APPENDIX 5
TUNDRA WATER TREATMENT
REPORTS

WASTEWATER TREATMENT PLANT
SEASONAL REPORT 2011

PHASE 2 REMEDIATION
TUNDRA MINE SITE, NT

Prepared for:

Aboriginal Engineering
100 Archibald Street
Yellowknife, NT X1A 2N1

Prepared by:

WESAtech
A Better Environment For Business

WESA Technologies Inc.
The Tower, The Woolen Mill
4 Cataraqui Street
Kingston, ON K7K 1Z7

WESAtech Project#: W-T8603

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1.0 CORPORATE PROFILE

WESA Group Inc. is an employee-owned consulting firm specializing in the fields of contaminant and water supply hydrogeology, engineering, earth sciences, industrial hygiene and occupational health & safety. WESA Group Inc. (WGI) is composed of WESA Inc. (WESA), WESA Technologies Inc. (WESAtech), and OEL.

- WESAtech provides water and wastewater treatment expertise, which includes design, build, and operation services, culminating in training owner representatives.
- WESA provides expertise in environmental engineering and assessment, project management, contract management, health and safety and quality controls.
- OEL provides knowledge in hydroelectric systems, design, tendering and project construction management including environmental assessments and associated components.

The company has a staff of over 140 highly qualified scientists, engineers, industrial hygienists, environmental auditors, project managers, environmental risk specialists, financial specialists and support personnel. Most of the members of the senior management team have worked for WESA for more than 10 years. The company work ethic is focussed on service, innovation and integrity. This is reflected in the company's broad client base; many clients have relied on WGI's services for over two decades.

2.0 INTRODUCTION

WESAtech was retained by Aboriginal Engineering Ltd. (AEL) to design, build, and operate a wastewater treatment plant (WWTP) capable of removing contaminants from water contained in the Tailings Containment Area (TCA) at the Tundra Mine site, Northwest Territories.

The WWTP was designed to remove arsenic and associated metals, described in **Table 1**, through chemical precipitation. The precipitation of the metals was executed using ferric sulfate ($Fe_2(SO_4)_3$) and hydrated lime ($Ca(OH)_2$), at a minimum iron to arsenic ratio of five to one by weight. A flocculent (floc) is then formed by adding a polymer flocculating agent (flocculent) to trap the precipitated metals in a filterable particle. The particle is then removed from the water using Geotube® geocontainment technology.

Table 1: Discharge criteria as found PWGSC's original tender document

Parameter	Unit	Maximum allowable concentration
Metals		
Total arsenic	mg/L	0.2
Total copper	mg/L	0.01
Total lead	mg/L	0.01
Total nickel	mg/L	0.05
Total zinc	mg/L	0.02
Anions		
Nitrate as nitrogen	mg/L	5
Nitrite as nitrogen	mg/L	0.4
Conventional Parameters		
Total ammonia as nitrogen	mg/L	5
Total suspended solids (TSS)	mg/L	15
pH	-	6 – 9

3.0 WASTEWATER TREATMENT PLANT CHEMICAL PROCESS DESIGN

The design of the WWTP relies on the principles of the physical-chemical entrapment of metals, by converting them from an aqueous dissolved state to a solid state. The treatment process is comprised of four steps which are coagulation, pH adjustment, flocculation and solid entrapment.

3.1. COAGULATION

The first step in the arsenic removal process, coagulation, was performed in the first reactor by the injection of a $Fe_2(SO_4)_3$ solution at a minimum ratio by weight of five to one $Fe_2(SO_4)_3$ to arsenic. In this process, soluble arsenic reacts with the coagulant to form a precipitate.

The removal of lead and zinc below the water license discharge criteria was attained by targeting the suspended solids; a strong linear correlation was found between the total suspended solids (TSS) concentration, and the total concentrations of both lead and zinc. The removal of these metal particulates was facilitated by the agglomeration of the suspended and colloidal solids with the chemically induced flocs formed during the coagulation and flocculation steps. These flocs are physically removed from the water by entrapping them in the Geotubes®. When an increase in the soluble fractions of lead and zinc were observed, the injection of a sodium metabisulfite (SMBS) solution was used to assist in the precipitation of these elements as metal sulfides.

3.2. pH ADJUSTMENT

The optimum removal of soluble arsenic (as a hydroxide precipitate), as well as lead and zinc (as sulfide precipitates) is achieved at a pH of 8.5; this is the point at which the solubility of these chemically induced precipitates are at their lowest. For this reason, a $Ca(OH)_2$ solution was injected into the second reactor in the treatment process in order to increase the pH to 8.5 following the addition of the $Fe_2(SO_4)_3$, to optimize metals removal.

3.3. FLOCCULATION

To aggregate the metal precipitate colloids and the particulates into a heavy and suspended floc, a polymer flocculent solution was injected into in the third rector of the treatment process. This polymer, which has a high molecular weight, allowed the colloids to aggregate together into flocs which results in a high removal efficiency of solids.

3.4. SOLIDS REMOVAL

The flocs containing both metal precipitate and suspended solids was removed as the wastewater with the addition of chemicals passes through the Geotube® geocontainment bags; the Geotubes® acted as filter. The flocs were captured in the matrix of the Geotubes®, while the filtrate, free of metal solids, was pumped to Hambone Lake for environmental discharge.

4.0 PLANT DESIGN AND CONSTRUCTION

The 2011 Tundra Mine WWTP was designed based upon existing knowledge, and past operational experiences encountered in the previous two project seasons. The WWTP built and operated during the 2010 project season underwent an extensive review, and deviances from the proposed design upgrades at the end of the 2010 project season are discussed in Section 4.8. The 2011 treatment facility was designed to operate as a triple train system, with each train capable of operating at a maximum capacity of 150 m^3/hr. The PWGSC water license issued by the MVLWB dictates that the plant can discharge to Hambone Lake at a maximum daily average of 275 m^3/hr. The chemically treated water exiting the WWTP was sent to a set of six Geotubes® contained within a bermed and lined area. The discharge from the Geotubes® was collected in a discharge sump prior to being pumped to the final discharge location, which is directly into Hambone Lake as per the Crown request. This is a change from the previous 2009 and 2010 seasons, where discharge was performed in Hambone lake wetlands area.

4.1. Platform Construction

WESAtech arrived at Tundra Mine site on the 27 April to begin the construction of the WWTP. The treatment system was erected on a site-assembled plywood platform, approximately 27 m by 45 m, and is located entirely within the containment area of the Upper Pond. The platform was divided into three steps, each successive step decreased in elevation by approximately 150 mm; the changes in elevation were introduced to provide enough hydraulic head to achieve the target treatment flow rate. Any overflow or spills from the WWTP flowed by gravity into Upper Pond. The site was powered using a fuel powered generator designated to solely provide power to the WWTP. The frame work used to support the WWTP equipment was a "Sikla" system is made from hot dip galvanized steel for outside use, and can remain in place. The Sikla steel framing system was lagged into the plywood platform. Throughout the construction phase, delays were encountered due to material shortages and civil construction limitations.

4.2. Chemical Reaction Tanks

The 37.85 m^3 Onion tanks were installed in series for each of the three trains. These HDPE tanks were placed on protective lay down mats. The piping for air agitation, process flow, and chemical injection was installed in each tank as required. The tanks were connected to each other with 305 mm schedule 80 PVC pipes, and flow between the tanks was controlled using 305mm wafer butterfly valves. Individual tank levels were controlled by adjusting valve between tanks.

4.3. Influent Distribution

The influent distribution header of the plant was made of schedule 80 PVC pipes and provisions had been implemented to control flow to the header using two 150mm butterfly valves. Flow to each train was controlled using two 200mm butterfly valves. A flow meter was mounted on each treatment train to enable the operator to balance the flow between the trains, and totalize the total amount of water entering the WWTP. The influent flow to the plant was supplied using two 150 mm diesel powered Godwin pumps, located in the Southwest corner of Lower Pond except near the end of the season when one of the intake pump was moved into Upper Pond. The untreated water was transferred from the pumps to the plant using two 150 mm layflat hoses. In the event that one of the pumps was taken offline, the influent header was designed such that one pump could supply a reduced flow rate to all treatment trains.

4.4. pH Control

The process piping exiting the first and second process tanks, where $Fe_2(SO_4)_3$ and $Ca(OH)_2$ were added respectively, had online pH monitoring to observe individual tank performance. The pH meter following the $Fe_2(SO_4)_3$ was installed as a method to indirectly monitor the $Fe_2(SO_4)_3$

dosage between calibrations of the $Fe_2(SO_4)_3$ dosing pumps; this was evaluated by ensuring the pH exiting the ferric tank was between 4.5 and 6. The pH meter following the $Ca(OH)_2$ addition was used to ensure the target pH of 8.5 was maintained to meet discharge criteria and to achieve the correct solubility of the metal fractions.

4.5. Chemical Agitation and Flow

All chemical solution makeup tanks were installed on the West end of the platform, and were plumbbed such that chemicals could be dosed to each of the treatment trains. Mixing in the $Fe_2(SO_4)_3$ and $Ca(OH)_2$ makeup tanks was achieved using a combination of both air and two mechanical agitators per tank. The air was provided by two 5 Hp positive displacement blowers. Each of the three polymer makeup tanks were agitated using one VFD controled mixer. The first and second process tanks were agitated with air supplied by two 10 Hp positive displacement blowers mounted between the treatment trains. Each of the blowers were complete with environmental enclosures, inlet filter, and discharge silencers. Air from the blowers was directed into a valved control manifold that can direct and control air flow individually to each diffuser drop in the appropriate process tanks or the chemical makeup tanks. Each drop is fitted with a neoprene capped durlin body hydro check diffuser, to allow forward air flow and then to close to prevent reverse flow into the drop to prevent clogging. The third and final process tank, where polymer was dosed, was agitated using two mechanical agitators.

4.6. Chemical Dosage Pumps

The chemical dosing pumps were mounted in close proximity to the appropriate chemical makeup tank they pumped from. One pump for each of the $Fe_2(SO_4)_3$, $Ca(OH)_2$, and polymer makeup tanks was dedicated to each train; a secondary pump for the dosing of the $Ca(OH)_2$ was also installed. The pumps were selected such that the target dosing rate fell in the middle of its maximum pumping capacity. The pumping rate for each pump could be manipulated by adjusting its stroke length and frequency.

4.7. Geotube Laydown Area

The Geotubes® were installed in a bermed containment area that was lined with a 15 mm thick polyethelene liner. The area was constructed with a slope from end to end to allow the water to drain from the tubes and flow to the central collection point. The geotubes sat on a filtration layer to allow better drainage at the bottom of the tubes. The Geotubes® were anchored to the earth outside of the berm using buried steel pipe for anchors; this prevented the Geotubes® from moving during the initial filling process. The two model GT500's for each treatment train were located adjacent to each other.

Discharge from each treatment train flowed through a manifold directing the flow into four 150mm layflat lines, which were installed into the first two inlet ports closest to the plant of each Geotubes®. During the beginning of the project season only Trains 2 and 3 were commissioned due to civil works in Upper Pond. The commissioning of Train 1 was not completed until 27 July. The construction of the three treatment trains was completed before the commissioning of Trains 2 and 3 began.

4.8. DESIGN UPGRADE DEVIENCES

The following recommendations that were outlined in the 2010 end of season report were not adopted, or require alterations for the 2012 project season:

- Tailings disturbance at the intake pumps
- Floating intake lines to avoid tailings in the treatment system
- Silt curtain to reduce tailings capture
- Pump failure alarms
- Communal sump
- Effective weirs between laydown area and sump
- Discharge intake not floating

Each of these items will be reviewed for future design considerations for the 2012 project season.

5.0 CHEMICAL FORMULATION

Before the on-site work at the Tundra Mine could begin for the 2011 project season, the quantities of the chemicals required were calculated, purchased and delivered to the site. These calculations were based on the contaminant concentrations of the water contained in Lower Pond during the 2010 project season. It was assumed that the contaminant concentrations of Lower Pond's water during the 2011 project season would comparable. A summary of the untreated wastewater contaminant concentrations from 2010 is presented in **Table 2**.

Table 2: Summary of Lower Pond's contaminant concentrations during the 2010 Tundra Mine project season

Substances	Feed Wastewater Concentration (mg/L)
Total Arsenic	1.99
Total Copper	0.0023
Total Lead	0.0007
Total Nickel	0.0013
Total Zinc	0.0114
Total Ammonia (as N)	<0.01
Nitrate (as N)	0.29
Nitrite (as N)	0.03
TSS	8
pH	8.25

On 22 June, on-site testing of the raw contaminated wastewater began. The purpose of this testing was to characterize the raw wastewater and compare it to the 2010 data. Both on-site and off-site testing were performed[1]. Most of the contaminants meet discharge criteria with the exception of: arsenic, zinc, lead and TSS; this data is presented in **Table 3**. Laboratory results gathered prior to the plant start-up have shown significant variability in its quality; sudden increases in both the suspended solids and metal concentrations were observed. Raw data is presented in **Appendix A**. The most significant differences between the wastewater data from the 2010 season to the 2011 project season are the higher concentrations of lead, zinc, and TSS. The average zinc concentration in 2011 appears comparable to that of 2010; however, consideration of the standard deviation statistically indicates that the zinc concentration can periodically exceed discharge criteria.

It was also demonstrate that the rise of zinc and lead is attributed to the increase of suspended solids in wastewater. Indeed, sudden increases of zinc and lead in raw water can be directly correlated to the rise in suspended solids with a correlation coefficient of 61.4 % and 79% respectively. When the concentrations of suspended solids are lessened, the total zinc and lead concentrations are also lowered and consistently below discharge criteria. The soluble fraction of these metals are therefore well below discharge criteria and thus, lead and zinc can be removed to discharge level by targeting the removal of suspended solids. While this is not the only contributing factor the TSS is the most targetable component of the influent water. Thus by removing TSS it allows for the control of these metal concentrations.

[1] Comparison between on-site and off-site testing discussed in the *Correlation Survey* Report.

Table 3: Influent 2011 Average Feed Wastewater Characteristics*

Parameter	Units	Average Feed Wastewater Concentration	Standard Deviation	Number of samples tested (n)
Total Arsenic	mg/L	1.54	0.17	52
Total Copper	mg/L	0.0028	0.0013	49
Total Lead	mg/L	0.0081	0.0062	50
Total Nickel	mg/L	0.0052	0.0016	49
Total Zinc	mg/L	0.0097	0.0075	50
Total Ammonia (as N)	mg/L	<0.05	-	41
Nitrate (as N)	mg/L	<0.05	-	44
Nitrite (as N)	mg/L	<0.05	-	44
TSS	mg/L	30.1	40.8	49
pH	-	8.29	0.10	45

* Analytical results that are below the method detection limit (MDL) were considered to be half of the MDL value.

As part of the on-site testing program wastewater from Lower Pond was used to perform small scale experiments in the field laboratory by WESAtech's environmental monitor, with the support of a Geotube® representative. This was done to confirm the required chemistry for both the conditioning phase of the Geotubes® and normal operation.

5.1. Arsenic Removal

The dosage of $Fe_2(SO_4)_3$ and polymer during normal operation of the first two project seasons was 75 mg/L and 0.5 mg/L, respectively. $Ca(OH)_2$ was added as necessary to achieve a pH of 8.5. The dosage rates for the $Fe_2(SO_4)_3$ and polymer were optimized and yielded good results. This year's small scale experiments were first performed using the historical dosage of $Fe_2(SO_4)_3$, and polymer. The results obtained were satisfactory yielding uniform flocs, and a reduction in the turbidity. However, the size of the floc appeared smaller than previous years; this result was attributed to the higher TSS concentration that was observed. The higher observed TSS decreased the stability of the floc and prevented the formation of larger floc particles. The active sites of both the coagulant and polymer were being consumed by the suspended solids, as opposed to the dissolved metals in the wastewater.

Additional experiments were performed by using a polymer dosage range between 0.5 mg/L and 3.0 mg/L Even though good flocs were obtained at an historical average concentration of 0.5 mg/L, the best dosage to overcome the increase in suspended solids was obtained at 1.5 mg/L with great floc formation in size, uniformity and strength as well as little residual turbidity. Polymer dosage concentrations between 1.5 mg/L and 3.0 mg/L also proved to be adequate, but residual unbounded polymer was observed. However, a polymer dosing rate of 3.0 mg/L was used during the commissioning phase of the Geotubes®, as recommended by their expert, to adequately coat the interior membrane and minimize bleed through of the solid material.

To verify the $Fe_2(SO_4)_3$ dosing rate, on-site experimentation included varying the $Fe_2(SO_4)_3$ dosage from 45 mg/L to 150 mg/L. The results of the small scale laboratory experiments indicated that a $Fe_2(SO_4)_3$ dosage rate of 75 mg/L yielded the best arsenic removal, with a residual concentration of 0.03 mg/L. It was found that a higher dosage of $Fe_2(SO_4)_3$ produced similar floc formation matters as the 75 mg/L dosage; however, lower $Fe_2(SO_4)_3$ dosages yielded fair to insufficient arsenic removal, along with smaller and less stable floc.

The lime dosing rate depended on the calco-carbonic equilibrium of the wastewater. Jar tests revealed that the required lime dosage rate varied from 32 mg/L and 45 mg/L. On rare occasions did the required lime dosage increase to 50 mg/L.

5.2. LEAD AND ZINC REMOVAL SODIUM METABISULPHITE

Even thought the zinc and lead residual concentrations were consistently below discharge criteria during the commissioning period, jar tests were nonetheless performed with the injection of sodium metabisulphite (SMBS). Small scale experiments were conducted to determine the optimal dosage rate for SMBS for the purposes of removing both lead and zinc. It was determined that the best injection point for the SMSB was the coagulation tank; this yielded good floc formation and little residual turbidity. It was found that an SMBS dosing rate of 30 mg/L to 60 mg/L yielded good removal efficiencies of both lead and zinc. Residual concentrations of these contaminants were typically less than 1 μg/L.

6.0 COMMISSIONING OF THE WWTP

6.1. CHRONOLOGY OF PLANT COMMISSIONING

The commissioning of the WWTP was initiated late June by WESAtech representatives, and required that the following steps be completed: dry start-up, wet start-up, and Geotube® commissioning. **Table 4** presents the chronology of the plant commissioning. The treatment trains were brought online throughout the season as soon as it was feasible.

Table 4: Chronology of plant commissioning

Initiation Date of Commissioning Step	Train 1	Train 2	Train 3
Dry start-up	27 June	27 June	27 June
Wet start-up	6 August	6 July	28 June
Geotube Conditioning	6 August	7 July	30 June
Discharge to Hambone Lake	24 August	12 July	12 July

6.2. DRY STARTUP

Dry start-up was conducted using untreated water. All electrical components were checked for rotation where necessary, and all others were checked for function. Tanks were filled with water to check for leaks, and air was introduced to ensure diffusers operated properly. Chemical pumps were primed using water and mixers were energized to ensure proper action. All mixing devices and tanks were operational and in line with the design.

6.3. WET STARTUP

As part of wet start-up, the chemical conditioning of the reaction tanks was first initiated over a period of a few days. During this step, the Geotubes® were bypassed and the chemically conditioned water exiting the flocculation tanks was sent directly into the individual discharge sumps. This water with containing flocs was not discharged to Hambone Lake, but rather pumped back to Lower Pond. Chemicals were added to condition each tank and build up a floc mass in the flocculation reactors. The chemical dosages were then optimized to confirm that the scale up from the jar tests to the plant would meet all requirements in terms of metal removal, as well as floc size, strength, and stability.

The ferric dosing concentration was initiated first at 75 mg/L. Increasing the concentration of the coagulant proved to be necessary during scale up in the field due to the flow continuum and the sudden variations in the turbidity and TSS concentrations of the wastewater. The concentrations varied from 105 mg/L to 150 mg/L as per the operator observations required to maintain great floc formation. Please note that the dosing always exceeded 75 mg/L. The lime was dosed according to the pH requirement of 8.5. The dosing rates varied considerably considering that the characteristics of the tailings wastewater varied as well. The polymer dosage varied between 1.5 and 3 mg/L upon floc requirements. The agitation of the tanks was optimized based on the tank configuration and on the positioning of the mixers/diffusers. The flocs were then consistently uniform, stronger, larger and the turbidity was considerably lower.

Further, the quality of the wastewater deteriorated as the project season progressed; gradual increases in the arsenic, lead, zinc, TSS concentrations were observed. Due to the elevation of contaminates in the influent the process water used for batching chemicals represented a secondary source of elevated contaminates. By using the wastewater to formulate the $Fe_2(SO_4)_3$ solution, some of the iron needed to precipitate metals from solution in the WWTPs influent water is being consumed before it is added. Similarly, the wastewater is being used to formulate the $Ca(OH)_2$ solution. The dosing of the $Ca(OH)_2$ effectively introduced an additional stream of untreated water, which was compensated for by increasing the $Fe_2(SO_4)_3$ dosing rate.

6.4. Geotube Commissioning

The plant flow was initiated and entered the Geotubes® upon the completion of the chemical balance in the treatment plant. Before intiating Geotube® comissioning, flow to the plant was turned off and the sump areas were inspected and cleaned of any residual floc to ensure compliance. Once completed the chemical dosage was increased to 3 mg/L as recommended by the Geotube® expert and developed during the small scale experiments. The water exited the Geotubes® and flowed over the weir and into the individual sump areas. Due to a lack of laydown space within the containment area, the Geotube® communal sump was not built. Treated water from sumps 2 and 3 overflowed into sump 1. From there, the water would overflow into Upperpond, or was pumped with an 200 mm diesel powered Godwin pump to the final discharge locaton at Hambone Lake. Prior to reaching the final discharge location, the treated water passes through a 254 mm flowmeter that displays the flowrate and records the total volume of treated water being discharged. This flowmeter was powered by a portable diesel powered light plant. Once commissioning was complete samples were taken for discharge approval by WESAtech. Upon submission of the laboratory results, AEL applied for discharge approval through the AANDC Water Inspector. Once granted, discharge began to Hambone Lake.

7.0 OPERATION SUMMARY

Overall the WWTP operated for a total of 92 days discharging into Hambone Lake 527,222 m^3 of water during the 2011 season. On October, 10th 2011 the decision was made to shutdown the WWTP due to inclement weather causing plant components to freeze. Performance in regard to compliance of the water license will be discussed in Section 9.0.

7.1. Discharge Scenarios

Prior to the commencement of the 2011 Tundra Mine remediation project season, there were discussions with regards to two potential scenarios in which water may be discharged to the

environment after treatment. Water was only discharged to Hambone Lake after written approval was received from the AANDC Water Inspector, formerly INAC, on 9 July.
The proposed Discharge Scenario A outlined that after commissioning of both the WWTP and the Geotubes® was complete, and environmental discharge approval was granted, the treated water exiting the Geotubes® would be transferred by pump, or overflow into Upper Pond. This was also provided that all civil works removing tailings from Upper Pond were completed. The proposed discharge scenario was such that the plant could be operated at its full capacity of 450 m^3/h, and all of the treated water would have been transferred to Upper Pond; its capacity is approximately 200,000 m^3. This would have offered both holding and buffering capacity, and allowed treated water to be discharged after the WWTP is shut down for the season into Hambone Lake. For Upper Pond to be converted into and effluent holding pond, all contaminated material had to be removed and baffles installed to increase its hydraulic retention time. Due to various delays, the removal of tailings from Upper Pond was not completed until 9 September. At this time, untreated water was pumped from Lower Pond into Upper Pond filling it by the end of the project season. For this reason Discharge Scenario B was implemented.

