

**SOLID WASTE MANAGEMENT**  
**Annual Operations and Monitoring Report**  
**Salmon Arm Refuse Disposal Site MR-05479**  
**2016**



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## 1.0 EXECUTIVE SUMMARY

This report has been prepared in accordance with Section 4.4 of Operational Certificate MR-05479. The main objective of the report is to provide the Ministry of Environment with an overview of the operations at the Salmon Arm landfill for 2016 and to address the specific requirements outlined in Section 4.4.

In 2016, approximately 18,564 tonnes of waste was directed to the active face and landfilled. This figure represents a 7% increase over 2015 and, based on census data for the area, a per capita disposal rate of 0.56 tonnes per person.

## 2.0 INTRODUCTION

The Salmon Arm refuse disposal site (hereinafter referred to as “the site”) is located at 4290 20th Ave SE Salmon Arm, approximately 3.5 km from downtown Salmon Arm. The legal description of the property is Lot 1, Plan 45716, Section 7, Township 20, Range 9, West of the Sixth Meridian, Kamloops Division of the Yale District.

The site has been in operation since 1979, when the Ministry of Environment, Lands and Parks issued Permit PR-05479 to the District of Salmon Arm. In 1997, the permit was transferred to the Columbia Shuswap Regional District (CSRD). The property is owned by the CSRD and covers an area of approximately 22 hectares. The site was operated by R. Craig Hillson in 2016 under contract with the CSRD.

The site provides solid waste disposal and residual processing services to residents, businesses, and institutions located within the municipality of Salmon Arm and to Electoral Areas C, D, E and F. CSRD operated transfer stations in Malakwa, Skimikin, Scotch Creek, Seymour Arm, Glenemma, and Falkland deliver solid wastes to the site in 50 yard containers on a regular frequency.

The site is operated under an Operating Certificate issued by the Ministry of Environment (MOE) and is governed by the operating and closure standards by Provincial criteria. Requirements include remedial plans to establish methods by which the site will be upgraded or closed. Site specific closure plans are required to set out a closure schedule, procedure and post-closure environmental monitoring protocol.

Western Water Associates Ltd. conducted all monitoring and reporting for the Salmon Arm landfill in 2016, as per the requirements of the Operational Certificate. Western Water has provided conclusions and recommendations based on the 2016 data collected, which will be posted on the CSRD website for public review after April 1, 2017.

In accordance with the user-pay principles of the Solid Waste Management Plan, fees are charged for the disposal of all waste materials. The disposal fee for co-mingled municipal solid waste across scaled sites is set at \$70 per tonne, as per changes in 2009 in accordance with the Solid Waste Management Plan. Furthermore, in 2010 a differential tipping fee was introduced to encourage recycling by creating disincentive fees for loads which are not separated.

### 3.0 BACKGROUND

The site was open in 2016 on the following schedule:

April 1 - October 31	Monday - Sunday 9:00 am to 5:00 pm.
November 1 - March 31	Monday - Sunday 9:00 am to 4:00 pm.

\*The site was closed Christmas, New Year’s & Remembrance Day

The site contains a lockable gate, a single truck scale with electronic weighing and reporting software, a scale house, and an internal transfer station. The site operates on a user pay system where payment is collected on a load weight basis.

