Kelvin Grove
Wastewater Treatment Plant
2017 Annual Report

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Public Works Manager

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INTRODUCTION

The Kelvin Grove neighbourhood in the Village of Lions Bay is serviced by a sanitary sewer network that culminates in a wastewater treatment plant located on the waterfront of Howe Sound. A total of 94 residential lots are connected to the Kelvin Grove WWTP through a network of 2,173 meters of 200mm PVC sanitary sewer pipes, manholes, and property connections or service laterals. A map of this sanitary sewer system is shown in Appendix 1.

TREATMENT

The Kelvin Grove WWTP is a package Rotating Biological Contactor (RBC) treatment system constructed in 1981. The RBC is constructed of a series of closely spaced circular bacterial media disks that are mounted to a full length shaft. The shaft rotates on end bearings fastened to concrete supports. The Kelvin Grove WWTP utilizes the L400 ROTORdisks™ system, which has four (4) sets of media disks operating in series.

This treatment system consists of the following processes:

- Primary Sedimentation;
- Biological Treatment;
- Secondary Sedimentation;
- Effluent Flow Measurement;
- Ocean Outfall Effluent Discharge; and
- Off-Site Sludge Disposal.

Wastewater flows by gravity from the collection system directly into a primary sedimentation tank. Settling in the primary sedimentation tank allows the heavy solids to separate out to the bottom of the tank, while the supernatant (separated liquid) enters the secondary (biological) treatment zone.

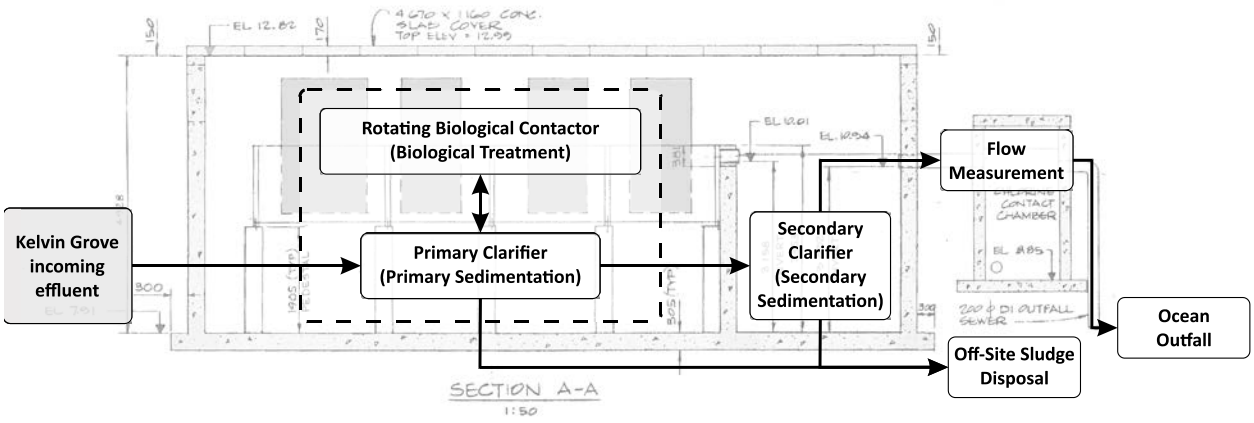
The biological treatment consists of a fixed film process designed to reduce the carbonaceous biological oxygen demand (BOD). The biological growth attaches itself onto the rotating media and forms a film over the entire wetted surface area of these disks. The continuous rotation of the disks allows the biomass to contact the organic material in the wastewater, and then adsorb oxygen as it is exposed to the air. Bacterial decomposition of the organic material in the wastewater creates additional bacterial growth which separates or sloughs off the media discs and settles at the bottom of the primary sedimentation tank.

The biologically treated supernatant then flows into the secondary clarifier where further settlement of suspended solids is facilitated. From there the effluent then flows through a flow measurement system consisting of a weir and level transducer mounted within a chlorine contact chamber. This chamber was installed at the time of construction in preparation for possible

increased treatment requirements. From there the effluent is released into Howe Sound through an ocean outfall pipe. This 150mm series 60 HDPE Sclarepipe extends out 185m into the ocean at to a depth of 72 metres.

Sludge from the primary and secondary clarifiers is removed on an annual basis and disposed of off-site.

