Dominski, P. Eng.
Manager, Waste Section

MW/st
Encls.
cc: District Manager, Timmins District Office
Isabelle O'Connor, Legal Services Branch
Robert M. Fishlock, Blake, Cassels & Graydon

You are hereby notified that Provisional Certificate of Approval No. A 570402 for a Waste Disposal Site (Landfill), dated March 5, 1992, is hereby revoked in its entirety and the following substituted therefor:

Under the Environmental Protection Act and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

Town of Haileybury
Postal Bag "D", 451 Meridian Avenue
Haileybury, Ontario
P0J 1K0

for the use and operation of a 5.8 hectare Landfill Site within a 32.4 hectare total Site area;

all in accordance with the following plans and specifications:

listed in Schedule "A";

Located: S ½ Lot 1, Concession 2
Town of Haileybury
District of Timiskaming

which includes the use of the site only for the disposal *of the following categories of waste (Note: Use of the site for additional categories of wastes requires a new application and amendments to the Provisional Certificate of Approval)* municipal waste;

and subject to the following conditions:

DEFINITIONS

1. In this Provisional Certificate of Approval:

   (1) "Certificate" means this Amended Certificate of Approval No. A 570402, as amended from time to time, including all Schedules attached to and forming part of this Certificate;

(2) "Director" means the one or more persons who, from time to time, are so designated for the purpose of Part V of the *Environmental Protection Act*, R.S.O. 1990, c.E.19;

(3) "District Manager" means the District Manager of the Timmins District Office of MOE;

(4) "Drainage Act" means the *Drainage Act*, R.S.O. 1990, c.D. 17;

(5) "EPA" means the *Environmental Protection Act*, R.S.O. 1990, c.E. 19;

(6) "Fill Area" means the portion of the Site where waste may be disposed as delineated by the "Limit of Sanitary Landfill Fill Area" shown on Sheet 10 of Item 2 in Schedule "A" and described in Item 5 in Schedule "A";

(7) "MOE" means the Ministry of the Environment;

(8) "OWRA" means the *Ontario Water Resources Act*, R.S.O. 1990, c.O. 40;

(9) "Regional Director" means the Director, Northern Region, Ministry of the Environment;

(10) "Town" means the Corporation of the Town of Haileybury; and

(11) "Site" means the 32.4 hectare landfill site including the Fill Area and buffer zone on Lot 1, Concession 2, in the Township of Bucke, District of Timiskaming as shown on the Plan of Survey, Sheet No. 2 of Item 2 in Schedule "A".

GENERAL REQUIREMENTS

2. This Certificate revokes all previously issued Provisional Certificates of Approval issued under Part V, EPA, for this Site. The approval given herein, including the Terms and Conditions set out, replaces all previously issued approvals and related Terms and Conditions under Part V, EPA for this Site.

3. The requirements of this Certificate are severable. If any requirement of this Certificate to any circumstance is held invalid, the application of such requirement to other circumstance and the remainder of this Certificate shall not be affected thereby.

4. The Town shall allow MOE personnel, or a MOE authorized representative(s), upon presentation of credentials, to:

(1) carry out any and all inspections authorized by the EPA, OWRA, or the *Pesticides Act*, R.S.O. 1990, c.P. 11, as amended from time to time, of any place to which this Certificate relates, and without restricting the generality of the foregoing, to:

a. enter upon the premises or the location where the records required by the conditions of this Certificate are kept;

b. have access to and copy, at any reasonable time, any records required by the conditions of this Certificate;

c. inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices or operations required by the conditions of this Certificate; and

d. sample and monitor, at reasonable times, for the purposes of assuring compliance with the conditions of this Certificate.

5. (1) The Site shall be developed, operated and maintained by the Town in accordance with the Terms and Conditions herein and items 1 to 4 listed in Schedule "A" of this Certificate.

(2) Should there be any discrepancies between any of items 1 to 4 of Schedule "A" and the conditions in this Certificate, the conditions shall take precedence. Should there be discrepancies between items 1 to 4 listed in Schedule "A", the document bearing the most recent date shall take precedence.

STORMWATER MANAGEMENT WORKS APPROVALS

6. (1) This Certificate does not provide an approval for any works subject to approval under the OWRA, the Drainage Act, or any other legislation that may be applicable.

(2) The Town shall complete the construction of the swale ditches, the sedimentation ponds, and the diversion ditch as outlined in Section 3.2 of Item 3 of Schedule "A", within 12 months from the issuance of this Certificate. Town Completed

(3) Within six months of the date of issuance of this Certificate, the Town shall submit to the Director an application for approval under the OWRA of the on-site stormwater management works. The Town shall fulfill the requirements under the Drainage Act, or any other legislation that may be applicable. HSL

CONTAMINANT ATTENUATION ZONE

7. Within twelve months from the date of issuance of this Certificate, the Town shall either acquire or obtain an easement and all of the water rights to the land described as: Town HSL

Parcel 904 NND
Part of the South Half of Lot 1
Concession 2
Township of Firstbrook
District of Timiskaming

CERTIFICATE OF PROHIBITION

8. (1) For the purpose of this condition "Property" means the Site and, effective on the date of acquisition of the land or acquisition of the easement and water rights by the Town, the parcel of land referred to in Condition No. 7, above.

(2) Pursuant to Section 197 of the EPA, neither the Town nor any person having an interest in the Property shall deal with the Property in any way without first giving a copy of this Certificate to each person acquiring an interest in the Property as a result of the dealing.

