Village of Cache Creek

Independent Review of the 2007 Annual Report for the Cache Creek Landfill
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Prepared by:

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Project Number:

GLL 80-162

Date:

January 2009
Statement of Qualifications and Limitations

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This Statement of Qualifications and Limitations is attached to and forms part of the Report.
January 13, 2009  Project Number:  GLL 80-162

Village of Cache Creek
1389 Quartz Road
P.O. Box 7
Cache Creek, BC   V0K 1H0
Attention: Ms. Natalie Aalderink

Dear Ms. Aalderink:


We are pleased to submit the final report of our independent review of the 2007 Annual Report for the Cache Creek Landfill prepared by Golder Associates Ltd. for Wastech Services Ltd. The primary objective of the review is to assess whether the operation of the Cache Creek Landfill meets the requirements set out in the Operational Certificate.

Thank you for the opportunity to assist the Village of Cache Creek once again with this important assignment. We trust this report meets your expectations and requirements.

Yours very truly,

AECOM Canada Ltd.

Rob Dickin, M. Sc., P. Geo.
Lead Consultant - Hydrogeology

RCD/RG:gc

Encl.
cc:

### Distribution List

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Executive Summary

AECOM (formerly Gartner Lee Limited) was retained by the Village of Cache Creek to complete an independent review of the 2007 Annual Report for the Cache Creek Landfill, prepared by Golder Associates. The primary objective of the review was to determine whether or not the landfill was operating under the conditions set out in the Operational Certificate (MR-7577). The 2007 Annual Report for the Cache Creek Landfill summarizes the operational, engineering and environmental activities at the Site during 2007 and the filling plan for 2008.

Monitoring of groundwater, leachate and landfill gas has been carried out based on the 2005 Operation and Closure Plan and recommendations from annual reports issued since that time.

AECOM provides the following conclusions following our review of the 2007 Annual Report for the Cache Creek Landfill:

1. The 2007 Annual Report meets the reporting requirements stipulated in Section 7.2 of the Operational Certificate. Overall the Cache Creek Landfill appears to be well managed.
2. The total tonnage of municipal solid waste discharged into the Cache Creek landfill during 2007 was reported to be 579,417 tonnes, about 20% more than in 2006 (481,313 tonnes). This increase in waste tonnage was due to the diversion of waste from the Vancouver Landfill to the Cache Creek Landfill during the garbage strike that occurred in Vancouver in 2007. The Annual Report indicates that the Operational Certificate was amended by the Ministry of Environment in October 2007 by increasing the 2007 maximum authorized discharge rate from 500,000 to 585,000 tonnes per annum. The actual 2007 waste discharge rate was within the annual discharge rate authorized by the Ministry of Environment.
3. The airspace consumed in 2007 was reported to be 689,981 m³. There was more than two years of lifespan remaining at the Cache Creek Landfill as of the end of 2007. It is estimated that the landfill will close in the fall or summer of 2010 depending on influencing factors including excavation, compaction and peak elevation.
4. Wastech inspects waste at Metro Vancouver transfer stations before loading the waste into trailers for transport and all other loads are inspected during spreading and compaction to ensure that wastes other than municipal solid waste (e.g., hazardous or biomedical wastes) are not discharged to the landfill.
5. Discharged municipal solid waste in 2007 was received from the Metro Vancouver Regional District, Cowichan Valley Regional District, Powell River Regional District, and Thompson Nicola Regional District in compliance with the Operational Certificate (i.e., from a source area within British Columbia).
6. Environmental protection monitoring (Section 5 of the Operational Certificate) for groundwater, leachate collection sump fluids and landfill gas is generally based on the requirements set out in the current Operations and Closure Plan. Some monitoring data are not available in the 2007 Annual report, e.g., the first quarter chemistry results for monitoring well OW2. Upgradient monitoring well TH3 was damaged in September and decommissioned in October 2007, thus it was not monitored in the fourth quarter of 2007. Installation of a new monitoring well to serve as a replacement well for TH3 should be considered. Two new downgradient monitoring wells – MW07-1A and MW07-1B – were installed in the fall of 2007 as replacement wells for MW03-1A and MW03-1B. The monitoring of the two new wells will start in 2008 according to the 2007 Annual Report.
7. Leachate management systems have been installed and are operated by Wastech to meet the requirements specified under Section 6 of the Operational Certificate. The volume of leachate pumped from the sumps in 2007 was about 752 m³ (increased from 568 m³ in 2006). The increase in total leachate quantity is largely attributed to Stage 4 operations and increased volumes collected at Sump #4, which was installed in 2002. The volume of liquid removed from Sump #4 had increased since 2004. Some leachate quality concentrations, e.g., chloride for Sumps #2 and #4 and dissolved nickel for Sump #4 continued to increase with time. This trend, in AECOM’s opinion, may continue as leachate continues to be recycled through the landfill.

8. The 2007 Annual Report indicated that methane concentrations at monitoring well locations OW1, OW3 and MW03-1, nearest the eastern boundary of the landfill site, were above 50% total methane (OW1-GP1 and MW03-1GP {4 of 4 dates in 2007 as in 2006} OW3-well {two of four dates}). This is more than ten times the BC Landfill Criteria for Municipal Solid Waste of 5% total methane (100% LEL) at the property boundary. These wells are the closest (10 m to 40 m) to the landfill property boundary and the 2007 gas monitoring results could be interpreted as non-compliance with the BC Landfill Criteria.

9. Methane concentrations in MW97-2 located 90 m east of the landfill property boundary were 42% LEL for GP1 and 48% LEL for GP2. There are off-site structures located within approximately 90 m east of the landfill based on Figure VI-19. The methane concentration in the facility should be closely monitored to ensure the 25% LEL criterion for on-site and off-site structures are met. Wastech staff indicated that the landfill gas collection system in this area may not have been operating at 100% efficiency for several months due to an inability to pump out the leachate. The sump could not be pumped because freezing temperatures prevented hydrogen sulphide treatment (work place safety issue).

10. Trichloroethene concentrations in the sand and gravel aquifer downgradient to the east of the landfill for 2006 and 2007 at well OW3 exceeded the recently revised, more stringent, BC Drinking Water Quality Guideline. OW3 is one of the closest monitoring wells to the property boundary in this area. Therefore, the available data could be interpreted that groundwater quality is not in compliance with the BC Landfill Criteria. Sulphide concentrations for all samples in 2007 at well MW03-1B met the BC Drinking Water Quality Guideline, as opposed to one exceedance in the first quarter of 2006.

11. Conductivity and chloride levels in downgradient off-site well OW2 have shown an increasing trend since 2000, with conductivity values consistently exceeding the drinking water criterion. Ammonia and alkalinity concentrations at this location, however, appear to be decreasing. Low VOC concentrations have been detected at overburden wells OW2 and OW4, but they do not exceed standards. Interpretation of leachate impacts is difficult at this site due to relatively poor and variable background water quality and the use of road salt for de-icing and magnesium chloride for dust control.

AECOM offers the following recommendations for consideration regarding the 2007 Annual Report and future reporting of landfill operations and monitoring results at the Cache Creek landfill.

1. Several new gas monitoring wells along the east boundary, between N9800 and N10100, are required to better assess gas concentrations along the eastern property boundary and to assess compliance with the BC Landfill Criteria of 100% lower explosive limit (5% total methane). We understand that the ditch and power lines makes installation of monitors on or near the property line difficult and alternative approaches for assessing compliance with combustible landfill gas criteria may need to be considered.

2. Additional investigation and development of appropriate mitigation measures are warranted to deal with landfill impacts on groundwater quality in excess of the BC Drinking Water Quality Guidelines (due to
the lowering of the trichloroethene standard) along the eastern property boundary near OW3. The installation of additional groundwater monitoring wells along the property boundary should be considered.

3. The applicability of the BC Contaminated Site Regulation (CSR) water quality and soil vapour standards at the boundary of the Cache Creek landfill should be determined including any required notification of existing or potential off-site impacts.

4. Explanations for some of the deviations from the environmental monitoring schedule in the current Operations and Closure Plan have been provided in the 2007 Annual Report (e.g., well TH3 was not monitored in the fourth quarter due to damage and was decommissioned in October 2007). However, explanations for other discrepancies (e.g., OW2 was not monitored for chemistry for the first quarter of 2007) were not found during the review. Clear explanations for all deviations from the Operations and Closure Plan monitoring requirements should be provided in future annual reports.

5. The municipal solid waste at the southeast corner of the landfill was discharged prior to 1993, when the BC Landfill Criteria came into effect. This waste appears to be closer than 15 m from property line and does not comply with the 50 m buffer requirement in the BC Landfill Criteria. If the opportunity appears in the future, it is recommended that additional property be acquired to meet the buffer requirements, current BC Landfill Criteria.
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1. Introduction

1.1 Background

The Village of Cache Creek retained AECOM (formerly Gartner Lee Limited) to complete an independent review of the 2007 Annual Report for the Cache Creek Landfill prepared by Golder Associates Ltd. (Golder, 2008). Landfill operations at Cache Creek began in early 1989 and by the end of 2007 the landfill had received 7.68 million tonnes of municipal solid waste.

The Cache Creek Landfill is managed by the Village of Cache Creek and Wastech Services Ltd. under the provisions of the Waste Management Act (Operational Certificate No. MR-7577 dated June 27, 1996 and amended November 14, 2003) and in accordance with the Thompson-Nicola Regional District Solid Waste Management Plan. The Operational Certificate stipulates that the Operations and Closure Plan must be updated every five years. As such, the previous 2000 Operations and Closure Plan was updated in 2005 (Golder, 2006b). The landfill operator continues to be Wastech Services Ltd. (Wastech). A copy of the current Operational Certificate is included in Appendix A for ease of reference.