### 4.0 OBJECTIVES

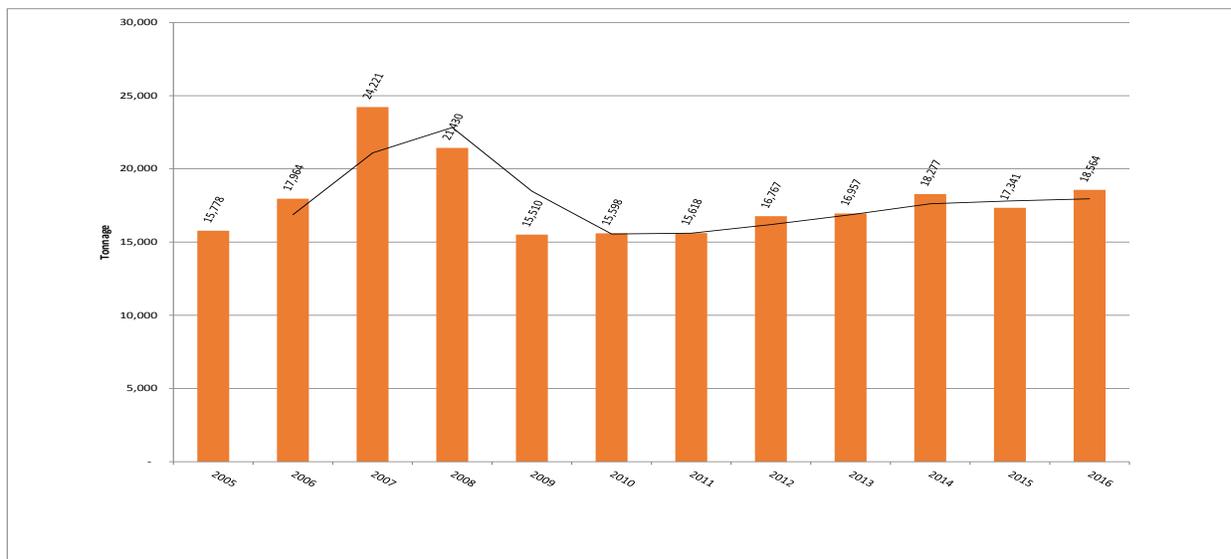
The objective of this report is to provide information required to meet the annual reporting requirements in Section 4.4 of Operational Certificate MR- 05479 issued by the BC Ministry of Environment (MOE) on December 19, 2006 (most recent).

#### 4.1 Total Tonnage of Waste Discharged (Figure 1)

In 2016 approximately 28,345 tonnes of refuse and recoverable wastes were managed at the Salmon Arm landfill. Approximately 18,564 tonnes of waste was directed to the active face and landfilled. This figure represents a 7% increase over 2015. Using the most recent census date (2016) the per capita disposal rate for 2016 was 0.56 tonnes/person/year, based on a population of 32,882 for the service area.

9,781 tonnes were diverted to marshaling areas for recovery. Existing diversion programs include; mattresses, drywall, asphalt shingles, concrete, contaminated soil, wood waste, yard and garden waste, metal and reusable items.

**Figure 1**



#### **4.2 Design Volume/Life Expectancy**

The Salmon Arm Landfill Design and Operations (D&O Plan) was prepared by Sperling Hansen Associates in December 2008. According to the plan, the site will be constructed and progressively closed in four phases. The first scheduled closure is phase 1 and the majority of work to close phase 1 was completed in 2010. During the closure work, phase 2 was prepared, incorporating a liner system and leachate collection works.

The D&O Plan required revisions to detail the phase 1 closure work, which were forwarded to the MOE. In addition, as per the requirements of the British Columbia Landfill Gas Regulation, an Initial Assessment Report was submitted to the MOE in December, 2010.

It was determined by survey that 27,137 m<sup>3</sup> of air space was consumed at the site in 2016, representing a 12% increase over 2015. The surveyed air space represents the refuse that has been landfilled in phase 2.

#### **4.3 Accomplishments in 2016**

The CSRD continued to manage and maintain 1,100 hybrid poplar trees, planted on top of the closed phase 1 of the landfill, for the purposes of leachate disposal. A report on the activities related to phytoremediation was prepared by the CSRD's summer student with the help of Forsite Engineering. The report discusses moisture assessments, foliar analysis and leachate quality results and can be made available upon request.

The landfill gas collection system continues to operate and in 2016 Fortis BC was able to operate their equipment to upgrade gas to pipeline quality for much of the year. It is estimated that approximately 7,000 CO<sub>2</sub> equivalents will be claimed for 2016.