(3) The Town shall,

a. within 60 days of the date of the date that the Town obtains the easement and water rights required under Condition No. 7, submit to the Director for the Director's signature two copies of a completed Certificate of Prohibition containing a registrable description of the Property, in accordance with Form 1 of O. Reg. 14/92; and Town

b. within 10 calendar days of receiving the Certificates of Prohibition signed by the Director, register the Certificate of Prohibition in the appropriate Land Registry Office and submit to the Director immediately following registration the duplicate registered copy. Town

LIMITS OF WASTE

9. (1) Waste disposal shall be limited to the Fill Area.

(2) Waste may only be placed above ground level to the final contour elevations shown on Sheet No. 10 of Item 2 of Schedule "A".

(3) Waste may only be placed below ground level in trenches as shown on Sheet No. 4 of Item 2 of Schedule "A" and to depths of approximately 3 metres below ground level but not exceeding 3.66 metres.

(4) There shall be no further final disposal of waste in the Bulk Material Storage Area shown on Sheet No. 10 of Item 2 of Schedule "A".

WASTE TYPE

10. Only municipal waste, as defined in Ontario Regulation 347, R.R.O. 1990 (as amended), may be disposed of at the Site.

SITE SECURITY AND OPERATING HOURS

11. The Town shall install a complete perimeter fence within 18 months from the issuance of this Certificate.

12. (1) The Site shall not be operated outside of the hours of 9:00 a.m. to 5:00 p.m., Monday to Friday, and from 9:00 a.m. to 12:00 noon on Saturday. The Site will be closed on Sundays and statutory holidays. These operating hours may be varied with the approval of the Regional Director.

(2) During non-operating hours, the Site entrance gate shall be kept locked.

(3) Except for waste deposited in the after-hours dumping bin located outside of the Site gate, waste shall only be received under the supervision of a Site attendant.

13. The Town shall ensure that all Site attendants are adequately trained with respect to the following:

(1) terms, conditions and operating requirements of this Certificate;

(2) the operation and management of the Site;

(3) relevant waste management regulations and legislation;

(4) environmental concerns related to the waste being handled at the Site; and

(5) occupational health and safety concerns pertaining to the management of waste at the Site.

OPERATIONAL REQUIREMENTS

14. The Town shall ensure that waste is deposited in a manner that minimizes the size of the Fill Area working face and that the waste is compacted before cover material is applied.

15. (1) All exposed waste shall be covered by a minimum of 15 centimetres of cover material at the end of each working day.

(2) A cover material layer of at least 30 centimetre-depth shall be applied as soon as reasonably possible on all areas of waste disposal where no final cover has been applied and where no additional waste or final cover is to be placed for six months or more.

16. Alternative materials to clean soil may be used as daily cover only if approval is obtained in accordance with the "Procedure for Gaining Approval to use Alternative Materials to Soil as Daily Cover in Landfills that Receive Only Municipal and Non-Hazardous Solid Wastes" (May, 1994) released by the Science and Technology Branch of the MOE or if approval is obtained in accordance with subsequent MOE procedures, guidelines or regulations.

17. (1) Where final waste contours have been reached for a given cell of the Site, final cover application and seeding shall be completed as soon as practical but not later than nine months from the completion of cover application.

(2) Except where Phase II development is scheduled to begin above a trench within one year of filling the trench, a 30 centimetre-thick layer of interim cover shall be placed above each trench as soon as practicable once it is filled and in any case within nine months of being filled. The interim cover shall be removed, to the extent practicable, and scarified prior to commencement of Phase II development.

18. The Town shall submit to the Director for approval, within three months from the issuance of this Certificate, a plan outlining the options for handling of clean wood at the Site. The plan shall contain the analysis of the environmental impacts of each option, and it shall identify the option preferred by the Town.

done

HSL complete

MONITORING WELLS

19. (1) Within three months of the issuance of this Certificate, a monitoring well to replace TW 7/94 and a monitoring well in the vicinity of Test Pit 14 shall be constructed and incorporated into the Site monitoring program.

done

Completed

(2) Any monitoring wells which are no longer needed or are operational shall be properly abandoned in accordance with Ontario Regulation 903, R.R.O. 1990 or rehabilitated within 3 months of such a determination being made.

(3) A report on the abandonment or rehabilitation of any monitoring well shall be included in the applicable Annual Report prepared in accordance with Condition No. 24 of this Certificate.

done

(4) The well development procedures and data for any new monitoring wells constructed at the Site shall be reported in the applicable Annual Report prepared in accordance with Condition No. ~~24~~ 25 of this Certificate.

Town

LITTER

20. (1) A visual inspection shall be made at least once each week of the public roadways immediately adjacent to the site and any litter

which may have originated from the Site or from vehicles hauling to the Site which is observed on the inspections, shall be retrieved forthwith.

(2) A visual inspection of the buffer zone shall be made at least once each month from April to October. Any litter present shall be retrieved and disposed of in the Fill Area.

SITE GRADING

21. Site grading and contours shall be maintained such that all surface water run-off from the buffer zone and areas capped with final cover is directed away from the working face of the Site.

SITE MONITORING

22. (1) Ground water shall be monitored three times per year in April/May, August/September and November/December at each of the following monitoring wells:

Replacement well for MW No. 2
TW 1/91(D)
TW 1/91(S)
TW 3/91
TW 4/91
TW 5/91
TW 6/94
TW 8/94
Replacement well for TW 7/94 as required by Condition No. 19(1)
Well to be constructed in the vicinity of Test Pit 14 as required by Condition No. 19(1).

