Coquitlam-Buntzen Project Water Use Plan

Lower Coquitlam River Substrate Quality Assessment

Implementation Year 7

Reference: COQMON #8

Study Period: 2013-2014

G3 Consulting Ltd.

January 15, 2015

LOWER COQUITLAM RIVER SUBSTRATE QUALITY ASSESSMENT

COQMON #8

Annual Report Year 7 (2013/14)

Final Report

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EXECUTIVE SUMMARY

G3 Consulting Ltd. (G3) was retained by BC Hydro to complete the *Lower Coquitlam River Substrate Quality Assessment* program (COQMON#8) in salmonid spawning and rearing habitat in the Lower Coquitlam River from 2012 to 2017. A primary objective of this study is to evaluate the effectiveness of flushing flow provisions intended to increase fish productivity through improved substrate quality in the Lower Coquitlam River.

As part of the *Coquitlam River Water Use Plan* (WUP), eight (8) separate monitoring programs have been implemented with the objectives and monitoring indicators reported to BC's Comptroller of Water Rights. The *Lower Coquitlam River Substrate Quality Assessment* (COQMON#8) is the focus of this report and one of the eight monitoring programs. The following annual data report is based on Year 7 of this study (the second year of G3 monitoring and employing the current study methodology) and provides an update on the project activities and results of three (3) surveys undertaken, October 2013, January 2014 and May 2014. Data reporting on substrate quality performance measures is conducted annually, while analysis of effectiveness of flushing flows is to be done every third year (after May 2015 sampling) and again at the end of the review period (2017). No flushing flows occurred in 2013 or 2014.

Substrate quality at six (6) sampling sites in the Lower Coquitlam River was assessed by measuring percent particle size distribution for surficial and subsurface (<10.0 mm) samples. Subsurface sample material >10.0 mm also underwent pebble counts. This report includes the results of sample pebble counts from the first year of this methodology (October 2012, January 2013 and May 2013). Surficial sediments consisted largely of sand in all samples. Percentages were generally lowest in May 2014 with higher occurrences of clay and silt, compared to October 2013 and January 2014. This higher proportion of clay and silt in May coincided with periods of low discharge in the Lower Coquitlam River.

Particle sizes in subsurface sediments <10 mm collected in October 2013, January 2014 and May 2014 were highest in percentages of sand and gravel. With the exception of one site (Site 4 in January 2014 compared to May 2014), there were no statistically significant differences in the composition of subsurface sediment (<10 mm) at each study site between the three (3) sampling events.

Pebble counts of the subsurface material (>10 mm) from October 2012 through May 2014 samples showed that the dominant sediment type was medium gravel (10-16 mm) and coarse gravel (17-32 mm) was subdominant; cobble was not notable at any site or season. There was variation for subsurface sediment (both less than and greater than 10 mm) between sampling sites during individual sampling events; however, little variation at each site over time (i.e., the same sites during the different sampling events).

Suitable substrates for spawning and rearing were observed at the sampling sites; however, given this was the second year of sampling there remains limited data from which to draw conclusions as to whether river flows were effective at mobilizing sediments and whether sediment particle size profiles at each site are a reflection of discharge or other environmental factors. Analysis of substrate quality results will require several years of data to develop robust correlations between substrate quality results and fish productivity.

1.0 INTRODUCTION

G3 Consulting Ltd. (G3) was retained by BC Hydro to complete the *Lower Coquitlam River Substrate Quality Assessment* program (COQMON #8) in salmonid spawning and rearing habitat in the Lower Coquitlam River from 2012 to 2017. The *Lower Coquitlam Substrate Quality Assessment* program was established by BC Hydro as part of the *Coquitlam-Buntzen Water Use Plan* (WUP) to investigate the effectiveness of channel substrate flushing flows in improving substrate quality.

As part of the *Coquitlam River WUP* eight (8) separate monitoring programs have been implemented with objectives and monitoring indicators reported to BC's Comptroller of Water Rights. Of the eight (8) programs the *Lower Coquitlam River Substrate Quality Assessment* study is the focus of this annual data report. The primary objective of this program is to evaluate the effectiveness of flushing flow provisions outlined in the *Coquitlam-Buntzen WUP* to increase fish productivity through improved substrate quality in the Lower Coquitlam River. The Consultative Committee (CC) for the WUP agreed on a set of operating conditions that includes two (2) flow release regimes:

- Treatment 1 (2000-fall 2008): releases between 0.8 m^3/s to 1.7 m^3/s; and,
- Treatment 2 (fall 2008-2017): releases between 1.1 m^3/s to 5.9 m^3/s depending on the time of year.

The *Lower Coquitlam River Substrate Quality Assessment* involves monitoring of substrate quality three (3) times (i.e., fall, winter and mid spring) over five (5) annual field surveys. Surveys are to be repeated at representative spawning and rearing sites in the Lower Coquitlam River with primary efforts focused on specific areas (Reaches 2 and 3; Figure A1, Appendix 1). The primary indicator of substrate quality assessed was particle size distribution of surficial sediment samples and the secondary indicator assessed was particle size distribution of subsurface samples. Other indicators of sediment quality also included in this assessment were embeddedness and turbidity of overlaying water. Substrate categories and size classes were defined by BC Hydro. Substrate quality is reported annually with an analysis of the effectiveness of flushing flows reported every third year (after May 2015 sampling) and at the end of the review period (2017).

Previous program methods of assessing fine sediments using areal fraction in photogrammetric surface samples was determined to be inadequate in addressing management objectives (NHC, 2012). Photographs of each sample continue to be collected; however, areal fractions are not determined. Bulk sampling was recommended only during an endorsed 'opportunistic' annual "flushing flow" as defined by BC Hydro (i.e., releases of 30 m^3/s to 50 m^3/s from the Coquitlam Dam every year for 3-5 days coinciding with peak inflows from Or Creek; BC Hydro, 2006). No flushing flows occurred between October 2013 and May 2014; therefore, no bulk sampling was undertaken.

This annual data report provides an update on the project activities and results of surveys undertaken in October 2013, January 2014 and May 2014 and includes:

- a review of the effectiveness of the surficial and subsurface sediment as an indicator of substrate quality; and,
- an assessment of general trends in surficial (fine material covering larger particles, <10 mm) and subsurface (material remaining within the sampler after surficial material has been removed; only includes material to the penetration depth of the sampler) data from October 2013 to May 2014.

Additionally, subsurface sediment results from October 2012 through May 2013, not available at the time of the previous annual report, have been included in this report.

This section outlines study background and objectives. Section two discusses study design and methodology for field and laboratory work. Section three provides program results from October 2013, January 2014 and May 2014. Section four provides program conclusions and recommendations followed by cited references. Details of sampling locations, photographs, figures and raw data are included as appendices.

1.1 Perspective & Background

The Coquitlam River watershed is one of many on the north shore of the lower reach of the Fraser River and is approximately 30 km east of Vancouver in the Lower Mainland region of BC. It is primarily located within the municipalities of Coquitlam and Port Coquitlam and includes the Coquitlam Lake Reservoir above Coquitlam Dam. From this catchment area, at least thirty watercourses flow into a highly developed lower watershed that drains into the Fraser River and subsequently outflows into the Strait of Georgia. The largest contributors to the Coquitlam River flow are Or, Hoy, Scott and Pinnacle Creeks. Since the early 1900s the river has been dammed to provide a consistent water supply and power generation to support growing communities in the Lower Mainland. In the 1950's gravel operations began in and along the Coquitlam River and in the 1960's and 1970's commercial logging occurred along the watershed. Development pressures and impacts on the watershed are the focus of numerous volunteer, government and private sector initiatives, projects and plans. High, eroding glaciolacustrine terrace scarps near the mouth of Or Creek are a notable source of silt and clay input into the Lower Coquitlam River (NHC, 2007). The other tributaries drain smaller, less rugged watersheds further downstream and provide additional sources of sediment to the river. Bank erosion along the Lower Coquitlam River has provided minimal input of sediment. Wastewater from the gravel mines located along the Coquitlam River (Reach 2b), is treated in settling ponds before being discharged into the river. After the settling pond sediment introduced to the river from the gravel mines consists mostly of fine sands, silt and clays and can create frequent turbidity events below the point of discharge (NHC, 2007). In the past, coarser sediments were also delivered to the river from these mines (NHC, 2007). The City of Coquitlam has periodically monitored turbidity and suspended sediment concentration upstream and downstream of the gravel mines (City of Coquitlam, 2003).

1.2 Monitoring Program Rationale

The Consultative Committee (CC) for the Water Use Plan (WUP) highlighted two (2) factors potentially affecting fisheries productivity in the Lower Coquitlam River (BC Hydro, 2006):

1. instream flows: timing/magnitude of flow released from Coquitlam Dam were evaluated in terms of habitat benefits (BC Hydro, 2003); and,
2. substrate quality: fine sand content and availability of substrate suitable for spawning and overwintering (NHC, 2001).

The CC noted that habitat quality could be increased through improved substrate quality and commissioned a study to investigate how flow releases could be used to improve substrate quality (BC Hydro, 2006). The study concluded that short-term, high magnitude flow releases from Coquitlam Dam (flushing flows) would be highly effective at mobilizing fines from the channel bedload and recruit gravel through erosion and bedload movement (NHC, 2001). Based on Fisheries Technical Committee (FTC) recommendations, the CC supported annual flushing flow releases of 30 m^3/s to 50 m^3/s from the Coquitlam Dam for 3 to 5 days/year, coinciding with peak inflows from Or Creek (for a total flow of 70 m^3/s to 100 m^3/s). Given that the effectiveness of this decision was not fully assessed the CC wanted to monitor substrate quality on a seasonal basis throughout the review period to better understand if there may be linkages between fish productivity and substrate quality.

1.3 Monitoring Program Requirements & Objectives

Based on the above rationale, management questions and hypotheses were developed for future water use decisions related to flushing flows. The main management question addresses if the recommended flushing flow operations will result in improvements to Lower Coquitlam River substrate quality and fish productivity.

The primary objective of this substrate quality assessment was to collect additional data on Lower Coquitlam River substrate composition and quality at the previously identified sampling sites following the methods defined in the 2012-2013 monitoring program (G3, 2014) and outlined in Section 2.

The procedure used to assess how substrate composition affects habitat quality and fish productivity in the Lower Coquitlam River involves a review of fish productivity results in conjunction with substrate quality monitoring data. Substrate quality indicators and methods of data collection can vary significantly and depend on the dominant channel and substrate forms evaluated. For the purpose of this study, and to maintain interpretive and comparative consistency, substrate quality was assessed using surficial fine material (<10 mm) and subsurface material (<10 mm and >10 mm) as defined by BC Hydro (BC Hydro, 2006). An analysis of both regulated and unregulated flushing flow events will also be undertaken as they occur during the study period. Given that spawning and rearing success is linked to substrate quality (Tappel and Bjornn, 1983; Bjornn and Reiser, 1991) an assessment of whether substrate quality is limiting fish productivity in the Lower Coquitlam River will eventually be undertaken in the report at the end of every third year (2015) and at the end of the review period (2017) by:

1. assessing whether there is a correlation between substrate quality results and fish productivity; and,
2. comparing field monitoring results with established biostandards relating spawning and rearing success to substrate quality.

1.3.1 Key Water Use Decision Affected

The results from this study will help assess substrate conditions and effectiveness of flushing flow events (regulated or unregulated). By 2017, the evaluation of both flow releases outlined in the *Coquitlam-Buntzen WUP* will be completed and based on the results from this and other studies, BC Hydro will recommend a base flow regime to the Consultative Committee (CC) for the WUP.

Flow recommendations will:

a) meet the objective of optimizing fish interests in the Lower Coquitlam River; and,

b) be constrained within the two (2) releases being tested in consideration of Metro Vancouver planning requirements (BC Hydro, 2002).

1.4 Past Results & Recommendations

Field sampling has been conducted to measure substrate quality during spawning, incubation and emergence periods for salmonids and designed to assess changes in substrate conditions to fish productivity. Previous substrate monitoring studies under the *Lower Coquitlam River Substrate Quality Assessment* program (COQMON#8) were undertaken by Northwest Hydraulic Consultants (NHC) from 2007-2012. NHC used two (2) methods (bulk sampling and photogrammetric analysis) to characterize substrate surface grain size distribution. Freeze-core sampling was attempted as an alternative method for collecting bulk subsurface samples in which the sample material is frozen *in situ* with liquid nitrogen prior to extraction to enable collection within the wetted channel without the loss of fine sediment fractions that would occur with a manually excavated sample. The substrate was too coarse to insert the sampling device into the riverbed as required by the freeze-core method, except at a few isolated spots where only small samples could be obtained. Given the problems with the freeze-core technique, results of the field sampling effort were not reported and the technique discontinued.

Photogrammetric sampling between 2006 and 2011 provided no clear temporal or spatial trends in sediment composition (NHC, 2012). There was natural variability in sediment composition that appeared to be unrelated to flushing flows. Between 2006 and 2011 there had been two (2) unmanaged flushing flows (i.e., flows that met the flushing flow criteria) and two (2) dam release augmented flows that were close to flushing flow criteria (NHC, 2012). In each of these events the quantity of fines were found to have decreased; however, changes in substrate were temporary and within an expected range of natural variability (NHC, 2010, 2012).

In general, definitive links between flows and changes in surface grain size distribution have, to date, not been established due to previous assessment methods and high natural variability. Photo sampling was unsuccessful in addressing management objectives and was discontinued. Further, it was recommended that bulk sampling be continued, but only after an official “flushing flow” as defined by BC Hydro for this project (i.e., releases of 30 m^3/s to 50 m^3/s from the Coquitlam Dam every year for 3-5 days coinciding with peak inflows from Or Creek; BC Hydro, 2006). It was also recommended that additional exposed gravel bars be sampled if additional suitable monitoring locations could be identified (NHC, 2012).

1.5 Lower Coquitlam River Channel Morphology & Substrate

The Lower Coquitlam River was previously divided into five (5) reaches by BC Hydro (Figure A1, Appendix 1; COQ FTC, 2001a). Reach 4 is the uppermost reach, extending between the Coquitlam Dam and Or Creek confluence. Reach 3 extends downstream from the Or Creek confluence to the upstream end of the gravel mining area. Reach 2 includes the gravel mining area and extends downstream north of Lougheed Highway. Two sub-reaches exist along the area of gravel mines (Reach 2B) and further downstream through an urbanized area (Reach 2A). Reach 1 extends approximately 0.6 km upstream and 1.2 km downstream of Lougheed Highway, at or near an alluvial fan. Reach 0 is the lowermost reach, extending across the Fraser River floodplain and was not included in the monitoring program. Channel gradient declines in a downstream direction along the Lower Coquitlam River from 1.8% in Reaches 3 and 4, 1.1% in Reach 2, 0.4% in Reach 1 and 0.07% in Reach 0 (NHC, 2012).

Reaches 2 and 3 were the primary focus of current monitoring program. The channel morphology at these locations was described by NHC (2006, 2010, 2012). Reach 3 was dominated by coarse sediment from Or Creek with channel bed and bars comprised primarily of boulders. Reach 3 was also noted to have clusters of larger boulders with areas of sand and granules immediately downstream. Reach 2 was dominated by boulder bars and riffles, separated by long pools and glides. In general in Reach 2, boulder bars tended to be larger, less active and more vegetated than in Reach 3 (NHC, 2010). Reach 2 also includes smaller, unvegetated cobble bars, located within narrowed channels, which may indicate more recent temporary river bedload (NHC, 2010). Within the interstices of pool and glide bed material sand and granules were prevalent. Lag boulders also occurred throughout Reach 2; however, they were isolated, not in clusters, with greater accumulations of sand and granules located downstream.

2.0 METHODOLOGY

This section provides methodologies employed during the Year 7 substrate quality monitoring program.

2.1 Site Reconnaissance & Selection

Prior to selecting field sites for the 2012-2017 monitoring program, a review of previous Lower Coquitlam River substrate monitoring reports was conducted to locate past sample sites (Northwest Hydraulic Consultants, 2001, 2004, 2006, 2007, 2008, 2010, 2012). Field reconnaissance in October 2012 identified locations and areas of salmon rearing and redds. Reach transects and sampling sites were established and markers set.

Six (6) sampling sites were established during the reconnaissance survey (Figure A1, Appendix 1): Site 1 (Reach 2a), Sites 2, 3 and 4 (Reach 2b) and Sites 5 and 6 (Reach 3). Photographs of all cardinal directions were taken at each site. Preliminary assessments for confounding influences, habitat classification and mapping, vegetation (aquatic and terrestrial), presence of wildlife, erosional and depositional areas, slope of stream banks, propensity for banks to erode or be undercut, general water flow and depth was conducted for each site. Photographs and notes were taken of stream morphology and features such as islands, gravel bars, large woody debris placement and other factors affecting stream morphology and salmon habitat. Public access, constructed side channels and changes in riparian vegetation were also recorded. An assessment of fish habitat was conducted at each site following the Resources Inventory Committee (RIC) standard (MOE, 2008).

Each site will continue to be monitored for changes in habitat and recorded accordingly. Comments on local disturbance indicators (local erosion, sediment sources) and other factors were also considered during analysis and recorded as necessary.

2.2 Field Monitoring

Each site was located using a map and GPS coordinates and confirmed by locating site markers. Site descriptions were recorded/updated as required and photographs of all cardinal directions taken. Each of the six (6) sites had two (2) sampling positions (upstream and downstream). A total of six (6) replicate samples were collected at each sample site (i.e., three (3) from upstream and three (3) from downstream).

2.2.1 Surficial & Subsurface Substrate Samples

A suitable location at each sample site within the wetted channel, in flowing water <40 cm deep, was selected and an aluminum, modified Hess sampler (856 cm^2) placed in the substrate. Sampling must be conducted in water less than 40 cm to prevent water flow over the top of the Hess sampler. The sampler was swivelled back and forth to aid penetration and embed the bottom of the sampler in the riverbed while ensuring the 20 µm mesh window remained facing upstream. The 20 µm mesh window was permitted to face upstream to enable water to flow into the unit through the filter mesh and aid flushing of the surficial sample into the collection cup. It was important to not block the mesh window thereby preventing water flowing through the Hess sampler.

During October 2012 and 2013 sampling events, salmonid redds were identified and avoided before sampling commenced. Due to very high salmon reproductive activity in October 2013 samples were unable to be collected from Sites 1 and 2 and downstream at Site 5 without causing disturbance to the salmon. No fish were captured or disturbed during sampling. In 2014 fall sampling was performed in mid-September (two weeks earlier) as not to conflict with the salmon reproduction.

A photograph was taken of each site (Photo A1-A12, Appendix 2) and sample using a photo card, which included sample ID number, date and a gray scale. The percentage penetration of the sampler in the riverbed was measured (100% was to the bottom of the mesh window, 6.5 cm) as was the height of water on the inside of the Hess sampler. Each field technician visually assessed embeddedness (degree to which larger particles were covered with finer particles; Sylte and Fischenich, 2002) of the sample. Results were recorded and averaged amongst the estimates (n=3).

The field technicians estimated the range of particle sizes within the Hess sampler and identified the D_{95} (particle larger than 95% of all materials larger than sand) and D_{50} (particle larger than 50% of all materials larger than sand). The D_{50} and D_{95} were measured along the B-axis (intermediate axis of the particle, i.e., the side that the particle rolls along if flow is sufficient). If D_{50} or D_{95} was too fine to measure then a value of zero (0) was recorded. If boulders were buried or too large to measure, the B-axis was estimated and reduced precision is recorded. After measuring D_{95} and D_{50} samples were placed in a pre-labeled pail.

Surficial samples were obtained by churning over substrates within the Hess sampler 20 times using a small hand trowel (Photo A18, Appendix 2). Surficial sediments were flushed by the river flow through the downstream 20 µm mesh tunnel and rinsed into a labeled container (Photo A18, Appendix 2). Samples were sent to Maxxam laboratories (Burnaby) in coolers with accompanying chain of custody (COC) forms for percent (%) particle size distribution analysis.

Remaining material within the Hess sampler (subsurface sample) was then removed using a trowel to the bottom of the penetration depth reached by the Hess Sampler and added to the labeled pail containing the D_{95} and D_{50} samples. Given that the sampler was pushed into the substrate as close to 6.5 cm (height of the mesh window) as possible, sample volumes were considered consistent between sites and samples (5.6 L). Subsurface samples were transported to the G3 warehouse for drying and processing.

2.2.2 Sample Sieving & Processing

Samples transported to G3's warehouse were checked-in on arrival using COCs. Samples were weighed and wet weights recorded on project specific field forms before samples were prepared for drying. Each sample was then spread over clean plastic polyethylene sheeting within individual cells on the drying rack (Photo A22-A23, Appendix 2) to prevent contamination with other samples. Sample drying occurred at room temperature with drying time improved using commercial drying fans directed upward so as to not disturb the samples while improving airflow. Samples were left to dry completely before sieving and sorting.

Once samples were completely dry (Photo A24, Appendix 2), weights were recorded and samples sieved through a 10.0 mm sieve (Photo A25, Appendix 2). Particles <10.0 mm, which passed through the sieve, were placed in a pre-labeled sample bag, weighed using a calibrated analytical balance (Photo A26, Appendix 2) then sent to Maxxam laboratories (Burnaby), with accompanying COC forms, for percent (%) particle size distribution analysis.

Particles >10.0 mm were weighed before being volumetrically assessed. Particles were manually sorted into size classes (Table 1) and counted to determine the frequency of particles in each size class within each sample (Wentworth, 1922). The pebble counts for each sample were standardized to sample volume (5.6 L) for each site. Each particle was measured individually along its B-axis (i.e., the side that the particle rolls along if flow is sufficient) before placing it in the appropriate size category. During processing samples were photographed using a labelled photo card and sample identification verified at each stage of processing.

Table 1. Udden-Wentworth Scale

Particle Diameter (mm)	Size Category
<0.0039	Clay
0.0039-0.0625	Silt
0.0625-2	Sand
2-64	Gravel (laboratory classification)
10-16	Medium Gravel
17-32	Coarse Gravel
33-64	Very Coarse Gravel
65-90	Small Cobble
91-128	Medium Cobble
128-256	Large Cobble
>256	Boulder

2.2.3 Bulk-Sieve Subsurface Samples

Lower Coquitlam River discharge is monitored on a regular basis via contact with the City of Coquitlam and Water Survey Canada to obtain data from their *in situ* flow meters to confirm if flushing flows have occurred. No flushing flows occurred between October 2013 and May 2014 and, therefore, no bulk sampling was conducted.

2.3 QA/QC & Data Management

Quality Assurance and Quality Control (QA/QC) procedures and practices were implemented to ensure program integrity at every level and incorporated into work plans, management strategy and protocols for handling and recording information.

Instrumentation used in surveys was calibrated regularly to ensure accurate performance and backup meters were used to verify and support measurements taken. Transcription or entry errors were checked by cross referencing and data reviewed by alternate staff members (20-25% of entered data). If an error greater than 5% was encountered the entire dataset was re-examined.

2.4 Data Analysis

Data was compiled and graphed using Microsoft Excel. Analysis, ANOVA with post-hoc Tukey Tests, was performed using the JMP 11 statistical software package.

3.0 RESULTS

Substrate quality was assessed at six (6) sampling sites in the Lower Coquitlam River in October 2013, January 2014 and May 2014. During each sample period six (6) samples were collected at each site, three (3) upstream and three (3) downstream. Substrate quality was evaluated using particle size distribution for surficial and subsurface samples; percent (%) particle size distribution evaluated for both surficial and subsurface (<10 mm) substrate; and, pebble counts done on larger subsurface substrate (>10 mm). Surficial substrate was the preferred primary indicator of substrate quality with subsurface substrate as a secondary indicator. Results of pebble counts for large subsurface substrate (>10 mm) from October 2012 to May 2013 have been included in this report.

3.1 Lower Coquitlam River Discharge

Discharge for the Lower Coquitlam River was measured downstream of Site 1 at Water Survey Canada Site 08MH002 (Coquitlam River at Port Coquitlam, 49°15'56'' N, 122°46'51'' W; Figure A2, Appendix 1). Given that the gauge is downstream of the sampling sites, this discharge data accounted for all tributaries to the Lower Coquitlam River over the reaches discussed in this study.

Yearly comparisons of discharge showed marked peaks in discharge (September to January) from 2003 to 2007. The average monthly discharge from 1993 to 2002 remained below 10 m^3/s with few exceptions (Figure A3-1, Appendix 1). Monthly comparisons showed peaks in discharge from October through January over the last ten (10) years which coincided with fall and winter sampling events (October and January; Figure A3-2, Appendix 1).

Overall average daily flow over flow treatment 1 (2000 to Fall 2008) was lower (8.02 m^3/s) than flow treatment 2 (Fall 2008 to present; 8.95 m^3/s). Average monthly flow values showed higher flow during treatment 2 for all months, except November, December and January (Figures A4-1 and A4-2, Appendix 1).

Average monthly discharges in the Lower Coquitlam River were <14 m^3/s between October 2013 and October 2014 (Figure A3-1, Appendix 1). Minimum average discharges were recorded in summer months (June through September 2014; 2.19 m^3/s to 4.25 m^3/s) and maximum average discharges were recorded in March and October 2014 (13.0 m^3/s and 13.12 m^3/s, respectively). Daily discharge averages ranged throughout each month with larger ranges occurring in January (4.16 m^3/s to 43.7 m^3/s), March (6.1 m^3/s to 40.7 m^3/s) and October, 2014 (6.73 m^3/s to 37.5 m^3/s).