1.2 Site Description

The Cache Creek Landfill is located within the Village of Cache Creek immediately west of the Trans Canada Highway. The property is trapezoidal with the north boundary being 415 m long, the west boundary 757 m long and the south boundary 825 m long. The east boundary (Trans Canada Highway) is approximately 860 m long. The property area is about 48 hectares with a slope rising from east to west. The legal description of the property is Block C of Section 18, Township 21, Range 24, Kamloops Division Yale District, West of the Sixth Meridian.

The lower portions of the Site are underlain by alluvial fan deposits while the upper portions are underlain by a relatively thin veneer of glacial and post-glacial deposits over bedrock. The landfill is located in an area of low precipitation (230 mm/year) and high evapotranspiration minimizing the potential for leachate generation. Surface water is diverted around the landfill through a series of ditches to minimize surface water contact with the refuse.

1.3 Scope of Work and Objectives

The following documents were provided to AECOM for review:

- Operational Certificate for the Cache Creek Landfill (MR-7577) (Appendix A);
- 2007 Annual Report, Cache Creek Landfill, Cache Creek, BC (Golder, 2008) (The report was first issued in March 2008 and revised in September 2008);
The objective of the independent review was to address the following questions:

- Does operation of the Cache Creek Landfill comply with the Operational Certificate based upon a review of the available data and records?
- Has the annual engineering report met the reporting conditions as specified in the Operational Certificate?
- Does the data appear to be properly interpreted and/or can the data be interpreted in another way?
- Are there data or comments in the annual report that are of potential concern?
- Are there any identifiable aspects of the landfill operation, that have not been reported, which may be significant?

The above questions are addressed in the following sections of our report.

1.4 Cache Creek Landfill Site Visit

A site visit to Cache Creek Landfill was conducted on June 23, 2008 by Mr. Rob Dickin and Mr. Robert Ge of AECOM. The following items were checked during the site walkover: overall cleanliness, recycling area, residential drop-off, active face operations, selected monitoring wells, leachate collection sumps, surface water control, closed landfill sections, off-site structures, borrow pits, etc. Mr. Tom Land (Wastech Landfill Manager) was interviewed about landfill operations during the visit. Selected photographs from the site visit are provided in Appendix B.

2. Review of Operational Certificate

A review of the Operational Certificate (OC) was completed to determine if operation of the Cache Creek Landfill complies with the Operational Certificate.

2.1 Municipal Solid Waste Management

The Cache Creek Landfill has been receiving waste since 1989; the majority of which originates from the Metro Vancouver Regional District and the Fraser Valley Regional District. Waste is also received from the Cowichan Valley Regional District, Powell River Regional District, and the Thompson-Nicola Regional District.
In 2007, a total of 10,843 tonnes of fly ash was placed in the Cache Creek Landfill, which was more than the 9,860 tonnes deposited in 2006. According to the current Operations and Closure Plan (Golder, 2006b), the MOE has approved placement of fly ash in the Cache Creek landfill provided it is treated with WES-Phix® and subject to the results of monthly analytical testing. Treatment of the fly ash and reporting of the analytical results to the MOE is the responsibility of the Waste-to-Energy facility operator. The 2007 Annual Report provides a summary of the chemical testing results for 13 fly ash samples that were collected by Montonay Inc. and analyzed by CANTEST in 2007. The Annual Report indicates the concentrations of metals that were analyzed for were either below detection limits or less than the leachate quality standards of the BC Environmental Management Act Hazardous Waste Regulation.

The 2007 Landfill operations are required to meet the requirements of a sanitary landfill as outlined in the Landfill Criteria for Municipal Solid Waste (MWLAP, 1993). The characteristics of waste discharged at the Cache Creek Landfill are specified in the Operational Certificate (OC). Waste materials not permitted according to the OC include:

- Hazardous Wastes as defined by the Hazardous Waste Regulations with the exception of asbestos;
- anatomical, pathological and untreated biomedical wastes as defined in the Guidelines for the Management of Biomedical Wastes in Canada;
- bulk liquids or semi-solid wastes which contain free liquids (e.g., septage, raw sewage or sewage sludge\(^1\)); and
- hog fuel, logs, yard debris and chipped wood waste.

All waste is inspected by a suitably trained Wastech Services Ltd. employee to ensure compliance with the OC prior to being disposed at the Cache Creek landfill. Wastech inspects all waste materials at the Metro Vancouver transfer stations and manages any unapproved wastes at those stations (i.e., removes them from the waste stream before transfer to Cache Creek). Municipal solid waste from the TNRD transfer stations that Wastech does not operate are inspected by the compactor operator at the tipping face as the material is unloaded. Wastech compactor operators are trained to recognize unacceptable waste materials and call the landfill supervisor for direction if any unapproved materials are identified. This includes hog fuel and log waste.

The permitted maximum waste discharge rate is 500,000 tonnes per year. Recyclable materials that are diverted from the landfill may be temporarily stored on-site prior to being transported off-site for reuse or processing.

2.2 Operating Requirements

Operating requirements are specified in Section 4 of the OC. Landfill design reports that have been reviewed and approved by the MOE are listed in Section 4.1.1 of the OC.

\(^1\) Discharge of sewage sludges from the Village of Cache Creek and Ashcroft has been approved in letter agreements by both the TNRD and the MOE.
The OC stipulates that a knowledgeable representative from the engineering design firm shall carry out field reviews of the landfill construction and installation of works (Section 4.1.5 of the OC). The design engineer of record for the Cache Creek Landfill is Golder Associates. Golder Associates’ lead design engineer, Mr. Colin Wong, P.Eng., visited the Site twice in 2007 (June 1 and October 23) to observe landfill construction and installation of works. Two site visits were conducted in 2007 to observe surface water drainage and the condition of drainage structures (by Mr. Bruce Kenning, P.Eng. of Focus on June 11 and October 29, 2007). Other site visits were carried out by Golder technical staff for compaction testing (QA/QC) of berm fill and soil liner construction.

Other landfill development and operational activities include:

- prevention of surface water run-on and management of run-off from the Site;
- surface preparation and placement of 1 m thickness of compacted soil liner;
- placement of waste at the working face in layers with a maximum thickness of 0.6 m, followed by compaction;
- application of 0.15 m daily cover (in areas where filling ceases for more than 24 hours) and 0.30 m of intermediate cover (in areas where filling ceases for more than 30 days and/or after a 3 m platform has been filled);
- application of final cover within 30 days of placement of waste to design elevations; and
- landfill management for site security, litter, dust and odour control, vector control, as well as regular inspections by the landfill supervisor.

Wastech employs landfill operators, supervisors and management staff to meet the above operational requirements.

Based on observations made during our site visit on June 23, 2008 we note that the Site is equipped with locking gates at access points in accordance with the OC.

### 2.3 Monitoring Requirements

The OC stipulates that monitoring of ground and surface water, leachate collection sump fluids and landfill gas shall be carried out in accordance with the monitoring program in the approved Operations and Closure Plan (OCP). Current monitoring requirements are summarized below.

#### 2.3.1.1 Surface Water

Surface water diversion structures are in place to minimize surface water contact with waste. When surface water is flowing in the diversion works, the flow is generally insignificant in volume and short in duration so surface water monitoring is not required at the Site.
2.3.1.2 Groundwater

Eighteen groundwater monitoring wells (TH1A, TH1B, TH3, TH5, TH6, TH9A, TH9B, TH10, OW1, OW2, OW3, OW4, MW305, MW97-1, MW03-1A, MW03-1B, MW03-2A and MW03-2B) are monitored for liquid levels on a quarterly basis using an electronic water level probe. Monitoring well TH3 was decommissioned on October 24, 2007 and was not monitored in the fourth quarter of 2007. It is recommended to consider installing a new monitoring well as a replacement for TH3.

Groundwater samples are collected from the monitoring wells according to the following schedule:

- **Quarterly**: downgradient wells TH3 (not sampled in October), TH6, OW1, OW2, OW4, MW03-1B and MW03-2A
- **Semi-annually**: upgradient wells TH1A, MW305 and MW97-1 (if sufficient water)
- **Annually**: downgradient wells TH9A, TH9B and OW3 (if sufficient water)

The groundwater samples are analyzed for leachate indicator parameters including pH, conductivity, hardness, alkalinity, total dissolved solids (TDS), total suspended solids (TSS), total organic carbon (TOC), biological oxygen demand (BOD), chemical oxygen demand (COD), nitrate, nitrite, ammonia, major anions (sulphate, chloride, fluoride, and sulphide), major cations (calcium, magnesium, sodium and potassium), dissolved metals and total mercury. Samples from all wells listed above are also analyzed for volatile organic compounds (VOCs) on a semi-annual basis.

2.3.1.3 Leachate

A sample of fluid from each of the leachate collection sumps is collected quarterly and submitted for analyses for the leachate indicator parameters included in the groundwater monitoring program.

2.3.1.4 Landfill Gas

Field monitoring for landfill gas is completed on a quarterly basis at the monitoring wells and gas probes (GP) identified in the following table (Table 2-1):

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<th>Field Monitoring Location</th>
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Landfill extraction wells, sumps, and monitoring locations identified with an asterisk (*) are monitored by Wastech as part of the operational monitoring of the landfill gas management system.