The proposed Discharge Scenario B outlined that if Upper Pond was not ready to be used as a treated water communal sump, Upper Pond would be bypassed and the treated water would be pumped from the Geotube® sump directly to Hambone Lake. Discharge Scenario B was implemented from 9 July, until 6 September; the WWTP treated water from Lower Pond at a rate of 275 m^3/h. 275 m^3/h of treated water was pumped from the Geotube® communal sump to Hambone Lake. On 6 September Discharge Scenario B was modified. The East end of Upper Pond had been cleaned of contaminated material, and an overflow weir from Geotube® Sump 1 was constructed and reinforced to minimize the effect of erosion. From 6 September until 12 October, the WWTP treated tailings water at a rate between of 280 m^3/h and 320 m^3/h. Treated water was pumped from the Geotube® communal sump at a rate of 275 m^3/h to Hambone Lake for environmental discharge, while excess water overflowed into Upper Pond. During this time, untreated tailings water from Lower Pond was also being pumped into Upper Pond.

7.2. AANDC Discharge Approval

Discrete combined effluent samples from Trains 2 and 3 were collected on 9 and 10 July during the commissioning period, and flown to Yellowknife for analysis at an accredited laboratory. The analytical results demonstrated that the two treatment trains successfully met discharge criteria with an average of 5.9 ± 2.2 mg/L suspended solids, 73.1 ± 8.6 μg/L total arsenic, 6.6 ± 4.2 μg/L total zinc, as well as 0.86 ± 0.04 μg/L total lead.

When conditioning of the Train 1 Geotubes® was completed, discrete effluent samples were collected on 14 to 16 August, and sent for anlaysis. The analytical results demonstrated that the treatment train successfully met discharge criteria with an average of 3.8 ± 2 mg/L suspended solids, an average of 29.6 ± 10.4 μg/L total arsenic, as well as non detectable levels of lead and zinc.

After each event, submissions to the AANDC Water Inspector was performed by Aboriginal Engineering Ltd. to gain approval to discharge to Hambone Lake.

7.3 Plant Winterizing

The operators noticed the plant freezing on Oct 10th 2011 and therefore had to shut it down. Train 1 was officially shut down for the season on Oct 10th 2011 at which time the teardown/winterization began. The tear down/winterization of the other two (2) trains began the following day, on Oct. 11th 2011.

Start-up of the WWTP in the spring of 2012 will be much quicker and easier than in previous years. Rather than undertaking a major deconstruction/reconstruction of the plant, it was decided this year that any equipment that could be safely left in position without damage was to be left in place over the winter months. Only the equipment that must be stored indoors was removed from the plant platform. This equipment will simply have to be reconnected for the 2012 operating season.

Pictures of the WWTP winterizing phase and storage of equipment are presented at the end of text from **Figure 11** to **Figure 24**.

<u>Chemical Tank Makeup Area</u>

At the end of the season, some chemical injection lines had frozen. During teardown/winterizing, these lines were drained as best as possible and left in place. Chemical pumps and other equipment that had frozen were thawed out using “Frost Fighter” heaters and then drained, cleaned and dried prior to final storage. Chemical pumps and fittings, such as foot valves, etc. were placed on pallets and stored in the Seacan located next to the WWTP. Mixer motors were removed from the framing, and placed in the Seacan as well. All valves that remained in place on the platform were placed in the open position to prevent cracking over the winter.

The ferric onion tanks were drained, rolled up, wrapped up with their laydown mats and left in place on the WWTP platform where as the lime makeup onion tanks were drained and left in place on the deck.

The polymer and sodium metabisulfite makeup tanks were drained, flipped upside down and secured to the WWTP platform using lag screws. The lids were stored in the Seacan.

The chemical makeup blowers were serviced, covered with tarps and left in place on the WWTP platform. The "Sikla" framing was left mounted on the platform, ready for reuse next season.

Treatment Trains Area

All process onion tanks were drained within 6"-8" (150-200 mm) of being empty. A 30' x 100' (9m x 30m) tarp was placed over each of the (3) three rows of onion tanks. This tarp was then strapped down to the deck with wood strapping and nails. All 12"(305mm) pvc piping was disconnected. This piping was placed on top of the Ferric make-up tanks.

All valves were thawed, cleaned and dried. They were then stored in the storage room next to the operators shack. Influent flow meters were removed, thawed, cleaned and dried prior to storage in the Seacan. Transmitters and pH sensors were removed and shelved in the storage room as well as all miscellaneous fittings such as but not limited to backpressure valves, flow alarms, injection & sample port valves, etc.

All mixers, process air diffuser drops, were disconnected, removed and placed in the Seacan where as the process blowers were serviced, wrapped in tarps and left in place on the deck. The electrical control panels were left intact on the WWTP platform. A plywood enclosure was constructed around all 3 panels. The roof of this enclosure was wrapped with tarp. The discharge flow meter was removed and brought to the WWTP to be stored within the Seacan.
A complete inventory of the equipment and its location was performed by WESA personnel and submitted to AEL prior to closing up and WESA leaving the Tundra Mine site.

8.0 MAINTENANCE CHALLENGES AND RECOMMENDATIONS

8.1. Ball Check Valves

During the course of the 2011 project season, one ongoing issue was the plugging of ball check valves of chemical dosing pumps. Attempts to mitigate this problem were made during the season by placing screens, or loose mesh fabrics over the suction end of the foot valves. This prevented the accumulation of grit in the ball check valves, but resulted in the complete plugging of fabric or screen stopping all flow. If the removal of suspended solids prior to entering the chemical tanks is not possible, check valves will need to be removed once per shift as regular maintenance.

8.2. Influent Feed Lines

During the 2011 project season, when one of the influent feed lines to the WWTP developed a large leak, the water entering the WWTP from an influent line that was intact would short circuit the WWTP and return down the blown line. To prevent this from happening, it is recommended that check valves be installed on the inlet pipes to the WWTP.

8.3. LIME CHEMICAL ADDITION

It is also recommended that the dosing of the $Ca(OH)_2$ solution into the WWTP be automated. This would not eliminate the requirement of checking the pH entering the flocculation tank, but would minimize the amount of manipulation of the $Ca(OH)_2$ dosing pump and potential operator error.

8.4. PLANT LIGHTING

At the beginning and end of the project season, when it is dark during the night shift, it was very difficult to see into the flocculation tanks and assess the quality of the floc, even with the use of headlamps and flashlights. For this reason, it is recommended that halogen flood lights be installed over the flocculation tanks.

8.5. ELECTRICAL

In the middle of the project season, an electrical problem within the panel arose. The 60 amp breaker on blower B-2000 became very sensitive, and should be replaced. The generator used to supply power to the plant had a series of maintenance and mechanical issues in the latter half of the season. Repair or replacement should be considered.

8.6. HYDRAULIC CONSIDERATIONS

After the commissioning of Train 1 of the WWTP, it was found that its influent flow rate could not be increased beyond 125 m^3/h without overflowing the process tanks. After approximately 1.5 months of operation, the influent flow rate of Train 1 could not exceed 100 m^3/h without overflowing the process tanks. The restriction of the influent flow rate and the deterioration of the hydraulic performance of Train 1 are attributed to the slope that developed along the North side of the platform, as well as the use of rubber discharge hose to feed the Geotube® inlets from the Train 1 Geotube header. The unlevelled platform allowed for the accumulation of sludge and floc in half of the tank, which effectively reduces the size of the tank. Solids also accumulated around the tank outlet restricting its flow. Further, the rubber discharge hose did not expand fully while the treated wastewater flowed through it, adding another flow restriction to the process. It is recommended that the WWTP be repaired and levelled, and that the rubber discharge hose be replaced with rigid green suction hose.

8.7. GEOTUBE RELAXATION

As the project season progressed, it was noted that the relaxation of the Geotubes became more and more difficult to relax even after the frequency with which the Geotubes® were relaxed was increased. This may be mitigated by increasing the number of inlets to the Geotubes®. Under its current configuration, green rigid suction hoses are being used to connect the hose from the Geotube® header to the Geotube® inlet. This rigid suction hose extends three feet into the Geotube® and is often sitting on the bottom of the Geotube®. It is suspected that this configuration does not allow for dispersion of the floc allowing it to accumulate at the inlet. It is recommended that PVC connections be used in lieu of the rigid suction hose in order to keep the inlet off the bottom of the Geotube® to promote better dispersion.

9.0 DISCHARGE MONITORING AND QUALITY CONTROL PROGRAM

The Discharge Monitoring and Quality Control Program (DMQCP) was developed to ensure that the performance of the WWTP assessed and recorded properly, during the course of the environmental remediation project at the Tundra Mine, NWT. The DMQCP was implemented to ensure that all on-site practices and procedures, execution of the chain of custody, and off-site laboratory analyses adhere to quality assurance and quality control (QA/QC) policies, relevant territorial and federal regulations and standards, and the quality objectives for the project procedure and deliverables.

9.1. DOCUMENTATION AND RECORDS

For the duration of the on-site work at the Tundra Mine, the documentation requirements, as outlined in the DMQCP, were followed. These tasks include:

- Storing all electronic documents and data (field data, off-site laboratory results, daily and weekly reports, etc.) on both the on-site computer's hard drive and external hard drive;
- All electronic data was periodically archived throughout the project season on CD-ROMs;
- All samples that were collected in the field were labelled with the project number, sampling location, time and date of collection, and sample number, and recorded in both field notebooks and electronic databases;
- All off-site laboratory data was stored and filed, and transcribed to the appropriate electronic database;
- The QA/QC data received for both duplicate analyses and inter-laboratory comparisons were stored and filed, and transcribed to the appropriate electronic database;
- Electronic charts were updated and reviewed regularly, to monitor both the WWTP's influent and effluent water quality;

- Deviations from approved protocols and standard operating procedures (SOPs) were documented in field notebooks;
- Completed chain of custody (COC) forms for all sample shipments were filed, stored and transcribed to the appropriate electronic database.

9.2. SAMPLING

For the duration of the 2011 project season, Discharge Scenario B was employed. For this reason, compliant samples were taken from a sample port installed in the influent pipe feeding the WWTP, and a sample port on the discharge line sending treated water to Hambone Lake. The Geotube® communal sump was considered equivalent to the sample port on the discharge line. Samples from the individual Geotube® sumps were taken as necessary throughout the 2011 project season. For each sampling event, all samples were taken in triplicate; one sample was analyzed on-site, while the remaining two samples were sent to an off-site accredited laboratory for analysis.

As outlined in the DMQCP, compliant effluent samples were taken every six hours per 24 hour period. The sampling frequency for the WWTP's effluent stream was increased as necessary during the project season. One compliant influent sample was taken for every 24 hour period. However, the frequency of the influent sampling increased to as much as every hour as required during the project season.

During the 2011 project season, two different phases in the DMQCP were outlined as the *Correlation Survey* and the *Monitoring Plan*. For both phases, the number of sampling events and the on-site analyses remained the same; however, the number of samples that were analyzed off-site decreased.

Table 5: Summary of both on-site and off-site sampling during the correlation survey

Sampling location	Samples collected per day	Analyses	On-site analysis per day	Off-site analysis per day
Plant inlet	1	As, TSS, pH	1	1
		Pb, Zn, Cu, Ni, NO_2^{-1}, NO_3^{-1}, NH_3	1	1
Discharge port	4	As, TSS, pH	4	4
		Pb, Zn, Cu, Ni, NO_2^{-1}, NO_3^{-1}, NH_3	1	1

Table 6: Summary of both on-site and off-site sampling during the monitoring plan

Sampling location	Samples collected per day	Analyses	On-site analysis per day	Off-site analysis per day
Plant inlet	1	As, TSS, pH	1	Once per week
		Pb, Zn, Cu, Ni, NO_2^{-1}, NO_3^{-1}, NH_3	1	Once per week
Discharge port	4	As, TSS, pH	4	4
		Pb, Zn	1	4
		Cu, Ni, NO_2^{-1}, NO_3^{-1}, NH_3	1	Once per week

9.3. Correlation Survey

As outlined in the DMQCP, a correlation survey was performed for the purposes of developing a correlation between the on-site field instruments, and off-site results from accredited laboratories. This correlation survey began at the start of the commissioning phase of the WWTP on the June 25th, and continued until August 6th. During this time, an intensive sampling and monitoring program was executed. A correlation survey report was submitted to AEL August 17th. Comments in response to the correlation survey from PWGSC, dated September 2nd, were received by WESAtech September 4th. A response to PWGSC's comments was submitted September 11th to their satisfaction; no additional comments in response were received.

For the analysis of arsenic on-site, *Orebecco Arsenic Test Strips* were used. This method was originally to be used as verification of the *PDV6000 plus*, but was used as the primary analytical method due to problems with the *PDV6000 plus*. The field analyses using the test strips were conducted in duplicate. During the correlation survey, the average on-site and off-site arsenic concentrations were measured to be 51.5 µg/L and 46.8 µg/L, respectively. The correlation coefficient that was calculated using both the on-site and off-site arsenic concentration data sets was 0.98, which indicates there was a strong positive linear correlation. Further, the relative percent difference (RPD) was, on average, ±6%. This indicates that there was a small variance between the two data sets.

Due to the detection limits of the *Hach DR2700* spectrophotometer, it was not able to measure accurately the lead and zinc concentrations in the effluent water. The standard operating procedures (SOPs) of the *DR2700* published by the manufacturer were adhered to judiciously, and the instrument itself was operating properly. However, the lead and zinc concentrations in the effluent water were too low for the instrument to measure. For this reason, a correlation could not be developed using the on-site and off-site lead and zinc concentration data. However, it was found that the correlation coefficient between the off-site TSS and lead measurements was 0.79, indicating that there was a strong positive linear correlation between the data sets. Further, the correlation coefficient between the off-site TSS and zinc measurements was 0.614, indicating that there was a good positive linear correlation between the data sets. The on-site TSS data was plotted against the off-site TSS data. A linear regression was performed by setting the y-intercept as zero. The resulting linear function had a slope of 1.21 which indicates that the on-site TSS measurements were higher, or more conservative, than the off-site results. The correlation coefficient was calculated to be 0.93 for the off-site and on-site TSS data; this indicates there is a strong positive linear correlation between the two data sets. From the empirical data that was collected and analyzed, it was concluded that it is adequate to infer the total lead and zinc concentrations using the on-site TSS measurements.

A *PDV6000 plus* metal detector, which employs anodic stripping voltammetry, was introduced at the beginning of the DMQCP for the purposes of measuring arsenic, lead, and zinc in trace concentrations. The *PDV6000 plus* was expected to be the primary instrument for on-site field analyses; however, it was brought offline to overcome variability in its analytical signals. For this reason, the methods originally listed as secondary verification in the DMQCP, were used as the primary field analytical methods. Furthermore, as a complementary arsenic monitoring tool, the arsenic test strips were part of the DMQCP (monitoring plan) and were therefore used as the main arsenic testing tool in lieu of the PDV 6000 plus. This initiative was taken with the approval of all parties involved. Duplicate analyses were performed to introduce QA for the technique as described below. With the support of the manufacturer, the "standard operating procedures" were optimized and the electrodes were revitalized which allowed the instrument to measure, with good precision, the lead, zinc and arsenic concentrations of the effluent when the instrument was brought back on-site September 22th. In conclusion, the PDV 6000 plus metal detector proves to be very accurate when measuring trace levels of heavy metals as a field screening tool.

A memorandum regarding the redeployment of the *PDV6000 plus* dated October 11th was issued. A response by AECOM was issued October 14th for which WESAtech presented an additional memo November 15th.

9.4. MONITORING PLAN

The on-site monitoring plan, as outlined in the DMQCP, began August 6th and ended at the conclusion of the project season October 10th. The outlined monitoring plan was adhered with the exception of the late redeployment of the *PDV6000 plus*, as discussed in the previous section.

Throughout the monitoring program, there was no parameter that exceeded the contractual discharge limits. The plant effluent was consistently below the discharge limits.

A summary of the average effluent concentrations of parameters that were monitored as part of the contractual requirements that were measured at the off-site laboratories is presented in **Table 7**. **Figures 1 to 10** represent the trending daily results over the course of the 2011 discharge season. Please note that the results that are below detection limit are represented to be at detection limit. However, when calculating the average concentration and standard deviation, results below detection limit were assumed to be half of the MDL value as it is standard practice.

Table 7: Effluent 2011 Average Wastewater Characteristics*

Parameter	Unit	Average effluent concentration	Standard deviation	Number of samples tested (n)
Total arsenic	mg/L	0.0431	0.0142	178
Total copper	mg/L	0.0022	0.0012	62
Total lead	mg/L	0.0004	0.0002	112
Total nickel	mg/L	0.0029	0.0005	59
Total zinc	mg/L	0.0037	0.0018	110
Total ammonia (as N)	mg/L	<0.05	-	54
Nitrate (as N)	mg/L	0.05	0.05	53
Nitrite (as N)	mg/L	<0.05	-	53
TSS	mg/L	3.0	2.3	89
pH	-	8.21	0.17	96

* Analytical results that are below the method detection limit (MDL) were considered to be half of the MDL value.

9.5. QUALITY ASSURANCE AND QUALITY CONTROL

The DMQCP outlined a number of quality assurance and quality control (QA/QC) requirements in order to ensure the sampling procedure and handling is executed properly to mitigate the risk of sample corruption, and to ensure that both on-site and off-site laboratory results are accurate.

As described above, all sampling events were conducted in triplicate; one sample was kept on-site for field analyses, and two samples were sent to the off-site laboratory. In the event of an anomalous result, the other two samples collected during the same sampling event could be analyzed by the off-site laboratory. During this season a sample collected September 27th at 8:00 was measured at Taiga to have an elevated zinc concentration of 17.3 µg/L, as demonstrated in **Figure 5**. The off-site duplicate sample was shipped from the Taiga lab in Yellowknife to ALS

Laboratories in Edmonton. The off-site duplicate sample was collected at the same time, and in the same fashion as the primary off-site sample. The duplicate sample was measured to have a zinc concentration of 6.9 μg/L, which indicates that the primary off-site sample was corrupted.

Further, the QA/QC requirements outlined in the DMQCP include the analysis of travel blanks, duplicates, equipment rinses, and inter-laboratory samples. Travel blanks were sent with every shipment, and were used to determine if there was any background contamination during the transport and handling of the samples from the site to the laboratory. Sample bottles were filled with deionised water on site.

Duplicate off-site samples were sent to the laboratory each time; they were only analyzed periodically as per the DMQCP. The collection of duplicate samples provides a measure of precision of the sampling procedure and analytical technique, the heterogeneity of the sample, and was representative of the sampling event and location. As outlined in the DMQCP, 10% of all samples analyzed were to be analyzed in duplicate; 10.4% of samples analyzed were analyzed in duplicate exceeding the QA/QC requirements. The remaining duplicate samples were archived in the off-site laboratory for further analysis when required. All but one set of duplicate samples were within control limits.

Equipment rinses were sent for off-site analysis to verify that all field sampling and analytical equipment was cleaned properly. Cleaned equipment and glassware was rinsed with deionised water; the resulting rinse water was sent off-site for analysis. As outlined in the DMQCP, one equipment rinse will be analyzed for every 20 samples analyzed. During the 2011 project season, approximately one equipment rinse was analyzed every 15 samples, exceeding the QA/QC requirements.

During the 2011 project season, both Taiga Laboratory and ALS Laboratories Edmonton were retained to analyze off-site samples. Inter-laboratory samples involve sending samples to both laboratories from the same sampling event to verify their respective results. As outlined in the DMQCP, 2% of all samples analyzed were to be analyzed at the secondary laboratory; inter-laboratory samples were analyzed at a rate of 2.6%, exceeding the QA/QC requirements. All inter-laboratory analyses returned results that were within acceptable control limits.

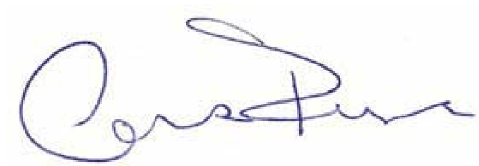
10.0 CONCLUSION

The observations, results and design recommendations were based on the conditions encountered during the operation of the Wastewater Treatment Plant during the 2011 discharge period. The implementation of the recommendations provided for the operation and design of the WWTP will allow for a reduced risk of producing water out of compliance, and addresses the past years maintenance issues.

WESAtech has used its professional judgment in analyzing this information and formulating its conclusions. No other warranty or representation, expressed or implied, as to the accuracy of the information or recommendations is included or intended in this report. This report has been prepared for the exclusive use of the Aboriginal Engineering Limited. No other party may use or rely upon this report without the express written permission of WESAtech.

Respectfully submitted,

Wayne Ingham, HED, Ph.D.
Vice-President, Business Development
Principal and Senior Consultant
WESA Inc.



Corinne Proux, M.Eng, Eng
Chemical Engineer
WESA Inc.

