

## Appendix A



## Submission Checklist for the Hydrogeological Study

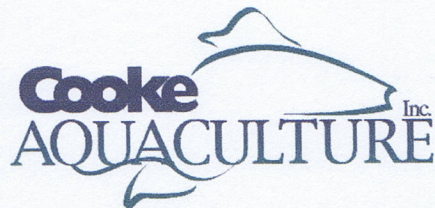
Hydrogeological Study – General Requirements		Included in Report? (√ = yes)	Page Number
Site Description	Site Description	✓	4
	Wellfield Description	✓	4
	Description of Intended Water Use	✓	5
	Groundwater Withdrawal Details	✓	5
	Description of Existing and Previous Water Withdrawal Approvals	✓	5
Description of Hydrogeology	Regional and Local Geology	✓	6
	Regional and Local Hydrogeology	✓	6
	Surface Water Features	✓	7
Pumping Test Information	Pumping Test Description and Analysis	✓	9
	Water Quality Analysis	✓	11-15
Evaluation of Potential Impacts	Design Safe Yield	✓	16
	Well Interference Effects	✓	11-15
	Water Quality Effects	✓	11-15
	Groundwater Under Direct Influence (GUDI)	✓	16
	Salt Water Intrusion	✓	16
	Open Loop Earth Energy System Information	N/A	—
Supporting Figures and Data	Site Location Map and Site Plan	✓	L-1, L-4
	Well Logs	✓	Excel
	Pumping Test Data and Graphs	✓	Appendix C
	Laboratory Reports	✓	Appendix E
Notes on General Requirements:			
Water Supply Source Assessments and EIA Registrations are required for groundwater wells with a capacity for water withdrawals greater than 50,000 L/day (50 m <sup>3</sup> /day).			
Hydrogeological studies must be signed and professionally sealed by a qualified Engineer or Geoscientist registered with the Association of Professional Engineers and Geoscientists of New Brunswick.			
Reports and data must be submitted in hard copy and electronic copy.			
A constant rate pumping test and analysis is required for each pumping well included in the EIA Registration.			
Production well(s) must be pump tested at a rate greater than or equal to the requested withdrawal rate.			
Well interference effects should be evaluated for wells within a minimum radius of 500 m.			
Salt water intrusion effects should be evaluated if the production well is within 500 m of a salt water body.			
Potential for groundwater under the direct influence of surface water (GUDI) should be evaluated for each proposed production well.			
Any work that is to be completed within 30 m of a watercourse or regulated wetland first requires a Watercourse and Wetland Alteration (WAWA) Permit.			



**PROJECT: C16.05a**  
**Water Supply Source Assessment**

**VERSION: 1**

**ASSESSMENT OF ON-SITE WATER SUPPLY**



**PREPARED FOR:**

**KELLY COVE SALMON  
OAK BAY HATCHERY  
93 OAK HAVEN ROAD  
OAK BAY, NB**

**PREPARED BY:**

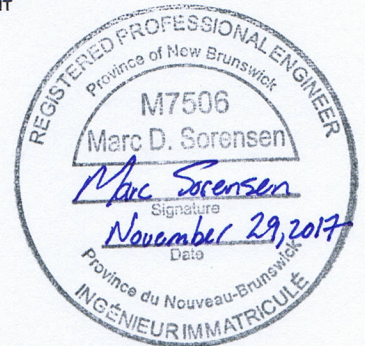


**sorensen**

**ENGINEERING LTD.  
RECIRCULATING AQUACULTURE  
WATER TREATMENT**

**134 CARLETON STREET  
SAINT ANDREWS  
NEW BRUNSWICK, CANADA  
E5B 1N9**

**11/29/2017**



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## 1. Project Description

Sorensen Engineering Ltd. was contracted by Kelly Cove Salmon, a division of Cooke Aquaculture, to conduct a Water Supply Source Assessment (WSSA) on the existing production and back-up wells for Oak Bay Hatchery located in Oak Bay, NB. As part of the Environmental Impact Assessment in progress for Oak Bay Hatchery, the WSSA will be used to determine sustainable groundwater withdrawals from the existing wells on site and to obtain the necessary approval from NB Department of Environment and Local Government to continue withdrawing groundwater at the site.

The contact information for the proponent and project consultants are summarized in table 1.

*Table 1: Contact Information*

<b><u>Proponent</u></b> <b>Name of Proponent:</b> <b>Postal Address:</b>  <b>Telephone:</b>	<b>Kelly Cove Salmon, a Div. of Cooke Aquaculture</b> <b>669 Main Street</b> <b>Blacks Harbour, NB</b> <b>E5H 1K1</b> <b>(506) 466-6634</b>
<b><u>Proponent Contact</u></b> <b>Name:</b> <b>Official Title:</b> <b>Address:</b> <b>Phone:</b> <b>E-Mail:</b> <b>Website:</b>	<b>Mitchell Dickie</b> <b>Project Manager for Freshwater Systems</b> <b>As Above</b> <b>(506) 755-5282</b> <b>mitchell.dickie@cookeaqua.com</b> <b>cookeaqua.com</b>
<b><u>Engineer Contact</u></b> <b>Name:</b> <b>Official Title:</b> <b>Address:</b>  <b>Phone:</b> <b>E-Mail:</b> <b>Website:</b>	<b>Marc Sorensen, P. Eng.</b> <b>President</b> <b>134 Carleton St.</b> <b>St. Andrews, NB</b> <b>E5B 1N9</b> <b>(506) 529-0093</b> <b>marc@soreng.ca</b> <b>soreng.ca</b>
<b><u>Hydrogeologist Contact</u></b> <b>Name:</b> <b>Official Title:</b> <b>Address:</b>  <b>Phone:</b> <b>E-Mail:</b> <b>Website:</b>	<b>Doug Craig, P. Geo.</b> <b>President</b> <b>140 Meadow Cove Road</b> <b>Dipper Harbour, NB</b> <b>E5J 2S9</b> <b>(506) 659-3064</b> <b>dcraig@craighydrogeologic.ca</b> <b>craighydrogeologic.ca</b>

## 2. Existing Site Conditions

### 2.1. Site Description

The site is located in Oak Bay, New Brunswick on three PID numbers: #01265925, 01270503, and 15155419, owned by Kelly Cove Salmon (KCS). The site is centered at GPS coordinates 45.213719, -67.197776 and covers approximately 4 acres. Bordering Oak Bay, this site is primarily used for the production of Atlantic Salmon broodstock of the Saint John river strain and has been operated by KCS since 1989.

Existing infrastructure on the property includes 7 fish rearing sections in 3 greenhouses and two buildings along with a “tech room” which stores the generator, intake water treatment, and electrical systems. A wastewater treatment system located on the east, bay-side of the property, treats all water discharged from the facility. There are waste-solids storage containers below ground near the wastewater treatment system, diesel storage near the tech room, and an on-site septic system. A site plan with labelled infrastructure on the property is attached in Appendix A.

A small stream, known as Hitchins Creek, runs through the property. The flow in the creek is frequently low, in the mid to late summer and throughout the winter the creek is dry.

Attached in appendix A, a 1:10 000 scale map of the site and surrounding area shows the location of existing and potentially existing wells within a 500 m radius. Table 2 summarizes the location details.

*Table 2: Property Location Information*

<b>Site Name</b>	<b>Oak Bay Salmon Hatchery</b>
<b>Civic Address</b>	<b>93 Oak Haven Road</b>
<b>PID(S)</b>	<b>01265925, 01270503, 15155419</b>
<b>Community</b>	<b>Oak Haven, NB</b>
<b>1:50,000 Topographic Map #</b>	<b>21G Edition 3 UTM Zone 19</b>
<b>Grid Reference</b>	<b>45°12'49.30"N, 67°11'51.43"W 5008269.75m N, 641525.99m E (Zone 19T)</b>

### 2.2. Wellfield Description

Three wells are in continuous operation on site: Wells #1, 2, and 8 (as depicted on drawing L-1 in appendix A). Wells #3, #6, and #7 serve as back-up wells but are not normally in operation. Originally well #4 was planned to be used as a back-up well, but inconsistency in flow and the potential for manganese and iron render it unsuitable for use in the facility and so it will be decommissioned following this WSSA.

[REDACTED]

[REDACTED]


[REDACTED]





Other existing wells (#5, 9, 10, 11, 12, and 13) were unused and have been decommissioned with the exception of well #13 which was used as an observation well for hydrogeological assessment. Well #13 and #4 will be decommissioned following the submission of this WSSA. All decommissioning will be done in accordance with DELG protocol outlined in “Guidelines for decommissioning (abandonment) of Water Wells” included in appendix B.

A spring is also used for water supply to the facility (shown on drawing L-1 in appendix A). The spring water is captured through infiltration galleries which extend to a depth of approximately 2.4 m (approx. 6 m elevation as shown in drawing L-5). The infiltration galleries are plumbed to a collection basin which flows by gravity to the spring water building through two 6” pipes. This water is UV irradiated prior to use in the farm to mitigate the potential risk of disease.

A cross-section diagram of the production wells, back-up wells,  is shown in appendix A.

### 2.3. Current and Intended Water Use

The wells are currently being used to supply water for the operation of the salmon hatchery and broodstock units on site as well as a comparably low volume to supply two neighbours with well water for non-potable use. Existing drilled well water withdrawal peaked at 99 m<sup>3</sup>/h based on available data between May 3 and October 21, 2016. To the current date, the peak drilled well water withdrawal in 2017 has been 93 m<sup>3</sup>/h. The water withdrawal from drilled wells stated in the hatchery’s Approval to Operate (I-9758, I-9633 in appendix B) is 909 LPM (54.5 m<sup>3</sup>/h). The purpose of this WSSA is to establish sustainable groundwater withdrawal from the existing drilled wells on site.

### 2.4. Description of Proposed Groundwater Withdrawal

Based on the long-term pump tests completed on well #1, #2, #3, #6, and #8, the following proposed withdrawal rates were determined.

*Table 3: Proposed Groundwater Withdrawal*

Well	Maximum Q (Pumping test) m <sup>3</sup> /h	Proposed Withdrawal Rate (m <sup>3</sup> /h)	Proposed Withdrawal Volume (m <sup>3</sup> /day)
#1	18.6	18.6	446
#2	34.0	34.0	816
#3*	11.4	11.4	274
#6*	7.4	7.4	178
#8/#7	43.8	43.8	1051
<i>Total Wellfield</i>	<i>96.4</i>	<i>96.4</i>	<i>2591</i>

\*Back-up wells not included in total wellfield maximum flow rate as they will be used intermittently in the event of a production well (#1, 2, or 8) interruption or failure.

### 3. Description of Hydrogeology

#### 3.1. Regional and Local Geology

The NB Environment and Local Government Well Log Database was searched for a 1600-meter radius around PID 01265925 (one of three PIDs that make up the site) which yielded a total of nine well logs. Copies of the nine well logs and a summary table are provided in Appendix B. Extracted information about geology and hydrogeology is shown in Table 4.

The Oak Bay Hatchery Site is located on a gravel deposit that extends beyond the site boundaries. The NB Department of Energy and Resource Development map, Granular Aggregate Resources of St. Stephen 21 G/3 (Plate 82-162), shows a deposit which extends approximately 1700-meters North to South and approximately 1600 meters West to East, with an estimated surface area of 1,665,000 m<sup>2</sup> (167 Hectares). There are three grading diagrams associated with this specific deposit, which show sand and gravel deposits of 6.0, 7.0 and 20.0 meters thickness. The well log data shown in Table 4 indicates overburden thicknesses of from 0.9 meters (3 feet) to 17.7 meters (58 feet) in the local area.

The bedrock beneath the site is mapped as Cambrian to Ordovician age grey/black shale and siltstone of the Calais Formation. There is a fault running roughly north westerly located approximately beneath the highway at the western boundary of the site. West of this fault is Cambrian to Ordovician age wacke (hard fine sandstone) and shale of the Woodland Formation.

#### 3.2 Regional and Local Hydrogeology

The gravel surface aquifer is the groundwater source for the Oak Bay Hatchery. As mentioned above, the NB Environment and Local Government Well Log Database was searched for a 1600-meter radius around PID 01265925 which yielded a total of nine well logs. Copies of the nine well logs and a summary table are provided in Appendix B. One of the well logs represented a gravel aquifer well and eight of the well logs represented bedrock aquifer wells. Extracted information about geology and hydrogeology from the eight bedrock aquifer wells is shown in Table 4.

*Table 4: Summary of bedrock aquifer well hydrogeologic information derived from 1600-meter radius around PID 01265925 search of NBDELG well log database*

Well Depth (feet)	Estimated Yield (igpm)	Depth to Bedrock (feet)	Casing Length (feet)
Average: 225	Average: 18.9	Average: 24.5	Average: 31.0
Median: 250	Median: 1.75	Median: 15.5	Median: 20
Minimum: 125	Minimum: 0.85	Minimum: 3	Minimum: 20
Maximum: 450	Maximum: 130	Maximum: 58	Maximum: 65

The single gravel aquifer well in the data set was 42 feet in depth with an estimated yield of 220 igpm. The well has no screen and the yield is a result of water flowing from the gravel aquifer into the open



bottom of the well. This is probably a private well. More private wells in the general area may utilize the gravel aquifer; however, many of the surrounding residences are of an age that precedes the establishment of the well log database and their well logs are not available.

All the well logs summarized in Table 4 above are developed in the bedrock aquifer. The average estimated yield, 18.9 igpm (5.2 m<sup>3</sup>/h) and the maximum observed yield, 130 igpm (35.5 m<sup>3</sup>/h) suggest that adequate ground water resources may be present in the bedrock aquifer in the area. It is equally obvious from the data that the gravel aquifer exceeds the resource yields of the bedrock aquifer by a significant margin.

**NB Environment Well Water Chemistry Database:** A 1600-meter radius location search around PID 01265925 of the NBDELG well chemistry database provided results from a total of eight wells located in the area for which groundwater chemistry data was available. The precise locations of the wells from which the ground water chemistry data was obtained are not available due to right to privacy considerations of the property owners. The analytical results for the samples are provided in Table 5 which follows. In Table 5 any result that exceeds the Canadian Drinking Water Quality Guidelines (CDWQG) is bolded and colour shaded for ease of recognition. The groundwater chemistry data in Table 2 was collected and analyzed using the water analysis certificate provided to the homeowner by the well driller when the well is new. The water samples are usually collected by the homeowner shortly thereafter to provide confidence that they can use the water. Because of the well just being drilled, the well from which the water sample was collected typically has not had enough time or use for the water to clear sufficiently prior to the water sample being collected. The result of this is that the chemistry data in Table 2 may overestimate the long-term turbidity and some trace metal concentrations as most wells will clear naturally with use and time. Although the groundwater chemistry data provided in Table 5 if of general interest is assessing the area hydrogeology, the actual site data represents actual conditions at the hatchery.

### *3.3 Surface Water Features*

Hitchin's Creek, flowing adjacent the hatchery is hydraulically linked to the gravel aquifer and supplies fresh water recharge water. The creek is dry during part of the year. The hatchery site is adjacent to Oak Bay and on site groundwater levels are impacted by tidal fluctuations in the bay.

Table 5: NBDOE Groundwater Chemistry Database

Parameter	ALK_T mg/L	Al mg/L	As µg/L	B mg/L	Ba mg/L	Br mg/L	COND µSIE/cm	Ca mg/L	Cd µg/L	Cl mg/L	Cr µg/L	Cu µg/L	E_coli P/A P/A	F mg/L	Fe mg/L	HARD mg/L	K mg/L
	115	0.025	1.5	0.018	0.016	0.1	286	27	0.5	7.99	24	10	Ab	0.195	1.34	85.7	1
	110	0.025	1.5	0.024	0.015	0.1	255	3.32	0.5	5.27	10	10	Ab	0.49	0.105	10.5	0.4
	159	0.23	2.4	0.032	0.01	0.1	389	2.28	0.5	16	10	10	Ab	1.07	1.19	6.95	0.4
	90.5	0.15	1.5	0.014	0.019	0.1	237	8.24	0.5	4.09	10	10	Ab	1.77	0.933	23.4	0.4
	101	0.025	54	0.011	0.01	0.1	280	43.4	0.5	7.76	10	10	Ab	0.1	0.039	129	0.3
	108	0.025	1	0.2	0.052	0.1	448	34.1	0.5	67.8	10	10	Ab	0.239	0.394	108.2	2.53
	104	0.025	1	0.2	0.012	0.1	248	15.5	0.5	2.87	10	10	Ab	1.94	1.03	43.6	0.319
	94.4	0.025	2.59	0.01	0.01	0.1	239	27	0.5	3.58	13	10	Ab	0.232	6.27	77.4	0.272
<b>Mean</b>	<b>110.2</b>	<b>0.066</b>	<b>8.2</b>	<b>0.064</b>	<b>0.018</b>	<b>0.1</b>	<b>298</b>	<b>20.1</b>	<b>0.5</b>	<b>14.4</b>	<b>12</b>	<b>10</b>		<b>0.75</b>	<b>1.413</b>	<b>60.6</b>	<b>0.70</b>
<b>CDWQG</b>			<10	<5.0	<1.0				<5.0	<250	<50	<1000		<1.5	<0.3		

Parameter	Mg mg/L	Mn mg/L	NO <sub>2</sub> mg/L	NO <sub>3</sub> mg/L	NO <sub>x</sub> mg/L	Na mg/L	pH	Pb µg/L	SO <sub>4</sub> mg/L	Sb µg/L	Se µg/L	TC-P/A P/A	TURB NTU	TI µg/L	U µg/L	Zn µg/L	TDS mg/L
	4.42	0.11	0.05	0.05	0.05	30.1	7.98	1	19.1	1	1.5	Pr	8	1	0.5	12	161
	0.54	0.033	0.05	0.05	0.05	55.8	8.32	1	13.2	1	1.5	Ab	0.45	1	0.7	5	146
	0.3	0.023	0.05	0.05	0.05	87.8	8.87	3.1	14.8	1	1.5	Ab	35	1	1.4	10	220
	0.68	0.023	0.05	0.05	0.05	45.1	8.19	2.5	14.4	1	1.5	Pr	8.2	1	0.7	5	130
	5	0.032	0.05	0.05	0.05	8.27	8.11	1	20.4	1	1.5	Pr	0.78	1	3.4	5	146
	5.6	0.067	0.05	0	0.05	43.3	8.21	1	12.8	1	5	Ab	2.6	1		54	
	1.2	0.104	0.05	0	0.05	38.7	7.87	1	15.1	1	1	Ab	7.7	1		10	
	2.43	0.222	0.05	0.05	0.05	18.9	7.49	1	15	1	1.5	Pr	35.1	1	0.832	8	131
<b>Mean</b>	<b>2.52</b>	<b>0.077</b>	<b>0.05</b>	<b>0.04</b>	<b>0.05</b>	<b>41.00</b>	<b>8.13</b>	<b>1.5</b>	<b>15.60</b>	<b>1</b>	<b>1.9</b>		<b>12.2</b>	<b>1</b>	<b>1.3</b>	<b>14</b>	<b>156</b>
<b>CDWQG</b>		<0.05	<10	<10	<10	<200	6.5-8.5	<10	<500				<1.0		<20	<5000	<500

\*CDWQG = Canadian Drinking Quality Guideline



#### 4. Pumping Test Information

##### 4.1. Pumping Test Description

All wells that are part of this study are existing, information can be found in table 6 regarding the date of drilling if known and the pump depth in each well. Prior to testing, each production and back-up well was flushed by E.R. Steeves. The only available well log (for well #8) is included in appendix B.

*Table 6: Well Information*

Well #	Well Tag ID	Date Drilled	Well Depth (m)	Depth to Screen (m)	Pump Depth (m)	Pump Size
1	0054177	-	11.58	8.53	8.02	5 HP
2	0054178	-	13.16	10.18	10.51	5 HP
3	0054179	-	13.94	10.77	8.53	3 HP
6	0054181	-	12.09	8.99	9.14	2 HP
7	0054180	-	13.41	No Screen	9.14	2 HP
8	0027924	09/15/2004	12.85	8.79	10.06	10 HP
13	0017975	-	10.59	-	N/A	N/A
Neighbour's Well	-	-	9.45	Unknown	N/A	N/A

As production on site is continuous, the hydrogeological study was conducted with the knowledge that on-site fish health and wellness was paramount. This meant that wells 1, 2, and 8 (the main production wells) were pumping throughout the testing with the exception of individual recovery tests which were limited to 1-2 hours, during which hatchery personnel monitored the production systems closely while the production well was off.

*Table 7: Pump Test Summary*

Well #	Observation Wells	Pump Size	Pump Depth (m)	Flow Control	Water Level Measuring Device	Test Conducted	Date Tested
1	2, 6, 8	5 HP	8.02	VFD	Solinst Levellogger	Step Test, Constant Rate	Sept 1, 3-7, 2017
2	1, 6, 8	5 HP	10.51	VFD	Solinst Levellogger	Step Test, Constant Rate	Sept 1, 3-7, 2017
3	2, 6, 8	3 HP	8.53	VFD	Solinst Levellogger	Step Test, Constant Rate	Sept 19-25, 2017
6	1, 2, 8	2 HP	9.14	VFD	Solinst Levellogger	Step Test, Constant Rate	Sept 3-7, 2017
8	2, 6, 13	10 HP	10.06	VFD	Solinst Levellogger	Step Test, Constant Rate	Sept 25-27 & Oct 2-6, 2017
Neighbour	-	½ HP	8.43	Valve	INW Level/Cond. Probe	Short Term (2-hour)	October 13, 2017

\*Solinst Levelloggers measured water level and temperature in the well, INW Probe measured water level, temperature, and conductivity and calculates TDS and salinity.

Wells #1 and #2 are located 25.9 m apart and well #3 is located 65.5 m from well #2 as shown in L-2. All three wells are piped together before a flowmeter and are always be operated simultaneously in pairs or all three together. These wells were considered as one unit supplying well water to Lines A, B, C, D, and G lines. Step testing was conducted on each, and two constant pumping rate tests were conducted, first on wells 1 and 2 and second on wells 2 and 3. Plotting the results of the step tests (see appendix C), a trendline may be drawn and used to back-calculate well flow rate from observed drawdown. This method was used to determine individual well flow rates when two wells were pumping water through the same flowmeter.

The period of March to September 2017 had the lowest rainfall amounts in at least 10 years, particularly July-September which averaged 70 mm lower per month than the 10-year averages (see appendix D).

Hourly barometric pressures from the Government of Canada website for St. Stephen (located approximately 6.5 km from the project site) was used to factor in barometric pressure interferences with well water level readings.

Water levels and temperature were recorded throughout the duration of the pump tests. Water samples taken 24, 48, and 72 hours into the constant rate pump tests were sent to RPC (Fredericton) for potable water analysis including trace metals and E. Coli and Coliform detection.

#### *4.2. Determination of Static Level*

Static (rest) level of the back-up wells #3 and #6 were measured prior to pumping as they had not been used for over a month. The static levels of the production wells #1 and #2 were established during the step test when they recovered for 130 minutes and 326 minutes respectively.

Well #8 was not able to recover completely after three hours of no pumping. The pump was not able to be left off any longer so as not to jeopardize fish health. To estimate the static level for the sake of calculating safe pumping rates and drawdown, the median of the static water levels of wells #1, #2, #3, and #6 was used. This median of 3.45 m elevation matches with the original static water level in the well when it was drilled in 2004 (3.62 m elevation).

Some combination of wells are always being pumped at the site, and this condition existed during the period of the pump test. This condition is necessary to protect the health of the broodstock and is unavoidable except for the short time periods described above. The gravel aquifer has a high transmissivity, as shown by the long-term yields at this site. In such an aquifer drawdowns from operating wells will impact water levels in non-pumping wells. As a result, the measured static levels are subject to some uncertainty and potential error. Given the operational requirements at this site there is no practical way around this problem.

### 4.3. Well Analysis and Safe Yield

Table 8 summarizes the results of the constant rate pump tests.

*Table 8: Pump Test Analysis Results*

Well	Total Depth (m)	Pump (m)	Test Duration	AVDD (m)	Drawdown Achieved (m)	Rate Pumped (m <sup>3</sup> /h)	Transmissivity (m <sup>2</sup> /day)
#1	11.58	8.02	94 hr	2.29 m	1.8 m	18.6	320-388
#2	13.16	10.51	94 hr	5.06 m	2.0 m	34	568-671
#3	13.94	8.53	136 hr	1.48 m	2.4 m	11.4	202-378
#6	12.09	9.14	89 hr	4.79 m	4.3 m	7.4	78-96
#8	12.85	10.06	96 hr	3.40 m	2.2 m	43.8	434-759

\*AVDD = Available Drawdown Depth; Calculated based on the pump level for wells #1, #2, #3, #6 and average sea level for well #8.