Monitoring involves measuring the pressure in each well and measuring the concentration of methane, oxygen and carbon dioxide using a landfill gas monitor. In addition, the concentration total organic vapours and hydrogen sulphide is also monitored on a quarterly basis.

2.4 Reporting Requirements

Reporting requirements are outlined in Section 7 of the OC.

2.4.1 Interim Reporting

The monitoring results of the groundwater elevations, leachate collection sump fluid levels and gas monitoring as well as the results of the analyses for groundwater, sump fluid and gas samples are to be available for inspection at the Wastech Cache Creek Landfill office. The above monitoring and sampling data are to be submitted to the MOE Regional Waste Manager on a quarterly basis.

2.4.2 Annual Reporting

An Annual Report must be submitted to the MOE each year for the previous calendar year of landfill operations (or post-closure activities). The Annual Report shall provide the following information:

- proposed changes to the approved plans and/or design;
- compacted volume and tonnage of waste discharged and remaining capacity;
- sources of the waste;
- review and interpretation of the analytical data from monitoring of the leachate collection system sumps, groundwater, and landfill gas;
- summary of the landfill inspection reports; and
- proposed amendments to the monitoring programs.

Section 4.1.5 of the OC also outlines the requirement for preparation and submission of as-built drawings of the landfill. The Annual Report is an appropriate document for submitting as-built drawings to the MOE. Figure 1 in the 2007 Annual Report presents a plan view of a survey carried out in December 2007. The approximate limit of refuse has been added to this figure. We understand that no waste has been placed outside the property boundary although at the southeast corner of the site, the waste discharged before 1993 (when the BC Landfill Criteria for Municipal Solid Waste came into effect) appears to be closer than 15 m from the property line on Figure 1. Figure 8 presents a plan view of the existing and proposed (i.e., future) landfill gas extraction system including gas extraction wells and collection piping and future expansion plans. Figures in Appendix IV present a record of existing surface water drainage works at the Site.

Copies of the annual report shall be provided to the public libraries in Ashcroft and Cache Creek.
2.5 Post-Closure Security Requirements

Post-closure security requirements are specified in Section 8 of the OC. A post-closure monitoring, maintenance and repair fund has been established and is administered by the Director of Waste Management for the benefit of the Village of Cache Creek. Contributions to the fund are obtained from tipping fees for waste originating out of the local area of Cache Creek as per the schedule in Section 8 of the OC. Monies are to be collected by Wastech and deposited quarterly. AECOM has not reviewed 2007 or prior contributions to the fund and/or the balance of the trust fund. Assessment of the fund and contributions is beyond our approved scope of work.

3. Review of Landfill Operations

The 2007 Annual Report prepared by Golder Associates was reviewed. A site visit was conducted on June 23, 2008 to observe conditions and general operating procedures at the Cache Creek Landfill. The following sections summarize our review of the Annual Report and landfill operations.

3.1 Discharged Waste

The waste quantity discharged in 2006 was reported to be 579,417 tonnes, which is beyond the annual authorized discharge rate of 500,000 tonnes.

The waste originated from five regional districts as indicated below:

- Metro Vancouver Regional District 539,740 tonnes (93%)
- Fly ash 10,843 tonnes (2%)
- Cowichan Valley Regional District 19,041 tonnes (3%)
- Powell River Regional District 5,100 tonnes (1%)
- Thompson-Nicola Regional District 4,693 tonnes (1%)

Total 579,417 tonnes (100%)

The OC indicates that the waste accepted at the Cache Creek landfill may originate from any area within British Columbia, subject to two conditions. First, the source area must be stipulated in the Thompson-Nicola Regional District Solid Waste Management Plan, and second, the export of waste must stipulated in the Regional Solid Waste Management Plan from which the waste originated. Although AECOM was not provided copies the solid waste management plans for the above regional districts, it is assumed that the above regional districts are permitted to export waste to the Cache Creek Landfill under their respective solid waste management plans.
The consumed airspace in 2007 was calculated to be approximately 689,981 m³ (based on topographic surveys completed in December 2006 and December 2007). This is more than the 632,110 m³ consumed in 2006.

### 3.2 Landfill Design Capacity and Remaining Lifespan

The total available landfill capacity is reported to be about 11.4 million m³ (the same as stated in the 2005 Operations and Closure Plan). Appendix I of the 2007 Annual Report provides a summary of airspace consumed in 2007 and remaining airspace volume for continued landfill operations. A total of 689,981 m³ of airspace was consumed during 2007 not including volume gained through waste settlement. The estimated remaining airspace is about 1.7 million m³. Thus, the landfill is reported to have an estimated lifespan of more than two years, assuming an average filling rate of about 500,000 tonnes of waste placed or about 680,000 m³ of airspace consumed per year.

### 3.3 2008 Filling Plan

Figures 2 through 6 present plan views of the proposed filling plan through the end of the fourth quarter of 2008. The filling plan indicates that in 2008 waste will be placed within Stage 4 to an elevation of 643 m. This represents placement of approximately four new platforms, each with a height of about 3 m, for a total rise of about 12 m during 2008 (from between 629 and 633 m at end of 2007). Construction of the 630 and 650 m bench access roads will be completed in 2008. The sequence of waste placement and road development appears logical.

### 3.4 Waste Placement, Compaction and Cover Material

Transfer trailers are brought up to the working cell and placed onto a tipping platform. After tipping, the waste is spread with a steel wheeled compactor and screened for unacceptable materials. Once the operator is satisfied that the waste is acceptable, it is pushed over to the active face in separate lifts and compacted. Approximately three passes of the compactor are made over each lift of waste, however the operator is trained to recognize when additional compaction effort is required. Approximately five to six lifts of waste comprise a 3 m high platform.

The Annual Report states that in 2007 cover soil originated from two sources, the North Borrow Pit and the Airport Borrow area. The total quantity of cover material excavated from the North Borrow Pit in 2007 was reported as approximately 45,034 m³. The volume of cover material excavated from the Airport Borrow area in 2007 was about 35,325 m³. Using the total volume of cover material of 80,359 m³ and an estimated airspace volume of 689,981 m³ consumed in 2007, the volume of waste placed was about 609,622 m³ (not including settlement volume) indicating that good compaction is being achieved. Golder estimates that approximately 91,675 m³ of cover materials will be obtained from the North Borrow Pit in 2008. No cover soil will be obtained from the Airport Borrow Area in 2008.
Daily cover is not normally required since the landfill operates 24 hours per day. Interim soil cover (of 0.3 m thickness) is applied to areas where waste disposal is not anticipated for 30 days or more. In practice the active face is covered with 0.3 m of interim soil cover after filling (i.e., lift placement and compaction) has progressed to the top of the current platform.

3.5 Dust Control

It was reported that dust control measures include the use of a water truck and application of chemical dust suppressant (magnesium chloride). A total of 170,000 litres of magnesium chloride solution was reportedly used for the off-landfill access roads for dust control in 2007. Only water was used to control dust within the landfill footprint. The Landfill Advisory Committee (LAC) and Village of Cache Creek inspection reports do not indicate that lack of dust control was a problem at the landfill in 2007. It was observed during AECOM’s site visit that dust control at the site was effective.

3.6 Litter Control

The use of temporary litter control fencing and daily collection of litter from fencing, ditches and roadways are described in the Operations and Closure Plan. The LAC and Village of Cache Creek inspection reports indicated that litter was either being blown or was scattered around the landfill on site inspections. Litter was found at the access road and entrances in windy weather. The condition, however, was rated acceptable or good in most of the inspection reports. It is impossible to totally stop litter from being blown by wind, however; the current litter control measures (maintaining a small active face, using litter fencing and litter pickers) appears to be working satisfactorily most of the time. AECOM’s site visit indicated that litter control at the site was effective in general although litter was found in some ditches and depressions.

3.7 Vector Control

The annual report indicated no significant rodent problems at the landfill. Wastech contracted monthly inspections and rodent control to PCO Services Corporation. Rodent activity was reported at the tippers, truck wash and public disposal area at different times. However, control measures (e.g., applying bait and installing traps) had been taken. Our review of the landfill inspection reports completed by the Landfill Advisory Committee (LAC) and the Village of Cache Creek staff indicated that rodents have not been observed during landfill inspections.

Bird control is achieved by maintaining a small working face, regular application of cover soil, and active equipment (motion deters birds from the active face). A “bird banger” is used by Wastech when required. Some of the landfill inspection reports completed by the LAC and the Village of Cache Creek staff indicated that significant numbers of birds were observed on some of the inspections (e.g., on February 15, March 14, October 18, November 24, and December 11). The 2007 Annual Report notes the importance of continued bird control measures, in part, due to the Cache Creek airstrip located about 800 m from the landfill. If a high
number of birds are observed at the landfill then landfill management or operating staff should be notified immediately so that active bird control measures may be implemented.

3.8 Public Disposal and Recycling Area

Access to the public disposal area is not controlled, however it is considered likely that only local residents use the facility. When the drop-off bin is full, Wastech transports the bin up to the active face and the municipal solid waste is placed into the landfill. The LAC and Village inspection reports indicated several days when the access road was muddy. Several inspection reports indicated the recycling bags were almost full. However the public disposal area appears to be generally well run.

A recycling area is provided near the public disposal area to accept lead-acid batteries, corrugated cardboard, white goods, newsprint, metals, tires, mixed paper and Type 2 plastic (high density polyethylene). We understand that Wastech contracts transport of the recyclable materials to markets in Kamloops and the Metro Vancouver area.