The treatment zones of the existing WWTP are shown diagrammatically below:



KELVIN GROVE WWTP OPERATING PERMIT

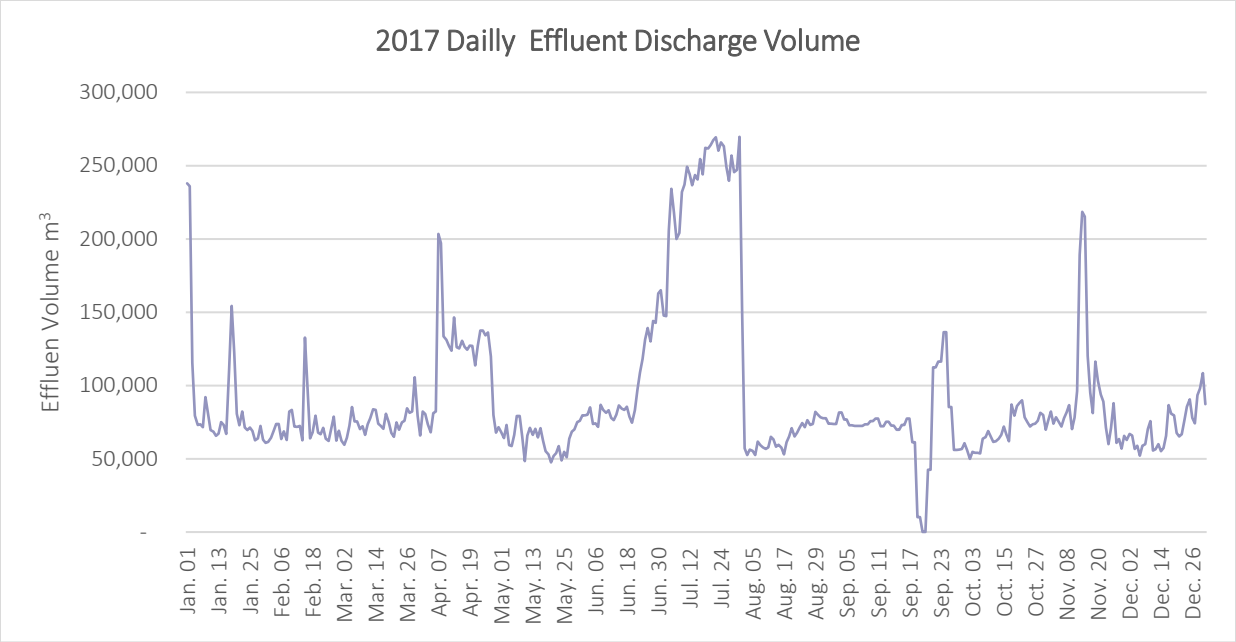
The authority to discharge effluent into the waters of Howe Sound is governed by the provincial *Environmental Management Act*. The Kelvin Grove WWTP operates under permit number 5188 (the "Permit") which regulates the quantity and quality of the plant's discharge. The parameters stipulated in the Permit are as follows:

Parameter	Permit Value
Volume (m^3/day)	340
BOD_5 (mg/L)	45
TSS (mg/L)	60

WATER QUALITY

Reporting requirements consist of quarterly sampling of treated effluent for five-day biochemical oxygen demand and total suspended solids as well as the submission of an annual report to the Ministry of the Environment each January.

The following graph indicates daily effluent discharge volumes for 2017. Detailed daily flow tables are contained in Appendix 2.



The following table indicates quarterly sampling results for five day biological oxygen demand (BOD_5) and total suspended solids (TSS). Complete laboratory analysis records are contained in Appendix 3.

Date	BOD_5 (mg/L)	TSS (mg/L)
17-JAN-17	46.4	70.4
19-APR-17	21.4	21.5
18-JUL-17	11.8	15.5
17-OCT-17	8.9	9.3

As indicated by the table above, the results of the January 17, 2017 grab sample were slightly out of compliance. It is believed that two factors contributed to this result:

1. Rainfall intensity maxima on the date of sampling ranged from 3.0 to 11.8 mm/hour. These high intensity can have a negative effect upon TSS levels,
2. Temperature levels for the beginning of January hovered between plus 4 and minus 6 Celsius which likely reduced biological activity. Cold temperatures result in decreased efficiency of organic removals and lead to higher BOD levels.

MAINTENANCE

In accordance with the Permit, regular inspection and maintenance activities are conducted to keep the facility in good working order. Biweekly inspections are performed to check for vandalism, damage to the media disks, misalignment or excessive shaft deflection, motor torque loading (excessive heat), and for clogging of weirs or orifice areas. At the time of inspection, grease fittings and bearings are lubricated.

Routine inspection and maintenance activities in 2017 identified a cracked shaft coupler between the first and second pair of disks. This deficiency was repaired in early September in conjunction with the annual sludge dewatering operations.

ANNUAL DEWATERING

Annual dewatering or removal of the sludge from the primary and secondary clarifiers is carried out in the fall of each year. This labour and resource intensive process involves the removal of the roof, pressure washing of the interior well, and vacuuming out the sediment accumulations from the bottom of the wastewater well. During this maintenance activity, a detailed inspection of the bearings, shaft, motor and media disc occurs with repairs or maintenance performed as needed.

As identified above, a shaft coupler was replaced during this operation in 2017.