(2) Each sample taken under Condition No. 22(1) shall be analysed for the following parameters:

Metals:	aluminium, arsenic, boron, barium, calcium, cadmium, chromium, copper, iron, potassium, magnesium, lead, manganese, sodium, selenium, strontium, mercury, zinc
Anions:	fluoride, chloride, nitrate, nitrite, phosphate, sulphate
Other Parameters:	(hardness) alkalinity, total Kjeldhal nitrogen (TKN), ammonia, total dissolved solids (TDS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), dissolved organic carbon (DOC), phenols
Field Parameters:	static level, temperature, conductance, pH

(3) Surface water samples shall be taken from monitoring stations SW1, SW2, SW3, SW4 and SW5 twice per year in April/May and August/September. For each sample, an analysis or determination shall be done for the following parameters:

Metals:	aluminium, boron, cadmium, chromium, cobalt, copper, iron, lead, nickel, potassium, sodium, zinc
Other Parameters:	alkalinity, ammonia, chloride, COD, DOC, phenols, TDS, turbidity, suspended solids
Field Parameters:	temperature, conductance, pH, dissolved oxygen, estimated streamflow

(4) The monitoring station SW5 shall be located at the outlet of a beaver dam just upstream of SW4.

(5) Changes to the monitoring requirements shall be made on the basis of recommendations made in the Annual Report and only with the Regional Director's written approval.

23. The Town shall install battery-operated methane gas monitors in the garage, operator's office and any other structure at the landfill, within 3 months from the issuance of this Certificate.

DAILY RECORDS

24. Daily records of Site operations shall be made and shall be kept at the Site for a period of at least two years from the date of the record. The daily records shall include the following:

(1) The type, hauler, vehicle license number and time of arrival for all waste received at the Site;

(2) All complaints from the public received by the Town and an indication of the action taken in response by the Town; and

(3) A record of litter collection activities, Site inspections and application of interim and daily cover.

ANNUAL REPORTS

25. Beginning with the 1998 calendar year, an Annual Report addressing water quality monitoring and Site operations shall be submitted to the Regional Director no later than April 30th following the calendar year being reported upon. The Annual Report shall include the following:

(1) tables outlining analytical parameters sampled and frequency of sampling for each monitoring location;

(2) summary data tables for key analytical parameters and locations;

(3) an analysis and interpretation of the groundwater monitoring results including a discussion of groundwater monitoring data in relation to compliance with the boundary criteria;

(4) a drawing of the Site and neighbouring land showing all monitoring locations;

(5) review of the current monitoring program and a recommendation for any changes;

(6) review of the sampling and analytical procedures, including the QA/QC programs;

(7) a summary of monthly and total annual waste loads received at the Site;

(8) drawings showing existing conditions, completed Fill Areas, buffer area, current Fill Area contours and maximum final Site contours;

(9) calculation of the volume of available space utilized, the remaining Site capacity, the volume of cover material applied and the waste compaction density;

(10) an estimate of the remaining Site life;

(11) an update of changes in Site operations, equipment, procedures and any operating difficulties encountered;

(12) a summary of any complaints made regarding Site operation and the Town's response and action taken; and

(13) recommendations respecting any proposed changes in the operation of the Site.

CLOSURE AND END USE PLANS

26. (1) Within five years of the commencement of landfilling in Phase II of Areas B, C & D of the Site, the Town shall submit a final Site closure and end use plan to the Director for approval.

(2) The Site closure and end use plans shall include, but not be limited to, details regarding the following:

a. proposed end use;

b. any adjustments to the final contour plan that may be recommended;

c. fencing and access control;

d. additional vegetative plantings planned;

e. the sequence and schedule for final cover installation;

f. plans and schedules for the management and continued monitoring;

g. plans and schedules for the routine monitoring and maintenance of the final cover and stormwater management works; and

h. notification procedures related to the Site closure.

CONTINGENCY PLANS

27. (1) Contingency plans as outlined in Section 4.15.2 of Item 3 of Schedule "A" shall be implemented in accordance with the criteria and procedures outlined in Section 4.0 of Item 6 of Schedule "A".

(2) Contingency plans as outlined in Section 4.15.2 of Item 3 of Schedule "A" shall be implemented if groundwater monitoring indicates that leachate migration has or will result in exceedance of the boundary criteria as determined from MOE Guideline B-7, "Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities", as amended.

SCHEDULE "A"

This Schedule "A" forms part of Provisional Certificate of Approval No. A 570402:

1. Application for a Certificate of Approval for a Waste Disposal Site (Landfill), signed by Alexander L. Herbert, Town of Haileybury, dated October 27, 1986.

2. Set of Plans entitled "Haileybury Landfill Site - Development, Operational and Closure Plans, Project No. E91008", prepared by H. Sutcliffe Limited, dated October 1992.

3. Report entitled, "Corporation of the Town of Haileybury, Landfill Site Approval Report, Project No. E91008", prepared by H. Sutcliffe Limited, revised July 1997.

4. Report entitled, "Supplemental Hydrogeological Investigation, Town of Haileybury Landfill Site, Haileybury, Ontario", prepared by International Water Consultants Ltd., dated April 3, 1995.