4. Review of Environmental Controls

4.1 Surface Water Management

Surface water diversions and drainage works are required to ensure water is kept away from the waste. Two levels of surface water drainage (primary and secondary) are now required at the landfill. The tertiary surface water drainage system is no longer required because the catchment area between the landfill and upper secondary storm water system is small.

As part of the storm water management plan, field inspections of the drainage system are carried out by the Wastech site manager after each run-off event or at least semi-annually. These inspections are augmented by a semi-annual inspection of the drainage works on the landfill property by a professional engineer specializing in hydrology. Recommendations stemming from the engineer’s semi-annual review are implemented by Wastech and documented.

The semi-annual inspections were undertaken by Focus Corporation Ltd. (included in Appendix IV of the 2007 Annual Report). The first inspection was completed on June 11, 2007 and at that time the surface water diversion works and internal drainage structures were in good condition. All maintenance items requiring attention at that time were minor (e.g., excavating sediment traps, installing riprap water bars, and diverting surface drainage from active dump face). The second inspection was carried out on October 29, 2007, and at that time the surface water diversion works continued to remain in good operating condition. Only minor non-urgent maintenance work was required. Based on the 2007 inspection records, as long as Wastech
continues to address maintenance items and recommendations efficiently, the surface water management system at the landfill should continue to function well.

4.2 Leachate Management

The Cache Creek landfill was constructed with sumps at the bottom of each landfill stage. Leachate collects in the sumps and is automatically pumped into fiberglass underground storage tanks. The system was designed to keep leachate levels in the landfill low resulting in less head on the liner systems. The leachate holding tanks are equipped with liquid level monitoring systems and alarms that indicate when the tanks are full. When the tanks are near capacity they are pumped out with a vacuum truck and the leachate is deodorized and sprayed onto areas of the landfill covered with interim cover where it evaporates and/or seeps back into the waste. The volume of leachate captured from the four sumps in 2007 and recirculated to the landfill was 752 m³.

Leachate samples were collected from the sumps as part of the 2007 environmental monitoring program. The leachate samples generally have elevated concentrations of common leachate indicator species including electrical conductivity, hardness, total dissolved solids (TDS), alkalinity, chloride, sulphate, metals and volatile organic compounds (VOCs), however leachate chemistry has been more variable than groundwater chemistry.

Total VOC concentrations in the sumps have shown a high degree of variability over the years of historic monitoring with concentrations in the sumps ranging from 57.78 μg/L (at Sump 3) to 12,285.5 μg/L (at Sump 4) in 2007. High total VOC concentrations measured in the recently installed Sump 4 are lower than those measured in 2006 and are primarily composed of 2-butanone (methyl ethyl ketone or MEK), which is consistent with previous patterns of initially high concentrations of 2-butanone in the other sumps that decreased with time.

High hydrogen sulphide (H₂S) concentrations were measured at the leachate tank for Sump 2 in January 2007 (300 ppm from one of the tank ports by Wastech and 30 ppm when a lid on the tank was lifted by Golder). Golder recommended a standard sampling procedure and carried out sampling work in February 2007. Recommendations for treatment of H₂S was made in March 2007 by Golder. Treatment of H₂S in the leachate in the Sump 2 tank was carried out in June 2007 by Golder Associates Innovates Applications Inc. The treatment of the leachate in the Sump 2 tank has been carried out by Wastech since then to ensure safety. The 2007 annual report indicates the H₂S concentrations in the Sump 2 tank are expected to remain high. AECOM recommends to closely monitor the Sump 2 leachate tank and the tanks for the other three sumps to ensure safety. Inability to pump out Sump 2 for safety reasons can result in rising leachate levels and possibly less effective gas collection in the area due gas collector well screen submergence.
4.3 Landfill Gas Management

Landfill gas (LFG) is generated during decomposition of organic refuse and is generally composed of about equal parts methane and carbon dioxide with trace concentrations of oxygen, nitrogen, hydrogen sulphide and non-methane organic compounds (NMOC). Management of landfill gas is a requirement of the BC Landfill Criteria for Municipal Solid Waste (MWLAP, 1993) under certain conditions for protection of the environment, human health and safety (i.e., explosive hazard). Collection and flaring of landfill gas is carried out to control the subsurface migration of landfill gas (i.e., methane) beyond the landfill property, which also results in reduced greenhouse gas and NMOC emissions to the atmosphere.

One of the primary objectives of the landfill gas management plan is to prevent the migration of LFG from the landfill property. Another objective of the LFG management plan is to ensure that the concentration of combustible gas (i.e., methane) is less than the lower explosive limit (LEL) at the landfill property line. The LEL is defined as a concentration of 5% methane gas by volume. Therefore, 100% LEL is equivalent to a methane concentration of 5%. The BC Landfill Criteria (MWLAP, 1993) requires that the concentration of combustible gas (i.e., methane) is less than 25% LEL in any on-site structure for the protection of workers.

The landfill gas management system consists of 59 landfill gas extraction wells, a series of gas collection headers and condensate drip legs, a condensate collection tank and candlestick flares. The landfill gas extraction wells (except wells A-14, A-15, A-32, A-39 and A-40), flare(s) and leachate sumps are monitored at least once a month by Wastech staff for methane, carbon dioxide, oxygen and balance gases. Groundwater monitoring wells and gas probes are monitored at least once a month for landfill gas concentrations. Landfill gas monitoring is also conducted in structures around the landfill as well as at facilities adjacent to the landfill property.

Gas concentration versus time was plotted for the extraction wells, flare, sumps and six of the other wells are provided in Appendix III of the 2007 Annual Report. The landfill gas monitoring results are presented and discussed in Appendix VIII of the 2007 Annual Report.

4.3.1 Landfill Gas Flaring Operations

The 2007 Annual Report indicates that approximately 7.5 million standard cubic meters of landfill gas were collected and flared and that approximately 55% of this volume was methane gas representing about 156 TJ (148 billion BTU) of energy.

4.3.2 Landfill Gas Composition

The gas concentration vs. time plots for the extraction wells, flare station and the sumps included in Appendix III provide information on landfill gas composition. The gas concentrations vs. time plots indicate that the composition of the landfill gas varied from well to well and with time. Generally, the average landfill gas composition was approximately 55% methane, 38% CO₂, and 7% balance gases and O₂. This composition of landfill gas is typical based on reported ranges in the literature. Temporary spikes and fluctuations of gas composition may be a result of local changes (anaerobic to aerobic) at the wells.
atmospheric condition (high/low pressure systems), operational conditions (vacuum may eventually draw atmospheric air) or some combination of these influences.

4.3.3 Landfill Gas Monitoring Results

The results of the landfill gas monitoring program were summarized in Appendix VIII of the Annual Report. Methane levels are recorded as a percentage of the lower explosive limit (%LEL) and for higher concentrations as a percentage of the headspace vapour samples (% total methane). Five percent (5%) total methane is considered to be equivalent to 100% LEL. The BC Landfill Criteria for Municipal Solid Waste (Section 6.4) state, “At no time should combustible gas concentrations be allowed that exceed or are predicted to exceed the lower explosive limit in soils at the property boundary or 25% of the lower explosive limit at or in on-site or off-site structures.” Thus the criteria for compliance in soil at the property boundary is 100% LEL or 5% total methane.

The results were broken into geographic areas around the landfill. Methane concentrations in wells on the west and upper slope of the landfill remained low in recent years but gas concentrations of 29% LEL were detected in January 2007 at TH5 (20 m south of property boundary). The result is interpreted to indicate that off-site gas migration is occurring but the available information does not indicate that the Landfill Criteria have been exceeded at the property boundary.

Methane concentrations at the northeast end of the landfill were below detection in 2007 suggesting compliance with the Landfill Criteria in this area.

Methane concentrations east of the landfill but inside the landfill property boundary were greater than the 100% LEL Landfill Criteria in 2007. Total methane concentrations were frequently above 60% methane (12 times the Landfill Criteria of 5% total methane). The high concentrations above 100% LEL at OW1, OW3 and MW03-1-GP gas probes (located on-site near the east property boundary) are interpreted to indicate that the landfill may not be in compliance with the Landfill Criteria for methane along this property boundary.

Methane concentrations further east at MW97-2-GP1 (90 m east of the landfill property) were 6% LEL for July and 42% LEL for October in 2007. Methane concentrations in MW97-2GP2 located 90 m east of the landfill property boundary were 0%, 37%, 4% and 48% LEL on the four monitoring dates in 2007. Based on Figure VI-19 there appears to be off-site structures located within 90 m of the landfill. The BC Landfill Criterion for on-site and off-site structures is 25% LEL. These results could be interpreted as off-site landfill gas migration that exceeds the 25% LEL limit for off-site buildings on the property to the east. Additional gas monitoring wells in this area (e.g., along the east boundary) are required to better assess compliance and to quantify the risk of gas migration to adjacent properties.

Methane was detected at OW2-GP1 in one of the 4 monitoring events in 2007, which was at 4% LEL. Methane was detected before 1998 (up to 24% LEL) at the same location and was not detected during 1999 - 2006. More monitoring results is needed to assess the migration of methane at this location.

No methane was detected in the air space beneath the Wastech office, shop, truck wash building or the Casidio and Son Holding Co Ltd. office trailer.
4.3.4 Gas Migration Issue

Landfill gas concentrations along the east of the landfill may be related to high hydrogen sulphide in the leachate collection tank for Sump 2. AECOM discussed the high hydrogen sulphide issue with Mr. Tom Land (Wastech) during the site visit and he inferred that high hydrogen sulphide in the tank might indirectly contribute to off-site gas migration. According to Mr. Land, H$_2$S could not be treated during the winter (approximately three months) due to the fact that low temperature caused deposition of treatment chemicals from solution leading to difficulty in adding chemicals into the tank. As a result, the leachate in the tank was not removed for three months and leachate levels rose in the sump. The rising leachate level may have blocked the screen of at least one gas extraction well and may have reduced the gas extraction efficiency. This may have led to a higher gas pressure within the landfill and promoted gas migration to the east.