OUTFALL PIPE INSPECTION

Quinquennial inspection of the WWTP effluent outfall pipe is performed by certified divers or remotely operated vehicles. Video footage of the inspection is reviewed and analyzed with remedial measures budgeted and scheduled as required.

The last pipe inspection was conducted in 2013 with no significant deficiencies identified. The next outfall dive is scheduled to take place during the 2018 calendar year.

FACILITY CLASSIFICATION AND OPERATOR CERTIFICATION

The Kelvin Grove WWTP has been evaluated as a Small Wastewater System (Lagoon) by the Environmental Operators Certification Program Society (EOCP). 2017 saw the lead operator for the plant move on to other employment in the lower mainland. Two operators will be completing certification in accordance with the ECOP in 2018 to ensure the plant is appropriately staffed.

APPENDIX 1 – SANITARY SEWER SYSTEM DIAGRAM

Legend

- Manhole
- Treatment Plant
- Gravity Main

Existing Sanitary Sewer System Overview

Project: Infrastructure Master Plan
Client: Village of Lions Bay, BC
Date: January 2016
Created by: SG
Reviewed by: WdS

DISCLAIMER: The Village of Lions Bay does not warrant in any way the accuracy and completeness of the information shown on this map. Field verification of the accuracy and completeness of the information shown on this map is the sole responsibility of the user.

0 30 60 120
Meters

N E S W

Figure 1

APPENDIX 2 – DAILY FLOW MONITORING LOGS

Date	Daily Total	Maximum Day Flow	Minimum Day Flow
Jan. 01	237,930	4.71	0.89
Jan. 02	235,935	4.87	0.82
Jan. 03	115,473	3.45	0.70
Jan. 04	79,446	1.65	0.42
Jan. 05	73,135	1.88	0.26
Jan. 06	73,608	1.44	0.44
Jan. 07	71,471	1.72	0.23
Jan. 08	92,151	1.97	0.27
Jan. 09	80,937	1.52	0.38
Jan. 10	69,534	1.78	0.30
Jan. 11	68,425	1.74	0.32
Jan. 12	65,751	1.72	0.25
Jan. 13	67,133	1.55	0.26
Jan. 14	74,949	1.92	0.32
Jan. 15	73,052	1.93	0.27
Jan. 16	67,060	1.70	0.24
Jan. 17	110,939	2.62	0.33
Jan. 18	154,292	3.10	1.05
Jan. 19	122,321	2.42	0.87
Jan. 20	80,647	1.90	0.53
Jan. 21	72,803	1.92	0.35
Jan. 22	82,311	2.31	0.34
Jan. 23	71,420	1.60	0.32
Jan. 24	69,485	1.63	0.32
Jan. 25	71,233	1.75	0.32
Jan. 26	68,909	1.71	0.32
Jan. 27	62,543	1.73	0.31
Jan. 28	63,927	1.95	0.25
Jan. 29	72,435	1.87	0.26
Jan. 30	63,071	1.36	0.26
Jan. 31	60,756	1.57	0.22
Feb. 01	61,575	1.58	0.23
Feb. 02	64,249	1.49	0.26
Feb. 03	68,863	1.61	0.23
Feb. 04	73,687	1.81	0.32
Feb. 05	73,651	1.71	0.31
Feb. 06	63,438	1.21	0.27
Feb. 07	68,696	1.56	0.31
Feb. 08	62,821	1.73	0.28
Feb. 09	82,298	1.80	0.34

Date	Daily Total	Maximum Day Flow	Minimum Day Flow
Feb. 10	83,283	1.76	0.47
Feb. 11	71,882	2.08	0.34
Feb. 12	71,875	1.85	0.30
Feb. 13	72,367	2.04	0.27
Feb. 14	62,638	1.53	0.22
Feb. 15	132,779	2.89	0.63
Feb. 16	98,464	1.83	0.70
Feb. 17	63,853	1.50	0.32
Feb. 18	67,979	1.71	0.30
Feb. 19	79,340	2.04	0.31
Feb. 20	67,862	1.57	0.33
Feb. 21	66,671	2.01	0.26
Feb. 22	71,117	1.61	0.30
Feb. 23	63,713	1.77	0.25
Feb. 24	62,062	1.56	0.25
Feb. 25	70,535	1.86	0.25
Feb. 26	78,788	3.09	0.24
Feb. 27	62,345	2.01	0.24
Feb. 28	69,064	1.72	0.23
Mar. 01	62,398	1.45	0.23
Mar. 02	59,552	2.02	0.23
Mar. 03	64,356	1.64	0.28
Mar. 04	72,741	1.90	0.33
Mar. 05	85,235	1.92	0.33
Mar. 06	75,435	1.82	0.39
Mar. 07	75,546	1.78	0.39
Mar. 08	70,191	1.61	0.37
Mar. 09	72,191	1.83	0.34
Mar. 10	66,290	1.78	0.32
Mar. 11	73,581	1.38	0.33
Mar. 12	77,664	1.71	0.41
Mar. 13	83,746	1.56	0.56
Mar. 14	83,255	1.62	0.40
Mar. 15	73,866	1.91	0.40
Mar. 16	72,326	1.56	0.40
Mar. 17	70,387	1.51	0.34
Mar. 18	80,660	1.63	0.55
Mar. 19	74,903	1.81	0.34
Mar. 20	67,596	1.58	0.30
Mar. 21	64,959	1.20	0.28
Mar. 22	74,744	1.58	0.34
Mar. 23	69,792	1.47	0.35