Sampling was completed on days with lower flows when possible to aid safety and to ensure that samples most accurately reflected representative conditions at each sample site; however, individual samples can be influenced by river flow occurring prior to sampling. While the discharge on the sampling dates was similar for each sampling event (October 2013, January 2014 and May 2014), flow regimes leading up to sampling differed. Daily discharges on the seven (7) days prior to sampling were lowest in May 2014 (4.75 m^3/s to 8.95 m^3/s) and highest in January 2014 (10.3 m^3/s to 43.7 m^3/s). Maximum discharge in the week prior to sampling occurred in January 2014 (43.7 m^3/s). The daily discharge for the fifteen (15) days before sampling and on the sampling days has been included in Table B1 (Appendix 3).

3.2 Surficial Sediments

Surficial sediment collected was <10 mm in diameter. Data was compared between sites for each sampling event and each site between sampling events. Any data trends were then compared to river discharge as measured downstream of Site 1.

The dominant surficial sediment type at all sample sites was sand, with silt being subdominant sediment at most sites (Figure A5-A7, Appendix 1). The mean percentage (%) of sand at all sites ranged from 55.5% ± 6.1% (mean ± standard error; May 2014, Site 3) to 96.3% ± 0.8% (January 2014, Site 2). Maximum mean percentage (%) of silt was 24.7% ± 5.1% and clay was 20.0% ± 2.7% (both at Site 3 in May 2014).

May 2014 generally had lower mean percentages of sand at all sites, with the exception of Site 1, than the sites during the other sampling events (October 2013 and January 2014; Figure A5-A7, Appendix 1); however, was only statistically significant at Sites 2, 3 and 6 ($p<0.05$). The lowest mean percentage of sand in May 2014 was at Site 3 (55.5% ± 6.1%), and was significantly lower than Site 3 in October 2013 (78.6% ± 4.8%) and January 2014 (87.8% ± 3.7%) sampling events ($p<0.05$). May 2014 generally had greater mean silt (6.1% ± 1.9% to 24.7% ± 5.1%) and clay (5.6% ± 1.0% to 20.0% ± 2.7%) compared to other sampling events. The mean silt percentage at Site 3 in May 2014 (24.7% ± 5.1%), was greater than all other sites in May 2014 (statistically significant for Sites 1 and 2; $p<0.01$) and at Site 3 during the other sampling events (not statistically significant; $p=0.16$). The mean percentage of clay at Site 3 in May 2014 (20.0% ± 2.7%) was significantly greater than the other sites in the same sampling event (5.6% ± 1.0% to 10.6 ± 2.6%; $p<0.05$) and significantly greater than Site 3 during the other sampling events (October: 4.4% ± 1.2%, January: non-detect; $p<0.01$; Figure A7, Appendix 1).

In samples collected in January 2014 there was some noted variation in mean surficial sediment composition between sites (Figure A6, Appendix 1). Site 2 had a higher mean proportion of sand (96.3% ± 0.8%) and corresponding decrease in the proportion of silt (3.7% ± 0.6%), compared to the other sites (84.5% ± 1.9% to 90.3% ± 2.0%). At Sites 2 and 3 (January 2014) the mean percentage (%) of clay was below detection limit (<2.0%). In comparing Site 2 between sampling events (January and May 2014) there was also significantly greater mean sand percentage in January (96.3% ± 0.8%) compared to May 2014 (83.7% ± 4.1%; $p<0.01$) and a corresponding decrease in the mean percentage (%) of both silt (January: 3.7% ± 0.5%, May: 7.5% ± 1.3%; $p<0.05$) and clay (January: non detect, May: 8.8% ± 1.4%; $p<0.01$).

In October 2013 there was no statistically significant difference in mean surficial sediment composition between sample sites (Figure A5, Appendix 1).

In May 2014 river discharge was lowest downstream of the sampling sites leading up to and during sampling which may account for the increased mean proportion of silt and clay at most sites, especially downstream sites (Sites 1 to 3). In January 2014 a high discharge event (43.7 m^3/s) in the week prior to sampling may be attributed to slightly higher mean proportions of sand and lower mean proportions of silt and clay at most sites.

3.3 Subsurface Sediments

Subsurface sediment samples were divided into two (2) components, (<10 mm and >10 mm) and analyzed separately. Particle size distribution for sediment <10 mm was measured as percentages (following the same method as surficial sediments). For sediment >10 mm pebble counts (per standardized volume) were performed.

3.3.1 Subsurface Sediment (<10 mm)

Subsurface sediments <10 mm were composed of clay, silt, sand and gravel. The dominant subsurface sediment type was sand for Sites 1, 2 and 5 in October 2013 and January 2014, gravel for Sites 3 and 4 in January 2014 and sand and gravel for the rest of the sites and sampling events (Figure A8-A10, Appendix 1). The mean proportion of silt ranged from below the reported detection limit (<2.0%) to 4.8% ± 0.5% and clay ranged from below detection (<2.0%) to 2.3% ± 0.2%. Given that percent (%) silt and clay was very low in all subsurface samples were not examined any further in this report.

In January and May 2014, at Sites 1 and 2 (Figure A9-A10, Appendix 1), mean sand percentage (64.2% ± 5.5% [January 2014, Site 2] to 79.7% ± 2.0% [January 2014, Site 1]) was significantly ($p<0.05$) greater than most other sites assessed during the same sampling event. Accordingly, the mean percentage of gravel was significantly ($p<0.05$) lower at Sites 1 and 2 in January and May 2014 (17.2% ± 1.7% [January 2014, Site 1] to 33.3% ± 5.8% [January 2014, Site 2]).

The highest mean percentage of gravel was recorded at Site 4 in January 2014 (69.2% ± 5.2%). In January 2014, while not all differences were significant, there was a decreasing trend in the mean percentage of gravel (and corresponding increase in mean percentage of sand) from Site 4 (gravel: 69.2% ± 5.2%; sand: 27.3% ± 5.3%) downstream to Site 1 (gravel: 17.2% ± 1.7%; sand: 79.7% ± 2.0%). Sites 3 to 6 in October 2013 (Figure A8, Appendix 1) and May 2014 (Figure A10, Appendix 1) had comparable mean proportions of gravel and sand (Table 2) with no one site being significantly ($p>0.05$) different.

Table 2. Comparison of Sand & Gravel percentages (%) at Sites 3-6 in October 2013 & May 2014

Sediment Type	October 2013	May 2014
Sand	43.7% ± 5.4% to 61.3% ± 7.1%	45.8% ± 3.8% to 52.8% ± 3.2%
Gravel	35.3% ± 7.1% to 54.5% ± 5.6%	40.8% ± 3.1% to 51.3% ± 3.4%

There was no significant ($p>0.05$) difference in the composition of subsurface sediments <10 mm at Sites 1, 2, 3, 5 and 6 between the three (3) sampling events (October 2013, January 2014, May 2014). At Site 4 in January 2014 the mean percentage of sand (27.3% ± 5.3%) was significantly less ($p<0.05$) and gravel (69.2% ± 5.2%) significantly greater ($p<0.05$) than May 2014 at Site 4 (sand: 52.8% ± 3.2%, gravel: 40.8% ± 3.1%).

3.3.2 Subsurface Sediment (>10 mm)

Subsurface sediment >10 mm was sorted based on size and total pebble count per standardized volume (5.6 L). The pebble counts of each sample were for a consistent sample volume collected in the field from within the set volume of the Hess sampler used; therefore, all counts were reported as the number of pebbles per standardized volume (5.6 L). Pebble counts from October 2012 through May 2013, in addition to October 2013 through May 2014, have been included in this report. Mean pebble counts of each sediment type (medium gravel [10-16 mm] through boulder [>256 mm]) were compared between sites during each sampling event and within each site between sampling events.

The dominant sediment type (>10 mm) identified was medium gravel (10-16 mm) at all sites, with the exception of Site 6 in January 2014 (Figure A17-A22, Appendix 1), ranging from 131.7 (pebbles per sampler volume) ± 32.3 (January 2014, Site 2) to 501.8 ± 84.6 (January 2013, Site 5; Figure A16, Appendix 1). The subdominant subsurface sediment type was coarse gravel (17-32 mm) at all sites, with the exception of Site 6 (January 2014). The mean pebble count of coarse gravel ranged from 88.7 ± 19.6 (October 2013, Site 4) to 281.3 ± 44.7 (January 2013, Site 5; Figure A15, Appendix 1). At Site 6 in January 2014 counts of coarse gravel and medium gravel were relatively comparable (Figure A21, Appendix 1).

There was more cobble than gravel at the sample sites during all sampling events (October 2012, 2013, January 2013, 2014, May 2013, 2014). Large cobble (128-256 mm) was not common in samples with mean counts ranging from 0 (January 2013, Site 6) to 3.0 ± 0.8 (May 2014, Site 3; Figure A11, Appendix 1).

Mean medium cobble (91-128 mm) counts were also low and ranged from 1.5 ± 0.8 (October 2012, Site 1) to 6.0 ± 1.8 and 6.0 ± 1.9 (October 2012, Site 2; May 2013, Site 6). As noted for large cobble, there was great variation and low totals in mean counts of medium cobble. In October 2012 medium cobble pebble count per standardized volume was significantly greater at Site 2 compared to Site 1 ($p<0.05$). During all subsequent sampling events there was no significant difference between any sites with respect to medium cobble (Figure A12, Appendix 1).

Mean counts of small cobble (65-90 mm) were moderately higher than medium and large cobble, (2.7 ± 0.9 [October 2013, Site 5] to 12.5 ± 1.9 [May 2014, Site 4]); however, like other cobbles there was high variation within results. The mean counts of small cobble were consistent between sites during each sampling event with few significant differences at individual sites (i.e., January 2014, Sites 2 and 6 and May 2014, Sites 3 and 4; Figure A13, Appendix 1).

A comparison of the same site during each sampling event noted that during May 2014 mean counts of small cobble at Sites 2, 5 and 6 were significantly ($p<0.05$) greater than at least one other sampling event at the same sites (Figure A13, Appendix 1). Although only significant for October 2012 (7.4 ± 1.2) and January 2013 (6.5 ± 1.2), compared to May 2014 (11.5 ± 0.7) at Site 2, small cobble may have been increasing since October 2012. This will be tested further with improving datasets.

The mean amount of gravel at each site, based on counts, appears to be greater than that of cobble. Medium and coarse gravel were the dominant and subdominant sediment types as stated above. Counts of very coarse gravel (33-64 mm) ranged from 25.8 ± 5.5 (May 2013, Site 1) to 61.5 ± 8.1 (May 2014, Site 4) with a majority of the counts ranging from 30 to 45 (Figure A14, Appendix 1). In general, the mean counts of very coarse gravel were consistent between sites and sampling events. The exception to this was that in May 2014 there was more very coarse gravel at Site 4 (61.5 ± 8.1) than the other sites (33.2 ± 5.6 to 49.0 ± 4.2); however this was only significant when compared to Sites 1 (33.2 ± 5.6) and 3 (36.8 ± 8.5; $p<0.05$).

Mean counts of medium (10-16 mm) and coarse gravels (17-32 mm) follow similar patterns at all sites over the different sampling events despite there being less coarse gravel present at all sites (with the exception of Site 6 in January 2014; Figure A15-A16, Appendix 1). In January 2013 there appears to have been an influx of medium and coarse gravel upstream as both Site 5 (medium: 501.8 ± 84.6, coarse: 281.3 ± 44.7) and Site 6 (medium: 395.5 ± 62.3, coarse: 238.3 ± 97.0) had greater mean counts of both gravel types in January 2013 compared to other sampling events at the same sites (Site 5 medium: 145.5 ± 49.0 to 398.2 ± 47.6, coarse: 127.7 ± 36.3 to 237.4 ± 41.4; Site 6 medium: 76.8 ± 35.1 to 258.2 ± 22.3, coarse: 83.7 ± 31.5 to 152.3 ± 29.3) with one (1) to three (3) events being significantly less ($p<0.05$).

There was no obvious relationship between river discharge (downstream of the sample sites) and mean subsurface sediment (>10 mm) composition and pebble counts at the sampling sites during the six (6) sampling events between October 2012 and May 2014. This will be tested further with improving datasets.

3.4 Embeddedness

Embeddedness of each sample was visually assessed by three (3) observers in the field prior to the sample being collected. The embeddedness values from each observer were averaged to determine overall embeddedness for each sample from October 2013, January 2014 and May 2014.

Average embeddedness ranged from 32.2% ± 6.3% (January 2014, Site 1) to 64.2% ± 4.2% (May 2014, Site 1; Table 3; Figure A23, Appendix 1). There were no significant differences between sites during any sampling event except for Site 1 and 6 in May 2014 ($p<0.05$).

Table 3. Average Embeddedness (%) – October 2013 to May 2014						
	Sampling Event					
	October 2013		January 2014		May 2014	
Site	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
1	nd[1]	nd[1]	32.22	6.32	64.17	4.25
2	nd[1]	nd[1]	38.33	8.28	53.75	4.92
3	51.11	11.24	39.31	13.06	55.97	3.95
4	52.67	9.69	45.56	6.93	54.86	11.40
5	56.39	18.01	42.92	10.28	43.89	2.88
6	50.97	4.83	34.17	6.33	32.78	1.55

nd - no data
[1] Samples were not collected from Sites 1 and 2 and downstream Site 5 in October 2013 due to high salmon reproductive activity.

3.5 Turbidity

Turbidity was measured in the field on samples collected at each sample site in January and May 2014. One sample was collected from each sample site and turbidity measured three (3) times and values were then averaged.

The range of turbidity was 0.28 NTU ± 0.06 NTU (January 2014, Site 5) to 10.44 NTU ± 0.12 NTU (January 2014, Site 3; Table 4; Figure A24, Appendix 1). When January and May 2014 turbidity results were compared there were no significant differences between Sites 5 and 6 ($p>0.05$). At Site 4, May 2014 turbidity was significantly ($p<0.05$) greater than in January 2014 whereas for Sites 1 through 3 turbidity was significantly ($p<0.05$) less in May 2014 than January 2014. During each sampling event turbidity at Site 3 was significantly ($p<0.01$) greater than the other sites. This corresponds with the surficial sediment results as January 2014, Site 3, had a high mean percentage of silt (11.9% ± 3.7%) and May 2014 had high mean percentages of silt (24.7% ± 5.1%) and clay (20.0% ± 2.7%).

Despite turbidity at Site 3 in May 2014 (2.78 NTU ± 0.08 NTU), being greater than the other sites, was significantly lower than January 2014 at Site 3 (10.44 NTU ± 0.12 NTU; $p<0.01$). The greatest difference (7.66 NTU) in turbidity between January 2014 and May 2014 was at Site 3.

Table 4. Turbidity (NTU) – October 2013 to May 2014				
	Sampling Event			
	January 2014		May 2014	
Site	Mean (replicate measurements)	Standard Error	Mean (replicate measurements)	Standard Error
1	2.23	0.39	0.50	0.067
2	1.25	0.25	0.52	0.055
3	10.44	0.12	2.78	0.084
4	0.30	0.07	0.73	0.064
5	0.28	0.06	0.30	0.043
6	0.44	0.12	0.57	0.040

3.6 Comparison to Previous Years

The current methodology has been applied to only one previous monitoring year (October 2012 to May 2013). In October and November 2012 there were high flows in the weeks prior to sampling with thirteen (13) consecutive days of unregulated discharge measured to be greater than 30 m^3/s. This duration of high flow was not repeated at any other time from December 2012 through May 2014 and may have influenced October 2012 sampling results. Based on previous studies this prolonged increased flow may have temporary impacts on sediment composition (NHC, 2012).

There were no flushing flow events and few instances of flow exceeding 30 m^3/s after November 2012 (2% of days from December 2012 through May 2014).

The dominant surficial sediment type throughout the two (2) years studied using the current methodology was sand with clay and silt being present in much lower proportions (<25% for each site and sampling event). Sand and gravel were the dominant sediment types in subsurface sediment <10 mm and medium and coarse gravel were the dominant sediment types in subsurface sediment >10 mm.

As this is the second year of sampling using the current methods there is limited data at this time with which to draw any definitive conclusions. Temporal analysis of substrate composition will require several more years of data to better assess long term trends.

3.7 Sediment Quality

Sediment quality is integral to both spawning and rearing success for salmonids and provides important habitat requirements for cover. When spawning, salmonids build gravel nests (redds) which are designed to hold eggs within the interstitial spaces in the substrate. Appropriate interstitial space between substrate enables oxygenated water to flow over eggs, supplying oxygen to embryos (Keeley and Slaney, 1996). Finer substrate sizes such as sand and silt can ultimately reduce flow of water and oxygen to developing embryos and result in reduced survival. Substrates for rearing salmonids provide protection from fast currents as well as habitat for aquatic invertebrates, a main food source for salmon fry. Emergence can also be difficult if alevins cannot pass through interstitial spaces in substrate. Bjornn and Resier (1991) noted difficulty with emergence when fine sediment percentages (<6.4 mm) were >30% to 40% volume. While size of rearing substrate may vary between individual species (depending on their size), rearing salmonids are associated with gravel and larger sized substrates that are relatively free of high levels of fine particles (Keeley and Slaney, 1996).

Separate and concomitant monitoring for the Coquitlam River monitoring program involves the monitoring of adult escapement and smolt outmigration of four anadromous species (coho, steelhead, chum and pink). Coho and steelhead reside in freshwater longer than chum and pink which emigrate soon after emergence. As such, coho and steelhead smolt production is used as an indicator for freshwater production while chum and pink smolt production and egg-to-smolt survival can help determine quality of spawning substrate for eggs.

A preliminary assessment of sediment quality based on the two (2) years of program data collected using the current revised methods suggests that suitable substrates for spawning and rearing were observed at each of the six (6) sampling sites. While making up less than 30% of the total sample volume, the majority of fines measured were composed of sand (surficial and subsurface) and gravel (subsurface). The dominant subsurface sediment type >10 mm was medium (10-16 mm) and coarse (17-32 mm) gravel. This description of sediment quality is preliminary and ongoing given the limited dataset with which to draw any conclusions. Analysis of substrate quality results will require several years of data to develop a robust set of correlations between substrate quality results and fish productivity.

The results of this monitoring program (COQMON#8) will be integrated with results of the other programs currently being conducted on the Lower Coquitlam River for a robust analysis of sediment quality and potential influences of flushing flows on fish productivity.

4.0 SUMMARY & RECOMMENDATIONS

G3 Consulting Ltd. (G3) completed the Year 7 (2013-2014) *Lower Coquitlam River Substrate Quality Assessment* program (COQMON#8) for BC Hydro as part of requirements under the Water Use Plan (WUP) and ongoing evaluations of substrate conditions in salmonid spawning and rearing habitat in the Lower Coquitlam River. To evaluate the effectiveness of flushing flows on substrate quality in the Lower Coquitlam River, sediment conditions at six (6) sample sites were assessed with Site 1 being the most downstream location from the Coquitlam Dam and Site 6 furthest upstream. Composition of surficial and subsurface substrates <10.0 mm was assessed using laboratory measured percentage (%) particle size. Subsurface sediments (>10.0 mm) were also evaluated for composition using total pebble counts per sampler volume. Six (6) replicate samples were collected at each sample site and mean values calculated for each site for each sampling event (October 2013, January 2014 and May 2014).

No “flushing flows” (i.e., 30 m^3/s to 50 m^3/s release from the dam, total river discharge of 70 m^3/s to 100 m^3/s) have occurred during this study; however, there was variation of discharge between the different sampling events. While there is great variation in daily discharge, in the days prior to sampling, discharge was greatest in January 2014 and lowest in May 2014.

Surficial sediment at all sites during all sampling events was largely comprised of sand (55.5% ± 6.1% to 96.3 ± 0.8%). While notable at all sites, in January 2014 there was more sand present in surficial sediment samples while May 2014 had generally a lower percentages of sand. Lower percentage (%) of sand and higher percentages of clay and silt, especially at sites farthest from the Coquitlam Dam, relative to all other sites and sampling events were noted in May 2014. This coincides with low discharge in the Lower Coquitlam River.

The composition of subsurface sediments from October 2012 through May 2014 was consistent in the types of material present, regardless of the flow prior to sampling. Subsurface sediment <10 mm was primarily composed of sand and gravel. Medium (10-16 mm) and coarse (17-32 mm) gravel were the dominant and subdominant sediment types identified in subsurface sediments >10 mm. Cobbles were not common. For larger subsurface sediment (>10 mm) there were no consistent trends between sampling sites during the same events. Trends down river in subsurface sediment composition (>10 mm), while not always significant, varied between sampling events; however, there was little variation in composition of subsurface sediment (>10 mm) at each site with time (i.e., the same sites during the different sampling events).

A river such as the Lower Coquitlam River is a heterogeneous composition of sediment types with natural variation along the length of the river and through time. Monitoring of the river for an extended period of time is necessary to determine if the observed results from this study are due to changing discharge, other environmental or anthropogenic factors or, more likely a combination. With the collection of future data the composition and volume of surficial sediments can be used to more reliably to assess substrate quality used by salmonids for spawning and rearing habitat. With few exceptions the daily discharge in the Lower Coquitlam River was substantially lower than that defined by BC Hydro for this project as a “flushing flow” (i.e., 30 m^3/s to 50 m^3/s release from the dam, total river discharge of 70 m^3/s to 100 m^3/s) and, therefore, results do not represent potential influences arising from such an event. Based on current study results, the relatively low flows experienced over the measured sampling events would have little influence on the subsurface sediments in the river.

It is recommended that sample collection methods continue following the methodology used in this study. Adding the measurement of volume and dry weight of all samples processed for particle size percentage would provide information as to the total amount of surficial and subsurface sediments (<10 mm) present in each sample. This would add to the assessment of sediment quality as it would be a reflection of the amount of fines present that may infill the larger particles (gravel and cobble) which would reduce sediment quality for salmonids.