Mr. Land indicated that Wastech was working on a solution to this problem.

5. Review of Groundwater Monitoring Results

5.1 Groundwater Flow

During the design of the Cache Creek Landfill, two related groundwater flow systems were identified beneath the Site: one in fractures in the relatively tight bedrock and the second at the bedrock-overburden boundary. Bedrock is relatively close to the ground surface over much of the Site. East of the landfill, in the area of the Wastech office and the highway, bedrock forms a channel that is infilled with glacial and post-glacial sediments and slopes southeastwardly, away from Cache Creek.

Groundwater levels were measured quarterly in 18 monitoring wells (except well TH3) during 2007. The 2007 Annual Report indicates monitoring well TH3 was damaged by earth moving equipment and was decommissioned in October 2007. The groundwater elevation data are presented in Table VI-2 of the 2007 Annual Report. Appendix VI presents plots showing water table elevation vs. time for 16 monitoring wells (Figures VI-3 through 18) and a groundwater elevation contour plan (Figure VI-19). Table 5-1 below provides a summary of groundwater monitoring wells, their location relative to the landfill and the frequency of sample collection.

AECOM agrees with the interpretation of groundwater flow direction in the vicinity of the landfill presented on Figure VI-19 in the 2007 Annual Report. Upslope of the landfill, a strong downward hydraulic gradient was consistently measured in TH1A and TH1B (Figure VI-20), which indicates that groundwater recharge occurs in this area. Groundwater recharge (downward flow) is expected to occur below most or all of the landfill. Lateral groundwater flow in the landfill area is to the east and northeast perpendicular to the landfill slopes.
### Table 5-1. Groundwater Monitoring at the Cache Creek Landfill in 2007

<table>
<thead>
<tr>
<th>Well</th>
<th>Location</th>
<th>Frequency of Sampling</th>
<th>Water Level Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH1A</td>
<td>Upgradient</td>
<td>Semi-Annual</td>
<td>Quarterly</td>
</tr>
<tr>
<td>TH1B</td>
<td>Upgradient</td>
<td>N/A</td>
<td>Quarterly</td>
</tr>
<tr>
<td>TH3</td>
<td>Upgradient</td>
<td>Semi-annual 2007/ Discontinued</td>
<td>Quarterly/ Discontinued</td>
</tr>
<tr>
<td>TH5</td>
<td>Upgradient</td>
<td>N/A</td>
<td>Quarterly</td>
</tr>
<tr>
<td>TH10</td>
<td>Upgradient</td>
<td>N/A</td>
<td>Quarterly</td>
</tr>
<tr>
<td>MW305</td>
<td>Upgradient</td>
<td>Semi-Annual 2</td>
<td>Quarterly</td>
</tr>
<tr>
<td>MW97-1</td>
<td>Upgradient/Cross-Gradient</td>
<td>Semi-Annual 2</td>
<td>Quarterly</td>
</tr>
<tr>
<td>TH6</td>
<td>Downgradient</td>
<td>Quarterly 2</td>
<td>Quarterly</td>
</tr>
<tr>
<td>TH9A</td>
<td>Downgradient</td>
<td>Annual 2</td>
<td>Quarterly</td>
</tr>
<tr>
<td>TH9B</td>
<td>Downgradient</td>
<td>Annual 2</td>
<td>Quarterly</td>
</tr>
<tr>
<td>OW1</td>
<td>Downgradient</td>
<td>Quarterly 2</td>
<td>Quarterly</td>
</tr>
<tr>
<td>OW2</td>
<td>Downgradient</td>
<td>Quarterly 2</td>
<td>Quarterly</td>
</tr>
<tr>
<td>OW3</td>
<td>Downgradient</td>
<td>Semi-Annual 2</td>
<td>Quarterly</td>
</tr>
<tr>
<td>OW4</td>
<td>Downgradient</td>
<td>Quarterly – 3 times 2</td>
<td>Quarterly</td>
</tr>
<tr>
<td>MW03-1A</td>
<td>Downgradient</td>
<td>NOT Sampled Quarterly 2</td>
<td>Quarterly</td>
</tr>
<tr>
<td>MW03-1B</td>
<td>Downgradient</td>
<td>Quarterly 2</td>
<td>Quarterly</td>
</tr>
<tr>
<td>MW03-2A</td>
<td>Downgradient</td>
<td>Quarterly 2</td>
<td>Quarterly</td>
</tr>
<tr>
<td>MW03-2B</td>
<td>Downgradient</td>
<td>N/A</td>
<td>Quarterly</td>
</tr>
</tbody>
</table>

1: When sufficient water available.

Groundwater elevations measured at downgradient wells in the valley (TH9A and TH9B) indicate a slight upward gradient, which suggests a zone of groundwater discharge at this location in the valley bottom. In the valley to the east and south of the landfill the direction of groundwater flow is to the southeast. The southeastern flow is interpreted as following the bedrock depression that underlies the valley at the toe of the landfill.

Water levels measured in 2007 are generally consistent with recent trends. Groundwater levels in upgradient wells TH1A, TH1B and MW3005 appear to be consistent with previous data and do not show consistent rising or declining trends. A slight declining trend in water levels since the early 1990’s was noted at TH5 south of the landfill, which Golder attributes to changes in the drainage system. Some of the downgradient monitoring wells near the landfill appear to have a very slight increasing trend in water levels since 1990.

Water level monitoring was restarted at TH3 in 2006 (no monitoring in 2005 due to access issues) and was continued in 2007. Based on the available monitoring data, there is a steep trend of rising water levels at TH3 with an increase of more than 8 m since 1997. This water level data was discussed with Golder and Wastech in 2007 and was considered to be anomalous. Monitoring well TH3 was decommissioned during 2007 due to damage from earth moving equipment.
5.2 Groundwater Chemistry Results

The OC states that the requirements for groundwater monitoring shall be carried out in accordance with the monitoring program approved in the Operating and Closure Plan. The 2005 Operating and Closure Plan (Golder, 2006b) outlines the current groundwater quality monitoring program. Groundwater quality data were compared to the British Columbia Water Quality Guidelines (BCWQG). The applicable BCWQG criteria depend on the downgradient use of groundwater. Groundwater downgradient of the landfill flows beneath the Tolko Industries chip mill industrial property that does not have any active drinking water wells. Beyond the chip mill property, groundwater could be used by other land owners for livestock watering and irrigation. As a result, the 2007 Annual Report compares groundwater chemistry results to Drinking Water, Irrigation and Livestock criteria.

In the 2007 Annual Report, Golder indicates that observed trends in groundwater chemistry were mostly consistent with those in 2006. Changes in concentrations of some constituents, however, were observed, which include arsenic, selenium, uranium, and some redox sensitive constituents. AECOM reviewed the groundwater chemistry results and discussion presented in Appendix VII of the 2007 Annual Report. Appendix VII presents tables containing the 2007 groundwater monitoring data, graphs of concentrations of selected parameters over time, piper plots of the groundwater chemistry, and plan views illustrating the concentration of select parameters at well locations. Constituents exceeding BCWQG in downgradient wells were compared to background and baseline (i.e., pre-landfilling) conditions.

5.2.1 Leachate Sumps

Concentrations of both inorganic and organic leachate constituents in Sump 4 increased dramatically during 2007, due to the increased amount of refuse placed in Stage 4. Sump 4 is showing high total VOC concentrations, which is consistent with early sampling results at other sumps where VOC concentrations subsequently decreased with time. Leachate concentrations of some constituents at this location may have increased due to the recent placement of wastes in this area and due to recycling of leachate from the other sumps on the Stage 4 platform. Continued recycling of leachate within the landfill may result in a concentrating effect that leads to higher concentrations over time.
5.2.2 Upgradient Wells

Section 1.3.2 of Appendix VII describes upgradient groundwater quality.

Table VII-10 (in Appendix VII of the 2007 Annual Report) provides a summary of constituents that exceed the lowest BCWQG for Drinking Water, Irrigation and Livestock criteria at sampled upgradient wells (MW305, TH3 and TH1A) and cross-gradient wells (MW97-1). Well TH3 has been affected by composting operations and will soon be impacted by landfilling operations. Golder has indicated that they only use baseline data (prior to potential impact) from this well for assessing background water quality. Well MW305 is only considered to represent typical background conditions in wells that are screened in carbonaceous argillite and is not suitable for comparison to water quality from other wells because of the different bedrock geology encountered by this well, according to information provided by Golder on page VII-6. Therefore water quality in TH1A and MW97-2 is considered to represent typical background bedrock groundwater quality at this location. For background wells TH1A and MW97-1 the list of constituents that exceed applicable BCWQG includes conductivity, hardness TDS, TSS, nitrate, sulphate, boron, manganese, and sodium.

VOCs were not detected at significant concentrations at the upgradient monitoring wells in 2007. Where very low concentrations of total VOCs were detected they could be related to landfill gas partitioning.

