



2020 ANNUAL REPORT FOR THE VANCOUVER LANDFILL

Prepared for:

BC MINISTRY OF ENVIRONMENT AND CLIMATE
CHANGE STRATEGY

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VANCOUVER LANDFILL OVERVIEW

The Vancouver Landfill opened in 1966 and is owned and operated by the City of Vancouver. It is located at 5400 72nd Street in Delta, in the southwest corner of Burns Bog, and is only accessible via Highway 99 Southbound.

The Landfill is responsible for the management of municipal solid waste (MSW) from commercial and residential sources within Metro Vancouver as part of Metro Vancouver's 2010 *Integrated Solid Waste and Resource Management Plan*. Most of the waste received at the Landfill is first delivered to either the Vancouver South Transfer Station (VSTS), also owned and operated by the City of Vancouver, or one of Metro Vancouver's transfer stations.

Landfill operations are regulated by Operational Certificate MR-01611 issued by the BC Ministry of Environment and Climate Change Strategy (MOE) and conducted according to engineered plans and legal agreements with Metro Vancouver and the City of Delta. These legal agreements expire in 2037 which coincide with current fill and closure plans and associated financing. The engineered plans, titled *Design Plan, Vancouver Landfill, Delta BC* and *Operating Plan, Vancouver Landfill, Delta BC*, were prepared by Golder Associates and submitted to the MOE in early 2019.

The Landfill property is 320 hectares in size, which contains the footprint (area filled with garbage) at 225 hectares and a 16.7 hectare (ha) pond historically used for dredging cover material. Approximately 320 ha of undeveloped land that were part of the original Landfill property were transferred back to Delta as shown in Figure 1. The site plan for the Landfill property is shown in Figure 2.



Figure 1: 2020 Vancouver Landfill Property and Footprint



Figure 2: 2020 Vancouver Landfill Site Plan

The Landfill is authorized to accept up to 750,000 tonnes of municipal solid waste (MSW) for disposal each year. Materials used beneficially, such as for cover, road building and closure, are not counted towards this limit.

In 2020, 654,521 tonnes of MSW and 44,138 tonnes of demolition waste were accepted for a total of 698,659 tonnes. This reflects approximately 71% of the total MSW generated in Metro Vancouver, with the remaining 29% being delivered to the Burnaby Waste to Energy Facility and out of region landfills.

Leachate and surface runoff are collected in the inner ditch of a double ditch collection system, and then pumped to the Annacis Island Wastewater Treatment Plant under the Greater Vancouver Sewerage & Drainage District Waste Discharge Permit SC-100168-FSA. In 2020, 2.7 million m³ of leachate, surface runoff and stormwater from closed areas were collected, pumped into the sewer and treated, at a cost of over \$3.9 million. A total of 52 leachate, surface and groundwater monitoring stations were sampled quarterly as part of the Landfill's Water Quality Monitoring Program to confirm the effectiveness of the leachate collection and containment system.

As part of the Landfill's Stormwater Monitoring Program, six additional monitoring stations were sampled during wetter months in 2020 to assess stormwater quality from closed areas and potential receiving water bodies. Two tests resulted in the discharge of 81,040 m³ of clean stormwater to the Dredge Pond in the last quarter for a savings of \$117,500 in leachate conveyance and treatment costs.

In 2020, landfill gas (LFG) was extracted by 253 vertical wells, 123 horizontal collectors (monitoring points), 32 Drintube collectors, 3 pressure relief wells and 11 side slope collectors for a total of 422 LFG collection points. Approximately 28% of the LFG was used off site to generate electricity for sale to BC Hydro and heat for Village Farms' greenhouses. A small portion was used to heat the Landfill Operations and Engineering Buildings. Excess gas was burned in on-site flares at the Landfill Gas Management System (Flare Station) to minimize greenhouse gas emissions. Approximately 65.4 million m³ of LFG (normalized to 50% methane) was collected and destroyed in 2020, which is equivalent to the emissions of approximately 88,400 vehicles.

In 2018, FortisBC and the City reached an agreement for FortisBC to develop an upgrading plant at the Landfill to convert LFG to renewable natural gas (RNG) for the FortisBC pipeline. This agreement was approved by the BC Utilities Commission in late 2019. FortisBC completed the design requirements for their RNG facility which is planned to be on line in Q1-Q2 2023. In October 2020, the City and Village Farms Clean Energy (VFCE) finalized an amendment to their 20 year agreement to extend the term to allow VFCE to upgrade their equipment at the Landfill to produce RNG for the Fortis pipeline and carbon dioxide for their greenhouses. Design began in late 2020 and commercial operation is planned for Q3 2022.

As each phase of the Landfill is filled to design height, it is closed using an engineered cover system to minimize leachate generation and maximize landfill gas capture. Since 2009, Phases 1, 2, 3, Western 40 Hectares, 5.2 ha of Phase 4 South (Phase 4S) and 3.7 ha of a new stormwater pond have been progressively closed. This equates to closure of a total of 116.2 ha, or 52% of the landfill footprint.

The Landfill Zero Waste Centre, formerly known as the Residential Drop-Off Area, is located at the entrance to the site and provides a safe and convenient location for residential and small commercial customers to drop off waste and recyclables. Over 20 categories of materials were collected for reuse and recycling in 2020, including six categories of residential packaging and printed paper collected on behalf of Recycle BC. The majority of recyclables are collected free of charge. In addition, the Paint Plus depot opened in December 2020 to allow for the collection of paint, aerosol paint, other aerosols, solvents and pesticides in cooperation with Product Care Association of Canada.

The City operates a composting facility to process the yard and garden trimmings dropped off at the VSTS and Landfill into finished compost for sale and donation. In 2020, approximately 28,500 tonnes of yard trimmings was composted and 7,500 m³ of finished compost distributed.

The purpose of this report is to fulfill the annual reporting requirements defined by the Landfill's Operational Certificate and BC *Landfill Criteria for Municipal Solid Waste, Second Edition* (BC Ministry of Environment, 2016). This report also includes the MOE Annual Status Form. Additional information on the Landfill including hours of operation, location and disposal rates is available online at vancouver.ca/landfill. Historical annual reports are also available online at vancouver.ca/landfill-annual-report.

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1. Introduction

This annual report covers the period from January to December 2020, and has been prepared to fulfill the requirements of the Landfill's Operational Certificate MR-01611. This report is available online at vancouver.ca/landfill-annual-report.

Issued by the Ministry of Environment and Climate Change Strategy (MOE) on March 8, 2001, the Operational Certificate authorizes the discharge of MSW from within Metro Vancouver and other sources as authorized by the MOE and specifies the operating and environmental protection requirements for the Landfill.

This report meets the reporting requirements in Section 3.5.2 of the Operational Certificate by providing the information listed in Table 1.

Table 1: Operational Certificate Reporting Requirements

Reporting Requirement	2020 Annual Report Section(s)
Updates to the design and operating plan.	2. Design and Operating Plans
Revised closure/post closure costs.	3. Closure and Post Closure Costs
Planned improvements.	4. Planned Improvements
Records for waste, recyclable material and compost quantities.	Table 2: Inbound Material Quantities for 2019 & 2020 Table 3: 2019 & 2020 Recycling Quantities Appendix 1: Annual Waste Quantities
An evaluation of recycling and composting programs, including waste diversion projections.	5.2 Municipal Solid Waste Disposal 6.1 Residential Drop-Off Area 6.3 Yard Trimmings Collection and Composting
A review of receiving environmental monitoring data with interpretation, including leachate flow data and leachate/drainage ditch levels suitably tabulated.	7.3 Water Quality Monitoring Program & Annual Review Appendix 6: 2020 Water Quality Monitoring Program Review Executive Summary Appendix 7: 2020 Weekly Leachate and Drainage Ditch Water Elevations
An evaluation of leachate generation control measures.	7.2 Leachate Generation Control Measures
An evaluation of the efficiency of the landfill gas management systems, including an estimation of the landfill gas generation rate, percent recovery and the actual rates/volumes of gas collected, utilized and flared.	7.5 Landfill Gas Collection Efficiency

Reporting Requirement	2020 Annual Report Section(s)
A list of operating problems and corrective actions taken.	8.5 Operating Problems & Corrective Actions
A summary of the public complaint and resolution log.	8.7 Public Complaint & Resolution Log

This report also meets the additional reporting requirements as per Section 10.6 of the BC *Landfill Criteria for Municipal Solid Waste, Second Edition* (BC Ministry of Environment, 2016) (Landfill Criteria) by providing the information listed in Table 2.

Table 2: Additional Reporting Requirements as per the Landfill Criteria

Reporting Requirement	2020 Annual Report Section(s)
Total volume of waste discharged into the landfill for the year	Table 2: Inbound Material Quantities for 2019 & 2020 Appendix 1: Annual Waste Quantities
Operational plan for the next 12 months	2. Design & Operating Plans
Remaining site life and capacity	2.3 Remaining Capacity
Closure works completed	2.1 Fill Plan & Progressive Closure Status
Results of regular inspection for cover integrity, health of vegetation, undesirable plant species, burrowing animals, erosion, settlement, etc.	8.4 Site Inspections
Any changes from approved reports, plans and specifications	2. Design & Operating Plans
Compaction, waste to cover ratio, waste to road ratio and airspace utilization factor	2.2 Operational Efficiency
Operational and maintenance expenditures	8.6 Operational and Maintenance Expenditures

As of January 1, 2016, annual reports for high priority authorizations must include the MOE Annual Status Form. The Form for the Vancouver Landfill lists all OC conditions, all of which were met in 2020, and is included in Appendix 8.

2. Design and Operating Plans

The *Design Plan, Vancouver Landfill, Delta BC* (Design Plan) and *Operating Plan, Vancouver Landfill, Delta BC* (Operating Plan) were completed by Golder Associates (Golder) in early 2019. The Design Plan is a reference for landfill design and progressive closure, while the Operating Plan is a guide for day-to-day operation of the Landfill.

In September 2019, the City notified the MOE by letter of the following changes to the Design Plan:

- The grade of the top of Phases 4 and 5 was decreased from 6% to 4% to have a more usable area post-closure;
- The drainage orientation for Phases 4 and 5 was changed from a crown in the middle draining north-south, to two crowns draining east-west;
- Phase 5 South (Phase 5S) will be filled ahead of Phase 5 North (Phase 5N) to facilitate directing clean stormwater to a new pond that was constructed with Phase 4S closure in 2020.

A number of figures in the Design Plan that referenced the final contours of Phases 4 and 5 are being updated along with the filling sequence figures and will be finished by April 2021. These will be forwarded to the MOE upon completion.

2.1. Fill Plan & Progressive Closure Status

Plan and profile views of the engineered fill plan, including projected phase closure dates, are shown in Figure 3.

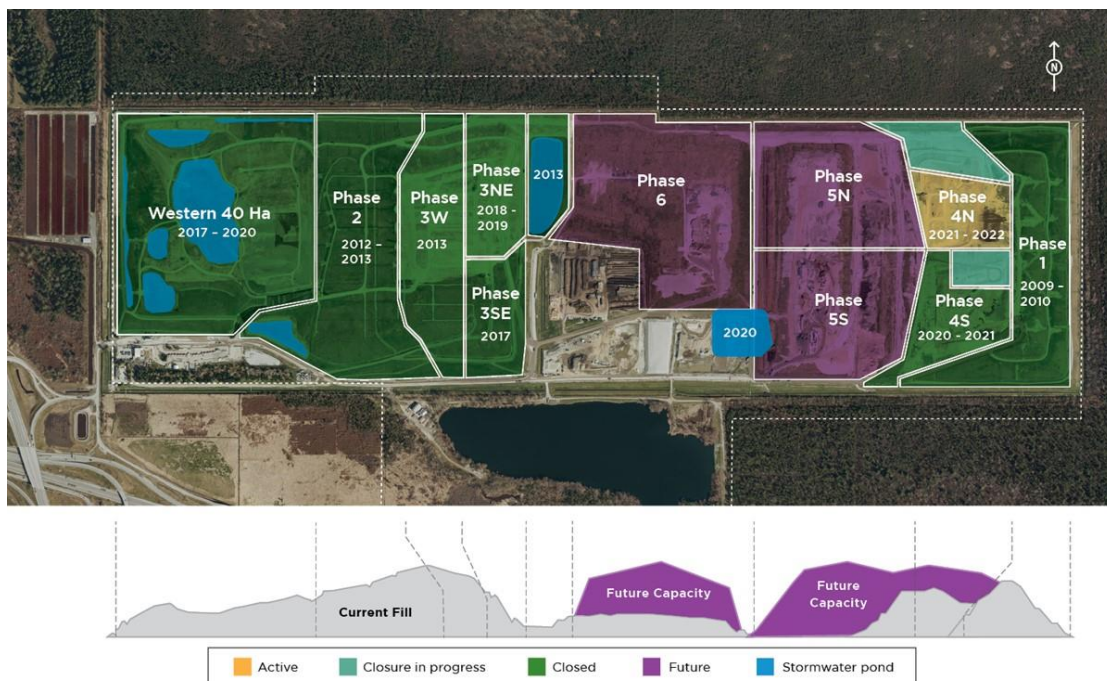


Figure 3: 2020 Landfill Fill and Progressive Closure Plan

A full time GPS Technician and one of the Landfill Engineers work closely with Superintendents and Operations staff in the active areas to ensure filling proceeds according to the intent of the engineered fill plan for each lift and phase.

Up until April 29, 2020, municipal solid waste (MSW) filling occurred in Phase 4S and then moved into Phase 4 North (Phase 4N) for the remainder of the year. A small amount of

asbestos waste was disposed of in Phase 5 as well. The rate of filling slowed due to the impacts of COVID-19 with an overall delay of approximately two months to the 2020 filling plan. This resulted in delays in infrastructure installation that is dependent on the filling plan.

Fill areas are typically prepared with a base layer of demolition material (also known as a 'demo mat') to facilitate conveyance of leachate to the perimeter leachate ditch system and the installation of gas works. Construction of the demo mat in Phase 5, which began in 2019, continued in 2020.

A summary of the operational plan for the next 12 months is as follows:

- Disposal of MSW in Phase 4N until Q3 2021 and then moving to Phase 5S;
- Use of demolition material in Phase 5 to complete the demo mat; and
- Litter fencing on every lift.

As of the end of 2020, several phases have been closed with engineered cover systems, including the Western 40 Hectares, Phases 1, 2, and 3, 5.2 ha of Phase 4S along with 3.7 ha of a new stormwater pond as detailed in Table 3.

Table 3: 2020 Progressive Closure Status

Area	Construction Timeframe	As of Dec 31, 2020			Completed by
		Area Closed	Additional Infrastructure Installed	Actual Spend	
Phase 1	2009-2010	14 ha	22 vertical gas wells and 1 horizontal collector; 9 stormwater discharge bridges	\$ 12M	CH2M Hill, Sperling Hansen Associates (SHA), Tyam Construction
	2012-2013	3.5 ha	Toe closure and ditch to divert stormwater to 2 southern discharge bridges only	included with Phase 2	RF Binnie Civil Engineering Consultants (Binnie), SHA, SCS Engineers (SCS), King Hoe Excavating (King Hoe)
Phase 2	2012-2013	19 ha	89 vertical gas wells and 12 horizontal gas collectors; 1 stormwater retention pond with 11,500 m ³ capacity	\$ 17.4M	Binnie, SHA, SCS, King Hoe
Phase 3W	2013	9.5 ha	13 vertical gas wells; 1 stormwater retention pond with 88,500 m ³ capacity (to serve all of Phase 3)	\$ 15.3M	Binnie, SHA, SCS, BD Hall Constructors (Hall)
Phase 3SE	2017 - 2018	9.7 ha	11 vertical gas wells	\$ 10M	Binnie, Golder, Hall

Area	Construction Timeframe	As of Dec 31, 2020			Completed by
		Area Closed	Additional Infrastructure Installed	Actual Spend	
Phase 3NE	2018-2019	15.2 ha	33 vertical gas wells and 7 horizontal gas collectors	\$ 19.9M	Binnie, SHA, M2K
W40Ha	2017-2020	36.4 ha	27 vertical gas wells, 32 Draintube collectors; 6 stormwater retention ponds with 87,700 m ³ capacity	\$ 23.5M	Binnie, SHA, King Hoe
Phase 4S*	2020	8.9 ha	19 vertical gas wells, 28 horizontal gas collectors; 1 stormwater retention pond with 100,000 m ³ capacity (to serve Phase 4 and future phases)	\$ 11.5M	King Hoe, SHA, SCS
Total (ha)		116.2			
*Closure of the remaining 1.1 ha of Phase 4S and 0.8 ha of Pond 4 will occur in 2021. ha = hectare (equal to 10,000 m ² or 2.47 acres)					

2.2. Operational Efficiency

Aerial mapping and analysis has been completed at the Landfill on an annual basis since 2000. The annual flight to generate contour data is completed around the beginning of April when weather permits, and the data are typically available within three months. AECOM Canada Ltd. (AECOM) is under contract to the City to complete annual data analysis from 2017 to 2021.

The purpose of the aerial mapping and analysis is to utilize the contour data from the previous and current years coupled with the tonnages of materials disposed and beneficially used to assess the following parameters:

- Landfill settlement;
- Compaction density;
- Air space consumption;
- Waste to cover ratio and waste to other¹ materials ratio;
- Remaining capacity; and
- Lifespan analysis.

¹ Other refers to cover, road construction and other beneficial use materials.

As per AECOM's *Vancouver Landfill Aerial Mapping Report April 2019 - April 2020* (2020 Aerial Mapping Report), the following operational efficiencies were achieved for the period from March 17, 2019 to April 7, 2020, for the Phase 4 active area:

- Compaction density of 0.83 tonne/m³ for MSW. This value, also known as the effective density, is back calculated using assumed densities from various geotechnical sources and survey volumes after accounting for settlement.
- Airspace utilization factor of 1.2 m³/tonne.
- Waste to cover ratio by volume of 3.81 to 1, a waste to road materials ratio by weight of 15.5 to 1, and a waste to all other materials ratio of 1.2 to 1 in Phase 4.

2.3. Remaining Capacity

The 1999 Agreement between the City of Vancouver and the City of Delta defined the remaining capacity of the Landfill as of October 1, 1997 to be 20 million tonnes of MSW. The remaining capacity excludes any demolition waste disposed of in the Western 40 Hectares area. The remaining capacity of the Vancouver Landfill as of December 31, 2020 is 7,154,344 tonnes.

The 2020 Aerial Mapping Report identified the remaining volumetric capacity for MSW as of April 7th until the final contours are achieved to be 6.54 million m³. This capacity is available in Phases 4N to 6. The volume is derived from taking the difference between the latest aerial contours (2020 in this case) and the final design contours in the Design Plan.

3. Closure and Post Closure Costs

The Landfill's Operational Certificate requires the City to maintain a dedicated reserve fund sufficient to finance closure, post-closure and environmental contingencies related to the Landfill. The Solid Waste Capital Reserve (SWCR) was established to address these costs. In 2001, Council set the minimum balance of the SWCR at \$30 million and directed that the requirements for the SWCR be reviewed every five years. At the end of 2020, the closing balance of the SWCR was approximately \$64.9 million. This reflects a net decrease of \$5.8 million from 2019, which is due to closure work undertaken and offset by planned operational surpluses, interest revenue and Metro Vancouver contributions.

Every year, closure and post-closure costs are reviewed and updated with current available information. For the 2020 Landfill Liability, the 2019 Design Plan was used as the primary resource. The Net Present Value for closure and post closure costs is \$113.6 million, down from \$114.7 million from 2019 as a result of 2020 closure expenditures.