#### Well #1 and #2 Analysis

A step-test was conducted on wells #1 and #2 on September 1, 2017 (see figure C1 in appendix C) during which three pumping rates were tested for each well (8.1, 14.3, 23.9 m<sup>3</sup>/h for well #1; 11.7, 21.8, 36 m<sup>3</sup>/h for well #2). Drawdown of 59, 47, and 63 cm were observed for each step respectively for well #1 for a total drawdown of 169 cm. Drawdown of 45, 46, and 77 cm were observed for each step, respectively, for well #2 for a total drawdown of 167 cm. The slope of the drawdown plotted against time does not change significantly for any of the steps indicating that each of the step pumping rates are within the capabilities of the well and aquifer, and turbulent flow is not encountered at the pumping rates tested.

From September 3-7, 2017 a 94-hour pump test was completed on Well #1 and #2. The length of the pump test was extended beyond 72 hours for the convenience of the on-site staff. There was no technical reason to extend the length of the pump test. Well #1 and #2 were pumped at 18.6 m<sup>3</sup>/h and 34 m<sup>3</sup>/h, respectively, throughout the test, apart from two start/stops partway through the test for an automated generator test at the facility. Based on the observed water levels and the response of the well, the impact of this short-term stop was insignificant on the overall test. Well #6 was being pumped simultaneously at 7.4 m<sup>3</sup>/h. Well #8 was observed during the constant rate test and no impacts on its water levels were detected, well #8 was pumped at a constant rate of 24-25 m<sup>3</sup>/h. The log plot of drawdown vs time is shown in Figure C2 for well #1 and in Figure C3 for well #2. The trend lines used to calculate the Transmissivity are shown in the figures, extending the trend line out to approximately 20 years of pumping shows a predicted drawdown of approximately 2.6 meters for well #1 and approximately 2.8 meters for well #2. The analytical method reference is C.W. Fetter, 1994: Applied Hydrogeology, Macmillan College Publishing Company Inc. Pages 214-241. It is the Jacob straight line method that was used for this and all calculations in this report.

Total drawdown of 182 cm and 204 cm were recorded for well #1 and #2 after 89 hours. Wells #1 and #2 recovered 128 cm and 148 cm in the first two minutes of recovery, respectively (70% and 73%). After 64 minutes, the well #1 and #2 had recovered 144 cm and 174 cm, respectively (79% and 85%).

Transmissivity was calculated to be 320 – 388 m<sup>2</sup>/day in Well #1 and 671-568 m<sup>2</sup>/day in well #2 based on well drawdown and recovery from the constant rate pump test, indicating a hydraulic conductivity of approximately 105-127 m/day and 261-308 m/day for well #1 and #2, respectively. The specific capacity is estimated at approximately 10.2 m<sup>3</sup>/h per meter of drawdown and 16.6 m<sup>3</sup>/h per meter of drawdown for well #1 and #2, respectively. The wells have been producing for approximately 20 years to date at 16-18 m<sup>3</sup>/h and 28-30 m<sup>3</sup>/h and have only been interrupted for power outages and maintenance. The actual pump test was conducted at slightly higher rates. There have been no issues with low water levels in the aquifer even with record-low rainfall amounts in 2016-2017 (see appendix D).

Water chemistry samples were taken at 24, 48, and 72 h. Combined discharged groundwater is characterized as fresh with maximum salinity of 0.03 ppt, conductivity ranging from 190-191 µs/cm, and TDS ranging from 101-106 mg/L over the 72-hour pump test.

All measured water chemistry parameters remained constant over the course of the pump test. All measured parameters were within drinking water quality standards. No Coliforms or E. Coli were present in any of the samples taken. Refer to appendix C for detailed results. The observed water quality is acceptable for use in the Oak Bay Hatchery.

#### Well #3 Analysis

A step-test was conducted on well #3 on September 19, 2017 (Figure C4) during which four pumping rates were tested (3.0, 7.4, 9.1, and 12.0 m<sup>3</sup>/h). Drawdown of 58, 63, 34, and 78 cm were observed for each step respectively for a total drawdown of 232 cm. The slope of the drawdown plotted against time does not change significantly for any of the steps indicating that each of the step pumping rates are within the capabilities of the well and aquifer, and turbulent flow is not encountered at the pumping rates tested.

From September 19-25, 2017 a 136-hour pump test was completed on Well #3 (Figure C5). The length of the pump test was extended beyond 72 hours for the convenience of the on-site staff. There was no technical reason to extend the length of the pump test. Well #3 was pumped at 11.4 m<sup>3</sup>/h throughout the test, however one interruption in pumping occurred 24 hours into the pump test. The impact of this interruption in pumping is felt to be insignificant in terms of impact on the overall test.

Total drawdown of 239 cm was recorded after 135 hours. The well recovered 181 cm in the first two minutes of recovery (76% of total drawdown). After 60 minutes, the well had recovered 194 cm (81% of total drawdown).

Well #2, #6, and #8 were observed during the constant rate test. The water level in #2 increased 17 cm over the pumping period during which time well #2 was being pumped at a constant rate of 34 m<sup>3</sup>/h. The water levels in well #6 and #8 decreased by 35 cm and 14 cm, respectively indicating that wells #3 and #6 are geologically connected. As mentioned previously, the gravel aquifer is very transmissive, and drawdowns will spread rapidly and over relatively large distances (compared to site well separation



distances). Quantifying interference between the individual site wells is very difficult given the operational necessity of keeping the broodstock alive and healthy at the site.

Transmissivity was calculated based on results from pumping and recovery during the constant rate pump test to be 202-378 m<sup>2</sup>/day, indicating a hydraulic conductivity of approximately 64-119 m/day. The specific capacity is estimated at approximately 4.7 m<sup>3</sup>/h per meter of drawdown. Extending the worst-case trend line out to approximately 20 years of pumping predicts a drawdown of approximately 3.16 meters.

Water chemistry samples were taken at 24, 48, and 72 h. Combined discharged groundwater from well #2 and #3 is characterized as fresh with maximum salinity of 0.03 ppt, conductivity ranging from 183-187 µs/cm, and TDS ranging from 99-103 mg/L over the first 72 hours of the pump test. The conductivity did not deviate from the same conductivity range for the remaining 64 hours.

No significant change in the measured parameters was observed over the course of the pump test. No Coliforms or E. Coli were present in any of the samples taken. All measured parameters were within drinking water quality standards. Refer to Appendix C for detailed results. The observed water quality is acceptable for use in the Oak Bay Hatchery.

#### Well #6 Analysis

A step-test was conducted on well #6 on September 3, 2017 during which six pumping rates were tested (6.7, 7.7, 7.9, 6.6, 2.8, and 4.5 m<sup>3</sup>/h) (Figure C6). The first three steps were the planned steps, the additional three steps were added to confirm the non-linearity of the pumping rate vs drawdown graph (see appendix C). Drawdown of 371, 45, and 143 cm were observed for the first three steps for a total drawdown of 559 cm. The fourth and fifth steps (reductions in flow) caused increases in water level of 223 cm followed by 273 cm. The last step (an increase in flow) caused a drawdown of 120 cm. The degree to which the water levels observed in Well #6 during the step tests was impacted by other, on site, wells is not known. The slope of the drawdown plotted against time does not change significantly for any of the steps indicating that each of the step pumping rates are within the capabilities of the well and aquifer, and turbulent flow is not encountered at the pumping rates tested.

From September 3-7, 2017 an 89-hour pump test was completed on Well #6. The length of the pump test was extended beyond 72 hours for the convenience of the on-site staff. There was no technical reason to extend the length of the pump test. Well #6 was pumped at 7.4 m<sup>3</sup>/h throughout the test, however, after 40 hours of constant pumping the facility's automated generator test was triggered. As the generator test stoppage of pumping appeared to impact the water levels following the test, the trend line used for that analysis is based on test results up to that point. As can be seen in Figure C7 this represents a worst case assessment of the data.

Total drawdown of 423 cm was recorded after 40 hours. The greatest drawdown, which occurred after 89 h, was 426 cm. The well recovered 701 cm in the first 3 minutes of recovery (166% of total drawdown). The well did not reduce to the original static water level in the days that followed but maintained a new static level which was 84 cm higher than the original static level.

As can be seen in Figure C7, using the trend line for the period prior to the generator test and the short term stoppage in pumping resulted in a transmissivity of 96 m<sup>2</sup>/day and the trend line for the data after

the generator test resulted in a transmissivity estimate of 79 m<sup>2</sup>/day, indicating a hydraulic conductivity of approximately 25-31 m/day. The specific capacity is estimated at approximately 1.7 m<sup>3</sup>/h per meter of drawdown. The overall predicted drawdowns after approximately 20 years are not significantly different (5.43 vs 5.62 meters, a difference of about 3%)

Water chemistry samples were taken at 24, 48, and 72 h. Discharged groundwater is characterized as fresh with maximum salinity ranging from 0.10-0.11, conductivity ranging from 412-443 µs/cm, and TDS ranging from 216-222 mg/L over the 72 hour pump test.

A slight increase in sodium was observed over the 72 hour test (39.5-44.8 mg/L) but remained under both drinking water quality standards (200 mg/L) and aquaculture water quality standards (75 mg/L). All measured parameters remained within drinking water and aquaculture water standards with the exception of pH (6.9), but this change was minor and is suitable for aquaculture operation (Timmons et al, 2010). No Coliforms or E. Coli were present in any of the samples taken. Refer to Appendix C for detailed results. The observed water quality is acceptable for use in the Oak Bay Hatchery.

#### Well #8 Analysis

A step-test was conducted on well #8 from September 25-27, 2017 (Figure C8) during which two sets of steps test with three and four pumping rates were tested (11.6, 19.5, and 27.6 m<sup>3</sup>/h; 9.9, 19.4, 30.8, and 36.86 m<sup>3</sup>/h). Additionally, due to the lack of stabilization at the different steps, a “long-term” step test was conducted in which the pump was left at a constant rate for greater than 12 hours for three rates (27.6, 36.9, and 44.9 m<sup>3</sup>/h). The short-term step tests and the long-term step test resulted in linear relationships between pumping rate and drawdown indicating that the well was capable of flow rates up to at least 44.9 m<sup>3</sup>/h. All three pumping rates for the long-term step test reached a stable well water level in under 24 hours. The degree to which the water levels observed in Well #8 during the step tests was impacted by other, on site, wells is not known.

From October 2-6, 2017 a 96-hour pump test was completed on Well #8. The length of the pump test was extended beyond 72 hours for the convenience of the on-site staff. There was no technical reason to extend the length of the pump test. Well #8 was pumped at 43.8 m<sup>3</sup>/h on average, the flow ranged from 41.8-44.9 m<sup>3</sup>/h (-4.6% to 2.5% of the average flow). Drawdown and recovery data are shown in figure C9.

Total estimated drawdown of 383 cm was recorded after 96 hours. The well recovered 31 cm in the first two minutes of recovery (an estimated 8% of total drawdown). After 180 minutes, the well had recovered 66 cm (17% of total drawdown). It is possible that the recovery in well #8 was impacted by other, on site, wells pumping.

Well #2, #6, and #13 were observed during the constant rate test. The water level in #2 decreased 10 cm over the pumping period during which time well #1 and #2 were being pumped at a constant rate of 44 m<sup>3</sup>/h (combined). The water levels in well #6 also decreased by 10.5 cm.

Figure C9 shows the plot of drawdown vs time for the pump test on Well #8. A number of trend lines are shown in the figure. Transmissivity was calculated based on the worst case scenario (before the generator test) to be 440 m<sup>2</sup>/day, indicating a hydraulic conductivity of approximately 108 m/day and a specific

capacity is estimated at approximately 20.1 m<sup>3</sup>/h per meter of drawdown, resulting in a long-term pump rate of 43.8 m<sup>3</sup>/h.

Water chemistry samples were collected at 24, 28, and 72 hours. Discharged groundwater is characterized as brackish with maximum salinity ranging from 3.84-4.12 ppt, conductivity ranging from 9700-10300 µs/cm, and TDS ranging from 5210-5420 mg/L over the first 72 hours of the pump test.

Slight increases in sulphate, TDS, salinity, magnesium, potassium, and sodium were noted but no drastic changes were observed over the 72-hour test. Several parameters were out of drinking water quality standards and some were out of aquaculture water quality standards (sulphate, iron, magnesium, manganese, and potassium) (Timmons et al, 2010). No Coliforms or E. Coli were present in any of the samples taken. Refer to Appendix C for detailed results. Fish have been reared using this water with no issues related to water quality for over 10 years so the observed water quality is acceptable for use in the Oak Bay Hatchery.

The safe pumping yield determined through pump testing on well #8 is should be comparable to well #7 as the two wells are only 1.65 m apart.

[REDACTED]

A water chemistry sample was collected after the 2-hour pump test on October 13, 2017. Discharged groundwater is characterized as fresh with a salinity of 0.17 ppt, conductivity of 549  $\mu\text{s}/\text{cm}$ , and TDS of 305 mg/L.

#### *4.4. Sustainable Yield*

Based on the results of the pump tests described above, the gravel aquifer that supplies water to the Oak Bay Hatchery has a high transmissivity. The aquifer is capable of supplying the hatchery demand as is demonstrated by the fact that supply wells #1 and #2 have been in use since 1989 and supply well #8 has been in use since 2004 and have been pumped at rates slightly below what the wells were pump tested at. Recharge to the gravel aquifer comes from precipitation, Hitchin's Creek and the surrounding bedrock.

Twenty year drawdowns calculated from the long term pumping tests are conservative as the tests were conducted during a 10-year low rainfall period and do not account for seasonal recovery of the aquifer. Therefore, based on the above information it is concluded that Well #1 has a sustainable yield of 18.6  $\text{m}^3/\text{h}$ , Well #2 has a sustainable yield of 34  $\text{m}^3/\text{h}$ , Well #3 has a sustainable yield of 11.4  $\text{m}^3/\text{h}$ , Well #6 has a sustainable yield of 7.4  $\text{m}^3/\text{h}$ , and, Well# 8 has a sustainable yield of 43.8  $\text{m}^3/\text{h}$ .

#### *4.5. Groundwater Under Direct Influence*

There are two surface water bodies located near the facility: Oak Bay and Hitchin's Creek.

No influence of tidal fluctuation on on-site well water levels (#1, #2, #3, #6, and #8) was observed. Though well #8 exhibits brackish water conditions, no significant or rapid shifts in water quality has been observed during storms which have significantly impacted the bay water.

Hitchin's Creek near the hatchery is hydraulically linked to the gravel aquifer and supplies recharge water. The hydrogeological setting is sensitive and would not screen out in the first step of the NB GUDI Assessment Protocol. Extensive testing over the history of the hatchery has shown that the water quality, despite being GUDI, is acceptable for use at the hatchery. Water entering the facility from well #1, #2, #3, and #6 and the spring water is irradiated with UV light to mitigate the potential risk of disease. UV irradiation on well #8 is planned for 2018.

The well casing for well #2 was elevated from approximately 20 cm to 80 cm in August 2017. All well casings for wells in use or back-up are elevated at least 60 cm above grade to mitigate the risk of flooding. There have been no reports of flooding events causing issues with wells on site in the past 20 years of operation of the facility.

#### *4.6. Salt Water Intrusion*

All available drawdown (AVDD) used in the calculations of 20-year safe pumping rates were such that the water level would not pass below average sea level (as shown on drawing L-5 in appendix A). According to the Ghyben-Herzberg relation, maintaining a water level in the well sufficiently above sea level will mitigate the risk of salt water intrusion. All wells are within 500 m of the ocean but Well #8 appears to be the only on-site well influenced by salt water intrusion, revealing elevated levels of chloride and hardness. The intrusion appears to be isolated as the pump tests did not cause an increase of salinity in the neighbour's well nor any of the other on-site wells.

Unlike well #13 and the neighbour's well, no tidal influence was observed in the water level of well #8.



## 5. Monitoring and Decommissioning Plan

It is recommended that the water level in the production wells (#1, #2, and #8) be monitored to ensure the AVDD is not exceeded. If exceedances occur during dry periods, water withdrawal should be reduced to avoid salt water intrusion or excessive pump wear. Daily flow rates from production wells should be recorded or data logged. Potable water chemistry samples should be collected and sent to a certified laboratory for analysis annually in late August to assess changes in water chemistry during typical dry periods.

Wells #4 and #13 should be decommissioned according to the decommissioning guidelines approved method 1 for drilled wells found in appendix B.

## 6. Conclusions

The production wells #1, #2, and #8 have been in operation for over 10 years and have not experienced low water levels to date. Step tests and constant rate pumping tests were conducted on these wells and their backups (#3, #6) to determine sustainable pumping rates. Wells #1, #2, #3, #6, and #8 were pumped for at least 72 hours at 18.6, 34, 11.4, 7.4, and 43.8 m<sup>3</sup>/h, respectively. The flow rates used for the constant rate pump tests were deemed sustainable based on 20-year drawdown calculations and considering the historical withdrawal rates of the facility (well #1 and #2 are considered as one unit):

*Table 9: Long Term Pumping Rates*

Well #	Long Term Pumping Rate (20-year)
#1/#2	52.6 m <sup>3</sup> /h
#3	11.4 m <sup>3</sup> /h
#6	7.4 m <sup>3</sup> /h
#8	43.8 m <sup>3</sup> /h
<i>Total</i>	<i>96.4 m<sup>3</sup>/h</i>

\*Total long term pumping rate does not include #3 and #6 as these are back-up wells and will not be in continual operation at the same time as well #1, #2, and #8.

Groundwater quality on site is predominantly fresh with one well exhibiting brackish conditions (#8). Wells #1, #2, #3, and #6 are within drinking water quality and aquaculture standards. Well #8 exhibited elevated levels of several parameters rendering it unsuitable for drinking. Some parameters exceeded recommended aquaculture standards, however, this water source has been used for the past 10 years with no recorded incidence of problems. It is recommended Kelly Cove Salmon monitor these parameters in the future. If necessary, mixing groundwater from well #8 with groundwater from well #1/2 may prove to alleviate problematic parameters and prove beneficial as higher hardness and chlorides are optimal at different life stages of salmonids.

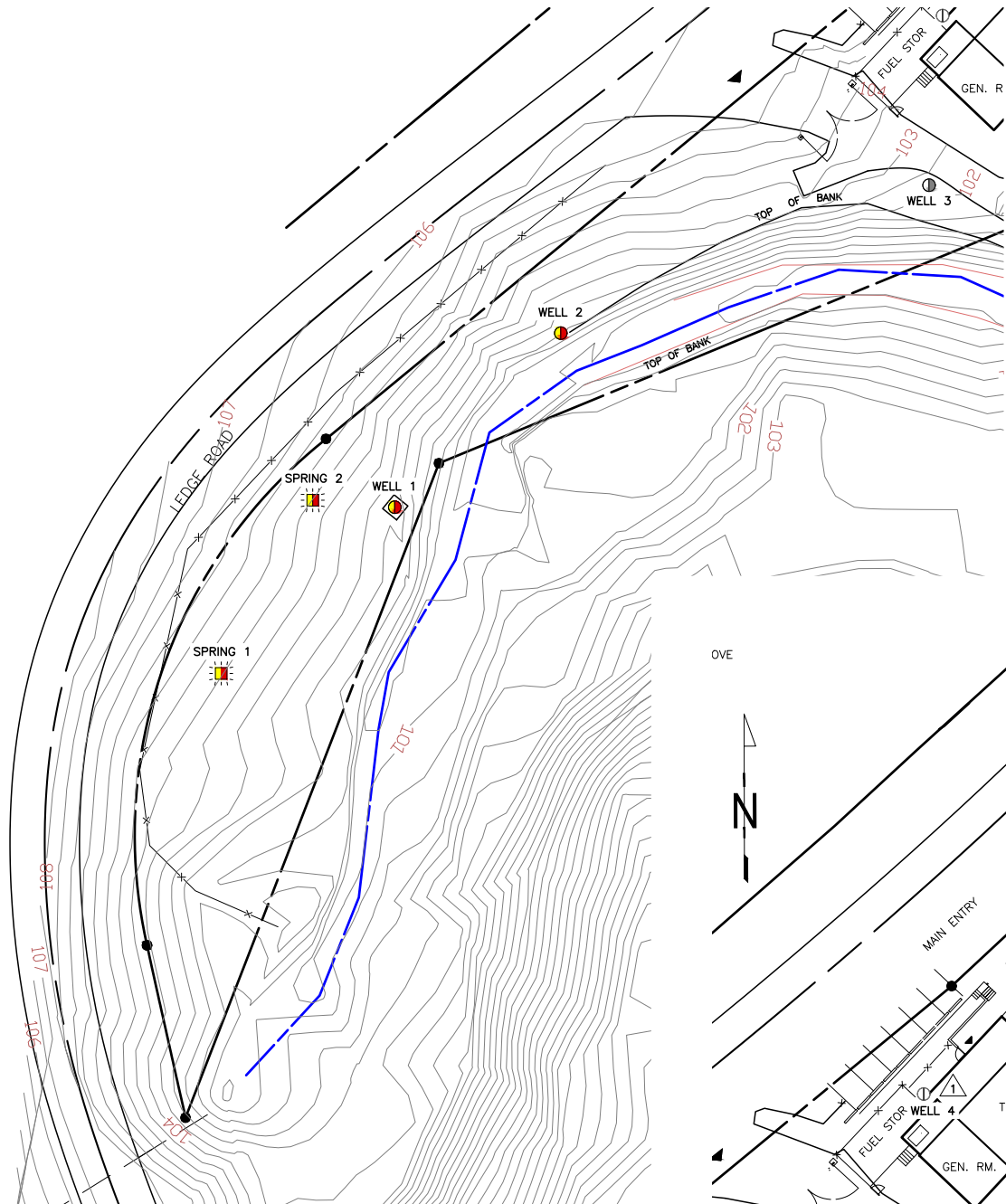
## Appendix A

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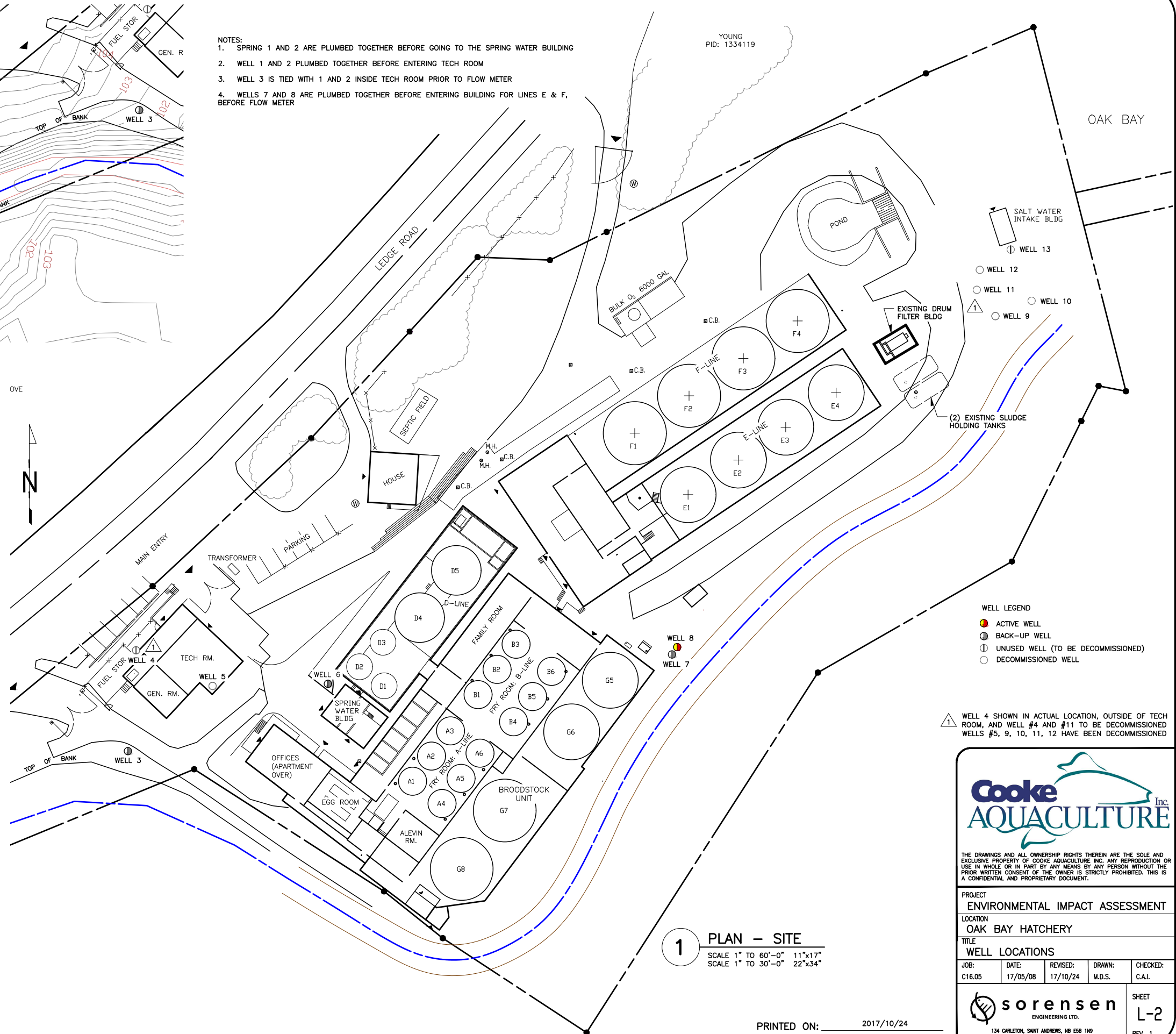
- Well Locations and Site Map
- 1:10 000 Scale Map/Neighbouring Well Map
- On-Site Well Cross Section Diagram

- NOTES:
1. SPRING 1 AND 2 ARE PLUMBED TOGETHER BEFORE GOING TO THE SPRING WATER BUILDING
  2. WELL 1 AND 2 PLUMBED TOGETHER BEFORE ENTERING TECH ROOM
  3. WELL 3 IS TIED WITH 1 AND 2 INSIDE TECH ROOM PRIOR TO FLOW METER
  4. WELLS 7 AND 8 ARE PLUMBED TOGETHER BEFORE ENTERING BUILDING FOR LINES E & F, BEFORE FLOW METER

YOUNG  
PID: 1334119



**2 PLAN - UPPER SITE**  
SCALE 1" TO 60'-0" 11"x17"  
SCALE 1" TO 30'-0" 22"x34"



**1 PLAN - SITE**  
SCALE 1" TO 60'-0" 11"x17"  
SCALE 1" TO 30'-0" 22"x34"

- WELL LEGEND**
- ACTIVE WELL
  - ⊕ BACK-UP WELL
  - ⓪ UNUSED WELL (TO BE DECOMMISSIONED)
  - DECOMMISSIONED WELL
- ▲ WELL 4 SHOWN IN ACTUAL LOCATION, OUTSIDE OF TECH ROOM, AND WELL #4 AND #11 TO BE DECOMMISSIONED  
WELLS #5, 9, 10, 11, 12 HAVE BEEN DECOMMISSIONED



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PROJECT ENVIRONMENTAL IMPACT ASSESSMENT				
LOCATION OAK BAY HATCHERY				
TITLE WELL LOCATIONS				
JOB: C16.05	DATE: 17/05/08	REVISED: 17/10/24	DRAWN: M.D.S.	CHECKED: C.A.I.