5. Letter dated November 19, 1996 from H.J. Hawken, H. Sutcliffe Ltd., to J. Connelly, Ministry of Environment and Energy, providing responses to Ministry's concerns from August 16, 1996.

6. Letter dated July 28, 1997 from H.J. Hawken, H. Sutcliffe Ltd., to J. Connelly, Ministry of Environment and Energy, providing responses to Ministry's concerns.

7. Report entitled, "Investigation of Proposed Leachate Attenuation Zone, Town of Haileybury Landfill Site, Haileybury, Ontario, 1997", dated February 18, 1997; prepared by International Water Consultants Ltd.

The reasons for the imposition of these conditions are as follows:

1. Conditions No. 1 through 27 have been included to adopt the decision of the Environmental Assessment Board. EP-97-05, dated October 2, 1998.

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990 c. E-19, you may by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this Notice, require a hearing by the Board. Section 142 of the Environmental Protection Act, as amended provides that the Notice requiring a hearing shall state:

1. *The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;*
2. *The grounds on which you intend to rely at the hearing in relation to <u>each</u> portion appealed.*

In addition to these legal requirements, the Notice should also include:

3. *The name of the appellant;*
4. *The address of the appellant;*
5. *The Certificate of Approval number;*
6. *The date of the Certificate of Approval;*
7. *The name of the Director;*
8. *The municipality within which the waste disposal site is located;*

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary,
Environmental Appeal Board,
2300 Yonge St., 12th Floor,
P.O. Box 2382
Toronto, Ontario
M4P 1E4

<u>AND</u>

The Director,
Section 39, Environmental Protection Act,
Ministry of the Environment,
250 Davisville Avenue, 3rd Floor,
Toronto, Ontario.
M4S 1H2

DATED AT TORONTO this 10th *day of* November, 1998.

A. Dominski, P. Eng.,
Director,
Section 39,
Environmental Protection Act

MW/st
cc: District Manager, Timmins

600 - 20 - 08

Ontario

Ministry of the Environment | Ministère de l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A570402
Notice No. 1

RECEIVED
MAY - 9 2005

The Corporation of the City of Temiskaming Shores
PO Box 2050
Haileybury, Ontario
P0J 1K0

cc: Dan Harvey
Ken P. Zerby
Dave Treen

Site Location: Haileybury Landfill
Lot 1, Concession 2
Haileybury Town, District of Timiskaming
P0J 1K0

You are hereby notified that I have amended Provisional Certificate of Approval No. A570402 issued on November 10, 1998 and amended November 10, 1999 for a waste disposal site (landfill), as follows:

I. The name of the Owner has changed:

From: **The Corporation of the Municipality of Haileybury**

To: **The Corporation of the City of Temiskaming Shores**

II. The service area for this site is hereby changed to the municipal boundary of the City of Temiskaming Shores.

III. The hours of operation are hereby changed to 1:00pm-5:00pm, Tuesday through Saturday.

All in accordance with the Application for a Provisional Certificate of Approval for a Waste Disposal Site dated November 19, 2004, signed by Dan Harvey, Director of Public Works, City of Temiskaming Shores, including all supporting documentation.

The reason for this amendment to the Certificate of Approval is as follows:

1. To approve the Owner's requests.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A570402 dated November 10, 1998

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as

amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 39, *Environmental Protection Act*
Ministry of Environment and Energy
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this 27th day of April, 2005

Ian Parrott, P.Eng.
Director
Section 39, *Environmental Protection Act*

AN/

c: District Manager, MOE North Bay
H. James Hawken, P.Eng., Sutcliffe Rody Quesnel Inc.

APPENDIX C

NEW LISKEARD LANDFILL SITE PHOTOGRAPHIC LOG
SEPTEMBER 17, 2009

APPENDIX C
LANDFILL SITE INSPECTION - PHOTOGRAPHIC RECORD

PROJECT NO. TY91049

PROJECT Landfill Feasibility Study (Conceptual Assessment) Expansion of Existing Landfill Sites

LOCATION City of Temiskaming Shores, Ontario

New Liskeard Landfill

Observations

Photo taken from the top of New Liskeard Landfill, facing southwest.

Showing application of cover material on the south portion of the landfill.

South portion of the landfill is the most recently active disposal area.

This area represents the C of A approved 2.02 ha disposal area.

Site equipment garage located on the right side of the photo.

New Liskeard Landfill

Observations

Photo taken from the top of New Liskeard Landfill, facing southwest.

Showing uncovered landfill waste material in the south portion of the landfill.

Cover material is applied progressively on exposed landfill waste material.

Site equipment garage and granular haul road pictured.

Site access gate from Rockley Road is located behind equipment garage.

New Liskeard Landfill

Observations

Photo of haul road loop and material stockpiles, facing north.

Stockpiled materials include white goods, scrap metal and concrete debris.

Scrap tire stockpile located to the right side of the photo.

APPENDIX C
LANDFILL SITE INSPECTION - PHOTOGRAPHIC RECORD

PROJECT NO. TY91049

PROJECT Landfill Feasibility Study (Conceptual Assessment) Expansion of Existing Landfill Sites

LOCATION City of Temiskaming Shores, Ontario

New Liskeard Landfill

Observations

Photo of scrap tire stockpile, facing east.

City arranges for off-Site disposal of stockpiled materials.

Granular road/path on left hand side leads to bedrock outcrop.

New Liskeard Landfill

Observations

Photo of New Liskeard Landfill, facing south.