In addition, Class "A" compost continues to be produced at the site, registered under the Organic Matter Recycling Regulation, and the finished product was distributed to CSRD transfer stations, as well as the Salmon Arm landfill, and made available for sale to the public.

The site was inspected four times in 2016 by CSRD staff. The contractor was found to be in compliance with the contract and the design and operations plan during all inspections.

#### **4.4 Wildlife Occurrences**

There were no issues with wildlife in 2016.

#### **4.5 Closure Fund**

Each spring the CSRD's Finance Department assesses closure reserves, future closure projects and landfill capacity to ensure adequate reserve funds are available for planned closure work. A copy of this assessment work has been included as Appendix 'A'.

#### **4.6 Landfill Gas**

The CSRD continued to flare landfill gas in 2016 and monitor the associated flow rates and composition to comply with a new agreement with the BC Government's Climate Action Secretariat (CAS), signed in 2016. The agreement allows the CSRD to collect carbon credits and sell those credits to CAS. Carbon credits are verified through an independent third party verifier, Ruby Canyon Engineering out of Colorado.

Fortis BC continues to upgrade gas collected via the CSRD's gas collection system to pipeline quality standards. The system consists of vessels to remove hydrogen sulphide, siloxanes and carbon dioxide from the gas. The CSRD receives revenue from Fortis BC for gas supplied, which helps offset maintenance costs related to the gas collection system.

In 2015 the landfill gas collection system was expanded to include a second horizontal gas collection piping network, embedded into the active area of the landfill. The additional collection network will allow the CSRD to collect gas in a more timely fashion and help the environment by reducing methane emissions from the site.

#### **4.7 Plans for 2017**

The CSRD has budgeted the necessary funds to develop phase 2B which will include a leachate collection system connected to the current leachate management system. This project will also involve the reduction of the phytoremediation leachate treatment area and intermediate closure of phase 2A.