TABLES

Sample ID nomenclature:

Location	Purpose	Date	Totalizer Number
A: Influent B1-B2-B3: Flocculation Tanks C1-C2-C3: Individual Sumps D: Communal Sump E1-E2: Upper Pond F: Effluent Discharge Port	ON: On-site OFF: Off-site INT: Inter-lab comparison DOF: Off-site Duplicate EQ: Equipment Rinse Blank TR: Travel Blank	(dd/mm/hh) HH 8AM: 08 2PM: 14 8PM: 20 2AM: 02	xxx

Table 8 : 2011 Off-site Influent Wastewater Characteristics

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
A-ON/OFF-18-06-1130-02	1.25	0.00301	0.0058	0.0017	0.00598	-	-	-	10	-
A-ON/OFF-18-06-1130-03	1.24	0.00296	0.006	0.0018	0.00592	-	-	-	7	-
A-ON/OFF-18-06-1130-04	1.24	0.00302	0.0064	0.0018	0.00592	-	-	-	6	-
A-ON/OFF-18-06-1130-05	1.23	0.00301	0.0067	0.0018	0.00585	-	-	-	8	-
A-OFF-23-06-14-07	1.47	0.00729	0.013	0.0025	0.00571	-	<0.05	<0.05	16	8.25
A-OFF-23-06-14-10	2.16	0.0365	0.0518	0.0085	0.0125	-	<0.05	0.095	166	8.17
A-OFF-24-06-1120-14	1.41	0.00512	0.0118	0.0019	0.00511	-	<0.05	<0.05	7	8.22
A-OFF-25-06-08-18	1.43	0.00862	0.0112	0.0024	0.00556	<0.05	<0.05	0.087	13	8.18
A-OFF-26-06-09-21	1.48	0.0109	0.0123	0.0027	0.00611	<0.05	<0.05	<0.05	30	8.23
A-OFF-26-06-09-24	1.54	0.0128	0.0139	0.003	0.00639	<0.05	<0.05	<0.05	43	8.21
A-OFF-29-06-11-28	1.49	0.0117	0.013	0.0028	0.00587	<0.05	<0.05	<0.05	27	8.2
A-OFF-30-06-18-31	1.52	0.017	0.0164	0.0028	0.00595	<0.05	<0.05	<0.05	69	8.26
A-OFF-01-07-14-35	1.46	0.0143	0.0126	0.0024	0.00548	<0.05	<0.05	<0.05	66	8.27
A-OFF-07-07-02-61	1.37	0.00627	0.0061	0.002	0.00439	<0.05	<0.05	<0.05	14	8.33
A-OFF-09-07-23-93	1.44	0.00496	0.0056	0.002	0.00442	<0.05	<0.05	<0.05	12	8.26
A-OFF-10-07-20-108	1.63	0.0221	0.0189	0.0038	0.00718	<0.05	<0.05	<0.05	134	8.38
A-OFF-11-07-20-125	1.38	0.00408	0.0051	0.002	0.00419	<0.05	<0.05	<0.05	<3	8.33
A-OFF-12-07-20-137	1.39	0.00585	0.0072	0.0023	0.0046	<0.05	<0.05	<0.05	18	8.34
A-OFF-13-07-20-157	1.4	0.00463	0.0054	0.0021	0.00432	<0.05	<0.05	<0.05	8	8.33
A-OFF-14-07-20-174	1.42	0.00499	0.0054	0.0021	0.00445	<0.05	<0.05	<0.05	14	8.35
A-OFF-15-07-20-196	1.72	0.0176	0.0166	0.0041	0.00685	<0.05	<0.05	<0.05	183	8.28
A-OFF-16-07-20-215	1.47	-	-	-	-	-	-	-	-	-
A-OFF-18-07-20-258	1.54	0.00472	0.0061	0.0022	0.0044	<0.05	<0.05	<0.05	11	8.31
A-OFF-19-07-20-284	1.68	-	-	-	-	-	-	-	-	-
A-OFF-20-07-20-308	1.63	0.0112	0.0149	0.0034	0.00568	<0.05	<0.05	<0.05	38	8.43
A-OFF-21-07-20-329	1.55	0.00724	0.0086	0.0026	0.00461	-	-	-	-	-
A-OFF-22-07-02-336	1.5	0.00661	0.0028	0.0045	0.00464	<0.05	<0.05	<0.05	14	8.36
A-OFF-23-07-02-354	1.45	0.00584	0.0051	0.0065	0.00468	<0.05	<0.05	<0.05	6	8.37
A-OFF-24-07-02-375	1.5	0.00474	0.0058	0.0021	0.00394	<0.05	<0.05	<0.05	6	8.39
A-OFF-25-07-02-395	1.62	0.00456	0.006	0.0023	0.00423	<0.05	<0.05	<0.05	7	8.3
A-OFF-26-07-02-412	1.54	0.00349	0.0079	0.0031	0.00441	<0.05	<0.05	<0.05	5	8.35
A-OFF-27-07-02-432	1.6	0.00598	0.0108	0.0034	0.00496	<0.05	<0.05	<0.05	18	8.37
A-OFF-28-07-02-451	1.65	0.00473	0.0063	0.0023	0.00439	<0.05	<0.05	<0.05	10	8.38

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
A-OFF-29-07-02-468	1.62	0.00392	0.0048	0.0022	0.00429	<0.05	<0.05	<0.05	<3	8.4
A-OFF-30-07-02-485	1.69	0.00549	0.0077	0.0024	0.00448	<0.05	<0.05	<0.05	13	8.4
A-OFF-31-07-02-503	1.69	0.00479	0.0081	0.0023	0.00435	<0.05	<0.05	<0.05	9	8.41
A-OFF-01-08-02-521	1.7	0.00392	0.0048	0.002	0.00411	<0.05	<0.05	<0.05	5	8.39
A-OFF-02-08-02-540	1.69	0.005	0.0057	0.0021	0.005	<0.05	<0.05	<0.05	10	8.35
A-OFF-03-08-02-558	1.63	0.00403	0.0055	0.0023	0.00435	<0.05	<0.05	<0.05	16	8.38
A-OFF-04-08-02-577	1.65	0.00456	0.0065	0.0021	0.00418	<0.05	<0.05	<0.05	12	8.36
A-OFF-05-08-02-596	1.66	0.00339	0.0044	0.0019	0.00369	<0.05	<0.05	<0.05	4	8.4
A-OFF-06-08-02-614	1.7	0.00324	0.0044	0.0019	0.00386	<0.05	<0.05	<0.05	5	8.43
A-OFF-13-08-02-748	1.72	0.0042	0.0025	0.0021	0.0037	0.01	<0.01	0.13	8	8.25
A-OFF-20-08-02-957	1.73	0.0067	0.008	0.0025	0.0039	< 0.01	<0.01	0.12	38	8.14
A-OFF-26-08-02-1105	1.65	-	0.007	0.0028	0.0038	<0.01	<0.01	0.11	16	8.15
A-OFF-03-09-02-1290	1.65	0.007	0.007	0.0025	0.0036	0.01	<0.01	0.12	22	8.2
A-OFF-10-09-02-1514	1.8	0.0082	0.0073	0.0023	0.0036	0.01	<0.01	0.11	22	8.2
A-OFF-16-09-20-1736	1.75	0.012	0.014	0.004	0.0047	<0.01	<0.01	0.12	36	8.16
A-OFF-22-09-16-1943	1.53	0.0192	0.022	0.006	0.0098	0.18	<0.01	0.09	90	8.1
A-OFF-26-09-0730-2069	1.36	0.0128	0.014	-	-	-	-	-	108	8.09
A-OFF-27-09-14-2112	1.34	0.0125	0.014	0.0044	0.0076	0.15	<0.01	0.16	48	8.06
A-OFF-04-10-08-2366	1.29	0.0111	0.014	0.0041	0.007	0.14	<0.01	0.19	42	-

Table 9: 2011 Off-site Effluent Wastewater Characteristics

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-09-07-18-85	0.088	0.00097	0.0072	0.0016	0.00309	<0.05	<0.05	<0.05	7	8.22
F-OFF-09-07-23-90	0.0753	0.0015	0.0116	0.0061	0.00295	<0.05	<0.05	<0.05	7	8.21
F-OFF-10-07-04-96	0.0696	0.00105	0.0058	0.002	0.00298	<0.05	<0.05	<0.05	5	8.25
F-OFF-10-07-09-99	0.0619	0.00038	<0.004	0.0012	0.00269	<0.05	<0.05	<0.05	<3	8.29
F-OFF-10-07-13-102	0.0752	0.00036	0.0052	0.0011	0.00283	<0.05	<0.05	<0.05	8	8.28
F-OFF-10-07-20-105	0.0864	0.00059	0.0059	0.0032	0.00287	<0.05	<0.05	<0.05	3	8.32
F-OFF-11-07-02-113	0.0852	-	-	-	-	-	-	-	-	-
F-OFF-11-07-08-116	0.0765	-	-	-	-	-	-	-	-	-
F-OFF-11-07-14-119	0.0557	-	-	-	-	-	-	-	-	-
F-OFF-11-07-20-122	0.0441	0.00052	0.0047	0.0017	0.00259	<0.05	<0.05	<0.05	-	8.22
F-OFF-12-07-02-128	0.0497	-	-	-	-	-	-	-	-	-
F-OFF-12-07-08-131	0.0515	-	-	-	-	-	-	-	-	-
F-OFF-12-07-14-134	0.0535	-	-	-	-	-	-	-	-	-
F-OFF-12-07-02-140	0.0525	0.00088	0.0051	0.0022	0.00236	<0.05	<0.05	<0.05	-	8.31
F-OFF-13-07-02-143	0.0494	-	-	-	-	-	-	-	-	-
F-OFF-13-07-08-146	0.0561	-	-	-	-	-	-	-	-	-
F-OFF-13-07-14-151	0.054	-	-	-	-	-	-	-	-	-
F-OFF-13-07-20-154	0.0526	0.00042	<0.004	0.0015	0.00239	<0.05	<0.05	<0.05	-	8.29
F-OFF-14-07-02-160	0.0478	-	-	-	-	-	-	-	-	-
F-OFF-14-07-08-163	0.0846	-	-	-	-	-	-	-	-	-
F-OFF-14-07-14-167	0.0454	0.0004	0.0079	0.0012	0.00256	<0.05	<0.05	<0.05	-	8.28
F-OFF-14-07-20-171	0.0369	-	-	-	-	-	-	-	-	-
F-OFF-15-07-02-177	0.0366	-	-	-	-	-	-	-	-	-
F-OFF-15-07-08-180	0.0414	0.00038	<0.004	0.0012	0.00252	<0.05	<0.05	<0.05	-	8.23
F-OFF-15-07-15-189	0.0313	-	-	-	-	-	-	-	-	-
F-OFF-15-07-20-193	0.0317	0.0004	<0.004	0.0012	0.00282	<0.05	<0.05	<0.05	-	8.2

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-16-07-02-199	0.0338	-	-	-	-	-	-	-	-	-
F-OFF-16-07-08-203	0.0438	-	-	-	-	-	-	-	-	-
F-OFF-16-07-14-209	0.0479	0.00046	-	0.0014	0.00303	<0.05	<0.05	<0.05	5	8.21
F-OFF-16-07-20-212	0.0323	-	-	-	-	-	-	-	-	-
F-OFF-17-07-02-219	0.032	0.00046	<0.004	0.0015	0.0025	<0.05	<0.05	<0.05	<3	8.32
F-OFF-17-07-08-224	0.039	-	-	-	-	-	-	-	-	-
F-OFF-17-07-14-229	0.0391	0.00037	<0.004	0.0016	0.0024	<0.05	<0.05	<0.05	<3	8.39
F-OFF-18-07-08-244	0.0672	0.0003	<0.004	0.0012	0.0025	<0.05	<0.05	<0.05	3	8.39
F-OFF-18-07-14-249	0.0599	0.00034	<0.004	0.0014	0.0029	<0.05	<0.05	<0.05	4	8.31
F-OFF-19-07-03-262	0.0615	-	-	-	-	-	-	-	-	-
F-OFF-19-07-08-267	0.0682	-	-	-	-	-	-	-	-	-
F-OFF-19-07-14-275	0.0526	-	-	-	-	-	-	-	-	-
F-OFF-19-07-20-281	0.0474	-	-	-	-	-	-	-	-	-
F-OFF-20-07-02-291	0.0501	-	-	-	-	-	-	-	-	-
F-OFF-20-07-08-296	0.0569	0.00038	<0.004	0.0013	0.0029	<0.05	<0.05	<0.05	4	8.34
F-OFF-20-07-14-301	0.0478	0.00036	<0.004	0.0013	0.00262	<0.05	<0.05	<0.05	<3	8.34
F-OFF-20-07-20-305	0.0419	-	-	-	-	-	-	-	-	-
F-OFF-21-07-02-312	0.041	-	-	-	-	-	-	-	-	-
F-OFF-21-07-08-316	0.0365	-	-	-	-	-	-	-	-	-
F-OFF-21-07-16-322	0.0407	-	-	-	-	-	-	-	-	-
F-OFF-21-07-20-326	0.0436	0.00088	0.0055	0.0024	0.00291	<0.05	<0.05	<0.05	4	8.3
F-OFF-22-07-02-333	0.0464	0.00045	0.0041	0.0017	0.00275	<0.05	<0.05	<0.05	<3	8.38
F-OFF-22-07-08-340	0.0592	-	-	-	-	-	-	-	-	-
F-OFF-22-07-1330-345	0.0479	-	-	-	-	-	-	-	-	-
F-OFF-22-07-20-349	0.0508	-	-	-	-	-	-	-	-	-
F-OFF-23-07-02-357	0.0551	-	-	-	-	-	-	-	-	-
F-OFF-23-07-08-360	0.0567	0.00031	<0.004	0.0012	0.0024	<0.05	<0.05	<0.05	<3	8.33

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-23-07-14-364	0.0704	-	-	-	-	-	-	-	-	-
F-OFF-23-07-20-371	0.0428	0.00043	0.0056	0.0018	0.00227	<0.05	<0.05	<0.05	<3	8.34
F-OFF-24-07-02-378	0.0375	0.00054	0.0064	0.0026	0.00221	<0.05	<0.05	<0.05	3	8.41
F-OFF-24-07-08-381	0.0339	0.00029	<0.004	0.0015	0.00221	<0.05	<0.05	<0.05	<3	8.41
F-OFF-24-07-14-387	0.0382	-	-	-	-	-	-	-	-	-
F-OFF-24-07-20-391	0.0463	0.00039	0.0051	0.0023	0.00232	<0.05	<0.05	<0.05	<3	8.25
F-OFF-25-07-02-398	0.0464	-	-	-	-	-	-	-	-	-
F-OFF-25-07-08-401	0.0343	-	-	-	-	-	-	-	-	-
F-OFF-25-07-14-404	0.0391	-	-	-	-	-	-	-	-	-
F-OFF-25-07-20-408	0.047	0.00038	0.005	0.0019	0.00268	<0.05	<0.05	<0.05	<3	8.25
F-OFF-26-07-02-415	0.0459	-	-	-	-	-	-	-	-	-
F-OFF-26-07-08-420	0.0466	-	-	-	-	-	-	-	-	-
F-OFF-26-07-25-424	0.0404	-	-	-	-	-	-	-	-	-
F-OFF-26-07-20-428	0.0512	0.00064	0.0078	0.005	0.00229	<0.05	<0.05	<0.05	5	8.29
F-OFF-27-07-02-435	0.042	-	-	-	-	-	-	-	-	-
F-OFF-27-07-08-438	0.0365	-	-	-	-	-	-	-	-	-
F-OFF-27-07-15-443	0.0302	-	-	-	-	-	-	-	-	-
F-OFF-27-07-20-447	0.0241	0.0004	0.0043	0.0027	0.00189	<0.05	<0.05	<0.05	<3	8.31
F-OFF-28-07-02-454	0.0266	-	-	-	-	-	-	-	-	8.16
F-OFF-28-07-08-457	0.0278	-	-	-	-	-	-	-	-	-
F-OFF-28-07-14-462	0.0396	0.00036	<0.004	0.0015	0.00233	<0.05	<0.05	<0.05	<3	8.36
F-OFF-28-07-20-466	0.046	0.00041	0.0068	0.0037	0.00259	<0.05	<0.05	<0.05	8	8.35
F-OFF-29-07-02-471	0.0329	-	-	-	-	-	-	-	-	-
F-OFF-29-07-08-474	0.0309	-	-	-	-	-	-	-	-	-
F-OFF-29-07-14-477	0.0388	-	-	-	-	-	-	-	-	-
F-OFF-29-07-20-481	0.0482	0.00053	0.0068	0.004	0.00267	<0.05	<0.05	<0.05	<3	8.31
F-OFF-30-07-02-488	0.0383	-	-	-	-	-	-	-	-	-

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-30-07-08-491	0.0369	-	-	-	-	-	-	-	-	-
F-OFF-30-07-14-495	0.0399	-	-	-	-	-	-	-	-	-
F-OFF-30-07-20-499	0.0428	0.00052	0.0058	0.0048	0.00266	<0.05	<0.05	<0.05	<3	8.37
F-OFF-31-07-02-506	0.0344	-	-	-	-	-	-	-	-	-
F-OFF-31-07-08-509	0.0294	-	-	-	-	-	-	-	-	-
F-OFF-31-07-20-517	0.0431	0.00057	0.0054	0.0031	0.00286	<0.05	<0.05	<0.05	<3	8.35
F-OFF-01-08-02-524	0.048	-	-	-	-	-	-	-	-	-
F-OFF-01-08-08-527	0.0394	-	-	-	-	-	-	-	-	-
F-OFF-01-08-14-532	0.033	-	-	-	-	-	-	-	-	-
F-OFF-02-08-02-543	0.0369	0.00032	0.0043	0.0015	0.00292	<0.05	<0.05	<0.05	3	8.3
F-OFF-02-08-08-546	0.0464	-	-	-	-	-	-	-	-	-
F-OFF-02-08-14-549	0.0527	-	-	-	-	-	-	-	-	-
F-OFF-02-08-20-553	0.039	0.00044	0.0057	0.0039	0.00336	<0.05	<0.05	<0.05	<3	8.32
F-OFF-03-08-02-561	0.0364	-	-	-	-	-	-	-	-	-
F-OFF-03-08-08-564	0.0336	-	-	-	-	-	-	-	-	-
F-OFF-03-08-14-567	0.0325	-	-	-	-	-	-	-	-	-
F-OFF-03-08-20-570	0.0287	0.00029	<0.004	0.0017	0.00301	<0.05	<0.05	<0.05	<3	8.32
F-OFF-04-08-02-574	0.0284	-	-	-	-	-	-	-	-	-
F-OFF-04-08-08-582	0.0379	-	-	-	-	-	-	-	-	-
F-OFF-04-08-14-585	0.0354	0.00033	<0.004	0.0016	0.00296	-	-	-	-	-
F-OFF-04-08-20-588	0.0412	0.00031	<0.004	0.0015	0.00334	<0.05	<0.05	<0.05	4	8.32
F-OFF-05-08-02-593	0.0374	-	-	-	-	-	-	-	-	-
F-OFF-05-08-08-599	0.055	-	-	-	-	-	-	-	-	-
F-OFF-05-08-14-603	0.06	-	-	-	-	-	-	-	-	-
F-OFF-05-08-20-608	0.0629	0.00039	<0.004	0.0024	0.00298	<0.05	<0.05	<0.05	4	8.37
F-OFF-06-08-02-611	0.0788	-	-	-	-	-	-	-	-	-
F-OFF-06-08-20-625	0.0481	0.00032	<0.004	0.0017	0.00278	-	-	-	5	8.33

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-07-08-20-643	0.0576	0.00025	<0.004	0.0012	0.00262	-	-	-	<3	8.36
F-OFF-08-08-15-656	0.0485	0.00039	0.0064	0.0019	0.00378	-	-	-	<3	8.25
F-OFF-09-08-20-686	0.036	0.00015	<0.004	0.0011	0.00312	-	-	-	<3	8.28
F-OFF-10-08-02-695	0.0483	0.0004	<0.005	-	-	-	-	-	-	-
F-OFF-11-08-02-710	0.0419	0.0007	<0.005	-	-	-	-	-	-	-
F-OFF-12-08-02-727	0.0391	0.0002	<0.005	-	-	-	-	-	-	-
F-OFF-13-08-02-745	0.0591	0.0007	<0.005	0.0021	0.003	0.02	<0.01	0.13	<3	8.29
F-OFF-14-08-02-772	0.0419	0.0002	<0.005	-	-	-	-	-	-	-
F-OFF-15-08-02-800	0.0362	0.0003	<0.005	-	-	-	-	-	-	-
F-OFF-16-08-02-831	0.0375	0.0003	<0.005	-	-	-	-	-	-	-
F-OFF-17-08-02-863	0.0506	0.0004	<0.005	-	-	-	-	-	-	-
F-OFF-18-08-02-893	0.0418	0.0003	<0.005	-	-	-	-	-	-	-
F-OFF-19-08-20-947	0.0236	0.0002	<0.005	0.0014	0.0029	<0.01	<0.01	0.13	<3	8.11
F-OFF-20-08-20-979	0.0342	0.0002	<0.005	-	-	-	-	-	-	-
F-OFF-21-08-20-1010	0.0397	0.0002	<0.005	-	-	-	-	-	-	-
F-OFF-22-08-20-1040	0.0339	0.0002	0.0027	-	-	-	-	-	-	-
F-OFF-23-08-20-1062	0.0313	0.0002	0.002	-	-	-	-	-	-	-
F-OFF-25-08-20-1098	0.0302	0.0002	<0.005	-	-	-	-	-	-	-
F-OFF-26-08-08-1108	0.034	0.0002	<0.005	-	-	-	-	-	-	-
F-OFF-27-08-02-1120	0.0472	0.0004	<0.005	0.0023	0.0028	<0.01	<0.01	0.1	<3	8.11
F-OFF-28-08-20-1138	0.0533	0.0005	0.0045	-	-	-	-	-	-	-
F-OFF-29-08-02-1156	0.0357	0.0003	0.0028	-	-	-	-	-	-	-
F-OFF-29-08-20-1171	0.0687	0.0005	<0.005	-	-	-	-	-	<3	8.17
F-OFF-30-08-08-1181	0.0399	0.0003	<0.005	-	-	-	-	-	4	8.30
F-OFF-31-08-18-1222	0.0219	0.0004	0.007	-	-	-	-	-	4	8.15
F-OFF-01-09-20-1263	0.0448	0.001	<0.005	-	-	-	-	-	<3	8.2
F-OFF-02-09-20-1285	0.0493	0.0006	<0.005	0.0024	0.0029	0.01	-	-	<3	8.36

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-03-09-08-1298	0.0341	0.0004	<0.005	0.0026	0.003	0.02	<0.01	0.11	4	8.21
F-OFF-03-09-20-1311	0.0392	0.0013	0.0033	-	-	-	-	-	12	8.32
F-OFF-04-09-20-1331	0.041	0.001	0.0032	-	-	-	-	-	<3	8.39
F-OFF-05-09-20-1355	0.0343	0.0008	0.0033	-	-	-	-	-	<3	8.36
F-OFF-06-09-20-1417	0.0389	0.0005	0.0042	-	-	-	-	-	<3	8.22
F-OFF-07-09-08-1433	0.0376	0.0004	0.0028	0.0017	0.0023	<0.01	<0.01	0.17	<3	8.38
F-OFF-08-09-02-1461	0.031	0.0004	0.004	0.0024	-	-	-	-	<3	8.12
F-OFF-08-09-20-1484	0.0253	0.0004	0.0034	0.0024	-	-	-	-	<3	8.11
F-OFF-09-09-20-1508	0.0481	0.0004	0.0038	0.002	0.0033	<0.01	<0.01	0.11	<3	8.18
F-OFF-11-09-20-1579	0.0355	0.0005	<0.005	0.0019	-	-	-	-	<3	8.06
F-OFF-12-09-10-1603	0.079	0.0006	0.0045	0.0021	0.0041	<0.01	<0.01	0.13	4	8.02
F-OFF-12-09-10-1607	0.0767	0.00043	<0.004	0.0013	0.00416	<0.05	<0.05	<0.05	<3	8.12
F-OFF-12-09-20-1624	0.0487	0.0004	0.0038	-	-	-	-	-	4	8.06
F-OFF-13-09-20-1655	0.0686	0.0006	0.0064	-	-	-	-	-	8	8.04
F-OFF-14-09-22-1670	0.0394	0.0004	0.0035	-	-	-	-	-	6	8.01
F-OFF-15-09-20-1703	0.0279	0.0002	0.0033	-	-	-	-	-	<3	8.19
F-OFF-17-09-08-1751	0.0292	0.0003	0.0024	0.0014	0.0029	<0.01	<0.01	0.09	<3	8.25
F-OFF-17-09-20-1773	0.0232	0.0004	0.0027	-	-	-	-	-	3	8.15
F-OFF-18-09-20-1809	0.0376	0.0005	0.004	-	-	-	-	-	<3	7.97
F-OFF-20-09-02-1857	0.0302	0.0004	0.002	-	-	-	-	-	<3	8.13
F-OFF-20-09-20-1879	0.029	0.0004	0.0025	-	-	-	-	-	<3	8.3
F-OFF-21-09-20-1913	0.0231	0.0002	0.0023	-	-	-	-	-	6	8.19
F-OFF-22-9-20-1948	0.0224	0.0002	0.0034	-	-	-	-	-	4	8.24
F-OFF-23-09-08-1967	0.0243	0.0005	0.0035	0.002	0.0029	<0.01	<0.01	0.12	8	8.13
F-OFF-23-09-20-1984	0.0273	0.0003	0.0027	-	-	-	-	-	8	7.65
F-OFF-24-09-14-2013	0.0278	0.0005	0.0043	-	-	-	-	-	8	8.23
F-OFF-25-09-14-2051	0.0263	0.0002	0.0041	-	-	-	-	-	6	8.03

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-26-09-20-2083	0.0212	0.0004	0.0057	-	-	-	-	-	<3	7.99
F-OFF-27-09-08-2104	0.0304	0.0003	0.0173 (0.0069)	0.0014	0.0039	0.11	<0.01	0.15	6	7.27
F-OFF-27-09-20-2126	0.021	0.0004	0.0031	0.0024	0.0037	0.11	<0.01	0.15	<3	8.07
F-OFF-28-09-08-2144	0.0237	0.0004	0.0038	-	-	-	-	-	<3	8.16
F-OFF-29-09-0830-2180	0.0254	0.0002	0.0087 (0.0087)	-	-	-	-	-	<3	7.62
F-OFF-30-09-0815-2216	0.0278	0.0002	0.0041	-	-	-	-	-	<3	8.14
F-OFF-01-10-0920-2259	0.0404	0.0004	0.0047	-	-	-	-	-	<3	7.97
F-OFF-02-10-0830-2297	0.0289	0.0003	<0.005	-	-	-	-	-	<3	8.1
F-OFF-03-10-0830-2334	0.0318	0.0002	0.0033	-	-	-	-	-	<3	8.18
F-OFF-04-10-0930-2370	0.0402	0.0004	0.0059	-	-	-	-	-	<3	7.93
F-OFF-04-10-15-2378	0.0395	0.0003	0.0046	0.0015	0.0047	0.11	<0.01	0.18	<3	8.08
F-OFF-05-10-09-2410	0.0251	<0.0004	-	-	-	-	-	-	<3	8.14
F-OFF-06-10-0830-2444	0.0298	0.0002	0.0029	-	-	-	-	-	<3	8.21
F-OFF-07-10-0830-2481	0.0306	0.0002	0.0035	-	-	-	-	-	<3	8.09
F-OFF-08-10-0830-2517	0.0326	0.0004	0.0044	-	-	-	-	-	<3	8.11
F-OFF-09-10-09-2552	0.0386	0.0005	0.005	-	-	-	-	-	4	8.26
F-OFF-10-10-0830-2585	0.0323	0.0022 (0.00014)	0.011 (0.0045)	0.0077	0.0042	0.1	<0.01	0.19	<3	8.42

* () samples that were reanalyzed because considered anomalous laboratory results; the values used for the average and standard deviation calculations were those in ().

