XCG
Environmental Engineers & Scientists

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June 29, 2011 **XCG File No. 4-2803-01-01**

Ms. Maura Walker
Maura Walker and Associates
1178 Khenipsen Rd.
Duncan, British Columbia V9L 5L3

Re: Landfill Assessment, Lasqueti Island Landfill Facility

Dear Ms Walker:

1. INTRODUCTION

XCG Consultants Ltd. (XCG) is pleased to provide the following letter report outlining development options for the Lasqueti Island Landfill Facility (Site) with respect to either maintaining the existing landfill site or closing it and developing a transfer station for off-island waste export.

This letter report has been developed based upon a site visit undertaken by XCG on January 10, 2011 and the following documents made available to XCG for review:

- Permit PR-4904, issued on October 17, 1978;
- British Columbia Ministry of Environment (BC MOE) correspondence dated July 11, 2001;
- BC MOE Compliance Review Record dated December 13, 2006;
- BC MOE correspondence entitled, "Lasqueti Island Landfill Photos" dated December 29, 2006;
- BC MOE Compliance Review Record dated August 25, 2008; and
- Maura Walker memorandum, entitled "Residual Waste Management Options for Lasqueti Island," dated October 10, 2008.

2. SITE DESCRIPTION

The Lasqueti Island Landfill Facility, operating under Permit PR-4904, is located on the southeast 40 acres of North West ¼ of Section 18, Lasqueti Island, as shown on Figure 1.

The Site is located in an undeveloped valley (Figure 2) at approximately mid island. Ephemeral creeks, emanating from groundwater seeps along the steep valley slopes, were noted to the north and south of the Site. Preliminary reconnaissance activities undertaken by XCG, on January 10, 2011, indicated that these creeks flowed to the west toward a wetland area located approximately 1 kilometre from the Site.

The Site has a cleared area of approximately 2,500 square metres and is approximately 80 metres long (west to east) by 30 metres wide (north to south). A gravel road extends through the middle of the Site to a BC Highways and Transportation aggregate borrow pit, located approximately 300 metres east of the Site.

The limit of waste encompasses an area of approximately 800 square metres, located in the southwest quadrant of the Site. The waste is contained within a 1-metre high earthen berm constructed to prevent surface water run-on from the aforementioned southern ephemeral creek and prevent run-off from the active area into the perimeter ditches. A scrap metal pile and white goods area are located in the southeast quadrant of the Site. Tires and bicycles are stockpiled in the northeast quadrant.

At the time of the Site reconnaissance (January 10, 2011), intermediate cover was not reported to have been placed on the waste mass within the last year. However, no vector concerns were noted at the Site or reported by landfill staff.

The Site is accessed via an unpaved road with a locked gate and is open to the public on Sundays.

3. REGULATORY ENVIRONMENT

The following section provides an overview of the regulatory environment which governs landfill design, operations, and closure of the Site.

3.1 Provincial Regulations

There are currently three documents published by the BC MOE, which regulate landfill design, operations, and monitoring:

- Landfill Criteria for Municipal Solid Waste (June 1993);
- Guidelines for Environmental Monitoring at Municipal Solid Waste Landfills (January 1996);
- Environmental Management Act (July 2004); and
- Landfill Gas Management Regulation (December 2008).

Key elements of these documents applicable to this project are as follows.

Landfill Criteria for Municipal Solid Waste (MSW)

This document applies to all new landfills and both lateral and vertical expansions of existing landfills, designed and constructed for the disposal of MSW. Key elements of the Landfill Criteria for Municipal Solid Waste are as follows:

- Landfills must not be operated in a manner such that ground or surface water quality in existing or potential future water supply aquifers or surface waters, decreases beyond that allowed by the Approved and Working Criteria for Water Quality at or beyond the landfill property boundary.
- A landfill must not be operated in a manner such that a significant threat to public health or safety or a public nuisance is created with respect to: unauthorized access, roads, traffic, noise, dust, litter, vectors, or wildlife attraction.
- For existing landfills, in the event that leachate discharge from the landfill results in excursions to the established criteria, the leachate shall be managed to control the impact.