Photo showing cover material applied on the majority of the landfill area.

On left, showing the deposition of cover material on most recently active area.

New Liskeard Landfill

Observations

Photo taken from the top of New Liskeard Landfill, facing east.

Town of New Liskeard can be seen from the top of the landfill.

Contaminant attenuation zone (CAZ) located between landfill and town.

APPENDIX D

HAILEYBURY LANDFILL SITE PHOTOGRAPHIC LOG
SEPTEMBER 18, 2009

APPENDIX D
LANDFILL SITE INSPECTION - PHOTOGRAPHIC RECORD

PROJECT NO. TY91049

PROJECT Landfill Feasibility Study (Conceptual Assessment) Expansion of Existing Landfill Sites

LOCATION City of Temiskaming Shores, Ontario

Haileybury Landfill

Observations

Photo of Haileybury Landfill, facing northwest.

Photo shows location of construction material landfill on left.

Active landfill area shown on the right.

Central area reserved for construction debris and future landfilling.

Equipment building and operator's shed located to the right (off-photo).

Haileybury Landfill

Observations

Photo of Haileybury Landfill, facing south.

Photo showing site access gate and haul road.

Equipment building and operator's shed located to the left (off-photo).

Haileybury Landfill

Observations

Photo of Haileybury Landfill, facing east.

Photo showing active landfill disposal area and landfill operations

APPENDIX D
LANDFILL SITE INSPECTION - PHOTOGRAPHIC RECORD

PROJECT NO. TY91049

PROJECT Landfill Feasibility Study (Conceptual Assessment) Expansion of Existing Landfill Sites

LOCATION City of Temiskaming Shores, Ontario

Haileybury Landfill

Observations

Photo of Haileybury Landfill, facing east.

Wetlands located to the east of the active landfill area.

Haileybury Landfill

Observations

Photo of Haileybury Landfill, facing southeast.

West portion of landfill area is currently inactive with applied interim cover.

Photo showing construction material landfill.

Future landfill area located in the center.

Site equipment building and operator's shed shown on the left.

Haileybury Landfill

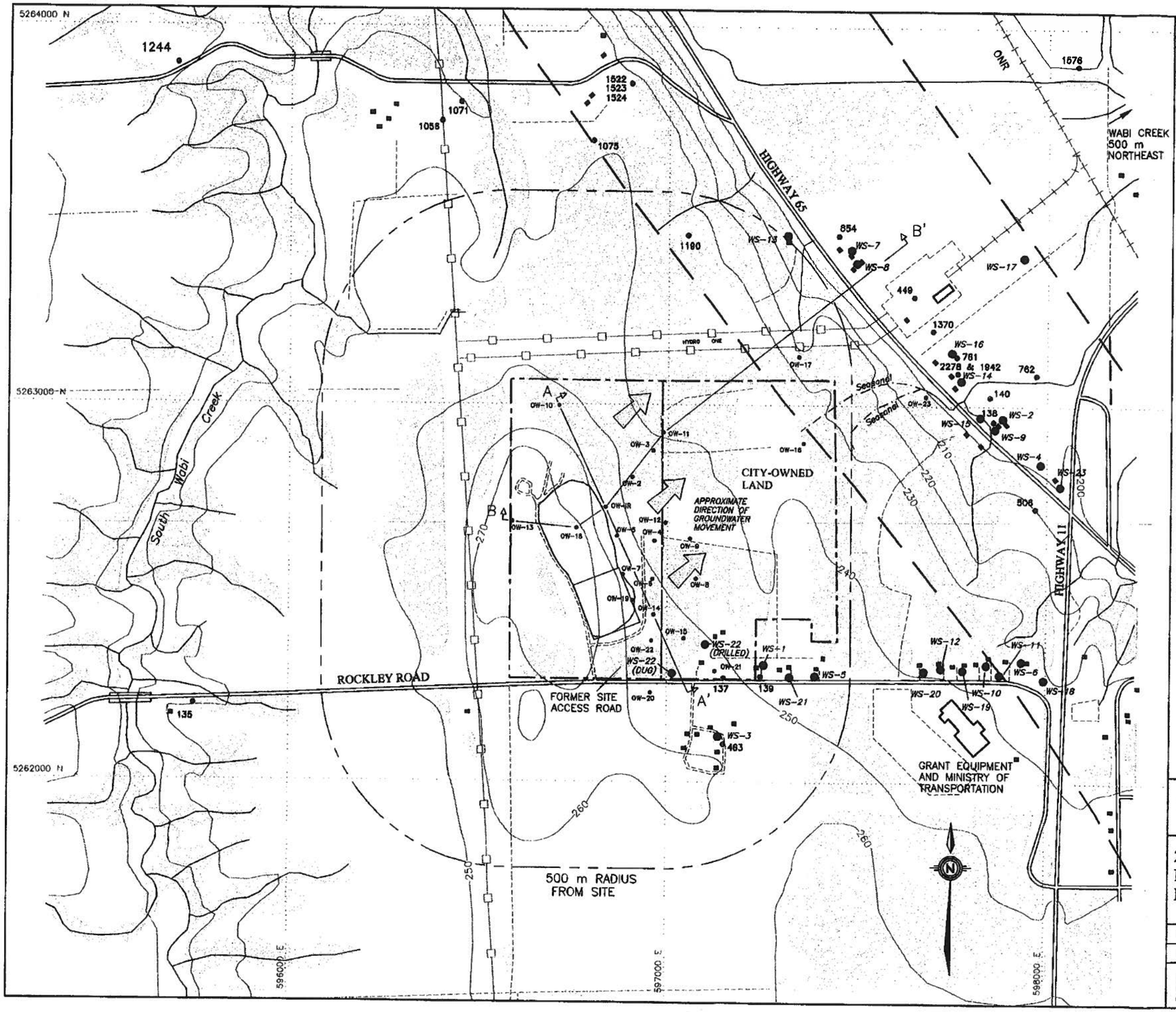
Observations

Photo of Haileybury Landfill, facing west.