**sorensen**  
ENGINEERING LTD.  
134 CARLETON, SAINT ANDREWS, NB E5B 1N9  
PHONE (504) 529-0993 EMAIL INFO@SORENSEN.CA

SHEET  
**L-2**  
REV. 1

PRINTED ON: 2017/10/24



**LEGEND**

- CONFIRMED WELL
- ASSUMED WELL
- CONTAMINATION HAZARD

PRINTED ON: 2017/04/13



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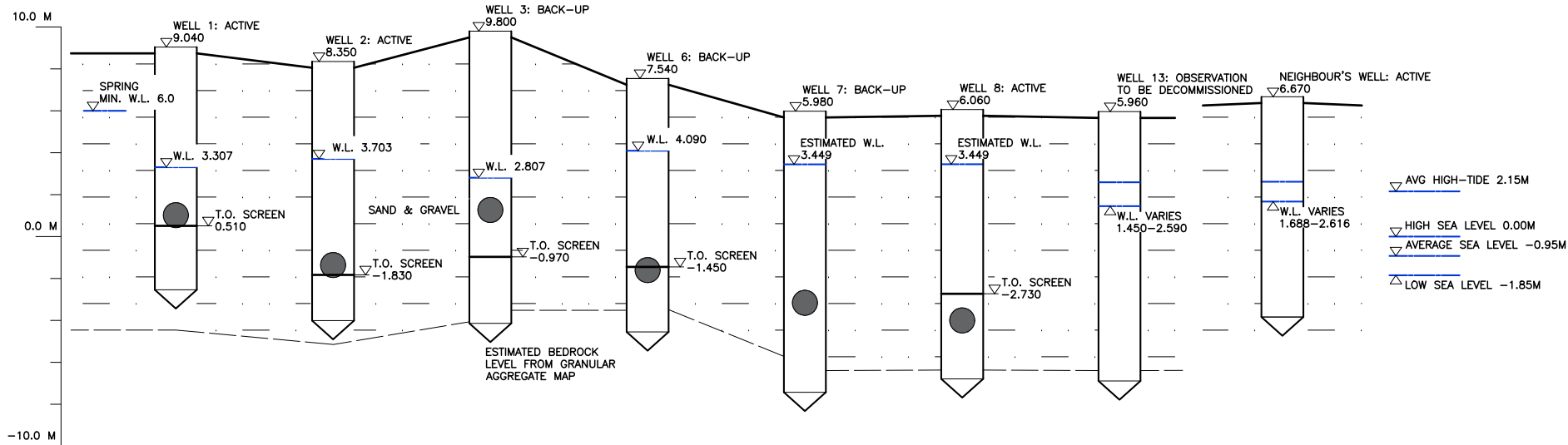
PROJECT OAK BAY HATCHERY EIA				
LOCATION OAK BAY, NB				
TITLE NEIGHBOURING WELL MAP				
JOB: C16.05	DATE: 17/04/13	REVISED: -	DRAWN: L.T.H.	CHECKED: -

**SORENG**  
SORENSEN ENGINEERING LTD.  
145 FREDERICK ST. SAINT ANDREWS, NB E5B 1Z2  
PHONE (506) 529-0093 EMAIL: MARIO@SORENG.CA

SHEET  
**L-4**  
REV. 0

**1** PLAN – APPROXIMATE LOCATION OF NEIGHBOURING WELLS  
SCALE 1 TO 10000 8.5"x11"





**1 SECTION – ON-SITE ACTIVE AND BACK-UP WELLS**

VERTICAL SCALE: 1 TO 300 11"x17"  
 HORIZONTAL SCALE : N.T.S.

**LEGEND**

- PUMP
- WATER LEVEL (SEPT-OCT 2017)

PRINTED ON: 2017/10/26



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PROJECT OAK BAY HATCHERY EIA				
LOCATION OAK BAY, NB				
TITLE ON-SITE WELL CROSS SECTION				
JOB: C16.05	DATE: 17/10/26	REVISED: -	DRAWN: L.T.H.	CHECKED: -

**sorensen** ENGINEERING LTD.  
 134 CARLETON, SAINT ANDREWS, NB E5B 1N9  
 PHONE (506) 529-0093 EMAIL INFO@SORENSON.CA

SHEET  
**L-5**  
 REV. 0

## Appendix B

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- Prior Approvals
  - I-9633
  - I-9758
- Well Log for Well ID 27924
- Decommissioning Water Well Guidelines



## APPROVAL TO OPERATE

**I-9633**

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Pursuant to paragraph 8(1) of the *Water Quality Regulation - Clean Environment Act*, this Approval to Operate is hereby issued to:

**Kelly Cove Salmon Ltd.**  
for the operation of the  
**Oak Bay Salmon Hatchery**

Description of Source: **An aquaculture recirculation facility consisting of covered grow-out tank fields for the culture of Atlantic salmon to the smolt stage.**

Source Classification: **Fees for Industrial Approvals Regulation - Clean Water Act** **Class 6**

Parcel Identifier: **01265925, 01270503, 15155419**

Mailing Address: **93 Oak Haven Road  
Oak Haven, NB E3L 3S7**

Conditions of Approval: **See attached Schedule (s)"A", "B" and "C" of this Approval**

Supersedes Approval: **I-9549**

Valid From: **February 01, 2017**

Valid To: **April 30, 2017**

Recommended by: \_\_\_\_\_ 

Issued by: \_\_\_\_\_   
for the Minister of Environment and Local Government

February 14, 2017  
Date

## SCHEDULE "A"

### A. DESCRIPTION AND LOCATION OF SOURCE

Kelly Cove Salmon Ltd. operate an aquaculture facility consisting of a hatchery, enclosed tank fields and wastewater treatment system. The facility is located on the Lower Ledge Road, Oak Bay, Charlotte County. The facility also includes a broodstock rearing operation for gamete production and incubation room for housing salmon eggs. The broodstock portion of the operation has a capacity of 40,000 kg.

The facility requires approximately 600 IGPM of water at the peak of the production cycle. Approximately 200 IGPM are provided by drilled wells, with the remainder obtained from a spring source. The facility incorporates recirculation technology with the wastewater treated for the removal of solids using a 60 micron screen drum filter with a capacity of 2,700 litres/minute. The solids are directed into a septic tank with the filtered water discharged to an intertidal area within Oak Bay.

This facility located adjacent to Oak Bay and referenced by parcel identifiers 01265925, 01270503 and 15155419 is hereby approved subject to the following:

### B. DEFINITIONS

1. **"Approval Holder"** means Kelly Cove Salmon Ltd.
2. **"after hours"** means the hours when the Department's offices are closed. These include statutory holidays, weekends, and the hours before 8:15 a.m. and after 4:30 p.m. from Monday to Friday.
3. **"Chemical"** means antibacterial and antibiotic agents, therapeutants, pesticides, herbicides, anesthetics, feed additives, hormones, veterinary biologics, biotechnology products, disinfectants, water treatment agents, fertilizers, paint products, organic solvents, anti-foulant products, petroleum products, liquid and gaseous fuels, sealants, lubricants, flocculants, and any other hazardous, toxic, or potentially harmful substance.
4. **"Department"** means the New Brunswick Department of Environment and Local Government.
5. **"Director"** means the Director of the Impact Management Branch of the Department of Environment and Local Government and includes any person designated to act on the Director's behalf.
6. **"Facility"** means all property, real or personal, utilized in the operation or maintenance of the source.



7. **"Inspector"** means an Inspector designated under the *Clean Air Act*, the *Clean Environment Act*, or the *Clean Water Act*.
8. **"Minister"** means the Minister of Environment and Local Government and includes any person designated to act on the Minister's behalf.
9. **"Mixing Zone"** a predefined area within a surface watercourse beyond an outfall or discharge point in which the applicable jurisdiction or regulatory agency permits water quality criteria to be exceeded while remaining below acute toxicity thresholds for the protection of aquatic life. Beyond the mixing zone boundary, applicable water quality criteria for the protection of aquatic life must be observed.
10. **"Source"** means "source of contaminant" as defined in the Act.
11. **"watercourse"** means the full width and length, including the beds, banks, sides and shoreline, or any part of a river, creek, stream, spring, brook, lake, pond, reservoir, canal, ditch or other natural or artificial channel open to the atmosphere, the primary function of which is the conveyance or containment of water whether the flow be continuous or not.

## C. EMERGENCY REPORTING

12. The Approval Holder, operator or any person in charge of the Facility shall **immediately** report to the New Brunswick Department of the Environment where:
  - a) there has been, or is likely to be, an unauthorized release of solid, liquid or gaseous material including wastewater, petroleum or hazardous materials, to the environment;
  - b) there has been a violation of the *Air Quality Regulation*, the *Water Quality Regulation* or any Approval issued thereunder; or
  - c) a release of a contaminant or contaminants is of such magnitude or period that there is concern for the health or safety of the general public, or there could be significant harm to the environment.

**During normal business hours, contact the:  
Saint John Regional Office  
(506) 658-2558**

**After hours, or in the event the Regional Office cannot be reached contact the:  
Canadian Coast Guard  
1-800-565-1633**

All reports shall include:

- a) a description of the source, including the name of the owner or operator;
- b) the nature, extent, duration and environmental impact of the release;
- c) the cause or suspected cause of the release; and

d) any remedial action taken or to be taken to prevent a recurrence of the release.

An Inspector will be contacted to return the call and provide direction, where required.

## D. GENERAL INFORMATION

13. The Approval Holder shall operate the facility in compliance with the *Water Quality Regulation - Clean Environment Act*.
14. This Certificate of Approval does not relieve the owner from complying with municipal bylaws, other provincial acts and regulations, or any federal acts and regulations.
15. Violation of any conditions of this Certificate of Approval constitutes a violation of the *Clean Environment Act*.
16. An Inspector, at any reasonable time, has the authority to inspect the Facility and carry out such duties as defined in the *Clean Air Act*, the *Clean Environment Act* or the *Clean Water Act*.
17. The Minister may revoke this approval at any time and the approval is automatically revoked by the issuing of a new approval applying to the same source.
18. The terms and conditions of this Approval are severable. If any term or condition of this Approval is held invalid, is revoked or is modified, the remainder of the Approval shall not be affected.

## E. TERMS AND CONDITIONS

### GENERAL CONDITIONS

19. The Approval holder shall operate the facility in accordance with the most recent version of the *Environmental Management Program for Land Based Finfish Aquaculture in New Brunswick* issued by the Department.
20. All water withdrawals, including those from ground, surface or pipeline sources shall be equipped with flow meters.
21. Ground water withdrawal from onsite well(s) shall not exceed 200 IGPM [909 litres/minute]. Requirements in excess of this will require a Water Supply Source Assessment to be conducted to establish a safe pumping limit.
22. The development of additional water supplies for this facility requires the Approval of the Minister.

23. The Approval Holder shall ensure that a copy of the Approval, including all attached schedules is maintained onsite at all times. A copy of the Approval must also be posted in a prominent and accessible location.
24. The Approval Holder shall apply in writing to the Director and receive approval for an amendment of this Approval before making any changes, including fish species, to the currently approved Facility.
25. The Approval Holder shall immediately notify the Minister in writing of any change in its legal name or address.

#### WASTE MANAGEMENT PLAN

26. The Approval Holder shall ensure that all wastes generated throughout the operation and maintenance of the facility are managed and disposed of in accordance with the procedures and practices detailed in the Waste Management Plan in the attached SCHEDULE "C", or in a manner deemed acceptable by an Inspector, or as otherwise directed by the Department.

#### SOLID WASTE MANAGEMENT

27. The Approval Holder shall ensure that all wastes generated during the maintenance and operation of the facility, including moribund fish, are disposed of in a manner approved by the Minister, or in a manner acceptable to an inspector.
28. The Approval Holder shall remove sludge from the catch basin at least once per year and make arrangements for disposal in a manner which is acceptable to an inspector. Additional cleanout(s) of sludge from the catch basin may be required should any monitoring results indicate a failure to achieve the limits specified within this Approval.

#### CHEMICAL STORAGE AND HANDLING

29. The Approval Holder shall ensure that all chemicals are stored in a manner such that any spill is contained and not released to the environment.

#### DISCHARGE LIMITS


30. The Approval Holder shall ensure that the level of total phosphorus and nitrogen at the edge of the established mixing zone is in accordance with Table 2.10 of the most recent version of the *Environmental Management Program for Land Based Finfish Aquaculture in New Brunswick*.


TESTING AND MONITORING

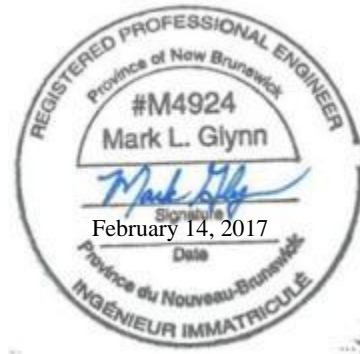
- 31. The Approval Holder shall conduct a water quality monitoring program in accordance Section 2.4, Table 2.9 and methodology in accordance with Appendix 1 and Table A1-4 within the most recent version of the *Environmental Management Program for Land Based Finfish Aquaculture in New Brunswick* issued by the Department and summarized in SCHEDULE "B".
- 32. The Approval Holder shall establish a monitoring program as outlined in SCHEDULE "B". Monitoring shall include samples taken from the outer perimeter and outside of the mixing zone as established by an inspector and approved by the Minister.

REPORTING

- 33. The Approval Holder shall submit reports in accordance with Appendix 2 of the most recent version of the document titled *Environmental Management Program for Land Based Finfish Aquaculture in New Brunswick*, issued by the Department.

Prepared by:   
\_\_\_\_\_  
Daniel Daley, EIT  
Approvals Coordinator

Reviewed by:   
\_\_\_\_\_  
Mark Glynn, P.Eng.  
Manager, Industrial Processes



## SCHEDULE "B"

### MONITORING AND SAMPLING PLAN

#### 1. WATER QUALITY MONITORING PROGRAM

##### Level 1

<u>Station</u> *	<u>Parameters</u> **	<u>Analysis</u>	<u>Time Period</u>	<u>Frequency</u>	<u>Method</u>
1	Flow	Self	Jan. 1-Dec. 31	weekly	Meter
3,4,5	TP <sub>L</sub> , TN Temp DO, pH	Lab Self	June 1-Nov.15	monthly	Grab Meter

##### Level 2

<u>Station</u> *	<u>Parameters</u> **	<u>Analysis</u>	<u>Method</u>
1	Flow	Self	Meter
2	TP <sub>L</sub> , TSS	Lab	Grab
3	TP <sub>L</sub> , TN, TSS Temp, DO and pH	Lab Self	Grab
4,5	TP <sub>L</sub> , TN Temp, DO and pH	Lab Self	Grab

##### \* Stations

1. Hatchery water intakes
2. Effluent water prior to entry into catch basin.
3. Effluent water at point of discharge from catch basin.
4. Oak Bay: Edge of mixing zone.
5. Oak Bay: Control station

##### \*\* Parameters

- TN - Total Nitrogen, reported in milligrams per litre.
- TP - Total Phosphorus, reported in milligrams per litre.
- Temp - Temperature in degrees Celsius.
- DO - Dissolved Oxygen in milligrams per litre.
- TSS - Total Suspended Solids

##### Note:

Sampling to be conducted on the ebb (outgoing) tide.



## **SCHEDULE "C"**

### **WASTE MANAGEMENT PLAN**

1. The following Waste Management Plan was developed through consultation between the Department and the Approval Holder. This plan must be updated, and approved whenever operational practices require substantive and routine deviation from the procedures outlined herein.



## APPROVAL TO OPERATE

**I-9758**

---

Pursuant to paragraph 8(1) of the *Water Quality Regulation - Clean Environment Act*, this Approval to Operate is hereby issued to:

**Kelly Cove Salmon Ltd.**  
for the operation of the  
**Oak Bay Salmon Hatchery**

Description of Source: **An aquaculture recirculation facility consisting of covered grow-out tank fields for the culture of Atlantic salmon to the smolt stage.**

Source Classification: **Fees for Industrial Approvals Regulation - Clean Water Act** **Class 6**

Parcel Identifier: **01265925, 01270503, 15155419**

Mailing Address: **93 Oak Haven Road  
Oak Haven, NB E3L 3S7**

Conditions of Approval: **See attached Schedule (s)"A", "B" and "C" of this Approval**

Supersedes Approval: **I-9633**

Valid From: **May 01, 2017**

Valid To: **November 01, 2017**

Recommended by: 

Issued by:   
for the Minister of Environment and Local Government

May 8, 2017  
Date

## SCHEDULE "A"

### A. DESCRIPTION AND LOCATION OF SOURCE

Kelly Cove Salmon Ltd. operate an aquaculture facility consisting of a hatchery, enclosed tank fields and wastewater treatment system. The facility is located on the Lower Ledge Road, Oak Bay, Charlotte County. The facility also includes a broodstock rearing operation for gamete production and incubation room for housing salmon eggs. The broodstock portion of the operation has a capacity of 40,000 kg.

The facility requires approximately 600 IGPM of water at the peak of the production cycle. Approximately 200 IGPM are provided by drilled wells, with the remainder obtained from a spring source. The facility incorporates recirculation technology with the wastewater treated for the removal of solids using a 60 micron screen drumfilter with a capacity of 2,700 litres/minute. The solids are directed into a septic tank with the filtered water discharged to an intertidal area within Oak Bay.

This facility located adjacent to Oak Bay and referenced by parcel identifiers 01265925, 01270503 and 15155419 is hereby approved subject to the following:

### B. DEFINITIONS

1. **"Approval Holder"** means Kelly Cove Salmon Ltd.
2. **"after hours"** means the hours when the Department's offices are closed. These include statutory holidays, weekends, and the hours before 8:15 a.m. and after 4:30 p.m. from Monday to Friday.
3. **"Chemical"** means antibacterial and antibiotic agents, therapeutants, pesticides, herbicides, anesthetics, feed additives, hormones, veterinary biologics, biotechnology products, disinfectants, water treatment agents, fertilizers, paint products, organic solvents, anti-foulant products, petroleum products, liquid and gaseous fuels, sealants, lubricants, flocculants, and any other hazardous, toxic, or potentially harmful substance.
4. **"Department"** means the New Brunswick Department of Environment and Local Government.
5. **"Director"** means the Director of the Impact Management Branch of the Department of Environment and Local Government and includes any person designated to act on the Director's behalf.
6. **"Facility"** means all property, real or personal, utilized in the operation or maintenance of the source.

7. **"Inspector"** means an Inspector designated under the *Clean Air Act*, the *Clean Environment Act*, or the *Clean Water Act*.
8. **"Minister"** means the Minister of Environment and Local Government and includes any person designated to act on the Minister's behalf.
9. **"Mixing Zone"** a predefined area within a surface watercourse beyond an outfall or discharge point in which the applicable jurisdiction or regulatory agency permits water quality criteria to be exceeded while remaining below acute toxicity thresholds for the protection of aquatic life. Beyond the mixing zone boundary, applicable water quality criteria for the protection of aquatic life must be observed.
10. **"Source"** means "source of contaminant" as defined in the Act.
11. **"watercourse"** means the full width and length, including the beds, banks, sides and shoreline, or any part of a river, creek, stream, spring, brook, lake, pond, reservoir, canal, ditch or other natural or artificial channel open to the atmosphere, the primary function of which is the conveyance or containment of water whether the flow be continuous or not.

## C. EMERGENCY REPORTING

12. The Approval Holder, operator or any person in charge of the Facility shall **immediately** report to the New Brunswick Department of the Environment where:
  - a) there has been, or is likely to be, an unauthorized release of solid, liquid or gaseous material including wastewater, petroleum or hazardous materials, to the environment;
  - b) there has been a violation of the *Air Quality Regulation*, the *Water Quality Regulation* or any Approval issued thereunder; or
  - c) a release of a contaminant or contaminants is of such magnitude or period that there is concern for the health or safety of the general public, or there could be significant harm to the environment.

**During normal business hours, contact the:**

**Saint John Regional Office  
(506) 658-2558**

**After hours, or in the event the Regional Office cannot be reached contact the:**

**Canadian Coast Guard  
1-800-565-1633**

All reports shall include:

- a) a description of the source, including the name of the owner or operator;
- b) the nature, extent, duration and environmental impact of the release;
- c) the cause or suspected cause of the release; and
- d) any remedial action taken or to be taken to prevent a recurrence of the release.

An Inspector will be contacted to return the call and provide direction, where required.

**D. GENERAL INFORMATION**

13. The Approval Holder shall operate the facility in compliance with the *Water Quality Regulation - Clean Environment Act*.
14. This Certificate of Approval does not relieve the owner from complying with municipal bylaws, other provincial acts and regulations, or any federal acts and regulations.
15. Violation of any conditions of this Certificate of Approval constitutes a violation of the *Clean Environment Act*.
16. An Inspector, at any reasonable time, has the authority to inspect the Facility and carry out such duties as defined in the *Clean Air Act*, the *Clean Environment Act* or the *Clean Water Act*.
17. The Minister may revoke this approval at any time and the approval is automatically revoked by the issuing of a new approval applying to the same source.
18. The terms and conditions of this Approval are severable. If any term or condition of this Approval is held invalid, is revoked or is modified, the remainder of the Approval shall not be affected.

**E. TERMS AND CONDITIONS**

## GENERAL CONDITIONS

19. The Approval holder shall operate the facility in accordance with the most recent version of the *Environmental Management Program for Land Based Finfish Aquaculture in New Brunswick* issued by the Department.
20. All water withdrawals, including those from ground, surface or pipeline sources shall be equipped with flow meters.
21. Ground water withdrawal from onsite well(s) shall not exceed 200 IGPM [909 litres/minute]. Requirements in excess of this will require a Water Supply Source Assessment to be conducted to establish a safe pumping limit.
22. The development of additional water supplies for this facility requires the Approval of the Minister.
23. The Approval Holder shall ensure that a copy of the Approval, including all attached schedules is maintained onsite at all times. A copy of the Approval must also be posted in a prominent and accessible location.



24. The Approval Holder shall apply in writing to the Director and receive approval for an amendment of this Approval before making any changes, including fish species, to the currently approved Facility.
25. The Approval Holder shall immediately notify the Minister in writing of any change in its legal name or address.

#### WASTE MANAGEMENT PLAN

26. The Approval Holder shall ensure that all wastes generated throughout the operation and maintenance of the facility are managed and disposed of in accordance with the procedures and practices detailed in the Waste Management Plan in the attached SCHEDULE "C", or in a manner deemed acceptable by an Inspector, or as otherwise directed by the Department.