Date	Daily Total	Maximum Day Flow	Minimum Day Flow
Mar. 24	74,889	1.52	0.46
Mar. 25	75,927	1.81	0.36
Mar. 26	84,409	1.80	0.33
Mar. 27	81,435	2.03	0.51
Mar. 28	82,150	1.70	0.40
Mar. 29	105,719	1.95	0.66
Mar. 30	79,336	1.66	0.56
Mar. 31	65,901	1.37	0.36
Apr. 01	82,339	1.88	0.45
Apr. 02	80,457	1.84	0.41
Apr. 03	73,439	1.75	0.32
Apr. 04	68,035	1.39	0.28
Apr. 05	81,196	1.70	0.47
Apr. 06	82,354	1.58	0.43
Apr. 07	203,392	6.24	0.52
Apr. 08	197,113	3.73	1.18
Apr. 09	133,668	2.31	0.86
Apr. 10	131,111	2.38	0.77
Apr. 11	127,077	2.44	0.99
Apr. 12	123,788	2.46	0.68
Apr. 13	146,477	2.45	1.00
Apr. 14	126,098	2.40	0.89
Apr. 15	125,170	3.92	0.76
Apr. 16	130,416	2.33	0.80
Apr. 17	126,415	2.46	0.72
Apr. 18	124,351	2.07	0.81
Apr. 19	127,173	2.16	0.77
Apr. 20	127,060	2.36	0.89
Apr. 21	113,777	2.20	0.75
Apr. 22	126,905	2.41	0.77
Apr. 23	137,512	2.56	0.90
Apr. 24	137,534	2.46	1.08
Apr. 25	134,168	2.53	0.96
Apr. 26	136,228	3.02	0.00
Apr. 27	119,906	2.48	0.74
Apr. 28	79,835	2.38	0.38
Apr. 29	67,829	1.81	0.21
Apr. 30	71,571	3.31	0.25
May. 01	68,238	1.57	0.25
May. 02	64,045	1.66	0.25
May. 03	73,142	1.72	0.36
May. 04	59,311	1.53	0.33

Date	Daily Total	Maximum Day Flow	Minimum Day Flow
May. 05	58,774	1.47	0.21
May. 06	66,223	1.35	0.26
May. 07	79,168	2.30	0.25
May. 08	79,235	1.62	0.39
May. 09	65,080	2.72	0.26
May. 10	48,306	1.30	0.13
May. 11	65,856	1.77	0.17
May. 12	71,020	2.02	0.29
May. 13	66,274	1.58	0.26
May. 14	70,461	1.55	0.26
May. 15	64,618	1.60	0.20
May. 16	70,798	2.27	0.29
May. 17	62,423	1.94	0.23
May. 18	55,271	1.53	0.21
May. 19	53,079	1.43	0.20
May. 20	47,605	1.46	0.15
May. 21	51,984	2.33	0.14
May. 22	53,841	1.80	0.16
May. 23	58,568	1.86	0.26
May. 24	48,883	1.70	0.14
May. 25	54,691	1.64	0.13
May. 26	50,961	2.05	0.14
May. 27	63,659	1.86	0.15
May. 28	68,522	1.85	0.17
May. 29	69,970	1.51	0.22
May. 30	75,136	2.14	0.20
May. 31	76,012	3.41	0.32
Jun. 01	79,721	2.14	0.35
Jun. 02	79,539	2.42	0.37
Jun. 03	80,160	2.06	0.38
Jun. 04	85,055	1.92	0.30
Jun. 05	73,699	1.71	0.28
Jun. 06	74,278	2.02	0.24
Jun. 07	71,688	1.67	0.24
Jun. 08	86,752	1.80	0.26
Jun. 09	83,333	2.35	0.44
Jun. 10	81,432	2.22	0.34
Jun. 11	83,097	1.74	0.36
Jun. 12	77,867	1.92	0.34
Jun. 13	76,279	1.73	0.34
Jun. 14	80,022	1.99	0.30
Jun. 15	86,325	2.03	0.35