### **5.0 ENVIRONMENTAL MONITORING**

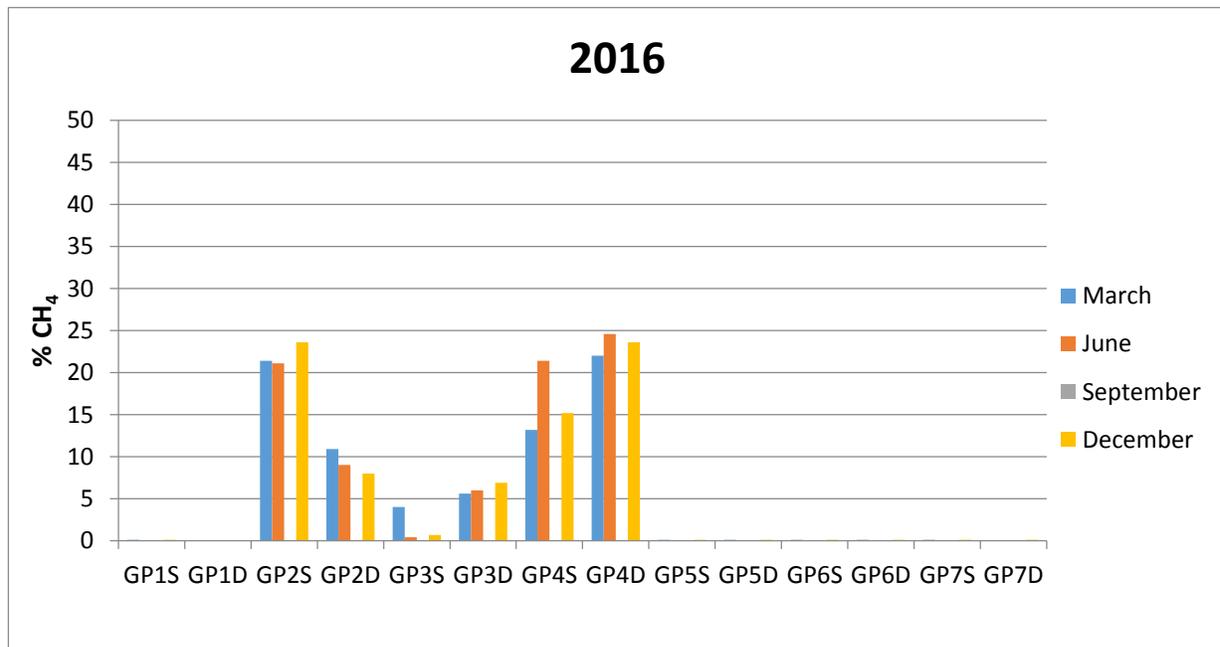
#### **5.1 Ground Water Monitoring**

Western Water Associates Ltd. conducts all environmental monitoring (groundwater) and reporting for the Salmon Arm Landfill, as per the requirements of the Operational Certificate. Western Water has provided conclusions and recommendations based on the 2016 data collected, which will be posted on the CSRD website for public review after April 1, 2017.

#### **5.2 Perimeter Gas Monitoring**

The Site has seven soil gas monitoring probes situated around the landfill property. Gas probes 1-4 are located along the north property boundary bordering the Salmon Arm airport. Gas probes 5 and 6 are on the northern portion of the west property boundary bordering an orchard. Gas probe 7 is located on the south property boundary as a control for natural soil conditions.

Figure 2 Methane Sampling



Each monitoring probe has two nested gas sampling probes for shallow and deep sampling indicated by an S or D in the tag. Each probe has 3 metres of screened pipe and nested probes are isolated by a 1 metre bentonite plug. Shallow probes are screened from approximately 1 to 4 metres depth and deep probes are screened approximately 5 to 8 metres depth.

Sampling was done quarterly using a Landtec GEM2000 portable gas analyzer. Each gas probe is purged for 10 minutes before the sample is taken. Landfill gas extraction from phase 1 began in January 2011 after it was closed and capped in the summer of 2010.

Overall averages show that soil methane concentrations decreased in 2016 by 0.5% from 6.6% in 2015 to 6.1% in 2016. The following is a summary of methane concentrations for each well for 2016:

- Methane concentrations in gas probe 1S remained at 0% this year after quickly dropping to zero in 2011 when methane extraction began. Gas probe 1D was damaged and was not sampled in 2016.
- Gas probe 2S showed a small decrease remaining in the 20 - 25% range and 2D increased to around 10% in 2016.
- Gas probe 3S and 3D continued to decrease to below 8%.
- Gas probe 4S decreased below 20% and 4D remained below 25%.
- Gas probe 5S and 5D remained at 0%.
- Gas probe 6S and 6D remained at 0%.
- Gas probe 7S and 7D is located on the far south edge of the property and has never produced any landfill gas.

Carbon dioxide was found in the soil gas in areas where methane is present as they are the two main constituents of landfill gas. Carbon dioxide was present from 0% – 30.6% and is an indicator of migrating landfill gas. The Site gas has a hydrogen sulphide gas range of 200-300 ppm. Gas probes 2 and 4 had traces of hydrogen sulfide gas below 47ppm. Carbon monoxide and hydrogen gas were detected in trace amounts with maximum readings of 2 and 21 ppm respectively.

Methane concentrations pose potential hazards with 3 of the 7 probes having readings above the methane Lower Explosive Level (LEL) of 5%. All structures on site are elevated on skids or are well vented to avoid the buildup of migrating landfill gas. Slight changes in landfill gas were observed in 2016 in the monitoring probes surrounding the landfill. The CSRD plans to continue quarterly gas readings to acquire more data and monitor landfill perimeter soil gas concentrations in 2017. With landfill gas extraction continuing at the landfill, soil gas concentrations should continue to drop in the coming years.

### **5.3 Litter, Dust and Vector Control**

Dust is controlled by the application of Magnesium Chloride to the high use dirt roads on an as need basis. Vectors were not an issue in 2016.