FIGURES

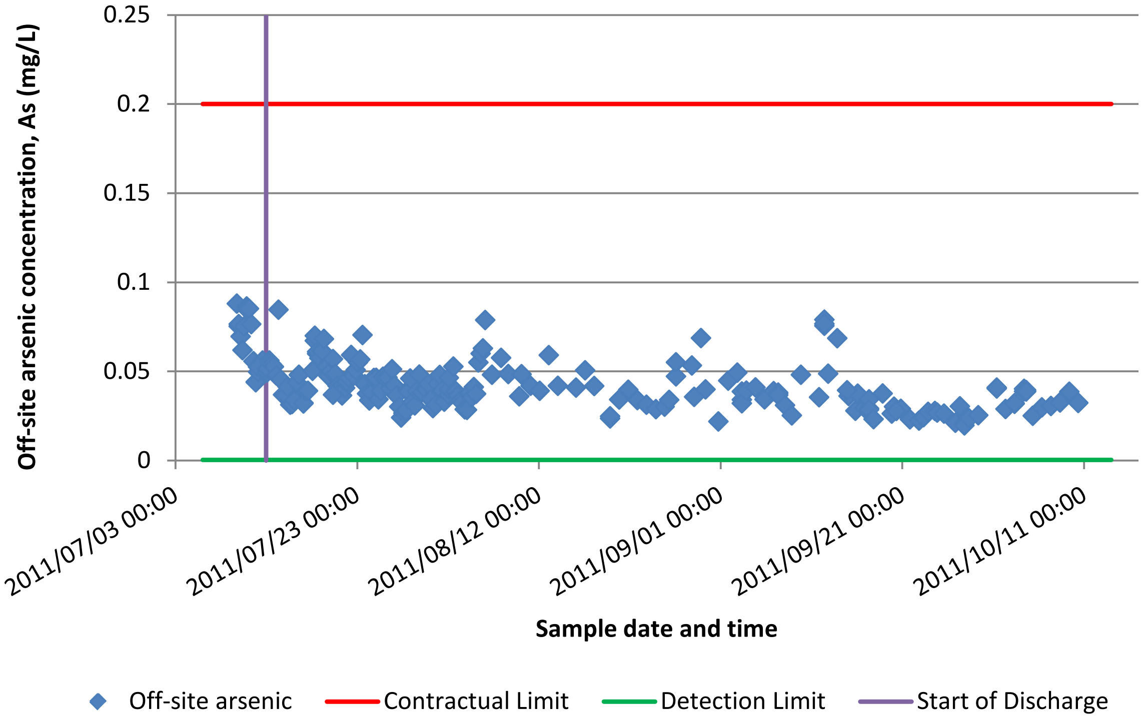


Figure 1: Summary of off-site arsenic concentration measurements for the 2011 project season

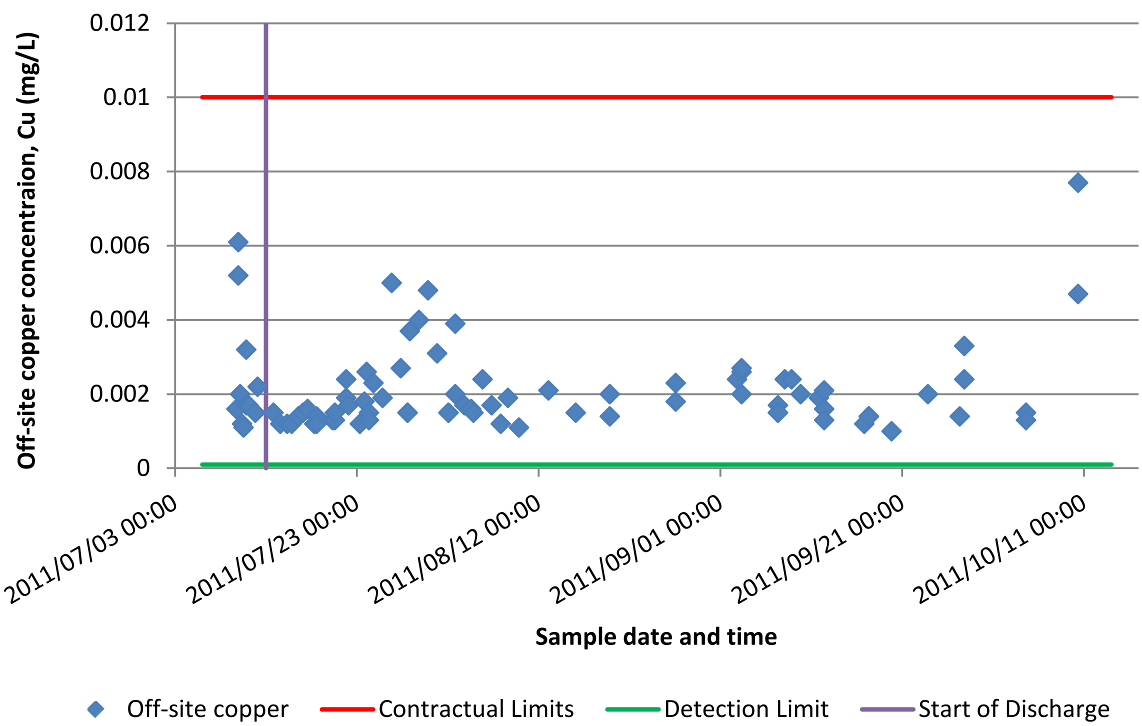


Figure 2: Summary of off-site copper concentration measurements for the 2011 project season

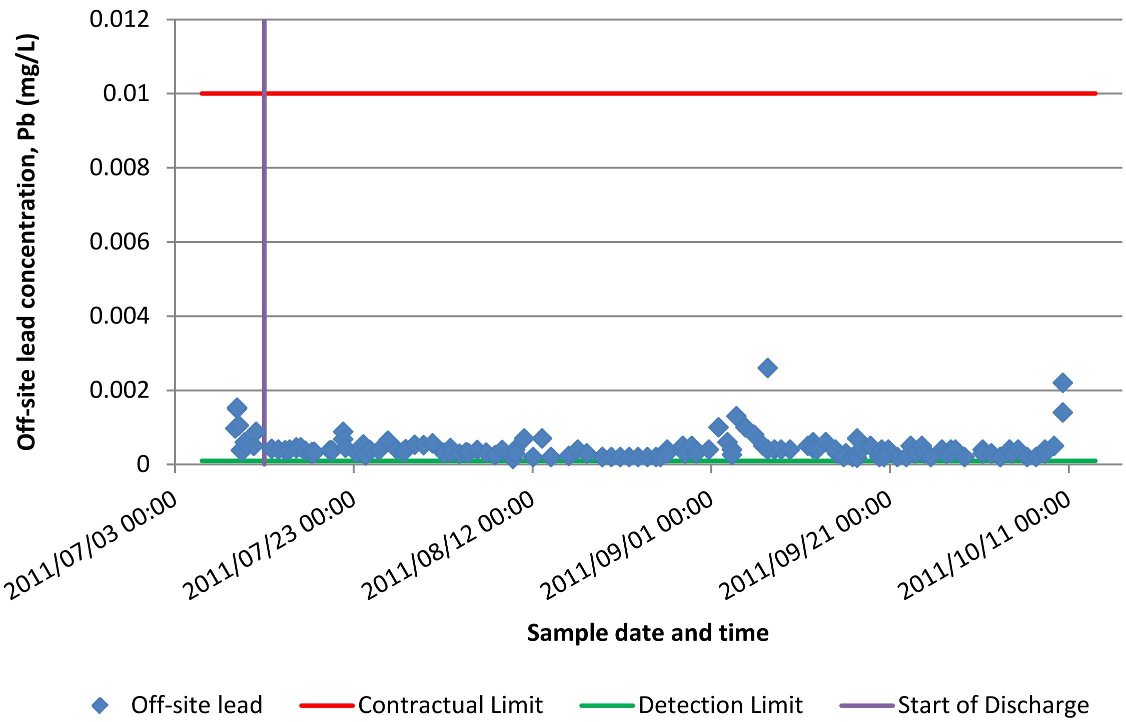


Figure 3: Summary of off-site lead concentration measurements for the 2011 project season

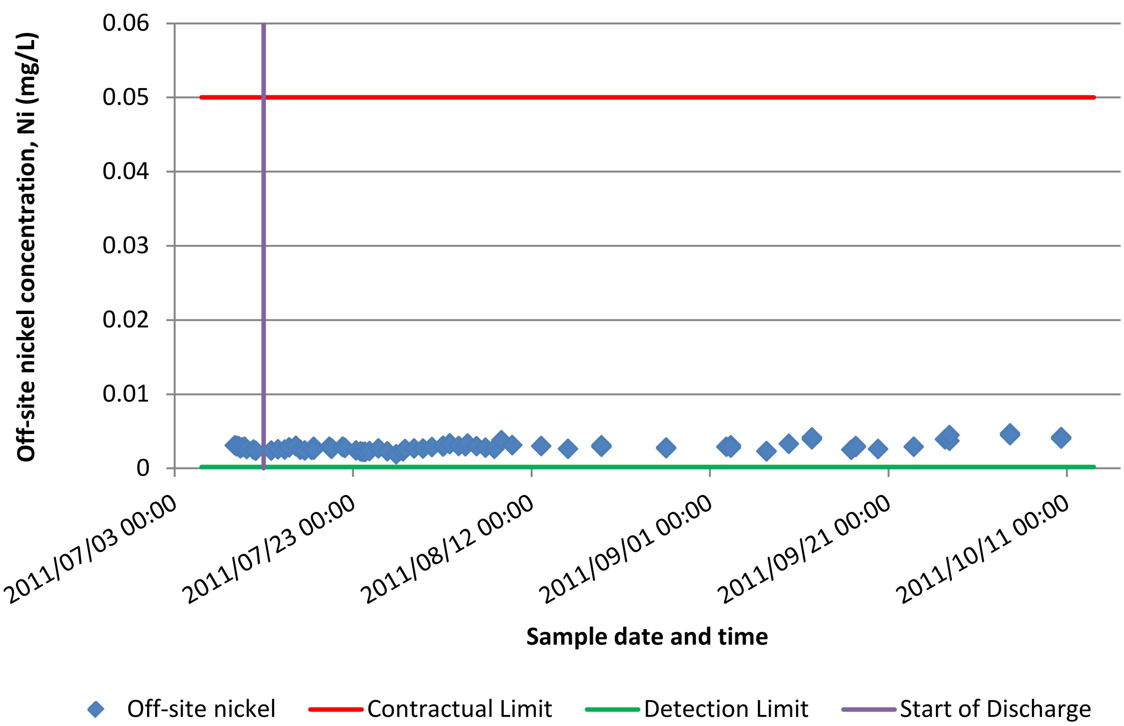


Figure 4: Summary of off-site nickel concentration measurements for the 2011 project season

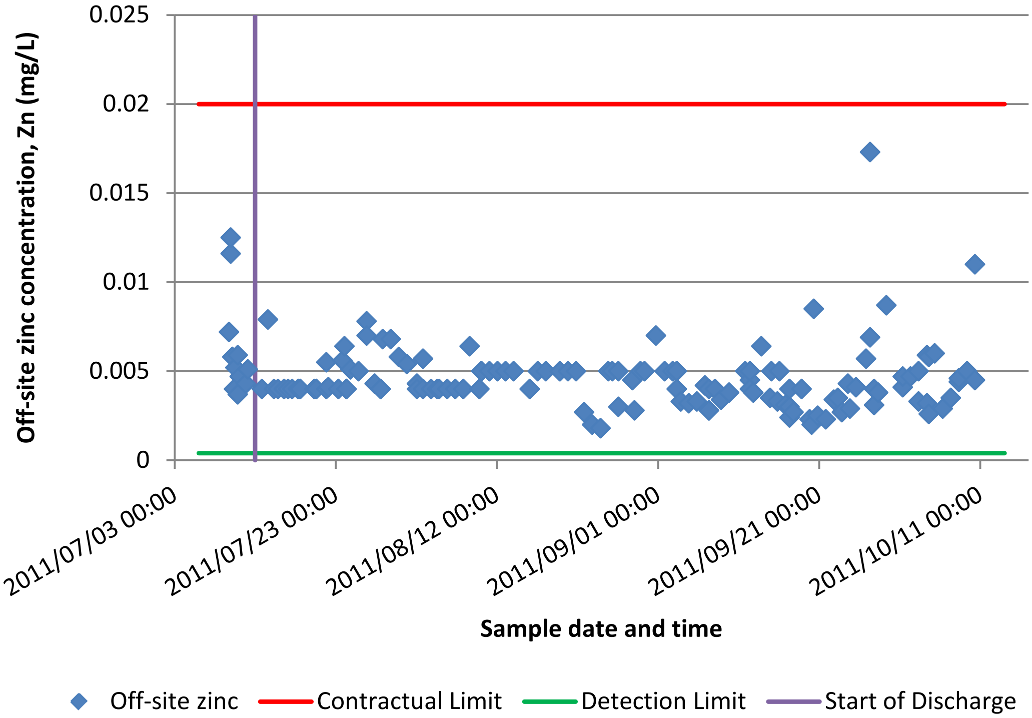


Figure 5: Summary of off-site zinc concentration measurements for the 2011 project season

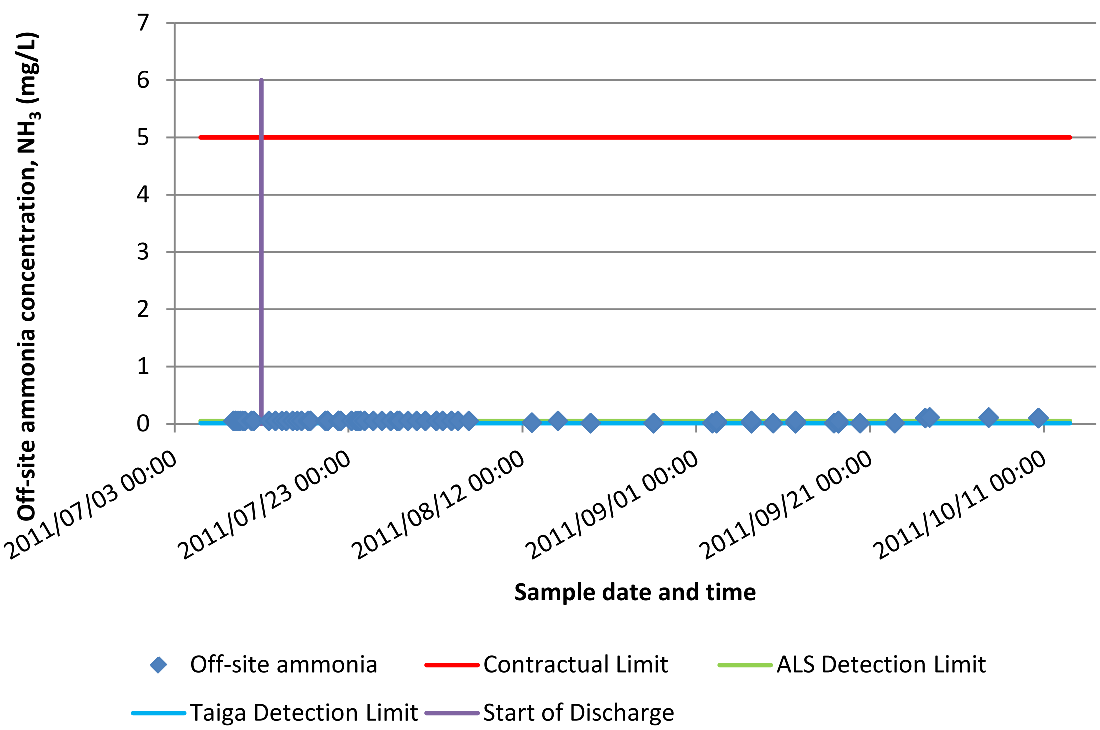


Figure 6: Summary of off-site ammonia concentration measurements for the 2011 project season

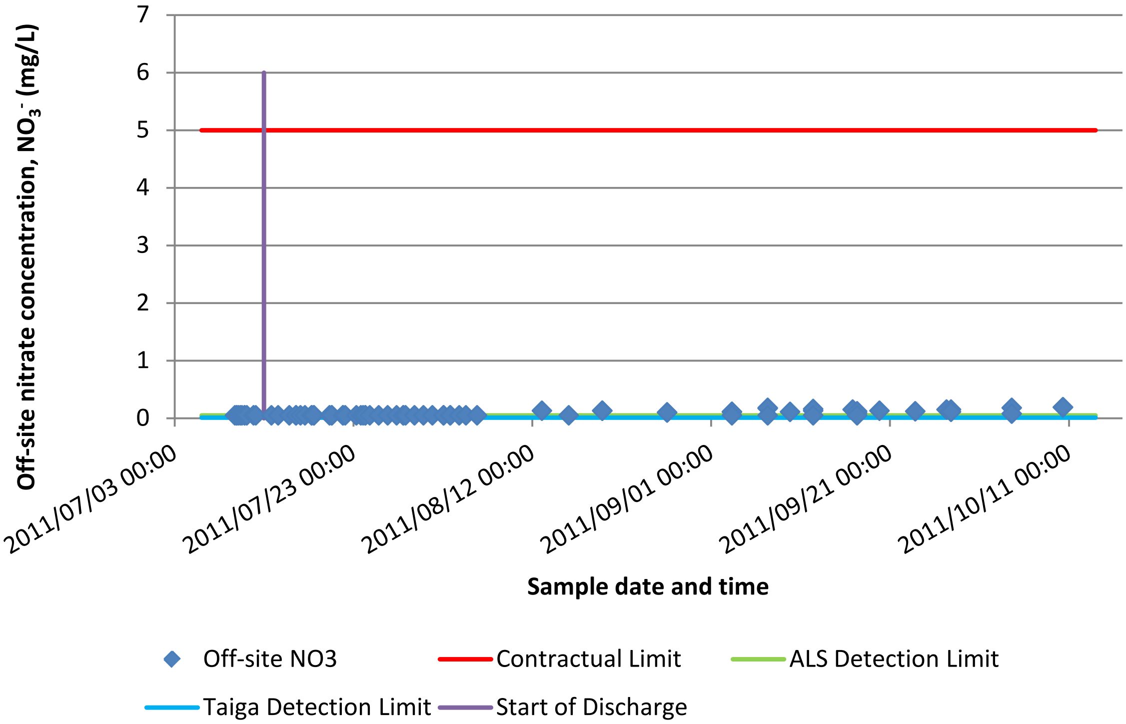


Figure 7: Summary of off-site nitrate concentration measurements for the 2011 project season

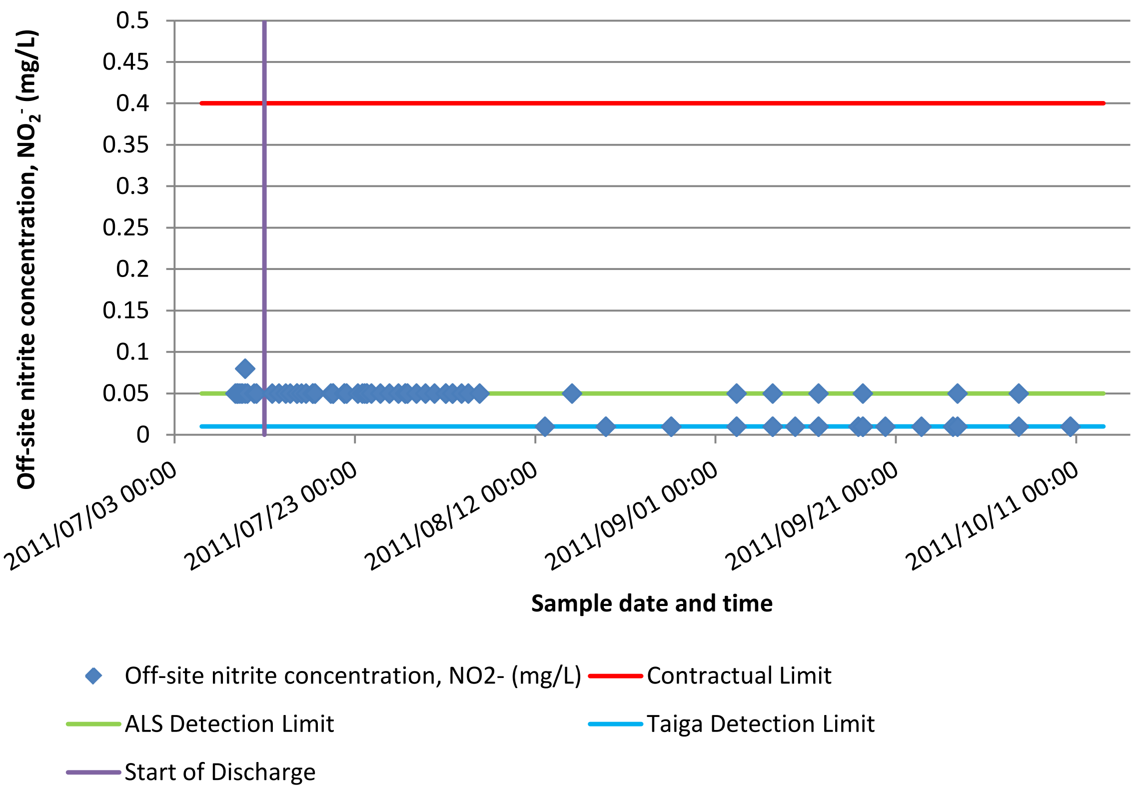


Figure 8: Summary of off-site nitrite concentration measurements for the 2011 project season