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APPENDICES

Appendix 1

Figures

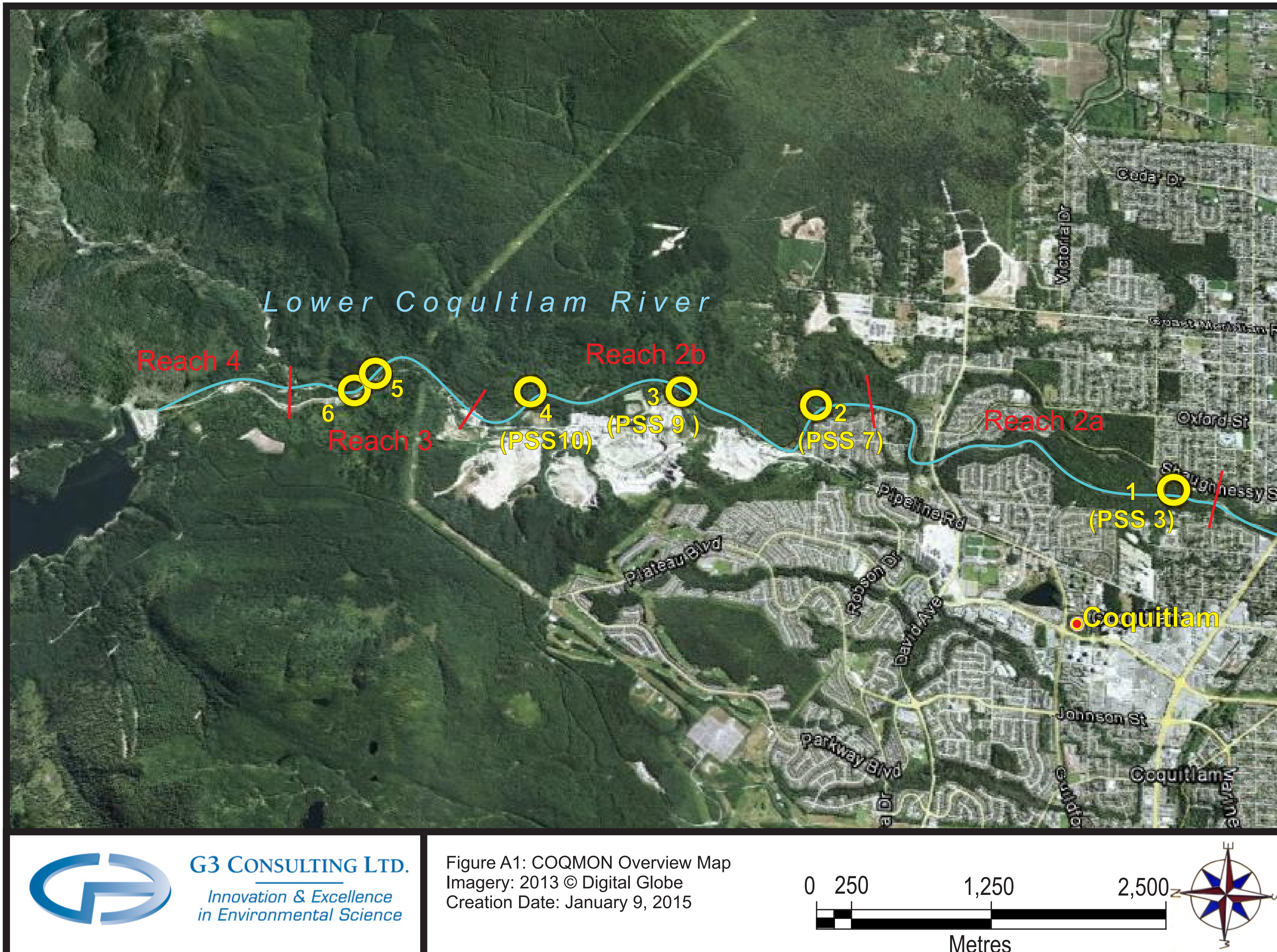

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Figure A1: COQMON Overview Map
Imagery: 2013 © Digital Globe
Creation Date: January 9, 2015

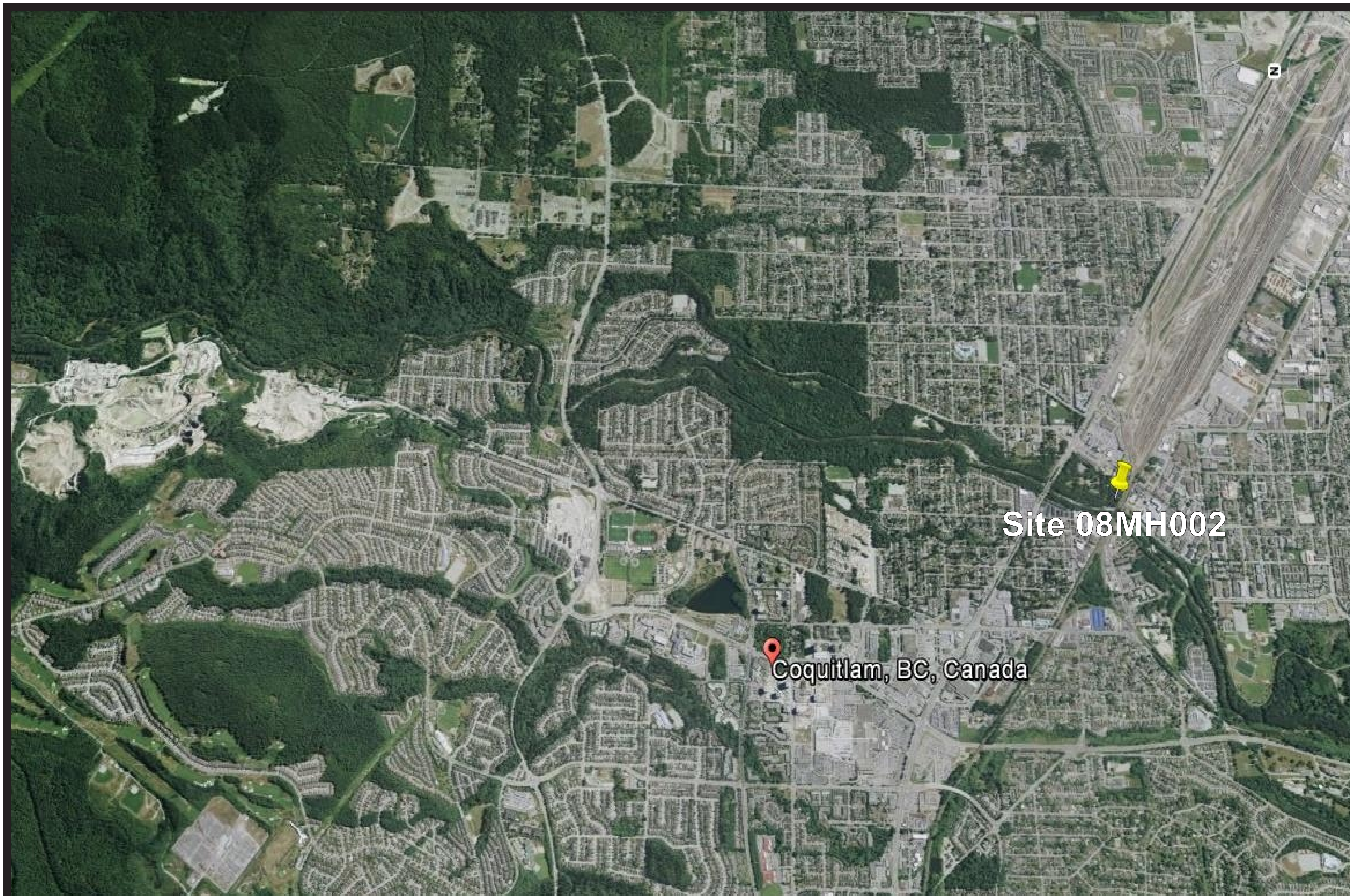

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Figure A2: Location of Water Survey Canada discharge logger (Site 08MH002)
Imagery: 2013 © Digital Globe
Creation Date: January 9, 2015

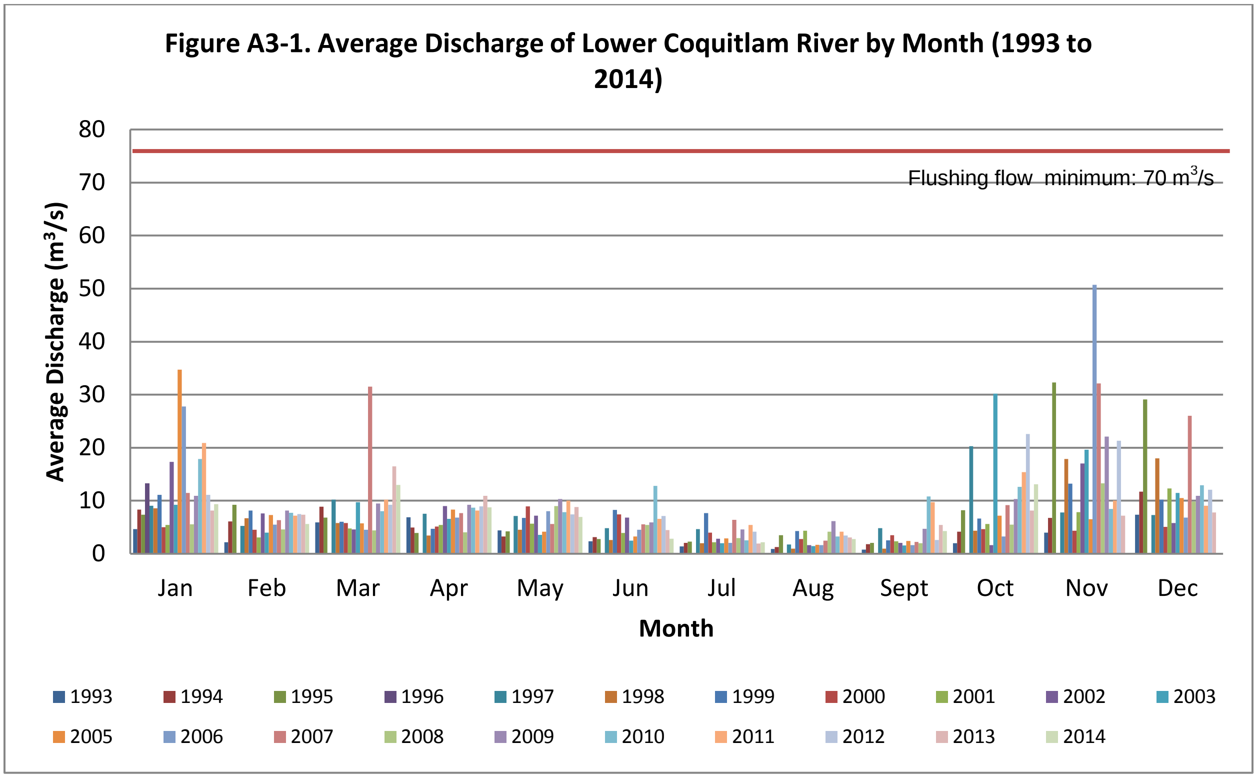
Figure A3-1. Average Discharge of Lower Coquitlam River by Month (1993 to 2014)
Average Discharge (m³/s)
Flushing flow minimum: 70 m³/s
0
10
20
30
40
50
60
70
80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Oct
Nov
Dec
Month
1993
1994
1995
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1999
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2001
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2008
2009
2010
2011
2012
2013
2014

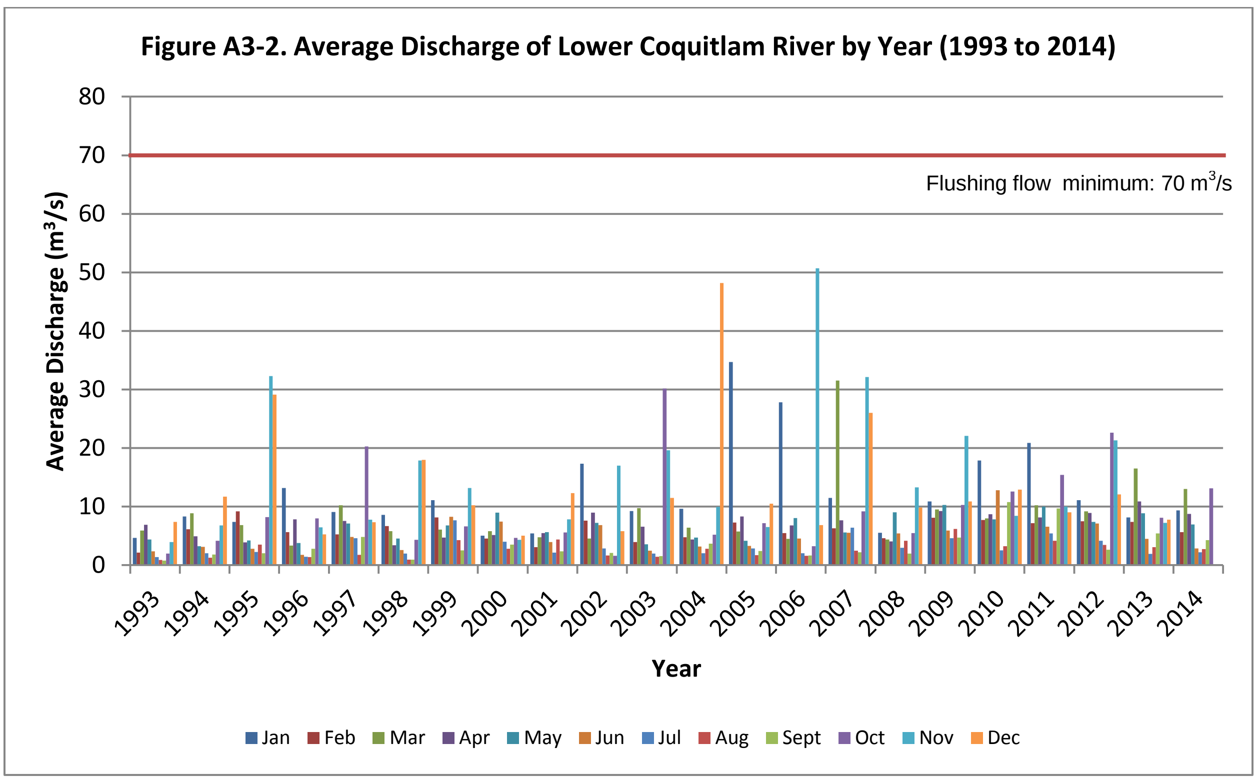
Figure A3-2. Average Discharge of Lower Coquitlam River by Year (1993 to 2014)
Average Discharge (m³/s)
Flushing flow minimum: 70 m³/s
0
10
20
30
40
50
60
70
80
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
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2012
2013
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Year
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Feb
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Jun
Jul
Aug
Sept
Oct
Nov
Dec

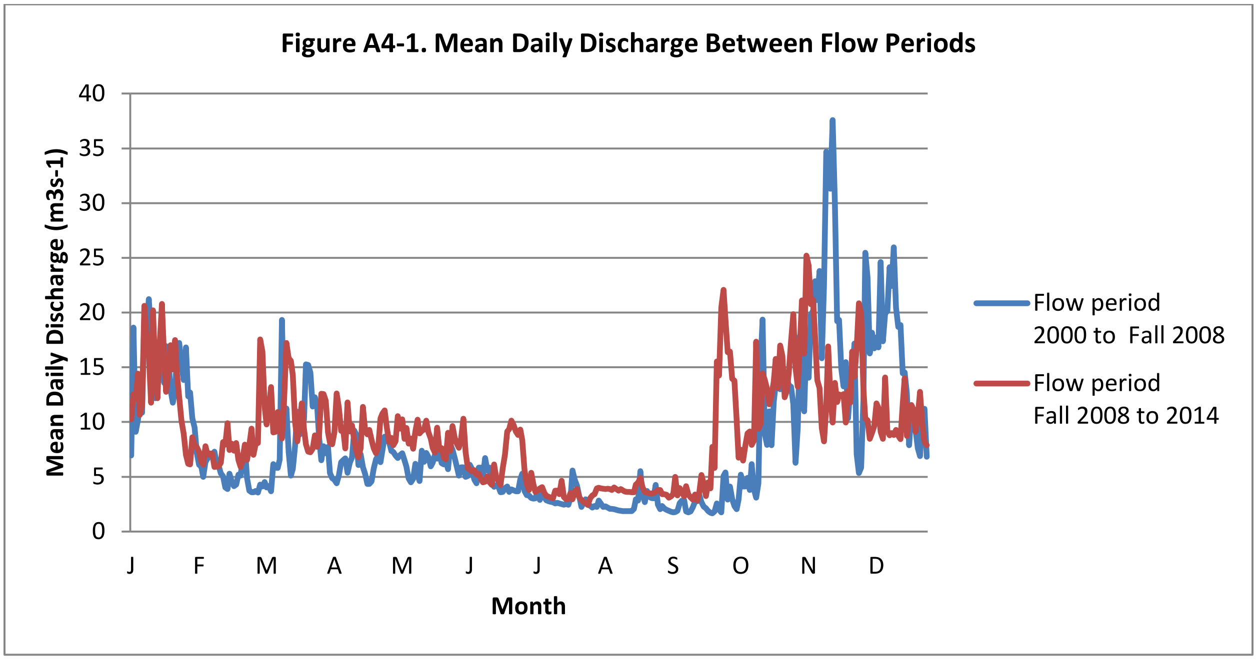


Figure A4-1. Mean Daily Discharge Between Flow Periods
Mean Daily Discharge (m3s-1)
40
35
30
25
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D
Month
Flow period
2000 to Fall 2008
Flow period
Fall 2008 to 2014

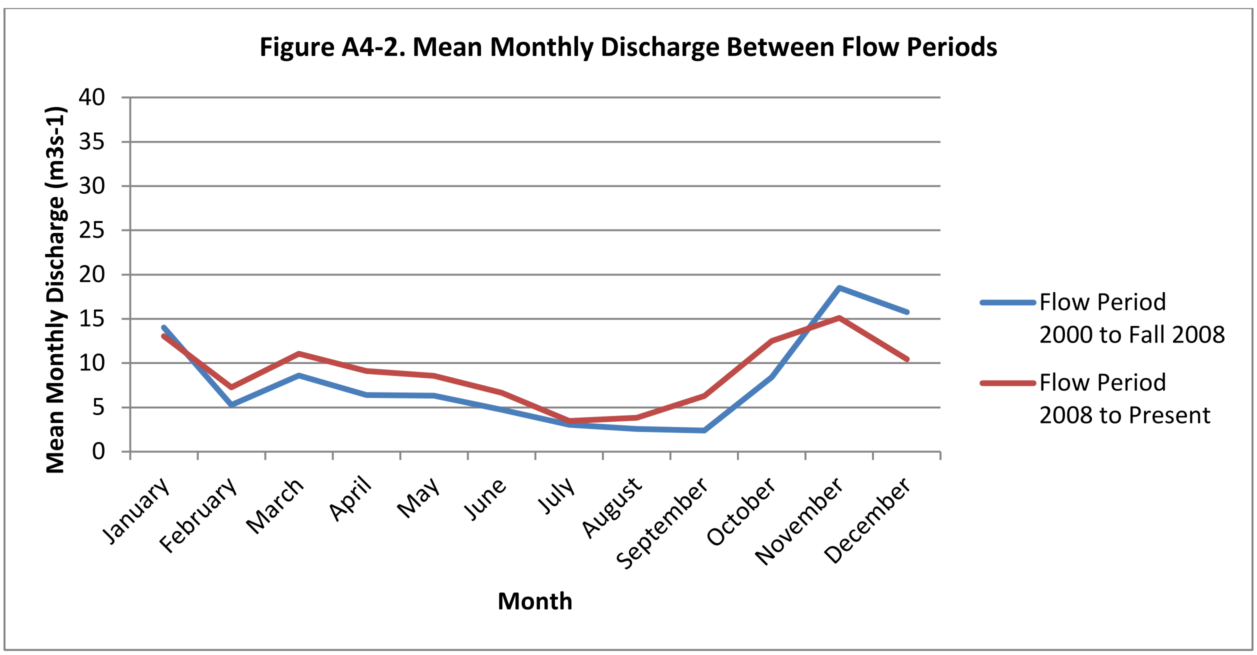
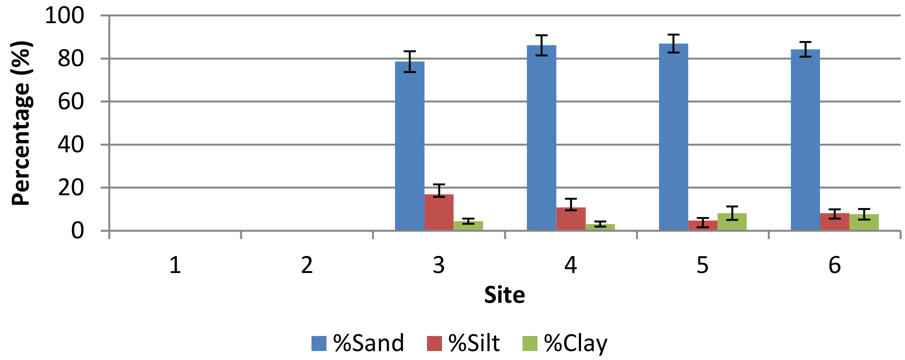


Figure A4-2. Mean Monthly Discharge Between Flow Periods
Mean Monthly Discharge (m3s-1)
40
35
30
25
20
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
Flow Period
2000 to Fall 2008
Flow Period
2008 to Present

Figure A7. Average Composition of Surficial Sediment - October 2013



Note: Samples were not collected at Sites 1, 2 and downstream at Site 5 due to high salmon reproductive activity in the area.

Figure A8. Average Composition of Surficial Sediment - January 2014

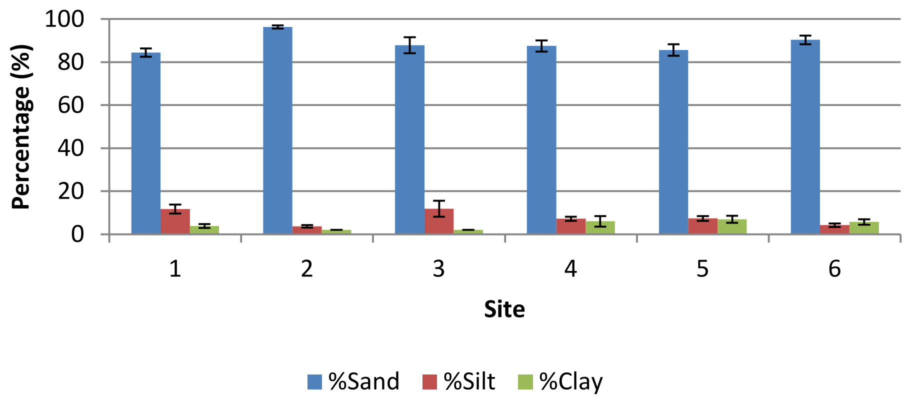


Figure A9. Average Composition of Surficial Sediment - May 2014

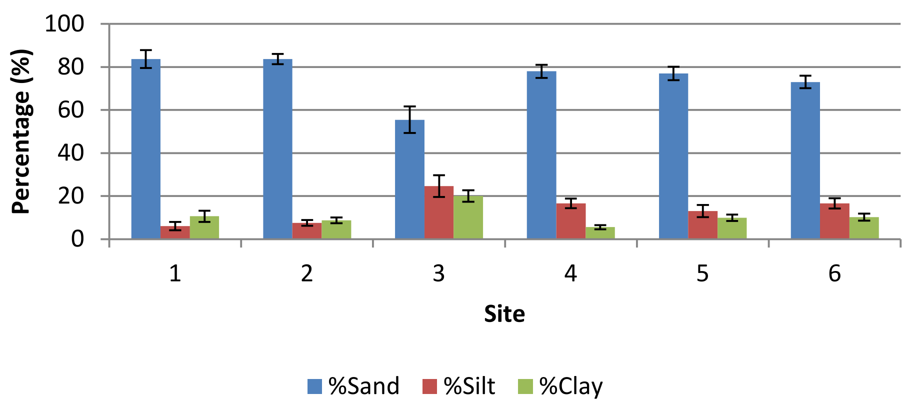
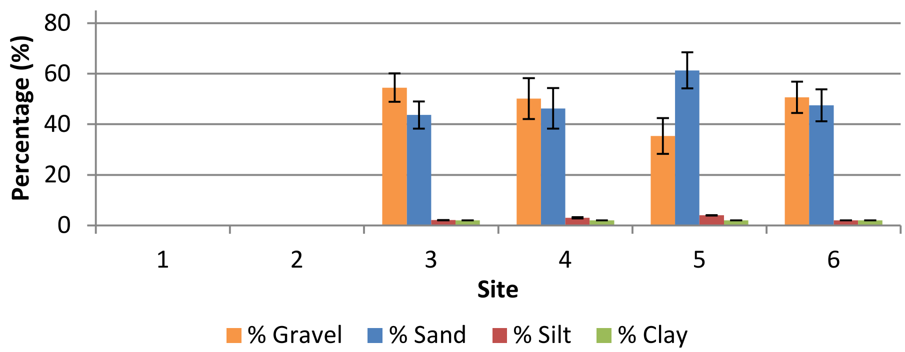


Figure A10. Average Composition of Subsurface Sediment (<10 mm) - October 2013



Note: Samples were not collected at Sites 1, 2 and downstream at Site 5 due to high salmon reproductive activity in the area.