Aggregate pit at natural gas pipeline located to the west of the property.

APPENDIX E

NEW LISKEARD LANDFILL
GROUNDWATER MONITORING WELL NETWORK



Legend

- LANDFILL PROPERTY BOUNDARY
- WASTE FILL AREA BOUNDARY
- REPORTED FAULT LINE
- 200 GROUND ELEVATION CONTOUR (mASL)
- SITE ROAD
- PUBLIC ROAD
- RAILROAD
- ELECTRIC POWER TRANSMISSION LINES
- WATERCOURSE
- FENCE
- ACTIVE WASTE FILLING AREA
- TREED AREA
- 140 SUPPLY WELL LISTED IN MOE WATER WELL DATABASE, LOCATION AND DESIGNATION
- WS-7 OFF-SITE SUPPLY WELL SAMPLED BY JAGGER HIMS LIMITED
- HOUSE OR PRIMARY BUILDING ON SATELLITE PHOTO (APPROXIMATE LOCATION)
- OW-10 GROUNDWATER MONITOR LOCATION AND DESIGNATION
- A A' LINE OF CROSS SECTION
- UTM COORDINATE LINE (NAD 27)

NOTES:

1. LOCATIONS OF SUPPLY WELLS MAPPED FROM MOE DATABASE AND GPS MEASUREMENTS BY JAGGER HIMS LIMITED STAFF. SOME MOE WELLS SHOWN IN SAME VICINITY MAY ACTUALLY BE THE SAME WELL.
2. SOME PROPERTIES ARE SHOWN WITHOUT A WELL, AND WELL(S) MAY BE PRESENT BUT NOT RECORDED.
3. INFORMATION FROM OBM BASE MAP SHEET 20 17 5900 52600, BASED ON 1982 AIR PHOTOGRAPHY.