Date	Daily Total	Maximum Day Flow	Minimum Day Flow
Jun. 16	84,272	1.94	0.37
Jun. 17	83,249	2.02	0.38
Jun. 18	85,533	1.79	0.36
Jun. 19	78,706	1.99	0.35
Jun. 20	74,587	1.93	0.35
Jun. 21	83,198	1.91	0.30
Jun. 22	97,169	2.34	0.37
Jun. 23	108,841	2.39	0.38
Jun. 24	118,109	2.69	0.42
Jun. 25	131,278	2.36	0.47
Jun. 26	139,202	2.30	0.79
Jun. 27	129,966	2.59	0.88
Jun. 28	143,990	2.81	0.90
Jun. 29	142,687	2.72	0.93
Jun. 30	162,716	4.25	1.11
Jul. 01	165,019	3.47	1.28
Jul. 02	147,656	3.32	1.03
Jul. 03	147,251	3.00	0.95
Jul. 04	205,634	3.90	1.03
Jul. 05	234,163	3.74	1.42
Jul. 06	218,297	4.10	0.94
Jul. 07	200,025	3.87	1.10
Jul. 08	204,109	3.78	0.00
Jul. 09	232,119	4.24	0.72
Jul. 10	237,032	4.53	1.32
Jul. 11	249,365	4.25	1.53
Jul. 12	244,210	4.20	1.47
Jul. 13	236,681	4.01	1.54
Jul. 14	243,634	4.18	1.56
Jul. 15	240,539	4.32	1.57
Jul. 16	254,629	4.60	1.49
Jul. 17	244,146	4.35	1.50
Jul. 18	262,229	4.82	1.52
Jul. 19	261,806	4.40	1.51
Jul. 20	264,071	4.35	1.63
Jul. 21	267,436	4.55	1.78
Jul. 22	269,340	4.65	1.47
Jul. 23	260,188	4.33	1.36
Jul. 24	265,925	4.75	1.83
Jul. 25	263,160	4.49	1.38
Jul. 26	249,169	4.52	1.24
Jul. 27	239,781	4.30	1.14

Date	Daily Total	Maximum Day Flow	Minimum Day Flow
Jul. 28	257,010	4.29	1.38
Jul. 29	245,612	4.07	1.32
Jul. 30	247,101	4.49	1.32
Jul. 31	269,683	5.13	1.77
Aug. 01	152,364	4.54	0.29
Aug. 02	57,072	1.43	0.25
Aug. 03	52,542	1.32	0.18
Aug. 04	56,205	1.63	0.17
Aug. 05	55,410	1.19	0.25
Aug. 06	52,561	1.43	0.17
Aug. 07	61,807	1.66	0.19
Aug. 08	59,305	1.57	0.23
Aug. 09	57,895	1.42	0.23
Aug. 10	56,689	1.35	0.19
Aug. 11	57,757	1.30	0.17
Aug. 12	64,915	1.83	0.16
Aug. 13	63,325	1.59	0.25
Aug. 14	58,149	1.53	0.20
Aug. 15	59,638	1.49	0.19
Aug. 16	57,506	1.47	0.18
Aug. 17	53,079	1.31	0.20
Aug. 18	61,348	1.61	0.20
Aug. 19	65,271	1.77	0.19
Aug. 20	70,947	2.05	0.32
Aug. 21	65,243	1.37	0.25
Aug. 22	67,738	1.75	0.31
Aug. 23	71,317	1.81	0.33
Aug. 24	74,308	1.84	0.34
Aug. 25	71,488	1.71	0.32
Aug. 26	76,319	1.41	0.32
Aug. 27	72,982	1.56	0.32
Aug. 28	73,704	1.62	0.32
Aug. 29	81,997	2.01	0.35
Aug. 30	79,974	1.80	0.31
Aug. 31	78,263	1.63	0.36
Sep. 01	77,653	1.46	0.44
Sep. 01	77653.07	1.46	0.44
Sep. 02	73,904	0.00	0.00
Sep. 02	73904.2	0	0
Sep. 03	73,687	1.56	0.35
Sep. 03	73687.21	1.56	0.35
Sep. 04	81,565	1.66	0.39