According to the 1989 Tripartite Agreement between the Metro Vancouver (formerly known as the Greater Vancouver Sewerage and Drainage District (GVS&DD)), the City of Delta and City of Vancouver, Metro Vancouver is responsible for closure and post closure costs based on the proportion of regional waste in place at the Vancouver Landfill. The City of Vancouver is responsible to pay for closure and post-closure costs for Vancouver and Delta waste. At the end of 2020, 34.3% of the total waste in place at the Vancouver Landfill was regional waste, with the remaining 65.7% originating from Vancouver and Delta. This represents an increase

of 1.4% in the proportion of regional waste since 2019, and corresponds to a current liability for the City of Vancouver of \$58.2 million.

4. Planned Improvements

4.1. Leachate, Surface Water Runoff and Stormwater Management

As filling progressed in Phase 4 in 2020, leachate collectors were installed as follows:

- On the east side of lift 1 of Phase 5N, between April 2019 and March 2020; and,
- On the east side of lift 5 of Phase 4N, between December 2019 and February 2020.

In 2021, one leachate collector is planned for:

- The east side of lift 3 of Phase 5S starting in August 2021.

Construction activities in 2020 also included installation of an 800 mm pipe and 600 mm pipe to convey stormwater to the Dredge Pond from Phase 1 and Phase 2 pond respectively.

In September 2017, the City kicked off the 2017-2021 Water Quality Consulting & Stormwater Management Planning Project following award to AECOM. Major milestones achieved in 2020 are listed in the remainder of this section.

An action plan was developed and implemented to address the recommendations from the 2018 Hydrogeological Review. Action items completed in 2020 included:

- Station 27-2013 was decommissioned and replaced with Station 27-2020;
- A protocol was put in place to clean sampling containers utilized for leachate toxicity testing prior to sampling;
- Surface water and stormwater samples were analyzed for dissolved organic carbon (DOC) starting in Q3 to assess compliance against the new Aquatic Life BC Water Quality Guideline for copper; and
- Sampling Well 70 continued as part of the routine monitoring program until sufficient data is collected from the 2019 replacement well (Well 125) to determine if they exhibit similar water quality (currently planned to continue until at least 2022).

The remaining recommendations shall be either:

- Pursued as part of the Stormwater Management Plan (leachate collection system capacity evaluation, pump station assessment, berm upgrades); or,
- Included as part of the 2023 Hydrogeological Review (verify conductivity of sand aquifer, measure leachate levels in each phase, monitor piezometer transects).

Stormwater management planning continued with stakeholder presentations and workshops and culminated in the Stormwater Management Plan (SMP) that was finalized in July 2020. The SMP addresses the OC requirement that stormwater from above the engineered cover system in closed areas be directed outside of the leachate collection system (Section 2.8).

Recommendations of the SWP that were undertaken in 2020 included routine stormwater monitoring as well as two stormwater discharge pilot tests. These pilot tests involved discharging approximately 83,000 m³ of stormwater from Phase 1 and Phase 2 and 3 Ponds into the Dredge Pond to assess impacts on Dredge Pond water levels and quality. The tests were conducted during dry and wet weather conditions in the fourth quarter. A summary of the findings will be reported in 2021.

The design for the Remote Water Level Monitoring System was completed in 2020 and system procurement and installation is planned for 2021.

4.2. Landfill Gas Collection

To maximize the collection of landfill gas during filling, the following infrastructure was installed in 2020 as follows:

- Phase 4S:
 - 19 new vertical gas wells (P04-V001 to V019) were drilled, connected and functional.
- Phase 4N:
 - Six lift 4 horizontal pipes (P04H407-412) were installed. 12 horizontal collectors connected and functional (P04H407-12E and P04H407-12W).
 - Five new side-slope collectors (P04-S501 to S505) were installed, connected and functional.
- Phase 3:
 - Ten vertical gas wells were decommissioned and re-drilled nearby (P03-V009 to V012, V014, V046, V049, V050, V074, V091). The re-drilled vertical gas wells were connected and functional.
- Phase 2:
 - Two vertical gas wells were decommissioned and re-drilled nearby (P02-V008 and P02-V029). The re-drilled vertical gas wells were connected and functional.
- Phase 1:
 - One vertical gas well was decommissioned and re-drilled nearby (P01-V040). The re-drilled vertical gas well was connected and functional.

There are many modifications and upgrades planned for the Landfill Gas Collection System in 2021. The City is planning to:

- Phase 4N:
 - Install six new horizontal collectors in lift 6 (P04H604-09E and P04H604-09W).
 - Install 27 vertical gas wells.

- Complete a temporary closure of 2.3 ha (north section of the north-west slope) plus 1.0 ha of biocover with seven temporary vertical gas wells and Draintube collectors panel with three monitoring devices.
- Phase 5S:
 - Install nine side-slope collectors on the east slope (P05-S501 to S509), five temporary vertical gas wells (P05-TV01 to TV05) and four permanent side-slope collectors (P05-S101 to S104) on the south wedge.
- Phase 1:
 - Re-drill (replace) two vertical gas wells (P01-V038 and P01-V042).
- Phase 3:
 - Install five new vertical gas wells in-between high producing vertical gas wells effectively overlapping the zone of influence to attempt to collect all possible gas in the area (P03-V119 to V123).
- Replace the main header (South portion, 1100 m) including condensate traps
- Develop a pilot project to install remote monitoring and auto-tuning devices on high producing vertical gas wells and horizontal collectors to effectively monitor, control, tune and optimize LFG collection.

In 2018, FortisBC and the City reached an agreement for FortisBC to develop an upgrading plant at the Landfill to convert LFG to renewable natural gas (RNG) for the FortisBC pipeline. This agreement was approved by the BC Utilities Commission in late 2019. FortisBC completed the design requirements for their RNG facility which is planned to be on line in Q1-Q2 2023. In October 2020, the City and Village Farms Clean Energy (VFCE) finalized an amendment to their 20-year agreement to extend the term to allow VFCE to construct upgrade their equipment at the Landfill to produce RNG for the Fortis pipeline and carbon dioxide for their greenhouses. The agreement extension is for a 20-year period and commences upon start-up and commercial operation of the Delta RNG project. The agreement extension has the option to extend for an additional 5-year period. Design began in late 2020 and commercial operation is planned for Q3 2022.

In July 2020, the City hired Jacobs Engineering Group Inc. (Jacobs) as the Owner's Engineer to provide technical guidance and support to the City on how to integrate the two new RNG plants into the current LFG system. The requirements development, detailed design, construction and commissioning will be completed by Fortis and VFCE for their respective RNG facilities.

4.3. Progressive Landfill Closure

Construction for the Western 40 Hectares Closure & Gas System Upgrades Project was awarded to King Hoe in May 2017, and occurred in stages over a four-year period (2017-2020) mainly due to the size of the area. The final stage of closure (approximately 2.4 ha) was completed in 2020 and included final portion of the liner.

Construction of the Phase 3 Northeast (Phase 3NE) Closure & Phase 4 LFG System Expansion Project was awarded to M2K in May 2018 and occurred over a two-year period. Phase 4 works

were substantially completed in November 2019 and Phase 3NE closure construction was substantially completed in February 2020.

Construction of the Phase 4 Closure and Gas Upgrades Project was awarded to King Hoe in early 2020. A total of 5.2 ha of liner construction in Phase 4S was completed in 2020 along with 3.7 ha of a new stormwater pond with a capacity of 100,000 m³ and 19 vertical gas wells. The remaining 1.1 ha of Phase 4S, 0.8 ha of the pond and 5.3 ha of Phase 4N are planned for 2021. Also planned in 2021 is the north portion of the temporary closure on the west bank of Phase 4N (2.3 ha) with a biocover planned for the lower bank elevation. In 2022, the southern portion of the temporary closure will be completed (1.2 ha). A further 3.4 ha of Phase 4N is deferred to 2022 due to delays in filling caused by COVID-19.

Progressive closure plans for 2021 to 2022 are summarized in Table 4.

Table 4: 2021-2022 Progressive Closure Plan

Area	Construction Timeframe	Area to be Closed	Additional Infrastructure Planned	Estimated Spend	To be Completed by
Phase 4S	2021	1.9 ha	0.8 ha stormwater retention pond	\$ 3.6M	King Hoe, SHA, SCS
Phase 4N	2021	5.3 ha	27 vertical gas wells and six horizontal gas collectors	\$ 13.2M	
	2022	3.4 ha	None		

4.4. Landfill Facilities

Follow on work for the Landfill Entrance Improvement Project was completed in 2020 and included:

- Paving of several areas and roadways around the weigh scales; and
- Line painting around the entrance and in the Zero Waste Centre.

Additional work is in development in 2021 including a new household hazardous waste area cover and three bin canopies in the Zero Waste Centre.

4.5. Material Diversion

Based on the successful six-month pilot of recovering wood waste suitable for use as an alternative fuel to cement kilns in 2017, the City developed a business case to build and operate a Construction & Demolition (C&D) Material Recovery Facility (MRF) to process 60,000 tonnes per year of C&D. However, since the pilot, C&D tonnages have steeply dropped from over 125,000 tonnes per year to less than 45,000 tonnes in 2020 significantly impacting the business case. As a result, the City has put the design and building of the MRF on hold while it assesses the tonnages in the next few years. In the meantime, the City is exploring the smaller diversion pilot initiatives including on-site recycling of mattresses, upholstered furniture and clean wood waste.

4.6. Landfill End Use

As per the terms of the 1999 Agreement between the City of Vancouver and the City of Delta, the two parties shall work together to establish the end use of the site for the post-closure period. In December 2019, Delta Mayor Harvie wrote a letter to Vancouver Mayor Stewart requesting the development of a comprehensive End Use Plan for the Landfill. In 2020, a statement of work was developed to retain a consultant to assist the City of Vancouver and City of Delta to develop suitable end use options for the site supported by stakeholder engagement and technical feasibility analysis. The consulting contract will be awarded in April 2021, and the project is expected to take approximately one year.

5. Waste Disposal

In addition to Vancouver and Delta, the Vancouver Landfill directly serves the communities of Richmond, White Rock, the University Endowment Lands and portions of Surrey under the terms of the 1989 Tripartite Agreement and 2010 *Integrated Solid Waste and Resource Management Plan*. The remaining waste generated in the region was directed by Metro Vancouver to the Vancouver Landfill via the regional transfer stations, to the Waste-to-Energy Facility in Burnaby, and starting in 2017 to contingency disposal facilities outside of the region.

The Vancouver Landfill is authorized to accept up to 750,000 tonnes of waste each year. The annual totals for 2019 and 2020 municipal solid waste, demolition waste, cover, road construction and closure materials received are provided in Table 5. The historical quantities are shown in Figure 4.

Table 5: Inbound Material Quantities for 2019 & 2020

Material	2020 Quantity (tonnes)	2019 Quantity (tonnes)
Waste Discharge		
Municipal Solid Waste	613,043	643,574
Bottom Ash	41,478	16,755
Demolition Material	44,138	61,178
Cover Soil	490,582	516,712
Road Construction & Other Beneficial Use Materials		
Demolition hog	77,500	70,524
Wood waste	4,440	4,571
Crushed concrete	18,096	45,613
Purchased concrete & rock	53,549	58,615
Sand	1,812	838
Closure Materials		
Aggregate	68,363	125,901
Sand & Soil	494,422	304,418
Total	1,907,423*	1,848,698
Note:		
Cover soil, road construction & other beneficial use materials, and closure materials are not included in waste discharge quantities.		
* Totals may vary due to rounding errors.		

In 2020, the total waste discharge was 698,659 tonnes, reflecting a decrease of approximately 3% from 2019.

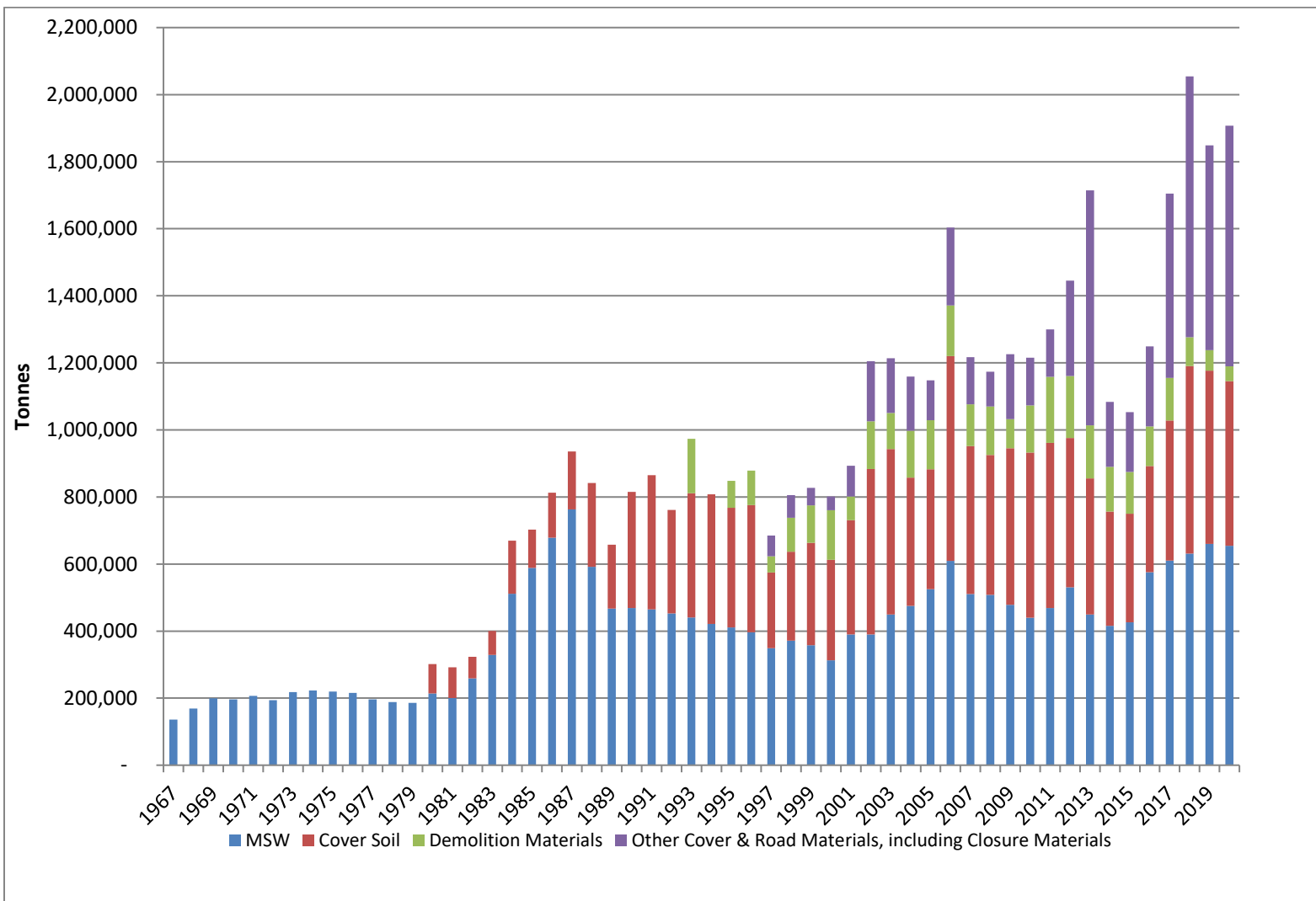


Figure 4: Historical Waste Quantities

5.1. Waste Composition

Metro Vancouver publishes waste composition study reports for the region, and the City of Vancouver contributes as a partner by coordinating waste audits at the VSTS. The data is combined with data gathered at the other regional facilities.

Metro Testing & Engineering Ltd. published the 2020 Waste Composition Study (Study) in March 2021. The Study provides current data on the material composition of the MSW and disposal rates of MSW within the Metro Vancouver region.

During the Study, Metro Testing & Engineering Ltd. analyzed the waste material composition, estimated disposal rates, quantities of personal protective equipment (PPE) and single-use items (SUIs) in each sector. The results provide current data on the composition of MSW for the following sectors:

- Single family residential waste;
- Multi-family residential waste;
- Commercial/Institutional waste; and
- Small loads waste (formerly known as Residential Drop-Off waste).

It is important to note that, given the Study happened during the COVID-19 pandemic, the results only provide a snapshot of how disposal habits have changed due to the pandemic. The overall 2020 results are not typical when compared to previous years.

The Study, as well as those completed in previous years, is available on Metro Vancouver's website: <http://www.metrovancouver.org/services/solid-waste/about/reports-resources/Pages/default.aspx>

5.2. Municipal Solid Waste Disposal

Waste disposed of at the Vancouver Landfill is either hauled directly to the Landfill, or transferred through the VSTS or one of Metro Vancouver's Transfer Stations.

In 2020, a total of 654,521 tonnes of municipal solid waste was disposed of at the Landfill, primarily in Phase 4. Of this, 131,253 tonnes was transferred through the VSTS and 362,573 tonnes was transferred from the regional transfer stations. A total of 11,215 tonnes was also received as non-recyclable residuals from licensed transfer stations and material recovery facilities in the region (known as demo garbage).

Table A1 in Appendix 1 provides a breakdown of material type, origin and disposal location for 2020. Table A2 provides a breakdown of material type, origin and disposal location for 2019. Table A3 shows the breakdown by month of MSW, bottom ash, demolition material, cover material, road & other beneficial use materials, closure materials and yard trimmings for 2020. Details on some of these materials are included in the following sections.

The Landfill's Operational Certificate restricts the type of waste discharged at the Landfill to typical MSW and other materials specifically authorized by the MOE. Asbestos waste may also be discharged in accordance with the *Hazardous Waste Regulation*. All other Hazardous Waste is prohibited from disposal at the Landfill.

5.2.1. Asbestos Waste

A total of 9,508 tonnes of asbestos waste was disposed of in 2020 from commercial and residential customers, down from 10,250 tonnes in 2019.

Commercial asbestos waste is received Monday to Friday from 8:00am to 2:00pm for direct burial, while residential asbestos waste is received during regular operating hours in a dedicated bin in the Zero Waste Centre. Burials occur a minimum of 20 metres away from all other active areas, and include the placement of a minimum of 0.5 metres of material on the waste. An exposure control plan is in place that includes periodic exposure monitoring to confirm the risk of asbestos exposure to Staff is low. The definition of asbestos waste used in the Landfill's Asbestos Policy follows the *Occupational Health & Safety Regulation*. Commercial loads of asbestos waste have to meet the *Transportation of Dangerous Goods Regulation*.

The used residential drywall pilot program at the Landfill started in September 2016 in alignment with a pilot program at two regional transfer stations, as a means of reducing illegal dumping and improper disposal of used drywall. It allows residents to deliver up to ten bags of used drywall, up to five times per year. In late 2018, the pilot program expanded to the remaining three regional transfer stations as well; however, it is not in place at the VSTS due to space constraints. A total of 667 tonnes of used residential drywall was received at the Vancouver Landfill in 2020, up from 589 tonnes in 2019. Used drywall from commercial customers is not accepted due to capacity constraints and the availability of alternative disposal options within the commercial sector.

5.3. Other Authorized Waste

Ongoing discharges authorized by the MOE prior to 2020 are those for Non-Recyclable Wastewater Treatment Plant (WWTP) Residuals, Non-Recyclable Drinking Water Treatment Plant (WTP) Residuals and Bottom Ash, all of which are generated by regional facilities. In 2018, the City received temporary authorization to accept Iona Grit Dump Solids for disposal until November 30, 2024. In 2019, the City received temporary authorization to accept up to 2 tonnes of non-recyclable marine debris from the Salish Sea Nearshore Habitat Recovery Program.