100 0 200 metres

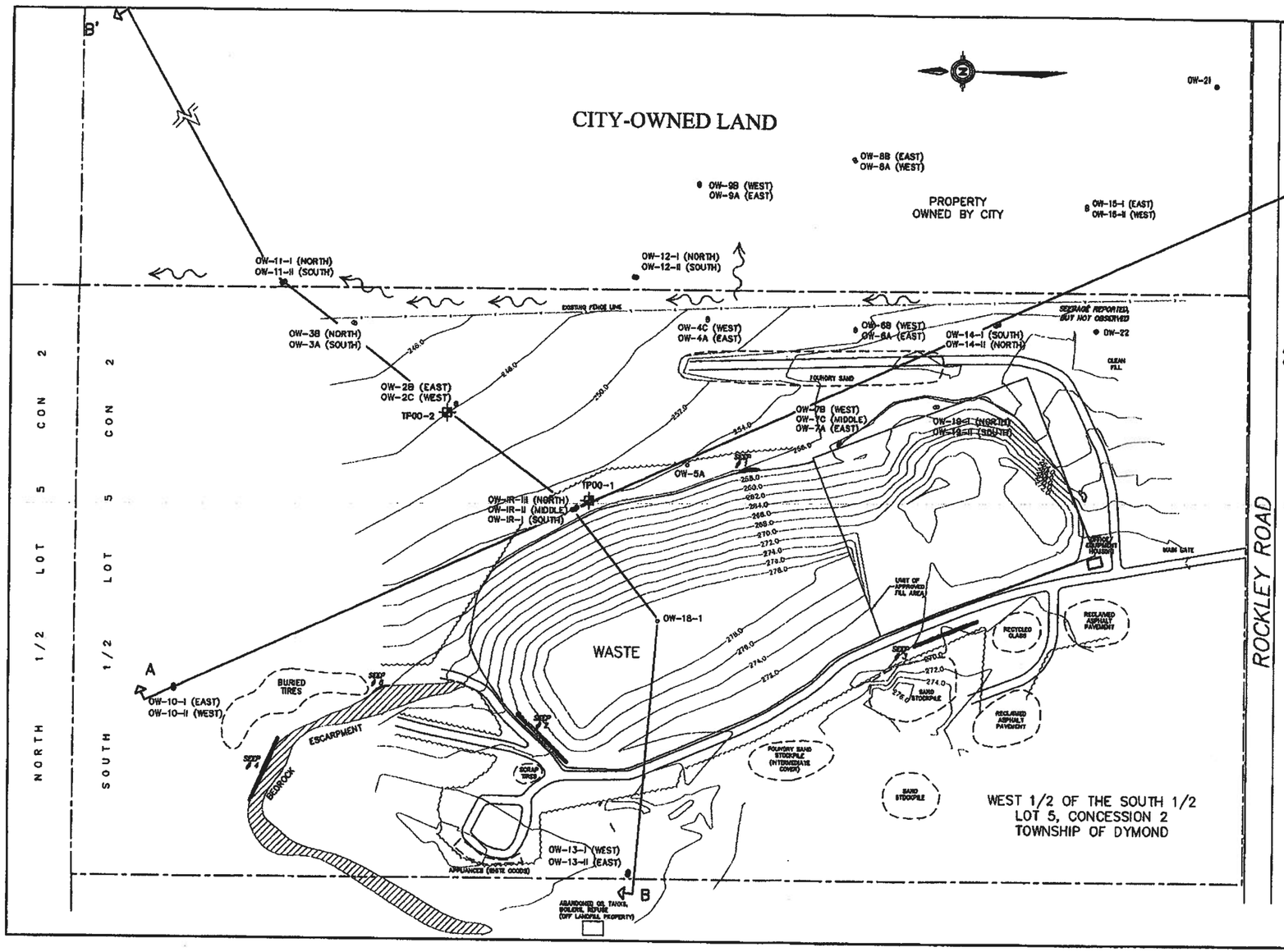
SITE MAP

2006 ANNUAL MONITORING REPORT
NEW LISKEARD LANDFILL SITE
For City of Temiskaming Shores

DATE: APRIL 2007	SCALE: 1:10,000
PROJECT: 001148.07	FILE NO.: 0-00114807F2-SP

JAGGER HIMS LIMITED
Environmental Consulting Engineers

Figure 2



Legend

- LANDFILL PROPERTY BOUNDARY
- WASTE FILL AREA BOUNDARY
- BURIED TIRES AND FOUNDRY SAND
- 252.0 GROUND ELEVATION CONTOUR (mASL)
- OW-5A (NORTH) GROUNDWATER MONITOR (RELATIVE POSITION)
- SURFACE WATER RUNOFF FLOW
- TP00-1 TEST PIT LOCATION AND DESIGNATION (LOCATION APPROXIMATE)
- A A' HYDROGEOLOGIC CROSS-SECTION
- SEEP #1 SEEPAGE ZONE (SEASONAL)

NOTES:

1. MONITORS OW-2 TO OW-9 INSTALLED FOR STUDY BY MORRISON BEATTY LIMITED, 1980/81.
2. MONITORS OW-1R, AND OW-10 TO OW-22 INSTALLED FOR JAGGER HIMS LIMITED STUDIES, 2000 TO 2004.

25 0 50 metres

LANDFILL SITE PLAN AND MONITOR NETWORK

2006 ANNUAL MONITORING REPORT
NEW LISKEARD LANDFILL SITE
For City of Temiskaming Shores

DATE: APRIL 2007	SCALE: 1:2500
PROJECT: 001148.07	FILE NO.: 0-00114807F3-SP

Jagger Hims Limited
Environmental Consulting Engineers

Figure 3

APPENDIX F

HAILEYBURY LANDFILL
WATER QUALITY MONITORING NETWORK

Note: new monitoring well (MW) and borehole (BH) locations are approximate until horizontal survey has been completed.

Scale (m)

0 50 100 150 200 250 300

Legend

- Monitoring Well / Borehole
- Fill Area
- Stream Gauge Site / Staff Gauge

PROFESSIONAL SEALS

I/R	YY/MM/DD	ISSUE/REVISION DESCRIPTION	DRN	CHK	DES	ENG	IDR	APP
0	08/04/17	Issued For Approval	ANM	KJK		MK		
P1	08/04/15	Issued For Review	ANM	KJK		MK		

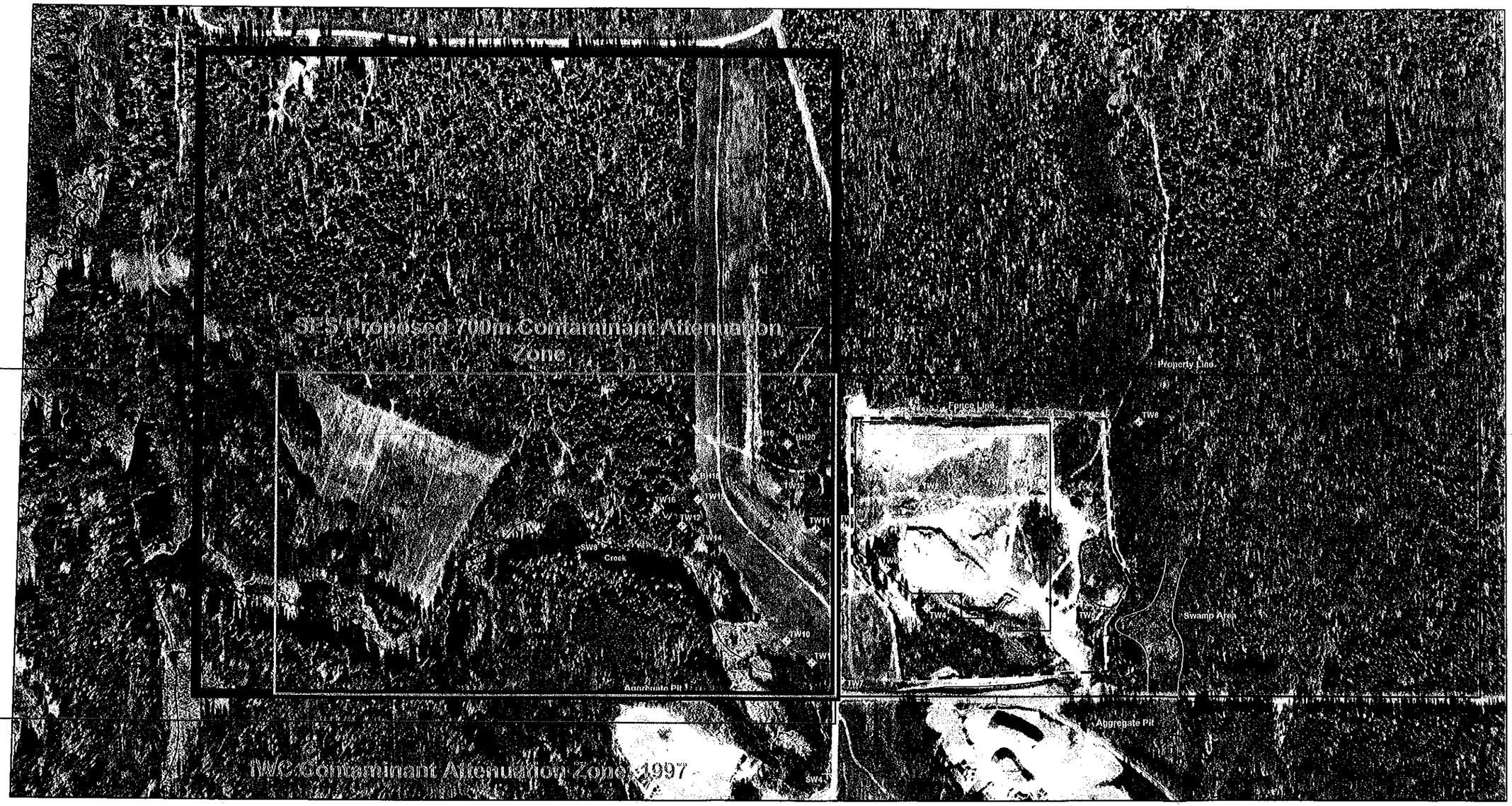
Story Environmental Services
770 Lakeshore Road S.
Haileybury, Ontario
P.O. Box 716, P0J 1K0
705-672-3324 telephone
705-672-3325 facsimile