#### SOLID WASTE MANAGEMENT

27. The Approval Holder shall ensure that all wastes generated during the maintenance and operation of the facility, including moribund fish, are disposed of in a manner approved by the Minister, or in a manner acceptable to an inspector.
28. The Approval Holder shall remove sludge from the catch basin at least once per year and make arrangements for disposal in a manner which is acceptable to an inspector. Additional cleanout(s) of sludge from the catch basin may be required should any monitoring results indicate a failure to achieve the limits specified within this Approval.

#### CHEMICAL STORAGE AND HANDLING

29. The Approval Holder shall ensure that all chemicals are stored in a manner such that any spill is contained and not released to the environment.

#### DISCHARGE LIMITS

30. The Approval Holder shall ensure that the level of total phosphorus and nitrogen at the edge of the established mixing zone is in accordance with Table 2.10 of the most recent version of the *Environmental Management Program for Land Based Finfish Aquaculture in New Brunswick*.


#### TESTING AND MONITORING

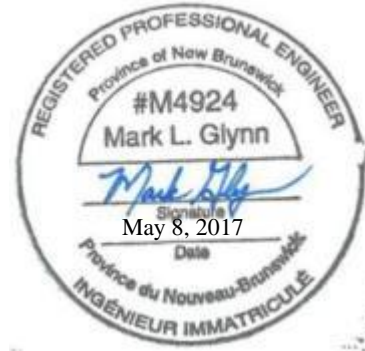
31. The Approval Holder shall conduct a water quality monitoring program in accordance Section 2.4, Table 2.9 and methodology in accordance with Appendix 1 and Table A1-4 within the most recent version of the *Environmental Management Program for Land Based Finfish Aquaculture in New Brunswick* issued by the Department and summarized in SCHEDULE "B".


- 32. The Approval Holder shall establish a monitoring program as outlined in SCHEDULE "B". Monitoring shall include samples taken from the outer perimeter and outside of the mixing zone as established by an inspector and approved by the Minister.

REPORTING

- 33. The Approval Holder shall submit reports in accordance with Appendix 2 of the most recent version of the document titled *Environmental Management Program for Land Based Finfish Aquaculture in New Brunswick*, issued by the Department.

Prepared by:   
Daniel Daley, EIT  
Approvals Coordinator



Reviewed by:   
Mark Glynn, P.Eng.  
Manager, Permitting South  
Impact Management Branch

## SCHEDULE "B"

### MONITORING AND SAMPLING PLAN

#### 1. WATER QUALITY MONITORING PROGRAM

##### Level 1

<u>Station</u> *	<u>Parameters</u> **	<u>Analysis</u>	<u>Time Period</u>	<u>Frequency</u>	<u>Method</u>
1	Flow	Self	Jan. 1-Dec. 31	weekly	Meter
3,4,5	TP <sub>L</sub> , TN Temp DO, pH	Lab Self	June 1-Nov.15	monthly	Grab Meter

##### Level 2

<u>Station</u> *	<u>Parameters</u> **	<u>Analysis</u>	<u>Method</u>
1	Flow	Self	Meter
2	TP <sub>L</sub> , TSS	Lab	Grab
3	TP <sub>L</sub> , TN, TSS Temp, DO and pH	Lab Self	Grab
4,5	TP <sub>L</sub> , TN Temp, DO and pH	Lab Self	Grab

##### \* Stations

1. Hatchery water intakes
2. Effluent water prior to entry into catch basin.
3. Effluent water at point of discharge from catch basin.
4. Oak Bay: Edge of mixing zone.
5. Oak Bay: Control station

##### \*\* Parameters

- TN - Total Nitrogen, reported in milligrams per litre.
- TP - Total Phosphorus, reported in milligrams per litre.
- Temp - Temperature in degrees Celsius.
- DO - Dissolved Oxygen in milligrams per litre.
- TSS - Total Suspended Solids

##### Note:

Sampling to be conducted on the ebb (outgoing) tide.

## **SCHEDULE "C"**

### **WASTE MANAGEMENT PLAN**

1. The following Waste Management Plan was developed through consultation between the Department and the Approval Holder. This plan must be updated, and approved whenever operational practices require substantive and routine deviation from the procedures outlined herein.

**Well Driller's Report**

Date printed **2017/04/13**

Drilled by <b>Clearwater Well Drilling Inc.</b>			
Well Use <b>Drinking Water, Domestic</b>	Work Type <b>New Well</b>	Drill Method <b>Rotary</b>	Work Completed <b>09/15/2004</b>

Casing Information		Casing above ground <b>2ft</b>		Drive Shoe Used? <b>Yes</b>	
Well Log	Casing Type	Diameter	From	End	Slotted?
<b>11619</b>	<b>Steel</b>	<b>6 inch</b>	<b>0ft</b>	<b>42ft</b>	

Aquifer Test/Yield							
Method	Initial Water Level (BTC)	Pumping Rate	Duration	Final Water Level (BTC)	Estimated Safe Yield	Flowing Well?	Rate
<b>Air</b>	<b>8ft</b>	<b>220 igpm</b>	<b>1hr</b>	<b>8ft</b>	<b>220 igpm</b>	<b>No</b>	<b>0 igpm</b>
<i>(BTC - Below top of casing)</i>							

Well Grouting
<b>There is no Grout information.</b>

Drilling Fluids Used	Disinfectant	Pump Installed
None	<b>Bleach (Javex)</b>	<b>Submersible</b>
	Qty <b>0 ig</b>	Intake Setting (BTC) <b>0ft</b>

Driller's Log				
Well Log	From	End	Colour	Rock Type
<b>11619</b>	<b>0ft</b>	<b>20ft</b>	<b>Brown</b>	<b>Sand and Gravel</b>
<b>11619</b>	<b>20ft</b>	<b>30ft</b>	<b>Brown</b>	<b>Gravel</b>
<b>11619</b>	<b>30ft</b>	<b>33ft</b>	<b>Brown</b>	<b>Sand</b>
<b>11619</b>	<b>33ft</b>	<b>42ft</b>	<b>Brown</b>	<b>Gravel</b>

Overall Well Depth  
**42ft**  
 Bedrock Level  
**20ft**

Water Bearing Fracture Zone		
Well Log	Depth	Rate
<b>11619</b>	<b>40ft</b>	<b>220 igpm</b>

Setbacks		
Well Log	Distance	Setback From
<b>11619</b>	<b>55ft</b>	<b>Septic Tank</b>
<b>11619</b>	<b>75ft</b>	<b>Leach Field</b>



## Guidelines for decommissioning (abandonment) of Water Wells

The Water Well Regulation- *Clean Water Act* (90-79), Section 27 states that: “27 Where a well is not in use and its continued existence might constitute a safety hazard or allow a contaminant to enter the aquifer, the owner of the well shall fill and seal the well using a method approved by the Minister sufficient to prevent the vertical movement of water in the well.”

If an individual or company is being contracted to carry out all operations incidental to the abandonment of water wells, they must be a licensed water well contractor who holds a valid New Brunswick Water Well Contractors Permit.

### **Approved Method 1 – Drilled Wells**

1. **a.** The entire well may be filled with bentonite clay or bentonite grout, or alternatively, suitable uncontaminated material (e.g. sand, drill cuttings, etc.) should be placed opposite the aquifers or water bearing fracture zones with bentonite grout placed opposite impermeable zones between the aquifers. **b.** If the distance between the aquifers is such that it is impractical to fill the borehole with grout for the entire length, suitable uncontaminated material may be used to fill the borehole provided that bentonite grout plugs of no less than 1.5 m (5ft) in thickness are placed within every 5 m (15ft) interval of fill between the aquifers or water bearing fracture zones.
2. If the casing is left in the borehole; **a.** the casing shall be cut off (1m or 3ft) below ground surface. In all water well abandonment the top three metres (10 ft) (below where the casing is cut off) shall be filled with bentonite grout. In certain cases it may be advisable to cap the top of the well with concrete. **b. a** bentonite plug

(3m or 10 ft in thickness) shall be placed straddling the position of the casing drive shoe seal or the bottom of the casing where it seats in the rock, such that approximately 0.5 to 1m (1.5 to 3 ft) of bentonite is inside the casing. **c.** If the casing is less than or equal to 10m (30 ft), then fill the entire casing with grout, if the casing is greater than 10 m (30 ft), apply condition **2a**, **2b** and **1b**.

### **Approved Method 2- Dug Wells**

The well should be backfilled with suitable uncontaminated material (e.g. sand, drill cuttings, clean fill, etc.) to 0.5 m (1.5 ft) below the static water level. A bentonite or grout seal should extend from this level to 0.5 m (1.5 ft) above the water table. The remaining cavity should be filled with suitable uncontaminated material that should extend to within 1 m (3 ft) below the final ground surface, and 0.5 m (1.5 ft) bentonite or grout seal should be placed on top. The remaining space is then filled with impervious natural material (e.g. clay, or hardpan) or native soil and slightly mounded in order to prevent surface water runoff from entering the well; seed or sod to establish ground cover. If water table is close to the land surface, the lower bentonite plug should simply extend to 1 m (3 ft) below ground surface.

### Approved Method 3 – Monitoring wells

This section applies to monitoring wells used for monitoring purposes only, not for wells used for potable purposes. Wells used for potable purposes must be decommissioned as per the applicable Approved Method 1 or 2 of this Guideline.

Responsible Parties or owners of contaminated sites are required by the Department to have monitoring wells decommissioned upon completion of the Management Process outlined in the Department's "*Guideline for the Management of Contaminated Sites*". Owners of sanitary landfills, dumps, composting facilities or other waste management facilities are also required to decommission monitoring wells once they are no longer in active use.

All monitoring wells must be decommissioned under the direction of a Site Professional licensed by the New Brunswick Association of Professional Engineers and Geoscientists to practice in New Brunswick.

- a) The approved decommissioning method for **single monitoring wells**, with an intact bentonite seal in the annulus, and which intersect a shallow groundwater table located in surficial deposits/weathered bedrock, is as follows:

Remove the casing and cap, or if it cannot be removed, cut it off 0.6 m below the ground surface. Fill the remaining casing (or hole if the casing has been removed) to 0.6 m below the ground surface with bentonite pellets or chips while tamping to prevent bridging of the chips or bentonite. Ensure that the bentonite is saturated to provide an effective seal. Fill the remainder of the casing (or hole if the casing has been removed) with silica sand or overburden material to surface.

The Site Professional will advise the Department, in writing, upon completion of the monitoring well decommissioning. This correspondence will be placed in the appropriate Departmental file.

- b) A site-specific decommissioning plan must be submitted for DELG for the following types of monitoring well installations:
  - i. Installations where groundwater contains chloride concentrations in excess of 10,000 mg/L;
  - ii. Multilevel well installations;
  - iii. Monitoring wells which may compromise the effectiveness of a low-permeability geological unit which overlies a water-bearing unit;
  - iv. Monitoring wells greater than or equal to 150 mm in diameter;
  - v. Monitoring wells lacking an intact bentonite seal in the annulus;
  - vi. Any other type of monitoring well installation which does not meet the definition in Part a).

The site-specific monitoring plan must include the following:

- A site plan showing the monitoring well locations;
- Monitoring well logs indicating geological strata and water table elevations;
- A drawing of the proposed decommissioned well design;
- Rationale for the design, which includes consideration of hydrogeological factors and mitigation of risks to the environment;
- Methodology for decommissioning, including the types of materials and techniques to be used.

Other optional information such as geological cross-sections or reference documents may be included.

The decommissioning plan must be submitted to the appropriate Branch Administrator in the Environmental Management Division, affixed with the applicable Departmental file number and professional seal. The plan will be co-reviewed by professional staff within the Environmental Management Division and within the Sciences and Planning Division. The Responsible Party or property owner and the Site Professional will be notified of the results of the Departmental review and given approval to proceed with decommissioning if the plan is found to be acceptable.

## Appendix C

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- Graphs and Charts
  - Well #1/#2
  - Well #3
  - Well #6
  - Well #8
  - Neighbour's Well
- Water Chemistry Results Summary

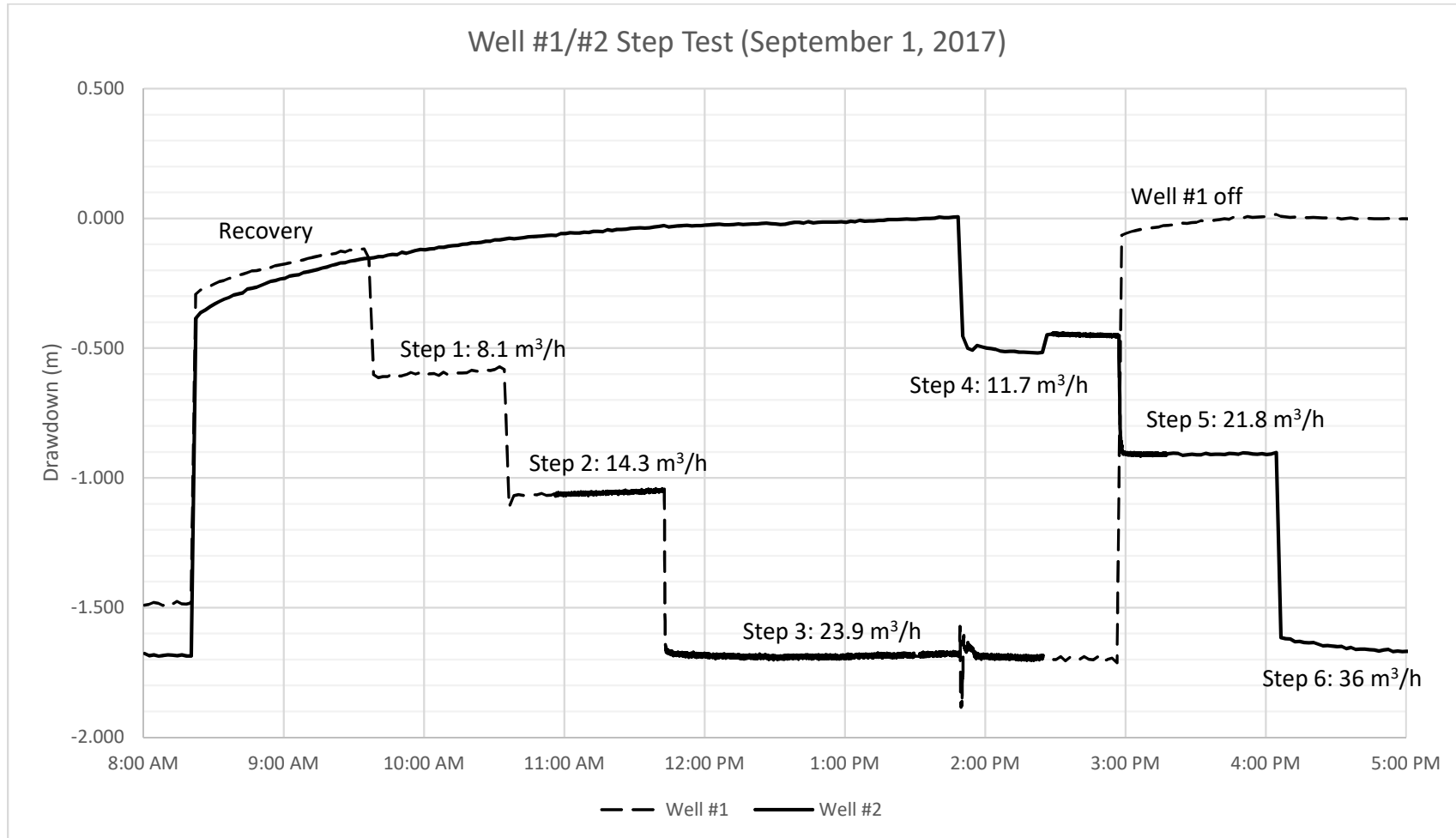


Figure C1: Water level in wells 1 and 2 during the step test. The slight deviations around 2:30 pm in the water level in well #2 is due to both wells discharging to a combined line, the variable frequency drives were adjusted on the wells so as to maintain a constant water level in well #1 (maintaining a constant flow) while monitoring the total flow rate to determine the flow rate from well #2.

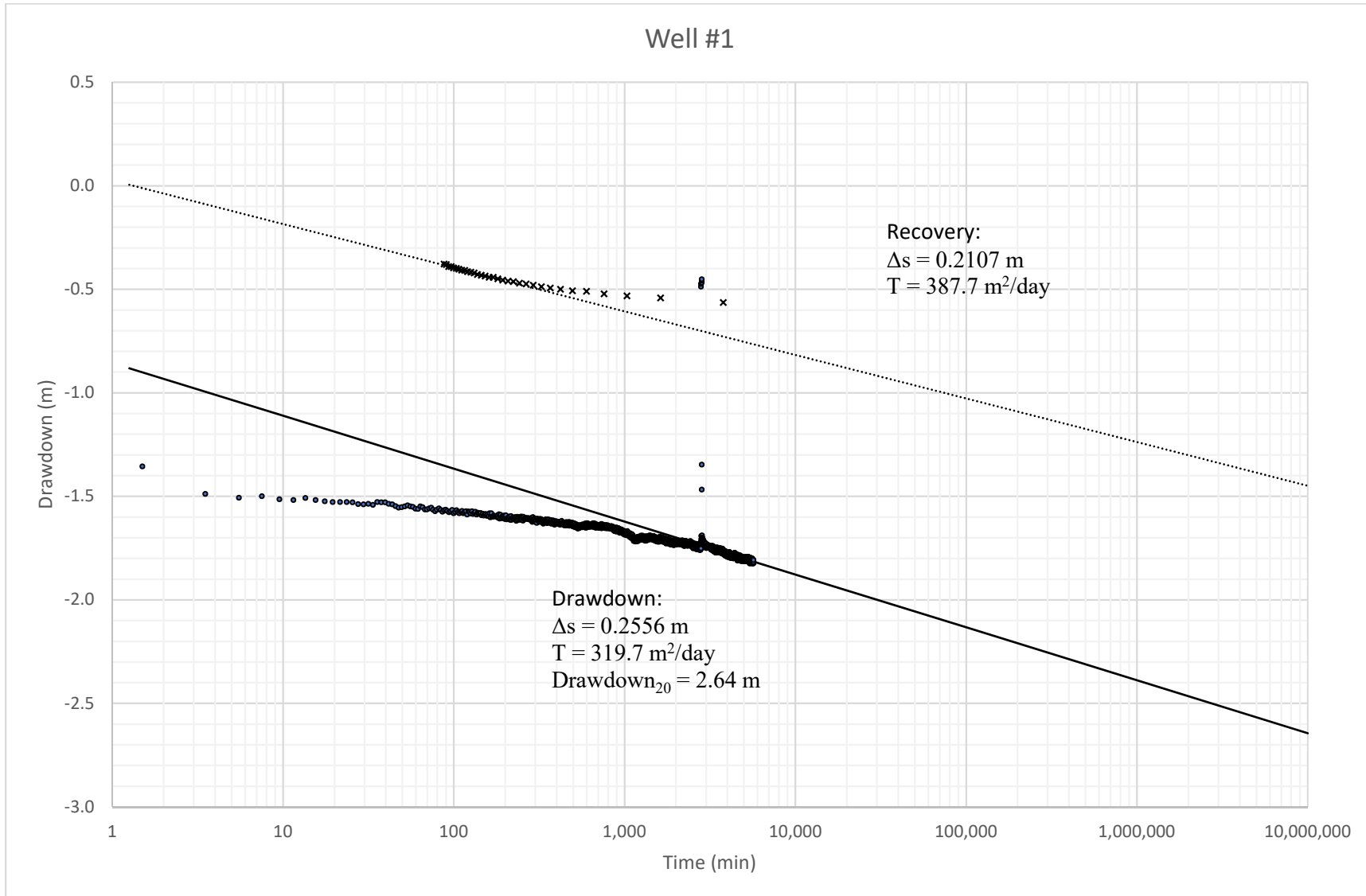


Figure C2: Constant rate drawdown test results for well #1 with the drawdown rate ( $\Delta s$ ) and transmissivity. The trendline was extended to 10,000,000 minutes (19 years) to estimate the 20-year drawdown ( $\text{Drawdown}_{20}$ ).



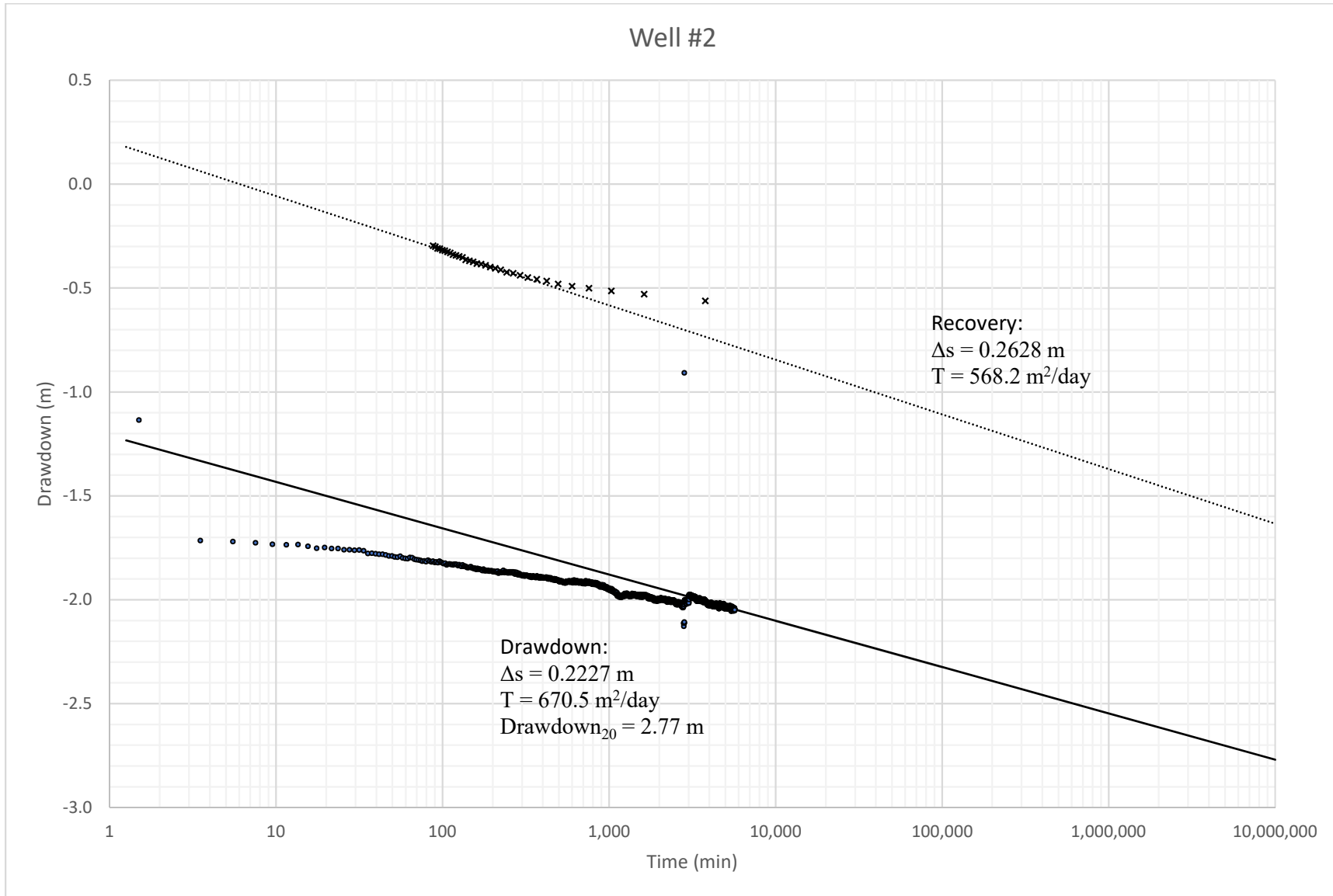


Figure C3: Constant rate drawdown test results for well #2 with the drawdown rate ( $\Delta s$ ) and transmissivity. The trendline was extended to 10,000,000 minutes (19 years) to estimate the 20-year drawdown ( $\text{Drawdown}_{20}$ ).