Date	Daily Total	Maximum Day Flow	Minimum Day Flow
Sep. 04	81565.03	1.66	0.39
Sep. 05	76,704	1.69	0.38
Sep. 05	76703.79	1.69	0.38
Sep. 06	72,882	1.67	0.35
Sep. 06	72881.66	1.67	0.35
Sep. 07	72,373	1.50	0.34
Sep. 07	72372.87	1.5	0.34
Sep. 08	72,353	1.56	0.36
Sep. 08	72353.33	1.56	0.36
Sep. 09	73,624	1.93	0.42
Sep. 09	73623.55	1.93	0.42
Sep. 10	75,644	1.69	0.34
Sep. 10	75644.13	1.69	0.34
Sep. 11	77,545	2.05	0.36
Sep. 11	77544.72	2.05	0.36
Sep. 12	72,241	2.06	0.38
Sep. 12	72240.55	2.06	0.38
Sep. 13	75,238	1.74	0.39
Sep. 13	75238.04	1.74	0.39
Sep. 14	72,720	1.92	0.32
Sep. 14	72720.28	1.92	0.32
Sep. 15	69,786	1.96	0.34
Sep. 15	69786.34	1.96	0.34
Sep. 16	73,181	1.95	0.31
Sep. 16	73180.52	1.95	0.31
Sep. 17	77,517	1.68	0.33
Sep. 17	77517.2	1.68	0.33
Sep. 18	61,309	1.55	0.28
Sep. 18	61308.51	1.55	0.28
Sep. 19	10,108	1.45	0.00
Sep. 19	10108.07	1.45	0
Sep. 20	99	0.48	0.00
Sep. 20	99.27	0.48	0
Sep. 21	42,569	2.15	0.00
Sep. 21	42568.94	2.15	0
Sep. 22	112,404	2.59	0.36
Sep. 22	112403.52	2.59	0.36
Sep. 23	116,396	2.24	0.31
Sep. 23	116395.59	2.24	0.31
Sep. 24	136,416	2.69	0.82
Sep. 24	136416.36	2.69	0.82
Sep. 25	85,225	3.43	0.00

Date	Daily Total	Maximum Day Flow	Minimum Day Flow
Sep. 25	85225	3.43	0
Sep. 26	56140.71	1.33	0.17
Sep. 27	56020.04	1.39	0.22
Sep. 28	56365.81	1.87	0.22
Sep. 29	56600.2	1.4	0.19
Sep. 30	60529.09	1.54	0.21
Oct. 01	56105.67	1.58	0.21
Oct. 02	49934.4	1.79	0.19
Oct. 03	54791.72	1.45	0.18
Oct. 04	54166.23	1.38	0.21
Oct. 05	54022.91	1.36	0.2
Oct. 06	53657.74	1.48	0.19
Oct. 07	63755.18	1.48	0.2
Oct. 08	64672.18	1.7	0.24
Oct. 09	69026.63	1.8	0.23
Oct. 10	65307.19	1.59	0.27
Oct. 11	61570.43	1.49	0.26
Oct. 12	61984.74	1.64	0.28
Oct. 13	63745.83	1.46	0.3
Oct. 14	66221.38	1.65	0.32
Oct. 15	71986.78	1.65	0.3
Oct. 16	66554.03	1.44	0.21
Oct. 17	61840.1	1.44	0.31
Oct. 18	87114.76	1.88	0.2
Oct. 19	79317.96	1.59	0.38
Oct. 20	85862.06	2.41	0.45
Oct. 21	88199.07	1.68	0.35
Oct. 22	89914.25	1.82	0.58
Oct. 23	78226	1.84	0.42
Oct. 24	74868.9	1.58	0.43
Oct. 25	72009	1.49	0.37
Oct. 26	73459.17	1.48	0.4
Oct. 27	73913.5	1.54	0.37
Oct. 28	75974.96	1.5	0.36
Oct. 29	81294.57	1.85	0.34
Oct. 30	79848.89	1.72	0.33
Oct. 31	69902.7	1.48	0.36
Nov. 01	76371.25	1.6	0.38
Nov. 02	82277.75	1.66	0.36
Nov. 03	73848.99	1.52	0.43
Nov. 04	78360.52	1.7	0.41
Nov. 05	75093.87	1.68	0.39

Date	Daily Total	Maximum Day Flow	Minimum Day Flow
Nov. 06	71935.1	1.48	0.34
Nov. 07	77723.88	1.56	0.37
Nov. 08	81505.72	1.93	0.49
Nov. 09	86637.01	1.64	0.47
Nov. 10	70313.16	1.49	0.43
Nov. 11	78112.98	1.6	0.39
Nov. 12	96301.93	1.93	0.65
Nov. 13	189301.81	3.59	0.99
Nov. 14	218450.75	6.31	0.88
Nov. 15	215187.64	6.06	1.28
Nov. 16	120209.97	2.73	0.87
Nov. 17	95175.25	2.12	0.76
Nov. 18	81246.21	1.6	0.5
Nov. 19	116224.68	2.53	0.47
Nov. 20	103310.74	2.05	0.75
Nov. 21	93795.17	2.04	0.53
Nov. 22	89120.13	2.5	0.52
Nov. 23	71264.08	1.64	0.43
Nov. 24	59933.07	1.31	0.3
Nov. 25	71145.38	1.66	0.28
Nov. 26	88017.82	1.74	0.48
Nov. 27	60881.54	1.48	0.29
Nov. 28	63370.91	1.5	0.25
Nov. 29	56816.61	1.4	0.24
Nov. 30	65659.08	1.57	0.27
Dec. 01	62802.1	1.33	0.31
Dec. 02	66980.48	1.72	0.29
Dec. 03	65962.38	1.66	0.27
Dec. 04	56768.66	1.34	0.27
Dec. 05	58853.69	1.29	0.2
Dec. 06	52173.37	1.31	0.19
Dec. 07	58939.08	1.5	0.24
Dec. 08	59986.51	1.6	0.22
Dec. 09	70337.66	1.61	0.37
Dec. 10	75656.94	2.05	0.33
Dec. 11	55683.38	1.44	0.23
Dec. 12	56379.71	1.5	0.2
Dec. 13	59959.52	1.64	0.2
Dec. 14	55157.88	1.33	0.19
Dec. 15	57393.22	1.25	0.21
Dec. 16	65630.57	1.81	0.23
Dec. 17	86719.76	1.76	0.31