5.3.1. Non-Recyclable Wastewater Treatment Plant Residuals

As of 1998, the Landfill has been accepting grit from the Annacis Island and Lions Gate WWTPs, and since 2000 from Lulu Island and Iona WWTPs as well. Grit is primarily composed of materials that are denser than water and may include sand, pebbles, cinders, coffee grounds, seeds, cigarette filters and organic matter. Before grit was accepted at the Landfill, testing was conducted to confirm that it is not a Hazardous Waste. To minimize nuisance impacts, containers are tarped, drained and sealed at the WWTP to eliminate leakage during transportation to the Landfill.

In 2005, the Landfill began accepting sludge and scum screenings from Annacis Island WWTP on a trial basis. Sludge screenings are solids composed of hair, plastic debris, paper fibers and other finer materials. Scum screenings are floating materials such as toilet paper, waste paper products, plastics and other buoyant materials, which are generally combined with fat

and grease. In October 2008, the MOE authorized disposal of WWTP residuals from the Annacis Island WWTP at the Landfill.

In 2012, the MOE consolidated the authorizations for the disposal of non-recyclable WWTP residuals from any of the five regional WWTPs. In 2020, the City received a letter amendment to add authorization for 2,500 tonnes of digester solids originating from Metro's WWTPs provided certain conditions are met. Digester solids are grit that has not been captured in upstream preliminary treatment system, and sludge generated during secondary treatment, which is mixed with sawdust prior to hauling to absorb excess liquid. As stipulated in the MOE authorization letter, the disposal of digester solids counts towards the allowable annual tonnage, and is reported as a separate line item in Table A1 in the Appendix.

As part of the 2012 authorization, the City and Metro Vancouver were required to develop a sampling and reporting program that meets the City's needs for operating the Landfill in compliance with the OC. In fulfillment of this requirement, Metro Vancouver completes a Waste Assessment Form for the Landfill on an annual basis to confirm that the WWTP residuals are not Hazardous Waste. Further, Metro Vancouver completes characterization sampling and reporting on a biennial basis.

The most recent characterization was completed by WSP Consultants (Canada) Ltd. and dated January 2021. This report summarizes the 2019 sampling program results of the non-recyclable WWTP residuals disposed of at the Vancouver Landfill. The Iona MV Bin, which receives the residue from Metro Vancouver vacuum trucks, failed the paint filter test thus indicating the presence of free liquids. However, this bin is kept outdoors, does not drain nor have a cover, allowing rainfall to accumulate in the bin. In early 2021, the MV bin will be decommissioned, and Metro Vancouver vacuum trucks will use the grit bay where other trucked liquid wastes are discharged. All residuals continue to be classed as non-hazardous and is suitable for disposal by the Landfill.

In 2020, 2,908 tonnes of grit was buried as nuisance waste in Phases 4. Only 24 tonnes of sludge and scum screenings were received and buried with the bulk processed at the Waste to Energy Facility as a means of energy recovery. A total of 185 tonnes of digester solids were received. The tonnage of grit, sludge and scum screenings and digester solids received is reported as a separate line item (Sewage Treatment Plant Residuals) in Table A1 in Appendix A1.

5.3.2. Non-Recyclable Drinking Water Treatment Plant Residuals

In November 2009, the Landfill began accepting drinking WTP residuals from the Seymour Capilano Filtration Plant on a trial basis. The residuals consist of silt and sediment from the raw water reservoir and the coagulants added to bind that sediment together. In November 2011, the MOE authorized the ongoing disposal of WTP residuals as MSW at the Landfill. In 2020, approximately 1,517 tonnes WTP residuals were accepted at the Landfill.

5.3.3. Bottom Ash

The regional Waste-To-Energy Facility (WTEF) opened in 1988 in Burnaby, and the bottom ash was initially managed at the Coquitlam Landfill. In 2001, bottom ash was first accepted as subgrade material for an expansion of the Vancouver Landfill Composting Facility. In late October 2017, bottom ash was redirected by Metro Vancouver to the Coquitlam Landfill for

use in the construction of the new Coquitlam Transfer Station in accordance with MOE approval. Deliveries of bottom ash to the Landfill resumed in August 2019, following completion of the work on the new transfer station. A total of 41,478 tonnes of bottom ash was disposed of in 2020.

5.3.4. Iona Grit Dump Solids

In August 2018, the MOE authorized the temporary disposal of Grit Dump Solids from a closed landfill on the Iona WWTP site until November 30, 2024. The landfill was operational from approximately 1963 to 2000, historically used to dispose of material from the grit collection tanks of both the Iona and Lulu Island WWTPs, and authorized under permit PE-00023 (now Operational Certificate ME-00023). During the last year of operation (1999 to 2000), the landfill also accepted material from an “oily sludge farm” which consisted of petroleum hydrocarbon contaminated waste from refinery storage tanks. Material removal is required to allow for planned upgrades to the Iona WWTP and will occur during an eight to twelve week period in the summer and early fall each year. It was initially estimated there were approximately 40,000 to 65,000 tonnes of Grit Dump Solids that require disposal.

As stipulated in the MOE authorization letter, the disposal of Grit Dump Solids counts towards the allowable annual tonnage, and is reported as a separate line item in Table A1 in the Appendix. In 2020, the Landfill received 34,285 tonnes of Grit Dump Solids, for a cumulative total as of 2018 of 67,504 tonnes. A survey is planned in 2021 to confirm the remaining amount of Grit Dump Solids for disposal.

5.3.5. Non-Recyclable Marine Debris

In October 2019, the City received a disposal request from the SeaChange Marine Conservation Society for the disposal of approximately 2 tonnes of non-recyclable marine debris from the Salish Sea Nearshore Habitat Recovery Program in North Vancouver. The debris was to include crab traps, tires, chains, rope, bricks, blocks and old docks. The City received an authorization letter from the MOE to allow for disposal before the end of 2019. Due to program delays, disposal was deferred until 2020 and the City was granted an extension to the disposal authorization by the MOE in late January. Approximately 5 tonnes was disposed of in early February 2020.

5.4. Demolition Material

Demolition material is mainly wood waste with small amounts of soft construction material, which has to meet the minimum criteria for wood content of 80%. Drywall, asbestos, putrescible material and Hazardous Wastes are prohibited. In 2020, a total of 44,138 tonnes of demolition material was received at the Landfill, down from 61,178 tonnes in 2019. Most was used for preparation of roads, drainage and gas collection layers in Phases 4, 5 & 6; the remaining material was landfilled.

5.5. Cover Materials

Cover soil for Landfill operations is excavation material generated by sewer, water and street construction activities in Metro Vancouver.

In 2020, the Landfill received a total of approximately 490,582 tonnes of soil. The material was distributed on site as follows:

- 67% was direct hauled to the soil stockpile area (see Figure 2);
- 19% was direct hauled to Phase 4 for cover; and
- 14% was direct hauled to Phase 5 to cover demo waste during drainage layer construction.

The soil stockpile area is managed by the on-site contractor, Poschner Construction 88 Ltd. (Poschner), who must maintain a minimum of 30,000 m³ of soil in the area at all times. Articulated ('Yuke') dump trucks are used to deliver soil to the active face on an as needed basis. Poschner installed a weighscale in the area in 2016. Soil usage data by fill location is considered for Annual Aerial Mapping.

5.6. Road Construction & Other Beneficial Use Materials

Road construction materials for temporary access roads on the active areas at the Landfill include purchased and recycled concrete, demolition (demo) hog and wood waste.

In late 2014, the City issued an Expression of Interest for the supply of clean concrete and asphalt directly from construction sites, and has since periodically brought in a crushing contractor for processing the material at the Landfill. Crushed material is used in closure works and for landfill operations. Crushing did not occur in 2020 because the material was used for constructing a base for the new soil stockpile area in Phase 6. Approximately 18,100 tonnes of concrete and asphalt and 53,550 tonnes of purchased aggregate were received and managed in 2020.

Demo hog is ground construction wood waste received at a reduced fee from local wood waste processors for use as top dressing on tipping pads. In 2015, the City issued a Letter of Interest and met with demo hog suppliers after revising the material specifications. Suppliers deliver demo hog on a rotating basis. Effective June 2019, a reduced rate was established for 'fine' demo hog, to reflect the additional processing costs required to reduce the size to meet the City Engineer's specifications. Fine demo hog is used to surface tipping pads, while both coarse and fine demo hog are used for road building and as a road base before placing rock for tipping pads. Approximately 77,500 tonnes of coarse and fine demo hog was received in 2020.

Since January 1, 2011, residential quantities of clean wood waste have been accepted at the Landfill at a reduced fee to encourage diversion. Starting that September, the types of wood accepted were expanded to include all wood waste free from fixtures. Wood waste is ground onsite and then used as road base and topped with demo hog.

Residential quantities of clean wood waste have also been accepted at the VSTS since January 2011, and the material was comingled with food and green waste collected curbside for composting at private facilities. Approximately 4,440 tonnes of wood waste was received in 2020.

5.7. Closure Materials

Materials used for the construction of engineered cover systems in completed areas of the Landfill include:

- soil to contour the areas to achieve design elevations;

- a geomembrane liner as an impermeable barrier;
- aggregate to convey landfill gas and stormwater to collection systems below and above the liner, respectively; and,
- topsoil to support the growth of grass and future vegetation.

In 2020, closure contractors sourced approximately 68,400 tonnes of aggregate and 494,400 tonnes of soil and topsoil for the W40 Ha and Phase 4S closure projects.

6. Waste Reduction & Recycling Initiatives

6.1. Zero Waste Centre

The Zero Waste Centre (ZWC) offers a recycling area for large items not typically included in curbside collection programs (mattresses, scrap metal, white goods) and a number of Product Stewardship Program materials (household batteries, lead acid batteries, smoke alarms, tires, thermostats, used oil, used oil filters). In May 2014, the City expanded collection to include all forms of packaging and printed paper covered by the provincial Product Stewardship Program, and under contract to RecycleBC. In June 2018, the City began collecting Other Flexible Plastic Packaging on behalf of RecycleBC for their pilot project as detailed later in this section.

In 2019, as part of the Landfill Entrance Improvement Project, the City expanded the Zero Waste Centre to manage existing material streams more effectively and plan and implement new programs. In December 2020, the Landfill formally starting accepting paint and household hazardous wastes that are part of the Product Care Association of Canada (Product Care) collection program. Customers bring program items to a sorting table where Staff will confirm if it is acceptable or not as part of the Product Care program.

Recycled quantities received are provided in Table 6. The total amount of materials recycled in 2020, including the tonnes associated with materials measured in litres and units, was 1,854 tonnes compared to 1,719 tonnes in 2019.

Table 6: Recycling Quantities for 2019 & 2020

Item	2020	2019	Units
Clothing	4.8	6.6	tonnes
Containers (Plastic, Metal, Paper) ¹	12.5	2.9	tonnes
Cooking Oil	1.2	0.6	tonnes
Drywall, new scraps only	23.7	123	tonnes
Electronics & Small Appliances ¹	180	117	tonnes
Fire Extinguishers	0.90	0	tonnes
	396	0	units
Glass Bottles & Jars ¹	5.9	5.4	tonnes
Household Batteries & Cell Phones ¹	1.4	0.7	tonnes
Lead Acid Batteries ¹	25.2	11.3	tonnes
Light Bulbs ^{1,2}	0.75	1.1	tonnes
Mattresses	259	247	tonnes

Item	2020	2019	Units
	10,394	9,146	pieces
Mixed Paper & Cardboard, Commercial	10	18	tonnes
Mixed Paper & Cardboard, Residential ¹	248	209	tonnes
Other Flexible Plastic Packaging	1.8	1.6	tonnes
Plastics Bags & Overwrap ¹	4.1	3.1	tonnes
Plastic Foam Packaging ¹	7.9	5.7	tonnes
Product Care Items (Paint, Aerosol, Pesticide, Solvent) ^{1,2}	22.9	3.8	tonnes
Propane Tanks	4,315	3,317	units
	8.2	4.3	tonnes
Refrigerators, Freezers & Air Conditioners	242	198	tonnes
	3,789	2,936	units
Scrap Metal (excluding Refrigerators, Freezers & Air Conditioners)	715	685	tonnes
Smoke Alarms ¹	2	4	boxes
Tires ¹	49	47	tonnes
	4,542	4,498	units
Waste Antifreeze ¹	0.8	1.2	tonnes
	805	1,160	litres
Waste Oil ¹	26	24	tonnes
	29,380	27,049	litres
Waste Oil Filters ¹	0.8	1.7	tonnes
Total³	1,854	1,719	tonnes

Note:

n/a means not available

¹ product stewardship program material

² abandoned or recovered from waste stream

³ includes tonnes calculated for those items measured in units, pieces, and litres. The conversion factors used were provided by Metro Vancouver and Product Stewards.

Additional details for select materials are as follows:

- Household batteries and cell phones were collected under the same program by Call2Recycle. However; cell phone total weights were not tracked by the vendor in 2020.
- As per Recycle BC's website², Other Flexible Plastic Packaging are types of film and flexible plastics that often include multiple layers of different types of plastic, making it more difficult to recycle. Collection of Other Flexible Plastic Packaging is part of a research and development project to determine how to best recycle this material. During this time, material that is unable to be recycled will be recovered and produced into engineered fuel.

² <https://recyclebc.ca/flexiblepackaging> accessed March 8, 2021

6.2. Disposal Bans

Since 2008, the City of Vancouver has enforced disposal bans in alignment with Metro Vancouver to reduce the amount of material being landfilled that could instead be recycled, and follow BC's *Recycling Regulation* (defines materials to be managed under provincial Product Stewardship Programs).

Materials banned from disposal as garbage at the Landfill are defined in the appendices of the City's Solid Waste Bylaw and mirror those in Metro Vancouver's Tipping Fee Bylaw in most cases. Both Bylaws were updated for 2015 to more effectively categorize the banned materials as follows:

- Banned Hazardous & Operational Impact Materials
- Banned Recyclable Materials
- Banned Product Stewardship Program Materials

The category of Banned Recyclable Materials was also expanded to include food scraps and clean wood.

The Disposal Bans are enforced by Metro Vancouver's Inspection Officers that randomly visit the City's disposal facilities. Disposal Ban Violation notices and surcharges are issued to those customers that dispose of banned materials in excess of the defined thresholds. Appendix 2 contains a complete list of materials that are accepted for recycling at the Landfill and those that are banned from disposal as garbage.

6.3. Yard Trimmings Collection and Composting

Since 1995, the Landfill has operated a composting facility for yard trimmings to divert organics from disposal. Major milestones in the history of organics diversion in the City are as follows:

- 2000 - City crews began collecting residential yard trimmings at the curbside for composting at the Landfill.
- 2006 - curbside collection was automated to reduce injuries to collection workers.
- 2013 - the City added food scraps to the curbside collection program for single family residents following a pilot that began 2010. However, since food scraps are not authorized for composting under the Landfill's Operational Certificate, commingled yard trimmings and food scraps from the curbside program are directed to a private composting facility in the region.
- January 2015 - the City bans food scraps from disposal as garbage

Yard trimmings delivered by customers to the VSTS and Landfill continue to be composted at the Landfill, in addition to the leaves collected from City Streets by City Crews. Since 2019, yard trimmings are delivered from two of the regional transfer stations (Maple Ridge and Langley), due to the closure of one of the commercial composting facilities in the region. In 2020, approximately 28,500 tonnes of yard trimmings were received, up from approximately 26,400 tonnes in 2019.

The Composting Facility includes a 3.2 ha paved surface, of which approximately 0.80 ha was paved in 2020 (West and North areas). The Compost area also has a dual-shaft shredder, excavator, two front-end loaders and a windrow turner. A rental star screener was used since 2015, and a permanent one is planned to be procured in 2021.

The static windrow composting method is used to process yard trimmings into finished compost. The feedstock is ground up and placed in windrows (piles) using front end loaders, then turned regularly to maintain optimal oxygen and temperature levels throughout. After a minimum of six months in windrows, the material is screened and stockpiled for curing and subsequent sale or donation.

Due to COVID-19, compost sales were temporary suspended from March 24, 2020 to May 22, 2020 to reduce traffic and allow the implementation of additional safety protocols. Approximately 7,500 m³ of finished compost was distributed in 2020, compared to 7,700 m³ in 2019. Compost sales totaled 7,407 m³ while 93 m³ of compost was purchased at a reduced rate by Delta Farmers. Approximately 1,026 m³ of compost was blended in the topsoil for Phase 4 closure. Unfortunately, due to COVID-19, the City of Delta and City of Vancouver residential free compost campaigns in April and May respectively, were cancelled.

Compost quality is compared to standards set out in the MOE's *Organic Matter Recycling Regulation* based on the feedstock and composting method used. In 2019 and 2020, the compost met the standards for unrestricted distribution for all parameters listed in the Regulation. A summary of the compost quality in 2019 and 2020, and the standards for unrestricted use, are provided in Table 7.

Table 7: Compost Quality for 2019 & 2020

Parameter	BC Standard mg/kg unless stated	2020 Mean Value mg/kg unless stated	2019 Mean Value mg/kg unless stated
Arsenic	13	5.1	4.8
Cadmium	3	0.5	0.6
Chromium	100	21.0	24.6
Cobalt	34	4.6	5.9
Copper	400	65.0	88.8
Lead	150	28.7	38.2
Mercury	2	0.1	0.1
Molybdenum	5	1.4	1.4
Nickel	62	16.2	16.5
Selenium	2	<0.50	<0.50
Zinc	500	162.7	201.6
Foreign Matter (%)	1	0.1	0.2

6.4. Diversion Projections

The 2010 *Integrated Solid Waste and Resource Management Plan* (ISWRMP) established future diversion targets, including an aspirational goal of 80% diversion by 2020. The Plan outlines initiatives for achieving these rates which include diverting demolition, landfill clearing and construction waste for recycling as well as food waste to composting and energy recovery.

As per the *Draft 2019 ISWRMP Biennial Progress Report* produced by Metro Vancouver and dated January 2020, 64% of the materials generated in the region in 2018 were recycled or diverted from disposal. This reflects an increase of 2% from 2016 as reported in the *2017 ISWRMP Biennial/5 year progress report*. The next report is anticipated in 2021.

7. Environmental Protection Programs

7.1. Leachate, Surface Runoff and Stormwater Management

Water management at the Vancouver Landfill is described using the following terminology:

- **Leachate** - produced by rainwater percolating through waste.
- **Surface Runoff** - rainwater that flows along the surface of areas of the Landfill (subject to the placement of daily or intermediate cover), and may be impacted by leachate.
- **Stormwater** - rainwater that is collected above the engineered cover system installed in closed areas of the Landfill. Stormwater is not impacted by leachate.

The Landfill site is underlain by compressed peat and a continuous layer of relatively impermeable clayey-silt, which is referred to as the natural soil barrier layer. Prior to the placement of waste in each landfill cell, a layer of demolition material was placed on top of

the peat. This provides the conduit for leachate to flow laterally to the double ditch system surrounding the Landfill footprint as shown in Figure 5. The layer of demolition material, natural soil barrier layer, and double ditch system are collectively referred to as the leachate collection system. The inner ditch collects leachate, while the outer ditch, more commonly known as the drainage ditch, collects clean water that runs off adjacent land. The drainage ditch is maintained at a higher level than the inner ditch to contain leachate in the inner ditch as shown in Figure 6. The leachate is then conveyed from the pump station located in the southwest corner of the Landfill through force mains to the Annacis Island WWTP under *Waste Discharge Permit SC-100168-FSA* (WDP) issued by the Greater Vancouver Sewerage & Drainage District.

In addition to leachate, surface runoff is routed to the inner ditch. To reduce peak discharge to the sewer system, two internal storage ponds are used: linear ponds 4 and 5 running south to north between the Compost Facility and Phase 1 (Figure 5). Due to planned filling activities and construction of the new stormwater pond in 2020, the capacity of these ponds was reduced from 103,000 m³ to 65,000 m³.