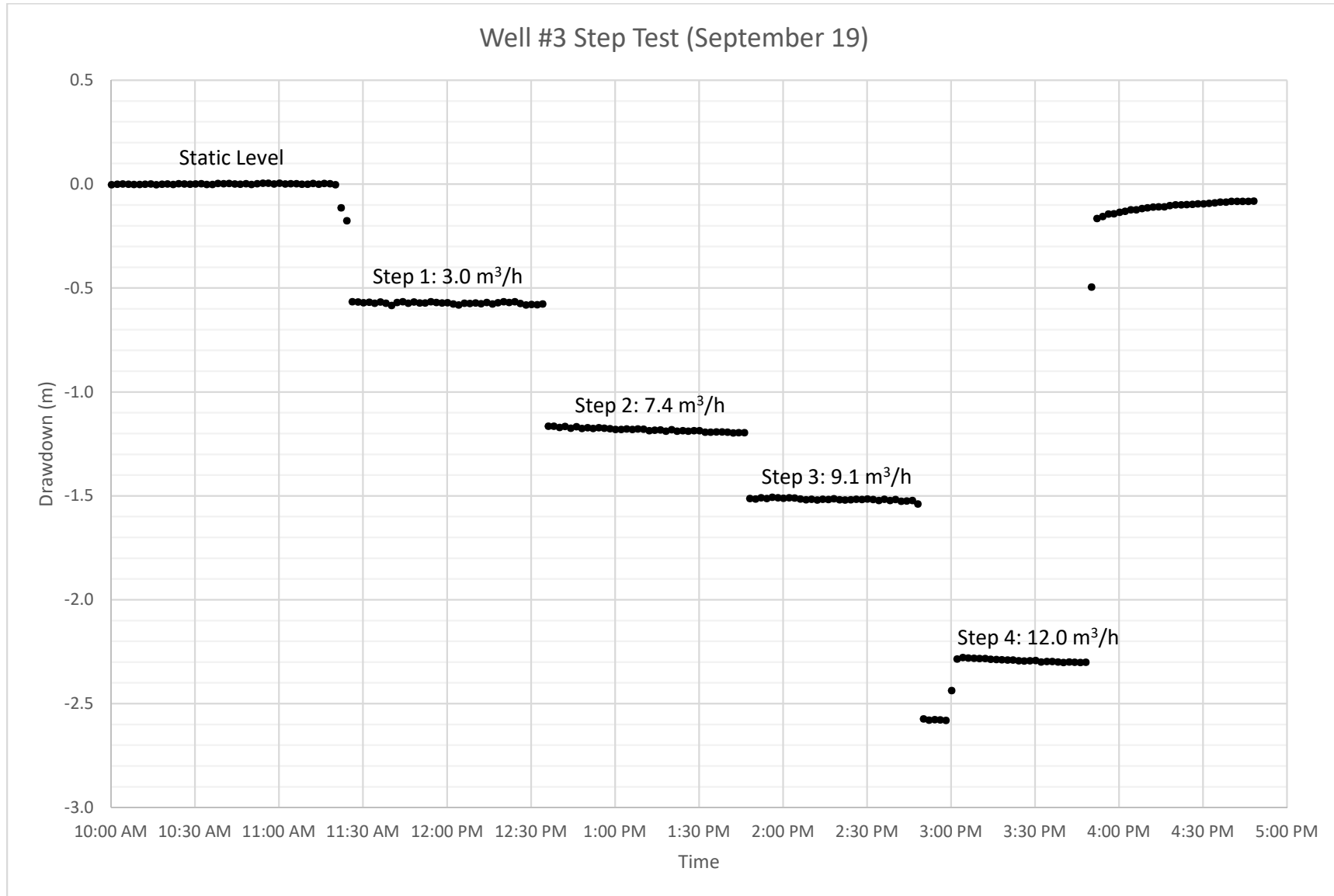


Figure C4: Drawdown in well #3 during the step test in which four steps were employed. The irregularity before 3:00 pm was a result of changing flows which stabilized at 3:00 pm.

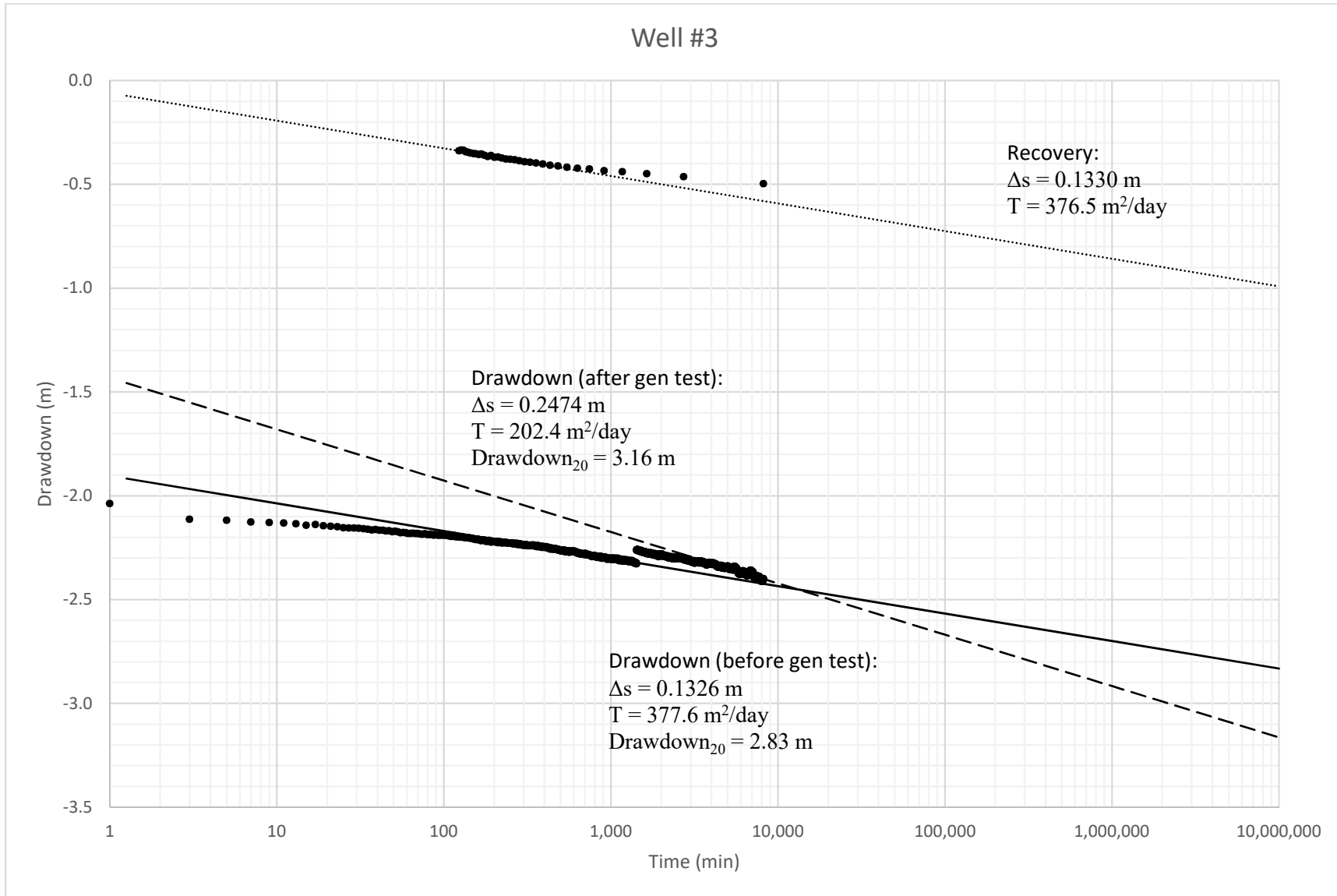


Figure C5: Constant rate drawdown test results for well #3 with the drawdown rate ( $\Delta s$ ) and transmissivity. The trendline was extended to 10,000,000 minutes (19 years) to estimate the 20-year drawdown ( $\text{Drawdown}_{20}$ ). The worst case trendline (after the generator test) was used for calculations.

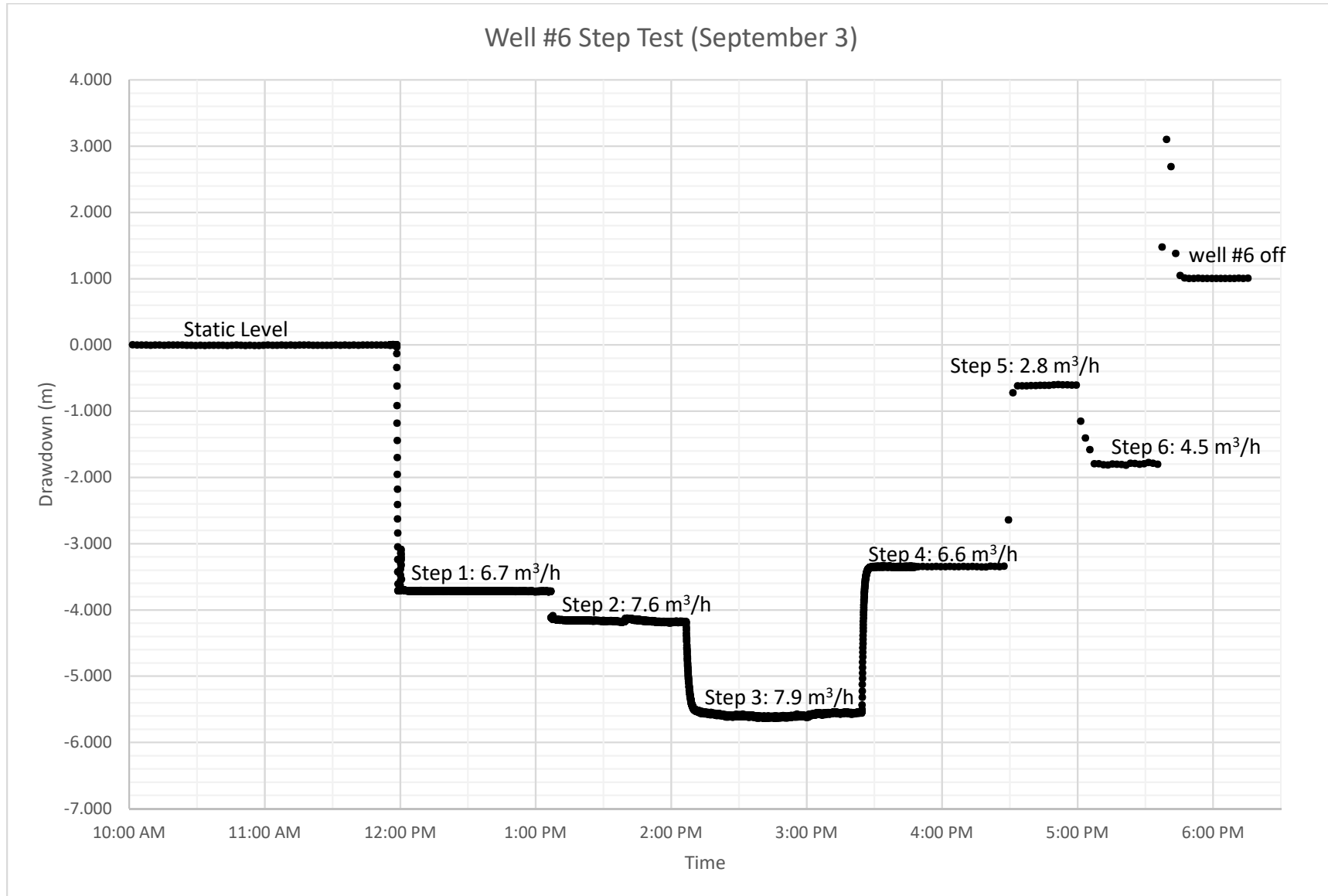


Figure C6: Drawdown in well #6 during the step test in which 6 steps were employed.

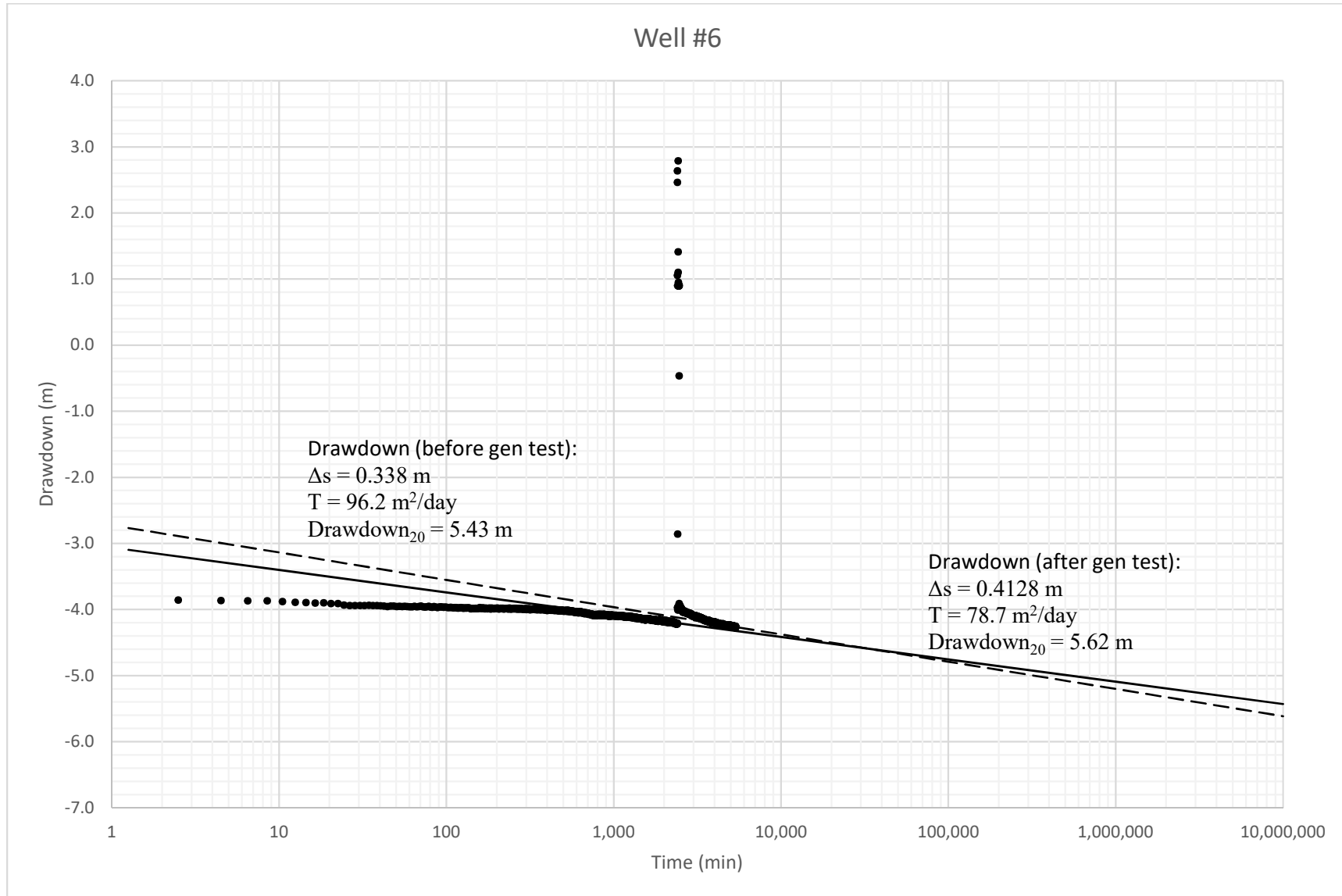


Figure C7: Constant rate drawdown test results for well #6 with the drawdown rate ( $\Delta s$ ) and transmissivity. The trendline was extended to 10,000,000 minutes (19 years) to estimate the 20-year drawdown ( $\text{Drawdown}_{20}$ ). The slopes of the trendlines before and after the generator test are similar and produce similar estimates of  $\text{Drawdown}_{20}$ .

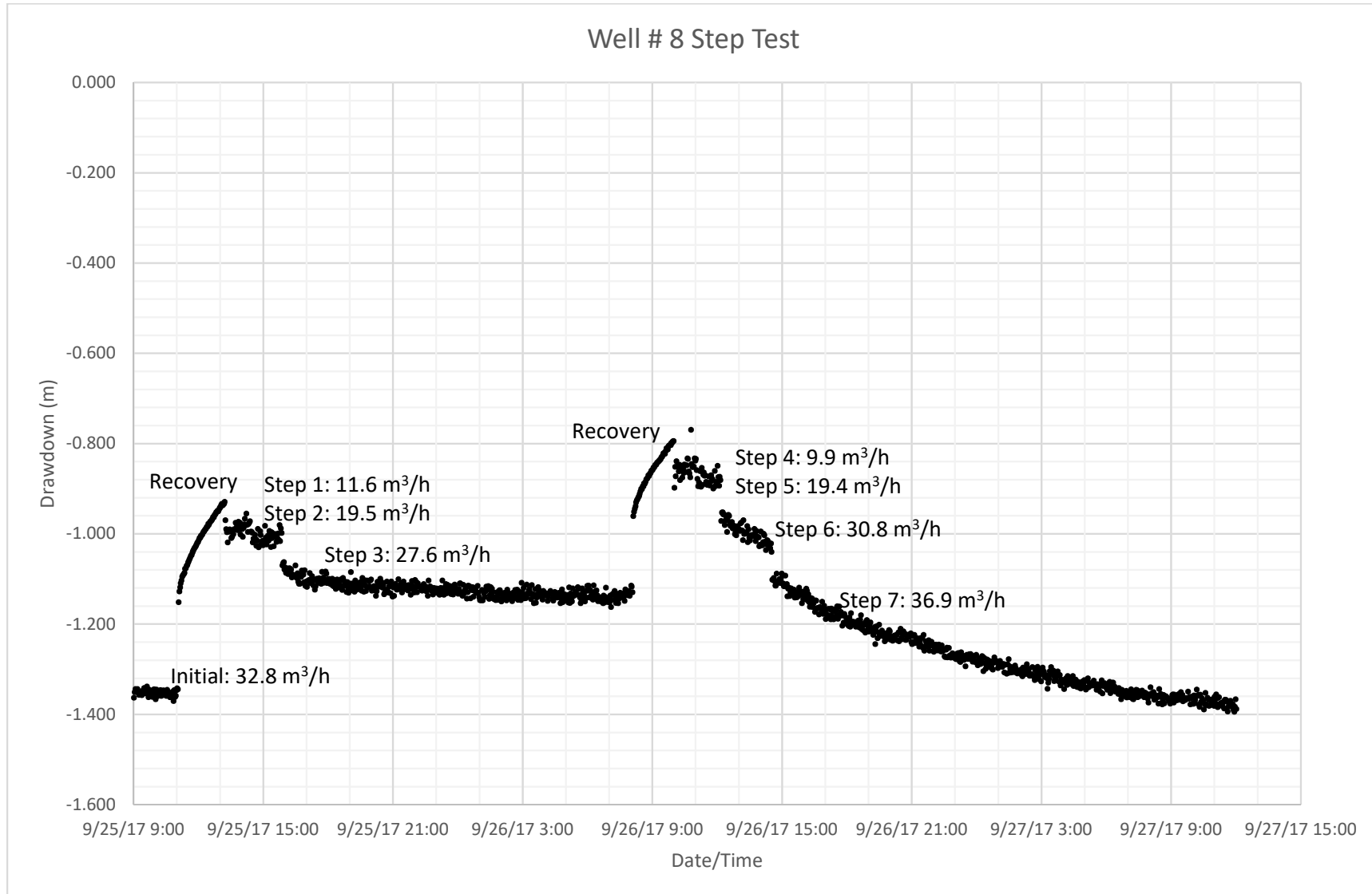


Figure C8: Drawdown in well #8 during the step test. Two step tests were conducted on two different days but the level did not stabilize in the typical 1-2 hour steps. A long term step test was conducted with three steps that were allowed to stabilize for an extended period of time. Both tests indicate that the pumping rates tested are within the capabilities of the well and aquifer.

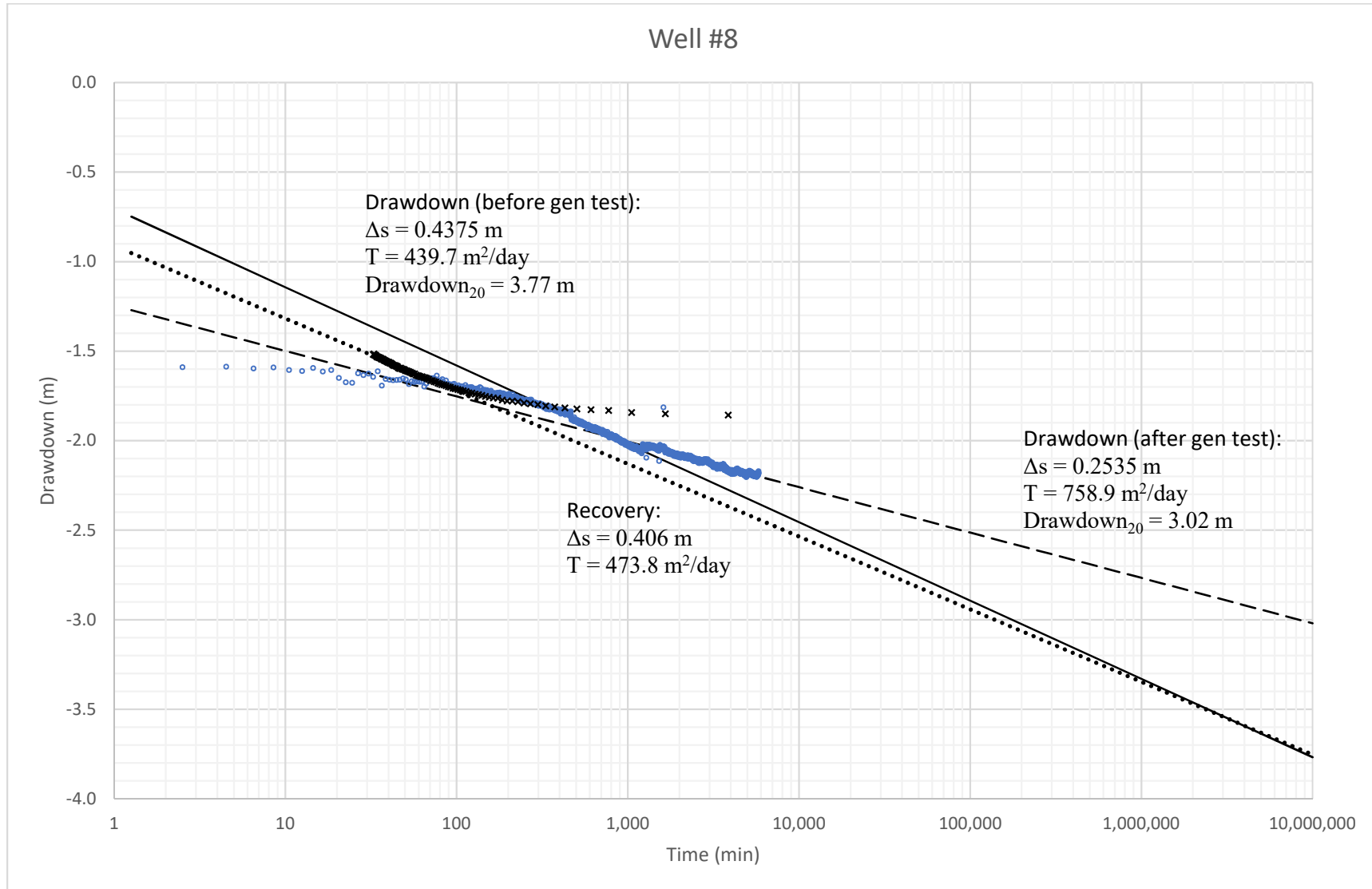


Figure C9: Constant rate drawdown test results for well #6 with the drawdown rate ( $\Delta s$ ) and transmissivity. The trendline was extended to 10,000,000 minutes (19 years) to estimate the 20-year drawdown ( $Drawdown_{20}$ ). Three trendlines are shown for before the generator test, after the generator test, and the recovery. The worst case trendline was used for calculations (before the generator test) resulting in a  $drawdown_{20}$  of 3.77m.