### **5.4 Bird Control**

Bird control services continued at the site in 2016, provided by an independent contractor. Bird control is achieved through the use of predatory birds (hawks and falcons) and pyrotechnics, which consist of bird bangers and screechers. The use of the predatory birds is governed by a permit issued by the Federal Government. The contractor's annual report is available upon request.

## **6.0 WASTE HIERARCY**

The CSRD emphasizes and encourages the 6R Hierarchy of Rethink, Reuse, Reduce, Recycle, Recovery and Residual management and continually strives towards a higher 'R' in waste management practice. At the Salmon Arm landfill there are a number of programs established to facilitate the separation and salvaging of various recyclable materials.

The CSRD also manages a network of Multi Material BC (MMBC) recycling depots throughout the regional district, including one in downtown Salmon Arm and one at the Salmon Arm landfill. MMBC is the provincial stewardship group responsible for collecting packaging and printed paper, including but limited to; paper, cardboard, newsprint, containers, plastics, glass and styrofoam. Furthermore, the CSRD tracks and reports the amount of recycling collected via the City of Salmon Arm's curbside recycling program.

### **6.1 Resource Recovery - Landfill Salvaged Materials**

In 2016 over 9,500 tonnes of material was marshaled and recycled or reused on site. Wood waste and yard and garden waste are separated on site and are chipped by the CSRD wood grinding contractor. Wood waste chips are used on site for access roads, unloading pads, and blended with cover material for use on interior landfill cells. Metal, gypsum/drywall, asphalt shingles, mattresses, and propane tanks are separated from waste on site and are salvaged by CSRD contractors for recycling off site.

Concrete, asphalt, brick, and porcelain are separated on site and stockpiled to be crushed into an aggregate product for use on site. No concrete crushing was done in 2016. Appliances containing refrigerants and Ozone Depleting Substances are separated on site and these substances are removed by a CSRD contractor before items are added to the metal area for salvage. Clean soil, contaminated soil, and chipped wood are separated for internal use at the site.

The following table provides an annual summary of 1) materials received and separated for processing and 2) categories and related tonnages processed for recycling or reused on the site for internal purposes:

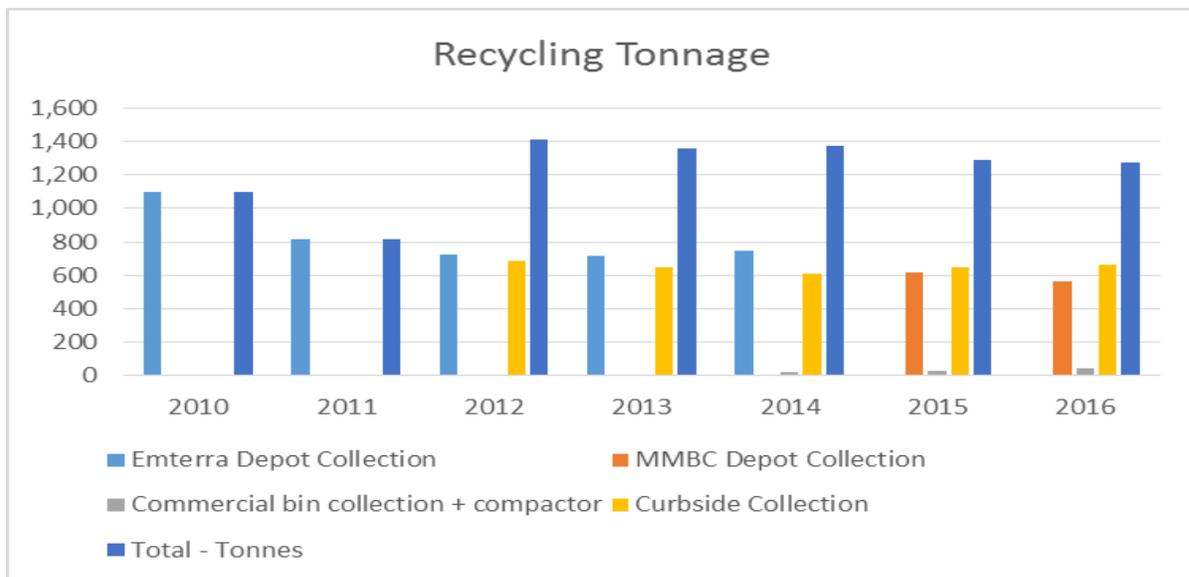
<b>Salmon Arm Landfill - Resource Recovery</b>							
Recoverable Resource	2010	2011	2012	2013	2014	2015	2016
Wood Waste - Received (MT)	1,694	2,478	2,246	2,735	2,300	2,672	2,706
Wood Waste - Processed (m <sup>3</sup> )	13,652	10,157	14,000	19,249	21,916	9,592	21,972
Yard & Garden Waste - Received (MT)	1,676	2,398	2,000	3,601	2,549	2,719	2,988
Yard & Garden Waste - Processed (m <sup>3</sup> )	9,668	6,335	7,000	5,784	12,203	7,926	11,118
Metal Waste - Received (MT)	550	665	690	673	518	553	555
Metal waste - Salvaged (MT)	486	965	600	568	502	443	679
Gypsum Drywall - Received (MT)	-	413	506	401	377	484	508
Gypsum Drywall - Salvaged (MT)	74	53	300	293	330	388	514
Asphalt Shingles - Received (MT)	-	435	354	377	353	385	406
Asphalt Shingles - Salvaged (MT)	79	55	140	359	303	432	384
Concrete/Brick/Porcelain - Received (MT)	33	181	181	255	376	317	364
ODS Units - Received	-	275	296	279	161	177	156
ODS Units - Processed	329	410	453	301	231	235	202
Propane Tanks - Salvaged	234	274	851	399	762	771	430
Auto Batteries - Salvaged	1,047	424	N/A	N/A	N/A	N/A	N/A
Mattresses - Received	-	-	-	-	994	1,778	1,912
Mattresses - Salvaged	-	-	-	-	994	1,944	2,733
Contaminated Soil Received (MT)	-	187	422	319	157	125	693
Clean Soil Received (MT)	-	3,861	2,534	1,832	4,217	455	399
Wood Waste Chipped Received (MT)	-	-	-	-	1	1	4
Bio-Solids Received (MT)	-	962	946	902	1,032	1,097	1,158
MT - Metric Tonne							
m <sup>3</sup> - cubic metre							

### 6.2 Recycling – Commercial and Residential Programs

In January of 2015, the residential recycling collection changed to the MMBC Packaging and Printed Paper collection Extended Producer Responsibility (EPR) program. Prior to the MMBC program the depot recycling program was not monitored which contributed to illegal dumping and inflated tonnage results. In addition, the City of Salmon Arm began collecting MMBC recyclable materials at the curb in 2012.

The CSRD maintains a recycling program for commercial users, which is tracked separately. In addition, the CSRD has been working to add other stewardship materials, such as power tools and electronics, where partnerships with stewardship groups can be achieved.

The following table is an overview of tonnage collected since 2010:



### 6.3 Recycling - Household Hazardous Waste

The CSRD is committed to providing residents with recycling opportunities for household hazardous waste materials by way of conducting round up events. Materials are collected, safely packed and consolidated in either drums or pails. The following table provides a summary of the amounts of materials collected, including but not limited to; flammable substances, corrosives, mercury, etc., since 2012:

Salmon Arm	Drums	Pails
2012	48	75
2014	70	95
2016	46	69

#### **6.4 Composting - CSRD Kickin' Compost**

The CSRD is currently producing approximately 1,500 cubic metres of Class 'A' compost from the yard and garden waste collected for disposal at the Site. Through a provincially regulated program, finished compost is made available to the public for purchase at transfer stations and landfills. In addition, commercial operations have also purchased the compost in bulk to create different soil blends for sale at their businesses. The CSRD is looking to expand composting operations to Revelstoke and Golden in the coming years.