The Phase 2 and Phase 3 closure areas each have a dedicated pond for stormwater retention, which had a combined capacity of 100,000 m³ when constructed, but has reduced to 67,200 m³ due to settlement. Six retention ponds for clean stormwater in the Western 40 Hectares have a combined storage capacity of approximately 87,700 m³.

Up until October 2020, stormwater was directed to the retention ponds then once the storm had passed, to the inner ditch. In October and November, two stormwater discharge pilots were conducted, resulting in approximately 81,040 m³ of stormwater discharged to the Dredge Pond and a savings of \$117,500 in leachate conveyance and treatment costs.

The annual fees associated with leachate, surface runoff and stormwater management include a conveyance fee paid to Delta for the use of the sewer system, and an industrial discharge fee made up of capacity and usage components for the treatment of the leachate at the WWTP. The capacity and usage charges account for biological oxygen demand (BOD), total suspended solids (TSS) and flow. In 2020, the cost associated with leachate conveyance and treatment totaled almost \$3.9 million. Approximately 79% of this cost was associated with conveyance, which is slightly higher than previous years.



Figure 5: Leachate, Surface Runoff and Stormwater Management

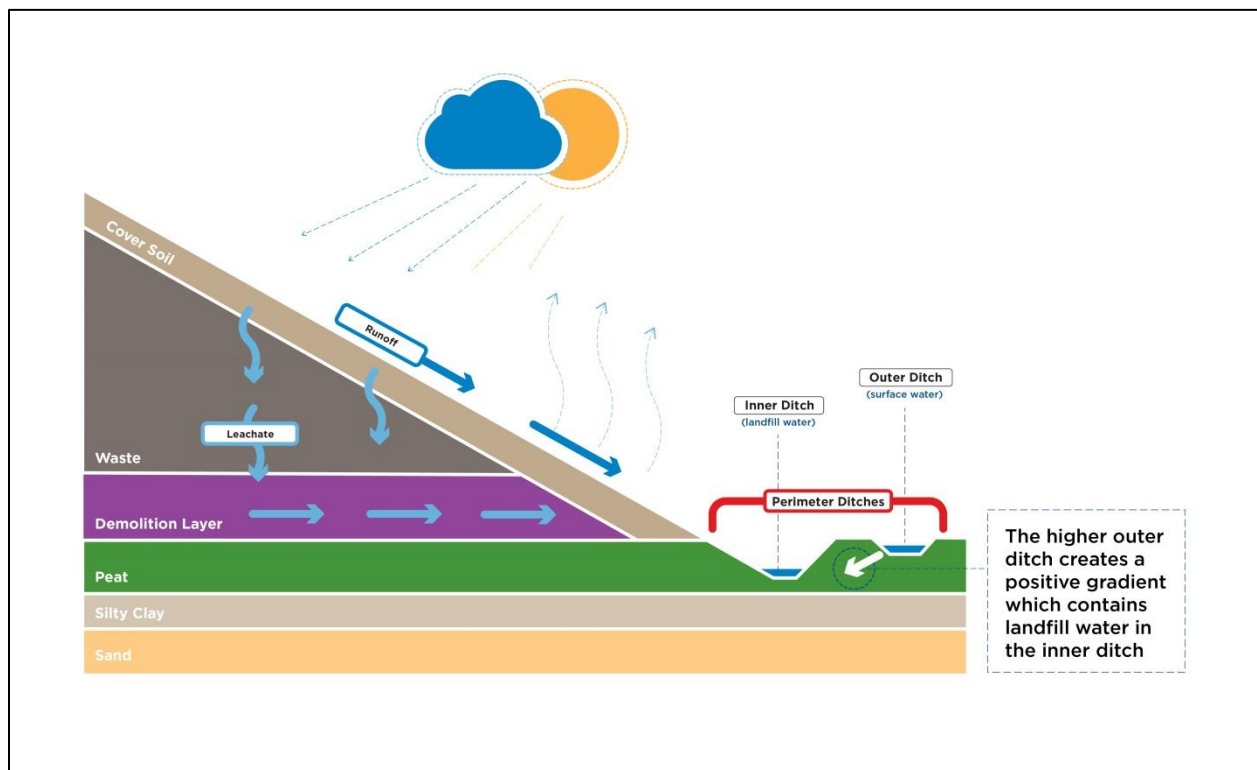


Figure 6: Leachate Collection System Cross-Section

Monthly leachate flow and precipitation data for 2020 are provided in Table 8.

Table 8: 2020 Leachate Flow Volumes and Precipitation

Month	Leachate Flow (m ³)	Precipitation ³ (mm)	Precipitation Volume (m ³)	Ratio of Leachate Flow to Precipitation Volume
January ¹	710,658	257	577,350	123%
February ¹	474,044	91	205,650	231%
March ¹	178,473	41	91,800	194%
April ¹	82,687	23	51,300	161%
May	61,097	56	126,000	48%
June	48,590	53	119,700	41%
July	37,626	27	61,200	61%
August	33,757	47	104,625	32%
September	49,462	59	133,200	37%
October	114,689	88	196,875	58%
November	400,563	189	425,925	94%
December ¹	517,387	210	472,275	110%
Total ²	2,709,033	1,140	2,565,900	106%

Notes:

¹ The high ratio of leachate flow to precipitation volume reported in select months can be due to the release of stored water that occurs when the landfill becomes saturated, and to the controlled release of clean stormwater from storage ponds in the winter months.

² The high ratio of leachate flow to precipitation volume is attributed to an increase in landfill surface area that has been closed with an engineered cover system, and overland flow from the outer drainage ditch to the inner ditch during significant rainfall events in winter.

³ Recorded at Vancouver Airport 1108395 since weather data at Delta Burns Bog Station 1102415 was not available as of May 2019.

A total of 2,709,033 m³ of leachate, surface runoff and stormwater was pumped to Annacis Island WWTP in 2020. Leachate from the Vancouver Landfill is considered dilute compared to other MSW landfills because of the high volume of surface runoff and stormwater from the closed areas that have historically been treated as leachate.

The average annual ratio of leachate discharge to precipitation volume has been on an upward trend since progressive closure started in 2009. This year represents the first in which the leachate discharge volume has exceeded precipitation volume. This is likely attributed in part to an increase in the surface area of the Landfill that has been progressively closed as well as other water inputs to the leachate collection system that have yet to be characterized (inflows from outer ditch and groundwater capture).

7.2. Leachate Generation Control Measures

Leachate generation at the Landfill is controlled through a number of mechanisms, which include the following:

- Progressive closure of completed phases, with an impermeable geomembrane cover system installed to minimize infiltration and leachate generation. Hydroseeding reduces erosion and increases evapotranspiration. See Figure 7 for the cross-section of the typical final cover system.
- Dedicated linear ponds for leachate and surface runoff to control flows to the leachate pump station as well as stormwater retention ponds to reduce flows from closed areas to the pump station or Dredge Pond during significant precipitation events. See Figure 5 for pond locations.
- Use of daily and intermediate cover at the active face and keeping the active face as small as possible to minimize infiltration from precipitation.
- Erosion control measures on side slopes, such as swales and downchutes, to convey water to internal ditches.

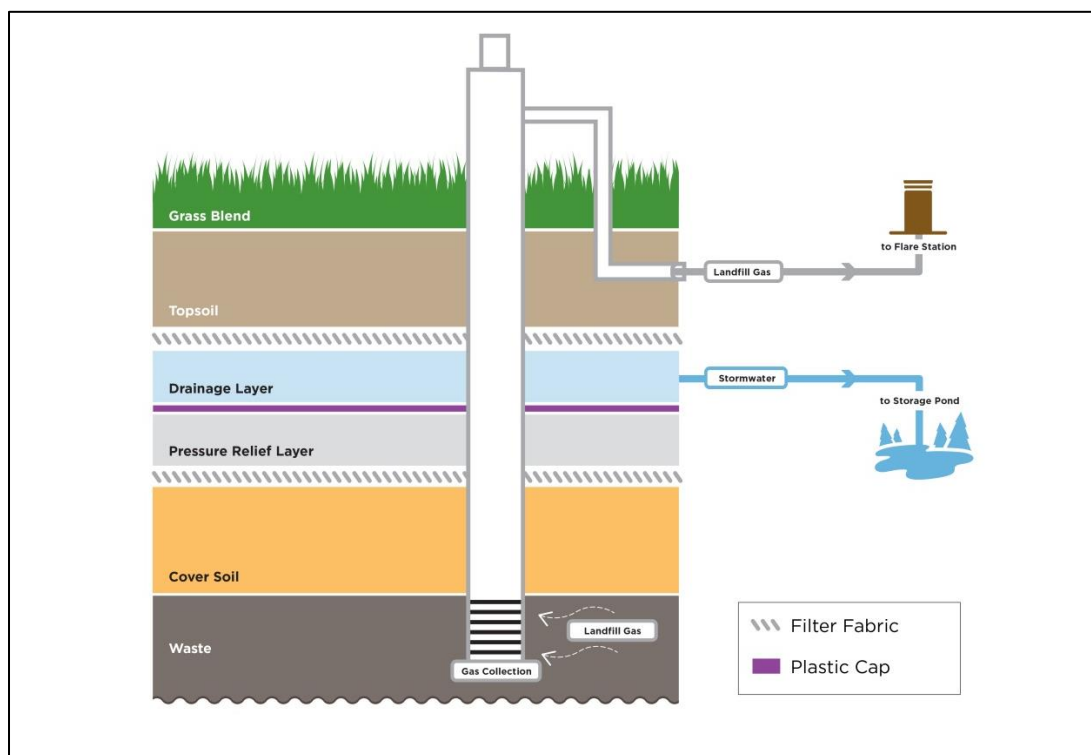


Figure 7: Final Cover System Cross-Section

7.3. Water Quality Monitoring Program & Annual Review

The OC requires regular sampling and analysis of leachate, and surface and ground waters in the vicinity of the Landfill, for the stations and parameters indicated. Leachate flow measurement and leachate/drainage ditch water level measurements are also required. The

Landfill's WDP also requires regular sampling and analysis of leachate, in addition to leachate flow measurement. The Landfill Water Quality Monitoring Program (WQM Program) is in place to meet the above requirements and includes stormwater sampling as well. Sampling and data collection is completed by City Staff, according to the 2017 Field Sampling and Quality Control Manual prepared by SNC-Lavalin Inc. (SNC-Lavalin) and the 2018/19 Stormwater and Surface Water Monitoring Report prepared by AECOM.

In 2020, 1 leachate station, 13 surface water locations, 18 shallow groundwater wells and 20 deep groundwater wells were grab-sampled quarterly by Landfill Staff. Shallow groundwater wells are screened in the peat aquifer and range in depth between 2.5 - 4 m, while deep groundwater wells are screened in the sand aquifer and range in depth between 6 - 9 m. Well and sampling locations are shown in Appendix 3. Additionally, a 24-hour composite sample representing the leachate pumped to Annacis Island WWTP was taken monthly. Samples were analyzed for the parameters listed in Appendix 4.

Consultants hired by the City have completed annual reviews of the WQM Program each year since 1999. As per the *City of Vancouver Landfill - 2020 Annual Water Quality Monitoring Report* (2020 Review) prepared by AECOM, the 2020 Landfill WQM Program meets or exceeds the requirements set out in the OC and WDP with respect to the number, type and locations of stations monitored, sampling frequency, water quality parameters, and detection limits with two exceptions:

- 5 surface water stations (Stations 43, 44, 45, 91 and 96) were not sampled during dry ditch conditions in the third quarter.
- Monitoring well 27-2013 was damaged in 2019 and replaced in June 2020 (new well is 27-2020). Monitoring and sampling of this new well could not be conducted in the fourth quarter because the well exhibited artesian flow when the cap was removed. Extending the PVC casing is planned for 2021.

As part of the the 2017-2021 Water Quality Consulting & Stormwater Management Planning Project described in Section 4.1, AECOM conducted stormwater and surface water monitoring at the Landfill and surrounding area between September 2018 and April 2019. The objective of the program was to assess the feasibility of discharging stormwater outside of the leachate collection system as required by the OC and WDP. The December 2019 *City of Vancouver - 2018/19 Stormwater and Surface Water Monitoring Report* recommended that a regular monitoring program for stormwater be implemented, and include monthly sample collection from October to March each year. Sampling began in December 2019 and continued into 2020. Results from the sampling events are included in the 2020 Review.

The executive summary from the 2020 Review, including report recommendations, is included in Appendix 6. A tabulation of the leachate/drainage ditch levels is included in Appendix 7.

Section 8.6 includes details of the intermediate berm displacement event that occurred in late December 2020, which resulted in surface water flow from the outer drainage ditch to the inner ditch.

7.4. Landfill Gas Management System

The City of Vancouver has operated an active landfill gas collection and flare system since 1991. The system was initially installed to control odour and had the added benefit of reducing greenhouse gas emissions. In December 2002, the City entered into a 20-year agreement with Maxim Power (Maxim) for LFG utilization and the following year Maxim commissioned a gas conditioning facility at the Landfill. In 2014, Maxim sold their conditioning equipment (located at the Landfill Gas Flare Station) and co-generation facility (located off site) to Village Farms International, owner and operator of the greenhouse site that hosts the co-generation facility. Village Farms also uses conditioned LFG as a natural gas replacement fuel in two of their six direct-fired boilers. A small portion of the gas is directed to the Landfill Administration and Engineering Buildings (Ops Buildings) where it is used to provide space heat.

An overview of the LFG management system is shown in Figure 8, with the distribution of the vertical gas wells, horizontal collectors and DRAINTUBE³ collectors across the Landfill footprint shown in Figure 9.

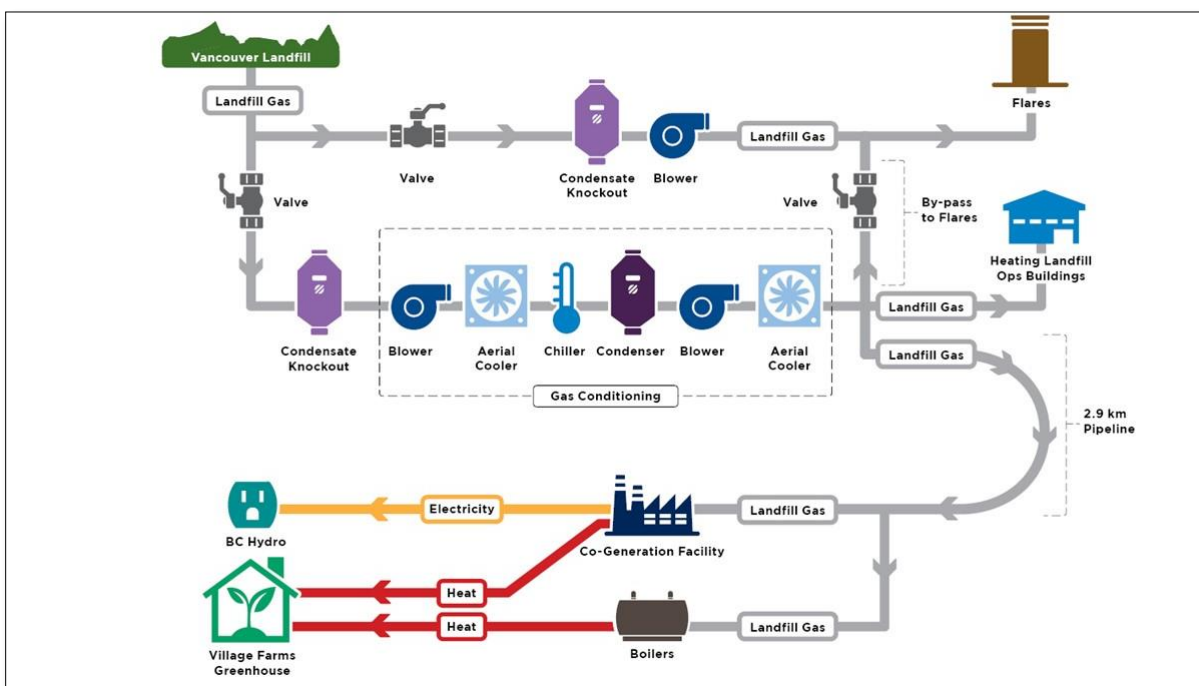


Figure 8: Landfill Gas Collection & Beneficial Use System

³ DRAINTUBE is a geocomposite mat consisting of small diameter plastic pipes (<25mm in diameter) between layers of geocomposite material that is used for collecting landfill gas under the geomembrane cover.



Figure 9: 2020 Landfill Gas Collection System

The total volume of landfill gas (LFG) collected in 2020 is reported in two ways in this section and Table 9:

1. As measured by individual meters; and,
2. On a normalized basis (to 50% methane by volume) as per the methodology used by the MOE in Section 3.2 of the 2010 *Landfill Gas Management Facilities Design Guidelines*).

Table 9: 2020 Landfill Gas Collection and Beneficial Use

Date	Weighted Average Methane Content (% by vol.)	LFG to Utilization Facility (m ³)	LFG to Flare (m ³)	LFG to Building Heat (m ³)	LFG Captured for Period (m ³)
2020 Total (metered)	50.9	17,664,550	46,519,254	44,783	64,228,586
2020 Total (normalized to 50 percent methane)	50.0	17,988,730	47,372,977	45,605	65,407,312
2020 Daily Average	50.9	48,396	127,450	123	175,969
2020 Daily Average (normalized to 50 percent methane)	50.0	49,284	129,789	125	179,198

The total metered volume of LFG collected in 2020 equates to approximately 21,100 tonnes of methane or 442,200 tonnes of carbon dioxide equivalents (CO₂e). It is equivalent to the emissions approximately of 88,400 vehicles over the period of a year.

In 2020, approximately 28% of the LFG collected was directed to beneficial use, and the remaining 72% was flared.

7.5. Landfill Gas Collection Efficiency

The average LFG collection efficiency for 2020, as calculated using the Landfill's site-specific model developed by SCS Engineers in 2011, was 73.3%. This reflects an increase of 3.3% compared to 2019. This increase in collection efficiency between 2019 and 2020 is due to the City's continued effort to maximize LFG collection through an aggressive capital works program constructing LFG infrastructure as early as possible.

Vertical gas wells were drilled as part of Phase 4S closure, horizontal collectors were installed as filling progressed in Phase 4S and 4N, side-slope collectors were installed in Phase 4N and replacement (re-drilled) vertical gas wells were installed in Phases 1, 2 and 3.

The decision to install the side-slope collectors in Phase 4 resulted from the analysis completed in 2019 that confirmed side-slope collectors installed in Phase 3NE are 60% cheaper than and just as efficient as horizontal gas collectors. Routine installation of side-slope collectors is now planned in Phase 5.

The City has also modified some operating procedures to increase collection efficiency including:

- The field monitoring (gemming frequency) of gas wells collecting at least 20 scfm of LFG was increased to twice per month; and
- A pressure relief (PR) wells audit was conducted to search for alternate sources of LFG collection. This led to three PR wells being added to the monthly field monitoring as they were found to be producing collectable gas.

Further details on LFG collection activities in 2020 can be found in the *2020 Annual Landfill Gas Report for the Vancouver Landfill* (City of Vancouver, 2021).

7.6. Landfill Gas Surface Emissions Monitoring Program

In 2015, the City hired Golder to conduct surface emissions monitoring to determine the total methane emissions or flux from the Landfill footprint with identification of general areas of higher emissions. The Airborne Matter Mapping method is used and applies a mass balance approach by sampling the emission plume with a helicopter and using multiple sampling runs at different elevations.

In the first year of monitoring, the method identified the active area (Phase 3) to be the largest source of emissions, and a few other areas for intermediate soil cover repair. Measurements collected in 2016 and 2018 yielded similar results. In 2020, the active portion of Phase 4 was identified as the largest emission source. Three minor emission sources were also discovered in the W40Ha area.