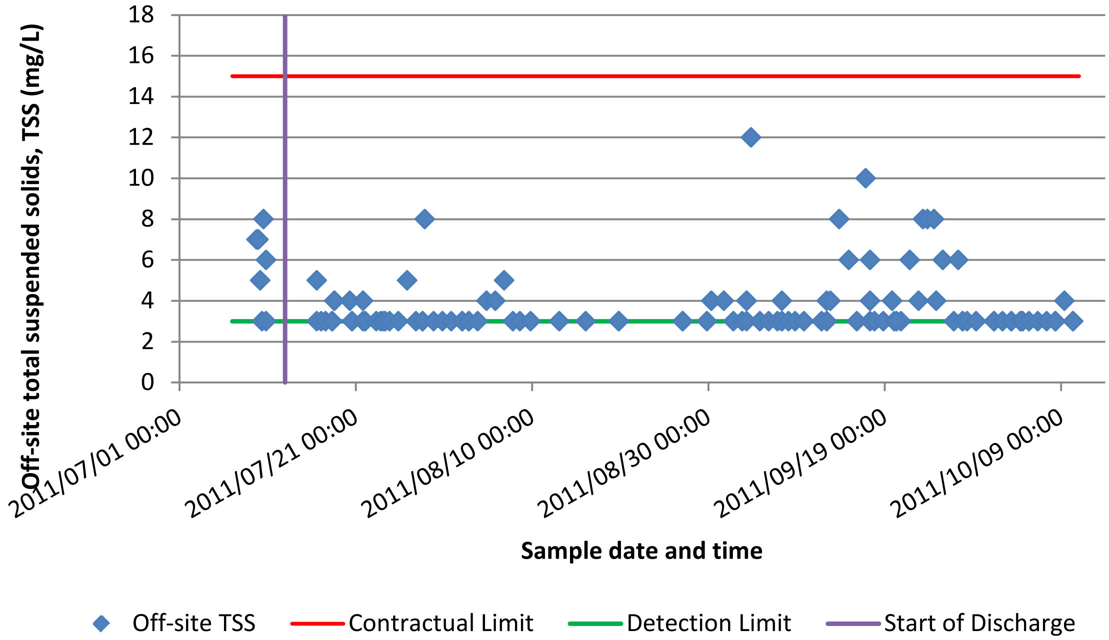


Figure 9: Summary of off-site TSS concentration measurements for the 2011 project season

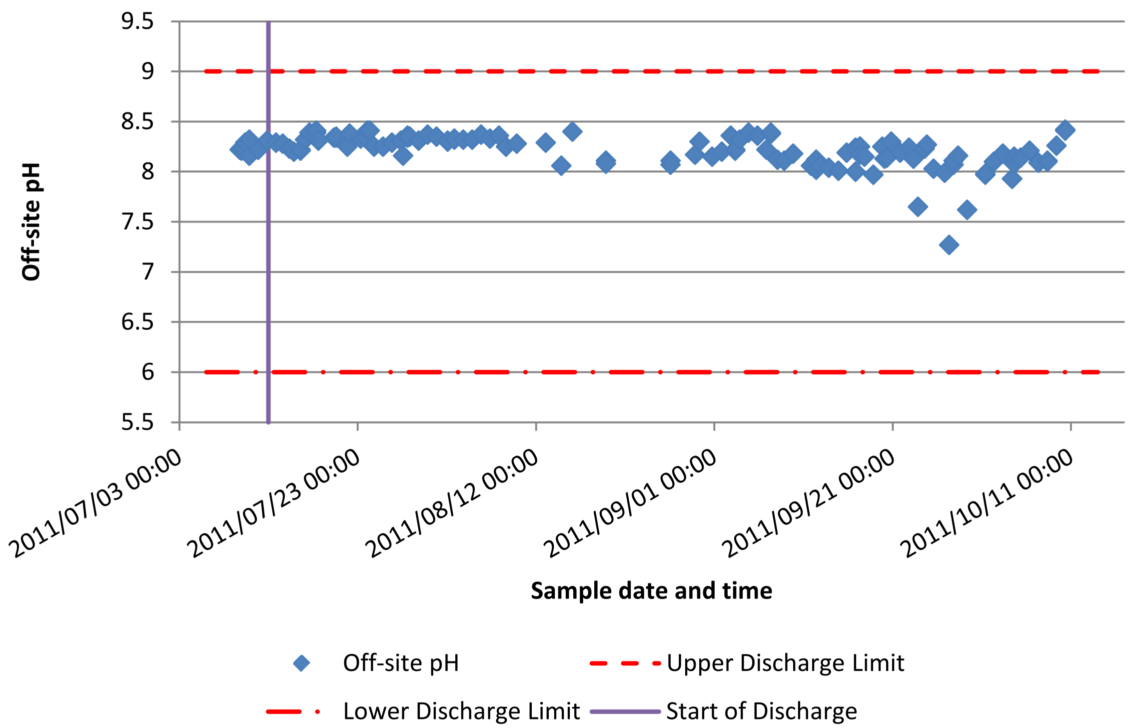


Figure 10: Summary of off-site pH measurements for the 2011 project season

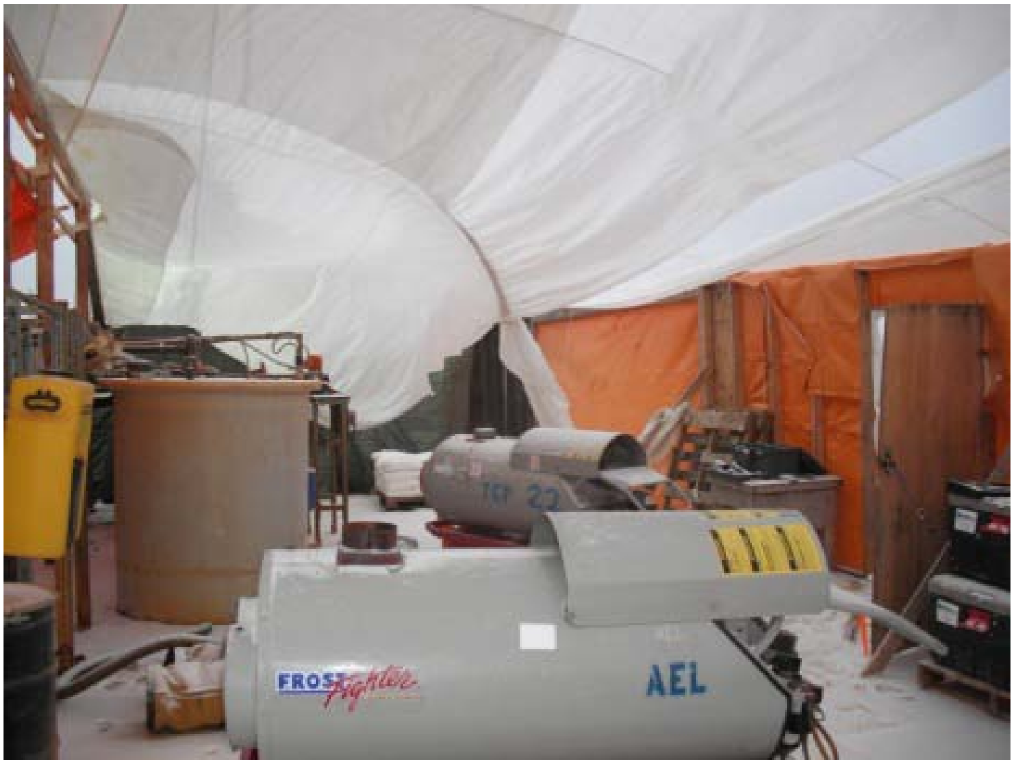


Figure 11: Plant Winterizing Phase – Frost Fighter

Figure 12: Plant Winterizing Phase – Tanks Freezing

Figure 13: Chemical Pump and Fitting Storage (Seacan)

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Figure 15: Ferric Onion Tank Storage (Platform)

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Figure 20: Flow Meter Storage (Seacan)

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Figure 24: Electrical Control Panel Plywood Enclosure (Platform)

2012 End of Season Closeout Treatment Report
Tundra Water Treatment Facility

prepared by

pure elements
environmental solutions

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SIGN-OFF AND ACKNOWLEDGEMENT

I have reviewed and endorse the 2012 End of Season Treatment Report for the Tundra Water Treatment Facility as prepared by Pure Elements Environmental Solutions.

Justin Bunz, Technician, TLICHO Representative
Aboriginal Engineering Ltd.

Date: December 5, 2012

REGISTERED PROFESSIONAL ENGINEER
T.L. COMARTIN
LICENSEE
NWT/NU

December 5, 2012

PERMIT TO PRACTICE
821951 Alberta Ltd. o/a Pure Elements Environmental Solutions
Signature
Date December 5, 2012
PERMIT NUMBER: P 655
NWT/NU Association of Professional Engineers and Geoscientists

Trina Comartin, P.Eng.
Supervising Operator – Level III Certified
Pure Elements Environmental Solutions

PURPOSE

This Report constitutes the requirements for the end-of-season Closeout Submittal, as outlined in Public Works and Government Services Canada Project No: R.014137 Phase 2 Remediation, Tundra mine Site, NWT para 1.3.1, Section 44 41 13, "Commercial Water Treatment Plants."

This report provides the reader with a summary of treatment operations for the 2012 treatment season, together with a set of recommendations for the 2013 season. For those readers who are unfamiliar with the project, the 2011 report has been provided in Appendix A, which will provide the reader a greater understanding of the season-to-season treatment setup, treatment facility photographs, and changes thereto.

There are a number of other pertinent reports and documents attached in the Appendices which will provide the reader additional detailed information regarding treatment and discharge monitoring at the Tundra Mine site as well as background information.

This Report intends to not only serve as the requirement for the closeout submittal but serve as a valuable summary document that will allow the reader to quickly review and understand the objectives met during the 2012 treatment season, as well as to quickly gain an understanding for changes proposed for the 2013 treatment season.

1 Executive Summary

Tundra Mine is a former underground gold mine located approximately 240 km northeast of Yellowknife in the Northwest Territories. The mine site is accessed by a shared airstrip, located approximately 5 kilometres from the Tundra Mine Site. The site has been under the Care and maintenance of Indian and Northern Affairs Canada (INAC), Contaminants and Remediation Division (CARD), since 1998. Phase 1 remediation was completed previously and Phase 2 remediation activities are indended to address remaining environmental concerns. **This report deals specifically with water treatment of remaining Tundra Mine site tailing ponds.**

2012 water treatment initiatives at Tundra Mine were undertaken and completed by Pure Elements Environmental Solutions on behalf of Aboriginal Engineering Services Ltd. A total of 784,000 cubic metres of water was treated throughout the June – September treatment season, with 669,000 cubic metres of water meeting contract specifications being discharged to Hambone Lake.

Both onsite and offsite testing programs were undertaken, with offsite testing conducted by Taiga Labs, Yellowknife, a CALA accredited laboratory, confirming water quality. Because remedial activities proposed by INAC were expected to have a potential impact in the aquatic environment of the former Tundra Mine site, a monitoring plan was developed. Baseline aquatic resource studies were undertaken and completed by others. Please refer to Appendices D and E for more information regarding these additional studies.

Onsite and offsite monitored parameters of concern were:

- Total Arsenic
- Total Copper
- Total Lead
- Total Nickel
- Total Zinc
- Nitrate as Nitrogen
- Nitrite as Nitrogen
- Total Ammonia as Nitrogen
- Total Suspended Solids; and
- pH.

There were several changes to process in 2012 from the previous treatment season resulting in improvements to overall treatment process, water quality and ease of operations over the prior treatment season (refer to Section 4 for additional details).

Challenges to overcome for the 2013 treatment season include improving quality control and quality assurance methods for onsite testing including lower detection limits for onsite analysis and verification of third party testing. Operational challenges to overcome include equipment redundancy and backup procedures in the event of primary equipment failure, and primary clarification of the remainder of the tailings water in order to reduce total suspended solids. Environmental issues to address prior to the 2013 treatment season include pilot testing and development of sludge handling program in order to properly de-water and dispose of sludge remaining in Geotubes and the development of a plan for removal and decommissioning of the water treatment plant and equipment.

2 Introduction

2.1 Facility Operators

Pure Elements Environmental Solutions was selected as the facility operators for the 2012 treatment season for Tundra Mine Water Treatment Operations.

Pure Elements' parent company is incorporated in the Northwest Territories and holds Permits to Practice Engineering in Northwest Territories, Alberta and Nunavut. Pure Elements operates and maintains approximately 15 municipal water and waste water treatment facilities throughout these areas and has been operating in the North for approximately four years.

Pure Elements retains a staff of Certified Operators, Equipment Operators and Civil and Mechanical Engineers.

3 Treatment Regime

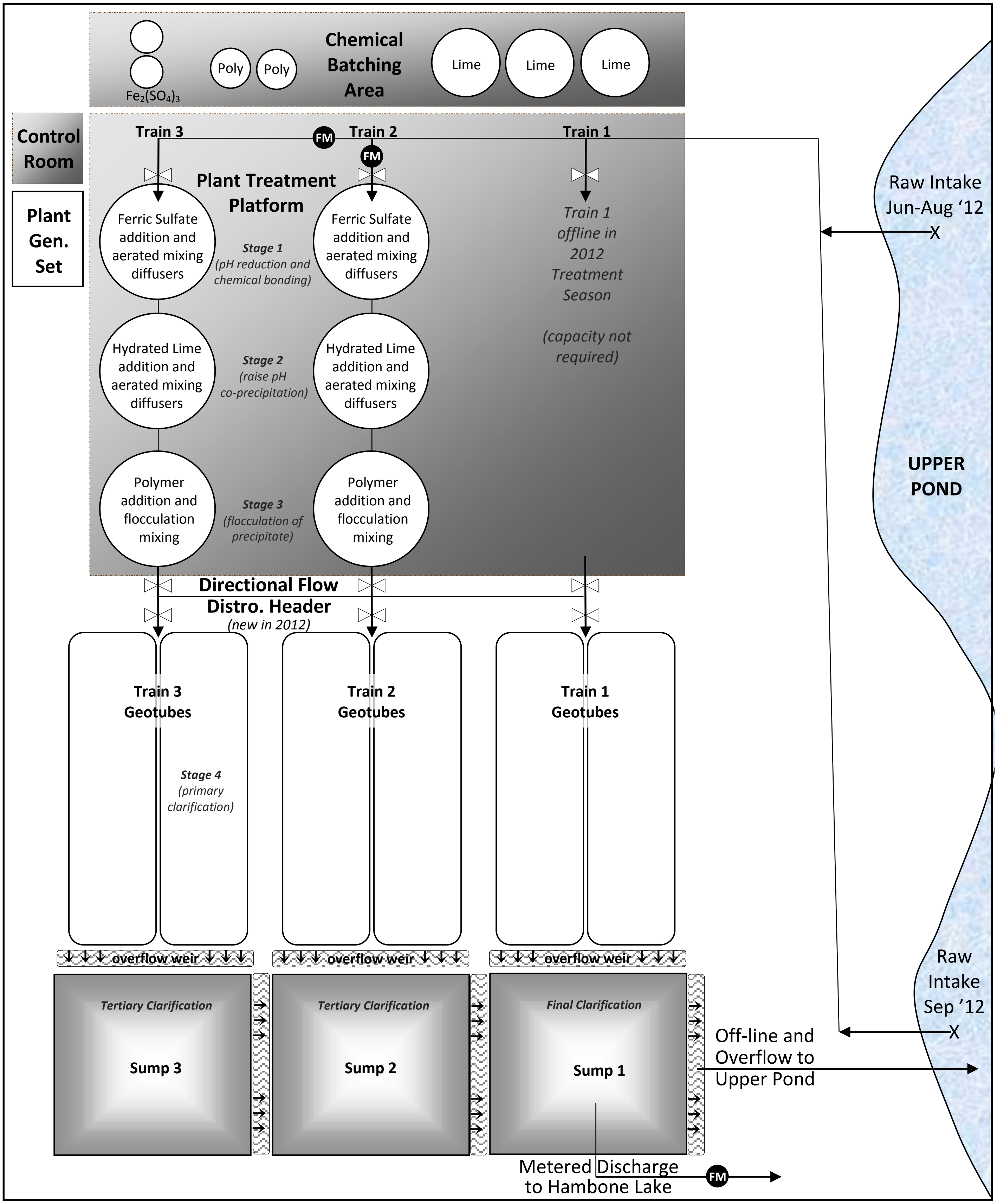
Pure Elements re-constructed the existing water treatment similar to 2011. A total of two complete treatment trains were utilized throughout the season (being Train 2 and Train 3), and a minimum of two Geotube trains at any given time. Upon startup, Geotubes for Train 2 and 3 were seeded with polymer and halfway through the season , Geotubes for Train 1 were re-commissioned.

The treatment regime consisted of the following process:

- Chemical injection of ferric sulphate into Reactor stage 1 under aerated mixing conditions;
- Chemical injection of lime into Reactor stage 2, under aerated mixing conditions;
- Chemical injection of polymer prior to Reactor stage 3;
- Ongoing flocculation in Reactor stage 3;
- Solids separation within six trains of Geotubes; and
- A minimum of two stage final clarification to a maximum of four stage final clarification, prior to pumping to Hambone Lake.

A process overview schematic is provided in the next section for additional clarification.

3.1 Treatment Schematic Overview



4 Changes to Treatment / Testing Regime

Several changes to the treatment regime from 2011 were implemented in order for system optimization and efficiency:

4.1 Directional Flow Distribution Header

A 10" header with three municipal gate valves was installed in order to enlist the ability flow process water from any or all of the reactor trains to any or all sets of solids separation and primary clarification Geotubes. This allowed for further optimization of treatment trains and available processes.

4.2 Ferric Sulphate Make-Up Changes

It was noted that in 2011, there were substantial issues with clogging of injection equipment, and settling of ferric sulphate in the chemical make-up tanks. Aeration of ferric sulphate in this manner would tend to cause the ferric to oxidize, and further precipitate as a solid. Therefore it was decided to remove aeration from the batching stage of ferric sulphate.

As well, the ferric sulphate had been batched 50 bags at a time in 2011. The 2000 gallon batching tanks utilized in the 2011 season were in poor shape as a result of a reaction between the metal bulkheads and the acidic ferric chemical. In order to gain more control over the dosage and the mixing of the ferric sulphate, and overcome the wearing and failure of the metal fittings, a total of two 400 gallon plastic batch reactors were selected for chemical batching of ferric sulphate. No air was added while mixing the ferric sulphate chemical in the batching area. The chemical was mixed consistently for a minimum of one hour to a uniform dosing solution. It was very easy to make changes up or down to the primary ferric dosage simply by changing the number of bags added to the 400 gallon batching tank (from a minimum of 4 bags per batch to a maximum of 6 bags per batch).

4.3 Changes to Chemical Dosage

Some modifications were made to chemical dosage from 2011 in order for process optimization. The scientific basis for modifications to dosages were supported by the following:

- Several sets of jar testing;
- a chemical analysis of treatment chemicals indicating exact weights of elemental chemical available for the co-precipitation process (Appendix B);
- a chemical analysis of the raw water upon start-up, as well as ongoing raw water chemical analysis';
- consultation with our Professional Chemist, Ron Connell, P.Chem., who has been working in mine remediation for 30-plus years and specifically with arsenic and heavy metal co-precipitation;
- <u>Removing and Stabilizing As in Acid Mine Water</u>, co-authors R.W. Lawrence and T.W. Higgs (Appendix C);

- on site pH optimization using online pH meters, with two methods of onsite verification for each of the three stages of the treatment process (range-targeted pH test strips and the Hach HQ 11d calibrated weekly) ; and
- settling tests post Reactor stage 3 (refer to schematic in previous section for description treatment stages) which allowed for visible measurement of floc size, shape as well as settled floc volume and settling time.

4.4 Reduction of Flocculation Rates in Stage 3

Mixing rates in Stage 3 flocculation stage 3 (refer to schematic in previous section for description treatment stages) was reduced to 10 Hertz in 2012 from 30 Hertz in 2011. This allowed for a larger size of floc and maximum amount of precipitate as indicated by the onsite settling tests conducted post stage 3.

4.5 Changes to Onsite Testing Regime

New onsite testing methods were requested for the 2012 treatment season due to challenges with the onsite test methods and equipment utilized in 2011.

As a result the Appendix H – Onsite Testing methods were selected and implemented for the 2012 treatment season.

5 Safety

Safety for water treatment operations was met by adherence to the overall site safety plan as prepared and implemented by Aboriginal Engineering Ltd.

Daily onsite safety meetings for both day shift and night shift were held in the water treatment plant office. Topics were consistent with site safety, as well as tasks specific to water facility operations or in the event a particular type of work was to take place. If work was to be performed during a shift or shifts, different from the routine work normally performed, a separate Job Hazard Analysis was completed, and signed by all workers and supervisors.

The most extreme safety hazard presented by water facility operations involved exposure to chemical dust. All water plant operators and supervisors were properly fitted and supplied with NIOSH breathing apparatus which was required to be worn when handling chemicals. There were no chemical exposure incidents.

There were a couple of minor incidents with workers slipping off of the Geotubes. As a result, there were two precautions implemented immediately: first, operators were re-trained in order to avoid over-filling the Geotubes (when the Geotubes reach their maximum design operating height of 11', they are more difficult to negotiate). Secondly ramps were placed between the Geotubes so workers did not have to jump between the tubes. This resulted in zero additional incidents.