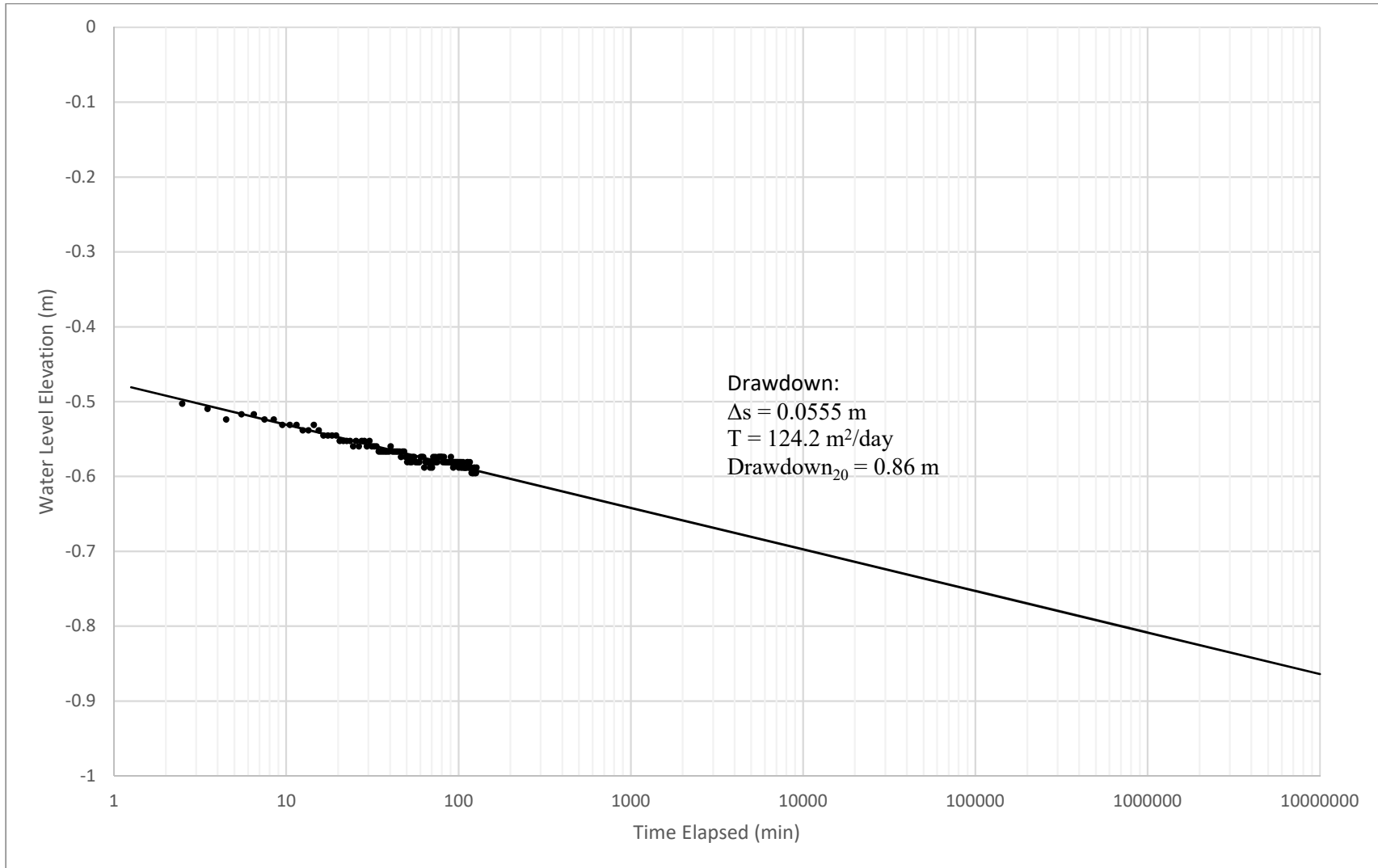


Figure C10: Constant rate drawdown test for the neighbour's well (2-hour pump test)

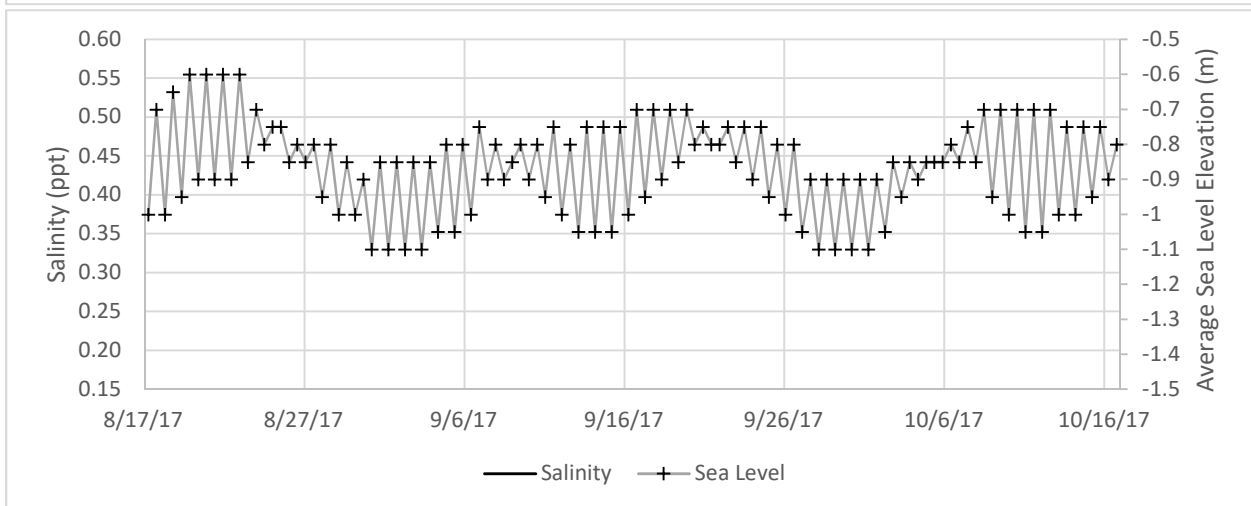
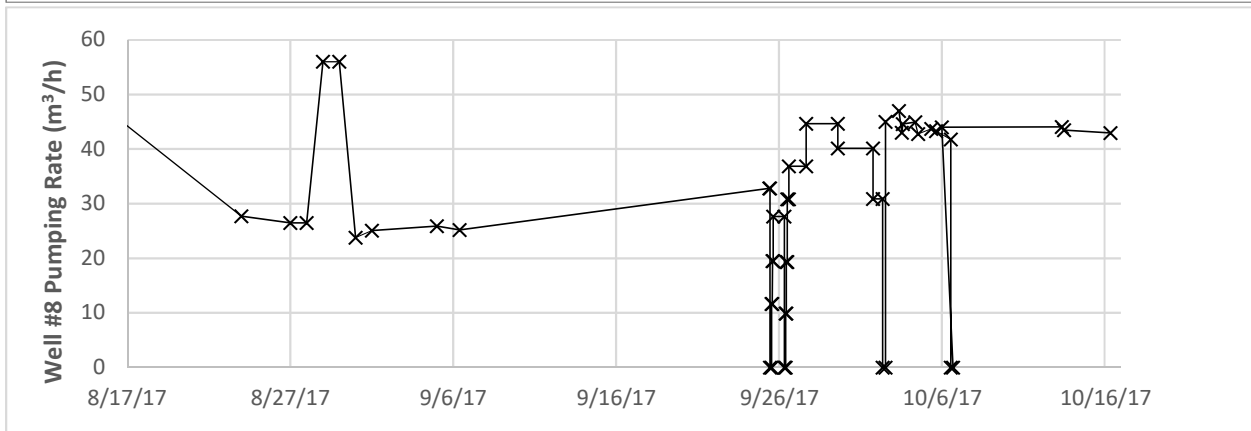
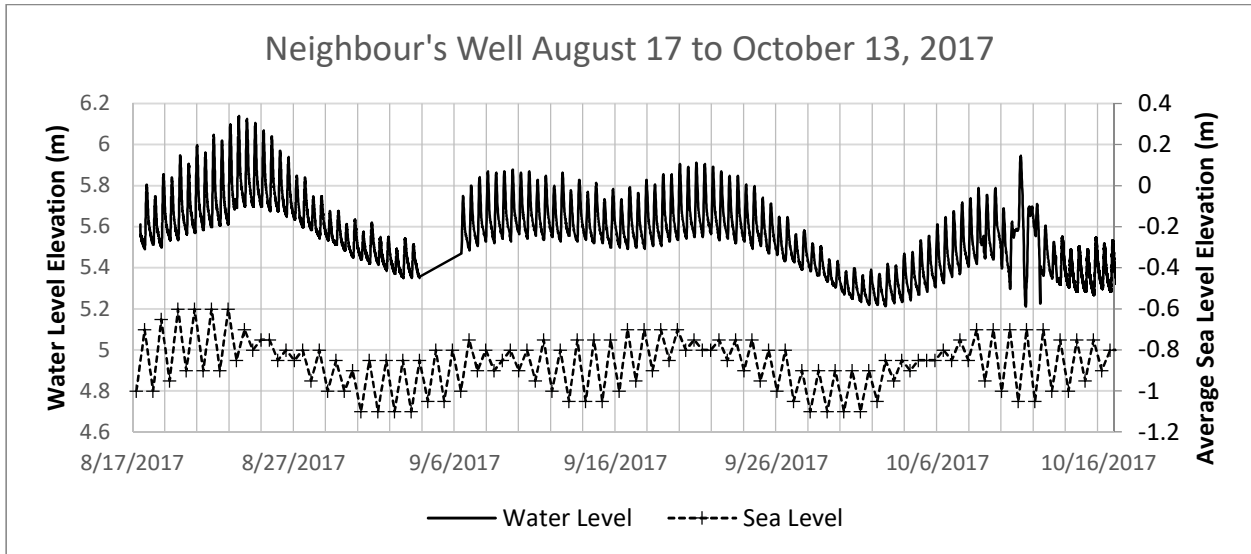


Figure C11: Water level in the neighbour's well vs time overlaid with the high tide heights for the same period (top) shows a direct tidal influence on water level in [REDACTED]

[REDACTED]

	AO/MAC	AQS	Units	Well 1/2			Well 2/3			Well 6			Well 8			
				24	48	72	24	48	72	24	48	72	24	48	72	
Alkalinity (as CaCO3)	-	50-300	mg/L	45	43	40	45	43	38	39	39	39	51	54	52	64
Chloride	250	-	mg/L	21.6	20.9	20	18.2	19.2	19.1	92.2	93.9	84	2930	2890	2980	106
Colour	15	-	TCU	<5	<5	<5	<5	<5	<5	<5	<5	<5	6	14	16	<5
Conductivity	-	-	µS/cm	190	191	191	183	187	187	412	418	443	9700	10000	10300	549
Fluoride	-	-	mg/L	0.11	0.1	0.1	0.12	0.12	0.12	0.1	0.11	0.09	0.47	0.48	0.48	0.18
Nitrate + Nitrate (N)	-	-	mg/L	0.14	0.14	0.12	0.21	0.19	0.18	1.12	1.09	1.03	1.2	0.09	0.11	0.27
pH	7.0-10.5	-	units	7.3	7.4	7.1	7.2	7.5	7.1	7.1	7.1	6.9	6.6	6.6	6.6	7.6
Phosphorus	-	<3.0	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05	<0.02	<0.02	<0.2	<0.2	<0.2	<0.02
r-Silica (as SiO2)	-	-	mg/L	10.5	10.3	11.1	10.7	10.7	10.7	10	10.2	10.8	12.2	12.3	12.4	11.3
Sulphate	500	<50	mg/L	11	11	11	12	11	11	14	14	13	390	400	410	36
Total Organic Carbon	-	-	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	0.9	0.8	<0.5	<0.5	<0.5	0.6
Turbidity	-	-	NTU	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.2	0.4	0.2	0.2
Hardness (as CaCO3)	-	>100	mg/L	54.4	54.3	53.8	53.9	55.1	55.1	88.1	87	90.3	1050	1060	1120	22.6
TDS (calc)	500	<400	mg/L	106	104	101	103	102	99	219	222	216	5220	5210	5420	305
Saturation pH (5°C)	-	-	units	8.7	8.7	8.7	8.7	8.7	8.8	8.5	8.6	8.5	8.2	8.2	8.2	9.1
Langelier Index (5°C)	-	-	-	-1.39	-1.31	-1.64	-1.49	-1.2	-1.65	-1.45	-1.46	-1.64	-1.6	-1.57	-1.57	-1.53
Salinity (Chloride)			ppt	0.04	0.03	0.03	0.03	0.03	0.03	0.15	0.15	0.14	4.83	4.76	4.91	0.17
Salinity (Sodium)			ppt	0.03	0.03	0.03	0.03	0.03	0.03	0.10	0.10	0.11	3.84	3.89	4.12	0.26
Aluminum	-	<0.01	mg/L	0.004	0.002	0.002	0.002	0.002	0.002	0.005	0.004	0.003	<0.01	<0.01	<0.01	0.001
Antimony	0.006	-	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.0001
Arsenic	0.01	<0.05	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	0.001
Barium	1	<5	mg/L	0.003	0.003	0.002	0.009	0.003	0.003	0.021	0.021	0.022	0.08	0.08	0.08	0.003
Boron	5	-	mg/L	0.006	0.006	0.006	0.007	0.007	0.007	0.008	0.008	0.007	0.59	0.59	0.63	0.069
Cadmium	0.005	0.049*	mg/L	0.00001	<0.00001	0.00002	0.00001	<0.00001	<0.00001	0.00003	0.0002	0.00003	0.0003	0.0003	0.0003	<0.00001
Calcium	-	160	mg/L	17.2	17.2	17.0	17.0	17.4	17.4	29.7	29.2	30.2	101	101	107	4.9
Chromium	0.05	-	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	<0.001
Copper	1	<1.3*	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.01	<0.01	<0.01	<0.001
Iron	0.3	<0.15	mg/L	<0.02	<0.02	<0.02	0.03	0.02	<0.02	0.02	0.03	0.02	0.7	0.5	0.6	0.07
Lead	0.01	<0.02	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.0001
Lithium	-	-	mg/L	0.0032	0.0032	0.0032	0.0031	0.0032	0.0032	0.0038	0.0037	0.0038	0.025	0.026	0.027	0.0035
Magnesium	-	<15	mg/L	2.77	2.75	2.75	2.77	2.82	2.84	3.39	3.43	3.62	193	195	207	2.52
Manganese	0.05	<0.01	mg/L	<0.001	<0.001	<0.001	0.02	0.001	<0.001	0.003	0.003	0.003	0.09	0.09	0.09	0.002
Molybdenum	-	-	mg/L	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	<0.001	<0.001	<0.001	0.0015
Nickel	-	<0.1	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	<0.001
Potassium	-	<5	mg/L	0.96	0.88	0.87	0.93	0.86	0.87	1.48	1.35	1.36	48.8	49.4	52.6	1.25
Selenium	0.05	<0.01	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	<0.001
Sodium	200	<75	mg/L	13.7	13.6	13.5	12.9	12.6	12.7	39.5	41	44.8	1510	1530	1620	102
Strontium	-	-	mg/L	0.085	0.086	0.086	0.083	0.085	0.086	0.233	0.225	0.229	1.44	1.47	1.55	0.035
Thallium	-	-	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.0001
Uranium	0.02	<0.1	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.0001
Vanadium	-	<0.1	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	<0.001
Zinc	5	17*	mg/L	0.003	<0.001	<0.001	0.002	<0.001	<0.001	0.003	0.003	0.003	<0.01	<0.01	<0.01	0.001
Total Coliforms			100 mL	0	0	0	0	0	0	0	0	0	0	0	0	
E. Coli			100 mL	0	0	0	0	0	0	0	0	0	0	0	0	

**Legend**

Max. Salinity (Calculated)

Exceeds Aesthetic Objective (AO)

or Maximum Acceptable Concentration (MAC)

Exceeds Aquaculture Standard (AQS) and/or all standards

\*Copper and Zinc AQS are based on a hardness of 10 mg/L

## Appendix D

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- St. Stephen 10-year Rainfall Data

Month/Year	January	February	March	April	May	June	July	August	September	October	November	December	March-Sept
<b>2017</b>	117.6	90.5	60.3	103	156.9	66.5	24.1	35.6	54.5	212	INCOMPLETE	INCOMPLETE	500.9
<b>2016</b>	96.9	128.4	81.1	77.4	47.6	74.2	99.2	85.9	36.2	91.2	58.9	141.7	501.6
<b>2015</b>	114.7	72.7	50.3	104.2	50.3	169.2	36.6	125.6	193.6	105.5	69.9	151.7	729.8
<b>2014</b>	108.9	73.1	104	110.7	84.1	112.5	213.2	99.4	55.7	178.3	140.1	197.5	779.6
<b>2013</b>	34.5	81.3	107.2	56.5	166.4	191	288.7	106.3	87.6	66.3	106.5	108.1	1003.7
<b>2012</b>	66.5	56.7	49.2	125.7	133.1	77.5	33.1	99	246.2	223.6	55.4	159.7	763.8
<b>2011</b>	56.9	88.5	121.2	108	127.4	85.1	125.6	156	51.9	113.6	87.7	109.8	775.2
<b>2010</b>	93.3	70.2	115.3	38.9	72.5	101.1	54.2	29.8	150	150.2	166.8	314.1	561.8
<b>2009</b>	80.1	73.6	77.5	126.5	96	149.3	105	123.3	50.6	195.2	97.1	114.7	728.2
<b>2008</b>	92	183	136.9	65.7	60.5	64.6	126.8	101.7	143.4	108.7	203.9	207	699.6
<b>2007</b>	89.7	47.2	112.7	165.9	84.6	56.5	71	81.7	66.1	103.7	186.5	110.1	638.5
<i>Average (2007-2016)</i>	83.4	87.5	95.5	98.0	92.3	108.1	115.3	100.9	108.1	133.6	117.3	161.4	718.2

Legend

Below 10 year average

## Appendix E

---

- Laboratory Results (RPC Fredericton)

Report ID: 248000-IAS  
 Report Date: 21-Sep-17  
 Date Received: 05-Sep-17

**CERTIFICATE OF ANALYSIS**

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7

**rpc**

921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

Location: Oak Bay NB

**Analysis of Potable Water**

RPC Sample ID:					248000-1
Client Sample ID:					Well 1/2 24hr
Date Sampled:					4-Sep-17
Analytes	Units	RL	MAC	AO	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	45
Chloride	mg/L	0.5	-	250	21.6
Colour	TCU	5	-	15	< 5
Conductivity	µS/cm	1	-	-	190
Fluoride	mg/L	0.05	1.5	-	0.11
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	0.14
pH	units	-	-	7.0 - 10.5	7.3
Phosphorus	mg/L	0.02	-	-	< 0.02
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	10.5
Sulfate	mg/L	1	-	500	11
Total Organic Carbon	mg/L	0.5	-	-	< 0.5
Turbidity	NTU	0.1	-	-	< 0.1
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	54.4
TDS (calc)	mg/L	-	-	500	106
Saturation pH (5°C)	units	-	-	-	8.7
Langelier Index (5°C)	-	-	-	-	-1.39

This report relates only to the sample(s) and information provided to the laboratory.

**RL = Reporting Limit; MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective**

Guidelines are from Guidelines for Canadian Drinking Water Quality (February 2017).



A. Ross Kean, M.Sc.  
 Department Head  
 Inorganic Analytical Chemistry

**POTABLE WATER CHEM**



Peter Crowhurst, B.Sc., C.Chem  
 Analytical Chemist  
 Inorganic Analytical Chemistry



Report ID: 248000-IAS  
 Report Date: 21-Sep-17  
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for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

Location: Oak Bay NB

**Analysis of Potable Water**

RPC Sample ID:					248000-2
Client Sample ID:					Well 6 24hr
Date Sampled:					4-Sep-17
Analytes	Units	RL	MAC	AO	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	39
Chloride	mg/L	0.5	-	250	92.2
Colour	TCU	5	-	15	< 5
Conductivity	µS/cm	1	-	-	412
Fluoride	mg/L	0.05	1.5	-	0.10
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	1.12
pH	units	-	-	7.0 - 10.5	7.1
Phosphorus	mg/L	0.02	-	-	0.05
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	10.0
Sulfate	mg/L	1	-	500	14
Total Organic Carbon	mg/L	0.5	-	-	0.8
Turbidity	NTU	0.1	-	-	< 0.1
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	88.1
TDS (calc)	mg/L	-	-	500	219
Saturation pH (5°C)	units	-	-	-	8.5
Langelier Index (5°C)	-	-	-	-	-1.45

This report relates only to the sample(s) and information provided to the laboratory.

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Guidelines are from Guidelines for Canadian Drinking Water Quality (February 2017).

Report ID: 248000-IAS  
 Report Date: 21-Sep-17  
 Date Received: 05-Sep-17

**CERTIFICATE OF ANALYSIS**

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

Location: Oak Bay NB

**Analysis of Potable Water**

RPC Sample ID:					248000-3
Client Sample ID:					Well 1/2 48Hr
Date Sampled:					5-Sep-17
Analytes	Units	RL	MAC	AO	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	43
Chloride	mg/L	0.5	-	250	20.9
Colour	TCU	5	-	15	< 5
Conductivity	µS/cm	1	-	-	191
Fluoride	mg/L	0.05	1.5	-	0.10
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	0.14
pH	units	-	-	7.0 - 10.5	7.4
Phosphorus	mg/L	0.02	-	-	< 0.02
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	10.3
Sulfate	mg/L	1	-	500	11
Total Organic Carbon	mg/L	0.5	-	-	< 0.5
Turbidity	NTU	0.1	-	-	< 0.1
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	54.3
TDS (calc)	mg/L	-	-	500	104
Saturation pH (5°C)	units	-	-	-	8.7
Langelier Index (5°C)	-	-	-	-	-1.31

This report relates only to the sample(s) and information provided to the laboratory.

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Report ID: 248000-IAS  
 Report Date: 21-Sep-17  
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**CERTIFICATE OF ANALYSIS**

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

Location: Oak Bay NB

**Analysis of Potable Water**

RPC Sample ID:					248000-4
Client Sample ID:					Well 6 48 Hr
Date Sampled:					5-Sep-17
Analytes	Units	RL	MAC	AO	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	39
Chloride	mg/L	0.5	-	250	93.9
Colour	TCU	5	-	15	< 5
Conductivity	µS/cm	1	-	-	418
Fluoride	mg/L	0.05	1.5	-	0.11
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	1.09
pH	units	-	-	7.0 - 10.5	7.1
Phosphorus	mg/L	0.02	-	-	< 0.02
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	10.2
Sulfate	mg/L	1	-	500	14
Total Organic Carbon	mg/L	0.5	-	-	0.9
Turbidity	NTU	0.1	-	-	0.2
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	87.0
TDS (calc)	mg/L	-	-	500	222
Saturation pH (5°C)	units	-	-	-	8.6
Langelier Index (5°C)	-	-	-	-	-1.46

This report relates only to the sample(s) and information provided to the laboratory.

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Guidelines are from Guidelines for Canadian Drinking Water Quality (February 2017).