Haileybury Landfill

Figure 2

Site Plan - Monitoring Wells and Other Features

PROJECT NUMBER	DRAWING NUMBER	ISSUE/REVISION
006-08	SES-00608-02	0



Notes:
1) New monitoring well (MW) and borehole (BH) locations are approximate until horizontal survey has been completed.
2) Due to the distortion inherent in the collection and mosaic presentation of aerial photographs the dimensions present within have relative amounts of error.
3) The dimensions of the IWC attenuation zone are based on a sketch and an area estimate of 50ha.

Scale (m)
0 50 100 150 200 250 300

Story Environmental Services

Contaminant Attenuation Zone

Revisions by: KJK	Scale: as shown	Drawing No.: 00615-06
Checked by: KJK	Date: 23 05 2008	Figure: 6

APPENDIX G

PROJECT LIMITATIONS

LIMITATIONS

1. The work performed in the preparation of this report and the conclusions presented are subject to the following:

   (a) The Standard Terms and Conditions which form a part of our Contract;
   (b) Work Plan and Fee Proposal for Engineering Services for the City of Temiskaming Shores Solid Waste Disposal Feasibility Study, dated June 19, 2009;
   (c) Time and Budgetary limitations as described in our Contract; and,
   (d) The Limitations stated herein.

2. No other warranties or representations, either expressed or implied, are made as to the professional services provided under the terms of our Contract, or the conclusions presented.

3. The conclusions presented in this report were based, in part, on visual observations of the site and attendant structures. Our conclusions cannot and are not extended to include those portions of the site or structures, which were not reasonably available, in AMEC's opinion, for direct observation.

4. The environmental conditions at the site were assessed, within the limitations set out above, having due regard for applicable environmental regulations as of the date of the inspection. A review of compliance by past owners or occupants of the site with any applicable local, provincial or federal by-laws, orders-in-council, legislative enactments and regulations was not performed.

5. The site history research included obtaining information from third parties and employees or agents of the owner. No attempt has been made to verify the accuracy of any information provided, unless specifically noted in our report.

6. Where testing was performed, it was carried out in accordance with the terms of our contract providing for testing. Other substances, or different quantities of substances testing for, may be present on site and may be revealed by different or other testing not provided for in our contract.

7. Because of the limitations referred to above, different environmental conditions from those stated in our report may exist. Should such different conditions be encountered, AMEC must be notified in order that it may determine if modifications to the conclusions in the report are necessary.

8. The utilization of AMEC's services during the implementation of any remedial measures will allow AMEC to observe compliance with the conclusions and recommendations contained in the report. AMEC's involvement will also allow for changes to be made as necessary to suit field conditions as they are encountered.

9. This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or contract. Any use which any third party makes of the report, in whole or the part, or any reliance thereon or decisions made based on any information or conclusions in the report, is the sole responsibility of such third party. AMEC accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on the report or anything set our therein.

10. This report is not to be given over to any third party for any purpose whatsoever without the written permission of AMEC.

11. Provided that the report is still reliable, and less than 12 months old, AMEC will issue a third-party reliance letter to parties client identifies in writing, upon payment of the then current fee for such letters. All third parties relying on AMEC's report, by such reliance agree to be bound by our proposal and AMEC's standard reliance letter. AMEC's standard reliance letter indicates that in no event shall AMEC be liable for any damages, howsoever arising, relating to third-party reliance on AMEC's report. No reliance by any party is permitted without such agreement.