6 Operating Procedures

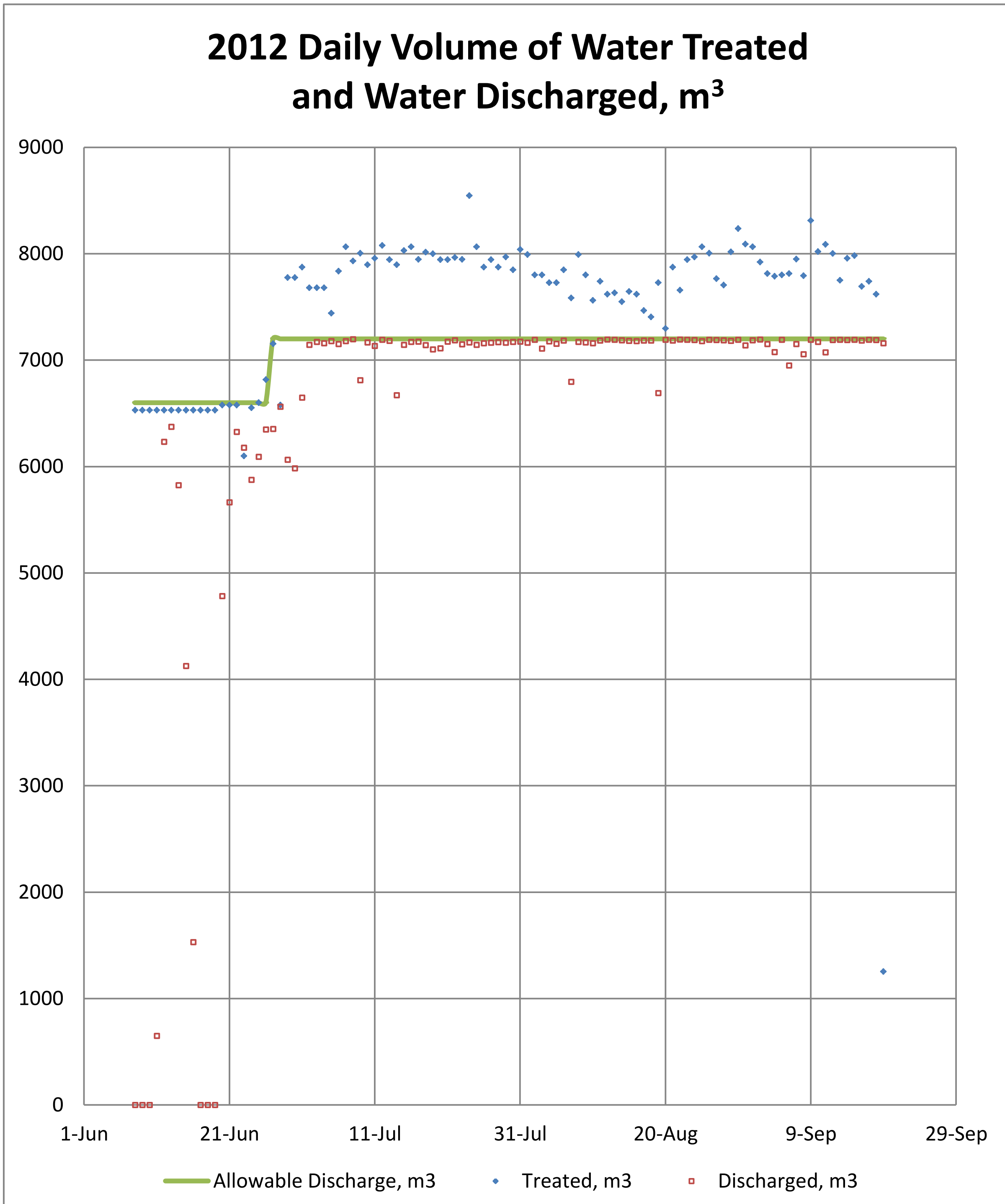
A number of water treatment specific procedures were developed by Supervisors which outlined the specific procedures for facility operations.

These were retained at site and include:

- Plant start up procedures;
- Plant shut down procedures;
- Plant routine operations procedures; and
- Procedures to take in the event water produced did not meet criteria.

7 Volumes of Water Treated

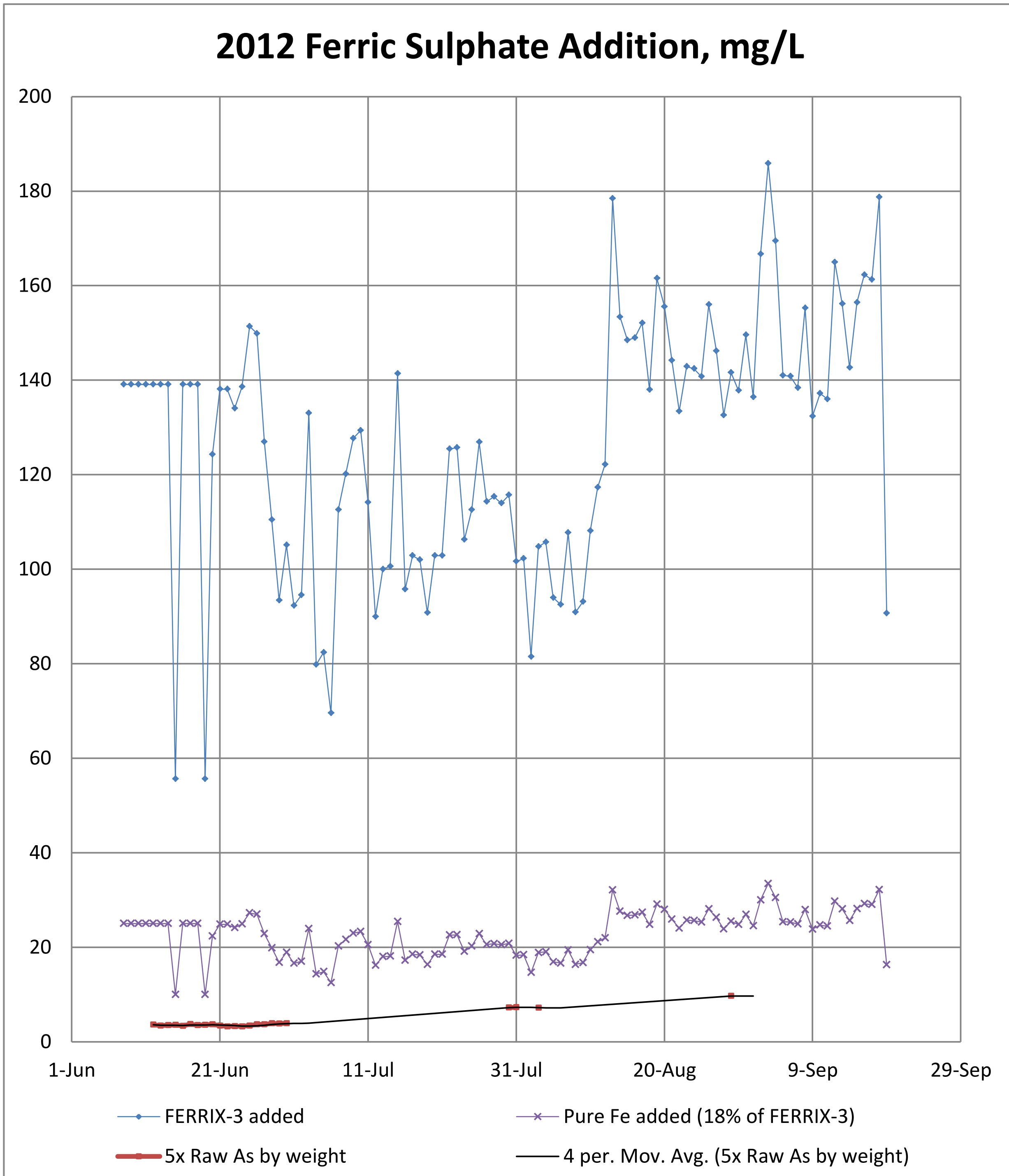
The Water License outlined the maximum allowable treated water volumes that could be discharged to Hambone Lake. The daily discharge volume varied, always within the allowable levels as outlined by the License. Below is a summary graph of the daily volume of water discharged to Hambone Lake.



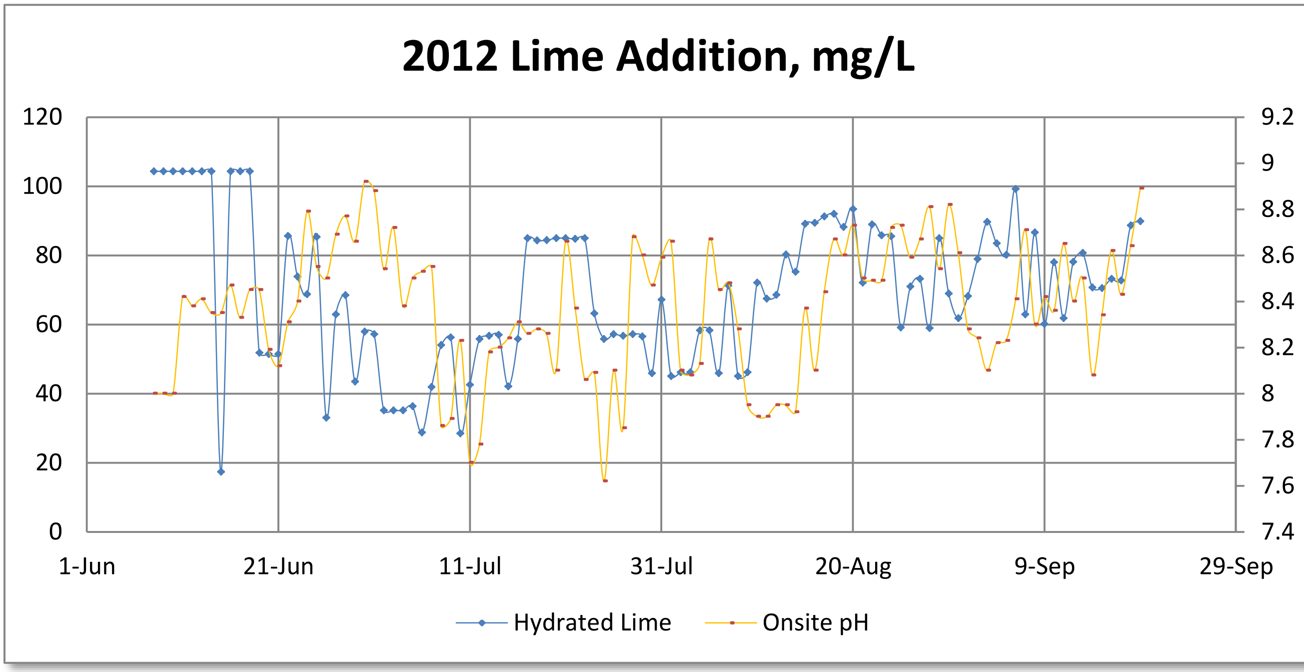
8 Chemical Usage

Three chemicals were added to the treatment process:

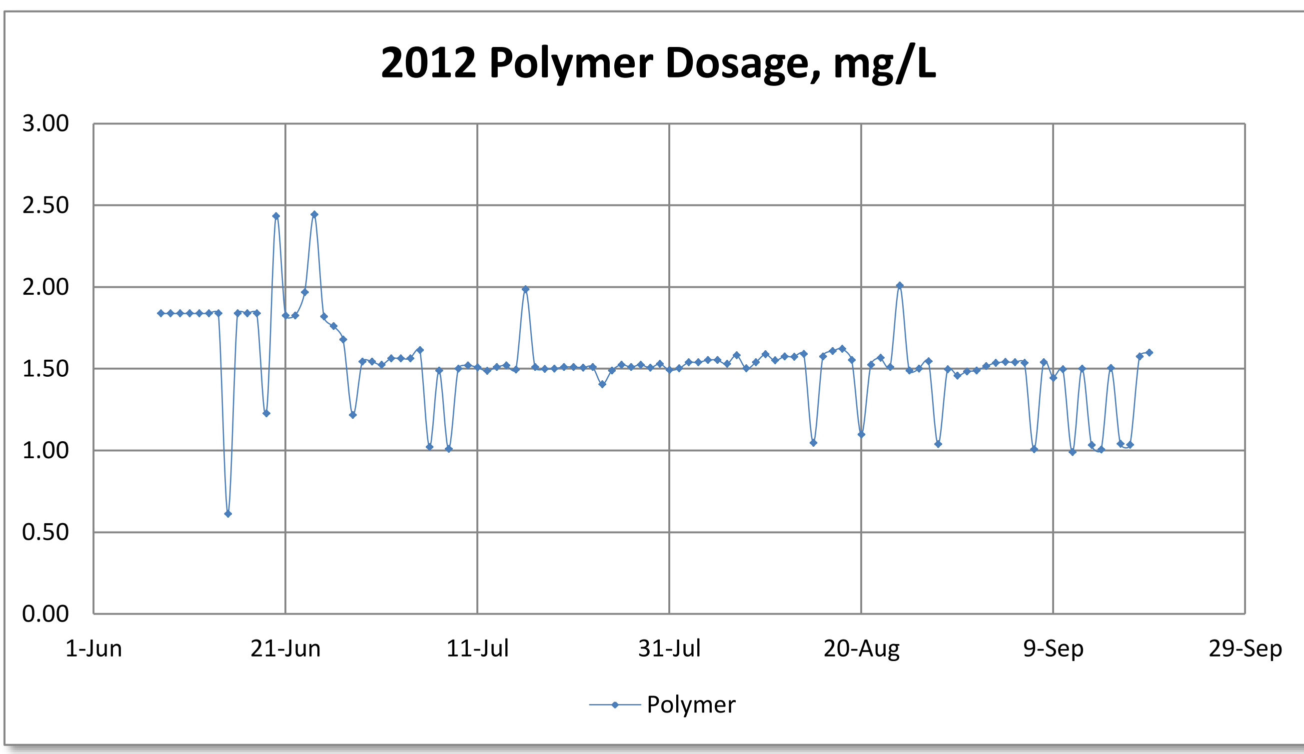
- Ferric Sulphate (18% ferric by weight as confirmed by 3rd party chemical analysis – Appendix B) , mixed and added to the raw water to reduce pH to allow for co-precipitation of +2 metals;



- Hydrated Lime (approximately 50% calcium by weight) added to rapidly increase the pH and complete the co-precipitation process; followed by



- A polymer to assist with floc development, solids separation and settling of ferric-arsenate.

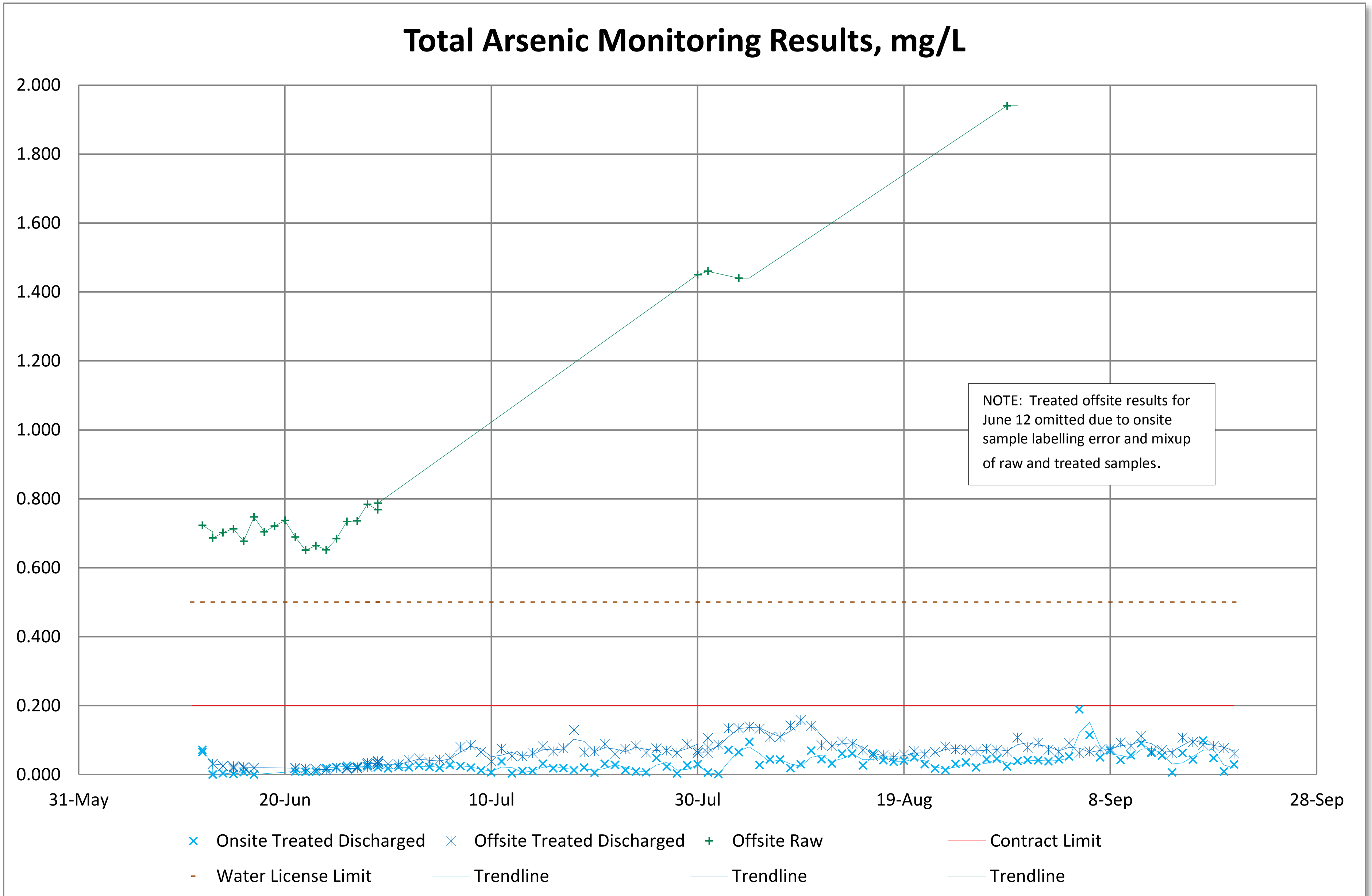


9 On and Off-site Analysis of Contaminants of Concern

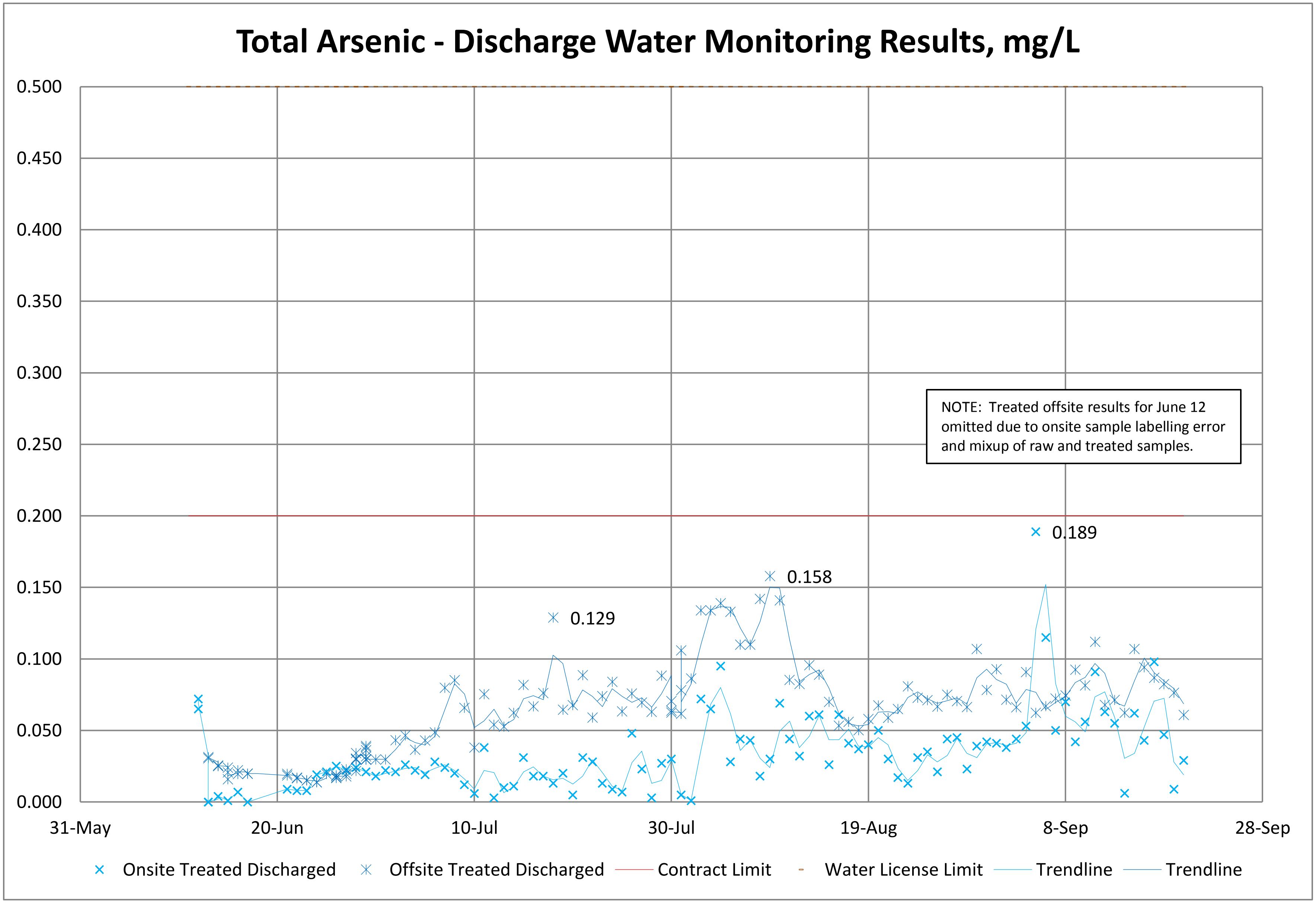
9.1 Regulated Contaminants of Concern – Treated Water

Parameter	Unit	Maximum Daily Average Concentration (contract)	Onsite Lower Detection Limit
Total Arsenic	mg/L	.200	0
Total Copper	mg/L	.010	0.001
Total Lead	mg/L	.010	0.003
Total Nickel	mg/L	.050	0.006
Total Zinc	mg/L	.020	0.010
Nitrate as nitrogen	mg/L	5	0.23
Nitrite as nitrogen	mg/L	0.400	0.015
Total Ammonia as nitrogen	mg/L	5	2
Total Suspended Solids	mg/L	15	5
pH	-	6 to 9	

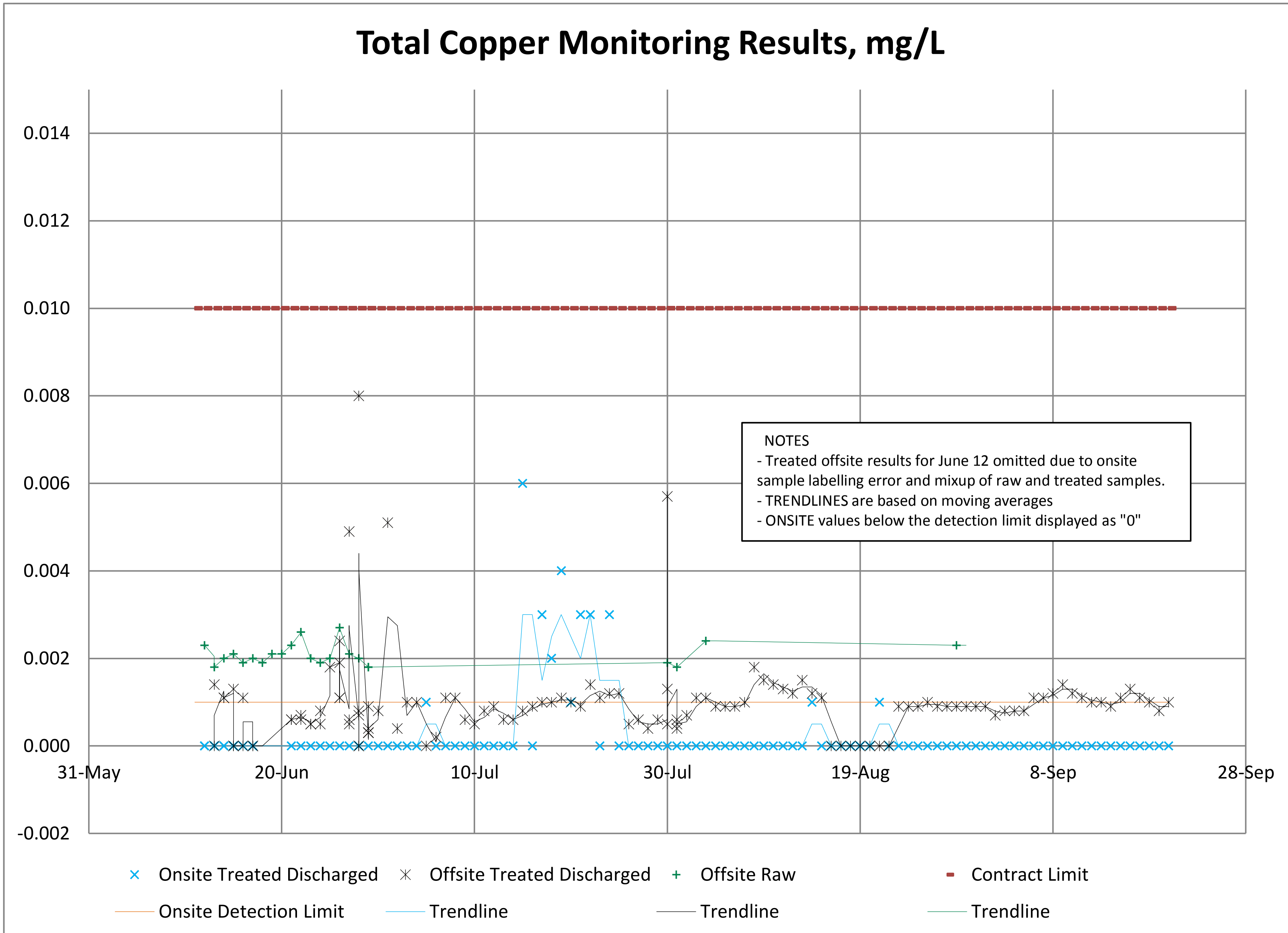
9.2 Total Arsenic Analysis'