Report ID: 248000-IAS  
 Report Date: 21-Sep-17  
 Date Received: 05-Sep-17

**CERTIFICATE OF ANALYSIS**

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

Location: Oak Bay NB

**Analysis of Metals in Potable Water**

RPC Sample ID:					248000-1
Client Sample ID:					Well 1/2 24hr
Date Sampled:					4-Sep-17
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	0.004
Antimony	mg/L	0.0001	0.006	-	< 0.0001
Arsenic	mg/L	0.001	0.01	-	< 0.001
Barium	mg/L	0.001	1	-	0.003
Boron	mg/L	0.001	5	-	0.006
Cadmium	mg/L	0.00001	0.005	-	0.00001
Calcium	mg/L	0.05	-	-	17.2
Chromium	mg/L	0.001	0.05	-	< 0.001
Copper	mg/L	0.001	-	1	0.001
Iron	mg/L	0.02	-	0.3	< 0.02
Lead	mg/L	0.0001	0.01	-	< 0.0001
Lithium	mg/L	0.0001	-	-	0.0032
Magnesium	mg/L	0.01	-	-	2.77
Manganese	mg/L	0.001	-	0.05	< 0.001
Molybdenum	mg/L	0.0001	-	-	0.0003
Nickel	mg/L	0.001	-	-	< 0.001
Potassium	mg/L	0.02	-	-	0.96
Selenium	mg/L	0.001	0.05	-	< 0.001
Sodium	mg/L	0.05	-	200	13.7
Strontium	mg/L	0.001	-	-	0.085
Thallium	mg/L	0.0001	-	-	< 0.0001
Uranium	mg/L	0.0001	0.02	-	< 0.0001
Vanadium	mg/L	0.001	-	-	< 0.001
Zinc	mg/L	0.001	-	5	0.003

Report ID: 248000-IAS  
 Report Date: 21-Sep-17  
 Date Received: 05-Sep-17

**CERTIFICATE OF ANALYSIS**

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

Location: Oak Bay NB

**Analysis of Metals in Potable Water**

RPC Sample ID:					248000-2
Client Sample ID:					Well 6 24hr
Date Sampled:					4-Sep-17
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	0.005
Antimony	mg/L	0.0001	0.006	-	< 0.0001
Arsenic	mg/L	0.001	0.01	-	< 0.001
Barium	mg/L	0.001	1	-	0.021
Boron	mg/L	0.001	5	-	0.008
Cadmium	mg/L	0.00001	0.005	-	0.00003
Calcium	mg/L	0.05	-	-	29.7
Chromium	mg/L	0.001	0.05	-	< 0.001
Copper	mg/L	0.001	-	1	0.001
Iron	mg/L	0.02	-	0.3	0.02
Lead	mg/L	0.0001	0.01	-	< 0.0001
Lithium	mg/L	0.0001	-	-	0.0038
Magnesium	mg/L	0.01	-	-	3.39
Manganese	mg/L	0.001	-	0.05	0.003
Molybdenum	mg/L	0.0001	-	-	0.0002
Nickel	mg/L	0.001	-	-	< 0.001
Potassium	mg/L	0.02	-	-	1.48
Selenium	mg/L	0.001	0.05	-	< 0.001
Sodium	mg/L	0.05	-	200	39.5
Strontium	mg/L	0.001	-	-	0.233
Thallium	mg/L	0.0001	-	-	< 0.0001
Uranium	mg/L	0.0001	0.02	-	< 0.0001
Vanadium	mg/L	0.001	-	-	< 0.001
Zinc	mg/L	0.001	-	5	0.003

Report ID: 248000-IAS  
 Report Date: 21-Sep-17  
 Date Received: 05-Sep-17

**CERTIFICATE OF ANALYSIS**

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

Location: Oak Bay NB

**Analysis of Metals in Potable Water**

RPC Sample ID:					248000-3
Client Sample ID:					Well 1/2 48Hr
Date Sampled:					5-Sep-17
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	0.002
Antimony	mg/L	0.0001	0.006	-	< 0.0001
Arsenic	mg/L	0.001	0.01	-	< 0.001
Barium	mg/L	0.001	1	-	0.003
Boron	mg/L	0.001	5	-	0.006
Cadmium	mg/L	0.00001	0.005	-	< 0.00001
Calcium	mg/L	0.05	-	-	17.2
Chromium	mg/L	0.001	0.05	-	< 0.001
Copper	mg/L	0.001	-	1	< 0.001
Iron	mg/L	0.02	-	0.3	< 0.02
Lead	mg/L	0.0001	0.01	-	< 0.0001
Lithium	mg/L	0.0001	-	-	0.0032
Magnesium	mg/L	0.01	-	-	2.75
Manganese	mg/L	0.001	-	0.05	< 0.001
Molybdenum	mg/L	0.0001	-	-	0.0003
Nickel	mg/L	0.001	-	-	< 0.001
Potassium	mg/L	0.02	-	-	0.88
Selenium	mg/L	0.001	0.05	-	< 0.001
Sodium	mg/L	0.05	-	200	13.6
Strontium	mg/L	0.001	-	-	0.086
Thallium	mg/L	0.0001	-	-	< 0.0001
Uranium	mg/L	0.0001	0.02	-	< 0.0001
Vanadium	mg/L	0.001	-	-	< 0.001
Zinc	mg/L	0.001	-	5	< 0.001

Report ID: 248000-IAS  
 Report Date: 21-Sep-17  
 Date Received: 05-Sep-17

**CERTIFICATE OF ANALYSIS**

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

Location: Oak Bay NB

**Analysis of Metals in Potable Water**

RPC Sample ID:					248000-4
Client Sample ID:					Well 6 48 Hr
Date Sampled:					5-Sep-17
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	0.004
Antimony	mg/L	0.0001	0.006	-	< 0.0001
Arsenic	mg/L	0.001	0.01	-	< 0.001
Barium	mg/L	0.001	1	-	0.021
Boron	mg/L	0.001	5	-	0.008
Cadmium	mg/L	0.00001	0.005	-	0.00002
Calcium	mg/L	0.05	-	-	29.2
Chromium	mg/L	0.001	0.05	-	< 0.001
Copper	mg/L	0.001	-	1	< 0.001
Iron	mg/L	0.02	-	0.3	0.03
Lead	mg/L	0.0001	0.01	-	< 0.0001
Lithium	mg/L	0.0001	-	-	0.0037
Magnesium	mg/L	0.01	-	-	3.43
Manganese	mg/L	0.001	-	0.05	0.003
Molybdenum	mg/L	0.0001	-	-	0.0002
Nickel	mg/L	0.001	-	-	< 0.001
Potassium	mg/L	0.02	-	-	1.35
Selenium	mg/L	0.001	0.05	-	< 0.001
Sodium	mg/L	0.05	-	200	41.0
Strontium	mg/L	0.001	-	-	0.225
Thallium	mg/L	0.0001	-	-	< 0.0001
Uranium	mg/L	0.0001	0.02	-	< 0.0001
Vanadium	mg/L	0.001	-	-	< 0.001
Zinc	mg/L	0.001	-	5	0.003



Report ID: 248000-IAS  
Report Date: 21-Sep-17  
Date Received: 05-Sep-17

## CERTIFICATE OF ANALYSIS

for  
Oak Bay Hatchery  
93 Oak Haven Road  
Oak Haven, NB E3L 3S7

**rpc**

921 College Hill Rd  
Fredericton NB  
Canada E3B 6Z9  
Tel: 506.452.1212  
Fax: 506.452.0594  
www.rpc.ca

### Methods

<u>Analyte</u>	<u>RPC SOP #</u>	<u>Method Reference</u>	<u>Method Principle</u>
pH	4.M03	APHA 4500-H <sup>+</sup> B	pH Electrode - Electrometric
Alkalinity (as CaCO <sub>3</sub> )	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Fluoride	4.M30	APHA 4500-F- D	SPADNS Colourimetry
Sulfate	4.M45	APHA 4500-SO <sub>4</sub> E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO <sub>3</sub> H	Hydrazine Red., Derivitization, Colourimetry
r-Silica (as SiO <sub>2</sub> )	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	4.M06	APHA 2130 B	Nephelometry
Colour	4.M55	APHA 2020 Color (A,C)	Single Wavelength Spectrophotometry
Conductivity	4.M04	APHA 2510 B	Conductivity Meter, Pt Electrode
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

## CERTIFICATE OF ANALYSIS / CERTIFICAT D'ANALYSE

for/pour  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1368  
 Fax: 506.452.1395  
 www.rpc.ca

Attention: Brian Donnelly

Client Location: Oak Bay NB  
 Microbiological Examination of Water/Qualité microbiologique de l'eau potable

RPC Sample ID/No. d'échantillon de RPC:				248000-1	248000-2	248000-3	248000-4
Client Sample ID/ID d'échantillon du client:				Well 1/2 24hr	Well 6 24hr	Well 1/2 48Hr	Well 6 48 Hr
Date collected/Date du prélèvement				4-Sep-17	4-Sep-17	5-Sep-17	5-Sep-17
Time sampled/Heure du prélèvement				4:10:00 PM	4:20:00 PM	2:05:00 PM	1:45:00 PM
Analytes/Paramètre(s)	Method/Méthode	Date Analyzed Date Analysé	Units Unités				
Total Coliforms/Coliformes totaux	FFA10	5-Sep-17	100mL	0	0	0	0
E. coli	FFA10	5-Sep-17	100mL	0	0	0	0

This report relates only to the sample(s) and information provided to the laboratory.

Tests were performed according to the corresponding Compendium of Analytical Methods, Health Protection Branch and/or AOAC Official Methods.

Le présent rapport ne s'applique qu'aux échantillons et à l'information transmis au laboratoire.

Les analyses ont été menées conformément au Compendium de méthodes pour l'analyse correspondant ou aux méthodes officielles de la Direction générale de la protection de la santé ou de l'Association of Official Analytical Chemists (AOAC).

Cathy Hay  
 Microbiology Supervisor  
 Food, Fisheries & Aquaculture

Gillian Hodges  
 Microbiology Technician  
 Food, Fisheries & Aquaculture

Report ID: 248300-IAS  
Report Date: 21-Sep-17  
Date Received: 07-Sep-17

### CERTIFICATE OF ANALYSIS

for  
Oak Bay Hatchery  
93 Oak Haven Road  
Oak Haven, NB E3L 3S7

**rpc**

921 College Hill Rd  
Fredericton NB  
Canada E3B 6Z9  
Tel: 506.452.1212  
Fax: 506.452.0594  
www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

#### Analysis of Potable Water

RPC Sample ID:					248300-1
Client Sample ID:					Well 6 72hr
Date Sampled:					6-Sep-17
Analytes	Units	RL	MAC	AO	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	39
Chloride	mg/L	0.5	-	250	84
Colour	TCU	5	-	15	< 5
Conductivity	µS/cm	1	-	-	443
Fluoride	mg/L	0.05	1.5	-	0.09
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	1.03
pH	units	-	-	7.0 - 10.5	6.9
Phosphorus	mg/L	0.02	-	-	< 0.02
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	10.8
Sulfate	mg/L	1	-	500	13
Total Organic Carbon	mg/L	0.5	-	-	0.8
Turbidity	NTU	0.1	-	-	< 0.1
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	90.3
TDS (calc)	mg/L	-	-	500	216
Saturation pH (5°C)	units	-	-	-	8.5
Langelier Index (5°C)	-	-	-	-	-1.64

This report relates only to the sample(s) and information provided to the laboratory.

**RL = Reporting Limit; MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective**

Guidelines are from Guidelines for Canadian Drinking Water Quality (February 2017).



A. Ross Kean, M.Sc.  
Department Head  
Inorganic Analytical Chemistry

**POTABLE WATER CHEM**

Page 1 of 5



Peter Crowhurst, B.Sc., C.Chem  
Analytical Chemist  
Inorganic Analytical Chemistry

Report ID: 248300-IAS  
 Report Date: 21-Sep-17  
 Date Received: 07-Sep-17

**CERTIFICATE OF ANALYSIS**

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

**Analysis of Potable Water**

RPC Sample ID:					248300-2
Client Sample ID:					Well 1/2 72hr
Date Sampled:					6-Sep-17
Analytes	Units	RL	MAC	AO	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	40
Chloride	mg/L	0.5	-	250	20.0
Colour	TCU	5	-	15	< 5
Conductivity	µS/cm	1	-	-	191
Fluoride	mg/L	0.05	1.5	-	0.10
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	0.12
pH	units	-	-	7.0 - 10.5	7.1
Phosphorus	mg/L	0.02	-	-	< 0.02
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	11.1
Sulfate	mg/L	1	-	500	11
Total Organic Carbon	mg/L	0.5	-	-	< 0.5
Turbidity	NTU	0.1	-	-	0.2
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	53.8
TDS (calc)	mg/L	-	-	500	101
Saturation pH (5°C)	units	-	-	-	8.7
Langelier Index (5°C)	-	-	-	-	-1.64

This report relates only to the sample(s) and information provided to the laboratory.

**RL = Reporting Limit; MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective**

Guidelines are from Guidelines for Canadian Drinking Water Quality (February 2017).

Report ID: 248300-IAS  
 Report Date: 21-Sep-17  
 Date Received: 07-Sep-17

**CERTIFICATE OF ANALYSIS**

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

**Analysis of Metals in Potable Water**

RPC Sample ID:					248300-1
Client Sample ID:					Well 6 72hr
Date Sampled:					6-Sep-17
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	0.003
Antimony	mg/L	0.0001	0.006	-	< 0.0001
Arsenic	mg/L	0.001	0.01	-	< 0.001
Barium	mg/L	0.001	1	-	0.022
Boron	mg/L	0.001	5	-	0.007
Cadmium	mg/L	0.00001	0.005	-	0.00003
Calcium	mg/L	0.05	-	-	30.2
Chromium	mg/L	0.001	0.05	-	< 0.001
Copper	mg/L	0.001	-	1	< 0.001
Iron	mg/L	0.02	-	0.3	0.02
Lead	mg/L	0.0001	0.01	-	< 0.0001
Lithium	mg/L	0.0001	-	-	0.0038
Magnesium	mg/L	0.01	-	-	3.62
Manganese	mg/L	0.001	-	0.05	0.003
Molybdenum	mg/L	0.0001	-	-	0.0002
Nickel	mg/L	0.001	-	-	< 0.001
Potassium	mg/L	0.02	-	-	1.36
Selenium	mg/L	0.001	0.05	-	< 0.001
Sodium	mg/L	0.05	-	200	44.8
Strontium	mg/L	0.001	-	-	0.229
Thallium	mg/L	0.0001	-	-	< 0.0001
Uranium	mg/L	0.0001	0.02	-	< 0.0001
Vanadium	mg/L	0.001	-	-	< 0.001
Zinc	mg/L	0.001	-	5	0.001

Report ID: 248300-IAS  
 Report Date: 21-Sep-17  
 Date Received: 07-Sep-17

**CERTIFICATE OF ANALYSIS**

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
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 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Brian Donnelly  
 Project #: Not Available

**Analysis of Metals in Potable Water**

RPC Sample ID:					248300-2
Client Sample ID:					Well 1/2 72hr
Date Sampled:					6-Sep-17
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	0.002
Antimony	mg/L	0.0001	0.006	-	< 0.0001
Arsenic	mg/L	0.001	0.01	-	< 0.001
Barium	mg/L	0.001	1	-	0.002
Boron	mg/L	0.001	5	-	0.006
Cadmium	mg/L	0.00001	0.005	-	0.00002
Calcium	mg/L	0.05	-	-	17.0
Chromium	mg/L	0.001	0.05	-	< 0.001
Copper	mg/L	0.001	-	1	< 0.001
Iron	mg/L	0.02	-	0.3	< 0.02
Lead	mg/L	0.0001	0.01	-	< 0.0001
Lithium	mg/L	0.0001	-	-	0.0032
Magnesium	mg/L	0.01	-	-	2.75
Manganese	mg/L	0.001	-	0.05	< 0.001
Molybdenum	mg/L	0.0001	-	-	0.0003
Nickel	mg/L	0.001	-	-	< 0.001
Potassium	mg/L	0.02	-	-	0.87
Selenium	mg/L	0.001	0.05	-	< 0.001
Sodium	mg/L	0.05	-	200	13.5
Strontium	mg/L	0.001	-	-	0.086
Thallium	mg/L	0.0001	-	-	< 0.0001
Uranium	mg/L	0.0001	0.02	-	< 0.0001
Vanadium	mg/L	0.001	-	-	< 0.001
Zinc	mg/L	0.001	-	5	< 0.001

Report ID: 248300-IAS  
Report Date: 21-Sep-17  
Date Received: 07-Sep-17

## CERTIFICATE OF ANALYSIS

for  
Oak Bay Hatchery  
93 Oak Haven Road  
Oak Haven, NB E3L 3S7

**rpc**

921 College Hill Rd  
Fredericton NB  
Canada E3B 6Z9  
Tel: 506.452.1212  
Fax: 506.452.0594  
www.rpc.ca

### Methods

<u>Analyte</u>	<u>RPC SOP #</u>	<u>Method Reference</u>	<u>Method Principle</u>
pH	4.M03	APHA 4500-H <sup>+</sup> B	pH Electrode - Electrometric
Alkalinity (as CaCO <sub>3</sub> )	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Fluoride	4.M30	APHA 4500-F- D	SPADNS Colourimetry
Sulfate	4.M45	APHA 4500-SO <sub>4</sub> E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO <sub>3</sub> H	Hydrazine Red., Derivitization, Colourimetry
r-Silica (as SiO <sub>2</sub> )	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	4.M06	APHA 2130 B	Nephelometry
Colour	4.M55	APHA 2020 Color (A,C)	Single Wavelength Spectrophotometry
Conductivity	4.M04	APHA 2510 B	Conductivity Meter, Pt Electrode
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

## CERTIFICATE OF ANALYSIS / CERTIFICAT D'ANALYSE

for/pour  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1368  
 Fax: 506.452.1395  
 www.rpc.ca

Attention: Brian Donnelly

### Microbiological Examination of Water/Qualité microbiologique de l'eau potable

RPC Sample ID/No. d'échantillon de RPC:				248300-1	248300-2
Client Sample ID/ID d'échantillon du client:				Well 1/2 72hr	Well 6 72hr
Date collected/Date du prélèvement				6-Sep-17	6-Sep-17
Time sampled/Heure du prélèvement				4:00:00 PM	4:10:00 PM
Analytes/Paramètre(s)	Method/Méthode	Date Analyzed Date Analysé	Units Unités		
Total Coliforms/Coliformes totaux	FFA10	7-Sep-17	100mL	0	0
E. coli	FFA10	7-Sep-17	100mL	0	0

This report relates only to the sample(s) and information provided to the laboratory.

Tests were performed according to the corresponding Compendium of Analytical Methods, Health Protection Branch and/or AOAC Official Methods.

Le présent rapport ne s'applique qu'aux échantillons et à l'information transmis au laboratoire.

Les analyses ont été menées conformément au Compendium de méthodes pour l'analyse correspondant ou aux méthodes officielles de la Direction générale de la protection de la santé ou de l'Association of Official Analytical Chemists (AOAC).

Cathy Hay  
 Microbiology Supervisor  
 Food, Fisheries & Aquaculture

Gillian Hodges  
 Microbiology Technician  
 Food, Fisheries & Aquaculture



Report ID: 250072-IAS  
Report Date: 02-Oct-17  
Date Received: 21-Sep-17

## CERTIFICATE OF ANALYSIS

for  
Oak Bay Hatchery  
93 Oak Haven Road  
Oak Haven, NB E3L 3S7

**rpc**

921 College Hill Rd  
Fredericton NB  
Canada E3B 6Z9  
Tel: 506.452.1212  
Fax: 506.452.0594  
www.rpc.ca

Attention: Brian Donnelly  
**Project #: Not Available**

### Analysis of Potable Water

RPC Sample ID:						250072-1
Client Sample ID:						Well 3 24h
Date Sampled:						20-Sep-17
Analytes	Units	RL	MAC	AO		
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	45	
Chloride	mg/L	0.5	-	250	18.2	
Colour	TCU	5	-	15	< 5	
Conductivity	µS/cm	1	-	-	183	
Fluoride	mg/L	0.05	1.5	-	0.12	
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	0.21	
pH	units	-	-	7.0 - 10.5	7.2	
Phosphorus	mg/L	0.02	-	-	< 0.02	
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	10.7	
Sulfate	mg/L	1	-	500	12	
Total Organic Carbon	mg/L	0.5	-	-	< 0.5	
Turbidity	NTU	0.1	-	-	< 0.1	
Calculated Parameters						
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	53.9	
TDS (calc)	mg/L	-	-	500	103	
Saturation pH (5°C)	units	-	-	-	8.7	
Langelier Index (5°C)	-	-	-	-	-1.49	

This report relates only to the sample(s) and information provided to the laboratory.

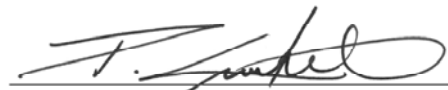
**RL = Reporting Limit; MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective**

Guidelines are from Guidelines for Canadian Drinking Water Quality (February 2017).



A. Ross Kean, M.Sc.  
Department Head  
Inorganic Analytical Chemistry

**POTABLE WATER CHEM**  
Page 1 of 5



Peter Crowhurst, B.Sc., C.Chem  
Analytical Chemist  
Inorganic Analytical Chemistry

Report ID: 250072-IAS  
 Report Date: 02-Oct-17  
 Date Received: 21-Sep-17

## CERTIFICATE OF ANALYSIS

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

### Analysis of Potable Water

RPC Sample ID:					250072-2
Client Sample ID:					Well 3 48h
Date Sampled:					21-Sep-17
Analytes	Units	RL	MAC	AO	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	43
Chloride	mg/L	0.5	-	250	19.2
Colour	TCU	5	-	15	< 5
Conductivity	µS/cm	1	-	-	187
Fluoride	mg/L	0.05	1.5	-	0.12
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	0.19
pH	units	-	-	7.0 - 10.5	7.5
Phosphorus	mg/L	0.02	-	-	< 0.02
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	10.7
Sulfate	mg/L	1	-	500	11
Total Organic Carbon	mg/L	0.5	-	-	< 0.5
Turbidity	NTU	0.1	-	-	< 0.1
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	55.1
TDS (calc)	mg/L	-	-	500	102
Saturation pH (5°C)	units	-	-	-	8.7
Langelier Index (5°C)	-	-	-	-	-1.20

This report relates only to the sample(s) and information provided to the laboratory.

**RL = Reporting Limit; MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective**

Guidelines are from Guidelines for Canadian Drinking Water Quality (February 2017).

Report ID: 250072-IAS  
 Report Date: 02-Oct-17  
 Date Received: 21-Sep-17

## CERTIFICATE OF ANALYSIS

for  
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 Tel: 506.452.1212  
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 www.rpc.ca

Attention: Brian Donnelly  
**Project #: Not Available**

### Analysis of Metals in Potable Water

RPC Sample ID:					250072-1
Client Sample ID:					Well 3 24h
Date Sampled:					20-Sep-17
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	0.002
Antimony	mg/L	0.0001	0.006	-	< 0.0001
Arsenic	mg/L	0.001	0.01	-	< 0.001
Barium	mg/L	0.001	1	-	0.009
Boron	mg/L	0.001	5	-	0.007
Cadmium	mg/L	0.00001	0.005	-	0.00001
Calcium	mg/L	0.05	-	-	17.0
Chromium	mg/L	0.001	0.05	-	< 0.001
Copper	mg/L	0.001	-	1	< 0.001
Iron	mg/L	0.02	-	0.3	0.03
Lead	mg/L	0.0001	0.01	-	< 0.0001
Lithium	mg/L	0.0001	-	-	0.0031
Magnesium	mg/L	0.01	-	-	2.77
Manganese	mg/L	0.001	-	0.05	0.002
Molybdenum	mg/L	0.0001	-	-	0.0002
Nickel	mg/L	0.001	-	-	< 0.001
Potassium	mg/L	0.02	-	-	0.93
Selenium	mg/L	0.001	0.05	-	< 0.001
Sodium	mg/L	0.05	-	200	12.9
Strontium	mg/L	0.001	-	-	0.083
Thallium	mg/L	0.0001	-	-	< 0.0001
Uranium	mg/L	0.0001	0.02	-	< 0.0001
Vanadium	mg/L	0.001	-	-	< 0.001
Zinc	mg/L	0.001	-	5	0.002

Report ID: 250072-IAS  
 Report Date: 02-Oct-17  
 Date Received: 21-Sep-17

## CERTIFICATE OF ANALYSIS

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



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 Tel: 506.452.1212  
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 www.rpc.ca

Attention: Brian Donnelly  
**Project #: Not Available**

### Analysis of Metals in Potable Water

RPC Sample ID:					250072-2
Client Sample ID:					Well 3 48h
Date Sampled:					21-Sep-17
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	0.002
Antimony	mg/L	0.0001	0.006	-	< 0.0001
Arsenic	mg/L	0.001	0.01	-	< 0.001
Barium	mg/L	0.001	1	-	0.003
Boron	mg/L	0.001	5	-	0.007
Cadmium	mg/L	0.00001	0.005	-	< 0.00001
Calcium	mg/L	0.05	-	-	17.4
Chromium	mg/L	0.001	0.05	-	< 0.001
Copper	mg/L	0.001	-	1	< 0.001
Iron	mg/L	0.02	-	0.3	< 0.02
Lead	mg/L	0.0001	0.01	-	< 0.0001
Lithium	mg/L	0.0001	-	-	0.0032
Magnesium	mg/L	0.01	-	-	2.82
Manganese	mg/L	0.001	-	0.05	0.001
Molybdenum	mg/L	0.0001	-	-	0.0002
Nickel	mg/L	0.001	-	-	< 0.001
Potassium	mg/L	0.02	-	-	0.86
Selenium	mg/L	0.001	0.05	-	< 0.001
Sodium	mg/L	0.05	-	200	12.6
Strontium	mg/L	0.001	-	-	0.085
Thallium	mg/L	0.0001	-	-	< 0.0001
Uranium	mg/L	0.0001	0.02	-	< 0.0001
Vanadium	mg/L	0.001	-	-	< 0.001
Zinc	mg/L	0.001	-	5	< 0.001

Report ID: 250072-IAS  
Report Date: 02-Oct-17  
Date Received: 21-Sep-17

## CERTIFICATE OF ANALYSIS

for  
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### Methods

<u>Analyte</u>	<u>RPC SOP #</u>	<u>Method Reference</u>	<u>Method Principle</u>
pH	4.M03	APHA 4500-H <sup>+</sup> B	pH Electrode - Electrometric
Alkalinity (as CaCO <sub>3</sub> )	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Fluoride	4.M30	APHA 4500-F- D	SPADNS Colourimetry
Sulfate	4.M45	APHA 4500-SO <sub>4</sub> E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO <sub>3</sub> H	Hydrazine Red., Derivization, Colourimetry
r-Silica (as SiO <sub>2</sub> )	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	4.M06	APHA 2130 B	Nephelometry
Colour	4.M55	APHA 2020 Color (A,C)	Single Wavelength Spectrophotometry
Conductivity	4.M04	APHA 2510 B	Conductivity Meter, Pt Electrode
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

## CERTIFICATE OF ANALYSIS / CERTIFICAT D'ANALYSE

for/pour  
Oak Bay Hatchery  
93 Oak Haven Road  
Oak Haven, NB E3L 3S7

**rpc**

921 College Hill Rd  
Fredericton NB  
Canada E3B 6Z9  
Tel: 506.452.1368  
Fax: 506.452.1395  
www.rpc.ca

Attention: Brian Donnelly

### Microbiological Examination of Water/Qualité microbiologique de l'eau potable

RPC Sample ID/No. d'échantillon de RPC:				250072-1	250072-2
Client Sample ID/ID d'échantillon du client:				Well 3 24h	Well 3 48h
Date collected/Date du prélèvement				20-Sep-17	21-Sep-17
Time sampled/Heure du prélèvement				4:25:00 PM	12:50:00 PM
Analytes/Paramètre(s)	Method/Méthode	Date Analyzed Date Analysé	Units Unités		
Total Coliforms/Coliformes totaux	FFA10	21-Sep-17	100mL	0	0
E. coli	FFA10	21-Sep-17	100mL	0	0

This report relates only to the sample(s) and information provided to the laboratory.