- The buffer zone between the discharged MSW and the property boundary should be at least 50 metres, of which the 15 metres closest to the property boundary must be reserved for natural or landscaped screening (berms or vegetative screens). Depending on the adjacent land use and environmental factors, buffer zones of less than 50 metres but not less than 15 metres may be approved by the Manager.
- The distance between the discharged MSW and the nearest surface water body or watercourse is to be a minimum of 100 metres. Greater or lesser separation distances may be approved by the Manager where justified by hydrogeological investigations or by provision of surface water diversion works to reroute the watercourse of concern.
- Final cover for landfill sites is to consist of a minimum of 1 metre of low permeability (less than 1×10^{-5} cm/s) compacted soil plus a minimum of 0.15 metres of topsoil with approved vegetation established. The depth of the topsoil layer should be related to the type of vegetation proposed to accommodate to necessary rooting depth. Soils of higher permeability may be approved based on leachate generation potential at the landfill site.
- Final cover is to be constructed with slopes between 4 percent and 33 percent with appropriate run-on/run-off drainage controls and erosion controls.
- Fencing is required around the perimeter of the landfill.
- Litter is to be controlled by compacting the waste, minimizing the working face area, applying cover at appropriate frequencies, providing litter control fences and instituting a regular litter pickup and general good housekeeping program or any other measures required by the Manager.

Guidelines for Environmental Monitoring at Municipal Solid Waste Landfills

These guidelines are intended to assist landfill owners and operators to design and implement an environmental monitoring program as required by the "Landfill Criteria for Municipal Solid Waste." Key elements of the guidelines are as follows:

Groundwater

- The location and installation of monitoring wells should address both existing and anticipated site development, including any predicted changes in groundwater flow;
- Up-gradient and down-gradient monitoring wells should be sampled at quarterly intervals as a minimum;
- The routine parameters monitored in groundwater include pH, redox potential (Eh), dissolved oxygen (DO), specific conductivity, metals, ammoniacal nitrogen, chloride, and chemical oxygen demand (COD); and
- For the monitoring of metals, the Environmental Protection Agency (EPA) recommends the following be monitored regularly; antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, thallium, vanadium, and zinc.

Surface Water

- Surface water monitoring locations should include the following locations:
  - Upstream to establish background water quality;
  - Immediately downstream to determine leachate impacts on water quality; and

- Downstream to document the extent of the mixing zone and distance required for the surface water to assimilate leachate and for water quality to recover to background levels.

- Surface water should be monitored for pH, redox potential, specific conductance, temperature, and dissolved oxygen concentration.

3.2 Landfill Operating Permit

The Site is currently approved to operate under Permit PR-4904, issued on April 17, 1978. Key elements of the approval with respect to design, operation, and closure include the following:

- The quantity of refuse which may be discharged is an average of 0.38 cubic metres per day; and
- The type of refuse which may be discharged is municipal solid waste.

In addition, as per the BC MOE Compliance Record, dated August 25, 2008, the landfill is classified as a level 'E' landfill which requires intermediate cover placed once every 40 days of operation and at least every two months.

A copy of the Permit is included as Attachment A.

4. WASTE GENERATION ESTIMATE

Based upon estimates provided by Maura Walker and Associates, it is understood that the Lasqueti Island population generates approximately 25 tonnes of residual (non diverted, non-recyclable, and inorganic waste material) waste per year.

5. RESIDUAL WASTE MANAGEMENT OPTIONS

It is understood by XCG that two residual waste management options have been identified for consideration: (1) upgrade the existing landfill to meet the current regulatory environment or (2) close the existing landfill and construct a transfer station to export the residual waste off-island to a permitted landfill on Vancouver Island.

It is noted that in either option, it is assumed that the scrap metal pile and white goods area will be relocated off-site. As such, this has not been included in the capital cost estimates presented herein. Furthermore, it is understood that the capital cost estimate for the development of a transfer station, under Option 2, will be addressed by others.

5.1 Option 1 - Upgrade Existing Landfill

Based upon the aforementioned Site reconnaissance and discussions with the BC MOE, the following elements have been identified which would require upgrade and/or remedial measures in order to comply with the current regulatory environment:

- Undertake a test pit investigation to confirm site conditions, surficial geology, minimum depth of groundwater, and the ability of the Site to operate as a natural attenuation landfill;

- Develop an Action Plan for formal submission to the BC MOE for approval prior to undertaking any remedial activities;
- Extend, upgrade and repair perimeter ditching to ensure that surface water is not adversely impacted by landfill activities;
- Construct a sedimentation pond to reduce impact to surface watercourses by landfill related runoff;
- Upgrade and remediate existing perimeter berms to reduce impact to surface water courses and to improve litter control;
- Fencing and site security as per the BC Landfill Criteria for Municipal Solid Waste;
- Up-gradient and down gradient groundwater monitoring wells to monitor the performance of the attenuation zone, facilitate the implementation of an annual environmental monitoring program, and confirm compliance with applicable regulations; and
- Establish formal surface water monitoring locations (upstream and downstream of the Site) to facilitate the implementation of an annual environmental monitoring program, and confirm compliance with applicable regulations.