7.7. Landfill Gas Migration & Emissions Monitoring Program

In October 2000, the City retained an independent consultant to develop the Landfill Gas Migration and Emission Monitoring Program (LFGMEM). The Landfill Gas Flare Station and confined spaces were tested for combustible gases, oxygen and hydrogen sulphide. On-site buildings were also tested for carbon dioxide. Property boundary stations were tested for total organic carbon (as methane; TOC) and hydrogen sulphide. Hydrogen sulphide was measured as a surrogate for the odorous compounds typically found in MSW landfills. The human nose can detect hydrogen sulphide at a concentration of less than 1 ppm with a Recognition Threshold of 0.0047 ppm or 4.7 ppb hydrogen sulphide. The Recognition Threshold is the concentration at which 50% of humans can identify the odourant. The Landfill started this program to better monitor odours at the Landfill boundary.

Starting in June 2001, ambient air was routinely monitored in confined spaces, on-site buildings, at the Landfill Gas Flare Station and at property boundary monitoring stations. Sampling at all locations was conducted using portable gas analyzers at a frequency of once every month.

In 2016, all onsite buildings were outfitted with permanent methane monitors in compliance with the requirements of the *Landfill Gas Management Regulation*. Confined spaces are routinely monitored before and during any confined space entry protocol, so these were not included as part of the LFGMEM. These changes were made effective January 2020 at contract renewal, and the LFGMEM monitors only the perimeter boundary stations.

In 2020, the test results were consistent with the historical pattern of generally low TOC readings and ranged from 0 to 9 ppm. No test locations had readings exceeding the City's 50 ppm guideline for TOC, and there were no detectable hydrogen sulphide readings at any locations in 2020.

There were also no odour complaints received at the Vancouver Landfill in 2020.

8. Operational Information

8.1. Nuisance Waste

In 1999, a database was created to track nuisance waste accepted at the Landfill. Nuisance waste is defined as material that requires special consideration, documentation, handling or disposal (such as direct burial). These materials typically originate from small businesses or light industry and are not classified as Hazardous Waste. The waste generator completes a Waste Assessment Form and submits it for review and approval by City staff. Waste Assessment Forms are entered into the database from which summary reports can be generated.

Nuisance waste also includes materials ordered for destruction by the Canadian Food Inspection Agency (CFIA). Deep burial is required to meet CFIA requirements and is often witnessed by a CFIA Officer.

Table 10 lists the types of nuisance wastes and quantities received at the Landfill in 2020. The tonnage of CFIA burials in 2020 was approximately 850 tonnes less than in 2019 numbers. In addition, street sweepings also decreased by over 5,000 tonnes compared to 2019. Overall 2020 nuisance waste quantities dropped by 6,617 tonnes when compared to 2019 quantities, which represents a 65% decrease.

Table 10: 2020 Nuisance Waste Quantities

Material	2020 Quantity (tonnes)
CFIA burials	1,669
Street sweepings	727
Other	531
Shellfish scrapings and shells	407
Non-Compostable Food	83
Invasive Species	50
Greenhouse waste	35
Fish nets	28
Rope	20
Fish waste	18
Marine Debris	5
Total	3,573
Note:	
* Other includes expired cosmetics, grain sweepings, non-recyclable products (rubber, hose assemblies, pocket coil cores, stumps, ice paint, post sortation residue).	

8.2. Bird Control & Counts

Birds, particularly gulls, are a nuisance at landfill sites. In large numbers, they create a negative image of landfills and scatter litter onto surrounding areas. Birds are also a potential aviation hazard. A formal program using birds of prey started in July 2001. The program includes the use of trained raptors (hawks) near the active face as a primary control method. The raptors discourage gulls and other birds from approaching the waste. Secondary control methods are used when trained raptors are not an option, such as when traffic is heavy or it is very windy or rainy. These methods include noise deterrents (stock or bull whips, pyrotechnics, whistles), visual deterrents (aerial projectiles, laser pointers, kites), and positioning the bird control vehicle close to the active area.

Pacific Northwest Raptors has been providing bird control service since January 2016 and is based on Vancouver Island.

Annual bald eagle counts are typically performed by the Hancock Wildlife Foundation (HWF); however, a count did not occur in 2020. In early 2018, the City began supporting the HWF in collaboration with Simon Fraser University for the Bald Eagle Tracking Alliance Project. The Project aims to better understand the movements of bald eagles using tracking devices.

8.3. Household Hazardous Waste

Household hazardous wastes (HHW), such as paints, used oil, flammable liquids and pesticides, are banned from disposal at the Vancouver Landfill. However, residents periodically abandon or discard HHW in loads of refuse.

In 1993, a storage facility was set up at the Vancouver Landfill for abandoned HHW. The facility was upgraded in 1999 to provide a larger covered drop-off area and improved security. The facility consists of a fenced area where HHW waste is placed into boxes, drums, tub skids or a fireproof storage cabinet. Used oil is bulked by Staff into a steel double walled tank. Product stewards and a HHW contractor regularly remove and safely dispose of the waste. The facility was updated in 2019 to add more space as part of the Landfill Entrance Improvement Project.

In December 2020, the Landfill formally starting accepting paint and HHW that is part of the Product Care collection program. Customers bring program items to a sorting table where Staff will confirm if it is acceptable or not. As a result, the Landfill Zero Waste Centre depot is now an authorized collection depot for Product Care, and the City receives revenues for collection program materials. This partnership is intended to provide more residential recycling options and reduce the costs for HHW management.

In 2020, the total cost of contracted services for the removal and disposal of HHW not covered by stewardship programs was approximately \$49,000 compared to \$25,500 in 2019. Costs during 2020 were over 90% higher than 2019, likely due to the increased residential traffic resulting from the COVID-19 pandemic. Note that City staff time to segregate and pack the materials is not included in the costs above.

8.4. Site Inspections

Formal site inspection activities beyond those conducted as part of environmental monitoring programs, are summarized in Table 11.

Table 11: 2020 Site Inspection Activities

Type of Inspection	Description	Findings & Action Taken (if applicable)
Site Tour	Conducted weekly by the GPS Technician and Superintendent to assess progress of filling, cover integrity, erosion, and settlement in active areas.	Any signs of erosion on side slopes are addressed promptly by Operations Staff at the direction of the Superintendent.
Workplace Inspections	Conducted monthly by representatives from the OH&S Committee and exempt Staff to verify compliance with the Landfill's Safety Management Program and <i>OH&S Regulation</i> .	Any deficiencies identified are logged and addressed as soon as practical with discussion following in the monthly OH&S Committee Meetings.
Vegetation Inspection	Site inspection conducted in spring, summer and fall by City staff with occasional support from landscaping services contractor to identify invasive species and prepare a management plan. Periodic inspections completed by the landscaping services contractor in habitat screening area for invasive plants.	<p>Scotch Broom identified in various areas of the site. Landscaper provided mechanical control for Scotch Broom and blackberries as needed.</p> <p>Sporadic patches of Japanese Knotweed have been observed in some areas - many of which have been injected with Roundup.</p> <p>Other invasive species have been observed in lesser amounts and are managed where practical.</p>
Leachate Collection System Inspection	Conducted in advance of and during significant precipitation events by the Environmental Technician to ensure ditches and culverts are not obstructed by debris, leachate flow is unobstructed, and freeboard exists between water levels in the leachate and drainage ditches and crest of the intermediate berm.	<p>Any accumulation of debris is managed promptly by Operations Staff.</p> <p>A portion of the intermediate berm sloughed into the inner ditch at one location in late December. See section 8.5 for details of action taken.</p>
Property Boundary Inspection	Conducted quarterly by Environmental Technician to monitor for litter so crews can be deployed for collection.	Contractor engaged to remove litter from trees bordering the active areas. Typically performed in the first, second and fourth quarter.

8.5. Operating Problems and Corrective Actions

The operating problems and corrective actions taken in 2020 are detailed in Table 12.

Table 12: 2020 Operating Problems and Corrective Actions

Problem	COVID-19, March 2020
Description	In March 2020, the COVID-19 outbreak caused disruptions to various City functions, including Landfill operations. Various activities including compost sales, new residential drywall acceptance, textile collection and cash acceptance all presented temporary challenges to serve all our customers safely.
Corrective Action	The City implemented COVID-19 safety protocols and evaluated safe handling measures to resume temporarily suspended services. In addition, the City supported our contractors while they worked to resume material collection services while ensuring physical distancing and safe measures were in place.
Problem	Leachate Collection System - Displacement of Intermediate Berm, December 2020
Description	It was discovered during an inspection of the leachate collection system that a 40 metre section (approximate) of the intermediate berm north of the W40Ha closure had sloughed into the inner ditch, partially restricting leachate flow. The resulting cracks allowed water from the outer ditch to flow into and mix with leachate in the inner ditch thereby increasing the amount of leachate that required disposal.
Corrective Action	The City restricted access to the area and notified the MOE and other stakeholders of the compromised berm. SHA was retained to assess the situation and proposed mitigation measures in consultation with a contractor who was working elsewhere on site. The berm was stabilized by placing geotextile fabric and gravel within the inner ditch to serve as a buttress to prevent further movement. The gravel was shaped to allow leachate to continue to flow. Cracks across the berm were filled with a mixture of sand and bentonite to seal the flow path and reduce the amount of flow from the outer ditch. Permanent repairs are under review, and a pilot test is planned in 2021 to assess the suitability of polyvinyl chloride (PVC) sheet piles as a permanent solution to stabilize the berm and stop water from flowing from the outer ditch over the berm into the inner ditch.

8.6. Operational and Maintenance Expenditures

The total spent in 2020 for operations and maintenance at the Landfill was approximately \$23.8 million, as detailed in Table 13. Total expenditures in 2020 were approximately 22% higher than in 2019 due to increased capital project spending and higher sewer fees due to more than expected precipitation. Soil deposit fees were also higher than budgeted.

Table 13: Operational and Maintenance Expenditures for 2019 & 2020

Item ¹	2020	2019
Salaries, Administration, Wages & Fringe Benefits	\$5,347,013	\$5,281,174
Vehicle & Equipment Rental	\$3,725,971	\$3,724,090
Insurance, Taxes, Loan Payments, Utilities, Building Maintenance, Permits & Landscaping ²	\$6,058,831	\$3,154,924
Recycling	\$317,671	\$242,748
Roads and Cover	\$1,502,619	\$1,974,885
Water Quality, Gas Management, Ditch Maintenance, Bird Control, Household Hazardous Waste Disposal, etc.	\$1,410,259	\$1,002,508
Consulting Projects (Leachate Upgrades, Gas, etc.)	\$153,298	\$133,939
Sewer and Soil Deposit Fees	\$4,589,487	\$3,376,175
Weighscales	\$736,689	\$679,720
Total	\$23,841,838	\$19,570,163

Note:

¹ Items do not include capital loan repayments and other cost allocations.

² In 2020, the \$2.9 Million increase is primarily due to the large capital project expenditures for routine gas works, entrance renovations, paving at the compost facility and road construction and litter fencing for new areas.

8.7. Public Complaint and Resolution Log

In 2020, the Landfill logged 24 complaints, up from 12 received in 2019. The Public Complaint and Resolution Log for 2020 is available in Appendix 5.

More than one complaint was received on the following items:

- Compost sales - Several customers were upset about the temporary suspension of compost sales at the Landfill from March 24 to May 22 due to COVID-19. Customers were also looking forward to free Delta compost usually given in April each year. They were advised that the Landfill was working on safe protocols to resume compost sales.
- New residential drywall - Several customers complained about not being able to bring new drywall as the Landfill temporarily suspended acceptance due to COVID-19 on March 24, 2020. Customers were advised that during this time with the restrictions they should contact New West Gypsum for disposal options. The City completed a risk assessment with plans to resume collection in January 2021.
- Customer experience - Several customers raised concern regarding communications by Staff, such that messaging could have been communicated in a more friendly and understanding manner. When a customer experience complaint is received, a Superintendent is in contact with the customer to gather information and the Staff member to resolve it.
- Webpage - Several customers had complaints about not being able to find or understand information on the Landfill City webpage. At times, the suggestion was to include more verbiage to clarify information. The City routinely updates their webpages to resolve these issues, and at times, will make decisions to balance out messaging content.

8.8. Landfill Tours

Landfill Staff regularly provide tours of the Landfill for a variety of visitors, including school groups (kindergarten to university levels), special interest groups, industry associations & professionals, delegates from other countries, and members of the public. Visitors in groups bring their own vehicles for tours since the Landfill does not have a dedicated vehicle for this purpose.

Tours provide the opportunity to showcase how waste is responsibly managed to minimize environmental impacts, and how much work we still have to do as a society to reduce the amount of waste sent for disposal.

In 2020, over 11 groups and 350 people participated in Landfill Tours before COVID-19 restrictions were in effect. Due to the pandemic, Landfill Tours were suspended on March 11, 2020 and the City canceled the 2020 open house. The next open house will be planned following the conclusion of the COVID-19 restrictions. A virtual tour of the Landfill was developed and used for two student groups from BCIT.

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Appendix 1: Annual Waste Quantities

Table A1: 2020 Material Summary by Source

Source	Waste Discharge				Cover	Road Construction & Other Beneficial Use					Closure		VLF Composting	
	VSTS MSW	VLF MSW	Total MSW	Demo	Cover Soil	Sand	Demo hog	Wood Waste	Crushed Concrete & Asphalt Grindings	Purchased Aggregate	Aggregate	Sand & Soil	VSTS Yard Trimmings	VLF Yard Trimmings
	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes
By Municipality	131,253	80,291	211,544										12,760	10,025
Vancouver Residential Collection	37,702		37,702											
Vancouver Public Works	5,336	2,278	7,614		285,513			9	2,988	22,903			995	6,960
Vancouver Commercial & Residential Drop-Off	53,278	12,462	65,740	12,056	2,785		11,281	814	26		2,482	183,123	11,247	847
Delta Residential Contractor	10	14,012	14,022											
Delta Public Works		4,694	4,694		63,918			25	12,242					142
Delta Commercial	722	13,328	14,050	3,500	41,583	1,812	64	80	2,263	14,267	756	43	5	59
Delta Residential Drop-Off	23	5,449	5,472					2,148					9	1,441
Richmond	31,069	12,056	43,125	2,232	22		55,755	440	22	1,483	48,525	147,297	287	128
UEL	2,291	67	2,359					1					30	-
Surrey	74	11,871	11,945	9,924	83,266		10,400	661	51	14,897		45,557	9	346
White Rock	17	821	838	629				98	89			919	2	75
Other Municipalities*	731	3,252	3,983	15,797	13,495			163	417		16,599	117,484	176	28
Regional Waste Transfer		362,573	362,573											5,711
Coquitlam Resource Recovery Transfer		122,292	122,292											
North Shore Transfer Station Transfer		74,538	74,538											
Surrey Transfer Station Transfer		148,077	148,077											
Maple Ridge Transfer Station		10,042	10,042											3,254
Langley Transfer Station		7,624	7,624											2,457
Other Authorized Waste		80,404	80,404											
Bottom Ash		41,478	41,478											
Water Treatment Plant Residuals		1,517	1,517											
Sewage Treatment Plant Residuals		2,933	2,933											
Digester Solids		185	185											
Iona Grit Dump Residuals		34,285	34,285											
Non-Recyclable Marine Debris		5	5											
Totals	131,253	523,268	654,521	44,138	490,582	1,812	77,500	4,440	18,096	53,549	68,363	494,422	12,760	15,737
Total Materials to Vancouver Landfill												1,907,425		28,496

* Burnaby, City of Langley, City of North Vancouver, Coquitlam, District of North Vancouver, District of West Vancouver, Langley Township, Maple Ridge, New Westminister, Pitt Meadows, Port Coquitlam, Port Moody.

Note: Totals may vary due to rounding errors.

Appendix 1: Annual Waste Quantities

Table A2: 2019 Material Summary by Source

Source	Waste Discharge				Cover	Road Construction & Other Beneficial Use					Closure		VLF Composting	
	VSTS MSW tonnes	VLF MSW tonnes	Total MSW tonnes	Demo tonnes	Cover Soil tonnes	Sand tonnes	Demo hog tonnes	Wood Waste tonnes	Crushed Concrete & Asphalt Grindings tonnes	Purchased Aggregate tonnes	Aggregate tonnes	Sand & Soil tonnes	VSTS Yard Trimmings tonnes	VLF Yard Trimmings tonnes
By Municipality	148,605	126,236	274,840										12,610	8,181
Vancouver Residential Collection	34,306	0	34,306											
Vancouver Public Works	4,831	1,740	6,571		239,698	38		64	1,118	28,315	3,930		893	5,978
Vancouver Commercial & Residential Drop-Off	65,421	9,565	74,986	17,409	139			1,175	3,201		1,705	36,618	11,113	402
Delta Residential Contractor		14,211	14,211											
Delta Public Works		4,612	4,612		80,911			12	12,841					51
Delta Commercial	516	12,999	13,515	4,455	83,633			133	1,165	292	1,717	3,025	0	61
Delta Residential Drop-Off	25	4,286	4,311					1,892					3	1,299
Richmond	39,472	53,998	93,470	2,902	81,446	800	70,279	446	24,188	13,588	4,738	136,259	300	71
UEL	3,016	53	3,068					2					0	0
Surrey	330	18,830	19,160	14,091	13,140		220	564	359	16,421	5,994	68,356	18	229
White Rock	5	783	789					116	411					63
Other Municipalities*	684	5,157	5,841	22,321	17,745		24	167	2,330		107,816	60,161	282	27
Regional Waste Transfer		347,879	347,879											5,609
Coquitlam Resource Recovery Transfer		127,087	127,087											
North Shore Transfer Station Transfer		69,221	69,221											
Surrey Transfer Station Transfer		135,123	135,123											
Maple Ridge Transfer Station		9,306	9,306											3,170
Langley Transfer Station		7,141	7,141											2,439
Other Authorized Waste		37,609	37,609											
Bottom Ash		16,755	16,755											
Water Treatment Plant Residuals		0	0											
Sewage Treatment Plant Residuals		2,807	2,807											
Iona Grit Dump Residuals		18,047	18,047											
Non-Recyclable Marine Debris		0	0											
Totals	148,605	511,724	660,329	61,178	516,712	838	70,524	4,571	45,613	58,615	125,901	304,418	12,610	13,790
Total Materials to Vancouver Landfill	1,848,698												26,400	

* Burnaby, City of Langley, City of North Vancouver, Coquitlam, District of North Vancouver, District of West Vancouver, Langley Township, Maple Ridge, New Westminster, Pitt Meadows, Port Coquitlam, Port Moody.

Note: Totals may vary due to rounding errors.

Appendix 1: Annual Waste Quantities

Table A3: 2020 Material Summary by Month

	Waste Discharge					Cover, Road & Closure Materials			VLF Composting		
	VSTS	VLF	Total	Bottom Ash	Demolition Material	Cover Material	Road & Other Beneficial Use Materials	Closure Materials	VSTS Yard Trimmings	VLF Yard Trimmings	Yard Trimmings Total
Month	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes
January	10,692	30,683	41,375	3,475	2,730	18,175	8,368	19,886	470	345	816
February	10,700	28,492	39,192	3,392	3,720	24,884	10,055	19,600	535	630	1,165
March	11,199	37,709	48,907	3,746	4,241	32,640	10,478	61,604	1,036	870	1,906
April	9,799	33,635	43,434	3,970	4,019	47,787	12,437	88,482	793	1,236	2,029
May	10,272	41,805	52,077	3,913	5,023	46,863	16,700	84,729	1,047	1,240	2,288
June	11,267	42,522	53,789	3,799	4,214	51,411	12,034	61,433	1,073	1,081	2,153
July	11,919	49,269	61,188	2,836	3,698	48,250	14,199	58,422	957	885	1,842
August	11,106	44,252	55,359	3,679	3,499	54,884	9,662	65,510	747	642	1,389
September	11,761	46,061	57,822	2,882	3,894	43,596	11,252	51,743	788	824	1,611
October	11,977	49,277	61,254	3,030	3,949	55,937	15,008	30,607	1,193	849	2,042
November	10,269	38,282	48,551	3,461	2,774	41,524	17,360	16,860	2,642	2,732	5,374
December	10,293	39,802	50,095	3,296	2,375	24,630	13,395	8,359	1,479	4,403	5,882
Totals	131,253	481,790	613,043	41,478	44,138	490,582	150,949	567,234	12,760	15,737	28,496
Total Materials to Vancouver Landfill								1,907,424			

Note: Totals may vary due to rounding errors.