Figure A11. Average Composition of Subsurface Sediment (<10 mm) - January 2014

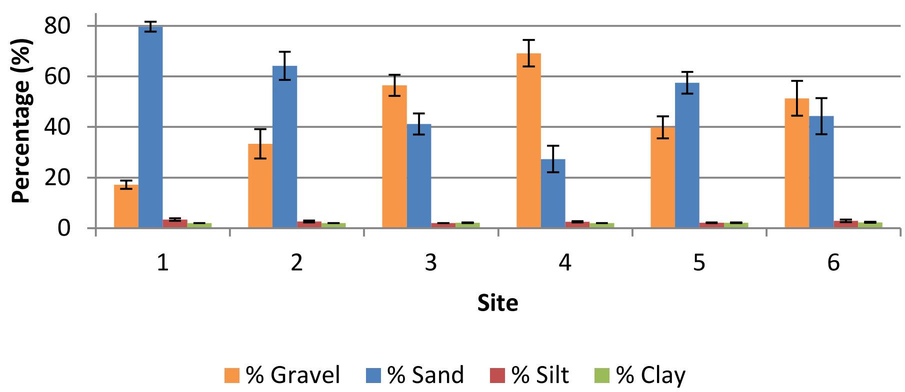
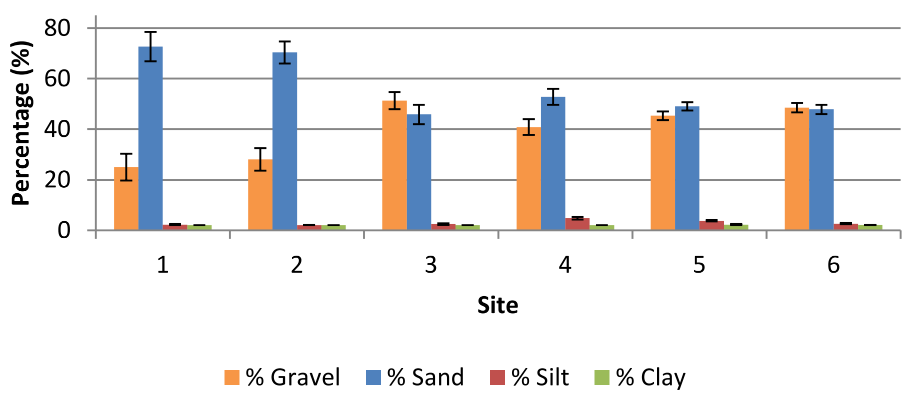


Figure A12. Average Composition of Subsurface Sediment (<10 mm) - May 2014



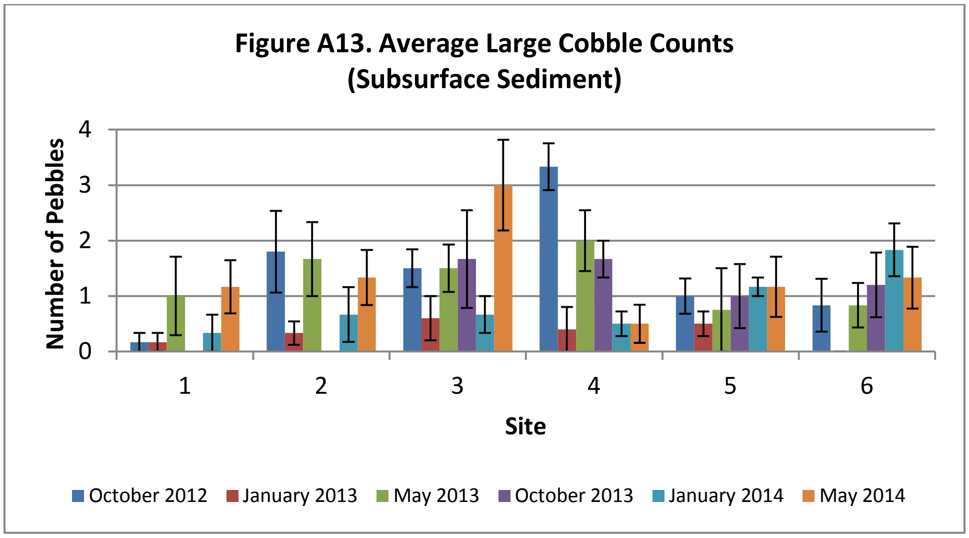


Figure A13. Average Large Cobble Counts
(Subsurface Sediment)
Number of Pebbles
0
1
2
3
4
1
2
3
4
5
6
Site
October 2012
January 2013
May 2013
October 2013
January 2014
May 2014

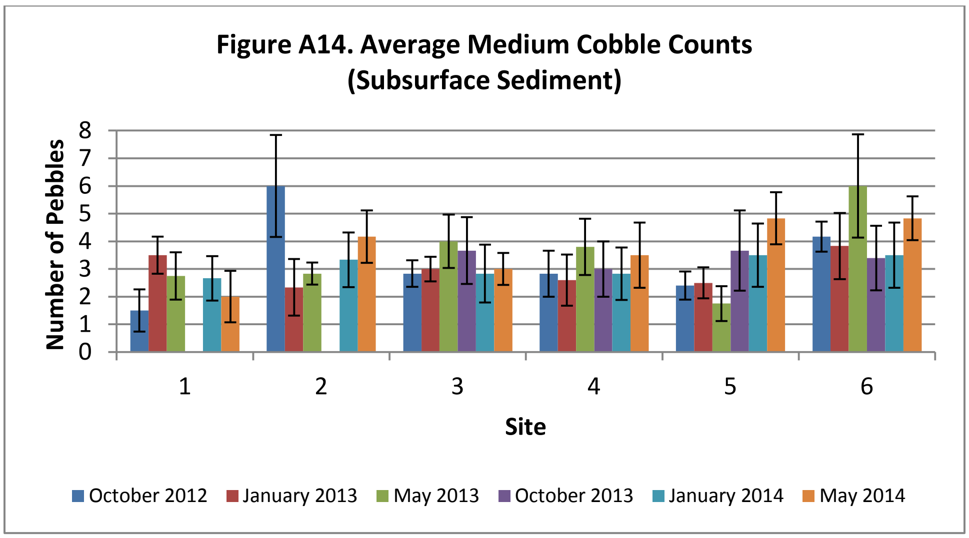


Figure A14. Average Medium Cobble Counts
(Subsurface Sediment)
Number of Pebbles
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
Site
October 2012
January 2013
May 2013
October 2013
January 2014
May 2014

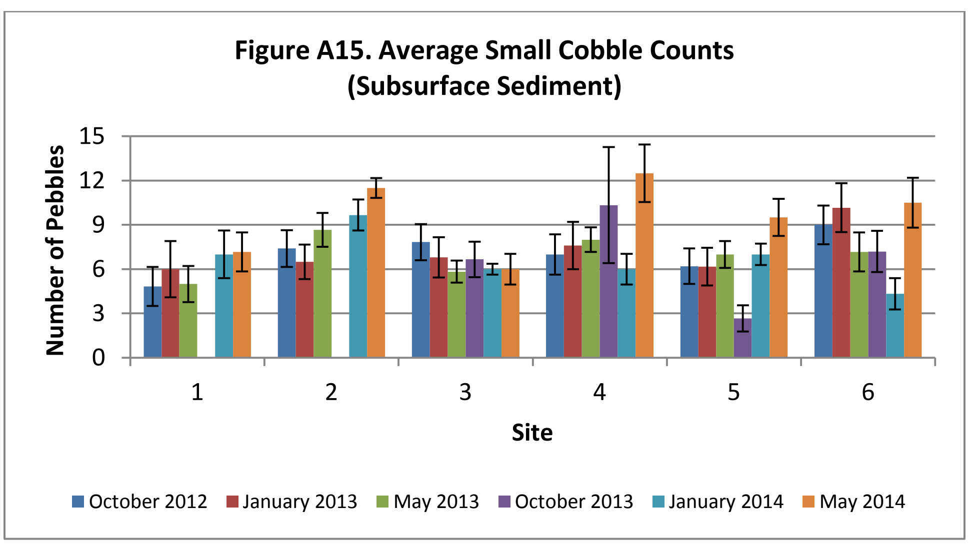


Figure A15. Average Small Cobble Counts
(Subsurface Sediment)
Number of Pebbles
0
3
6
9
12
15
1
2
3
4
5
6
Site
October 2012
January 2013
May 2013
October 2013
January 2014
May 2014

Figure A16. Average Very Coarse Gravel Counts (Subsurface Sediment)

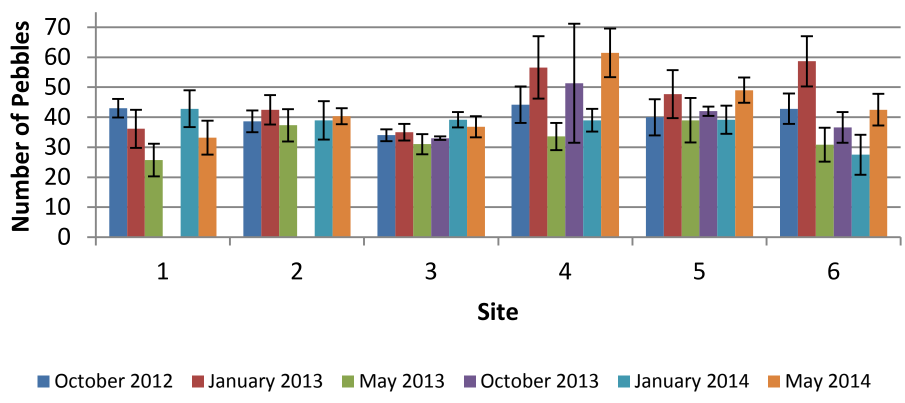


Figure A17. Average Coarse Gravel Counts (Subsurface Sediment)

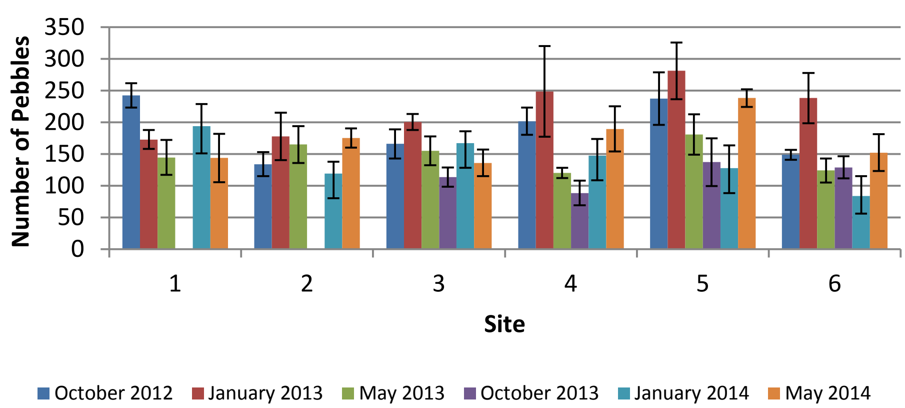
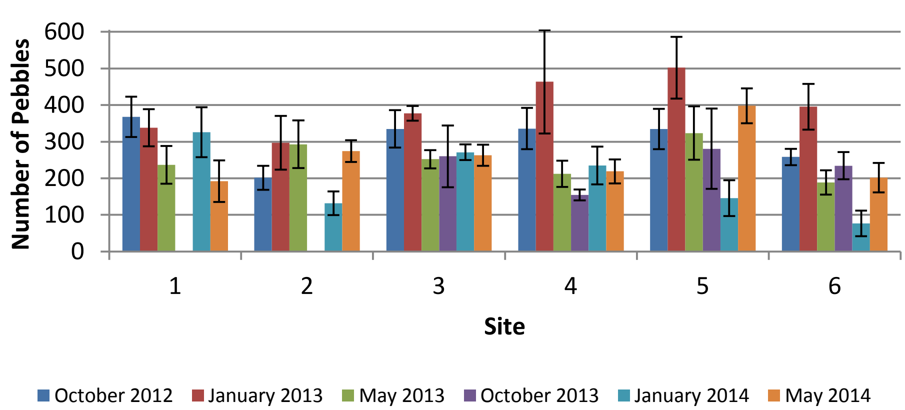


Figure A18. Average Medium Gravel Counts (Subsurface Sediment)



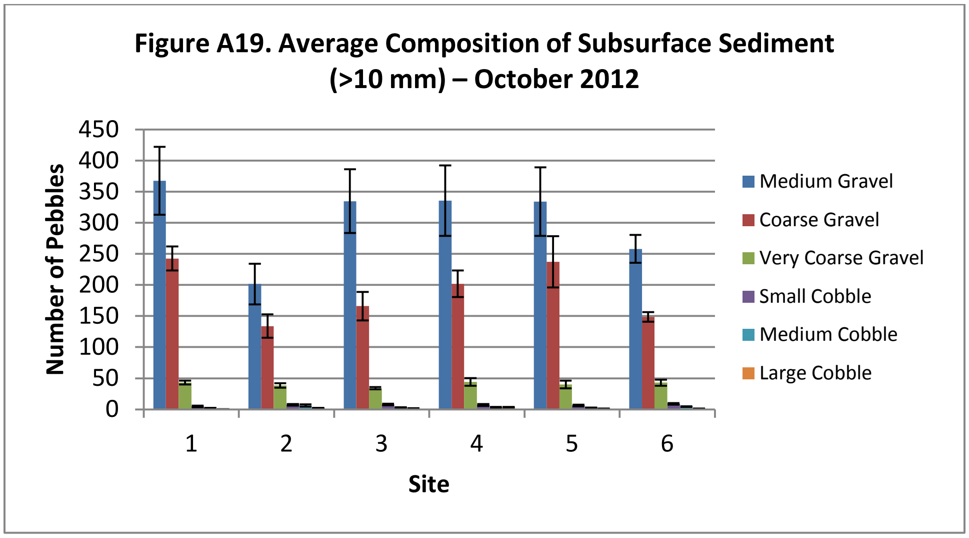


Figure A19. Average Composition of Subsurface Sediment (>10 mm) – October 2012
Number of Pebbles
450
400
350
300
250
200
150
100
50
0
1
2
3
4
5
6
Site
Medium Gravel
Coarse Gravel
Very Coarse Gravel
Small Cobble
Medium Cobble
Large Cobble

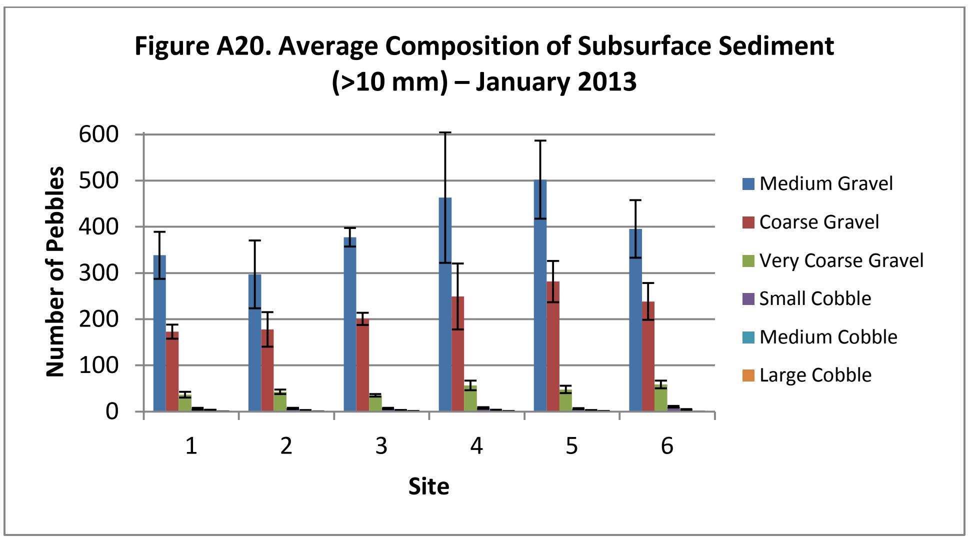


Figure A20. Average Composition of Subsurface Sediment (>10 mm) – January 2013
Number of Pebbles
600
500
400
300
200
100
0
1
2
3
4
5
6
Site
Medium Gravel
Coarse Gravel
Very Coarse Gravel
Small Cobble
Medium Cobble
Large Cobble

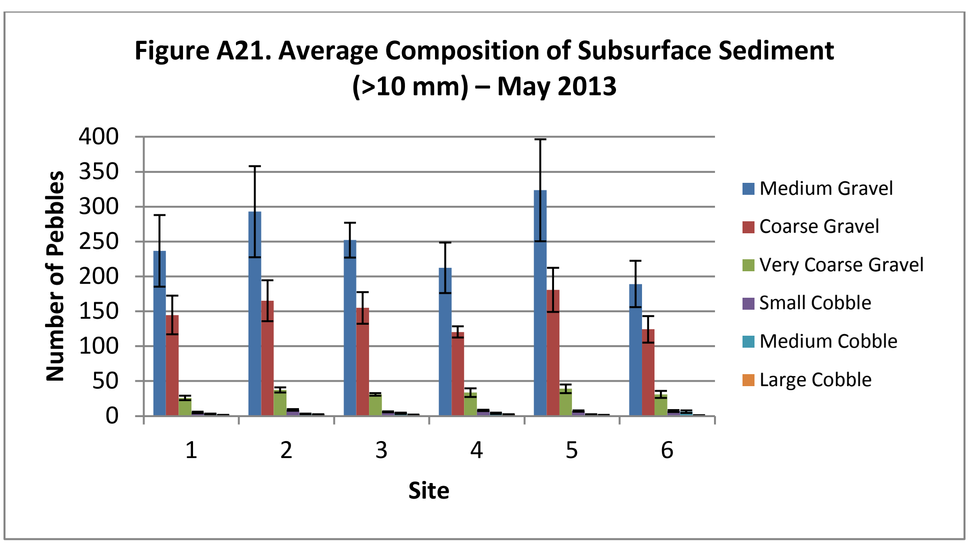
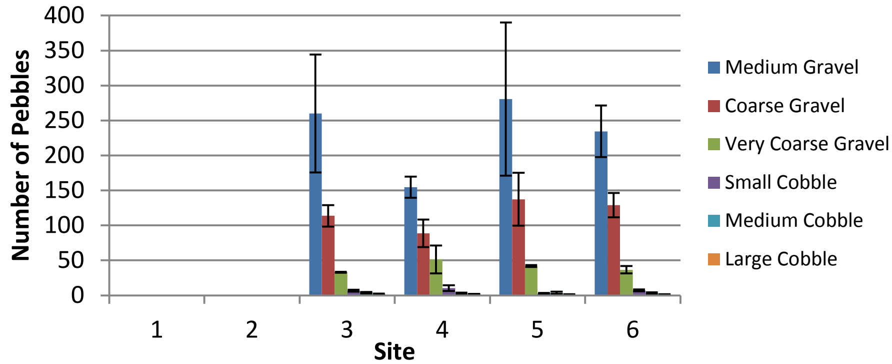


Figure A21. Average Composition of Subsurface Sediment (>10 mm) – May 2013
Number of Pebbles
400
350
300
250
200
150
100
50
0
1
2
3
4
5
6
Site
Medium Gravel
Coarse Gravel
Very Coarse Gravel
Small Cobble
Medium Cobble
Large Cobble

Figure A22. Average Composition of Subsurface Sediment (>10 mm) – October 2013



Note: Samples were not collected at Sites 1, 2 and downstream at Site 5 due to high salmon reproductive activity in the area.

Figure A23. Average Composition of Subsurface Sediment (>10 mm) – January 2014

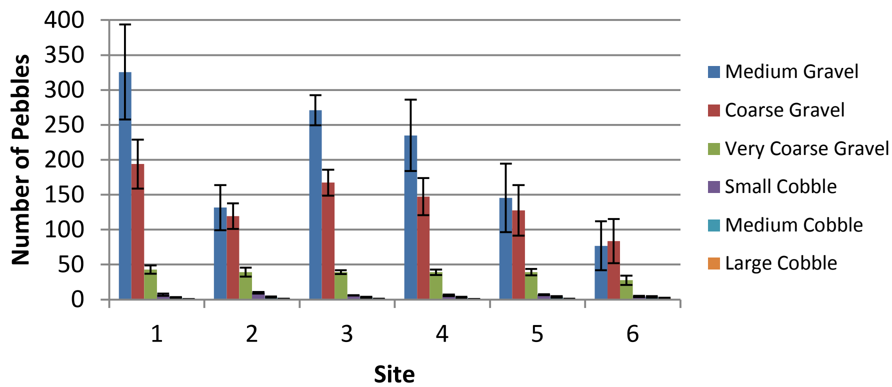
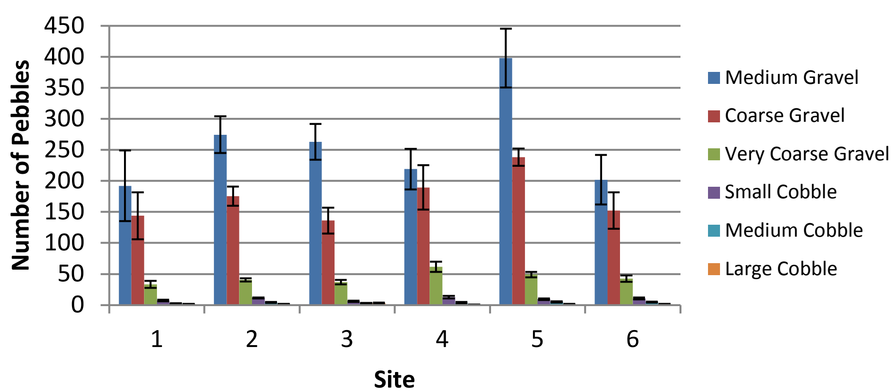


Figure A24. Average Composition of Subsurface Sediment (>10 mm) – May 2014



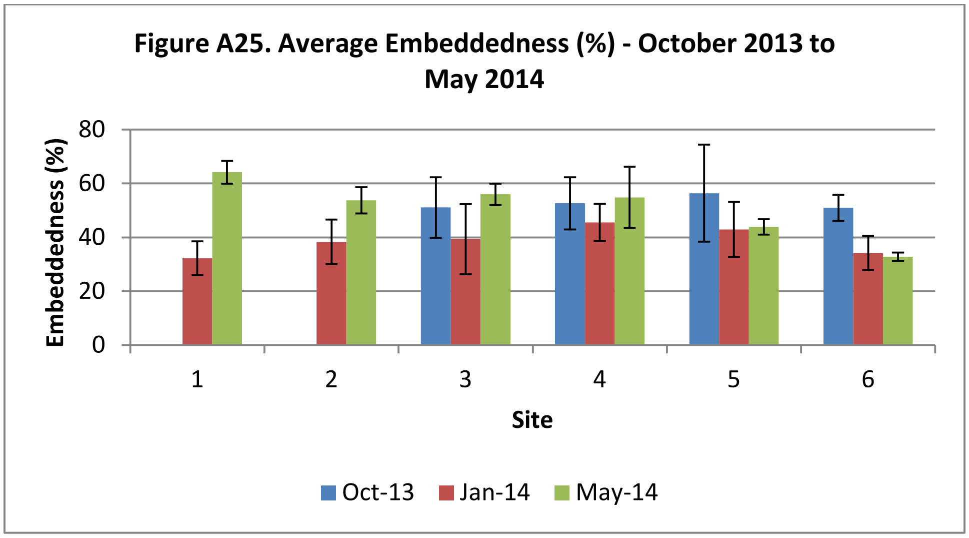


Figure A25. Average Embeddedness (%) - October 2013 to May 2014
Embeddedness (%)
80
60
40
20
0
1
2
3
4
5
6
Site
Oct-13
Jan-14
May-14

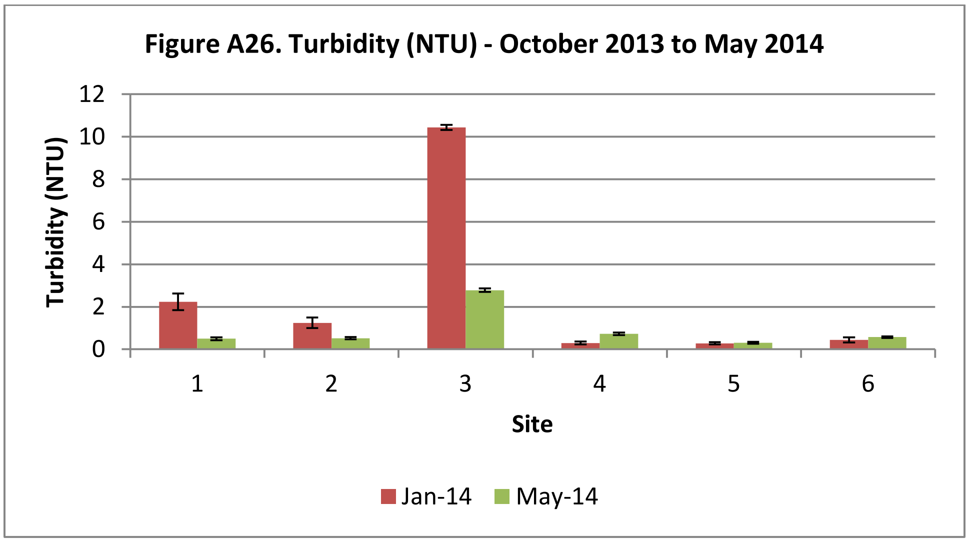


Figure A26. Turbidity (NTU) - October 2013 to May 2014
Turbidity (NTU)
12
10
8
6
4
2
0
1
2
3
4
5
6
Site
Jan-14
May-14

Appendix 2

Photographs

Photos A1-12:	Site Photos
Photos A13-19:	Sampling Photos
Photos A20-28:	Processing Photos

Photographs A 1-6: Representative Site Photos

Photo A 1: Site 1 (upstream) - Lower Coquitlam River facing downstream (May 2014).

Photo A 2: Site 1 (downstream) - Lower Coquitlam River facing upstream (May 2014).

Photo A 3: Site 2 (upstream) - Lower Coquitlam River facing downstream (May 2014).

Photo A 4: Site 2 (downstream) - Lower Coquitlam River facing upstream (May 2014).

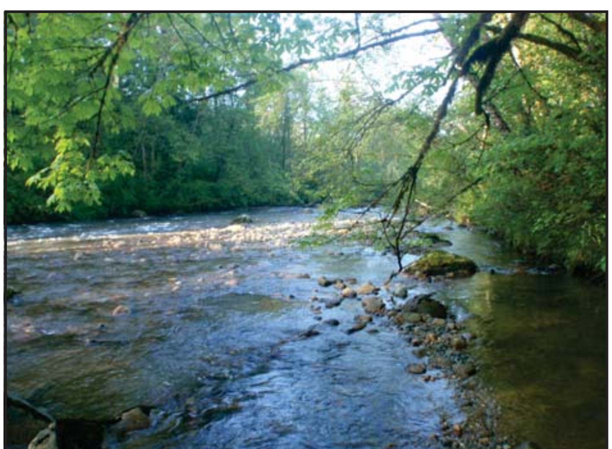


Photo A 5: Site 3 (upstream) - Lower Coquitlam River facing downstream (May 2014).

Photo A 6: Site 3 (downstream) - Lower Coquitlam River facing upstream (May 2014), two deer are present near left bank.

Photographs A7-12: Representative Site Photos

Photo A 7: Site 4 (upstream) - Lower Coquitlam River facing downstream (May 2014).

Photo A 8: Site 4 (downstream) - Lower Coquitlam River facing upstream (September 2014).

Photo A 9: Site 5 (upstream) - Lower Coquitlam River facing downstream (September 2014).

Photo A 10: Site 5 (downstream) - Lower Coquitlam River facing upstream (May 2014).

Photo A 11: Site 6 (downstream) - Lower Coquitlam River facing upstream (January 2014).

Photo A 12: Site 6 (downstream) - Lower Coquitlam River facing downstream (May 2014).

Photographs A 13-18: Sampling Photos

Photo A13: Placing sampler in river bed (Site 4 upstream September 2014).

Photo A14: Subsurface sample inside Hess Sampler (Site 1 May 2014).