The preliminary capital cost estimate for this program is presented in Table 1. In addition to the above capital expenditures, an environmental monitoring program (EMP) would also be required to be established based upon the groundwater and surface water monitoring infrastructure indicated above. A preliminary annual cost estimate for undertaking an EMP at the Site, not including labour costs for undertaking sampling activities, is presented in Table 2.

5.2 Option 2 – Landfill Closure

In conjunction with the development of the Transfer Station, the existing Site would be closed. The scope of work anticipated to be required to complete this task is as follows:

- Undertake a investigation program to confirm surficial geology, depth of shallow groundwater, and limit of waste;
- Submit a closure plan to the BC MOE for approval;
- Rehabilitate the metal and white goods stock pile areas;
- Install final cover on landfilled area;
- Rehabilitate existing ditches; and
- Hydroseed and erosion control.

The preliminary conceptual cost estimate for the landfill closure is presented in Table 3. It is noted that this cost estimate does not include the removal of the scrap metal stockpile and white goods area. Further, it is noted that pending the outcome of the investigation, a post-closure EMP would likely be required. The scope of the EMP would, at a minimum, require bi-annual surface water sampling in order to monitoring the performance of the closure works. The preliminary costs of undertaking a post-closure EMP would be similar to that presented in Table 2.

Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Yours very truly,

XCG CONSULTANTS LTD.

Michel Lefebvre, M.Sc., P.Eng.
Senior Project Manager

Attachments: Figures 1 and 2
Tables 1 to 3
Attachment A - Permit PR 4904

FIGURES

(file: R428030100 1FIG1.dwg)

SITE LOCATION MAP

LANDFILL ASSESSMENT

LASQUETI ISLAND LANDFILL FACILITY

LASQUETI ISLAND, BC

XCG CONSULTANTS LTD.

DATE	JOB NO.	FIGURE NO.
FEB. 2011	4-2803-01-01	1

0 50 100 m

1 : 3000

(file: R428030100 1FIG2.dwg)

SITE PLAN

LANDFILL ASSESSMENT

LASQUETI ISLAND LANDFILL FACILITY

LASQUETI ISLAND, BC

XCG CONSULTANTS LTD.

DATE	JOB NO.	FIGURE NO.
FEB. 2011	4-2803-01-01	2

TABLES

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Table 1 Existing Landfill Remediation Conceptual Cost Estimate

Task	Unit	Approx. Quantity	Unit Price	Total Price
Administration and Execution Requirements (10%)	L.S.			$8,650
Site Investigation	L.S.			$6,000
Action Plan and Approvals	L.S.			$8,000
Ditch rehabilitation	L.M.	250	$25	$6,250
Sediment retention pond	L.S.			$8,000
Perimeter berm rehabilitation	L.M.	120	$125	$15,000
Fencing	L.M.	250	$50	$12,500
Monitoring wells	Unit	2	$15,000	$30,000
Establish surface water sampling locations	Unit	3	$250	$750
Sub-total				**$95,150**
Engineering (10%)				$9,515
Total				**$104,665**

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Table 2 Landfill Environmental Monitoring Program Cost Estimate

Task	Unit	Sampling Events per Year	Quantity	Unit Price	Total Price
Groundwater Analytical Testing	Unit	2	2	$400	$1,600
Groundwater Field Parameters	Unit	2		$100	$200
Surface water Analytical Testing	Unit	2	3	$400	$2,400
Surface water Field Parameters	Unit	2		$100	$200
Annual Report	L.S.				$5,000
Total					**$9,400**

Notes:
(1) Cost estimate does not include labour to perform monitoring.

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Table 3 Landfill Closure Conceptual Cost Estimate

Task	Unit	Approx. Quantity	Unit Price	Total Price
Administration and Execution Requirements (10%)	L.S.			$5,065
Site Investigation	L.S.			$6,000
Closure Plan submission and approval	L.S.			$8,000
Stockpile Area cleanup	m^2	600	$4	$2,400
Final Cover, supply, place and compact	m^2	800	$30	$24,000
Ditching rehabilitation	L.M.	250	$25	$6,250
Hydroseeding	Unit	2,000	$2	$4,000
Sub-total				$55,715
Engineering (10%)				$5,572
Total				**$61,287**

ATTACHMENT A
PERMIT PR 4904

Province of
British Columbia

Ministry of
The Environment

POLLUTION CONTROL BRANCH

1106 Cook Street
Victoria
British Columbia
[redacted] V8V 1X4
Phone: 387-5321

YOUR FILE .....