Appendix 2: 2020 Recyclable and Banned Materials

Recyclable Materials - Accepted for FREE (Residential Only)

- | | |
|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| ✓ Antifreeze and empty antifreeze containers | ✓ Paper containers (tetra-packs, coffee cups) |
| ✓ Books | ✓ Plastic bags and overwrap |
| ✓ Cardboard (flatten) | ✓ Plastic containers (jars, jugs, bottles) |
| ✓ Cell phones | ✓ Printed paper and paper packaging (newspaper, magazines, catalogues, writing paper, paper bags) |
| ✓ Clothing | ✓ Propane tanks (maximum 4 disposable and 2 refillable) |
| ✓ Cooking oil | ✓ Scrap metal |
| ✓ Electronics, small appliances and power tools (max 5 large items) | ✓ Smoke and carbon monoxide alarms |
| ✓ Fluorescent light bulbs and tubes | ✓ Thermostats |
| ✓ Foam packaging (no foam peanuts) | ✓ Tires (passenger or light truck with or without rims; maximum of 10) |
| ✓ Glass bottles and jars | ✓ Used oil (maximum 15 litres), oil filters (maximum 3) and empty oil containers |
| ✓ Large appliances (refrigerators, freezers, air conditioners) | |
| ✓ Lead acid car and truck batteries | |
| ✓ Metal containers (cans, tins, foil, empty aerosol cans excluding spray paint cans) | |

Recyclable Materials - Accepted for a FEE

- ✓ Gypsum drywall, new scraps only (maximum level pick-up truckload)
- ✓ Food scraps (maximum 130 kg)
- ✓ Mattresses and box springs (maximum 8 pieces)
- ✓ Wood waste (includes painted, stained and treated wood, residential quantities)
- ✓ Yard & garden trimmings

Banned Materials

The lists of Banned Materials that follow are taken from City of Vancouver *Solid Waste By-Law No. 12849* in effect as of January 1, 2020.

Banned Hazardous and Operational Impact Materials (Schedule E)

The following wastes are prohibited from disposal at the Vancouver Landfill and Vancouver South Transfer Station:

1. Automobile bodies.
2. Refuse that is on fire, smoldering, flammable or explosive.
3. Hazardous Waste as defined in the *Hazardous Waste Regulation* (B.C. Reg. 63/88), with the exception of asbestos waste delivered to the Vancouver Landfill in accordance with the Asbestos Policy.
4. Propane tanks, with the exception of Propane Tanks delivered as recyclable materials;
5. Liquids or sludge.

6. Coated or uncoated wire and cable that exceeds either 1% of the total weight of the load or 1% of the total volume of the load.
7. Dead animals from personal or business activities.
8. Inert fill material including soil, sod, gravel, concrete and asphalt exceeding 0.5 cubic metres per load, with the exception of those materials meeting the City Engineer's specifications for landfill cover, road building, and closure.
9. Excrement, other than amounts of pet excrement that are double bagged and discarded with Municipal Solid Waste and that do not exceed either 5% of the total weight of the load or 5% of the total volume of the load.
10. Barrels, drums, pails or other large (205 litre or greater) liquid containers.
11. New or used gypsum (drywall), with the exception of residential used gypsum (drywall) delivered to the Vancouver Landfill in accordance with the Drywall Policy.
12. Mattresses, with the exception of Mattresses that are delivered in dedicated loads to the Vancouver Landfill for management as special handle waste requiring burial
13. Railroad ties or creosote treated wood.
14. Toxic Plants, with the exception of Toxic Plants that are double bagged and delivered in dedicated loads to the Vancouver Landfill for management as special handle waste requiring burial.
15. Personal hygiene products where the personal hygiene products make up more than 10% of the total weight of the load unless the personal hygiene products are double bagged in sealed plastic bags that are sufficiently durable to resist leaking or breaking during collection and disposal.
16. Any material that would cause undue risk of injury or occupational disease to any person at the Vancouver Landfill and Transfer Station or that would otherwise contravene the *Occupational Health and Safety Regulation* (B.C. Reg. 296/97) enacted pursuant to the *Workers Compensation Act*, as amended or replaced from time to time.
17. Any other material deemed by the City Engineer as unacceptable for disposal at the Vancouver Landfill or Vancouver South Transfer Station.

Banned Recyclable Materials (Schedule F)

1. Beverage containers identified in "Schedule 1 – Beverage Container Product Category" to the *Recycling Regulation* (B.C. Reg. 449/2004) of the *Environmental Management Act*.
2. Containers other than beverage containers made of:
 - i. Metal,
 - ii. Glass,
 - iii. Plastic identified by the SPI Code #1 (Polyethylene Terephthalate or PET) or SPI Code #2 (High Density Polyethylene or HDPE) or SPI Code #4 (Low Density Polyethylene or LDPE) or SPI Code #5 (Polypropylene or PP), or
 - iv. Composite materials to create rigid packaging consisting of paper and polyethylene (gable top cartons, frozen food boxes, ice cream cartons, and microwaveable dinner cartons) or paper, polyethylene and aluminum (aseptic cartons).
3. Recyclable Paper.
4. Corrugated Cardboard.
5. Yard Waste.
6. Food Waste.
7. Clean Wood Waste.
8. Expanded Polystyrene Packaging.

Banned Product Stewardship Materials (Schedule G)

The following materials included in the effective Product Stewardship Program product categories of the *Recycling Regulation* of the *Environmental Management Act*, are banned from garbage containers, and from disposal as garbage at the Vancouver South Transfer Station, and Vancouver Landfill:

1. The following materials pursuant to Schedule 2 - Residual Product Category to the *Recycling Regulation*:
 - Solvents and flammable liquids;
 - Pesticides;
 - Gasoline;
 - Pharmaceutical products and medications;
 - Oil, oil filters and oil containers;
 - Paint and paint containers;
 - Lead-acid batteries; and
 - Antifreeze and antifreeze containers;
2. Electronics and electrical products, including metal household and commercial appliance, as identified in Schedule 3 - Electronics and Electrical Products Category to the *Recycling Regulation*;
3. Tires pursuant to Schedule 4 - Tire Product Category to the *Recycling Regulation*.

Appendix 3: 2020 Water Quality Monitoring Location Plan



Note:

- Routine monitoring at Stations 101, 103, 105, 107, 108 and 202 continued in 2020 as part of the stormwater monitoring program.
- Required station 27-2013 was damaged in Q4 2019 and replaced in 2020 with 27-2020.
- Station 71 is not an OC compliance location and was last sampled in 2014.

Appendix 4: 2020 Water Quality Monitoring Program Parameters

Surface Water

alkalinity as CaCO ₃	dissolved organic carbon	sodium, total & dissolved
aluminium, total	hardness as CaCO ₃	specific conductivity
ammonia	iron, total & dissolved	sulphate
arsenic, total	lead, total	zinc, total
cadmium, total	magnesium, total & dissolved	temperature*
calcium, total & dissolved	manganese, total & dissolved	turbidity
chloride	nickel, total	TSS
chromium, total	pH*	TOC
cobalt, total	true colour	VOCs
copper, total	phenols	
dissolved oxygen*	potassium, total & dissolved	

Groundwater

alkalinity as CaCO ₃	cobalt, dissolved	pH*
aluminium, dissolved	copper, dissolved	phenols
ammonia	hardness as CaCO ₃	potassium, dissolved
arsenic, dissolved	iron, dissolved	sodium, dissolved
cadmium, dissolved	lead, dissolved	specific conductivity
calcium, dissolved	magnesium, dissolved	sulphate
chloride	manganese, dissolved	temperature*
chromium, dissolved	nickel, dissolved	zinc, dissolved
		VOCs

Leachate Grab Samples

alkalinity as CaCO ₃	cyanide	potassium, total & dissolved
aluminium, total	dissolved oxygen*	sodium, total & dissolved
ammonia	hardness as CaCO ₃	specific conductivity
cadmium, total	iron, total & dissolved	sulphate
calcium, total & dissolved	lead, total	sulphide, total & dissolved
chloride	magnesium, total & dissolved	temperature*
chromium, total	manganese, total & dissolved	toxicity
cobalt, total	pH*	volatile organic compounds
copper, total	phenols, total**	zinc, total

Leachate Composite Samples

aluminium, total	copper, total	nickel, total
cadmium, total	iron, total	pH
chemical oxygen demand	lead, total	total suspended solids
chromium, total	manganese, total	zinc, total
cobalt, total	molybdenum, total	

* Field Data

** Total of 2,3,4,5 and 2,3,4,6 tetrachlorophenols and pentachlorophenols

Appendix 5: 2020 Public Complaint and Resolution Log

No.	Issue	Resolution
1	<p>Customer wanted to dispose of their furniture packaging at the Landfill but felt upset that an employee stated they could not drop off a large volume of items and that the depot was for residential drop off only.</p> <p>The customer was given information for material disposal and was told that they would not be allowed to come back to the Landfill.</p>	<p>The superintendent spoke to the staff member involved regarding incident to get a better understanding of situation. The superintendent called the resident back to apologize for their experience and cleared up the misunderstanding.</p>
2	<p>Customer felt that the City website should indicate if weight restrictions were applicable to 10 bags of residential asbestos waste. They read the online information and assumed a weight restriction was in place. Customer was concerned the Landfill may turn people away if weight of asbestos material is high.</p>	<p>The customer was advised that there is no information currently on the City website. 311 offered to create a case for department to call the customer back; however, they declined. The customer did pass on feedback and the information on the website was updated.</p>
3	<p>Customer, who is a small business owner, had an employee haul a large load of what their employee thought was clean soil to the Landfill. The weighmaster suggested the driver take their load to other facilities that are near the Landfill. The driver proceeded to dump the soil load. The small business owner was later given a ticket showing a dump of waste at the garbage rate. The business owner feels this is a significant amount of money for a small business to pay.</p>	<p>Confirmed that business owner's employee brought in a load of sod and this is not clean soil. The account was charged at the garbage rate.</p>
4	<p>Customer called saying they wanted to open a Community Garden to help with COVID food shortages. The customer was curious if the City would supply compost from the Transfer Station or Landfill for this initiative.</p>	<p>The customer was provided GFL's contact information to pursue their compost request.</p>
5	<p>Customer was building a new house and had new drywall off-cuts. The customer did not understand what they are supposed to do with the off-cuts if the Transfer Station and Landfill are not accepting them during COVID-19.</p>	<p>The customer was advised that during this time with COVID-19 restrictions, they should contact New West Gypsum for disposal options.</p>
6	<p>Customer was wondering why compost sales were halted at the Landfill. They wanted to know why the City could not provide sales while incorporating COVID-19 protocols.</p>	<p>The customer was advised of COVID-19 measures and that the Landfill was working on safe protocols for future compost sales.</p>
7	<p>Customer wanted to know when the City will reinstate compost sales at the Landfill. The customer felt that it is an essential service to keep our food chain going and should be available during this pandemic.</p>	<p>The customer was advised of COVID-19 measures and that the City was working on safe protocols for future compost sales.</p>
8	<p>Customer recommended having compost sales during COVID-19. The customer mentioned that other facilities are allowing pickup trucks and trailers to be loaded with a front loader provided people stay in their vehicles.</p>	<p>The customer was advised of COVID-19 measures and that the City was working on safe protocols for future compost sales.</p>

No.	Issue	Resolution
9	Customer did not understand why ordering compost trailer loads from the Landfill had been suspended. They felt there would be no contact between the loader operator and the driver of the vehicle. The customer would like to know when the suspension is going to end.	The customer was advised of COVID-19 measures and that the City was working on safe protocols for future compost sales.
10	Customer was frustrated that they were not able to pick up compost from the Landfill. They had an open trailer and would remain in the vehicle to avoid contact with anyone while on site. The customer wanted to see an amendment to the current COVID-19 protocols around compost sales to allow trucks and trailers to pick up the compost if social distancing was the main concern. The customer wanted free compost in compensation for the inconvenience of driving out there and getting told they cannot pick up compost.	The customer was advised of COVID-19 measures and that the City was working on safe protocols for future compost sales.
11	Customer depends on the annual free compost in May for their vegetable garden. They wanted the event to happen in 2020 despite COVID-19. The customer thought it could be done with safe distancing or by appointment for customers. They suggested that the Landfill can just place cones to ensure vehicle spacing. The customer was hoping compost sales would resume very soon while it was still the time of year for compost demand.	The customer was advised of COVID-19 measures and that the City was working on safe protocols for future compost events.
12	Customer complained that employees at the Landfill were using the on-ramp as an off-ramp that goes onto Highway 99. They also had concerns that Landfill drivers should not speed and should adhere to the 30 km speed limit at the Landfill.	Staff and contractors were advised to not use the on-ramp as an off-ramp on Highway 99 and to abide by speed limits.
13	Customer felt they were overcharged for one of their loads. They claim they had 4 bags of drywall and some garbage but they were charged for everything at the drywall rate. The weighmaster said that the customer should have been weighed after the drywall was dumped so that there would be a separate charge for the garbage at the garbage rate. They felt that they were not given clear instructions and they would have done this if they had been instructed.	The Landfill disposal process for mixed loads was explained to the customer to clarify the misunderstanding. The customer was refunded for difference in disposal fees.
14	Customer called to advise that they disposed of green waste. They mentioned they received a receipt, but their credit card was rounded up to the nearest dollar. The customer is concerned that many other customers are being charged more than their receipt amount.	Staff confirmed that rounding to the nearest dollar for non-account transactions is a policy defined in the City's solid waste bylaw. Metro Vancouver's solid waste bylaw includes the same policy.
15	Customer thought there should be a policy in place for disposing of drywall attached to tiles. Waste wizard and the City website did not specifically say that tiles could be attached to the drywall when disposing of it as drywall.	The communication was noted for future consideration.

No.	Issue	Resolution
16	Customer would like to see the Landfill and Transfer Station begin accepting new drywall for disposal again soon.	The communication was noted but no follow-up was deemed necessary at this time.
17	Customer felt that there should be an accessible camera for all vehicle users waiting in lineup at Landfill.	The communication was noted but no follow-up was deemed necessary at this time.
18	<p>Customer called to explain they had a Landfill voucher to dispose of wood and household garbage. When exiting the Landfill the weighmaster refused to accept their voucher. The weighmaster had been misinformed by an operations staff member who indicated that the customer had also unloaded mattresses which was not the case.</p> <p>Customer was disappointed that there was miscommunication that prevented them from using their voucher and had concerns regarding the disposal charges being rounded up to the nearest dollar.</p>	The customer received a call back. The City accepted the voucher, apologized for any confusion and issued the customer a refund.
19	Customer was told not to put a piece of wire in the waste bin at the residential drop off. They were asked to place the wire in the appliances collection area, otherwise they would be fined. The customer asked where they can find this information and was directed to the City's website. The customer indicated they had been looking for hours and cannot find a simple list of where each waste material goes. The customer felt they should be given a printed form when being weighed at the scales.	The communication was noted for future consideration.
20	Customer brought double sealed bags of drywall to the Landfill. They claimed nobody checked the load to make sure the drywall was contained in the right bag or if was sealed as per instructions on the City website. When the customer disposed of the bags in the drop-off bin, they were surprised to see that only about 25% of the bags were sealed according to the instructions.	The superintendent relayed information to staff to ensure bags are being checked.
21	Customer complained that a weighmaster stuck their head in their vehicle without wearing a mask. The customer wants to know why the City has COVID-19 protocols if City employees are not following them. They would like the supervisors to talk to all staff.	Staff were reminded of COVID-19 safety protocols.
22	Customer had new drywall that they wanted to dispose of at the Landfill. They were upset that they could not dispose of it due to the pandemic. They were confused why used dry wall can be accepted at the landfill, but not new drywall during COVID-19. The customers feels this is very inconvenient.	The communication was noted but no follow-up was deemed necessary at this time.

No.	Issue	Resolution
23	Customer complained that the disposal rates were difficult to understand. They felt it is not obvious from the website, so they suggested adding some more wording to clarify messaging.	The communication was noted for future consideration.
24	Customer does not agree with the Landfill's policy on disposing drywall. They felt that drywall should not be double bagged. The customer had used residential drywall that was not tested.	The communication was noted but no follow-up was deemed necessary at this time.

Appendix 6: 2020 Annual Water Quality Monitoring Report Executive Summary

AECOM Canada Ltd. (AECOM) reviewed historical data and interpreted leachate, groundwater, surface water and stormwater quality data collected by City of Vancouver (CoV) and AECOM staff between January 1, 2020 and December 31, 2020. This annual monitoring report presents the findings of the monitoring program review in accordance with the landfill Operational Certificate MR-01611 (OC). The requirements of the monitoring program and subsequent interpretation and reporting are specified within the OC and Waste Discharge Permit SC-100168-FSA (WDP). Section 3.5.2 of the OC requires that the annual report include a review and interpretation of the analytical data from receiving environment monitoring for the preceding year, and leachate flow data and leachate/drainage ditch levels. The WDP governs the discharge of leachate from the Vancouver Landfill. Leachate discharged from the landfill is conveyed through City of Delta (CoD) and Metro Vancouver forcemains to the Annacis Island Wastewater Treatment Plant.

The monitoring data included measurements of leachate flows and leachate quality at the leachate pump station near the southwest corner of the landfill. Groundwater elevations and groundwater quality were measured in the shallow and deep aquifers surrounding the footprint of the landfill and immediately outside the perimeter ditch leachate collection system. Surface water elevations and surface water quality were measured in the perimeter drainage ditch surrounding the landfill footprint, and in downstream drainage ditches and the Delta Irrigation Enhancement Project (DIEP) irrigation canal that is connected to the Fraser River.

A regular stormwater monitoring program commenced in December 2019. Stormwater monitoring is not a requirement of the OC or the WDP. The purpose of the program is to monitor the quality of the stormwater from closed areas of the landfill to support discharge of stormwater outside the leachate collection system. Two pilot stormwater discharge tests were carried out in October and November 2020 which discharged clean stormwater from select closed and lined landfill phases to the Dredge Pond.

The 2020 monitoring program met or exceeded the requirements of the OC and WDP with respect to the stations monitored, media monitored and parameters analyzed, with the following exceptions:

- Similar to previous years, surface water samples could not be collected from a few monitoring stations in late summer when surface water was not present.
- Monitoring and sampling of OC compliance well 27-2013 could not be conducted in the first quarter of 2020 because the well was damaged during well casing maintenance activities. The well was decommissioned and replaced by the new OC compliance well 27-2020 and sampling commenced in the second quarter. Sampling at this location could not be completed in the fourth quarter due to flooding conditions.

The monitoring program contained a quality assurance and quality control component which confirmed the groundwater, surface water, leachate water and stormwater quality data are acceptably precise and reliable. It also included a field sampling audit which confirmed the absence of any issues that would materially affect the quality of data collected.