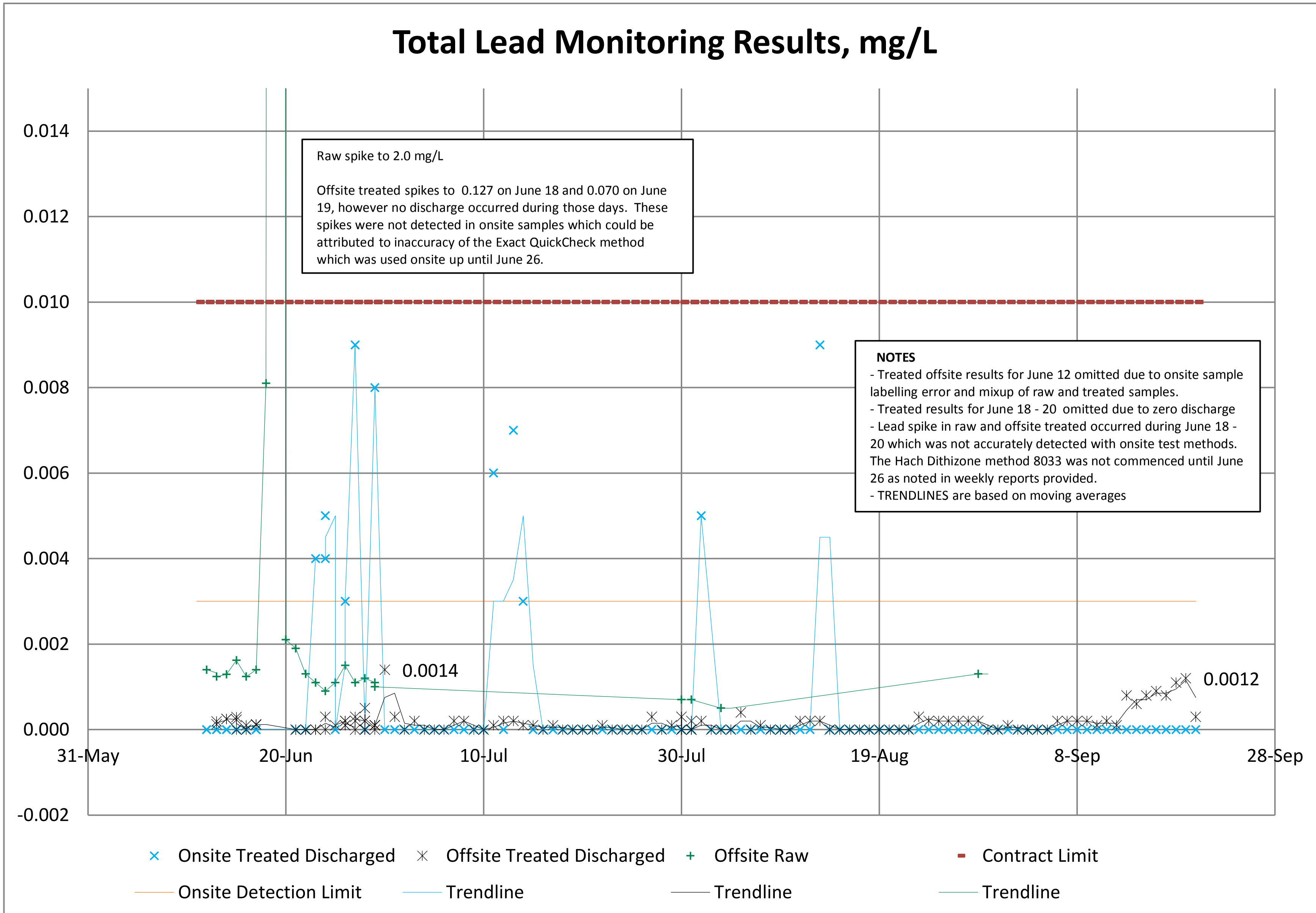
9.3 Total Arsenic Analysis – Discharged Water



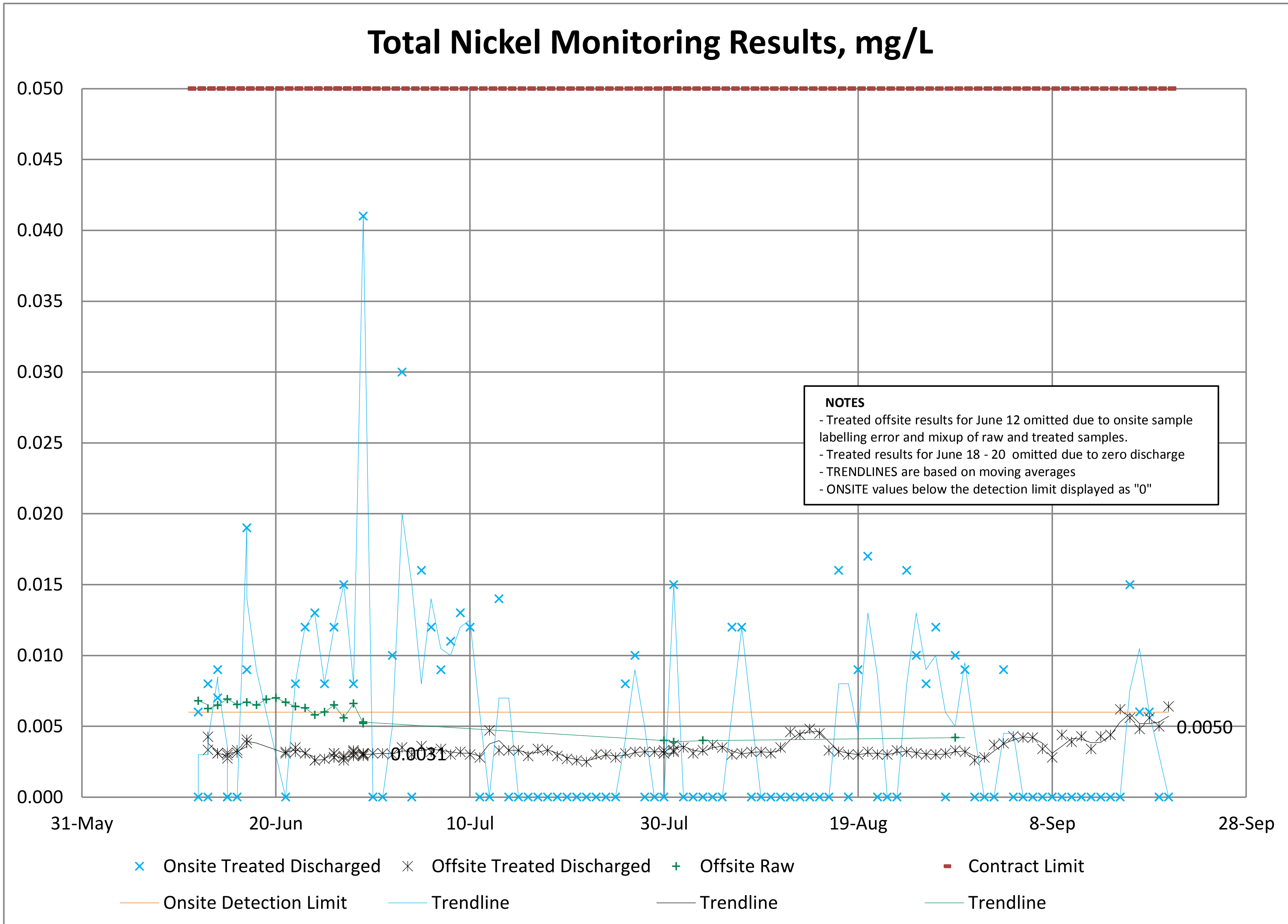
9.4 Total Copper Analysis'



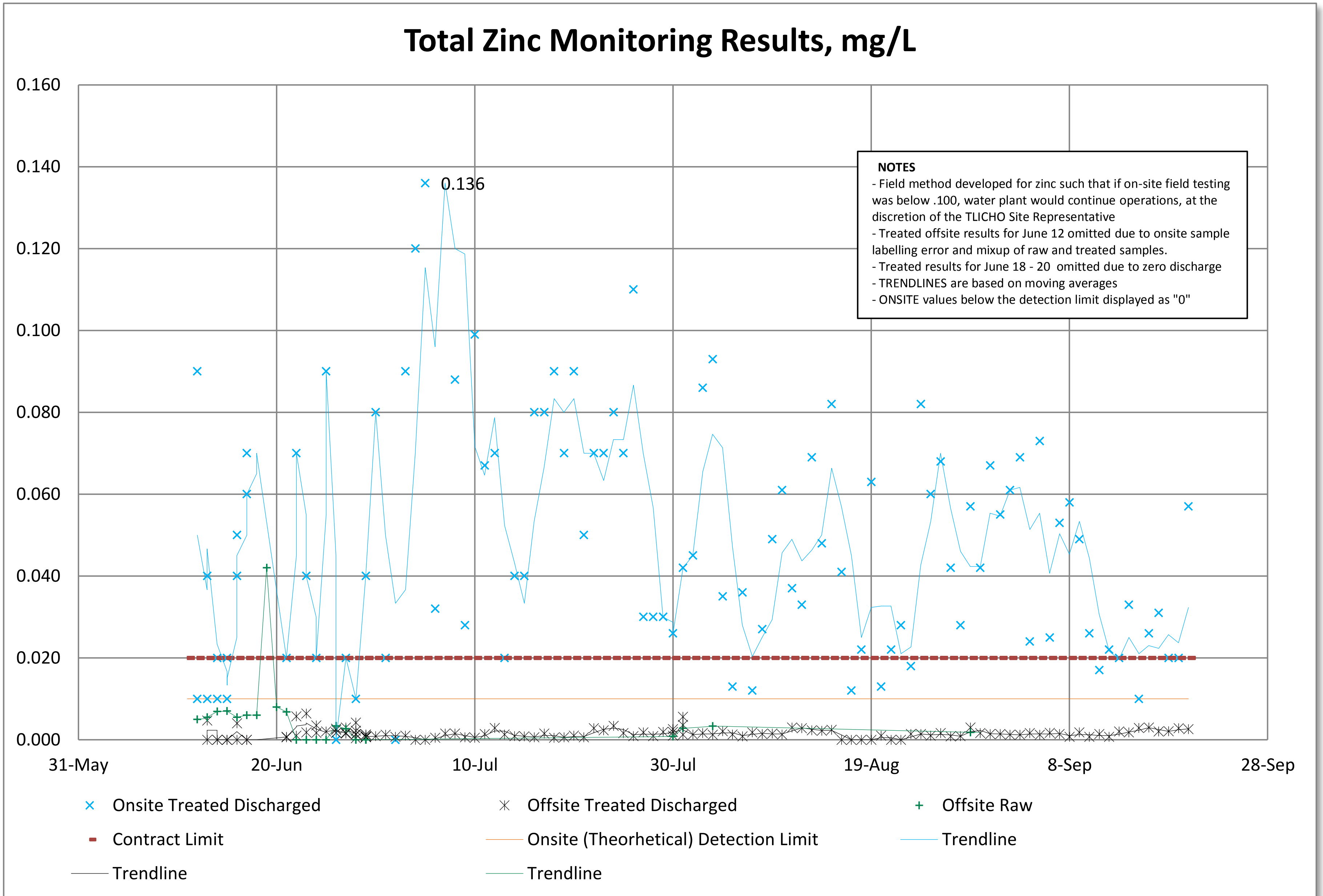
9.5 Total Lead Analysis'



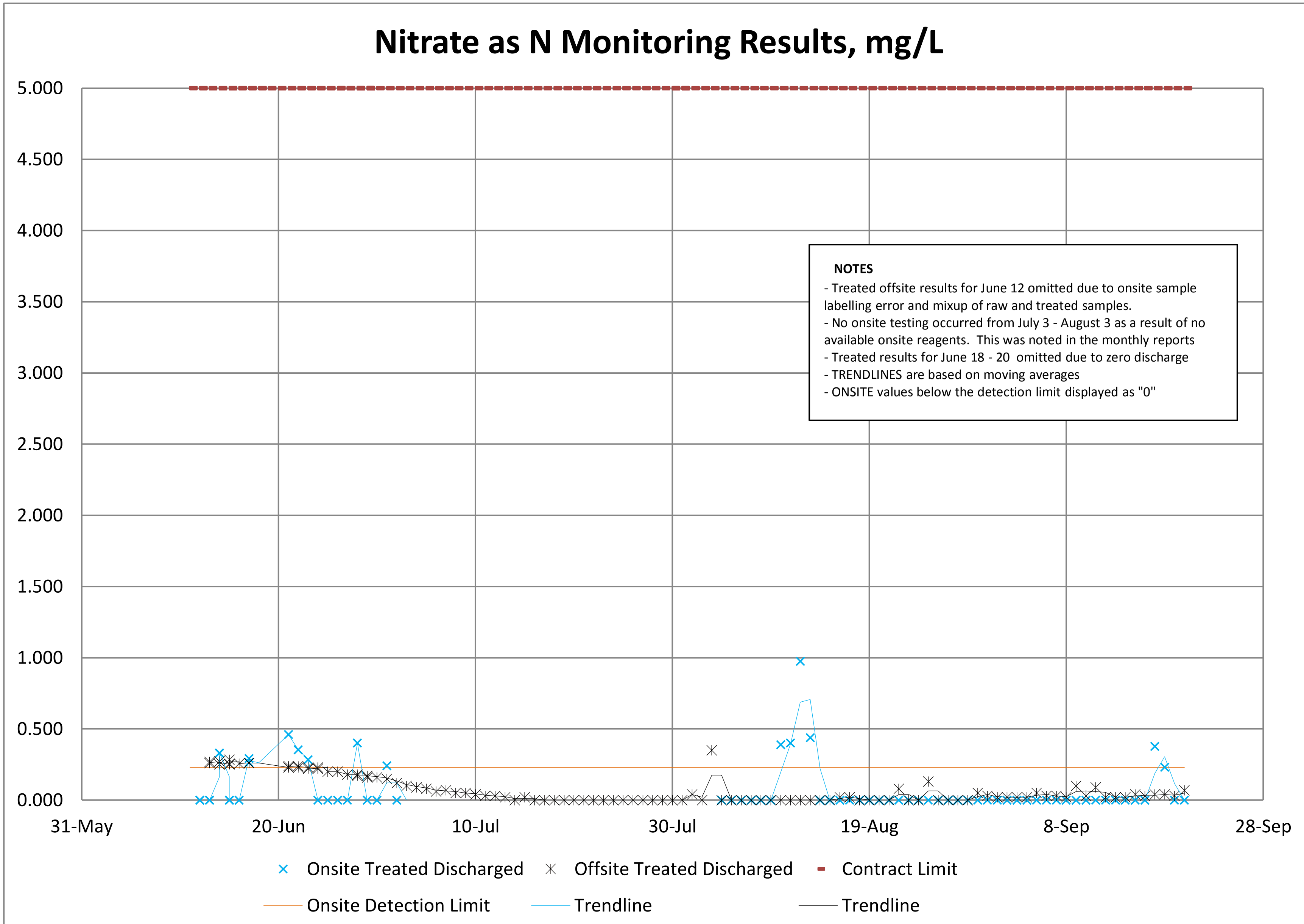
9.6 Total Nickel Analysis'



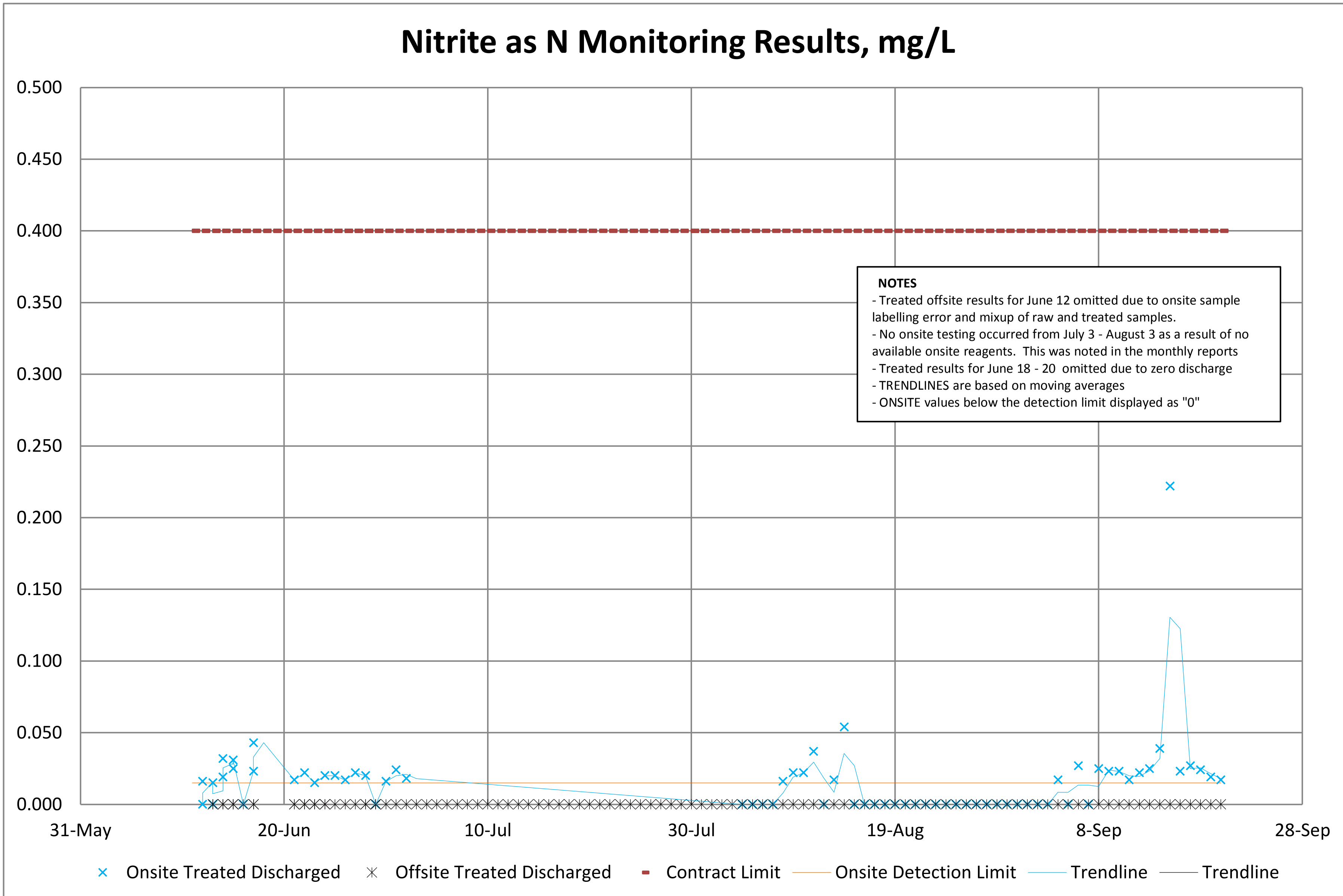
9.7 Total Zinc Analysis'



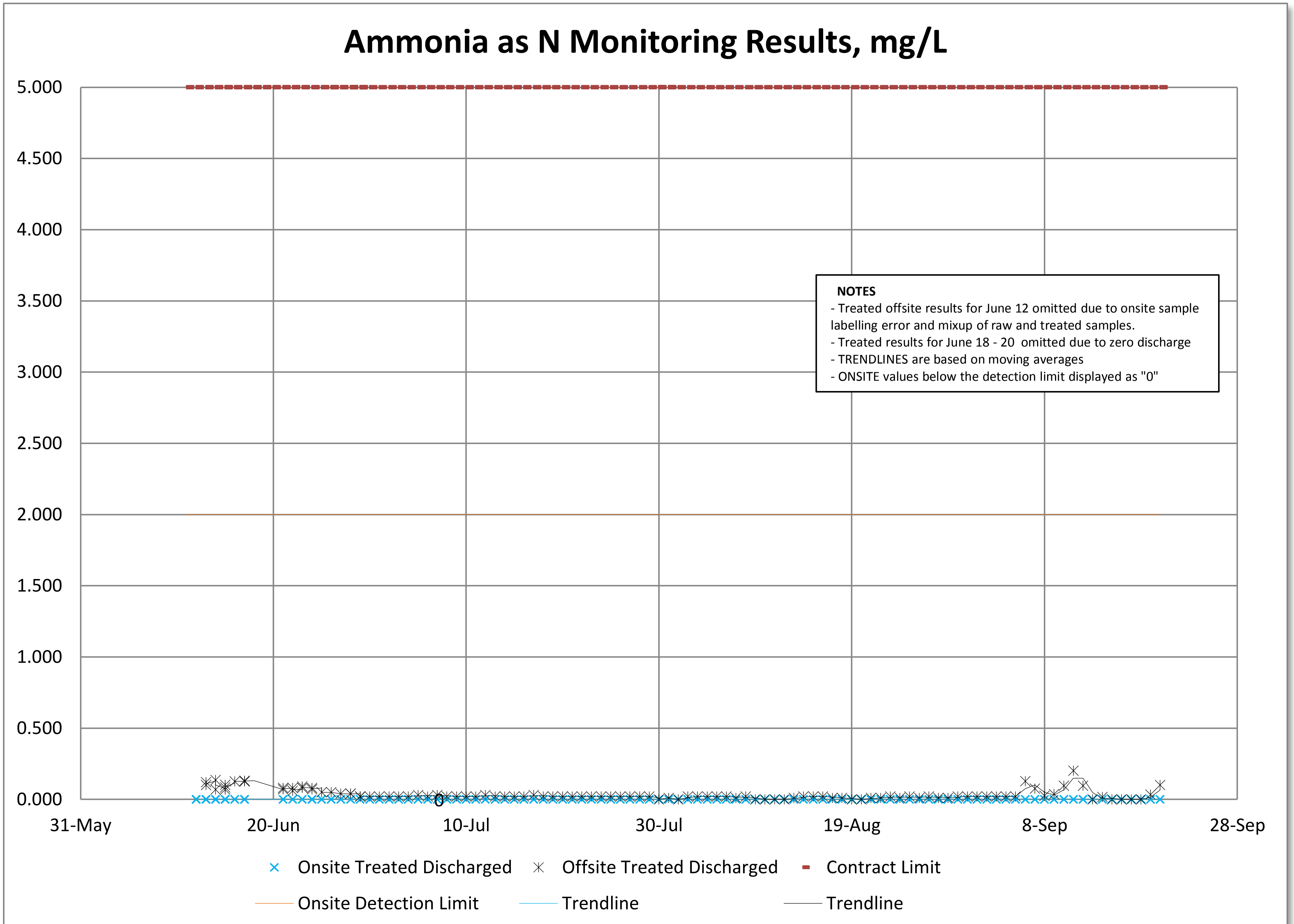
9.8 Total Nitrate Analysis'