Date	Daily Total	Maximum Day Flow	Minimum Day Flow
Dec. 18	80769.03	1.63	0.51
Dec. 19	79530.24	4.23	0.34
Dec. 20	67582.26	1.46	0.41
Dec. 21	65259.84	1.59	0.31
Dec. 22	66675.49	1.52	0.31
Dec. 23	75824.36	1.84	0.33
Dec. 24	85542.13	2.24	0.32
Dec. 25	90462.75	2.68	0.34
Dec. 26	77949.88	2.09	0.32
Dec. 27	74129.91	1.85	0.36
Dec. 28	93393.71	2.27	0.38
Dec. 29	98068.86	2.1	0.46
Dec. 30	108554.18	2.2	0.73
Dec. 31	87181.04	2.1	0.38

APPENDIX 3 – LABORATORY ANALYSIS RECORDS

VILLAGE OF LIONS BAY
ATTN: Naizam Jaffer
PO Box 141, 400 Center Road
Lions Bay BC V0N 2E0

Date Received: 17-JAN-17
Report Date: 27-JAN-17 12:48 (MT)
Version: FINAL

Client Phone: 604-921-9833

Certificate of Analysis

Lab Work Order #: L1880247
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Elwin Ko
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1880247-1				
	Description	Other				
	Sampled Date	17-JAN-17				
	Sampled Time	11:50				
	Client ID	SEWER TREATMENT PLANT				
Grouping	**Analyte**					
WATER						
Physical Tests	Total Suspended Solids (mg/L)	70.4				
Aggregate Organics	BOD (mg/L)	46.4				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- "BIOCHEMICAL OXYGEN DEMAND"

This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND

This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
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ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # _____

Report To				Report Format / Distribution				Service Requested (Rush for routine analysis subject to availability)
Company:	Village of Lions Bay			☐ Standard	☐ Other			◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Naizam Jaffer			☑ PDF	☐ Excel	☐ Digital	☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	400 Centre Rd			Email 1:	aurrutia@lionsbay.ca			○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Lions Bay, BC V0N 2E0			Email 2:	works@lionsbay.ca			○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604 921 9833	Fax:		Email 3:				
Invoice To	Same as Report ?	☑ Yes	☐ No	**Client / Project Information**				**Analysis Request**
Hardcopy of Invoice with Report?		☐ Yes	☐ No	Job #:				Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:				PO / AFE:				
Contact:				LSD:				
Address:								
Phone:		Fax:		Quote #:				
Lab Work Order # (lab use only)				**ALS Contact:**	Shane Ramos	**Sampler:**	Alberto Urrutia	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	BOD	Number of Containers
[redacted]	Sewer Treatment Plant	17-01-17	11:50	Other	X	X	1

Short Holding Time

Rush Processing

L1880247-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
			laly	Jan 17	1pm	-5 °C				

VILLAGE OF LIONS BAY
ATTN: Naizam Jaffer
PO Box 141, 400 Center Road
Lions Bay BC V0N 2E0

Date Received: 19-APR-17
Report Date: 01-MAY-17 14:13 (MT)
Version: FINAL

Client Phone: 604-921-9833

Certificate of Analysis

Lab Work Order #: L1914795

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Elwin Ko
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1914795-1				
	Description	Other				
	Sampled Date	19-APR-17				
	Sampled Time	12:20				
	Client ID	SEWER TREATMENT PLANT				
Grouping	**Analyte**					
WATER						
Physical Tests	Total Suspended Solids (mg/L)	21.5				
Aggregate Organics	BOD (mg/L)	21.4				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND

This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

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Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

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ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # _____

Report To		Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company:	Village of Lions Bay	☐ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Naizam Jaffer	☑ PDF ☐ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	400 Centre Rd	Email 1: aurrutia@lionsbay.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Lions Bay, BC V0N 2E0	Email 2: works@lionsbay.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604 921 9833 Fax:	Email 3:	
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information	Analysis Request
Hardcopy of Invoice with Report?	☐ Yes ☐ No	Job #:	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #:	
Lab Work Order # (lab use only)		ALS Contact: Elwin Ko	Sampler: Alberto Urrutia