Flow Control System - Perimeter Ditch System

The perimeter ditch system consists of an inner leachate collection ditch and an outer surface water drainage ditch, which are separated by an intermediate soil berm. The outer drainage ditch diverts natural surface runoff and shallow groundwater flow from Burns Bog around the landfill footprint. The inner leachate ditch collects the following which are collectively referred to as 'leachate' once they reach the inner ditch:

- Leachate - Rainwater that is contaminated after the water percolates through waste.
- Surface Runoff - Rainwater that flows along other surfaces at the landfill such as intermediate cover areas (temporarily closed) and operational areas (i.e., entrance area buildings and scales) that may be impacted by leachate.
- Stormwater - Rainwater that is collected above the impermeable geomembrane in closed areas of the Landfill. It is not impacted by leachate.

Water collected in the leachate ditch flows to the landfill's pump station before being transported offsite through the municipal sanitary sewer system. Water in the sanitary line is transported to the Annacis Island Waste Water Treatment Plant.

The purpose of the perimeter ditch system is to maintain an inward hydraulic gradient around the landfill footprint to ensure leachate is collected and conveyed to the leachate pump station. To achieve this, water levels in the leachate ditch are actively maintained at a lower elevation than the drainage ditch through pump station control. Water levels in the drainage ditch are reflective of natural inputs from the surrounding lands; however, a system of weirs is in place to increase retention of natural runoff and maintain higher water elevations.

Based on regular monitoring of five staff gauges installed in the perimeter ditch system, the overall efficiency of the system was 94.2% in 2020. This is comparable to the average containment efficiency from 1995 to present (93.2%). Short-lived outward gradients may occur during intense storm events when water levels in the leachate ditch rise more rapidly than in the outer drainage ditch. It is highly unlikely that leachate migrates through the berm during these events given the short duration and inferred groundwater velocities (Enterprise, 2009). Further, hydraulic containment is achieved because inward groundwater gradients are maintained around the perimeter of the landfill, even during the dry season (SNC, 2013 and AECOM, 2018c).

Leachate Flow

The CoV maintained suitable flow measuring devices for the purpose of recording the volume of leachate discharged to the sanitary sewer each month as required under Section 3.2.2 of the OC. The total volume of leachate discharged in 2020 was 2,709,033 m³, approximately 28% higher than in 2019 due to a relatively wet year (third highest since 1995). The volume of precipitation that fell across the landfill footprint in 2020 was estimated to be 2,565,900 m³ which is also higher than the 2,172,825 m³ observed in 2019. The high leachate to precipitation ratio (i.e., 106%) indicates that stormwater comprises a large proportion of the total discharge, likely due to increased geomembrane placement associated with progressive closure which has been occurring since 2009. The ratio is over 100% which may be due to water inputs from off-site sources or the spatial variability of precipitation measured at YVR Airport and Burns Bog weather stations. Progressive closure reduces infiltration rates and increases daily and monthly

maxima when the clean stormwater is discharged as leachate. Evapotranspiration rates will increase as vegetation matures on recently closed landfill phases.

The highest daily leachate flow rate (36,631 m³/day) occurred on February 4, 2020, which is well below the maximum (under review) daily limit of 45,000 m³/day.

Groundwater Flow

Two groundwater flow systems are present beneath the site. The shallow aquifer consists primarily of organic peat that extends from ground surface to approximately six metres depth and is underlain by a thick permeable deep sand aquifer (known as the deep aquifer). The shallow and deep aquifers are separated by a low permeability silt/clay aquitard that varies in thickness from 1 to 7 metres. Water levels are monitored in both aquifers on a quarterly basis using a series of monitoring wells located around the perimeter of the landfill. The perimeter ditch system and Dredge Pond are important hydrologic features that influence groundwater levels and flow directions in both aquifers. Groundwater elevations fluctuated on the order of one metre seasonally, and groundwater flow directions were predominantly from northeast to southwest which is consistent with previous years. Because topography is relatively flat, horizontal groundwater gradients and flow velocities in both the shallow and deep aquifers are relatively low.

Surface Water Flow

Regional surface water flows southwest from Burns Bog toward the perimeter ditch system. Surface water and shallow groundwater that enter the perimeter ditch system are carried around the landfill footprint and discharge into Crescent Slough from two connection points at the northwestern and southwestern corners of the landfill. Crescent Slough ultimately discharges to the Fraser River. The City of Delta intermittently opens a floodgate to allow river water to flow into the Delta Irrigation Enhancement Project (DIEP) canal for irrigation purposes on nearby agricultural lands. As a result, periodic surface water flow reversals have been observed under certain tidal, river discharge and operational scenarios. Portions of the perimeter ditch system on the north, east and southeast sides of the landfill cease to flow following prolonged periods of dry weather (i.e., late summer).

Leachate Quality Summary

Monthly leachate quality samples were collected from the approved sampling point at the leachate pump station in accordance with OC and WDP requirements. All samples were analyzed for the parameters stipulated in the OC and WDP. All leachate quality samples met applicable discharge criteria in 2020.

Increasing the volume of stormwater discharged outside the leachate collection system is currently being assessed and is expected to affect leachate quality.

Groundwater Quality

As per the OC, quarterly monitoring must be conducted on five shallow monitoring wells and seven deep monitoring wells. In 2020, the monitoring program included 18 shallow monitoring wells and 20 deep monitoring wells. Quarterly groundwater quality samples were collected from the monitoring stations required by the OC. The remaining monitoring wells were also sampled

on a quarterly basis, with the exception of three wells that were only monitored for water levels and field parameters. All samples were analyzed for the parameters stipulated in the OC. Groundwater quality in the shallow aquifer is strongly influenced by bog water chemistry. Upgradient groundwater flowing from Burns Bog toward the landfill is naturally acidic and contains elevated concentrations of several constituents that are readily mobilized under acidic conditions. Deep groundwater chemistry appears to have minimal influence from Burns Bog and represents a compilation of upgradient sources. Water chemistry in both shallow and deep aquifers naturally evolves along the flow path, particularly in the shallow aquifer, as groundwater travels away from the bog hydrologic system. Professional judgment was used to assess the nature and degree of any water quality impacts that may have occurred due to leachate, road salt, runoff from neighbouring lands and brackish waters from tidal fluctuations and municipal floodgate operations.

Groundwater quality results were tabulated and compared against applicable *Contaminated Sites Regulation* (CSR) standards. The shallow aquifer is not considered to be a drinking water aquifer due to the presence of organic soils. Primary leachate indicator parameters are considered to be ammonia, conductivity and chloride. Secondary leachate indicator parameters include alkalinity and hardness. All of these parameters were used to assess any leachate impacts in consideration of background concentrations of leachate indicator parameters and the results of statistical trend analysis.

Similar to previous years, leachate-impacted groundwater was contained within the landfill property.

Shallow Groundwater Quality

Background water quality in the shallow aquifer was similar to previous years and reflected natural water chemistry in Burns Bog. Shallow groundwater quality met applicable CSR standards in 2020. Shallow groundwater quality at all monitoring stations does not appear to be impacted by leachate, with one exception (54-2013).

Shallow groundwater quality at monitoring station 54-2013 (south of the landfill and northeast of the Dredge Pond) exhibited dilute leachate impacts. Based on the results of the 2018 Hydrogeology Review, groundwater quality at this location, immediately south and up to 40 metres outside of the perimeter ditch system, is impacted by dilute leachate. The impacts are relatively minor, decreasing with time, and contained within the landfill property boundary due to net-inward hydraulic gradients from the bog towards the perimeter ditch system. Further monitoring is planned during the next hydrogeology review (2023) to verify that the extent of the impacts.

Shallow groundwater quality at 26-2013 exhibited higher than historical concentrations of leachate indicator parameters in Q1, Q2 and Q3, but remained unimpacted by leachate because concentrations remained low. Groundwater degradation may be due to recent stormwater conveyance line upgrades between the Phase 2 Pond and the Dredge Pond and short-term hydraulic trap reversals induced by drier than usual weather in March 2020. Impacts appear to be temporary and water quality returned to normal by the fourth quarter of 2020.

Deep Groundwater Quality

In 2020, deep groundwater quality at all monitoring stations does not appear to be impacted by leachate. Background water quality in the deep aquifer was similar to previous years and reflected natural water chemistry. Concentrations of leachate indicator parameters and other dissolved minerals are higher than those observed in the overlying shallow aquifer. Concentrations of select leachate indicator parameters at downgradient monitoring wells are slightly higher than upgradient of the landfill, which may be the result of off-site sources (i.e., road salt and tidal influences).

Deep groundwater quality data met the applicable CSR Freshwater Aquatic Life Use (AW) standards. It also met CSR Irrigation Water Use (IW) standards, with the exception of chloride at well 23 and well 124 (located at the southwest corner of the landfill). Chloride concentrations at well 23 show a statistically significant decreasing trend but concentrations at well 124 show a statistically significant increasing trend.

Deep groundwater quality data met applicable CSR Drinking Water Use (DW) standards, with the exception of dissolved vanadium at background well 121 and downgradient well 57. Vanadium impacts are not considered an indicator of landfill leachate due to relatively low concentrations of vanadium in leachate and high natural background concentrations.

Surface Water Quality

As per the OC, quarterly monitoring and sampling must be conducted at eight surface water monitoring stations. In 2020, 13 surface water monitoring stations were monitored and sampled to confirm compliance with the OC.

In 2020, the surface water monitoring program met if not exceeded the requirements stipulated in the OC based on the number of stations and parameters monitored. The only exceptions were associated with locations that could not be sampled in the summer when the ditch was dry or stagnant, which is consistent with previous years.

Surface water quality at monitoring stations located northwest, northeast, southeast and southwest of the landfill does not appear to be impacted by leachate. Aside from the Crescent Slough background station 95, water chemistry at these locations is strongly influenced by naturally acidic surface water runoff and groundwater seepage from Burns Bog. Similar to previous years, pH and metals concentrations exceeded BC Approved and Working Water Quality Guideline (BCWQG) AW and IW criteria at several locations. Exceedances at these stations are consistent with background water quality in the bog and are attributed to the naturally acidic water quality associated with Burns Bog. Winter conductivity and chloride values at the Crescent Slough background monitoring station also exceeded BCWQG IW criteria, likely due to seasonal runoff from nearby roadways.

Surface water quality at monitoring stations located southwest and west of the landfill does not appear to be impacted by leachate. Similar to previous years, pH, turbidity and metals concentrations exceeded BCWQG AW and IW criteria. Water quality impacts at these locations are attributed seasonal runoff from nearby agricultural fields and roadways and influences from the Fraser River.

Stormwater Quality

Following recommendations in the *2018/19 Vancouver Landfill Stormwater and Surface Water Monitoring Report* (AECOM 2019c), a regular stormwater monitoring program was initiated in December 2019. The purpose of this program is to characterize the quality of stormwater coming from closed phases of the landfill to determine the suitability of discharging stormwater outside the leachate collection system.

Based on 2020 results, stormwater quality from monitoring stations 101, 103, 105 and 108 (Discharge from Phase 1, 2, 3, and Western 40 Pond 6, respectively) was similar to or better than water quality in the nearby on-site receiving environments (Dredge Pond) and off-site receiving environments (e.g. Crescent Slough, Centre Ditch). Stormwater from these discharge locations is suitable for discharge outside the leachate ditch.

Stormwater quality from station 107 (Western 40 Pond 4) continues to exhibit water quality that is not suitable for discharge outside the leachate collection system due to recent closure activities.

Based on the findings of the 2020 Water Quality Monitoring Program Review, the recommendations below are provided along with ongoing recommendations from previous years.

2020 - Water Quality Monitoring Program		Status
2020-1	Once each year in early fall, stormwater samples should be submitted for the same suite of pesticide and herbicide parameters as analyzed in 2018/19 Stormwater and Surface Water Monitoring Report	New
2020-2	Water quality modelling should be conducted during the next hydrogeology review to assess the effects on leachate quality as a result of diverting stormwater outside the leachate ditch and predict what parameters might have future Waste Discharge Permit compliance issues, if any.	New
2020-3	Water levels and water quality in well 26-2013 should be closely monitored following installation of the remote water level monitoring system to confirm the persistence of the hydraulic trap.	New
2020-4	The source of the elevated chloride and conductivity values in the southwest corner of the landfill remains unclear and a detailed water chemistry assessment in the vicinity of the leachate pump station is expected to be completed by AECOM in Q2 of 2021.	On-going
2020-5	Further monitoring in the vicinity of station 54-2013 should be conducted during the next hydrogeology review (2023) to verify that the extent of the impacts.	New
2019 - Monitoring Network		Status
2019-2	Inactive monitoring Wells 19 and 20 should be decommissioned once access to the property south of the landfill is granted.	On-going
2019 - Water Quality Monitoring Program		Status
2019-5	Well 70 should continue to be sampled as part of the routine monitoring program until sufficient data is collected from the 2019 replacement well (Well 125) to determine if they exhibit similar water quality. It is anticipated that two years of quarterly data is sufficient for the water quality comparison and therefore a water quality comparison should be conducted as part of the 2021 Annual Water Quality Monitoring Report. If it is concluded that Well 125 is a suitable replacement for OC Well 70, then CoV should request the change to the OC. Once ENV approves the change, the well should be decommissioned in accordance with the BC <i>Groundwater Protection Regulation</i> .	On-going
2017 - Monitoring Network		Status
2017-2	Permanent station markers should be installed to identify the exact location of each surface water monitoring station to ensure the integrity of the surface water quality dataset is maintained.	Ongoing

Appendix 7: 2020 Weekly Leachate and Drainage Ditch Water Elevations

Table 6-3. Vancouver Landfill Weekly Leachate and Drainage Ditch Water Elevations

Date	SG1		Flow Direction	SG2		Flow Direction	SG3		Flow Direction	SG4		Flow Direction	SG5		Flow Direction
	L1 ² m	D1 ² m		L2 m	D2 m		L3 m	D3 m		L4 m	D4 m		L5 m	D5 m	
Top of Gauge Elevation (masl) ^{1,3}	1.40	1.02		1.36	1.05		2.34	2.43		NA	2.32		0.92	1.41	
2020/01/03	-0.25	0.28	inward	-0.02	0.26	inward	0.41	1.02	inward	0.78	1.09	inward	0.14	0.43	inward
2020/01/10	-0.23	0.01	inward	0.11	0.23	inward	0	0.52	inward	0.7	1	inward	-0.14	0.42	inward
2020/01/16	-0.27	-0.05	inward	0.04	0.2	inward	0.56	0.99	inward	0.66	0.98	inward	0.54	0.33	outward
2020/01/23	-0.04	0.4	inward	0.26	0.36	inward	0.57	1.03	inward	0.82	1.17	inward	0.45	0.53	inward
2020/01/30	-0.27	-0.05	inward	0	0.2	inward	0.34	1	inward	0.66	1.07	inward	0.2	0.4	inward
2020/02/01	0.45	0.64	inward	0.39	0.59	inward	0.55	1.07	inward	0.85	1.22	inward	0.69	0.69	outward
2020/02/03	-0.25	0.35	inward	-0.02	0.35	inward	0.37	1.01	inward	0.7	1.11	inward	-0.15	0.45	inward
2020/02/07	-0.15	0.29	inward	0.08	0.32	inward	0.49	1.01	inward	0.72	1.04	inward	-0.1	0.47	inward
2020/02/11	-0.3	-0.12	inward	-0.1	0.15	inward	0.34	0.99	inward	0.66	1.1	inward	0.09	0.35	inward
2020/02/14	-0.47	-0.15	inward	-0.21	-0.01	inward	0.29	0.97	inward	0.62	0.99	inward	-0.26	0.22	inward
2020/02/18	-0.47	-0.15	inward	-0.22	-0.02	inward	0.27	0.98	inward	0.61	0.98	inward	-0.27	0.2	inward
2020/02/21	-0.47	-0.16	inward	-0.26	-0.1	inward	0.26	0.94	inward	0.61	0.95	inward	-0.28	0.13	inward
2020/02/28	-0.42	-0.15	inward	-0.19	-0.09	inward	0.75	0.61	outward	0.61	0.95	inward	-0.26	0.13	inward
2020/03/06	-0.43	-0.15	inward	-0.25	-0.12	inward	0.24	0.95	inward	0.58	0.93	inward	-0.3	0.1	inward
2020/03/13	-0.52	-0.15	inward	-0.24	-0.13	inward	0.27	0.92	inward	0.55	0.9	inward	-0.3	0.07	inward
2020/03/22	-0.56	-0.16	inward	-0.23	-0.13	inward	0.25	0.9	inward	0.52	0.88	inward	-0.31	0	inward
2020/03/27	-0.52	-0.15	inward	-0.25	-0.13	inward	0.42	0.9	inward	0.52	0.88	inward	-0.32	0	inward
2020/04/01	-0.25	-0.15	inward	-0.14	-0.09	inward	0.26	0.95	inward	0.5	0.9	inward	-0.3	0.05	inward
2020/04/09	-0.54	-0.17	inward	-0.3	-0.12	inward	0.23	0.9	inward	0.51	0.86	inward	-0.35	-0.01	inward
2020/04/15	-0.59	-0.16	inward	-0.3	-0.14	inward	0.2	0.87	inward	0.5	0.8	inward	-0.36	-0.01	inward
2020/04/21	-0.61	-0.17	inward	-0.3	-0.17	inward	0.19	0.8	inward	0.5	0.74	inward	-0.37	-0.02	inward
2020/04/30	-0.56	-0.18	inward	-0.3	-0.18	inward	0.21	0.76	inward	0.49	0.73	inward	-0.38	-0.05	inward
2020/05/08	-0.56	-0.15	inward	-0.3	-0.19	inward	0.19	0.73	inward	0.47	0.7	inward	-0.4	-0.07	inward
2020/05/15	-0.54	-0.16	inward	-0.3	-0.2	inward	0.18	0.7	inward	0.48	0.72	inward	-0.4	-0.06	inward
2020/05/22	-0.49	0.06	inward	-0.18	-0.18	neutral	0.2	0.68	inward	0.48	0.77	inward	-0.4	0.1	inward
2020/05/29	-0.52	0.17	inward	-0.16	-0.2	outward	0.2	0.65	inward	0.48	0.72	inward	-0.37	0.2	inward
2020/06/05	-0.5	0.1	inward	-0.16	-0.2	outward	0.25	0.64	inward	0.48	0.65	inward	-0.37	0.15	inward
2020/06/09	-0.46	0.19	inward	-0.2	-0.22	outward	0.18	0.6	inward	0.48	0.63	inward	-0.37	0.22	inward
2020/06/17	-0.55	0.18	inward	-0.23	-0.23	neutral	0.2	0.58	inward	0.48	0.64	inward	-0.39	0.14	inward
2020/06/25	-0.52	0.15	inward	-0.23	-0.2	inward	0.2	0.55	inward	0.48	0.6	inward	-0.4	0.19	inward
2020/07/02	-0.53	0.13	inward	-0.25	-0.22	inward	0.23	0.51	inward	0.48	0.56	inward	-0.4	0.15	inward
2020/07/10	-0.5	0.17	inward	-0.25	-0.2	inward	0.24	0.5	inward	0.48	0.55	inward	-0.4	0.2	inward
2020/07/17	-0.51	0.16	inward	-0.25	-0.22	inward	0.25	0.49	inward	0.48	0.52	inward	-0.38	0.19	inward
2020/07/24	-0.51	0.17	inward	-0.24	-0.21	inward	0.25	0.49	inward	0.47	0.5	inward	-0.4	0.18	inward
2020/07/31	-0.5	0.16	inward	-0.25	-0.22	inward	0.25	0.49	inward	0.47	0.5	inward	-0.4	0.18	inward
2020/08/07	-0.5	0.19	inward	-0.25	-0.22	inward	0.25	0.49	inward	0.48	0.5	inward	-0.38	0.2	inward
2020/08/12	-0.49	0.18	inward	-0.23	-0.25	outward	0.27	0.49	inward	0.46	0.48	inward	-0.38	0.19	inward
2020/08/21	-0.48	0.16	inward	-0.23	-0.25	outward	0.28	0.49	inward	0.47	0.5	inward	-0.36	0.18	inward
2020/08/28	-0.45	0.16	inward	-0.23	-0.26	outward	0.27	0.49	inward	0.35	0.5	inward	-0.38	0.18	inward
2020/09/04	-0.46	0.15	inward	-0.23	-0.26	outward	0.27	0.49	inward	0.34	0.5	inward	-0.38	0.18	inward
2020/09/11	-0.46	0.09	inward	-0.25	-0.26	outward	0.27	0.49	inward	0.34	0.5	inward	-0.37	0.11	inward
2020/09/17	-0.47	0.15	inward	-0.25	-0.26	outward	0.38	0.44	inward	0.35	0.49	inward	-0.37	0.16	inward
2020/09/23	-0.42	-0.16	inward	-0.18	-0.24	outward	0.35	0.45	inward	0.42	0.48	inward	-0.22	-0.04	inward
2020/10/02	-0.44	-0.18	inward	-0.27	-0.27	neutral	0.34	0.45	inward	0.34	0.49	inward	-0.36	-0.07	inward
2020/10/08	-0.45	-0.18	inward	-0.24	-0.27	outward	0.33	0.45	inward	0.34	0.49	inward	-0.35	0.06	inward
2020/10/09	-0.41	-0.18	inward	-0.27	-0.24	inward	-	-	-	0.34	0.49	inward	-	-	-
2020/10/15	-0.47	-0.17	inward	-0.25	-0.26	outward	0.46	0.5	inward	0.33	0.81	inward	-0.24	0.14	inward
2020/10/21	-0.48	-0.17	inward	-0.2	-0.26	outward	0.43	0.6	inward	0.34	0.85	inward	-0.2	0.18	inward
2020/10/23	-0.45	-0.18	inward	-0.2	-0.25	outward	0.48	0.61	inward	0.35	0.83	inward	-0.2	0.14	inward
2020/10/26	-0.5	-0.18	inward	-0.28	-0.25	inward	-	-	-	0.34	0.84	inward	-	-	-
2020/10/27	-0.51	-0.18	inward	-0.28	-0.25	inward	-	-	-	0.34	0.83	inward	-	-	-
2020/10/28	-0.51	-0.17	inward	-0.28	-0.23	inward	-	-	-	-	-	-	-	-	-
2020/10/29	-0.51	-0.18	inward	-0.28	-0.26	inward	-	-	-	0.34	0.81	inward	-	-	-
2020/10/30	-0.51	-0.17	inward	-0.27	-0.22	inward	0.45	0.7	inward	0.34	0.81	inward	-0.23	0.06	inward
2020/11/03	-0.43	-0.14	inward	-0.22	-0.2	inward	0.45	0.71	inward	0.37	0.8	inward	-0.2	0.07	inward
2020/11/04	-0.3	0.18	inward	-0.11	-0.16	outward	0.7	0.84	inward	0.45	1.1	inward	0.01	0.38	inward
2020/11/05	-0.32	-0.01	inward	-0.1	-0.1	neutral	-	-	-	0.39	0.98	inward	-	-	-
2020/11/06	-0.32	-0.08	inward	-0.09	-0.09	neutral	-	-	-	0.38	0.94	inward	-	-	-
2020/11/10	-0.41	-0.14	inward	-0.25	-0.12	inward	-	-	inward	0.37	0.87	inward	-	-	-
2020/11/12	-0.45	-0.12	inward	-0.26	-0.12	inward	0.49	0.81	inward	0.36	0.86	inward	-0.18	0.21	inward
2020/11/13	0.19	0.46	inward	0.35	0.34	outward	0.95	1.03	inward	0.7	1.15	inward	0.44	0.57	inward
2020/11/16	-0.23	0.17	inward	-0.08	0.25	inward	-	-	-	0.48	0.94				