**Appendix 'A' - Solid Waste Landfill Closure and Post-Closure Liability**

**COLUMBIA SHUSWAP REGIONAL DISTRICT**

**Notes to Consolidated Financial Statements**

**December 31, 2016**

**5. Solid Waste Landfill Closure and Post-Closure Liability**

The Environmental Management Act of B.C. and the Ministry of Environment of B.C. set out the landfill criteria to properly close and maintain all active and inactive landfill sites. Under the guidelines, there is a requirement for closure and post-closure care of solid waste landfill sites. Provisions are therefore made over the estimated remaining life of the Regional District landfill sites based on scalehouse records and through tipping fees.

The main components of the landfill closure plans are: final capping using an engineered cap design and the implementation of a drainage and gas management plan. The post-closure care requirements may involve: cap maintenance; groundwater monitoring; gas management system operation and maintenance; inspections; leachate treatment and monitoring; and annual reports. Post-closure care activities begin once the entire landfill site no longer accepts waste and continues on for a period of twenty-five years. As the date of the site closure is unknown, management estimates the liability to begin after the closure of the current active phase, assuming another phase will not be opened. In the event another phase is opened, the start date for the liability will be adjusted to begin upon closure of the newly opened phase.

The table below sets out the liability based on the estimated capacities used in cubic metres, multiplied by the estimated total expenditures, expressed as discounted present values, assuming 1.80% (2015 - 1.10%) inflation and 2.10% (2015 - 2.75%) long-term borrowing rate (fall issue MFA 25 year rate). The amount remaining to be recognized in future years is \$1,869,700 (2015 - \$1,619,300). The annual provision is reported as an Operating Fund expense and the accumulated provision is reported as a liability on the Consolidated Statement of Financial Position. Reserve funds totalling \$1,347,230 (2015 - \$1,004,009) have been established to provide for this liability in the Landfill Closure Special Reserve Fund.

The table also indicates the remaining landfill life in years and remaining capacity (100 minus % used) on the open phases and the anticipated post-closure costs recognized on total site capacity used.

	<b>Estimated Remaining Life (Years)</b>	<b>Estimated Total Expenditure for Closure</b>	<b>Cumulative Capacity Used (m<sup>3</sup>)</b>	<b>Total Estimated Capacity (m<sup>3</sup>)</b>	<b>Used (%)</b>	<b>Liability for Closure December 31, 2016</b>
Salmon Arm (phase 2 of 5)	10	\$ 2,202,700	165,799	383,778	43	\$ 951,600
Golden (pre-phase)	12	356,400	613,416	613,416	100	356,400
Golden (phase 1 of 4)	12	407,400	75,147	157,000	48	195,000
Revelstoke (pre-phase)	4	324,800	70,000	70,000	100	324,800
Revelstoke (phase 1 of 4)	4	728,800	57,476	98,535	58	425,100
Revelstoke (phase 2 of 4)	10	749,500	65,000	156,212	42	311,900
Revelstoke (phase 3 of 4)	21	911,000	10,000	160,688	6	56,700
Sicamous (phase 2 of 4)	9	293,300	87,315	166,000	53	154,300
Sicamous (phase 4 of 4)	27	463,600	110,000	125,000	88	408,000
<b>Closure liability subtotal</b>		<b>\$ 6,437,500</b>	<b>1,254,153</b>	<b>1,930,629</b>	<b>65</b>	<b>3,183,800</b>
<b>Post closure liability subtotal</b>						<b>1,384,000</b>
<b>2016 total liability</b>						<b>4,567,800</b>
Less: expenses previously recognized						<b>(3,430,700)</b>
<b>2016 increase in the liability for landfill closure</b>						<b>\$ 1,137,100</b>