OUR FILE 0262100-PR-4904

OCT 17 1978

POLLUTION CONTROL BRANCH
RECEIVED
OCT 18 1978
PR-4904
COAST REGION

DOUBLE REGISTERED

Powell River Regional District
4727 Marine Avenue
Powell River, British Columbia
V8A 2L2

Gentlemen:

LETTER OF TRANSMITTAL

Enclosed is a copy of Pollution Control Permit No. PR-4904 in the name of Powell River Regional District. Your attention is respectfully directed to the terms and conditions outlined in the Permit.

A. OPERATION

The works shall be maintained as a level 'E' landfill operation in accordance with the "Pollution Control Objectives for Municipal Type Waste Discharges in British Columbia," dated September, 1975, or as may be otherwise ordered by the Director from time to time.

B. DIVERSION OF SURFACE WATER RUNOFF

Construct works to control and divert surface water runoff in such a manner as to minimize leachate from the landfill. The works shall be constructed to the satisfaction of the Regional Manager.

You will note that values have been expressed in the International System of Units (SI). You are encouraged to use these units in submitting monitoring results and any other information in connection with this Permit.

The administration of this Permit will be carried out by staff from our Regional Office located at 1106 Cook Street, Victoria, British Columbia, V8V 1X4, (telephone 387-5321). Plans, data and reports pertinent to the Permit are to be submitted to the Director through the Regional Manager at this address.

.../2

J. D. Wkent.

This Permit 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 Permittee.

For your reference, enclosed is a copy of the Pollution Control Act, as amended, and the Regulations thereto. Also enclosed are copies of the Metric Practice Guide and Section 3 of the "Pollution Control Objectives for Municipal Type Waste Discharges in British Columbia," relative to solid waste landfills.

Yours very truly,

H. P. Klassen, P. Eng.
Assistant Director
Pollution Control Branch

Encl.

DEPARTMENT OF ENVIRONMENT
WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH

PERMIT

Under the Provisions of the Pollution Control Act, ~~XXXX~~

Powell River Regional District

4727 Marine Avenue, Powell River, British Columbia, V8A 2L2

is hereby authorized to discharge refuse

from Municipal Sources

located on Lasqueti Island

to the ground.

This permit has been issued under the terms and conditions prescribed in the attached appendices

01 and A

Assistant Director of Pollution Control

Date issued OCT 17 1978, 19

Amendments dated , 19

, 19

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Permit No. PR-4904

PCB 11— 0

DEPARTMENT OF ENVIRONMENT
WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH

APPENDIX No. 01

to Pollution Control Permit No. PR-4904

(*a*) The discharge of refuse applicable to this appendix is to the land known and described as South East 40 acres of North West 1/4 of Section 18, Lasqueti Island, Nanaimo Land District as shown on the attached Appendix A.

(*b*) The quantity of refuse which may be discharged is an average of 0.5 cubic yards (0.38 m^3) per day.

(*c*) The type of refuse which may be discharged is municipal.

(Municipal, industrial, etc.)

(*d*) The nature or characteristics of the refuse which may be discharged are typical municipal refuse.

(*e*) The works authorized are sanitary landfill as directed approximately located as shown on the attached Appendix A.

(*f*) The land from which the refuse originates and to which this appendix is appurtenant is Lasqueti Island.

(*g*) Those works authorized and proposed must be completed and in operation when discharge commences.