Appendix 8: 2020 Annual Status Form



Annual Status Form

AUTHORIZATION NUMBER: 1611

AUTHORIZATION TYPE: Municipal Waste

LEGAL AUTHORIZATION HOLDER NAME: City of Vancouver

AUTHORIZED PERSON NAME: Mike Budzik

AUTHORIZED PERSON SIGNATURE: [Signature]

SIGNATURE DATE: March 31/21

I understand that it is an offense to mislead a government official, and I declare that all of the information presented is accurate and true.

CONDITION NUMBER	CONDITION DESCRIPTION	COMPLIANT (Yes/No/ND)	ACTION TAKEN	ANNUAL REPORT SECTION(S)
1.1.1	The discharge [of refuse to a sanitary landfill from sources within the Greater Vancouver Regional District and other sources specifically authorized by the Regional Waste Manager] is authorized for the full term of the Greater Vancouver Regional Solid Waste Management Plan, dated July 1995. The solid waste management plan must be amended to authorize the discharge beyond this term.	Yes	N/A	Vancouver Landfill Overview
1.1.2	Maximum authorized rate of discharge is 750,000 tonnes per year	Yes	N/A	5. Waste Disposal
1.1.3	The characteristics of the discharge shall be typical municipal solid waste and other materials as specifically authorized by the Regional Waste Manager. Asbestos waste may be discharged in accordance with the <i>Special Waste Regulations</i> .	Yes	N/A	5. Waste Disposal
1.1.4	Waste shall not be discharged within a buffer zone as identified in Section 2.9. Putrescible and household waste shall not be discharged into water. The burning of waste is prohibited.	Yes	N/A	2. Design and Operations Plan
1.1.5	The authorized works common to this section and Sections 1.2, 1.3 and 1.4 are a locking gate to control access by the public, a weigh scale and fire protection equipment, approximately located as shown on attached Site Plan A.	Yes	N/A	
1.1.6	The authorized works specific to this section are those associated with a landfill operation and include berms, covering material, surface water diversionary works, environmental monitoring systems, leachate collection/pumping works and a landfill gas management system consisting of existing and future collection works, a blower/flare station and gas utilization works, approximately located as shown on attached Site Plan B.	Yes	N/A	7. Environmental Protection Programs; 8. Operational Information

Authorized Person Initial: [Signature]

Date: March 31/21

CONDITION NUMBER	CONDITION DESCRIPTION	COMPLIANT (Yes/No/ND)	ACTION TAKEN	ANNUAL REPORT SECTION(S)
1.1.7	The location of the point of discharge is Lot 9, Section 5 and 6, New Westminster District, Plan 38013. Discharge within the area identified as the "100 Acre Reserve", approximately as shown on Site Plan B, is restricted to construction and demolition waste in accordance with the approved closure plan required in Section 2.8	Yes	N/A	2. Design and Operations Plan
1.2.1	The characteristics of waste [at the landfill transfer station facility] are the same as set out in Section 1.1.3	Yes	N/A	6. Waste Reduction and Recycling Initiatives
1.2.2	The authorized works are those associated with a transfer station and include a paved access area and roll off bins, approximately located as shown on attached Site Plan C.	Yes	N/A	6. Waste Reduction and Recycling Initiatives
1.2.3	The location of the facilities is Lot 9, Section 5 and 6, New Westminster District, Plan 38013.	Yes	N/A	Vancouver Landfill Overview
1.3.1	The type of materials which may be managed at this facility [recycling depot and household hazardous waste storage facility] are typical recyclable materials and household hazardous waste.	Yes	N/A	6. Waste Reduction and Recycling Initiatives
1.3.2	The authorized works are those associated with a recycling depot and household hazardous waste storage facility and include roll off bins, recycling containers, a secure (fenced) storage area and storage shed for household hazardous waste, approximately located as shown on attached Site Plan C.	Yes	N/A	8. Operational Information; 6. Waste Reduction and Recycling Initiatives
1.3.3	The location of the facility is the same location as set out in Section 1.2.3.	Yes	N/A	Vancouver Landfill Overview
1.4.1	The type of waste that may be composted [at the composting facility for organic wastes from sources within the Greater Vancouver Regional District and other sources as specifically authorized by the Regional Waste Manager] is restricted to fruit and vegetable waste, typical yardwaste and Christmas trees.	Yes	N/A	6. Waste Reduction and Recycling Initiatives
1.4.2	The authorized works are those associated with a composting facility and include an impermeable pad, a stationary grinding plant, and windrow turning equipment, approximately located as shown on attached Site Plan A.	Yes	N/A	6. Waste Reduction and Recycling Initiatives
1.4.3	The location of the facilities is the same location as set out in Section 1.2.3.	Yes	N/A	Vancouver Landfill Overview
2.1	In the event of an emergency which prevents compliance with a requirement of this operational certificate, that requirement will be suspended for such time as the emergency continues or until otherwise directed by the Regional Waste Manager.	Yes	N/A	
2.2	Inspect the authorized works regularly and maintain them in good working order. Notify the Regional Waste Manager of any malfunction of these works.	Yes	N/A	8. Operational Information
2.3	Inspect the property boundaries regularly and notify the Regional Waste Manager of any visual evidence of environmental impacts on adjacent properties	Yes	N/A	8. Operational Information
2.4	Provision of fencing, site access, vehicle safety barriers, surface water diversionary works, firebreaks and on site restoration as required, shall be carried out to the satisfaction of the Regional Waste Manager.	Yes	N/A	

Authorized Person Initial: MB

Date: March 31/21

CONDITION NUMBER	CONDITION DESCRIPTION	COMPLIANT (Yes/No/ND)	ACTION TAKEN	ANNUAL REPORT SECTION(S)
2.5	In preparation for the placement of putrescible waste, construct a base cell consisting of an approximate 3 metre lift of demolition and construction waste covered with a minimum 0.15 metre layer of suitable cover material. Firebreaks shall be incorporated into each cell in such quantity and manner as to prevent fires from becoming an environmental or safety hazard. Putrescible and household waste shall not be discharged in the base cell. For the purpose of this section, suitable cover consists of soil, utilized in accordance with Section 2.7 or other material as deemed acceptable by the Regional Waste Manager.	Yes	N/A	7. Environmental Protection Programs
2.6	All waste shall be placed in cells of a size acceptable to the Regional Waste Manager. The working face shall be confined to the smallest practical area. Waste shall be discharged in layers of 0.6 metres or less and compacted to the smallest practical volume. Intermediate cover, consisting of a minimum 0.30 metre of suitable cover material shall be applied as the filling proceeds. Side slopes shall be a maximum of 1:3 (vertical: horizontal). During non-discharge hours, the working face shall be covered with a tarp or other measures to the satisfaction of the manager to provide vector and litter control. The working face shall be covered with a minimum of 0.15 metres of suitable cover material once a week. The manager may vary the frequency of covering when freezing conditions adversely affect normal operation.	Yes	N/A	5. Waste Disposal
2.7	Urban park quality soil may be utilized for berm construction, intermediate and final cover, top dressing and landscaping. Soil with any substance with a concentration exceeding the lowest applicable numerical standard for urban park land may only be used for internal berms or intermediate cover. The utilization or discharge of special waste soil is prohibited.	Yes	N/A	5. Waste Disposal
2.8	Submit a closure plan for the area identified as the "100 acre reserve", ..., to the Regional Waste Manager by December 31, 2001 for approval. For the remainder of the landfill, the operational certificate holder shall apply final cover to any area of the landfill, which will not receive any further waste. Final cover shall be applied within one (1) year of completing the subject area. Final cover shall consist of a minimum of 1.0 metre of low permeability (<1 x 10 ⁻⁵ cm/s) compacted soil (or equivalent) cap plus a minimum of 0.15 metre of topsoil and suitable vegetative cover. Final cover shall be sloped to promote surface water runoff. Surface water runoff shall be directed outside of the leachate collection system.	Yes	N/A	2. Design, Operations and Progressive Closure Plan; and 4. Planned Improvements
2.9	Maintain a buffer zone along the north, east and south perimeters of the site, approximately as shown on Site Plan B and as follows: a minimum of 50 metres wide along the west half of the northern boundary and 30 metres wide along the balance of the northern boundary; and a minimum of 50 metres wide along all remaining boundaries. The buffer zone along the southern boundary of the site shall include a minimum fifteen (15) metre wide natural or landscaped screen.	Yes	N/A	Vancouver Landfill Overview

Authorized Person Initial: MB

Date: March 31/21

CONDITION NUMBER	CONDITION DESCRIPTION	COMPLIANT (Yes/No/ND)	ACTION TAKEN	ANNUAL REPORT SECTION(S)
2.10	Post a sign, to the satisfaction of the Regional Waste Manager, at the entrance of the landfill site with the following current information: site name, owner and operator, contact telephone number and address for the owner and operator, telephone number in case of emergency, hours of operation, materials and wastes accepted for recycling and landfilling, prohibited materials and wastes, and tipping fees.	Yes	N/A	
2.11	Take all reasonable measures necessary to prevent fires from occurring at the site. Provide and maintain fire fighting equipment and materials to the satisfaction of the Regional Waste Manager. The operational certificate holder is responsible for complying with all municipal fire safety requirements. In the event of a landfill fire, immediately notify the local fire department, the Provincial Emergency Program and the manager.	Yes	N/A	8. Operational Information
2.12	Take measures to minimize leachate generation, including but not limited to, providing effective covering and surface water runoff. Measures taken, their effectiveness and any proposed measures shall be detailed in the annual report. The leachate collection works shall be maintained in accordance with sound engineering principles as supported by qualified personnel.	Yes	N/A	7. Environmental Protection Programs
2.13	Submit a report to the Regional Waste Manager by April 30, 2001 detailing measures taken to minimize odours and greenhouse gas emissions and their effectiveness. The annual report shall include a description of measures taken and the beneficial results accomplished by these measures, any revisions to the implementation schedule and any new measures planned for the coming year.	Yes	N/A	7. Environmental Protection Programs
2.14	The amount of compostable materials and finished compost accumulated at the facility shall be limited to the maximum which can be properly managed at the site.	Yes	N/A	6. Waste Reduction and Recycling Initiatives
2.15	The amount of recyclable materials and household hazardous waste accumulated at the facility shall be limited to the maximum which can be properly managed at the site	Yes	N/A	6. Waste Reduction and Recycling Initiatives
2.16	Conduct a hydrogeological assessment to determine the following: hydrogeological impact of continuing extraction of sand and water from the dredge pond and its effect on leachate management; the natural attenuation properties of the peat and silt layers in the long term; the effect of additional height of waste on the horizontal hydraulic conductivity of the demolition layer (base cell); and they hydrogeological impact of current operating practices. Take into consideration recommendations of the hydrogeological study completed in September 1995. Review and update the hydrogeological assessment every five years with the first review prior to December 31, 2005. Incorporate actions recommended in this review and subsequent reviews into the revised design and operating plan. Hydrogeological assessments and reviews shall be conducted by a qualified professional licensed to practice in the province of BC.	Yes	N/A	4. Planned Improvements
2.17	Register a covenant or other legal notification not later than 6 months following the subdivision of the property described in Section 1.1.7, that the property was used for the purpose of waste disposal as a charge against the title to the property.	Yes	N/A	

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CONDITION NUMBER	CONDITION DESCRIPTION	COMPLIANT (Yes/No/ND)	ACTION TAKEN	ANNUAL REPORT SECTION(S)
2.18	Operate the authorized facilities in accordance with a design and operating plan certified by a qualified professional. Review the plan on an annual basis. Any revisions to the plan shall be submitted as part of the annual report.	Yes	N/A	2. Design, Operations and Progressive Closure Plan
2.19	Accrue, during the lifetime of the landfill, a dedicated reserve fund sufficient to finance closure, post-closure and environmental contingencies related to the landfill. Include a minimum post closure period of twenty (25) years and how the fund will be accrued in the design and operations plan. Update estimated costs of closure and post-closure activities annually and incorporate into the annual report. Should estimated costs increase, increase the rate of the accrual accordingly.	Yes	N/A	3. Closure and Post Closure Costs
2.20	Submit a closure plan for the sanitary landfill and landfill transfer station facility at least six (6) months prior to the closure of the landfill for approval. Incorporate the required information.	Yes	N/A	
2.21	Submit a site profile to the Regional Waste Manager not less than 10 days prior to decommissioning the authorized facilities.	Yes	N/A	
3.1	Record the quantity, in tonnes, of waste received at the landfill, recycling and composting facilities. Record the quantity and destination of recyclable materials and mature compost removed from these facilities.	Yes	N/A	5. Waste Disposal; and 6. Waste Reduction and Recycling Initiatives
3.2.1	Maintain leachate, surface water and groundwater monitoring stations, approximately located as shown on the attached Site Plan D, and as outlined in Table 1. Obtain grab samples at each station and analyze for each parameter at a frequency as indicated in Table 2. Take care in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.	Yes	N/A	7. Environmental Protection Programs
3.2.2	Provide and maintain a suitable flow measuring device and record the volume of leachate discharge to sanitary sewer each month.	Yes	N/A	7. Environmental Protection Programs
3.2.3	Establish and maintain a minimum of four (4) water level monitoring stations and record once per month the water level elevation in the leachate and drainage ditches at each station.	Yes	N/A	7. Environmental Protection Programs
3.3.1	Sampling and flow measurement shall be carried out in accordance with the procedures described in "British Columbia Field Sampling Manual for Continuous Monitoring plus the Collection of Air, Air-Emission, water, Wastewater, Soil, Sediment and Biological Samples", 1996 Edition, or by suitable alternative.	Yes	N/A	7. Environmental Protection Programs
3.3.2	Analyses are to be carried out in accordance with procedures described in the latest version of "British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials, (March 1994 Permittee Edition)", or by suitable alternative.	Yes	N/A	7. Environmental Protection Programs
3.3.3	All data analysis required to be submitted by the permit shall be conducted by a laboratory acceptable to the Regional Waste Manager. Provide the laboratory quality assurance data, associated field blanks, and duplicate analysis results along with the submission of data required under section 3.2.	Yes	N/A	7. Environmental Protection Programs

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CONDITION NUMBER	CONDITION DESCRIPTION	COMPLIANT (Yes/No/ND)	ACTION TAKEN	ANNUAL REPORT SECTION(S)
3.4	Maintain the following information and records, current and suitably tabulated, at the landfill office for inspection: copy of Operational Certificate MR-01611; training procedures and personnel training records; contingency plans and notification procedures; current design and operating plan; inspection records from staff and regulatory agencies; hydrogeological, geotechnical and landfill gas assessments; incoming waste, and soil records; records of recyclable materials shipped off site; environmental monitoring results and interpretations; and annual operating and monitoring reports for the previous year.	Yes	N/A	
3.5.1	Maintain data of analyses and records of waste and recyclable material quantities for inspection. Submit data of analysis suitably tabulated, to the Regional Waste Manager for the previous three months. The reporting period ends Mar 31, Jun 30, Sept 30 and Dec 31. All reports shall be received by the manager within 31 days of the end of the reporting period.	Yes	N/A	
3.5.2	Prepare an annual report which shall include a compendium of data submitted under Section 3.5.1, in addition to: a review and interpretation of the analytical data from receiving environment monitoring for the preceding year; waste, recyclable material and compost records; leachate flow data and leachate/drainage ditch levels suitably tabulated; an evaluation of leachate generation control measures; an evaluation of the efficiency of the landfill gas generation rate, percent recovery and the actual rates/volumes of gas collection, utilized and flared; revised closure/post closure costs and amount of funds currently available; revised design and operating plan and planned improvements; identification of operating problems and corrective actions taken; an evaluation of the recycling and composting programs including waste diversion projections; and public complaint/resolution log for the landfill. Submit report to the Regional Waste Manager on or before Mar 31 of the following year.	Yes	N/A	

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