5.2.3 Downgradient Wells

Table VII-11 provides a summary of constituents that exceed Drinking Water, Irrigation and Livestock criteria at sampled downgradient wells. Golder screened the data by removing all constituents that were exceeded in upgradient, cross gradient and baseline monitoring locations and determined that in 2007 the following five constituents were found above BCWQG in downgradient wells and above baseline background levels: fluoride, nitrate, arsenic, selenium, uranium and trichloroethene. Golder suggests that fluoride concentrations are related to local natural geological conditions. Golder attributes the exceedences of nitrate and selenium to local geological and redox conditions. AECOM accepts this argument for deep bedrock wells with a similar geology (carbonaceous argillite) to that encountered at background well 305 but not for wells such as OW4 screened in the overburden sand and gravel aquifers where nitrate above 2.0 mg/L (but below the drinking water guideline of 10 mg/L nitrate) could be interpreted as evidence of minor leachate impact.

If the anomalous bedrock water quality from well MW305 is only compared to other wells screened in carbonaceous argillite and is not considered part of the baseline water quality for other wells then the parameters that exceeded BCWQG in 2007 at downgradient wells but not at upgradient wells (TH1 A and MW97-1) include fluoride, arsenic, selenium, uranium and trichloroethene.

Well OW1, located on-site near the property boundary, has shown increasing alkalinity, chloride, conductivity trends in recent years that may suggest the potential presence of minor landfill impact on groundwater quality at this location. However, elevated ammonia and nitrate concentrations were not present at OW1 in 2007. Ammonia concentrations were slightly elevated at TH6 in 2007.
Trichloroethene exceeds the new, more stringent BCWWQ drinking water guideline of 5 µg/L (formerly 30 µg/L) and the new Contaminated Sites Regulation (CSR) standard of 5 µg/L at well OW3. Trichloroethene concentrations at OW3 have exceeded the new 5 µg/L guideline on all dates except three over the period of record. OW3 also had elevated concentrations of other VOCs including benzene, dichlorethane, cis-1,2-dichloroethene and tetrachloroethene in 2007. Golder attributes the elevated VOC concentrations to partitioning from landfill gas. Regardless of the transport mechanism, the results exceed the current BCWQG standard. AECOM concludes from the data provided that OW3 is impacted by the landfill and exceeds the current BCWWQG drinking water guideline. OW3 is screened in the upper sand and gravel aquifer downgradient of the landfill (see cross-section on Figure VI-1), the most vulnerable aquifer for potential leachate impact.

Well MW03-1B is an overburden well located downgradient from OW3. MW03-1B has slightly elevated ammonia concentrations although the chloride levels remain low. MW03-1B also had sulphate concentrations that exceeded the BCWQG for drinking water in 2007, but all sulphide concentrations for MW03-1B met the BCWQG in 2007, compared to one exceedance in 2006. MW03-1B did not have detectable VOC concentrations in 2006 but MW 03-1B is screened deeper in the sand and gravel aquifer than OW3 and is less likely to be impacted by partitioning of VOCs from landfill gas due to the presence of an overlying clayey silt layer (see Figure VI-1).

For the sand and gravel aquifer downgradient of the landfill, OW3 and MWOW3-1B are the closest monitors to the eastern property boundary. Both wells exceeded one or more applicable water quality guidelines on one or more occasions in 2007 as indicated above. Off-site wells cannot be used to assess compliance, in our opinion. Due to the non-compliant water quality at OW3 and OW3-1B in 2007, the installation of additional monitoring wells at the property boundary is suggested to better assess compliance with the BCWQG guidelines and the CSR standards at the property boundary. We understand that the ditch and power lines makes installation of monitors on or near the property line difficult and alternative approaches for assessing compliance criteria may need to be considered.

The applicability of the Contaminated Site Regulation (CSR) to off-site movement of contaminants from a permitted landfill should be determined. The CSR has a requirement to notify affected neighbouring property owners who may be potentially impacted by off-site contaminant migration above the current CSR standards.

Further downgradient and off-site at OW2, conductivity and chloride concentrations are increasing with time. Conductivity values exceed the drinking water criterion but chloride concentrations do not. Ammonia and alkalinity concentrations at the location appear to be decreasing. Tritium is detectable and trace VOC concentrations are present. Further monitoring is required to assess whether these trends are caused by landfill impact.

Downgradient bedrock well MW03-2A has slightly elevated ammonia concentrations and high nitrate values. Golder attributes this poor water quality to natural geological conditions in the bedrock.
6. Conclusions and Recommendations

6.1 Conclusions

AECOM provides the following conclusions regarding the 2007 Annual Report for the Cache Creek Landfill based on our review of the Golder report:

1. The 2007 Annual Report meets the reporting requirements stipulated in Section 7.2 of the Operational Certificate. Overall the Cache Creek Landfill appears to be well managed.

2. The total tonnage of municipal solid waste discharged into the Cache Creek landfill during 2007 was reported to be 579,417 tonnes, about 20% more than in 2006 (481,313 tonnes). This increase in waste tonnage was due to the diversion of waste from the Vancouver Landfill to the Cache Creek Landfill during the garbage strike that occurred in Vancouver in 2007. The Annual Report indicates that the Operational Certificate was amended by the Ministry of Environment in October 2007 by increasing the 2007 maximum authorized discharge rate from 500,000 to 585,000 tonnes per annum. The actual 2007 waste discharge rate was within the annual discharge rate authorized by the Ministry of Environment.

3. The airspace consumed in 2007 was reported to be 689,981 m³. There was more than two years of lifespan remaining at the Cache Creek Landfill as of the end of 2007. It is estimated that the landfill will close in the fall or summer of 2010 depending on influencing factors including excavation, compaction and peak elevation.

4. Wastech inspects waste at Metro Vancouver transfer stations before loading the waste into trailers for transport and all other loads are inspected during spreading and compaction to ensure that wastes other than municipal solid waste (e.g., hazardous or biomedical wastes) are not discharged to the landfill.

5. Discharged municipal solid waste in 2007 was received from the Metro Vancouver Regional District, Cowichan Valley Regional District, Powell River Regional District, and Thompson Nicola Regional District in compliance with the Operational Certificate (i.e., from a source area within British Columbia).

6. Environmental protection monitoring (Section 5 of the Operational Certificate) for groundwater, leachate collection sump fluids and landfill gas is generally based on the requirements set out in the current Operations and Closure Plan. Some monitoring data are not available in the 2007 Annual report, e.g., the first quarter chemistry results for monitoring well OW2. Upgradient monitoring well TH3 was damaged in September and decommissioned in October 2007, thus it was not monitored in the fourth quarter of 2007. Installation of a new monitoring well to serve as a replacement well for TH3 should be considered. Two new downgradient monitoring wells – MW07-1A and MW07-1B – were installed in the fall of 2007 as replacement wells for MW03-1A and MW03-1B. The monitoring of the two new wells will start in 2008 according to the 2007 Annual Report.

7. Leachate management systems have been installed and are operated by Wastech to meet the requirements specified under Section 6 of the Operational Certificate. The volume of leachate pumped from the sumps in 2007 was about 752 m³ (increased from 568 m³ in 2006). The increase in total leachate quantity is largely attributed to Stage 4 operations and increased volumes collected at Sump #4, which was installed in 2002. The volume of liquid removed from Sump #4 had increased since 2004. Some leachate quality concentrations, e.g., chloride for Sumps #2, and #4 and dissolved nickel
for Sump #2, continued to increase with time. This trend, in AECOM's opinion, may continue as leachate continues to be recycled through the landfill.

8. The 2007 Annual Report indicated that methane concentrations at monitoring well locations OW1, OW3 and MW03-1, nearest the eastern boundary of the landfill site, were above of 50% total methane (OW1-GP1 and MW03-1GP (4 of 4 dates in 2007 as in 2006) OW3-well (two of four dates)). This is more than ten times the BC Landfill Criteria for Municipal Solid Waste of 5% total methane (100% LEL) at the property boundary. These wells are the closest (10 m to 40 m) to the landfill property boundary and the 2007 gas monitoring results could be interpreted as non-compliance with the BC Landfill Criteria.

9. Methane concentrations in MW97-2 located 90 m east of the landfill property boundary were 42% LEL for GP1 and 48% LEL for GP2. There are off-site structures located within approximately 90 m east of the landfill based on Figure VI-19. The methane concentration in the facility should be closely monitored to ensure the 25% LEL criterion for on-site and off-site structures are met. Wastech staff indicated that the landfill gas collection system in this area may not have been operating at 100% efficiency for several months due to an inability to pump out the leachate. The sump could not be pumped because freezing temperatures prevented hydrogen sulphide treatment (work place safety issue).

10. Trichloroethene concentrations in the sand and gravel aquifer downgradient to the east of the landfill for 2006 and 2007 at well OW3 exceeded the recently revised, more stringent, BC Drinking Water Quality Guideline. OW3 is one of the closest monitoring wells to the property boundary in this area. Therefore, the available data could be interpreted that groundwater quality is not in compliance with the BC Landfill Criteria. Sulphide concentrations for all samples in 2007 at well MW03-1B met the BC Drinking Water Quality Guideline, as opposed to one exceedance in the first quarter of 2006.

11. Conductivity and chloride levels in downgradient off-site well OW2 have shown an increasing trend since 2000, with conductivity values consistently exceeding the drinking water criterion. Ammonia and alkalinity concentrations at this location, however, appear to be decreasing. Low VOC concentrations have been detected at overburden wells OW2 and OW4, but they do not exceed standards. Interpretation of leachate impacts is difficult at this site due to relatively poor and variable background water quality and the use of road salt for de-icing and magnesium chloride for dust control.

AECOM offers the following recommendations for consideration regarding the 2007 Annual Report and future reporting of landfill operations and monitoring results at the Cache Creek landfill.