Tests were performed according to the corresponding Compendium of Analytical Methods, Health Protection Branch and/or AOAC Official Methods.

Le présent rapport ne s'applique qu'aux échantillons et à l'information transmis au laboratoire.

Les analyses ont été menées conformément au Compendium de méthodes pour l'analyse correspondant ou aux méthodes officielles de la Direction générale de la protection de la santé ou de l'Association of Official Analytical Chemists (AOAC).



Cathy Hay  
Microbiology Supervisor  
Food, Fisheries & Aquaculture



Cornelia Maston  
Microbiology Technician  
Food, Fisheries & Aquaculture

Report ID: 250231-IAS  
Report Date: 02-Oct-17  
Date Received: 22-Sep-17

### CERTIFICATE OF ANALYSIS

for  
Oak Bay Hatchery  
93 Oak Haven Road  
Oak Haven, NB E3L 3S7

**rpc**

921 College Hill Rd  
Fredericton NB  
Canada E3B 6Z9  
Tel: 506.452.1212  
Fax: 506.452.0594  
www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

#### Analysis of Potable Water

RPC Sample ID:					250231-1
Client Sample ID:					Well 3 72h
Date Sampled:					22-Sep-17
Analytes	Units	RL	MAC	AO	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	38
Chloride	mg/L	0.5	-	250	19.1
Colour	TCU	5	-	15	< 5
Conductivity	µS/cm	1	-	-	187
Fluoride	mg/L	0.05	1.5	-	0.12
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	0.18
pH	units	-	-	7.0 - 10.5	7.1
Phosphorus	mg/L	0.02	-	-	< 0.02
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	10.7
Sulfate	mg/L	1	-	500	11
Total Organic Carbon	mg/L	0.5	-	-	< 0.5
Turbidity	NTU	0.1	-	-	< 0.1
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	55.1
TDS (calc)	mg/L	-	-	500	99
Saturation pH (5°C)	units	-	-	-	8.8
Langelier Index (5°C)	-	-	-	-	-1.65

This report relates only to the sample(s) and information provided to the laboratory.

**RL = Reporting Limit; MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective**

Guidelines are from Guidelines for Canadian Drinking Water Quality (February 2017).



A. Ross Kean, M.Sc.  
Department Head  
Inorganic Analytical Chemistry

**POTABLE WATER CHEM**

Page 1 of 3



Peter Crowhurst, B.Sc., C.Chem  
Analytical Chemist  
Inorganic Analytical Chemistry

Report ID: 250231-IAS  
 Report Date: 02-Oct-17  
 Date Received: 22-Sep-17

**CERTIFICATE OF ANALYSIS**

for  
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 Fax: 506.452.0594  
 www.rpc.ca

Attention: Brian Donnelly

**Project #: Not Available**

**Analysis of Metals in Potable Water**

RPC Sample ID:					250231-1
Client Sample ID:					Well 3 72h
Date Sampled:					22-Sep-17
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	0.002
Antimony	mg/L	0.0001	0.006	-	< 0.0001
Arsenic	mg/L	0.001	0.01	-	< 0.001
Barium	mg/L	0.001	1	-	0.003
Boron	mg/L	0.001	5	-	0.007
Cadmium	mg/L	0.00001	0.005	-	< 0.00001
Calcium	mg/L	0.05	-	-	17.4
Chromium	mg/L	0.001	0.05	-	< 0.001
Copper	mg/L	0.001	-	1	< 0.001
Iron	mg/L	0.02	-	0.3	< 0.02
Lead	mg/L	0.0001	0.01	-	< 0.0001
Lithium	mg/L	0.0001	-	-	0.0032
Magnesium	mg/L	0.01	-	-	2.84
Manganese	mg/L	0.001	-	0.05	< 0.001
Molybdenum	mg/L	0.0001	-	-	0.0002
Nickel	mg/L	0.001	-	-	< 0.001
Potassium	mg/L	0.02	-	-	0.87
Selenium	mg/L	0.001	0.05	-	< 0.001
Sodium	mg/L	0.05	-	200	12.7
Strontium	mg/L	0.001	-	-	0.086
Thallium	mg/L	0.0001	-	-	< 0.0001
Uranium	mg/L	0.0001	0.02	-	< 0.0001
Vanadium	mg/L	0.001	-	-	< 0.001
Zinc	mg/L	0.001	-	5	< 0.001



Report ID: 250231-IAS  
Report Date: 02-Oct-17  
Date Received: 22-Sep-17

## CERTIFICATE OF ANALYSIS

for  
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**rpc**

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www.rpc.ca

### Methods

<u>Analyte</u>	<u>RPC SOP #</u>	<u>Method Reference</u>	<u>Method Principle</u>
pH	4.M03	APHA 4500-H <sup>+</sup> B	pH Electrode - Electrometric
Alkalinity (as CaCO <sub>3</sub> )	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Fluoride	4.M30	APHA 4500-F- D	SPADNS Colourimetry
Sulfate	4.M45	APHA 4500-SO <sub>4</sub> E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO <sub>3</sub> H	Hydrazine Red., Derivitization, Colourimetry
r-Silica (as SiO <sub>2</sub> )	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	4.M06	APHA 2130 B	Nephelometry
Colour	4.M55	APHA 2020 Color (A,C)	Single Wavelength Spectrophotometry
Conductivity	4.M04	APHA 2510 B	Conductivity Meter, Pt Electrode
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

## CERTIFICATE OF ANALYSIS / CERTIFICAT D'ANALYSE

for/pour  
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93 Oak Haven Road  
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**rpc**

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Tel: 506.452.1368  
Fax: 506.452.1395  
www.rpc.ca

Attention: Brian Donnelly

### Microbiological Examination of Water/Qualité microbiologique de l'eau potable

RPC Sample ID/No. d'échantillon de RPC:		250231-1		
Client Sample ID/ID d'échantillon du client:		Well 3 72h		
Date collected/Date du prélèvement		22-Sep-17		
Time sampled/Heure du prélèvement		1:00:00 PM		
Analytes/Paramètre(s)	Method/Méthode	Date Analyzed Date Analysé	Units Unités	
Total Coliforms/Coliformes totaux	FFA10	22-Sep-17	100mL	0
E. coli	FFA10	22-Sep-17	100mL	0

This report relates only to the sample(s) and information provided to the laboratory.

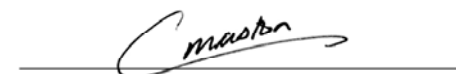
Tests were performed according to the corresponding Compendium of Analytical Methods, Health Protection Branch and/or AOAC Official Methods.

Le présent rapport ne s'applique qu'aux échantillons et à l'information transmis au laboratoire.

Les analyses ont été menées conformément au Compendium de méthodes pour l'analyse correspondant ou aux méthodes officielles de la Direction générale de la protection de la santé ou de l'Association of Official Analytical Chemists (AOAC).



Cathy Hay  
Microbiology Supervisor  
Food, Fisheries & Aquaculture



Cornelia Maston  
Microbiology Technician  
Food, Fisheries & Aquaculture

Report ID: 251502-IAS  
 Report Date: 17-Oct-17  
 Date Received: 04-Oct-17

## CERTIFICATE OF ANALYSIS

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Lionel Hayter  
**Project #: Not Available**

### Analysis of Potable Water

RPC Sample ID:					251502-1
Client Sample ID:					Well 8 24 hours
Date Sampled:					3-Oct-17
Analytes	Units	RL	MAC	AO	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	51
Chloride	mg/L	0.5	-	250	2930
Colour	TCU	5	-	15	6
Conductivity	µS/cm	1	-	-	9700
Fluoride	mg/L	0.05	1.5	-	0.47
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	1.2
pH	units	-	-	7.0 - 10.5	6.6
Phosphorus	mg/L	0.02	-	-	< 0.2
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	12.2
Sulfate	mg/L	1	-	500	390
Total Organic Carbon	mg/L	0.5	-	-	< 0.5
Turbidity	NTU	0.1	-	-	0.2
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	1050
TDS (calc)	mg/L	-	-	500	5220
Saturation pH (5°C)	units	-	-	-	8.2
Langelier Index (5°C)	-	-	-	-	-1.60

This report relates only to the sample(s) and information provided to the laboratory.

**RL = Reporting Limit; MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective**

Guidelines are from Guidelines for Canadian Drinking Water Quality (February 2017).

A. Ross Kean, M.Sc.  
 Department Head  
 Inorganic Analytical Chemistry

**POTABLE WATER CHEM**  
 Page 1 of 3

Peter Crowhurst, B.Sc., C.Chem  
 Analytical Chemist  
 Inorganic Analytical Chemistry

Report ID: 251502-IAS  
 Report Date: 17-Oct-17  
 Date Received: 04-Oct-17

## CERTIFICATE OF ANALYSIS

for  
 Oak Bay Hatchery  
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 Oak Haven, NB E3L 3S7



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 www.rpc.ca

Attention: Lionel Hayter  
**Project #: Not Available**

### Analysis of Metals in Potable Water

RPC Sample ID:					251502-1
Client Sample ID:					Well 8 24 hours
Date Sampled:					3-Oct-17
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	< 0.01
Antimony	mg/L	0.0001	0.006	-	< 0.001
Arsenic	mg/L	0.001	0.01	-	< 0.01
Barium	mg/L	0.001	1	-	0.08
Boron	mg/L	0.001	5	-	0.59
Cadmium	mg/L	0.00001	0.005	-	0.0003
Calcium	mg/L	0.05	-	-	101.
Chromium	mg/L	0.001	0.05	-	< 0.01
Copper	mg/L	0.001	-	1	< 0.01
Iron	mg/L	0.02	-	0.3	0.7
Lead	mg/L	0.0001	0.01	-	< 0.001
Lithium	mg/L	0.0001	-	-	0.025
Magnesium	mg/L	0.01	-	-	193.
Manganese	mg/L	0.001	-	0.05	0.09
Molybdenum	mg/L	0.0001	-	-	< 0.001
Nickel	mg/L	0.001	-	-	< 0.01
Potassium	mg/L	0.02	-	-	48.8
Selenium	mg/L	0.001	0.05	-	< 0.01
Sodium	mg/L	0.05	-	200	1510
Strontium	mg/L	0.001	-	-	1.44
Thallium	mg/L	0.0001	-	-	< 0.001
Uranium	mg/L	0.0001	0.02	-	< 0.001
Vanadium	mg/L	0.001	-	-	< 0.01
Zinc	mg/L	0.001	-	5	< 0.01

Report ID: 251502-IAS  
Report Date: 17-Oct-17  
Date Received: 04-Oct-17

## CERTIFICATE OF ANALYSIS

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### Methods

<u>Analyte</u>	<u>RPC SOP #</u>	<u>Method Reference</u>	<u>Method Principle</u>
pH	4.M03	APHA 4500-H <sup>+</sup> B	pH Electrode - Electrometric
Alkalinity (as CaCO <sub>3</sub> )	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Fluoride	4.M30	APHA 4500-F- D	SPADNS Colourimetry
Sulfate	4.M45	APHA 4500-SO <sub>4</sub> E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO <sub>3</sub> H	Hydrazine Red., Derivativization, Colourimetry
Amorphous Silica (as SiO <sub>2</sub> )	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	4.M06	APHA 2130 B	Nephelometry
Colour	4.M55	APHA 2020 Color (A,C)	Single Wavelength Spectrophotometry
Conductivity	4.M04	APHA 2510 B	Conductivity Meter, Pt Electrode
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

## CERTIFICATE OF ANALYSIS / CERTIFICAT D'ANALYSE

for/pour  
Oak Bay Hatchery  
93 Oak Haven Road  
Oak Haven, NB E3L 3S7

**rpc**

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Tel: 506.452.1368  
Fax: 506.452.1395  
www.rpc.ca

Attention: Lionel Hayter

### Microbiological Examination of Water/Qualité microbiologique de l'eau potable

RPC Sample ID/No. d'échantillon de RPC:				251502-1
Client Sample ID/ID d'échantillon du client:				Well 8 24 hours
Date collected/Date du prélèvement				3-Oct-17
Time sampled/Heure du prélèvement				1:00:00 PM
Analytes/Paramètre(s)	Method/Méthode	Date Analyzed Date Analysé	Units Unités	
Total Coliforms/Coliformes totaux	FFA10	4-Oct-17	100mL	0
E. coli	FFA10	4-Oct-17	100mL	0

This report relates only to the sample(s) and information provided to the laboratory.

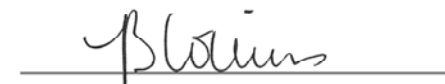
Tests were performed according to the corresponding Compendium of Analytical Methods, Health Protection Branch and/or AOAC Official Methods.

Le présent rapport ne s'applique qu'aux échantillons et à l'information transmis au laboratoire.

Les analyses ont été menées conformément au Compendium de méthodes pour l'analyse correspondant ou aux méthodes officielles de la Direction générale de la protection de la santé ou de l'Association of Official Analytical Chemists (AOAC).



Cathy Hay  
Microbiology Supervisor  
Food, Fisheries & Aquaculture



Breannah Collins  
Micro Technician  
Food, Fisheries & Aquaculture

Report ID: 251655-IAS  
 Report Date: 19-Oct-17  
 Date Received: 05-Oct-17

## CERTIFICATE OF ANALYSIS

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Lionel Hayter  
**Project #: Not Available**

### Analysis of Potable Water

RPC Sample ID:					251655-1
Client Sample ID:					Well 8 48H
Date Sampled:					4-Oct-17
Analytes	Units	RL	MAC	AO	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	54
Chloride	mg/L	0.5	-	250	2890
Colour	TCU	5	-	15	14
Conductivity	µS/cm	1	-	-	10000
Fluoride	mg/L	0.05	1.5	-	0.48
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	0.09
pH	units	-	-	7.0 - 10.5	6.6
Phosphorus	mg/L	0.02	-	-	< 0.2
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	12.3
Sulfate	mg/L	1	-	500	400
Total Organic Carbon	mg/L	0.5	-	-	< 0.5
Turbidity	NTU	0.1	-	-	0.4
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	1060
TDS (calc)	mg/L	-	-	500	5210
Saturation pH (5°C)	units	-	-	-	8.2
Langelier Index (5°C)	-	-	-	-	-1.57

This report relates only to the sample(s) and information provided to the laboratory.

**RL = Reporting Limit; MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective**

Guidelines are from Guidelines for Canadian Drinking Water Quality (February 2017).

A. Ross Kean, M.Sc.  
 Department Head  
 Inorganic Analytical Chemistry

**POTABLE WATER CHEM**  
 Page 1 of 5

Peter Crowhurst, B.Sc., C.Chem  
 Analytical Chemist  
 Inorganic Analytical Chemistry

Report ID: 251655-IAS  
 Report Date: 19-Oct-17  
 Date Received: 05-Oct-17

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Attention: Lionel Hayter  
**Project #: Not Available**

### Analysis of Potable Water

RPC Sample ID:					251655-2
Client Sample ID:					Well 8 72h
Date Sampled:					5-Oct-17
Analytes	Units	RL	MAC	AO	
Alkalinity (as CaCO <sub>3</sub> )	mg/L	2	-	-	52
Chloride	mg/L	0.5	-	250	2980
Colour	TCU	5	-	15	16
Conductivity	µS/cm	1	-	-	10300
Fluoride	mg/L	0.05	1.5	-	0.48
Nitrate + Nitrite (as N)	mg/L	0.05	10	-	0.11
pH	units	-	-	7.0 - 10.5	6.6
Phosphorus	mg/L	0.02	-	-	< 0.2
r-Silica (as SiO <sub>2</sub> )	mg/L	0.1	-	-	12.4
Sulfate	mg/L	1	-	500	410
Total Organic Carbon	mg/L	0.5	-	-	< 0.5
Turbidity	NTU	0.1	-	-	0.2
<b>Calculated Parameters</b>					
Hardness (as CaCO <sub>3</sub> )	mg/L	0.2	-	-	1120
TDS (calc)	mg/L	-	-	500	5420
Saturation pH (5°C)	units	-	-	-	8.2
Langelier Index (5°C)	-	-	-	-	-1.57

This report relates only to the sample(s) and information provided to the laboratory.

**RL = Reporting Limit; MAC = Maximum Acceptable Concentration; AO = Aesthetic Objective**

Guidelines are from Guidelines for Canadian Drinking Water Quality (February 2017).



Report ID: 251655-IAS  
 Report Date: 19-Oct-17  
 Date Received: 05-Oct-17

**CERTIFICATE OF ANALYSIS**

for  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Lionel Hayter  
**Project #: Not Available**

**Analysis of Metals in Potable Water**

RPC Sample ID:					251655-1
Client Sample ID:					Well 8 48H
Date Sampled:					4-Oct-17
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	< 0.01
Antimony	mg/L	0.0001	0.006	-	< 0.001
Arsenic	mg/L	0.001	0.01	-	< 0.01
Barium	mg/L	0.001	1	-	0.08
Boron	mg/L	0.001	5	-	0.59
Cadmium	mg/L	0.00001	0.005	-	0.0003
Calcium	mg/L	0.05	-	-	101.
Chromium	mg/L	0.001	0.05	-	< 0.01
Copper	mg/L	0.001	-	1	< 0.01
Iron	mg/L	0.02	-	0.3	0.5
Lead	mg/L	0.0001	0.01	-	< 0.001
Lithium	mg/L	0.0001	-	-	0.026
Magnesium	mg/L	0.01	-	-	195.
Manganese	mg/L	0.001	-	0.05	0.09
Molybdenum	mg/L	0.0001	-	-	< 0.001
Nickel	mg/L	0.001	-	-	< 0.01
Potassium	mg/L	0.02	-	-	49.4
Selenium	mg/L	0.001	0.05	-	< 0.01
Sodium	mg/L	0.05	-	200	1530
Strontium	mg/L	0.001	-	-	1.47
Thallium	mg/L	0.0001	-	-	< 0.001
Uranium	mg/L	0.0001	0.02	-	< 0.001
Vanadium	mg/L	0.001	-	-	< 0.01
Zinc	mg/L	0.001	-	5	< 0.01

Report ID: 251655-IAS  
 Report Date: 19-Oct-17  
 Date Received: 05-Oct-17

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for  
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 Oak Haven, NB E3L 3S7



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 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1212  
 Fax: 506.452.0594  
 www.rpc.ca

Attention: Lionel Hayter  
**Project #: Not Available**

**Analysis of Metals in Potable Water**

RPC Sample ID:					251655-2
Client Sample ID:					Well 8 72h
Date Sampled:					5-Oct-17
Analytes	Units	RL	MAC	AO	
Aluminum	mg/L	0.001	-	-	< 0.01
Antimony	mg/L	0.0001	0.006	-	< 0.001
Arsenic	mg/L	0.001	0.01	-	< 0.01
Barium	mg/L	0.001	1	-	0.08
Boron	mg/L	0.001	5	-	0.63
Cadmium	mg/L	0.00001	0.005	-	0.0003
Calcium	mg/L	0.05	-	-	107.
Chromium	mg/L	0.001	0.05	-	< 0.01
Copper	mg/L	0.001	-	1	< 0.01
Iron	mg/L	0.02	-	0.3	0.6
Lead	mg/L	0.0001	0.01	-	< 0.001
Lithium	mg/L	0.0001	-	-	0.027
Magnesium	mg/L	0.01	-	-	207.
Manganese	mg/L	0.001	-	0.05	0.09
Molybdenum	mg/L	0.0001	-	-	< 0.001
Nickel	mg/L	0.001	-	-	< 0.01
Potassium	mg/L	0.02	-	-	52.6
Selenium	mg/L	0.001	0.05	-	< 0.01
Sodium	mg/L	0.05	-	200	1620
Strontium	mg/L	0.001	-	-	1.55
Thallium	mg/L	0.0001	-	-	< 0.001
Uranium	mg/L	0.0001	0.02	-	< 0.001
Vanadium	mg/L	0.001	-	-	< 0.01
Zinc	mg/L	0.001	-	5	< 0.01

Report ID: 251655-IAS  
Report Date: 19-Oct-17  
Date Received: 05-Oct-17

## CERTIFICATE OF ANALYSIS

for  
Oak Bay Hatchery  
93 Oak Haven Road  
Oak Haven, NB E3L 3S7



921 College Hill Rd  
Fredericton NB  
Canada E3B 6Z9  
Tel: 506.452.1212  
Fax: 506.452.0594  
www.rpc.ca

### Methods

<u>Analyte</u>	<u>RPC SOP #</u>	<u>Method Reference</u>	<u>Method Principle</u>
pH	4.M03	APHA 4500-H <sup>+</sup> B	pH Electrode - Electrometric
Alkalinity (as CaCO <sub>3</sub> )	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Fluoride	4.M30	APHA 4500-F- D	SPADNS Colourimetry
Sulfate	4.M45	APHA 4500-SO <sub>4</sub> E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO <sub>3</sub> H	Hydrazine Red., Derivitization, Colourimetry
r-Silica (as SiO <sub>2</sub> )	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	4.M06	APHA 2130 B	Nephelometry
Colour	4.M55	APHA 2020 Color (A,C)	Single Wavelength Spectrophotometry
Conductivity	4.M04	APHA 2510 B	Conductivity Meter, Pt Electrode
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES

## CERTIFICATE OF ANALYSIS / CERTIFICAT D'ANALYSE

for/pour  
 Oak Bay Hatchery  
 93 Oak Haven Road  
 Oak Haven, NB E3L 3S7



921 College Hill Rd  
 Fredericton NB  
 Canada E3B 6Z9  
 Tel: 506.452.1368  
 Fax: 506.452.1395  
 www.rpc.ca

Attention: Lionel Hayter

### Microbiological Examination of Water/Qualité microbiologique de l'eau potable

RPC Sample ID/No. d'échantillon de RPC:				251655-1	251655-2
Client Sample ID/ID d'échantillon du client:				Well 8 48H	Well 8 72h
Date collected/Date du prélèvement				4-Oct-17	5-Oct-17
Time sampled/Heure du prélèvement				2:00:00 PM	8:30:00 AM
Analytes/Paramètre(s)	Method/Méthode	Date Analyzed Date Analysé	Units Unités		
Total Coliforms/Coliformes totaux	FFA10	5-Oct-17	100mL	0	0
E. coli	FFA10	5-Oct-17	100mL	0	0

This report relates only to the sample(s) and information provided to the laboratory.

Tests were performed according to the corresponding Compendium of Analytical Methods, Health Protection Branch and/or AOAC Official Methods.

Le présent rapport ne s'applique qu'aux échantillons et à l'information transmis au laboratoire.

Les analyses ont été menées conformément au Compendium de méthodes pour l'analyse correspondant ou aux méthodes officielles de la Direction générale de la protection de la santé ou de l'Association of Official Analytical Chemists (AOAC).

Cathy Hay  
 Microbiology Supervisor  
 Food, Fisheries & Aquaculture

Breannah Collins  
 Micro Technician  
 Food, Fisheries & Aquaculture





Report ID: 252606-IAS  
Report Date: 27-Oct-17  
Date Received: 16-Oct-17

## CERTIFICATE OF ANALYSIS

for  
Oak Bay Hatchery  
93 Oak Haven Road  
Oak Haven, NB E3L 3S7

**rpc**

921 College Hill Rd  
Fredericton NB  
Canada E3B 6Z9  
Tel: 506.452.1212  
Fax: 506.452.0594  
www.rpc.ca

### Methods

<u>Analyte</u>	<u>RPC SOP #</u>	<u>Method Reference</u>	<u>Method Principle</u>
pH	4.M03	APHA 4500-H <sup>+</sup> B	pH Electrode - Electrometric
Alkalinity (as CaCO <sub>3</sub> )	4.M43	EPA 310.2	Methyl Orange Colourimetry
Chloride	4.M44	APHA 4500-CL E	Ferricyanide Colourimetry
Fluoride	4.M30	APHA 4500-F- D	SPADNS Colourimetry
Sulfate	4.M45	APHA 4500-SO <sub>4</sub> E	Turbidimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO <sub>3</sub> H	Hydrazine Red., Derivitization, Colourimetry
r-Silica (as SiO <sub>2</sub> )	4.M46	APHA 4500-SI F	Heteropoly Blue Colourimetry
Carbon - Total Organic	4.M38	APHA 5310 C	UV-Persulfate Digestion, NDIR Detection
Turbidity	4.M06	APHA 2130 B	Nephelometry
Colour	4.M55	APHA 2020 Color (A,C)	Single Wavelength Spectrophotometry
Conductivity	4.M04	APHA 2510 B	Conductivity Meter, Pt Electrode
Trace Metals	4.M01/4.M29	EPA 200.8/EPA 200.7	ICP-MS/ICP-ES