Photo A15: Subsurface sample inside Hess Sampler (Site 6 May 2014).

Photo A16: Sampling (Site 4 downstream September 2014).

Photo A17: D50 and D95 substrate being selected for measurement (Site 1 upstream September 2014).

Photo A18:Hess Sampler being churned over 20 times with trowel.

Photographs A 19-24: Sampling and Processing Photos

Photo A 19: Rinsing mesh tunnel between samples (Site 6 downstream September 2014).

Photo A 20: Sampling equipment and drying rack (August 2014).

Photo A 21: Wet sample in pail with identification label (January 2014).

Photo A 22: Sample in drying rack (January 2014).

Photo A 23: Subsurface samples placed on clean polyethylene sheets in drying rack (October 2013).

Photo A 24: Dried labeled sample in drying rack (January 2014).

Photographs A 25-28: Processing Photos

Photo A 25: Rocks in sifter box in preparation for sorting (August 2014).

Photo A 26: Subsurface <10 mm sample weighed before sending to laboratory for particle size analysis (October 2013).

Photo A 27: Dry sample >10 mm in pail with identification label (October 2013).

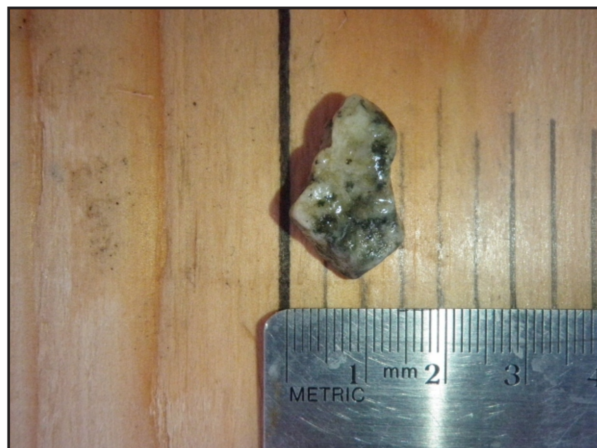


Photo A 28: Rock measured >10 mm (May 2013).

Appendix 3

Table

Table B1: Daily Discharge 15 Days Before Sampling at Water Survey Canada Site 08MH002

Table B1. Daily Discharge (m^3/s) 15 Days Before Sampling at Water Survey Canada Site 08MH002

Days Before Sampling	Discharge (m^3/s) October 2013	Discharge (m^3/s) January 2014	Discharge (m^3/s) May 2014
15	21.6	6.43	6.57
14	15.3	16.8	6.63
13	20.4	14.4	6.2
12	12.2	8.7	5.3
11	9.46	7.69	4.96
10	8.61	7.31	4.85
9	8.17	7.4	4.68
8	8.45	18	4.73
7	8.53	16.6	4.75
6	7.84	13	8.95
5	7.49	43.7	5.71
4	7.3	16.2	5.1
3	7.27	14	8.35
2	7.14	12	5.53
1	7.1	10.3	4.78
Sample Day 1	7.12	8.09	7.47
Sample Day 2	7.07	5.58	5.84

Appendix 4

Raw Data

Particle Size Analysis – Surficial Sediment <10 mm (Maxxam)

Particle Size Analysis – Subsurface Sediment <10 mm (Maxxam)

Pebble Counts

Embeddedness

Turbidity

Your P.O. #: 465171
Your Project #: 1238
Site Location: COQUITLAM
Your C.O.C. #: G081571, G081584

Attention: Adrian Mackay
G3 Consulting Ltd.
206-8501 162 St
Surrey, BC
Canada V4N 1B2

Report Date: 2013/10/24

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B394860
Received: 2013/10/15, 18:00

Sample Matrix: Soil
Samples Received: 20

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Texture by Hydrometer (Sand, Silt, Clay)	9	N/A	2013/10/22	BBY6SOP-00051	SSMA CH55.3
Texture by Hydrometer (Sand, Silt, Clay)	11	N/A	2013/10/23	BBY6SOP-00051	SSMA CH55.3

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Stefanie Teo, Project Manager
Email: STeo@maxxam.ca
Phone# (604) 734 7276

==
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Total cover pages: 1

Maxxam Job #: B394860
Report Date: 2013/10/24

G3 Consulting Ltd.
Client Project #: 1238
Site Location: COQUITLAM
Your P.O. #: 465171

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		HV1403	HV1404	HV1405	HV1406	HV1407		
Sampling Date		2013/10/15	2013/10/15	2013/10/15	2013/10/15	2013/10/15		
	UNITS	**12PYG338-O13-6U1A**	**12PYG338-O13-6U2A**	**12PYG338-O13-6U3A**	**12PYG338-O13-6D1A**	**12PYG338-O13-6D2A**	**RDL**	**QC Batch**
Physical Properties								
% sand by hydrometer	%	72	85	90	92	91	2.0	7238876
% silt by hydrometer	%	9.3	12	4.3	5.3	4.1	2.0	7238876
Clay Content	%	19	3.5	5.5	2.8	5.1	2.0	7238876

Maxxam ID		HV1408	HV1409	HV1410	HV1411		HV4521		
Sampling Date		2013/10/15	2013/10/15	2013/10/15	2013/10/15		2013/10/15		
	UNITS	**12PYG338-O13-6D3A**	**12PYG338-O13-5U1A**	**12PYG338-O13-5U2A**	**12PYG338-O13-5U3A**	**QC Batch**	**12PYG338-O13-4U1A**	**RDL**	**QC Batch**
Physical Properties									
% sand by hydrometer	%	76	79	93	89	7238876	93	2.0	7244386
% silt by hydrometer	%	14	7.0	3.9	3.5	7238876	5.4	2.0	7244386
Clay Content	%	10	14	3.2	7.2	7238876	<2.0	2.0	7244386

Maxxam ID		HV4532	HV4533	HV4534	HV4535	HV4536		
Sampling Date		2013/10/15	2013/10/15	2013/10/15	2013/10/15	2013/10/15		
	UNITS	**12PYG338-O13-4U2A**	**12PYG338-O13-4U3A**	**12PYG338-O13-4D1A**	**12PYG338-O13-4D2A**	**12PYG338-O13-4D3A**	**RDL**	**QC Batch**
Physical Properties								
% sand by hydrometer	%	72	71	93	94	94	2.0	7244386
% silt by hydrometer	%	19	27	6.3	4.4	2.6	2.0	7244386
Clay Content	%	8.9	2.0	<2.0	<2.0	3.7	2.0	7244386

Maxxam ID		HV4538	HV4539	HV4540	HV4541	HV4542		
Sampling Date		2013/10/15	2013/10/15	2013/10/15	2013/10/15	2013/10/15		
	UNITS	**12PYG338-O13-3U2A**	**12PYG338-O13-3U3A**	**12PYG338-O13-3D1A**	**12PYG338-O13-3D2A**	**12PYG338-O13-3D3A**	**RDL**	**QC Batch**
Physical Properties								
% sand by hydrometer	%	92	76	75	86	64	2.0	7244386
% silt by hydrometer	%	6.4	20	16	9.1	33	2.0	7244386
Clay Content	%	<2.0	4.1	8.6	4.7	3.0	2.0	7244386

RDL = Reportable Detection Limit

Maxxam Job #: B394860
Report Date: 2013/10/24

G3 Consulting Ltd.
Client Project #: 1238
Site Location: COQUITLAM
Your P.O. #: 465171

Package 1	13.7°C

Each temperature is the average of up to three cooler temperatures taken at receipt

General Comments

Maxxam Job #: B394860
Report Date: 2013/10/24

G3 Consulting Ltd.
Client Project #: 1238
Site Location: COQUITLAM
Your P.O. #: 465171

QUALITY ASSURANCE REPORT

			RPD	
QC Batch	Parameter	Date	Value (%)	QC Limits
7238876	% sand by hydrometer	2013/10/22	0.1	35
7238876	% silt by hydrometer	2013/10/22	NC	35
7238876	Clay Content	2013/10/22	NC	35
7244386	% sand by hydrometer	2013/10/23	1.3	35
7244386	% silt by hydrometer	2013/10/23	NC	35
7244386	Clay Content	2013/10/23	NC	35

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

Maxxam Job #: B394860

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

David Huang, BBY Scientific Specialist

==

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Maxxam

4606 Canada Way, Burnaby, BC Canada V5G 1K5 Ph: 604 734 7276 Toll Free: 1 800 665 8566 Fax: 604 731 2386

Maxxam Job#: B394860

CHAIN OF CUSTODY RECORD

Page: ___ of ___

G 081571

Invoice To: Require Report? Yes [X] No [ ]

Company Name: G3 Consulting
Contact Name: Wendy Harran
Address: 206- 8501 162 St.
PC:
Phone / Fax#: Ph: 604-598-8501 Fax:
E-mail: wharran@g3consulting.com

Report To:

Company Name: G3
Contact Name: Adrian
Address:
PC:
Phone / Fax#: Ph: Fax:
E-mail: amackay@g3consulting.com

PO #:
Quotation #:
Project #: 1238
Proj. Name:
Location: Coquitlam
Sampled By: A.M.

REGULATORY REQUIREMENTS SERVICE REQUESTED:

- [ ] CSR
- [ ] CCME
- [ ] BC Water Quality
- [ ] Other
- [ ] DRINKING WATER

- [X] Regular Turn Around Time (TAT) (5 days for most tests)
- [ ] RUSH (Please contact the lab) [ ] 1 Day [ ] 2 Day [ ] 3 Day
- Date Required: ___

Special Instructions:

Return Cooler [ ] Ship Sample Bottles (please specify) [ ]

HOLD REPORT until All Samples Received.

ANALYSIS REQUESTED: BTEX/VPH, MTBE, VOC/VPH, EPH, TEH, PAH, LEPH/HEPH, CCME-PHC (Fractions 1-4 Plus BTEX), CCME-PHC (Fractions 2-4), CCME BTEX (Fraction 1 Plus BTEX), PCB, Phenols by 4AAP, Phenols by GCMS, TOG, MOG, SWOG, Dissolved Metals (Field Filtered? Y/N, Field Acidified? Y/N), Totals Metals Field Acidified? Y/N, Nitrate, Nitrite, Ammonia, Chloride, Fluoride, Sulphate, Total Suspended Solids TSS, TDS, pH, Conductivity, Alkalinity, BOD, COD, Coliform, Total & E.coli, Fecal, Asbestos, Particle Size 1/4 S.Tao, HOLD

#	Sample Identification	Lab Identification	Sample Type	Date/Time Sampled	Particle Size 1/4 S.Tao
1	12-F46338-013-6U1A	HV1403	Sediment	Oct 15	1
2	" 6U2A	HV1404	↓	↓	1
3	" 6U3A	HV1405			1
4	" 6D1A	HV1406			1
5	" 6D2A	HV1407			1
6	" 6D3A	HV1408			1
7	" 5U1A	HV1409			1
8	" 5U2A	HV1410			1
9	" 5U3A	HV1411			1
10	" 4U1A				1
11	" 4U2A				1
12	" 4U3A				1

B394860

Samples are from a Drinking Water Source? YES / NO
Does source supply multiple households? YES / NO

*Relinquished by:	Date (YY/MM/DD):	Time:	Received by:	Date (YY/MM/DD):	Time:	Time Sensitive	Temperature on Receipt (°C)	Custody Seal Intact on Cooler?
[signature]	13/10/15		JIWANJOTE ROY	2013/10/15	18:00	[ ]	13, 14, 14	N/A Yes / No

Laboratory Use Only

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

White: Maxxam Yellow: Client

COC-1020 (05/10)

Maxxam International Corporation o/a Maxxam Analytics

Maxxam

4606 Canada Way, Burnaby, BC Canada V5G 1K5 Ph: 604 734 7276 Toll Free: 1 800 665 8566 Fax: 604 731 2386

Maxxam Job#: B394860

CHAIN OF CUSTODY RECORD

Page: ___ of ___

G 081584

Invoice To: Require Report? Yes [ ] No [ ]

Company Name: G3 Consulting Ltd.
Contact Name: Wendy Hanna
Address:
PC:
Phone / Fax#: Ph: Fax:
E-mail: whanna@g3consulting.com

Report To:

Company Name: G3
Contact Name: Adrian
Address:
PC:
Phone / Fax#: Ph: Fax:
E-mail: amackay@g3consulting.com

PO #:
Quotation #:
Project # : 1238
Proj. Name:
Location:
Sampled By:

REGULATORY REQUIREMENTS SERVICE REQUESTED:

- [ ] CSR
- [ ] CCME
- [ ] BC Water Quality
- [ ] Other
- [ ] DRINKING WATER

- [x] Regular Turn Around Time (TAT) (5 days for most tests)
- [ ] RUSH (Please contact the lab)
- [ ] 1 Day [ ] 2 Day [ ] 3 Day
- Date Required:

Special Instructions:

Return Cooler [ ] **Ship Sample Bottles (please specify)** [ ]

ANALYSIS REQUESTED

BTEX/VPH (MTBE); VOC/VPH; EPH (TEH); PAH (LEPH/HEPH); CCME-PHC (Fractions 1-4 Plus BTEX); CCME-PHC (Fractions 2-4); CCME BTEX (Fraction 1 Plus BTEX); PCB; Phenols by 4AAP (Phenols by GCMS); TOG (SWOG; MOG); Dissolved Metals (Field Filtered? Y/N; Field Acidified? Y/N); Total Metals Field Acidified? Y/N; Nitrate (Nitrite; Ammonia); Chloride (Fluoride; Sulphate); Total Suspended Solids-TSS (TDS); pH (Conductivity; Alkalinity); BOD; COD; Coliform, Total & E.coli (Fecal); Asbestos; Texture; HOLD

Samples are from a Drinking Water Source? YES / NO
Does source supply multiple households? YES / NO

	Sample Identification	Lab Identification	Sample Type	Date/Time Sampled	Texture
1	12PT6338-013-4U1A	HV4521	Sediment	Oct 16	✓
2	4U2A	HV4532	↓	↓	✓
3	4U3A	HV4533			✓
4	4D1A	HV4534			✓
5	4D2A	HV4535			✓
6	4D3A	HV4536			✓
7	3U1A	HV4537			✓
8	3U2A	HV4538			✓
9	3U3A	HV4539			✓
10	3D1A	HV4540			✓
11	3D2A	HV4541			✓
12	3D3A	HV4542	↓	↓	✓

B394860

*Relinquished by:	Date (YY/MM/DD):	Time:	Received by:	Date (YY/MM/DD):	Time:	Time Sensitive	Temperature on Receipt (°C)	Custody Seal Intact on Cooler?
[signature]	13/10/16	1630	[signature]	2013/10/16	4:30 PM	[ ]	16, 16, 15	Yes [ ] No [ ]

Laboratory Use Only

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

White: Maxxam Yellow: Client

COC-1020 (05/10)

Maxxam International Corporation o/a Maxxam Analytics

CS: N/A

Your P.O. #: 786596
Your Project #: 1238 COQMON-8
Your C.O.C. #: 08396969, 08396970, 08396971

Attention:Alex Caldicott

G3 Consulting Ltd.
206-8501 162 St
Surrey, BC
Canada V4N 1B2

Report Date: 2014/09/26
Report #: R1650635
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B483287
Received: 2014/09/18, 18:20

Sample Matrix: Sediment
Samples Received: 36

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Texture by Hydrometer (Sand, Silt, Clay)	36	N/A	2014/09/26	BBY6SOP-00051	Carter 2nd ed 55.3

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stefanie Teo, Project Manager
Email: STeo@maxxam.ca
Phone# (604) 734 7276
==
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Maxxam Job #: B483287
Report Date: 2014/09/26

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786596
Sampler Initials: AC

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		KQ2198	KQ2199	KQ2200	KQ2201		
Sampling Date							
COC Number		08396969	08396969	08396969	08396969		
	Units	**12PYG338-14J1D1-A**	**12PYG338-14J1D2-A**	**12PYG338-14M1D3-A**	**12PYG338-14M1U1-A**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	87	77	90	82	2.0	7650842
% silt by hydrometer	%	7.5	20	7.9	16	2.0	7650842
Clay Content	%	5.8	3.3	2.2	2.0	2.0	7650842
RDL = Reportable Detection Limit							

Maxxam ID		KQ2202	KQ2203	KQ2204		
Sampling Date						
COC Number		08396969	08396969	08396969		
	Units	**12PYG338-14M1U2-A**	**12PYG338-14M1U3-A**	**12PYG338-14M2D1-A**	**RDL**	**QC Batch**
Physical Properties						
% sand by hydrometer	%	88	83	95	2.0	7650842
% silt by hydrometer	%	9.6	9.6	3.1	2.0	7650842
Clay Content	%	2.2	7.3	<2.0	2.0	7650842
RDL = Reportable Detection Limit						

Maxxam ID		KQ2205	KQ2206	KQ2207	KQ2208		
Sampling Date							
COC Number		08396969	08396969	08396969	08396969		
	Units	**12PYG338-14M2D2-A**	**12PYG338-14M2D3-A**	**12PYG338-14M2U1-A**	**12PYG338-14M2U2-A**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	95	97	100	96	2.0	7652070
% silt by hydrometer	%	4.9	2.5	<2.0	4.5	2.0	7652070
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7652070
RDL = Reportable Detection Limit							

Maxxam ID		KQ2209	KQ2211	KQ2212	KQ2213		
Sampling Date							
COC Number		08396969	08396970	08396970	08396970		
	Units	**12PYG338-14M2U3-A**	**12PYG338-14M3D1-A**	**12PYG338-14M3D2-A**	**12PYG338-14M3D3-A**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	95	95	88	70	2.0	7652070
% silt by hydrometer	%	5.2	5.4	10	30	2.0	7652070
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7652070
RDL = Reportable Detection Limit							

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Maxxam Job #: B483287
Report Date: 2014/09/26

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786596
Sampler Initials: AC

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		KQ2214	KQ2215	KQ2216	KQ2217		
Sampling Date							
COC Number		08396970	08396970	08396970	08396970		
	Units	**12PYG338-14M3U1-A**	**12PYG338-14M3U2-A**	**12PYG338-14M3U3-A**	**12PYG338-14M4D1-A**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	94	91	89	92	2.0	7652070
% silt by hydrometer	%	5.6	9.5	11	7.6	2.0	7652070
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7652070
RDL = Reportable Detection Limit							

Maxxam ID		KQ2218	KQ2219		KQ2220		
Sampling Date							
COC Number		08396970	08396970		08396970		
	Units	**12PYG338-14M4D2-A**	**12PYG338-14M4D3-A**	**QC Batch**	**12PYG338-14M4U1-A**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	91	91	7652070	89	2.0	7652648
% silt by hydrometer	%	8.9	8.6	7652070	2.3	2.0	7652648
Clay Content	%	<2.0	<2.0	7652070	8.8	2.0	7652648
RDL = Reportable Detection Limit							

Maxxam ID		KQ2221	KQ2222	KQ2223	KQ2224		
Sampling Date							
COC Number		08396970	08396970	08396971	08396971		
	Units	**12PYG338-14M4U2-A**	**12PYG338-14M4U3-A**	**12PYG338-14M5D1-A**	**12PYG338-14M5D2-A**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	87	75	75	81	2.0	7652648
% silt by hydrometer	%	8.1	7.7	12	9.0	2.0	7652648
Clay Content	%	4.5	17	13	9.8	2.0	7652648
RDL = Reportable Detection Limit							

Maxxam ID		KQ2225	KQ2226	KQ2227	KQ2228		
Sampling Date							
COC Number		08396971	08396971	08396971	08396971		
	Units	**12PYG338-14M5D3-A**	**12PYG338-14M5U1-A**	**12PYG338-14M5U2-A**	**12PYG338-14M5U3-A**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	92	88	87	91	2.0	7652648
% silt by hydrometer	%	7.1	5.8	6.3	4.2	2.0	7652648
Clay Content	%	<2.0	6.1	6.4	4.4	2.0	7652648
RDL = Reportable Detection Limit							

Maxxam Job #: B483287
Report Date: 2014/09/26

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786596
Sampler Initials: AC

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		KQ2229	KQ2230	KQ2231	KQ2232		
Sampling Date							
COC Number		08396971	08396971	08396971	08396971		
	Units	**12PYG338-14M6D1-A**	**12PYG338-14M6D2-A**	**12PYG338-14M6D3-A**	**12PYG338-14M6U1-A**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	96	88	83	88	2.0	7652648
% silt by hydrometer	%	<2.0	6.3	6.3	4.5	2.0	7652648
Clay Content	%	2.0	5.6	11	7.2	2.0	7652648
RDL = Reportable Detection Limit							

Maxxam ID		KQ2233	KQ2234		
Sampling Date					
COC Number		08396971	08396971		
	Units	**12PYG338-14M6U2-A**	**12PYG338-14M6U3-A**	**RDL**	**QC Batch**
Physical Properties					
% sand by hydrometer	%	95	92	2.0	7652648
% silt by hydrometer	%	<2.0	4.2	2.0	7652648
Clay Content	%	4.6	4.1	2.0	7652648
RDL = Reportable Detection Limit					

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Maxxam Job #: B483287
Report Date: 2014/09/26

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786596
Sampler Initials: AC

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	23.0°C
Package 2	22.0°C
Package 3	22.0°C

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

			RPD	
QC Batch	**Parameter**	**Date**	**Value (%)**	**QC Limits**
7650842	% sand by hydrometer	2014/09/26	0.21	35
7650842	% silt by hydrometer	2014/09/26	NC	35
7650842	Clay Content	2014/09/26	NC	35
7652070	% sand by hydrometer	2014/09/26	0	35
7652070	% silt by hydrometer	2014/09/26	NC	35
7652070	Clay Content	2014/09/26	NC	35
7652648	% sand by hydrometer	2014/09/26	0.10	35
7652648	% silt by hydrometer	2014/09/26	NC	35
7652648	Clay Content	2014/09/26	NC	35

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

Maxxam Job #: B483287
Report Date: 2014/09/26

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786596
Sampler Initials: AC

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Andy Lu, Data Validation Coordinator

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics Inc

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Maxxam Job #: B483287 COC #: 08396970 Page: 2 of 3

Invoice To: Require Report? Yes ☑ No ☐		Report To:	
Company Name:	#8907 G3 CONSULTING	Company Name:	G3 Consulting
Contact Name:	ACCOUNTS PAYABLE	Contact Name:	Alex Caldicott
Address:	206 8501 162 STREET	Address:	
	SURREY, BC PC: V4N 1B2		PC
Phone / Fax#:	Ph: 604 598-8501 Fax: 604 598-8525	Phone / Fax#:	Ph: Fax:
E-mail	whannon@g3consulting.com	E-mail	acaldicott@g3consulting.com

PO #:	786596
Quotation #:	B12-1843-CI
Project #:	1238
Proj. Name:	COQMON-8
Location:	
Sampled by:	Alex Caldicott

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☐ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- (●) Regular Turn Around Time (TAT) (5 days for most tests)
- RUSH (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ Ship Sample Bottles (please specify) ☐

ANALYSIS REQUESTED

	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gr...)	Dry + Weigh	Texture (Sand, Silt Clay)	Number of Containers
1	12PYG338-14M3D1-A	KQ2211	Sediment			1	1	1
2	12PYG338-14M3D2-A	KQ2212	Sediment			1	1	1
3	12PYG338-14M3D3-A	KQ2213	Sediment			1	1	1
4	12PYG338-14M3U1-A	KQ2214	Sediment			1	1	1
5	12PYG338-14M3U2-A	KQ2215	Sediment			1	1	1
6	12PYG338-14M3U3-A	KQ2216	Sediment			1	1	1
7	12PYG338-14M4D1-A	KQ2217	Sediment			1	1	1
8	12PYG338-14M4D2-A	KQ2218	Sediment			1	1	1
9	12PYG338-14M4D3-A	KQ2219	Sediment			1	1	1
10	12PYG338-14M4U1-A	KQ2220	Sediment			1	1	1
11	12PYG338-14M4U2-A	KQ2221	Sediment			1	1	1
12	12PYG338-14M4U3-A	KQ2222	Sediment			1	1	1

B483287

*Relinquished By: (Print name and sign)	Date (yy/mm/dd)	Time (24hr)	Received by: (Print name and sign)	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive	Temperature on Receipt (°C) (Laboratory Use Only)	Custody Seal	Yes	No
	14/09/18	18:00	DARIA IVANOVA	2014/09/18	18:20	☐	A 23 B 23 C 23	Present?	☐	☐
							Just sampled & rec'd on ice ☐	Intact?	☐	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS. 22,22,22 | 22,22,22

N/A

BBY FCD-00077R2_C

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CHAIN OF CUSTODY RECORD

Maxxam Job #: B483287 **COC #:** 08396969 Page: 1 of 3

Invoice To: Require Report? Yes ☑ No ☐		Report To:			
Company Name:	#5907 G3 CONSULTING	Company Name:	G3 Consulting	PO #:	786596
Contact Name:	ACCOUNTS PAYABLE	Contact Name:	Alex Caldicott	Quotation #:	B12-1843-CI
Address:	206 8501 162 STREET	Address:		Project #:	1238
	SURREY, BC PC: V4N 1B2		PC:	Proj. Name:	COOMON-8
Phone / Fax#:	Ph: 604-598-8501 Fax: 604-598-8525	Phone / Fax#:	Ph: Fax:	Location:	
E-mail:	whannon@g3consulting.com	E-mail:	acaldicott@g3consulting.com	Sampled by:	Alex Caldicott