1. Several new gas monitoring wells along the east boundary, between N9800 and N10100, are required to better assess gas concentrations along the eastern property boundary and to assess compliance with the BC Landfill Criteria of 100% lower explosive limit (5% total methane). We understand that the ditch and power lines makes installation of monitors on or near the property line difficult and alternative approaches for assessing compliance with combustible landfill gas criteria may need to be considered.

2. Additional investigation and development of appropriate mitigation measures are warranted to deal with landfill impacts on groundwater quality in excess of the BC Drinking Water Quality Guidelines (due to the lowering of the trichloroethene standard) along the eastern property boundary near OW3. The installation of additional groundwater monitoring wells along the property boundary should be considered.
3. The applicability of the BC Contaminated Site Regulation (CSR) water quality and soil vapour standards at the boundary of the Cache Creek landfill should be determined including any required notification of existing or potential off-site impacts.

4. Explanations for some of the deviations from the environmental monitoring schedule in the current Operations and Closure Plan have been provided in the 2007 Annual Report (e.g., well TH3 was not monitored in the fourth quarter due to damage and was decommissioned in October 2007). However, explanations for other discrepancies (e.g., OW2 was not monitored for chemistry for the first quarter of 2007) were not found during the review. Clear explanations for all deviations from the Operations and Closure Plan monitoring requirements should be provided in future annual reports.

5. The municipal solid waste at the southeast corner of the landfill was discharged prior to 1993, when the BC Landfill Criteria came into effect. This waste appears to be closer than 15 m from property line and does not comply with the 50 m buffer requirement in the BC Landfill Criteria. If the opportunity appears in the future, it is recommended that additional property be acquired to meet the buffer requirements, current BC Landfill Criteria.

7. Closure

This report was prepared by AECOM and the information provided in this report is intended solely for the use of the Village of Cache Creek. Any use which a third party makes of this report, or any reliance on or decisions to be made based on this report are the responsibility of such third parties. AECOM accepts no responsibility for damages, if any, suffered by a third party, based on the information contained in this report.

This report is based upon data and information provided to AECOM by the Village of Cache Creek, observations made during a site visit of the Cache Creek Landfill on June 23, 2008 and discussions with Wastech Services Limited staff at the Cache Creek Landfill.

8. References

British Columbia Ministry of Water, Land and Air Protection (MWLAP), 1993:

Golder Associates Ltd., 2006a:

Golder Associates Ltd., 2006b:
Golder Associates Ltd., 2007:

Golder Associates Ltd., 2008:
Appendix A

Operational Certificate MR-7577
MINISTRY OF WATER, LAND AND AIR PROTECTION

OPERATIONAL CERTIFICATE

MR-7577

FOR THE CACHE CREEK LANDFILL

Under the Provisions of the Waste Management Act
and in accordance with the
Thompson-Nicola Regional District Solid Waste Management Plan

THE VILLAGE OF CACHE CREEK
Box 7
Cache Creek BC V0K 1HO

WASTECH SERVICES LTD.
1200 United Boulevard
Coquitlam BC V3T 5T4

are authorized to manage municipal solid waste at a sanitary landfill facility located in Cache Creek, British Columbia, subject to the conditions listed herein. Contravention of any of these conditions is a violation of the Waste Management Act and may result in prosecution.

This Operational Certificate does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the Operational Certificate Holder. This Operational Certificate is issued pursuant to the provisions of Section 18(5) of the Waste Management Act. In accord with Section 54 of that statute, it is an offence to discharge waste without proper authorization. It is also the responsibility of the Operational Certificate Holder to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

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F. Rhebergen
F. Rhebergen, P.Eng.
Assistant Regional Waste Manager

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1. **LOCATION OF AUTHORIZED FACILITY**

The location of the sanitary landfill facility for the management of municipal solid waste to which this Operational Certificate is applicable is described as:
- Block C of Section 18, Township 21, Range 24, and
- Lying to the west of Block C to include the easterly 80 metres of the N.E. ¼ of Section 13, Township 21, Range 25, and
- Extending south from the South Boundary of the N.E. ¼ of Section 13, Township 21, Range 25 into the N.E. corner of the S.E. ¼ of Section 13, Township 21, Range 25 by 155 metres, and
- Lying to the south of Block C to include the southerly remainder of the N.E. ¼ Section 18, Township 21, Range 24, and
- Including the northerly 155 metres of the S.W. ¼ of Section 18, Township 21, Range 24, and
- Including the remainder of the N.E. ¼ Section 18, Township 21, Range 24, lying to the west of the Trans-Canada Highway #1 Boundary, and
- Including the northerly 155 metres of S.E. ¼ of Section 18, Township 21, Range 24, lying to the west of the Trans-Canada Highway #1 Boundary,
- All west of the 6th Meridian Kamloops Division of Yale Land District.

2. **RECYCLABLE MATERIALS MANAGEMENT**

Municipal solid waste that has value for the purposes of reuse or reprocessing shall be considered recyclable material. Recyclable materials may be diverted from disposal and temporarily stored at the landfill facility prior to removal from the site. The nature of the recyclable material authorized for storage at the landfill facility is subject to the approval of the Regional Waste Manager.

3. **MUNICIPAL SOLID WASTE MANAGEMENT**

3.1 **Disposal to Landfill**

3.1.1 The works authorized are a sanitary landfill and related appurtenances located approximately as shown on the attached Site Plan A. The landfill shall be operated to meet the requirements of a sanitary landfill as described in the Landfill Criteria for Municipal Solid Waste (1993).

3.1.2 The discharged waste shall originate from within the boundaries of any source area within British Columbia, subject to the following:

   (a) Waste discharged to this landfill shall be from a source area stipulated in the Thompson-Nicola Regional District Regional Solid Waste Management Plan.

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(b) Waste discharged to this landfill shall be stipulated in the Regional Solid Waste Management Plan of the Regional District from which the waste originated.

3.1.3 All waste to be discharged at this site shall be inspected by a suitably trained Wastech Services Ltd. employee prior to receipt or shall be tipped, spread, and inspected by a suitably trained Wastech Services Ltd. employee prior to being placed into the working face for compliance with the terms and conditions of the Operational Certificate.

3.1.4 The maximum authorized rate of waste discharge is 500,000 tonnes annually.

3.1.5 The characteristics of the waste discharged to the landfill are those of municipal solid waste as defined in the Waste Management Act.

3.1.6 The following types of wastes shall not be discharged:


3. Bulk liquids or semi-solid wastes which contain free liquids including septic, raw sewage and sewage treatment sludge.


3.1.7 Notwithstanding the requirements of section 3.1.6(1), the disposal of waste asbestos in compliance with the requirements of the Special Waste Regulation under the Waste Management Act (B.C. Reg. 63/88, O.C. 268/88) is hereby authorized.

4. OPERATING REQUIREMENTS

4.1 Design, Operating and Closure Plans

4.1.1 The following design, operating and closure plans are approved:

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4.1.2 The Cache Creek Sanitary Landfill Operations and Closure Plan 2000, dated June 15, 2000, was submitted for approval to the Regional Waste Manager on June 22, 2000. The Regional Waste Manager will provide comments and/or approval upon completion of the review.

4.1.3 The design, operating and closure plans shall be reviewed every 5 years throughout the operating life of the landfill and updated to encompass the next 10 years of landfill operation and/or post-closure activities. The updated landfill design, operating and closure plans shall be prepared by a professional engineer or geoscientist licensed to practice in the province of British Columbia and knowledgeable in such matters. The updated plans shall be submitted to the Regional Waste Manager for approval and shall include any information relevant to the design, operation, closure and post-closure care of the landfill.

4.1.4 A landfill post-closure plan shall be submitted not less than 12 months prior to the estimated site closure date. The post-closure plan shall be reviewed every 5 years following closure and updated to encompass the next 10 years of post-closure activities. The post-closure plan and subsequent updates shall be prepared by a professional engineer or geoscientist licensed to practise in the province of British Columbia and knowledgeable in such matters. The post-closure plan and subsequent updates shall be submitted to the Regional Waste Manager for approval and shall include at least the following:

(1) a complete review and assessment report of the overall integrity of the landfill,
(2) a detailed timetable for closure and/or post-closure procedures and correction of any deficiency identified in the review and assessment report, and
(3) a detailed schedule of inspection, monitoring and maintenance to be carried out for a minimum post-closure period of 25 years.

4.1.5 The landfill facility shall be constructed and maintained in accordance with the plans approved under sections 4.1.1, 4.1.2, 4.1.3 and 4.1.4, subject to the conditions set herein. A knowledgeable representative from the engineering design firm shall carry out field reviews of the landfill construction and installation of works. As-constructed drawings of the landfill and all works, including elevations relative to a common datum, shall be submitted to the Regional Waste Manager. The as-constructed drawings shall be sealed by a professional engineer or geoscientist representing the engineering design firm who is licensed to practise in the province of British Columbia and knowledgeable in the appropriate field of study.

4.1.6 Written authorization from the Regional Waste Manager shall be obtained prior to implementing any changes to the approved plans. Based on any information obtained in connection with this facility, the Regional Waste Manager may require revision of, or addition to, the design, operating and closure plans.

4.2 Landfill Site Development

4.2.1 Discharge of waste into water is prohibited. Surface water diversions and groundwater drainage works shall be installed to prevent surface water run-off and groundwater seepage from entering the waste discharge area. The effect of sediment transport from areas upgradient and within the landfill site shall be considered when designing, installing and maintaining the surface water diversion system. Diversion and drainage structures shall be maintained by the Operational Certificate Holder on a regular basis to the satisfaction of the Regional Waste Manager.