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	BOD	Number of Containers
[redacted]	Sewer Treatment Plant	19-04-17	12:20	Other	X	X	1
[redacted]							
[redacted]							
[redacted]							
[redacted]							
[redacted]							
[redacted]							
[redacted]							
[redacted]							
[redacted]							
[redacted]							

L1914795-COFC

Short Holding Time

Rush Processing

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

[redacted] SHIPMENT RELEASE (client use) [redacted]			[redacted] SHIPMENT RECEPTION (lab use only) [redacted]				[redacted] SHIPMENT VERIFICATION (lab use only) [redacted]			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by: JC	Date: APR 19 2017	Time: 13:00	Temperature: 9 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

VILLAGE OF LIONS BAY
ATTN: Naizam Jaffer
PO Box 141, 400 Center Road
Lions Bay BC V0N 2E0

Date Received: 18-JUL-17
Report Date: 28-JUL-17 13:29 (MT)
Version: FINAL

Client Phone: 604-921-9833

Certificate of Analysis

Lab Work Order #: L1960356
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Elwin Ko
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1960356-1				
	Description	Other				
	Sampled Date	18-JUL-17				
	Sampled Time	11:50				
	Client ID	SEWER WATER TREATMENT				
Grouping	**Analyte**					
WATER						
Physical Tests	Total Suspended Solids (mg/L)	15.5				
Aggregate Organics	BOD (mg/L)	11.8				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND

This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
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Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

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COC # _____

Page 1 of 1

Report To				Report Format / Distribution				Service Requested (Rush for routine analysis subject to availability)
Company:	Village of Lions Bay			☐ Standard ☐ Other				◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Naizam Jaffer			☑ PDF ☐ Excel ☐ Digital ☐ Fax				○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	400 Centre Rd			Email 1: aurrutia@lionsbay.ca				○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Lions Bay, BC V0N 2E0			Email 2: works@lionsbay.ca				○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604 921 9833	Fax:		Email 3:				
Invoice To	Same as Report ?	☑ Yes	☐ No	**Client / Project Information**				**Analysis Request**
Hardcopy of Invoice with Report?		☐ Yes	☐ No	Job #:				Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:				PO / AFE:				
Contact:				LSD:				
Address:								
Phone:		Fax:		Quote #:				
Lab Work Order # (lab use only)				**ALS Contact:** Elwin Ko		**Sampler:** Alberto Urrutia		

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	BOD										Number of Containers
	Sewer Treatment Plant	18-07-17	11:50	Other	X	X										1

L1960356-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
			PAUL	JULY 18	12:42	16.4 °C				

VILLAGE OF LIONS BAY
ATTN: Naizam Jaffer
PO Box 141, 400 Center Road
Lions Bay BC V0N 2E0

Date Received: 17-OCT-17
Report Date: 27-OCT-17 10:21 (MT)
Version: FINAL

Client Phone: 604-921-9833

Certificate of Analysis

Lab Work Order #: L2008296

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Carla Fuginski
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2008296-1				
	Description	Other				
	Sampled Date	17-OCT-17				
	Sampled Time	11:50				
	Client ID	SEWER TREATMENT PLANT				
Grouping	**Analyte**					
WATER						
Physical Tests	Total Suspended Solids (mg/L)	9.3				
Aggregate Organics	BOD (mg/L)	8.9				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Laboratory Control Sample	BOD	G	L2008296-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
G	QC result did not meet ALS DQO. Refer to narrative comments for further information.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND

This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

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The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

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UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
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ALS Environment

Chain of Custody / Analytical Request Form

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Page 1 of 1

Report To				Report Format / Distribution				Service Requested (Rush for routine analysis subject to availability)
Company:	Village of Lions Bay			☐ Standard	☐ Other			◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Naizam Jaffer			☑ PDF	☐ Excel	☐ Digital	☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	400 Centre Rd			Email 1:	aurrutia@lionsbay.ca			○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Lions Bay, BC V0N 2E0			Email 2:	works@lionsbay.ca			○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604 921 9833	Fax:		Email 3:				
Invoice To	Same as Report ?	☑ Yes	☐ No	Client / Project Information				
Hardcopy of Invoice with Report?		☐ Yes	☐ No	Job #:				
Company:				PO / AFE:				
Contact:				LSD:				
Address:								
Phone:		Fax:		Quote #:				
Lab Work Order # (lab use only)				ALS Contact:	Carla Fuginski	Sampler:	Alberto Urrutia	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	BOD	Number of Containers
	Sewer Treatment Plant	17-10-17	11:50	Other	X	X	1

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

L2008296-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

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SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by: JC	Date: OCT 17 2017	Time: 12:31 pm	Temperature: 12 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

GENF 18.01 Front