Date OCT 17 1978, 19

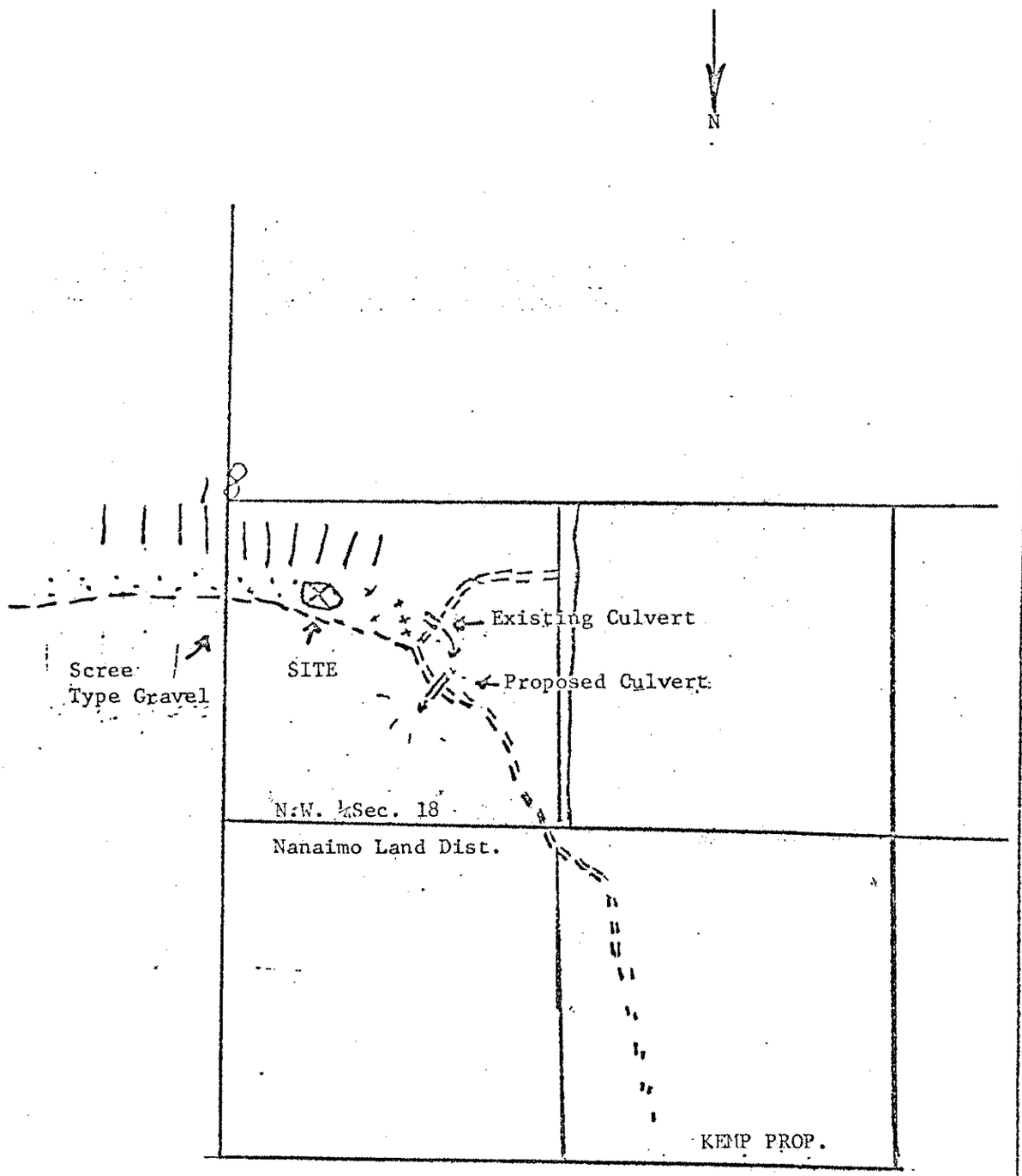
Amended , 19

Assistant Director of Pollution Control

PCB 14—o

DEPARTMENT OF ENVIRONMENT
WATER RESOURCES SERVICE
POLLUTION CONTROL BRANCH

SITE PLAN



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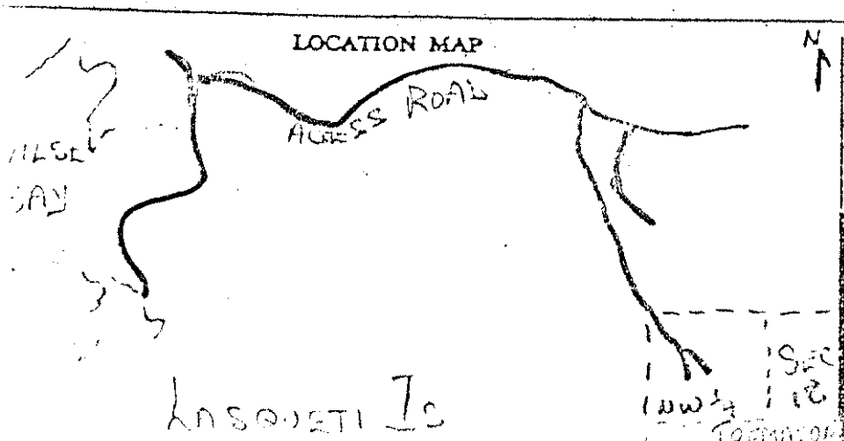
LOCATION MAP



Powell River Regional District
(Name of applicant(s))

(Date) (Signature of applicant(s) or agent)

(FOR OFFICE USE ONLY)

OCT 17 1978
(Date issued) Assistant (Director of Pollution Control)

Appendix A to Permit No. PR-4904