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☐ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- RUSH (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ Ship Sample Bottles (please specify) ☐

ANALYSIS REQUESTED

Lab Use Only

	Sample Identification	Lab Identification	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gr...)	Dry + Weight	Texture (Sand, Silt, Clay)	Number of Containers
1	12PYG338-14J1D1-A	KQ2198	Sediment			1	1	1
2	12PYG338-14J1D2-A	KQ2199	Sediment			1	1	1
3	12PYG338-14M1D3-A	KQ2200	Sediment			1	1	1
4	12PYG338-14M1U1-A	KQ2201	Sediment			1	1	1
5	12PYG338-14M1U2-A	KQ2202	Sediment			1	1	1
6	12PYG338-14M1U3-A	KQ2203	Sediment			1	1	1
7	12PYG338-14M2D1-A	KQ2204	Sediment			1	1	1
8	12PYG338-14M2D2-A	KQ2205	Sediment			1	1	1
9	12PYG338-14M2D3-A	KQ2206	Sediment			1	1	1
10	12PYG338-14M2U1-A	KQ2207	Sediment			1	1	1
11	12PYG338-14M2U2-A	KQ2208	Sediment			1	1	1
12	12PYG338-14M2U3-A	KQ2209	Sediment			1	1	1

B483287

Print name and sign / Print name and sign / Laboratory Use Only

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by:	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
	14/09/18	18:00	DARIA IVANOVA	2014/09/18	18:30	☐	A) 23 B) 23 C) 23	Present	☐	☐
	14/09/18	18:00					Just sampled & rec'd on ice: ☐	Intact?	☐	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS. 21,21,21 RJ

22,22,22 / 222272 N/A

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CHAIN OF CUSTODY RECORD

Maxxam Job #: B483287 COC #: 08396971 Page: 3 of 3

Invoice To: Require Report? Yes ☑ No ☐		Report To:	
Company Name:	#5907 G3 CONSULTING	Company Name:	G3 Consulting
Contact Name:	ACCOUNTS PAYABLE	Contact Name:	Alex Caldicott
Address:	206 8501 162 STREET	Address:	
	SURREY, BC PC: V4N 1B2		PC:
Phone / Fax#:	Ph: 604 598-8501 Fax: 604 598-8525	Phone / Fax#:	Ph: Fax:
E-mail	whannon@g3consulting.com	E-mail	acaldicott@g3consulting.com

PO #:	786596
Quotation #:	B12-1843-CI
Project #:	1238
Proj. Name:	COQMON-8
Location:	
Sampled by:	Alex Caldicott

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☐ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- RUSH (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ Ship Sample Bottles (please specify) ☐

ANALYSIS REQUESTED

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gr...)	Dry + Weigh	Texture (Sand, Silt Clay)	Number of Containers
1	12PYG338-14MSD1-A	KQ2223	Sediment			1	1	1
2	12PYG338-14MSD2-A	KQ2224	Sediment			1	1	1
3	12PYG338-14MSD3-A	KQ2225	Sediment			1	1	1
4	12PYG338-14MSU1-A	KQ2226	Sediment			1	1	1
5	12PYG338-14MSU2-A	KQ2227	Sediment			1	1	1
6	12PYG338-14MSU3-A	KQ2228	Sediment			1	1	1
7	12PYG338-14MMD1-A	KQ2229	Sediment			1	1	1
8	12PYG338-14MMD2-A	KQ2230	Sediment			1	1	1
9	12PYG338-14MMD3-A	KQ2231	Sediment			1	1	1
10	12PYG338-14MMU1-A	KQ2232	Sediment			1	1	1
11	12PYG338-14MMU2-A	KQ2233	Sediment			1	1	1
12	12PYG338-14MMU3-A	KQ2234	Sediment			1	1	1

B483287

*Relinquished By: (Print name and sign)	Date (yy/mm/dd):	Time (24hr):	Received by: (Print name and sign)	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive	Temperature on Receipt (°C) (Laboratory Use Only)	Custody Seal	Yes	No
	14/09/19	18:20	DARIA IVANOVA	2014/09/18	18:20	☐	A: 22 B: 22 C: 22	Present?	☐	☐
							Just sampled & rec'd on ice ☐	Intact?	☐	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

22,22,22 / 23,23,23

N/A

BBY FCD-00077R2_C

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Your P.O. #: 786578
Your Project #: 1238 COQMON-8
Your C.O.C. #: 08393842, 08393843, 08393844

Attention: Alex Caldicott
G3 Consulting Ltd.
206-8501 162 St
Surrey, BC
Canada V4N 1B2

Report Date: 2014/06/13
Report #: R1585345
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B446779
Received: 2014/06/06, 09:00

Sample Matrix: Sediment
Samples Received: 36

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Texture by Hydrometer (Sand, Silt, Clay)	13	N/A	2014/06/11	BBY6SOP-00051	SSMA CH55.3
Texture by Hydrometer (Sand, Silt, Clay)	23	N/A	2014/06/12	BBY6SOP-00051	SSMA CH55.3

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Stefanie Teo, Project Manager
Email: STeo@maxxam.ca
Phone# (604) 734 7276

==
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Total cover pages: 1

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Maxxam Job #: B446779
Report Date: 2014/06/13

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8

Your P.O. #: 786578
Sampler Initials: AC

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		JU0304	JU0305	JU0306	JU0307	JU0308		
Sampling Date		2014/05/30 12:55	2014/05/30 12:55	2014/05/30 12:55	2014/05/30 12:00	2014/05/30 12:00		
	UNITS	**12PYG338-14M1D1-A**	**12PYG338-14M1D2-A**	**12PYG338-14M1D3-A**	**12PYG338-14M1U1-A**	**12PYG338-14M1U2-A**	**RDL**	**QC Batch**
Physical Properties								
% sand by hydrometer	%	84	90	90	94	67	2.0	7519531
% silt by hydrometer	%	4.3	<2.0	3.6	2.8	11	2.0	7519531
Clay Content	%	12	9.8	6.8	3.2	22	2.0	7519531

Maxxam ID		JU0309	JU0310	JU0311	JU0312	JU0313		
Sampling Date		2014/05/30 12:00	2014/05/30 10:20	2014/05/30 10:20	2014/05/30 10:20	2014/05/30 09:30		
	UNITS	**12PYG338-14M1U3-A**	**12PYG338-14M2D1-A**	**12PYG338-14M2D2-A**	**12PYG338-14M2D3-A**	**12PYG338-14M2U1-A**	**RDL**	**QC Batch**
Physical Properties								
% sand by hydrometer	%	77	88	91	84	82	2.0	7519531
% silt by hydrometer	%	13	6.1	3.0	5.7	11	2.0	7519531
Clay Content	%	9.9	6.0	5.8	10	7.4	2.0	7519531

Maxxam ID		JU0314	JU0315	JU0327		JU0328	JU0329		
Sampling Date		2014/05/30 09:30	2014/05/30 09:30	2014/05/30 07:15		2014/05/30 07:15	2014/05/30 07:15		
	UNITS	**12PYG338-14M2U2-A**	**12PYG338-14M2U3-A**	**12PYG338-14M3D1-A**	**QC Batch**	**12PYG338-14M3D2-A**	**12PYG338-14M3D3-A**	**RDL**	**QC Batch**
Physical Properties									
% sand by hydrometer	%	83	74	73	7519531	62	69	2.0	7520441
% silt by hydrometer	%	8.4	11	14	7519531	24	11	2.0	7520441
Clay Content	%	8.3	15	14	7519531	14	20	2.0	7520441

Maxxam ID		JU0330	JU0331	JU0332	JU0333	JU0334		
Sampling Date		2014/05/30 07:15	2014/05/30 07:15	2014/05/30 07:15	2014/05/29 13:40	2014/05/29 13:40		
	UNITS	**12PYG338-14M3U1-A**	**12PYG338-14M3U2-A**	**12PYG338-14M3U3-A**	**12PYG338-14M4D1-A**	**12PYG338-14M4D2-A**	**RDL**	**QC Batch**
Physical Properties								
% sand by hydrometer	%	34	46	49	66	85	2.0	7520441
% silt by hydrometer	%	42	37	20	26	12	2.0	7520441
Clay Content	%	24	17	31	7.9	3.5	2.0	7520441

RDL = Reportable Detection Limit

Maxxam Job #: B446779
Report Date: 2014/06/13

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8

Your P.O. #: 786578
Sampler Initials: AC

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		JU0335	JU0336	JU0337		JU0338		
Sampling Date		2014/05/29 13:40	2014/05/29 13:40	2014/05/29 13:40		2014/05/29 13:40		
	UNITS	**12PYG338-14M4D3-A**	**12PYG338-14M4U1-A**	**12PYG338-14M4U2-A**	**QC Batch**	**12PYG338-14M4U3-A**	**RDL**	**QC Batch**
Physical Properties								
% sand by hydrometer	%	78	77	75	7520441	87	2.0	7522006
% silt by hydrometer	%	14	16	20	7520441	12	2.0	7522006
Clay Content	%	7.5	7.1	5.4	7520441	<2.0	2.0	7522006

Maxxam ID		JU0369	JU0370		JU0371	JU0372		
Sampling Date		2014/05/29 10:55	2014/05/29 10:55		2014/05/29 10:55	2014/05/29 10:55		
	UNITS	**12PYG338-14M5D1-A**	**12PYG338-14M5D2-A**	**QC Batch**	**12PYG338-14M5D3-A**	**12PYG338-14M5U1-A**	**RDL**	**QC Batch**
Physical Properties								
% sand by hydrometer	%	71	80	7520441	79	85	2.0	7522006
% silt by hydrometer	%	20	12	7520441	5.3	8.3	2.0	7522006
Clay Content	%	8.2	7.9	7520441	16	6.6	2.0	7522006

Maxxam ID		JU0373	JU0374	JU0375	JU0376		
Sampling Date		2014/05/29 10:55	2014/05/29 10:55	2014/05/29 07:30	2014/05/29 07:30		
	UNITS	**12PYG338-14M5U2-A**	**12PYG338-14M5U3-A**	**12PYG338-14M6D1-A**	**12PYG338-14M6D2-A**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	65	82	71	67	2.0	7522006
% silt by hydrometer	%	23	10	12	22	2.0	7522006
Clay Content	%	13	8.1	17	11	2.0	7522006

Maxxam ID		JU0377	JU0378	JU0379	JU0380		
Sampling Date		2014/05/29 07:30	2014/05/29 07:30	2014/05/29 07:30	2014/05/29 07:30		
	UNITS	**12PYG338-14M6D3-A**	**12PYG338-14M6U1-A**	**12PYG338-14M6U2-A**	**12PYG338-14M6U3-A**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	63	78	81	78	2.0	7522006
% silt by hydrometer	%	25	15	10	16	2.0	7522006
Clay Content	%	12	6.7	8.5	6.2	2.0	7522006

RDL = Reportable Detection Limit

Package 1	22.0°C

Each temperature is the average of up to three cooler temperatures taken at receipt

General Comments

Maxxam Job #: B446779
Report Date: 2014/06/13

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8

Your P.O. #: 786578
Sampler Initials: AC

QUALITY ASSURANCE REPORT

			RPD		QC Standard	
QC Batch	Parameter	Date	Value (%)	QC Limits	% Recovery	QC Limits
7519531	% sand by hydrometer	2014/06/11	0.1	35	99	90 - 110
7519531	% silt by hydrometer	2014/06/11	NC	35	87	68 - 132
7519531	Clay Content	2014/06/11	NC	35	118	60 - 140
7520441	% sand by hydrometer	2014/06/12	0	35	101	90 - 110
7520441	% silt by hydrometer	2014/06/12	0	35	83	68 - 132
7520441	Clay Content	2014/06/12	NC	35	116	60 - 140
7522006	% sand by hydrometer	2014/06/12	0.5	35	100	90 - 110
7522006	% silt by hydrometer	2014/06/12	1.6	35	99	68 - 132
7522006	Clay Content	2014/06/12	NC	35	98	60 - 140

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

Maxxam

Success Through Science®

Validation Signature Page

Maxxam Job #: B446779

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Andy Lu, Data Validation Coordinator

==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics Inc

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-...

CHAIN OF CUSTODY RECORD

Maxxam Job #: B446779 COC #: 08393842 Page: 1 of 3

Invoice To: Require Report? Yes ☑ No ☐		Report To:	
Company Name:	#5907 G3 CONSULTING	Company Name:	G3 Consulting
Contact Name:	ACCOUNTS PAYABLE	Contact Name:	Alex Caldicott
Address:	206 8501 162 STREET	Address:	
	SURREY, BC PC: V4N 1B2		PC:
Phone / Fax#:	Ph: 604 598-8501 Fax: 604 598-8525	Phone / Fax#:	Ph: Fax:
E-mail	whannon@g3consulting.com	E-mail	acaldicott@g3consulting.com

PO #:	786578
Quotation #:	B12-184.3-CI
Project #:	1238
Proj. Name:	COQMON-8
Location:	
Sampled by:	Alex Caldicott

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☐ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- (●) Regular Turn Around Time (TAT) (5 days for most tests)
- RUSH (Please contact the lab): ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ Ship Sample Bottles (please specify) ☐

ANALYSIS REQUESTED

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gr...)	Dry + Weigh	Texture (Sand, Silt Clay)	Number of Containers
1	12PYG338-14M1D1-A	JU0304	Sediment	14/05/30 12:55		1	1	
2	12PYG338-14M1D2-A	JU0305	Sediment	14/05/30 12:55		1	1	
3	12PYG338-14M1D3-A	JU0306	Sediment	14/05/30 12:55		1	1	
4	12PYG338-14M1U1-A	JU0307	Sediment	14/05/30 12:00		1	1	
5	12PYG338-14M1U2-A	JU0308	Sediment	14/05/30 12:00		1	1	
6	12PYG338-14M1U3-A	JU0309	Sediment	14/05/30 12:00		1	1	
7	12PYG338-14M2D1-A	JU0310	Sediment	14/05/30 10:20		1	1	
8	12PYG338-14M2D2-A	JU0311	Sediment	14/05/30 10:20		1	1	
9	12PYG338-14M2D3-A	JU0312	Sediment	14/05/30 10:20		1	1	
10	12PYG338-14M2U1-A	JU0313	Sediment	14/05/30 09:30		1	1	
11	12PYG338-14M2U2-A	JU0314	Sediment	14/05/30 09:30		1	1	
12	12PYG338-14M2U3-A	JU0315	Sediment	14/05/30 09:30		1	1	

B446779

*Relinquished By: (Print name and sign)	Date (yy/mm/dd):	Time (24hr):	Received by: (Print name and sign)	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive ☐
[signature]	14/06/05	12:00	[signature]	2014/06/06	09:00	

Laboratory Use Only				
Temperature on Receipt (°C) A) 22 B) 22 C) 22	Custody Seal	Yes	No	
	Present?	☐	☑	
Just sampled & rec'd on ice: ☐	Intact?	☐	☐	NA

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam Analytics Inc

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Maxxam Job #: B446779 COC 08393843

Invoice To: Require Report? Yes ☑ No ☐

Company Name:	#5907 G3 CONSULTING
Contact Name:	ACCOUNTS PAYABLE
Address:	206 8501 162 STREET
	SURREY, BC PC: V4N 1B2
Phone / Fax#:	Ph: 604 598-8501 Fax: 604 598-8525
E-mail	whannon@g3consulting.com

Report To:

Company Name:	G3 Consulting
Contact Name:	Alex Caldicott
Address:	PC:
Phone / Fax#:	Ph: Fax:
E-mail	acaldicott@g3consulting.com

PO #:	786578
Quotation #:	B12-184.3-CI
Project #:	1238
Proj. Name:	COQMON-8
Location:	
Sampled by:	Alex Caldicott

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☐ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ◯ 1 Day ◯ 2 Day ◯ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ Ship Sample Bottles (please specify) ☐

ANALYSIS REQUESTED

	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gr	Dry + Weigh	Texture (Sand, Silt Clay)	Number of Containers
1	12PYG338-14M3D1-A	JU0327	Sediment	14/05/30 07:15		1	1	
2	12PYG338-14M3D2-A	JU0328	Sediment	14/05/30 07:15		1	1	
3	12PYG338-14M3D3-A	JU0329	Sediment	14/05/30 07:15		1	1	
4	12PYG338-14M3U1-A	JU0330	Sediment	14/05/30 07:15		1	1	
5	12PYG338-14M3U2-A	JU0331	Sediment	14/05/30 07:15		1	1	
6	12PYG338-14M3U3-A	JU0332	Sediment	14/05/30 07:15		1	1	
7	12PYG338-14M4D1-A	JU0333	Sediment	14/05/29 13:40		1	1	
8	12PYG338-14M4D2-A	JU0334	Sediment	14/05/29 13:40		1	1	
9	12PYG338-14M4D3-A	JU0335	Sediment	14/05/29 13:40		1	1	
10	12PYG338-14M4U1-A	JU0336	Sediment	14/05/29 13:40		1	1	
11	12PYG338-14M4U2-A	JU0337	Sediment	14/05/29 13:40		1	1	
12	12PYG338-14M4U3-A	JU0338	Sediment	14/05/29 13:40		1	1	

B446779

Print name and sign

*Relinquished By:	Date (yy/mm/dd):	Time (24hr)	Received by:	Date (yy/mm/dd):	Time (24 hr)	Time Sensitive
[signature]	14/06/05	19:00	[signature]	2014/06/06	09:00	☐

Laboratory Use Only

Temperature on Receipt (°C)	Custody Seal	Yes	No
A) 22 B) 22 C) 22	Present?	☐	☑
Just sampled & rec'd on ice: ☐	Intact?	☐	☐ NA

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam Analytics Inc

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Maxxam Job #: B446779 COC #: 08393844 Page: 3 of 3

Invoice To: Require Report? Yes ☑ No ☐

Company Name:	#5907 G3 CONSULTING
Contact Name:	ACCOUNTS PAYABLE
Address:	206 8501 162 STREET
	SURREY, BC PC: V4N 1B2
Phone / Fax#:	Ph: 604 598-8501 Fax: 604 598-8525
E-mail	whannon@g3consulting.com

Report To:

Company Name:	G3 Consulting
Contact Name:	Alex Caldicott
Address:	
	PC:
Phone / Fax#:	Ph: Fax:
E-mail	acaldicott@g3consulting.com

PO #:	786578
Quotation #:	B12-184.3-CI
Project #:	1238
Proj. Name:	COQMON-8
Location:	
Sampled by:	Alex Caldicott

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☐ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- RUSH (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ Ship Sample Bottles (please specify) ☐

ANALYSIS REQUESTED

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gra	Dry + Weigh	Texture (Sand, Silt Clay)	Number of Containers
1	12PYG338-14M5D1-A	JU0369	Sediment	14/05/29 10:55		1	1	
2	12PYG338-14M5D2-A	JU0370	Sediment	14/05/29 10:55		1	1	
3	12PYG338-14M5D3-A	JU0371	Sediment	14/05/29 10:55		1	1	
4	12PYG338-14M5U1-A	JU0372	Sediment	14/05/29 10:55		1	1	
5	12PYG338-14M5U2-A	JU0373	Sediment	14/05/29 10:55		1	1	
6	12PYG338-14M5U3-A	JU0374	Sediment	14/05/29 10:55		1	1	
7	12PYG338-14M6D1-A	JU0375	Sediment	14/05/29 07:30		1	1	
8	12PYG338-14M6D2-A	JU0376	Sediment	14/05/29 07:30		1	1	
9	12PYG338-14M6D3-A	JU0377	Sediment	14/05/29 07:30		1	1	
10	12PYG338-14M6U1-A	JU0378	Sediment	14/05/29 07:30		1	1	
11	12PYG338-14M6U2-A	JU0379	Sediment	14/05/29 07:30		1	1	
12	12PYG338-14M6U3-A	JU0380	Sediment	14/05/29 07:30		1	1	

B446779

Print name and sign / Print name and sign / Laboratory Use Only

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by:	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
[signature]	14/06/05	12:00	[signature]	2014/06/06	09:00	☐	A: 22 B: 22 C: 22	Present?	☐	☑
							Just sampled & rec'd on ice: ☐	Intact?	☐	☐ NA

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Your P.O. #: 786589
Your Project #: 1238 COQMON-8
Your C.O.C. #: 08396870, 08396871

Attention:Alex Caldicott

G3 Consulting Ltd.
206-8501 162 St
Surrey, BC
Canada V4N 1B2

Report Date: 2014/09/22
Report #: R1646896
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B481168
Received: 2014/09/12, 19:15

Sample Matrix: Sediment
Samples Received: 21

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Texture by Hydrometer, incl Gravel (Wet)	15	N/A	2014/09/17	BBY6SOP-00051	Carter 2nd ed 55.3
Texture by Hydrometer, incl Gravel (Wet)	6	N/A	2014/09/18	BBY6SOP-00051	Carter 2nd ed 55.3

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stefanie Teo, Project Manager
Email: STeo@maxxam.ca
Phone# (604) 734 7276
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B481168
Report Date: 2014/09/22

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786589
Sampler Initials: COC

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		KO9298	KO9299	KO9300	KO9301		
Sampling Date							
COC Number		08396870	08396870	08396870	08396870		
	Units	**12PYG33813O-3U1B**	**12PYG33813O-3U2B**	**12PYG33813O-3U3B**	**12PYG33813O-3D1B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	49	37	20	55	2.0	7638065
% silt by hydrometer	%	<2.0	<2.0	<2.0	<2.0	2.0	7638065
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7638065
Gravel	%	50	62	79	42	2.0	7638065
RDL = Reportable Detection Limit							

Maxxam ID		KO9302	KO9303	KO9304	KO9305		
Sampling Date							
COC Number		08396870	08396870	08396870	08396870		
	Units	**12PYG33813O-3D2B**	**12PYG33813O-3D3B**	**12PYG33813O-4U1B**	**12PYG33813O-4U2B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	53	48	9.7	61	2.0	7638065
% silt by hydrometer	%	2.3	2.1	2.9	2.5	2.0	7638065
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7638065
Gravel	%	45	49	87	35	2.0	7638065
RDL = Reportable Detection Limit							

Maxxam ID		KO9306	KO9307	KO9308	KO9309		
Sampling Date							
COC Number		08396870	08396870	08396870	08396870		
	Units	**12PYG33813O-4U3B**	**12PYG33813O-4D1B**	**12PYG33813O-4D2B**	**12PYG33813O-4D3B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	58	57	54	38	2.0	7638065
% silt by hydrometer	%	3.2	3.9	3.2	2.5	2.0	7638065
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7638065
Gravel	%	39	39	42	59	2.0	7638065
RDL = Reportable Detection Limit							

Maxxam ID		KO9310	KO9311	KO9312		KO9313		
Sampling Date								
COC Number		08396871	08396871	08396871		08396871		
	Units	**12PYG33813O-5U1B**	**12PYG33813O-5U2B**	**12PYG33813O-5U3B**	**QC Batch**	**12PYG33813O-6U1B**	**RDL**	**QC Batch**
Physical Properties								
% sand by hydrometer	%	58	75	51	7638065	55	2.0	7639497
% silt by hydrometer	%	4.1	3.8	4.0	7638065	<2.0	2.0	7639497
Clay Content	%	<2.0	<2.0	<2.0	7638065	<2.0	2.0	7639497
Gravel	%	38	22	46	7638065	43	2.0	7639497
RDL = Reportable Detection Limit								

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B481168
Report Date: 2014/09/22

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786589
Sampler Initials: COC

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		KO9314	KO9315	KO9316	KO9317		
Sampling Date							
COC Number		08396871	08396871	08396871	08396871		
	Units	**12PYG33813O-6U2B**	**12PYG33813O-6U3B**	**12PYG33813O-6D1B**	**12PYG33813O-6D2B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	35	58	27	42	2.0	7639497
% silt by hydrometer	%	<2.0	<2.0	<2.0	<2.0	2.0	7639497
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7639497
Gravel	%	63	40	71	56	2.0	7639497
RDL = Reportable Detection Limit							

Maxxam ID		KO9318		
Sampling Date				
COC Number		08396871		
	Units	**12PYG33813O-6D3B**	**RDL**	**QC Batch**
Physical Properties				
% sand by hydrometer	%	68	2.0	7639497
% silt by hydrometer	%	<2.0	2.0	7639497
Clay Content	%	<2.0	2.0	7639497
Gravel	%	31	2.0	7639497
RDL = Reportable Detection Limit				

Maxxam Job #: B481168
Report Date: 2014/09/22

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786589
Sampler Initials: COC

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	31.7°C

Results relate only to the items tested.