4.2.2 A berm of suitable material shall be constructed to preclude visibility of the active waste discharge area and any exposed wastes from travellers using the Trans Canada Highway.

4.2.3 Waste shall not be deposited at this site beyond the landfill stages 1, 2, 3 and 4 as specified in the approved plans.
4.3 Waste Compaction and Coverage

4.3.1 Discharged wastes shall be compacted and cover material applied as outlined in section 4.3.2. Wastes shall be compacted and covered on a continuous basis and such that all wastes are covered within 24 hours of discharge to the landfill.

4.3.2 The area of the active landfill working face shall be minimized as much as possible. Wastes shall be spread in thin layers of 60 centimetres, or less, on the working face and compacted. A compacted layer of at least 15 centimetres of suitable soils, or a functionally equivalent depth of other cover material acceptable to the Regional Waste Manager, shall be placed on all exposed compacted waste.

4.3.3 An intermediate cover of at least 30 centimetres of compacted soils, or a functionally equivalent depth of other cover material acceptable to the Regional Waste Manager, shall be applied on any areas of the active landfill site to which waste will not be discharged for a period of 30 days or more.

4.3.4 Final cover shall be installed within 30 days of completion of the landfill to the final elevations as specified in the approved plans. Completed portions of the landfill shall progressively receive final cover during the active life of the landfill. Final cover shall consist of at least 1 metre of low permeability compacted mineral soil, overlain by at least 15 centimetres of topsoil capable of supporting indigenous vegetation. With the written approval of the Regional Waste Manager, the topsoil used for this final covering may be mixed with conditioning agents such as sludge (biosolids), compost and the like to add organics and improve the moisture holding capacity and nutrient value of the soil. Final cover shall be constructed and maintained with adequate drainage and erosion controls and seeded with suitable grasses.

4.3.5 The Regional Waste Manager may vary the frequency of final covering when freezing conditions adversely affect normal operation.

4.4 Landfill Management

4.4.1 The landfill shall be supervised to the satisfaction of the Regional Waste Manager. Landfill supervisors shall be trained in landfill operation pertaining to the conditions of this Operational Certificate and the approved design, operating and closure plans.

4.4.2 Access to the site shall be controlled and supervised. All access points shall have locking gates and shall be locked during periods when supervision is not available.

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4.4.3 Public scavenging and salvaging of waste at the landfill site is prohibited.

4.4.4 Designated areas shall be maintained for the storage of recyclable materials. These designated area(s) shall be separate from the active landfill area and shall be maintained free of litter. Storage of recyclable materials at the landfill site shall be limited to a reasonable length of time subject to the approval of the Regional Waste Manager.

4.4.5 Litter and wind strewn waste shall be controlled by limiting the area of the working face, installing a wind blown litter collection fence in a location which is in the anticipated prevailing downwind direction of the landfill working face, instituting a regular litter pickup, general good site maintenance practises or any other measures required by the Regional Waste Manager.

4.4.6 Dust and odour created within the landfill property shall be controlled using methods and materials acceptable to the Regional Waste Manager.

4.4.7 Open burning of waste is prohibited.

4.4.8 The landfill shall be operated so as to minimize the attraction of nuisance wildlife and disease vectors such as birds and rodents by applying adequate cover to the waste and by maintaining the site free of litter. Additional control measures may be specified by the Regional Waste Manager if wildlife and/or vector attraction to the site becomes a public safety hazard.

4.4.9 The landfill works shall be inspected on a regular basis by the landfill supervisor. In the event of an emergency or any condition which prevents continuing operation of the approved method of landfill operation and control, or results in non-compliance with the terms and conditions of this Operational Certificate, the Regional Waste Manager shall be notified immediately and appropriate remedial action taken.

4.4.10 The Regional Waste Manager may require future upgrading of the landfill control works to protect the environment during the operating life of the landfill and for a minimum post-closure period of 25 years.

4.4.11 Upon closure, the boundaries of the landfilled area shall be legally surveyed. A covenant that the property was used for the purpose of waste disposal shall be registered against the land title as provided for under Section 215.1 of the Land Title Act.
5. MONITORING

5.1 Environmental Protection Monitoring

Monitoring of ground and surface water, leachate collection sump fluids and landfill gas shall be carried out in accordance with the monitoring program approved in the design, operating and closure plans. The monitoring program shall be reviewed in the annual report required under section 7.2. Based on the information submitted in the annual report, or any other information obtained in connection with this site, the Regional Waste Manager may vary the frequency, location and analyses of ground and surface water, leachate collection sump fluid and landfill gas sampling.

6. LEACHATE CONTROL AND TREATMENT

6.1 Management of Leachate Collection System Fluid

Leachate collection sump fluid levels shall be monitored and fluid removed from the leachate collection system as specified in the approved design, operating and closure plans. A sample of fluid from each of the leachate collection sumps shall be collected on a quarterly basis and laboratory analyses obtained for the leachate indicator parameters identified in the monitoring program. The Regional Waste Manager may vary the location and frequency of sampling and analyses of leachate collection system fluid should conditions warrant. Fluid recovered from the leachate collection system may be used within the landfill footprint for irrigation, dust suppression and/or re-circulated within the buried waste unless otherwise directed by the Regional Waste Manager. Other methods of treatment and/or disposal of the leachate collection sump fluids must have the prior approval of the Regional Waste Manager.

6.2 Groundwater Contamination by Leachate

Should it be determined that leachate is being generated and carried in the groundwater or surface water and, in the opinion of the Regional Waste Manager, requires interception and treatment, appropriate remedial measures as determined by the Regional Waste Manager shall be implemented.
7. REPORTING

7.1 Interim Reporting and Record Keeping

The leachate collection sump fluid level readings, groundwater elevation and combustible gas monitoring data, and the sump fluid, groundwater and gas sampling analyses results shall be available for inspection at the Wastech Cache Creek Landfill office. Data from monitoring and sample analysis shall be submitted to the Regional Waste Manager on at least a quarterly basis.

7.2 Annual Report

An annual report shall be submitted by February 28 of each year for the previous calendar year of landfill operation or post-closure activities. The annual report shall review and interpret the analytical data from monitoring of leachate collection sump fluids, groundwater and landfill gas for the preceding calendar year. Proposed changes to the monitoring program shall be identified in the annual report. The annual report shall summarize the findings of the landfill supervisor’s routine inspections, and identify any proposed changes from the approved plans. For reporting of calendar years prior to landfill closure, the annual report shall include an estimate of the solid waste landfilled in the preceding calendar year in both tonnes and compacted in-situ cubic metres and review the remaining site capacity. The annual report shall include documentation of the method used to quantify the volume of waste discharged and the tonnage estimates shall be broken down into the estimated tonnes discharged from each regional district or other specific areas of origin to the satisfaction of the Regional Waste Manager. Copies of the annual report shall be provided to the public libraries in Ashcroft and Cache Creek.
8. **POST-CLOSURE SECURITY REQUIREMENTS**

A post-closure monitoring, maintenance and repair fund shall be established and administered by the Director of Waste Management for the benefit of the Village of Cache Creek. Within 30 (thirty) days of the end of each quarter, Wastech Services Ltd. shall contribute money into this trust fund for wastes discharged to the landfill originating from outside the local area of the Village of Cache Creek. The amount of money contributed shall be determined according to the following schedule:

- $0.75 per tonne of waste discharged during the first 8 (eight) years of waste transfer from the regional district or jurisdiction which is the source of the waste
- $0.60 per tonne of waste discharged during the next 12 (twelve) years of waste transfer from the regional district or jurisdiction which is the source of the waste
- $0.35 per tonne of waste discharged during each following year until landfill closure.

The Director of Waste Management shall have the sole authority to access and direct the use of monies from the trust fund for post-closure monitoring, maintenance and repair of the landfill site. The Director of Waste Management shall make monies available immediately upon closure of the landfill for the purposes of monitoring, maintenance and repair.

The trust fund shall remain in force for at least 10 (ten) years after closure of the landfill site. Thereafter, the need for the trust fund shall be reviewed by the Director of Waste Management once every 5 (five) years. The Director of Waste Management shall have the sole authority to reduce the size of the trust fund or eliminate the fund if, in the opinion of the Director of Waste Management, such action is warranted. In the event the trust fund is reduced or eliminated, the funds shall be released to the Village of Cache Creek to be used at the discretion of the Council of the Village of Cache Creek for municipal purposes.

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F. Rheberger, P. Eng.
Assistant Regional Waste Manager
OPERATIONAL CERTIFICATE: MR-7577
Note:
Contours and benches are of completed landfill.

SITE PLAN

Operational Certificate No. MR - 7577

Date: November 14, 2003

[Signature]
Regional Waste Manager
Appendix B

Selected Photographs from Cache Creek Landfill Site Visit of June 2008
Appendix B
Selected Photographs from Cache Creek Landfill Site Visit of June 2008

Photograph 1. Cache Creek Landfill’s Working Face

Photograph 2. Residential Drop-off
Appendix B
Selected Photographs from Cache Creek Landfill Site Visit of June 2008

Photograph 3. One of the Surface Drainage Ditches (No Flowing Water Observed during GLL’s Site Visit on June 23, 2008)

Photograph 4. Typical Landfill Gas Extraction Well
Appendix B
Selected Photographs from Cache Creek Landfill Site Visit of June 2008

Photograph 5. One of the Monitoring Wells (Two Yellow J-plugs for Groundwater and White Cap for Vapour)

Photograph 6. Off-Site Structure and Monitoring Locations