Maxxam Job #: B481168
Report Date: 2014/09/22

QUALITY ASSURANCE REPORT

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786589
Sampler Initials: COC

			RPD	
QC Batch	Parameter	Date	Value (%)	QC Limits
7638065	% sand by hydrometer	2014/09/17	1.7	35
7638065	% silt by hydrometer	2014/09/17	NC	35
7638065	Clay Content	2014/09/17	NC	35
7638065	Gravel	2014/09/17	3.9	35
7639497	% sand by hydrometer	2014/09/18	3.3	35
7639497	% silt by hydrometer	2014/09/18	NC	35
7639497	Clay Content	2014/09/18	NC	35
7639497	Gravel	2014/09/18	10	35

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B481168
Report Date: 2014/09/22

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786589
Sampler Initials: COC

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Andy Lu, Data Validation Coordinator

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Analytics Inc

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Maxxam Job #: B348168 **COC #:** 08396870 Page: 1 of 2

Invoice To: Require Report? Yes ☐ No ☐

Company Name:	#5907 G3 CONSULTING
Contact Name:	ACCOUNTS PAYABLE
Address:	206 8501 162 STREET
	SURREY, BC PC: V4N 1B2
Phone / Fax#:	Ph: 604 598-8501 Fax: 604 598-8525
E-mail	whannon@g3consulting.com

Report To:

Company Name:	G3 Consulting
Contact Name:	Alax Caldicott
Address:	PC:
Phone / Fax#:	Ph: Fax:
E-mail	acaldicott@g3consulting.com

PO #:	786589
Quotation #:	B12-184-CI
Project #:	1238
Proj. Name:	COQMON-8
Location:	
Sampled by:	Colm O Connell

REGULATORY REQUIREMENTS:
- ☐ CSR
- ☐ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:
- (●) Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ◯ 1 Day ◯ 2 Day ◯ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:
Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gra	Dry + Weigh	Texture (Sand, Silt Clay)	Number of Containers
1	12PYG338130-3U1B	K09298	Sediment		1			1
2	12PYG338130-3U2B	K09299	Sediment		1			1
3	12PYG338130-3U3B	K09300	Sediment		1			1
4	12PYG338130-3D1B	K09301	Sediment		1			1
5	12PYG338130-3D2B	K09302	Sediment		1			1
6	12PYG338130-3D3B	K09303	Sediment		1			1
7	12PYG338130-4U1B	K09304	Sediment		1			1
8	12PYG338130-4U2B	K09305	Sediment		1			1
9	12PYG338130-4U3B	K09306	Sediment		1			1
10	12PYG338130-4D1B	K09307	Sediment		1			1
11	12PYG338130-4D2B	K09308	Sediment		1			1
12	12PYG338130-4D3B	K09309	Sediment		1			1

B481168

*Relinquished By: (Print name and sign)	Date (yy/mm/dd):	Time (24hr):	Received by: (Print name and sign)	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
			JOHN CURRIE	2014/09/12	19:15		A) 32 B) 32 C) 31	Present?	☐	☐
						☐	Just sampled & rec'd on ice ☐	Intact?	N/A	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

BBY FCD-00077R2_C

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Maxxam Analytics Inc

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CHAIN OF CUSTODY RECORD

Maxxam Job #: B481168 COC #: 08396871 Page: 2 of 2

Invoice To: Require Report? Yes ☐ No ☐

Company Name:	#5907 G3 CONSULTING
Contact Name:	ACCOUNTS PAYABLE
Address:	206 - 8501 162 STREET
	SURREY, BC PC: V4N 1B2
Phone / Fax#:	Ph: 604 598-8501 Fax: 604 598-8525
E-mail	whannon@g3consulting.com

Report To:

Company Name:	G3 Consulting
Contact Name:	Alax Caldicott
Address:	PC:
Phone / Fax#:	Ph: Fax:
E-mail	acaldicott@g3consulting.com

PO #:	786589
Quotation #:	B12-184-CI
Project #:	1238
Proj. Name:	COQMON-8
Location:	
Sampled by:	Colm O Connell

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☐ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gra	Dry + Weigh	Texture (Sand, Silt Clay)	Number of Containers
1	12PYG338130-5U1B	K09310	Sediment		1			1
2	12PYG338130-5U2B	K09311	Sediment		1			1
3	12PYG338130-5U3B	K09312	Sediment		1			1
4								
5								
6								
7	12PYG338130-6U1B	K09313	Sediment		1			1
8	12PYG338130-6U2B	K09314	Sediment		1			1
9	12PYG338130-6U3B	K09315	Sediment		1			1
10	12PYG338130-6D1B	K09316	Sediment		1			1
11	12PYG338130-6D2B	K09317	Sediment		1			1
12	12PYG338130-6D3B	K09318	Sediment		1			1

B481168

Print name and sign / Print name and sign / Laboratory Use Only

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by:	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
			JOHN CURRIE	2014/09/12	19:15	☐	A) 32 B) 32 C) 31	Present?	☐	☐
							Just sampled & rec'd on ice. ☐	Intact?	☑	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

BBY FCD-00077R2_C

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Your P.O. #: 786589
Your Project #: 1238 COQMON-8
Your C.O.C. #: 08396875, 08396874, 08396873

Attention:Alex Caldicott

G3 Consulting Ltd.
206-8501 162 St
Surrey, BC
Canada V4N 1B2

Report Date: 2014/09/22
Report #: R1646820
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B481169
Received: 2014/09/12, 19:15

Sample Matrix: Sediment
Samples Received: 36

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Texture by Hydrometer, incl Gravel (Wet)	9	N/A	2014/09/18	BBY6SOP-00051	Carter 2nd ed 55.3
Texture by Hydrometer, incl Gravel (Wet)	27	N/A	2014/09/19	BBY6SOP-00051	Carter 2nd ed 55.3

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stefanie Teo, Project Manager
Email: STeo@maxxam.ca
Phone# (604) 734 7276
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B481169
Report Date: 2014/09/22

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786589
Sampler Initials: COC

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		KO9319	KO9320	KO9321	KO9322		
Sampling Date							
COC Number		08396875	08396875	08396875	08396875		
	Units	**12PYG33814J-1U1B**	**12PYG33814J-1U2B**	**12PYG33814J-1U3B**	**12PYG33814J-1D1B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	79	87	78	76	2.0	7639497
% silt by hydrometer	%	2.5	<2.0	2.9	3.3	2.0	7639497
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7639497
Gravel	%	18	12	17	20	2.0	7639497

RDL = Reportable Detection Limit

Maxxam ID		KO9323	KO9324	KO9325	KO9326		
Sampling Date							
COC Number		08396875	08396875	08396875	08396875		
	Units	**12PYG33814J-1D2B**	**12PYG33814J-1D3B**	**12PYG33814J-2U1B**	**12PYG33814J-2U2B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	84	74	80	72	2.0	7639497
% silt by hydrometer	%	4.7	4.8	4.4	2.3	2.0	7639497
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7639497
Gravel	%	13	23	16	26	2.0	7639497

RDL = Reportable Detection Limit

Maxxam ID		KO9327		KO9328	KO9329	KO9330		
Sampling Date								
COC Number		08396875		08396875	08396875	08396875		
	Units	**12PYG33814J-2U3B**	**QC Batch**	**12PYG33814J-2D1B**	**12PYG33814J-2D2B**	**12PYG33814J-2D3B**	**RDL**	**QC Batch**
Physical Properties								
% sand by hydrometer	%	72	7639497	65	45	51	2.0	7640905
% silt by hydrometer	%	3.2	7639497	<2.0	<2.0	<2.0	2.0	7640905
Clay Content	%	<2.0	7639497	<2.0	<2.0	<2.0	2.0	7640905
Gravel	%	25	7639497	33	54	46	2.0	7640905

RDL = Reportable Detection Limit

Maxxam ID		KO9331	KO9332	KO9333	KO9334		
Sampling Date							
COC Number		08396874	08396874	08396874	08396874		
	Units	**12PYG33814J-3U1B**	**12PYG33814J-3U2B**	**12PYG33814J-3U3B**	**12PYG33814J-3D1B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	51	35	54	40	2.0	7640905
% silt by hydrometer	%	<2.0	<2.0	<2.0	2.0	2.0	7640905
Clay Content	%	<2.0	<2.0	<2.0	2.8	2.0	7640905
Gravel	%	48	63	44	55	2.0	7640905

RDL = Reportable Detection Limit

Maxxam Job #: B481169
Report Date: 2014/09/22

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786589
Sampler Initials: COC

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		KO9335	KO9336	KO9337	KO9338		
Sampling Date							
COC Number		08396874	08396874	08396874	08396874		
	Units	**12PYG33814J-3D2B**	**12PYG33814J-3D3B**	**12PYG33814J-4U1B**	**12PYG33814J-4U2B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	26	41	11	33	2.0	7640905
% silt by hydrometer	%	<2.0	<2.0	<2.0	2.9	2.0	7640905
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7640905
Gravel	%	72	57	86	63	2.0	7640905
RDL = Reportable Detection Limit							

Maxxam ID		KO9339	KO9340	KO9341	KO9342		
Sampling Date							
COC Number		08396874	08396874	08396874	08396874		
	Units	**12PYG33814J-4U3B**	**12PYG33814J-4D1B**	**12PYG33814J-4D2B**	**12PYG33814J-4D3B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	25	42	39	14	2.0	7640905
% silt by hydrometer	%	<2.0	<2.0	3.0	3.1	2.0	7640905
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7640905
Gravel	%	73	55	57	81	2.0	7640905
RDL = Reportable Detection Limit							

Maxxam ID		KO9343	KO9344	KO9345	KO9346		
Sampling Date							
COC Number		08396873	08396873	08396873	08396873		
	Units	**12PYG33814J-5U1B**	**12PYG33814J-5U2B**	**12PYG33814J-5U3B**	**12PYG33814J-5D1B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	72	56	59	65	2.0	7642780
% silt by hydrometer	%	2.1	<2.0	<2.0	<2.0	2.0	7642780
Clay Content	%	<2.0	<2.0	<2.0	2.7	2.0	7642780
Gravel	%	25	43	40	31	2.0	7642780
RDL = Reportable Detection Limit							

Maxxam ID		KO9347	KO9348	KO9349	KO9350		
Sampling Date							
COC Number		08396873	08396873	08396873	08396873		
	Units	**12PYG33814J-5D2B**	**12PYG33814J-5D3B**	**12PYG33814J-6U1B**	**12PYG33814J-6U2B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	51	42	13	42	2.0	7642780
% silt by hydrometer	%	2.8	<2.0	5.3	<2.0	2.0	7642780
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7642780
Gravel	%	45	55	81	55	2.0	7642780
RDL = Reportable Detection Limit							

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B481169
Report Date: 2014/09/22

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786589
Sampler Initials: COC

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		KO9351	KO9352	KO9353	KO9354		
Sampling Date							
COC Number		08396873	08396873	08396873	08396873		
	Units	**12PYG33814J-6U3B**	**12PYG33814J-6D1B**	**12PYG33814J-6D2B**	**12PYG33814J-6D3B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	54	55	40	62	2.0	7642780
% silt by hydrometer	%	3.0	<2.0	3.2	<2.0	2.0	7642780
Clay Content	%	<2.0	2.9	<2.0	3.0	2.0	7642780
Gravel	%	42	40	56	34	2.0	7642780
RDL = Reportable Detection Limit							

Maxxam Job #: B481169
Report Date: 2014/09/22

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786589
Sampler Initials: COC

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	34.0°C
Package 2	35.0°C

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	RPD Value (%)	RPD QC Limits
7639497	% sand by hydrometer	2014/09/18	3.3	35
7639497	% silt by hydrometer	2014/09/18	NC	35
7639497	Clay Content	2014/09/18	NC	35
7639497	Gravel	2014/09/18	10	35
7640905	% sand by hydrometer	2014/09/19	2.2	35
7640905	% silt by hydrometer	2014/09/19	NC	35
7640905	Clay Content	2014/09/19	NC	35
7640905	Gravel	2014/09/19	3.9	35
7642780	% sand by hydrometer	2014/09/19	0.69	35
7642780	% silt by hydrometer	2014/09/19	NC	35
7642780	Clay Content	2014/09/19	NC	35
7642780	Gravel	2014/09/19	4.1	35

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

Maxxam Job #: B481169
Report Date: 2014/09/22

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786589
Sampler Initials: COC

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Andy Lu, Data Validation Coordinator

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Analytics Inc

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Maxxam Job #: B481169 COC #: 08396874 Page: 2 of 3

Invoice To: Require Report? Yes ☐ No ☐

	Invoice To		Report To
Company Name:	#5907 G3 CONSULTING	Company Name:	G3 Consulting
Contact Name:	ACCOUNTS PAYABLE	Contact Name:	Alax Caldicott
Address:	206 8501 162 STREET	Address:	
	SURREY, BC PC V4N 1B2		PC:
Phone / Fax#:	Ph: 604 598-8501 Fax: 604 598-8525	Phone / Fax#:	Ph: Fax:
E-mail	whannon@g3consulting.com	E-mail	acaldicott@g3consulting.com

PO #: 786589
Quotation #: B12-184-CI
Project #: 1238
Proj. Name: COQMON-8
Location:
Sampled by: Colm O Connell

REGULATORY REQUIREMENTS:
☐ CSR
☐ CCME
☐ BC Water Quality
☐ Other
☐ DRINKING WATER

SERVICE REQUESTED:
◉ Regular Turn Around Time (TAT) (5 days for most tests)
RUSH (Please contact the lab)
○ 1 Day ○ 2 Day ○ 3 Day
Date Required:

SPECIAL INSTRUCTIONS:
Return Cooler ☐ Ship Sample Bottles (please specify) ☐

ANALYSIS REQUESTED

	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gra	Dry + Weigh	Texture (Sand, Silt Clay)	Number of Containers
1	12PYG33814J-3U1B	K09331	Sediment		1			1
2	12PYG33814J-3U2B	K09332	Sediment		1			1
3	12PYG33814J-3U3B	K09333	Sediment		1			1
4	12PYG33814J-3D1B	K09334	Sediment		1			1
5	12PYG33814J-3D2B	K09335	Sediment		1			1
6	12PYG33814J-3D3B	K09336	Sediment		1			1
7	12PYG33814J-4U1B	K09337	Sediment		1			1
8	12PYG33814J-4U2B	K09338	Sediment		1			1
9	12PYG33814J-4U3B	K09339	Sediment		1			1
10	12PYG33814J-4D1B	K09340	Sediment		1			1
11	12PYG33814J-4D2B	K09341	Sediment		1			1
12	12PYG33814J-4D3B	K09342	Sediment		1			1

B481169

*Relinquished By: (Print name and sign)	Date (yy/mm/dd):	Time (24hr):	Received by: (Print name and sign)	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive
			John Currie	2014/09/12	19:15	☐

Laboratory Use Only
Temperature on Receipt (°C): A) 35 B) 33 C) 34 / 35 35 35
Just sampled & rec'd on ice: ☐
Custody Seal Present? Yes ☐ No ☐
Intact? N/A

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

BBY FCD-00077R2_C

Maxxam Analytics Success Through Science ©

Maxxam Analytics Inc

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Maxxam Job #: B481169 COC #: 08396875 Page: 1 of 3

Invoice To: Require Report? Yes ☐ No ☐

Company Name:	#5907 G3 CONSULTING
Contact Name:	ACCOUNTS PAYABLE
Address:	206 - 8501 162 STREET
	SURREY, BC PC: V4N 1B2
Phone / Fax#:	Ph: 604 598-8501 Fax: 604 598-8525
E-mail:	whannon@g3consulting.com

Report To:

Company Name:	G3 Consulting
Contact Name:	Alex Caldicott
Address:	PC:
Phone / Fax#:	Ph: Fax:
E-mail:	acaldicott@g3consulting.com

PO #:	786589
Quotation #:	B12-184-CI
Project #:	1238
Proj. Name:	COQMON-8
Location:	
Sampled by:	Colm O Connell

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☐ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- (●) Regular Turn Around Time (TAT) (5 days for most tests)
- RUSH (Please contact the lab): ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ Ship Sample Bottles (please specify) ☐

ANALYSIS REQUESTED

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gravel)	Dry + Weigh	Texture (Sand, Silt Clay)	Number of Containers
1	12PYG33814J-1U1B	K09319	Sediment		1			2
2	12PYG33814J-1U2B	K09320	Sediment		1			2
3	12PYG33814J-1U3B	K09321	Sediment		1			2
4	12PYG33814J-1D1B	K09322	Sediment		1			1
5	12PYG33814J-1D2B	K09323	Sediment		1			1
6	12PYG33814J-1D3B	K09324	Sediment		1			1
7	12PYG33814J-2U1B	K09325	Sediment		1			1
8	12PYG33814J-2U2B	K09326	Sediment		1			1
9	12PYG33814J-2U3B	K09327	Sediment		1			1
10	12PYG33814J-2D1B	K09328	Sediment		1			1
11	12PYG33814J-2D2B	K09329	Sediment		1			1
12	12PYG33814J-2D3B	K09330	Sediment		1			1

*Relinquished By: (Print name and sign)	Date (yy/mm/dd):	Time (24hr):	Received by: (Print name and sign)	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive
			DAN CURRIE	2014/08/12	19:15	☐

Laboratory Use Only

Temperature on Receipt (°C)	A) 35 B) 33 C) 34
	35 35 35
Just sampled & rec'd on ice	☐
Custody Seal Present?	Yes ☐ No ☐
Intact?	NA

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

BBY FCD-00077R2_C

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Maxxam Analytics Inc

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Maxxam Job #: B481169 **COC #:** 08396873 Page: 3 of 3

Invoice To: Require Report? Yes [ ] No [ ]

Company Name:	#5907 G3 CONSULTING
Contact Name:	ACCOUNTS PAYABLE
Address:	206 - 8501 162 STREET
	SURREY, BC PC: V4N 1B2
Phone / Fax#:	Ph: 604 598-8501 Fax: 604 598-8525
E-mail	whannon@g3consulting.com

Report To:

Company Name:	G3 Consulting
Contact Name:	Alax Caldicott
Address:	PC:
Phone / Fax#:	Ph: Fax:
E-mail	acaldicott@g3consulting.com

PO #:	786589
Quotation #:	B12-184-CI
Project #:	1238
Proj. Name:	COQMON-8
Location:	
Sampled by:	Colm O Connell

REGULATORY REQUIREMENTS:

- [ ] CSR
- [ ] CCME
- [ ] BC Water Quality
- [ ] Other
- [ ] DRINKING WATER

SERVICE REQUESTED:

(●) Regular Turn Around Time (TAT) (5 days for most tests)

RUSH (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day

Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler [ ] **Ship Sample Bottles (please specify)** [ ]

ANALYSIS REQUESTED

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gra	Dry + Weigh	Texture (Sand, Silt Clay)	Number of Containers
1	12PYG33814J-5U1B	K09343	Sediment		1			1
2	12PYG33814J-5U2B	K09344	Sediment		1			1
3	12PYG33814J-5U3B	K09345	Sediment		1			1
4	12PYG33814J-5D1B	K09346	Sediment		1			1
5	12PYG33814J-5D2B	K09347	Sediment		1			1
6	12PyG33814J-5D3B	K09348	Sediment		1			1
7	12PYG33814J-6U1B	K09349	Sediment		1			1
8	12PYG33814J-6U2B	K09350	Sediment		1			1
9	12PYG33814J-6U3B	K09351	Sediment		1			1
10	12PYG33814J-6D1B	K09352	Sediment		1			1
11	12PYG33814J-6D2B	K09353	Sediment		1			1
12	12PYG33814J-6D3B	K09354	Sediment		1			1

B481169

Print name and sign / Print name and sign / Laboratory Use Only

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by:	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
			J. JOHN CURRIE	2014/09/12	19:15	[ ]	A) 35 B) 33 C) 34	Present?	[ ]	[ ]
							Just sampled & rec'd on ice: [ ]	Intact?	✓	[ ]

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS. 35 35 35

BBY FCD-00077R2_C

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Your P.O. #: 786596
Your Project #: 1238 COQMON-8
Your C.O.C. #: 08396972, 08396973, 08396974

Attention:Alex Caldicott

G3 Consulting Ltd.
206-8501 162 St
Surrey, BC
Canada V4N 1B2

Report Date: 2014/09/26
Report #: R1650577
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B483289
Received: 2014/09/18, 18:20

Sample Matrix: Sediment
Samples Received: 36

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Texture by Hydrometer, incl Gravel (Wet)	15	N/A	2014/09/24	BBY6SOP-00051	Carter 2nd ed 55.3
Texture by Hydrometer, incl Gravel (Wet)	15	N/A	2014/09/25	BBY6SOP-00051	Carter 2nd ed 55.3
Texture by Hydrometer, incl Gravel (Wet)	6	N/A	2014/09/26	BBY6SOP-00051	Carter 2nd ed 55.3

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Stefanie Teo, Project Manager
Email: STeo@maxxam.ca
Phone# (604) 734 7276
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B483289
Report Date: 2014/09/26

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786596
Sampler Initials: COC

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		KQ2241	KQ2242	KQ2243	KQ2244		
Sampling Date							
COC Number		08396972	08396972	08396972	08396972		
	Units	**12PYG33814M-1U1B**	**12PYG33814M-1U2B**	**12PYG33814M-1U3B**	**12PYG33814M-1D1B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	82	44	80	78	2.0	7647694
% silt by hydrometer	%	<2.0	3.6	<2.0	<2.0	2.0	7647694
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7647694
Gravel	%	17	51	18	21	2.0	7647694
RDL = Reportable Detection Limit							

Maxxam ID		KQ2245	KQ2246	KQ2247	KQ2248		
Sampling Date							
COC Number		08396972	08396972	08396972	08396972		
	Units	**12PYG33814M-1D2B**	**12PYG33814M-1D3B**	**12PYG33814M-2U1B**	**12PYG33814M-2U2B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	73	79	80	81	2.0	7647694
% silt by hydrometer	%	<2.0	<2.0	<2.0	<2.0	2.0	7647694
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7647694
Gravel	%	24	19	18	17	2.0	7647694
RDL = Reportable Detection Limit							

Maxxam ID		KQ2249	KQ2250	KQ2251	KQ2252		
Sampling Date							
COC Number		08396972	08396972	08396972	08396972		
	Units	**12PYG33814M-2U3B**	**12PYG33814M-2D1B**	**12PYG33814M-2D2B**	**12PYG33814M-2D3B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	76	68	63	54	2.0	7647694
% silt by hydrometer	%	<2.0	<2.0	<2.0	2.2	2.0	7647694
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7647694
Gravel	%	22	31	36	44	2.0	7647694
RDL = Reportable Detection Limit							

Maxxam ID		KQ2253	KQ2254	KQ2255		
Sampling Date						
COC Number		08396973	08396973	08396973		
	Units	**12PYG33814M-3U1B**	**12PYG33814M-3U2B**	**12PYG33814M-3U3B**	**RDL**	**QC Batch**
Physical Properties						
% sand by hydrometer	%	52	59	49	2.0	7647694
% silt by hydrometer	%	<2.0	<2.0	<2.0	2.0	7647694
Clay Content	%	<2.0	<2.0	<2.0	2.0	7647694
Gravel	%	47	39	49	2.0	7647694
RDL = Reportable Detection Limit						

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Maxxam Job #: B483289
Report Date: 2014/09/26

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786596
Sampler Initials: COC

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		KQ2256	KQ2257	KQ2258	KQ2259		
Sampling Date							
COC Number		08396973	08396973	08396973	08396973		
	Units	**12PYG33814M-3D1B**	**12PYG33814M-3D2B**	**12PYG33814M-3D3B**	**12PYG33814M-4U1B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	39	43	33	61	2.0	7649204
% silt by hydrometer	%	3.3	2.0	3.7	3.8	2.0	7649204
Clay Content	%	<2.0	<2.0	<2.0	<2.0	2.0	7649204
Gravel	%	57	53	63	35	2.0	7649204
RDL = Reportable Detection Limit							

Maxxam ID		KQ2260	KQ2261	KQ2262	KQ2263		
Sampling Date							
COC Number		08396973	08396973	08396973	08396973		
	Units	**12PYG33814M-4U2B**	**12PYG33814M-4U3B**	**12PYG33814M-4D1B**	**12PYG33814M-4D2B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	57	55	57	47	2.0	7649204
% silt by hydrometer	%	5.0	4.2	6.9	4.4	2.0	7649204
Clay Content	%	<2.0	<2.0	2.1	2.0	2.0	7649204
Gravel	%	36	40	34	47	2.0	7649204
RDL = Reportable Detection Limit							

Maxxam ID		KQ2264	KQ2277	KQ2278	KQ2279		
Sampling Date							
COC Number		08396973	08396974	08396974	08396974		
	Units	**12PYG33814M-4D3B**	**12PYG33814M-5U1B**	**12PYG33814M-5U2B**	**12PYG33814M-5U3B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	40	47	56	50	2.0	7649204
% silt by hydrometer	%	4.4	3.2	4.6	3.4	2.0	7649204
Clay Content	%	2.0	<2.0	<2.0	2.0	2.0	7649204
Gravel	%	53	49	38	44	2.0	7649204
RDL = Reportable Detection Limit							

Maxxam ID		KQ2280	KQ2281	KQ2282		
Sampling Date						
COC Number		08396974	08396974	08396974		
	Units	**12PYG33814M-5D1B**	**12PYG33814M-5D2B**	**12PYG33814M-5D3B**	**RDL**	**QC Batch**
Physical Properties						
% sand by hydrometer	%	50	44	47	2.0	7649204
% silt by hydrometer	%	3.3	3.5	4.7	2.0	7649204
Clay Content	%	2.0	3.4	<2.0	2.0	7649204
Gravel	%	45	49	47	2.0	7649204
RDL = Reportable Detection Limit						

Maxxam Job #: B483289
Report Date: 2014/09/26

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786596
Sampler Initials: COC

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		KQ2283	KQ2284	KQ2285	KQ2286		
Sampling Date							
COC Number		08396974	08396974	08396974	08396974		
	Units	**12PYG33814M-6U1B**	**12PYG33814M-6U2B**	**12PYG33814M-6U3B**	**12PYG33814M-6D1B**	**RDL**	**QC Batch**
Physical Properties							
% sand by hydrometer	%	45	54	53	45	2.0	7650807
% silt by hydrometer	%	3.2	2.2	<2.0	3.1	2.0	7650807
Clay Content	%	2.3	2.1	<2.0	<2.0	2.0	7650807
Gravel	%	49	42	44	52	2.0	7650807
RDL = Reportable Detection Limit							

Maxxam ID		KQ2287	KQ2288		
Sampling Date					
COC Number		08396974	08396974		
	Units	**12PYG33814M-6D2B**	**12PYG33814M-6D3B**	**RDL**	**QC Batch**
Physical Properties					
% sand by hydrometer	%	47	43	2.0	7650807
% silt by hydrometer	%	3.2	2.0	2.0	7650807
Clay Content	%	<2.0	<2.0	2.0	7650807
Gravel	%	50	54	2.0	7650807
RDL = Reportable Detection Limit					

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Maxxam Job #: B483289
Report Date: 2014/09/26

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786596
Sampler Initials: COC

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	23.0°C
Package 2	22.0°C
Package 3	22.0°C

Results relate only to the items tested.

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Maxxam Job #: B483289
Report Date: 2014/09/26

QUALITY ASSURANCE REPORT

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786596
Sampler Initials: COC

QC Batch	Parameter	Date	RPD Value (%)	RPD QC Limits
7647694	% sand by hydrometer	2014/09/24	2.8	35
7647694	% silt by hydrometer	2014/09/24	NC	35
7647694	Clay Content	2014/09/24	NC	35
7647694	Gravel	2014/09/24	5.3	35
7649204	% sand by hydrometer	2014/09/25	0.40	35
7649204	% silt by hydrometer	2014/09/25	NC	35
7649204	Clay Content	2014/09/25	NC	35
7649204	Gravel	2014/09/25	0.67	35
7650807	% sand by hydrometer	2014/09/26	0.95	35
7650807	% silt by hydrometer	2014/09/26	NC	35
7650807	Clay Content	2014/09/26	NC	35
7650807	Gravel	2014/09/26	4.0	35

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

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Maxxam Job #: B483289
Report Date: 2014/09/26

G3 Consulting Ltd.
Client Project #: 1238 COQMON-8
Your P.O. #: 786596
Sampler Initials: COC

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Andy Lu, Data Validation Coordinator

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam Analytics Inc

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386 Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Maxxam Job #: B483289 COC #: 08396972 Page: 1 of 3

Invoice To: Require Report? Yes ☐ No ☐

Company Name: #5007 G3 CONSULTING
Contact Name: ACCOUNTS PAYABLE
Address: 206 - 8501 162 STREET
SURREY, BC PC: V4N 1B2
Phone / Fax#: Ph: 604 598-8501 Fax: 604 598-8525
E-mail: whannon@g3consulting.com

Report To:

Company Name: G3 Consulting
Contact Name: Alex Caldicott
Address:
PC:
Phone / Fax#: Ph: Fax:
E-mail: acaldicott@g3consulting.com

PO #: 786596
Quotation #: B12-184-CI
Project #: 1238
Proj. Name: COQMON-8
Location:
Sampled by: Colm O Connell

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☐ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- (●) Regular Turn Around Time (TAT) (5 days for most tests)
- RUSH (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:
Return Cooler ☐ Ship Sample Bottles (please specify) ☐

ANALYSIS REQUESTED

	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gr)	Dry + Weigh	Texture (Sand, Silt Clay)	Number of Containers
1	12PYG33814M-1U1B	KQ2241	Sediment		1			2
2	12PYG33814M-1U2B	KQ2242	Sediment		1			1
3	12PYG33814M-1U3B	KQ2243	Sediment		1			2
4	12PYG33814M-1D1B	KQ2244	Sediment		1			1
5	12PYG33814M-1D2B	KQ2245	Sediment		1			1
6	12PYG33814M-1D3B	KQ2246	Sediment		1			1
7	12PYG33814M-2U1B	KQ2247	Sediment		1			2
8	12PYG33814M-2U2B	KQ2248	Sediment		1			1
9	12PYG33814M-2U3B	KQ2249	Sediment		1			2
10	12PYG33814M-2D1B	KQ2250	Sediment		1			1
11	12PYG33814M-2D2B	KQ2251	Sediment		1			2
12	12PYG33814M-2D3B	KQ2252	Sediment		1			2

B483289

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by:	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
	14/09/18	18:00	DARIA IVANOVA	2014/09/18	18:20	☐	A: 23 B: 23 C: 23	Present?		
							Just sampled & received on ice ☐	Intact?		

22,22,22,22,22,22 N/A

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

BBY FCD-00077R2_C

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CHAIN OF COSTODY RECORD

Maxxam Job #: B483289 COC #: 08396973 Page: 2 of 3

Invoice To: Require Report? Yes ☐ No ☐		Report To:		
Company Name:	#5907 G3 CONSULTING	Company Name:	G3 Consulting	PO #: 786596
Contact Name:	ACCOUNTS PAYABLE	Contact Name:	Alax Caldicott	Quotation #: B12-184-CI
Address:	206 8501 162 STREET	Address:		Project #: 1238
	SURREY, BC PC: V4N 1B2		PC:	Proj. Name: COQMON-8
Phone / Fax#:	Ph: 604 598-8501 Fax: 604 598-8525	Phone / Fax#:	Ph: Fax:	Location:
E-mail	whannon@g3consulting.com	E-mail	acaldicott@g3consulting.com	Sampled by: Colm O Connell

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☐ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- (●) Regular Turn Around Time (TAT) (5 days for most tests)
- RUSH (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ Ship Sample Bottles (please specify) ☐

ANALYSIS REQUESTED

	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gr	Dry + Weigh	Texture (Sand, Silt Clay)	Number of Containers
1	12PYG33814M-3U1B	KQ2253	Sediment		1			1
2	12PYG33814M-3U2B	KQ2254	Sediment		1			2
3	12PYG33814M-3U3B	KQ2255	Sediment		1			1
4	12PYG33814M-3D1B	KQ2256	Sediment		1			1
5	12PYG33814M-3D2B	KQ2257	Sediment		1			1
6	12PYG33814M-3D3B	KQ2258	Sediment		1			1
7	12PYG33814M-4U1B	KQ2259	Sediment		1			1
8	12PYG33814M-4U2B	KQ2260	Sediment		1			1
9	12PYG33814M-4U3B	KQ2261	Sediment		1			1
10	12PYG33814M-4D1B	KQ2262	Sediment		1			1
11	12PYG33814M-4D2B	KQ2263	Sediment		1			1
12	12PYG33814M-4D3B	KQ2264	Sediment		1			1

B483289

*Relinquished By: (Print name and sign)	Date (yy/mm/dd):	Time (24hr):	Received by: (Print name and sign)	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive	Temperature on Receipt (°C) (Laboratory Use Only)	Custody Seal	Yes	No
	14/09/18	18:00	DARIA IVANOVA	2014/09/18	18:20	☐	A) 23 B) 23 C) 23	Present?	☐	☐
							Just sampled & rec'd on ice ☐	Intact?	☐	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS. 22,22,22 / 22,22,22 N/A

BBY FCD-00077R2_C

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Maxxam Analytics Inc

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) ###-####

CHAIN OF CUSTODY RECORD

Maxxam Job #: B483289 | COC #: 08396974 | Page: 3 of 3

Invoice To: Require Report? Yes ☐ No ☐		Report To:	
Company Name:	#5507 G3 CONSULTING	Company Name:	G3 Consulting
Contact Name:	ACCOUNTS PAYABLE	Contact Name:	Alax Caldicott
Address:	206 - 8501 162 STREET, SURREY, BC PC: V4N 1B2	Address:	PC:
Phone / Fax#:	Ph: 604 598-8501 Fax: 604 598-8525	Phone / Fax#:	Ph: Fax:
E-mail:	whannon@g3consulting.com	E-mail:	acaldicott@g3consulting.com

PO #:	786596
Quotation #:	B12-184-CI
Project #:	1238
Proj. Name:	COQMON-8
Location:	
Sampled by:	Colm O Connell

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☐ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- (●) Regular Turn Around Time (TAT) (5 days for most tests)
- RUSH (Please contact the lab): ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ Ship Sample Bottles (please specify) ☐

ANALYSIS REQUESTED

	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Texture+Gravel (Sand, Silt, Clay, Gr)	Dry + Weigh	Texture (Sand, Silt, Clay)	Number of Containers
1	12PYG33814AM-5U1B	[redacted]	Sediment		1			1
2	12PYG33814AM-5U2B	[redacted]	Sediment		1			2
3	12PYG33814AM-5U3B	[redacted]	Sediment		1			1
4	12PYG33814AM-5D1B	[redacted]	Sediment		1			1
5	12PYG33814AM-5D2B	[redacted]	Sediment		1			1
6	12PyG33814J-5D3B	[redacted]	Sediment		1			1
7	12PYG33814AM-6U1B	[redacted]	Sediment		1			1
8	12PYG33814AM-6U2B	[redacted]	Sediment		1			1
9	12PYG33814AM-6U3B	[redacted]	Sediment		1			1
10	12PYG33814AM-6D1B	[redacted]	Sediment		1			1
11	12PYG33814AM-6D2B	[redacted]	Sediment		1			1
12	12PYG33814AM-6D3B	[redacted]	Sediment		1			1

*Relinquished By: (Print name and sign)	Date (yy/mm/dd)	Time (24hr)	Received by: (Print name and sign)	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
	14/09/19	17:00	DARIA IVANOVA	2014/09/18	15:20	☐	A: 22 B: 22 C: 22	Present?	☐	☐
							Just sampled & rec'd on ice ☐	Intact?	☐	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS. 23,23,23/22,22,22

N/A

BBY FCD-00077R2_C

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October 2012 Pebble Count Raw Data

nd - no data

Sample Site	Medium Gravel	Coarse Gravel	Very Coarse Gravel	Small Cobble	Medium Cobble	Large Cobble	Boulder
1U1	455	264	58/	3	5	1	0
1U2	368	209	48	7	2	0	0
1U3	587	323	38	2	1	0	0
1D1	304	196	39	1	0	0	0
1D2	265	215	36	7	0	0	0
1D3	227	249	54	9	1	0	0
2U1	161	118	48	10	3	1	0
2U2	308	204	47	5	6	0	0
2U3	208	119	32	4	3	4	0
2D1	112	91	33	8	13	3	0
2D2	219	138	33	10	5	1	0
2D3	nd	nd	nd	nd	nd	nd	nd
3U1	504	210	35	11	3	2	0
3U2	299	125	32	8	5	0	0
3U3	280	161	32	3	2	1	0
3D1	151	78	29	7	2	2	0
3D2	329	199	33	11	2	2	0
3D3	446	224	43	7	3	2	0
4U1	164	160	27	3	5	4	0
4U2	427	234	41	8	0	3	0
4U3	267	170	37	4	3	3	0
4D1	467	282	52	9	5	3	0
4D2	480	220	38	6	3	5	0
4D3	210	145	70	12	1	2	0
5U1	415	270	39	4	4	1	0
5U2	122	179	29	5	1	1	0
5U3	384	370	62	10	2	0	0
5D1	414	241	41	8	2	2	0
5D2	nd	nd	nd	nd	nd	nd	nd
5D3	336	127	29	4	3	1	0
6U1	262	132	37	8	4	1	0
6U2	201	131	26	10	4	1	0
6U3	286	154	49	3	2	0	0
6D1	210	163	62	10	5	0	0
6D2	241	136	46	11	6	0	0
6D3	349	177	37	12	4	3	0

January 2013 Pebble Count Raw Data

nd - no data

Sample Site	Medium Gravel	Coarse Gravel	Very Coarse Gravel	Small Cobble	Medium Cobble	Large Cobble	Boulder
1U1	292	183	25	9	2	1	0
1U2	470	162	62	2	5	0	0
1U3	447	218	49	12	2	0	0
1D1	207	136	26	4	3	0	0
1D2	423	209	28	9	3	0	0
1D3	190	130	27	0	6	0	0
2U1	156	72	28	7	0	1	0
2U2	294	217	60	6	1	1	0
2U3	107	80	30	5	1	0	0
2D1	374	221	42	9	1	0	0
2D2	241	165	49	10	5	0	0
2D3	609	311	46	2	6	0	0
3U1	435	232	36	5	3	0	0
3U2	344	180	34	5	4	0	0
3U3	402	224	45	5	2	1	0
3D1	nd	nd	nd	nd	nd	nd	nd
3D2	323	164	30	7	2	2	0
3D3	382	203	30	12	4	0	0
4U1	256	142	42	5	3	0	0
4U2	364	191	45	9	1	0	0
4U3	171	95	34	7	6	2	0
4D1	561	328	89	4	1	0	0
4D2	nd	nd	nd	nd	nd	nd	nd
4D3	965	488	73	13	2	0	0
5U1	354	199	28	8	3	1	0
5U2	828	439	43	0	2	0	0
5U3	420	267	60	6	1	0	0
5D1	434	190	33	8	2	1	0
5D2	681	395	81	7	2	0	0
5D3	294	198	41	8	5	1	0
6U1	238	150	28	6	9	0	0
6U2	383	241	40	13	2	0	0
6U3	688	415	76	4	1	0	0
6D1	381	250	79	12	5	0	0
6D2	338	223	68	13	2	0	0
6D3	345	151	61	13	4	0	0

May 2013 Pebble Count Raw Data

nd - no data

Sample Site	Medium Gravel	Coarse Gravel	Very Coarse Gravel	Small Cobble	Medium Cobble	Large Cobble	Boulder
1U1	nd	nd	nd	nd	nd	nd	nd
1U2	351	181	42	5	2	0	0
1U3	nd	nd	nd	nd	nd	nd	nd
1D1	160	102	20	2	3	1	0
1D2	295	203	22	5	1	3	0
1D3	140	93	19	8	5	0	0
2U1	112	87	21	6	2	1	0
2U2	217	114	22	6	2	4	0
2U3	158	116	40	12	4	2	0
2D1	429	260	46	9	3	0	0
2D2	521	239	54	7	2	3	0
2D3	320	174	41	12	4	0	0
3U1	341	233	26	4	3	2	0
3U2	210	108	37	8	7	2	0
3U3	172	108	21	4	5	3	0
3D1	242	190	38	8	2	1	0
3D2	302	187	40	6	6	1	0
3D3	245	104	24	5	1	0	0
4U1	135	136	29	7	3	2	0
4U2	227	106	28	8	5	3	0
4U3	273	136	51	8	7	0	0
4D1	123	97	34	11	1	2	0
4D2	nd	nd	nd	nd	nd	nd	nd
4D3	303	127	26	6	3	3	0
5U1	427	236	57	9	2	0	0
5U2	369	188	30	6	2	0	0
5U3	nd	nd	nd	nd	nd	nd	nd
5D1	nd	nd	nd	nd	nd	nd	nd
5D2	107	90	24	8	0	3	0
5D3	391	209	45	5	3	0	0
6U1	176	118	29	5	6	2	0
6U2	140	96	13	5	5	1	0
6U3	269	136	32	3	3	2	0
6D1	60	53	19	9	15	0	0
6D2	219	183	42	11	3	0	0
6D3	270	159	50	10	4	0	0

October 2013 Pebble Count Raw Data

nd - no data

Sample Site	Medium Gravel	Coarse Gravel	Very Coarse Gravel	Small Cobble	Medium Cobble	Large Cobble	Boulder
1U1	nd	nd	nd	nd	nd	nd	nd
1U2	nd	nd	nd	nd	nd	nd	nd
1U3	nd	nd	nd	nd	nd	nd	nd
1D1	nd	nd	nd	nd	nd	nd	nd
1D2	nd	nd	nd	nd	nd	nd	nd
1D3	nd	nd	nd	nd	nd	nd	nd
2U1	nd	nd	nd	nd	nd	nd	nd
2U2	nd	nd	nd	nd	nd	nd	nd
2U3	nd	nd	nd	nd	nd	nd	nd
2D1	nd	nd	nd	nd	nd	nd	nd
2D2	nd	nd	nd	nd	nd	nd	nd
2D3	nd	nd	nd	nd	nd	nd	nd
3U1	nd	nd	nd	nd	nd	nd	nd
3U2	nd	nd	nd	nd	nd	nd	nd
3U3	91	83	32	9	6	2	0
3D1	nd	nd	nd	nd	nd	nd	nd
3D2	344	129	34	6	3	3	0
3D3	345	129	33	5	2	0	0
4U1	125	54	34	5	2	2	0
4U2	164	122	91	18	2	2	0
4U3	175	90	29	8	5	1	0
4D1	nd	nd	nd	nd	nd	nd	nd
4D2	nd	nd	nd	nd	nd	nd	nd
4D3	nd	nd	nd	nd	nd	nd	nd
5U1	183	109	44	4	6	1	0
5U2	160	91	39	1	1	2	0
5U3	499	212	43	3	4	0	0
5D1	nd	nd	nd	nd	nd	nd	nd
5D2	nd	nd	nd	nd	nd	nd	nd
5D3	nd	nd	nd	nd	nd	nd	nd
6U1	239	117	37	4	5	2	0
6U2	135	88	31	6	3	0	0
6U3	nd	nd	nd	nd	nd	nd	nd
6D1	340	184	56	11	1	1	0
6D2	284	152	32	10	7	0	0
6D3	174	104	27	5	1	3	0

January 2014 Pebble Count Raw Data

nd - no data

Sample Site	Medium Gravel	Coarse Gravel	Very Coarse Gravel	Small Cobble	Medium Cobble	Large Cobble	Boulder
1U1	366	323	66	5	1	0	0
1U2	582	262	56	5	2	0	0
1U3	443	210	39	11	2	0	0
1D1	170	133	26	4	4	0	0
1D2	212	113	33	4	6	2	0
1D3	181	123	37	13	1	0	0
2U1	101	133	42	8	0	3	0
2U2	16	29	14	10	1	0	0
2U3	256	141	38	14	5	0	0
2D1	116	123	30	11	3	0	0
2D2	167	149	56	8	5	1	0
2D3	134	141	54	7	6	0	0
3U1	233	127	28	5	2	1	0
3U2	314	139	39	6	2	0	0
3U3	202	167	42	7	2	0	0
3D1	284	254	43	5	1	1	0
3D2	250	146	37	6	2	2	0
3D3	343	171	46	7	8	0	0
4U1	67	75	26	4	0	1	0
4U2	237	168	36	4	6	0	0
4U3	122	83	34	10	3	1	0
4D1	251	119	39	8	1	1	0
4D2	329	223	48	6	2	0	0
4D3	404	217	51	4	5	0	0
5U1	100	72	34	6	3	1	0
5U2	214	191	53	6	3	1	0
5U3	50	71	29	5	1	1	0
5D1	114	93	28	10	2	1	0
5D2	40	59	37	7	3	2	0
5D3	355	280	54	8	9	1	0
6U1	4	7	7	1	1	4	0
6U2	37	49	24	5	1	1	0
6U3	43	48	15	8	3	2	0
6D1	227	199	49	4	8	1	0
6D2	19	38	26	6	6	1	0
6D3	131	161	44	2	2	2	0

May 2014 Pebble Count Raw Data

nd - no data

Sample Site	Medium Gravel	Coarse Gravel	Very Coarse Gravel	Small Cobble	Medium Cobble	Large Cobble	Boulder
1U1	417	291	50	5	2	0	0
1U2	6	23	10	10	0	2	0
1U3	232	188	44	11	3	1	0
1D1	217	167	34	9	1	0	0
1D2	185	106	29	5	0	3	0
1D3	96	88	32	3	6	1	0
2U1	259	167	48	13	5	1	0
2U2	259	174	34	10	4	0	0
2U3	279	174	46	11	0	2	0
2D1	156	111	33	14	4	2	0
2D2	373	218	44	10	5	3	0
2D3	321	208	37	11	7	0	0
3U1	307	156	41	8	2	5	0
3U2	377	231	36	5	5	1	0
3U3	210	120	24	3	1	6	0
3D1	250	110	50	10	3	2	0
3D2	256	110	36	5	4	2	0
3D3	179	90	34	5	3	2	0
4U1	156	107	38	14	3	1	0
4U2	174	130	49	13	7	0	0
4U3	181	134	45	10	7	2	0
4D1	171	192	74	21	2	0	0
4D2	358	339	86	8	2	0	0
4D3	275	236	77	9	0	0	0
5U1	284	200	57	8	2	2	0
5U2	519	275	57	15	7	0	0
5U3	368	233	38	9	5	3	0
5D1	287	201	41	11	3	0	0
5D2	371	243	61	7	4	0	0
5D3	560	278	40	7	8	2	0
6U1	81	100	24	7	3	3	0
6U2	133	82	38	10	8	1	0
6U3	161	97	34	7	5	3	0
6D1	210	192	58	8	4	1	0
6D2	346	265	55	14	6	0	0
6D3	280	178	46	17	3	0	0

Embeddedness October 2013

Sample Site	Obs. #1 (%)	Obs. #2 (%)	Obs. #3 (%)
130-3U1	90	80	80
130-3U2	25	30	40
130-3U3	15	15	20
130-3D1	85	50	30
130-3D2	40	65	30
130-3D3	90	85	80
130-4D1	75	60	80
130-4D2	50	75	70
130-4D3	75	65	75
130-4U1	35	65	50
130-4U2	20	15	10
130-4U3	45	33	10
130-5U1	85	70	70
130-5U2	15	15	20
130-5U3	75	40	80
130-6U1	65	25	20
130-6U2	45	55	50
130-6U3	70	65	60
130-6D1	70	60	30
130-6D2	45	55	30
130-6D3	80	55	65

Note: Samples were not collected at Sites 1 and 2 and downstream Site 5 due to high salmon reproductive activity.

Embeddedness January 2014

Sample Site	Obs. #1 (%)	Obs. #2 (%)	Obs. #3 (%)
14J-1U1	45	60	55
14J-1U2	30	20	25
14J-1U3	20	80	50
14J-1D1	10	10	30
14J-1D2	20	30	30
14J-1D3	10	35	20
14J-2U1	40	30	25
14J-2U2	60	65	50
14J-2U3	60	65	65
14J-2D1	40	35	55
14J-2D2	10	20	30
14J-2D3	15	10	15
14J-3U1	90	75	80
14J-3U2	20	35	20
14J-3U3	20	40	25
14J-3D1	80	80	80
14J-3D2	10	10	20
14J-3D3	10	15	15
14J-4U1	80	65	80
14J-4U2	80	20	70
14J-4U3	35	30	55
14J-4D1	25	15	40
14J-4D2	25	30	70
14J-4D3	45	40	30
14J-5U1	20	30	40
14J-5U2	20	30	50
14J-5U3	15	15	20
14J-5D1	50	85	65
14J-5D2	40	40	30
14J-5D3	80	90	80
14J-6U1	15	15	20
14J-6U2	25	25	25
14J-6U3	30	70	40
14J-6D1	60	60	50
14J-6D2	20	30	30
14J-6D3	15	45	75

Embeddedness May 2014

Sample Site	Obs. #1 (%)	Obs. #2 (%)	Obs. #3 (%)
14M-1U1	90	80	85
14M-1U2	60	70	65
14M-1U3	70	60	65
14M-1D1	50	50	70
14M-1D2	60	60	50
14M-1D3	60	60	70
14M-2U1	50	30	50
14M-2U2	70	80	75
14M-2U3	40	60	35
14M-2D1	50	50	60
14M-2D2	50	60	70
14M-2D3	50	40	50
14M-3U1	40	60	80
14M-3U2	50	60	50
14M-3U3	30	70	50
14M-3D1	60	40	60
14M-3D2	40	25	45
14M-3D3	70	55	70
14M-4U1	20	20	15
14M-4U2	30	40	30
14M-4U3	60	40	70
14M-4D1	80	45	60
14M-4D2	90	45	40
14M-4D3	100	100	100
14M-5U1	20	30	50
14M-5U2	50	40	50
14M-5U3	20	45	50
14M-5D1	70	30	55
14M-5D2	50	50	50
14M-5D3	30	40	60
14M-6U1	40	40	45
14M-6U2	30	55	25
14M-6U3	50	15	30
14M-6D1	50	30	40
14M-6D2	40	40	20
14M-6D3	60	35	15

Turbidity January 2014 and May 2014

Sample Site	**Reading 1**	**Reading 2**	**Reading 3**
January 2014			
1	1.81	3.01	1.88
2	0.98	1.01	1.75
3	10.58	10.54	10.2
4	0.44	0.23	0.22
5	0.21	0.24	0.39
6	0.64	0.44	0.24
May 2014			
1	0.44	0.42	0.63
2	0.43	0.52	0.62
3	2.93	2.64	2.77
4	0.85	0.63	0.71
5	0.3	0.38	0.23
6	0.5	0.64	0.57