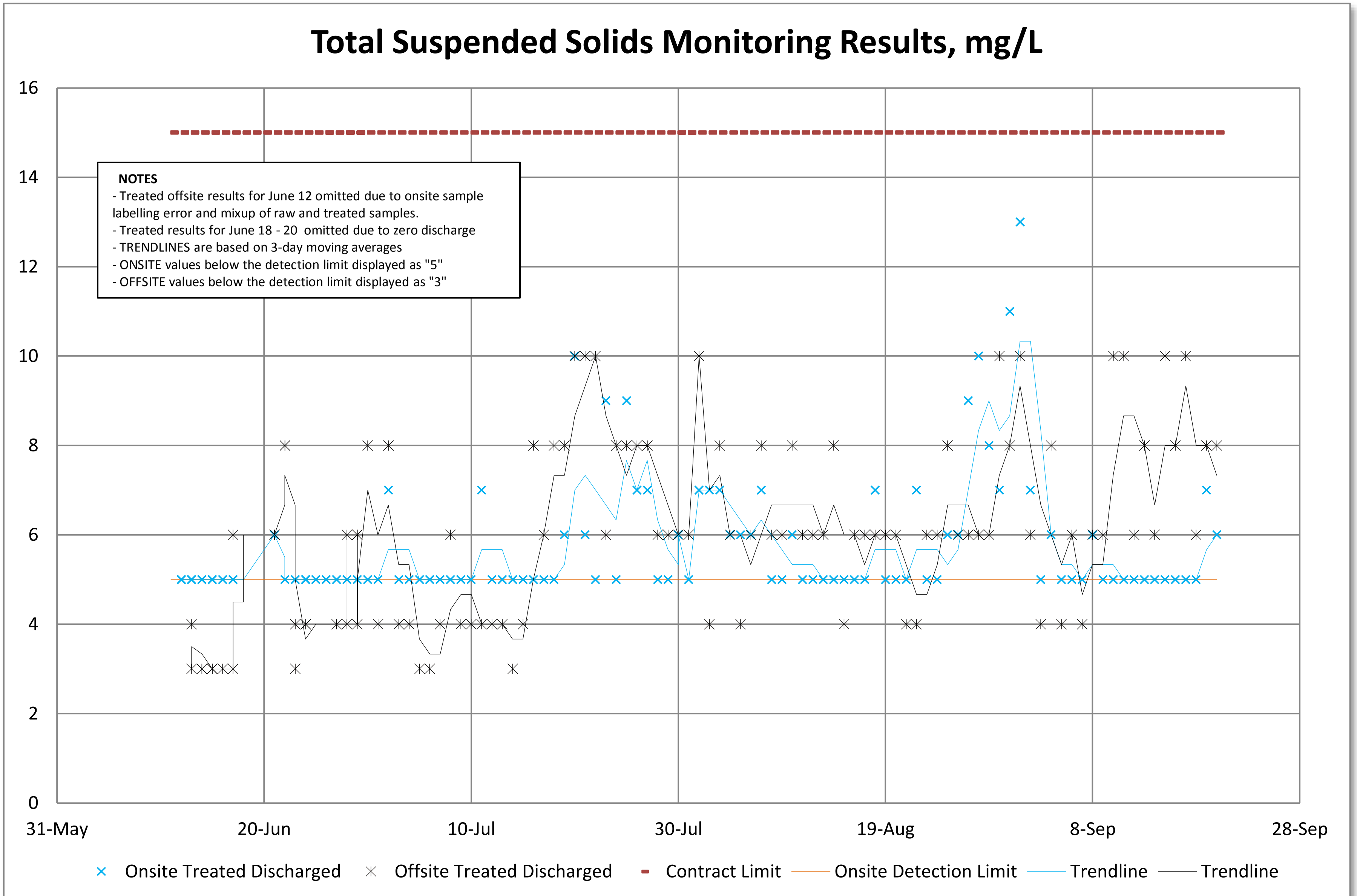
9.9 Total Nitrite Analysis’



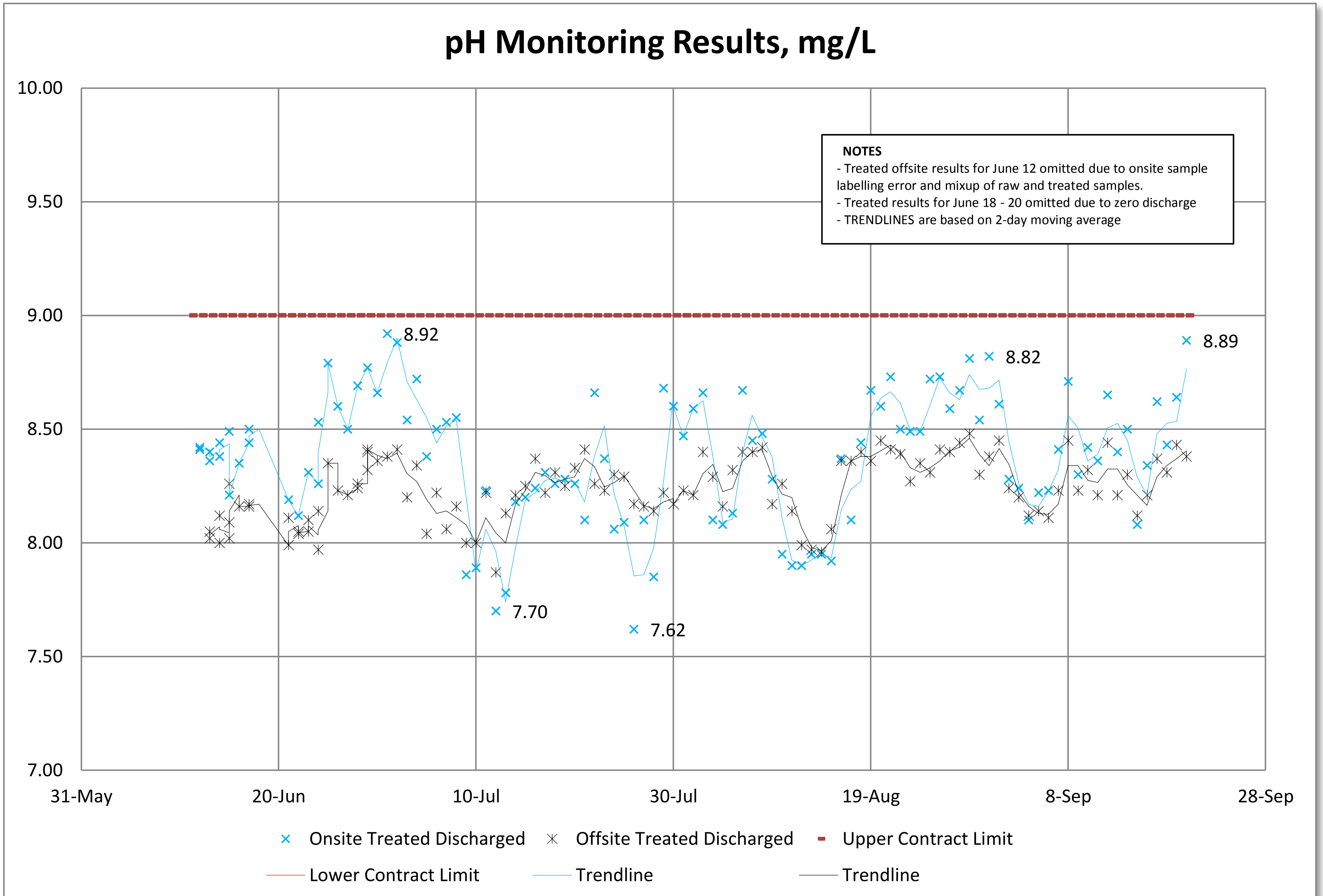
9.10 Total Ammonia Analysis'



9.11 Total Suspended Solids Analysis'



9.12 pH Analysis



10 Fuel Consumption

Fuel usage for water treatment plant operations consists of that utilized by the main water plant generator, two raw supply pumps, a discharge pump and light towers.

Total fuel consumed by this treatment equipment is estimated at 80,000 litres for the 2012 treatment season. This includes all the days the plant was producing water, whether or not discharge was occurring.

11 Overall System Operation and Performance

The overall plant operations were smooth, but not without a few incidents, mostly involving sampling errors and internal plant shut downs due to inability to accurately test to low enough detection levels . The sampling errors and the internal shut down are described in further detail in the sections below.

11.1 Commissioning

Commissioning occurred from May 29th – June 11th, and discharge approval was granted on June 12th. Discharge commenced on June 12th, with a minor amount of water being discharged from June 12th, which was added to the totals reported for June 13th by the TLICHO Site Representative. Therefore, due to the way the discharge volumes were recorded, the weekly report may indicate a water license exceedance over the initial allowable 6600 m^3 per day, however no actual exceedance occurred.

11.2 Process Changes

Process changes were made for plant optimization as described in this document (see Section 4 – Changes to Treatment Regime).

11.3 Raw Water Intake

Raw water was supplied by two diesel powered end suction centrifugal pumps, maintained by the onsite mechanical team. There were minimal supply problems. The intake was moved late in the year due to the lowering of Upper Pond as a result of treatment operations. Please refer to the schematic in Section 3 for intake location/s.

11.4 Performance - Water Treatment Plant

The plant treated water continuously from June 11th through to September 20th with the exception of June 10th, June 11th and June 12th when a self-imposed shut down occurred as a result of high onsite zinc values. During this shut down period, offsite values indicated a high treated lead exceedance, as well as an increase in raw zinc to double the discharge limit. No water was being released from June 10 – 12th therefore there was no contravention of the License or water released exceeding contract limits.

Minor shutdowns occurred throughout the treatment season to allow for ongoing repairs or maintenance as necessary. These are as noted in Sectio12 – System Upsets, Corrective Actions and Maintenance Performed.

The plant performed satisfactorily and as anticipated during all ongoing treatment operations.

11.5 Safety

Please refer to Section 5 – Safety for a summary of onsite safety at the water treatment plant.

11.6 Preventative Maintenance

Please refer to Section 12 – System Upsets, Corrective Actions and Maintenance Performed for a summary of preventative maintenance performed over the course of the treatment season

11.7 Winterization

The plant was shut down on September 20th and winterization occurred from September 20th through to September 26th.

11.8 Compliance - Total Water Treated and Discharged

The water treatment plant at Tundra Mine treated 784,000 cubic metres of water in the 2012 treatment year, of which 669,000 m^3 was discharged into Hambone Lake. The balance of the water was re-circulated back to Upper Pond. The treatment volume includes approximately 24,000 cubic metres of water treated from June 9 through June 12, during the commissioning period of May 29 through June 12, 2012. Please refer to Appendix I - Daily Discharge Volumes and Chemical Usage Data for exact volumes.

Regardless of two treatment trains (instead of all three) being utilized in the 2012 treatment season, targeted discharge volumes were easily met by the treatment plant.

11.9 Compliance - Discharge Water Quality Meeting Contract Specifications

All water discharged into Hambone Lake met contract specifications confirmed by third-party offsite results with the exception of 649 m^3 on June 12, 2012, the first day of discharge, for which the offsite samples indicated an arsenic level around 0.7 mg/L. Please refer to Section 9 – Onsite and Offsite Analysis of Contaminants of Concern together with Appendices F and G containing of Offsite and Onsite testing results for the parameters of concern.

Testing results from the first day of discharge operations was also the first day of onsite collection of samples to be air-shipped to Taiga in Yellowknife, and was completed very quickly. The onsite sampling program and notations for the samples themselves had not been formally launched. Nor had the laboratory program with Taiga been officially established.

Pure Elements and Aboriginal Engineering are confident the water released this particular day was also well within the contract limits. This statement is supported in the following section:

11.10 Field Sampling/Laboratory Error First Day of Discharge Operations

Offsite results for June 12 Total Arsenic results for treated water of 0.725 and 0.705 respectively, mg/L is attributed to the following set of conditions leading to the reporting errors:

- with 8 sets of sample bottles, and multiple labels, the site monitor placed raw water into the bottles later labelled treated; or
- a laboratory error whereby raw sample/s were analyzed as 'treated.'

The 649 m^3 discharged June 12 into Hambone Lake on the first day of discharge was most likely, well within the contract limits for the following reasons:

- Two separate sets of off-site samples taken June 13 indicate a treated water Total Arsenic level of 0.013 mg/L;
- Onsite samples indicate total arsenic levels as well within the contract limits prior to, during, and after the first day of discharge (Please refer to Appendices F and G, Off-site and On-site Test Results);
- The sample did not turn a dark brown colour during the onsite testing. The onsite test range is 0 – 0.200 mg/L. Attempting to test for arsenic levels higher than 0.200 mg/L results in a very dark brown colour which falls outside of the range of samples able to be read with the testing method used (see Appendix H – Onsite Testing Methods for complete onsite test methods.) This is why all raw samples required dilution prior to testing. Because the onsite test was even *able to be conducted,* evidences the total arsenic to be within the limits of the test range;
- Effluent results collected by the, TLICHO Site Representative post the two treatment trains being utilized, indicates results below the discharge limits, *as much as a week prior to discharge commencement*, confirming the treatment process was working correctly. After Train 2, the water goes through two additional settling stages and post Train 3, there are three additional settling stages, therefore the water quality can only improve with respect to Total Arsenic (refer to schematic in Section 3). It is not at all likely the plant worked well on June 5 & 6 (see results below) and then the treatment process stopped working during onsite treated sampling June 12 while 649 m^3 of water was discharged, and then resumed proper operations on June 13;

Date	Sample Location	Lab	Sample ID	Type	**Total As**
5-Jun-12	Train #3 Effluent	ALS	L1157516-1	Treated	**< 0.20**
6-Jun-12	Train #2 Effluent	ALS	L1158652-1	Treated	**0.014**

- The offsite raw results for June 12 indicated a raw Total Arsenic level of 0.723 mg/L. While, for the same day, the offsite results reported for treated water were 0.725 and 0.705 respectively for Composite Sample A and duplicate Composite Sample B. Offsite raw and treated values are within 97.5% to 99.7% of each other, and are therefore highly suspect; and
- The overall impact of a release of 649 m^3 of water with average 0.724 mg/L Total Arsenic on June 12 & 13 operations would be a resultant average discharge of 0.096 mg/L Total Arsenic (less than half of the allowable contract limit)

11.11 Mitigation of Field Sampling Errors

The steps taken to mitigate this type of potential sampling error was to sample separately for raw and treated water, and to keep the raw samples segregated from treated samples.

This mistake did not re-occur, though there was an additional onsite sampling error whereby the nitric and sulfuric acid preservatives were accidentally switched, which had the effect of inaccurate Nitrate/Nitrite and pH results. (July 11, see Note 6, Appendix F of this document). This error occurred partially as a result of confusion surrounding a variety of different preservatives being supplied for onsite preservation, due to an offsite laboratory shortage of preservatives. The duplicate sample was well within the contract limits.

12 System Upsets, Corrective Actions and Maintenance Performed

Outlined below is a summary of process and operations upsets and the corrective actions taken to resume operations, as well as system maintenance.

12.1 June

June 15th, 2012.	A tear in the liner developed in sump #1. The collected water from Geotubes and the composite samplers was re-routed to sump #2. Treated water from sump #2 was discharged pumped back into upper pond.
June 16th, 2012	Repairs were made to sump #1, and permission was granted to resume discharge to Hambone Lake.
June 18-20th, 2012	Plant shut down due to lab inability to produce repeatable results on the Zinc test. Offsite lead detected in raw and treated samples which were not detected onsite.
June 21st, 2012	All plumbing completed on 1st set of Geo-tubes.
June 26th, 2012	As a result of high winds, required repairs were made to the Sump #1 liner.
June	As required, cleaned and calibrated all pH probes

12.2 July

System maintenance performed on the water treatment equipment for the month of July was as follows:

July 5th, 2012	Rebuilt all Ferric Pumps, replaced all check valves and diaphragms as required.
July 6th, 2012	Installation of plant discharge header to allow water to be diverted from trains two and three, to all three sets of Geo-tubes.
July 10th, 2012	Servicing of intake and discharge pumps.
July 22nd, 2012	Cleaned lime pump injectors.
July 28th, 2012	Cleaned and repaired lime check valves and injectors.
July	As required, cleaned and calibrated all pH probes

12.3 August

System maintenance performed on water treatment equipment for the month of August was as follows:

August 1st, 2012	Repaired the floc mixer on train #3.
August 4th, 2012	Removed, overhauled and replaced parts as required on all chemical feed equipment and injectors.
August 6th, 2012	Repaired and secured top of liner on sump #1. Installed diffusers for discharge hoses into upper pond, from lower pond.
August 7th, 2012	Repaired liner on sump #1, with another layer of sandbags to help divert water from sump #2 to sump #1.
August 11th, 2012	Lime tank diffusers repaired.
August 15th, 2012	Installed screens on ferric tank pump foot valves, to reduce imposing sediment.
August 20th, 2012	Power lost for a short period of time to discharge flow meter overnight. New procedures implemented for all personnel to monitor light towers as indicators of flow meter working.
August 22nd, 2012	Lime pumps down due to source electrical issue. Repaired and returned to normal operation.
August 28th, 2012	Intake pump shut down due to low oil. Serviced and returned to normal operation.
August 29th, 2012	Repaired train 3 floc mixer. Shaft was shortened and re-machined to fit properly
August 30th, 2012	Over-hauled all backup chemical feed equipment.
August	As required, cleaned and calibrated all pH probes

12.4 September

System maintenance performed on water treatment equipment for the month of September was as follows:

September 7th, 2012	Plant generator was shutting down due to over-temperature- resolution by on-site mechanics.
September 13th, 2012	Discharge pump shutting down intermittently, no trouble codes evident however operator suspects pump is using more oil.
September 20th, 2012	Raw TSS on rise and intake pumps are sucking mud with high raw TSS. Decision made by TLICHO Site Representative to cease water treatment operations and commence winterization.
September	As required, cleaned and calibrated all pH probes

13 Downstream Effects

Impact on the water quality and the environment as a result of release of treated water through Hambone Lake has and is being evaluated on an ongoing basis by others.

Attached are the following appendices which support the aforementioned studies:

- Appendix D: 2012 SNP Results – Tundra Mine Remediation; and
- Appendix E: 2010 Tundra Aquatic Ecology Baseline and Construction Monitoring Report.

The entire treatment regime, discharge parameters and monitoring programs have been designed around minimizing downstream impact. Since all of the target treatment objectives have been met in the discharge water during the 2012 treatment season, it is logical to assume that downstream effects of the water facility operations and treatment program have met objectives of minimizing downstream effects. Without review of the 2012 Tundra Aquatic Ecology Baseline and Construction Monitoring Report, and complete evaluation of downstream water quality and other parameters, it is difficult, if not impossible, to accurately quantify downstream effects of water treatment operations occurring at the Tundra Mine remediation site.

We have provided a comparative analysis of the contaminants of concern and these are laid out on the following page. Data has been taken from Appendix D to produce monthly averages for these contaminants of concern. Appendix E data has not been included due to the availability of only a single data point, being July 23, 2012.

13.1 Comparative Analysis – Discharge vs Hambone Lake/Outlet vs Powder Mag Lake/Outlet

Data captured from Appendix E has been presented in Appendix J – Downstream Effects for comparative analysis together with observations outlined in the next section. Please refer to Appendix J while reviewing the observations in the following section.

13.2 Observations – Downstream Effects

***Qualifications**: The comments provided herein serve as observations only, specific to the contaminants of concern as outlined in the contract document, as well as a few parameters specific to treatment chemicals. No additional analysis' of results prior to the 2012 monitoring season have been evaluated. Additional review of prior sampling together with future sampling is required prior to further evaluation and comment. No evaluation of groundwater monitoring wells was considered. Monthly averages from the SNC report for the 2012 treatment season has been considered and presented. No data prior to June 2012 was considered. Precipitation and wind has not been considered as the overall stormwater and water basins have not been evaluated.*

Total Arsenic in Hambone Lake appears to have been slightly increased, potentially as a result of discharge operations in 2012. This is almost negligible and the effect dissipates and is not noticeable by the time the water reaches Powder Mag Lake.

Total Copper, Lead, Nickel and Zinc in Hambone and Powder Mag Lakes appears unaffected due to 2012 discharge operations.

Though suspended solids from discharge operations positively relates to increases in Hambone Lake, this gradual increase is likely a result of August and September wind and precipitation events.

Discharge operations appears to have slightly impacted pH in Hambone Lake, but the effect has diminished by the time the discharge flows through Powder Mag Lake.

Calcium, iron and sulphate concentrations have increased, most likely affected by discharge operations. Key components of chemicals used in the treatment process are calcium hydroxide and ferric sulphate. These have long been treatment chemicals of choice for arsenic removal and were approved treatment chemicals for Tundra site remediation.

14 Recommendations for the 2013 Treatment Season

Recommendations for the 2013 treatment season fall into three main categories:

- Quality Control and Quality Assurance;
- Operational; and
- Environmental recommendations.

A thorough evaluation of these recommendations will ensure smooth operations for the 2013 treatment season and will allow onsite water treatment operations to proceed smoothly, with minimal interruption. It will also allow for the proper preparation of contaminants for final disposal and/or de-commissioning, such that there is minimal, if any, environmental impact.

14.1 Quality Control and Quality Assurance

- **New Method for Onsite Analysis**:

  The onsite method utilized for zinc in the 2012 treatment season was not able to adequately meet the lower limit of .010 mg/L outlined by the Hach test method (see Appendix H – Onsite Testing Methods).

  There was a third party lead exceedance detected in the water during a period when the plant was off-line. The plant had previously shut down due to the inability to produce repeatable, accurate results for zinc. The lead exceedance was not detected with the onsite testing regime and more information regarding this exceedance is outlined in the following section.

  Additionally there were challenges with the arsenic test, in that there are so many steps to the test, it was difficult to achieve onsite repeatability of the test. The onsite arsenic results were also significantly lower, in most cases, than the off-site results however this was not always by a consistent amount.

  The correlation study provided for the 2012 season left some questions unanswered. In order for onsite accuracy and repeatability, a new onsite testing method is recommended for the upcoming and for what is anticipated as the final treatment season.

Verification of Third Party Results and Improved Delivery Times

2012 operations relied heavily on results from third party laboratories for confirmation of results as well as for discharge authorization. It is possible that field operations from 2012, in fact, relied *too* heavily on third party laboratory results. There was no third party QA-QC program performed on the laboratory used, and in some cases the laboratory provided results that did not seem logical.

This heavy reliance should instead be replaced by a QA-QC check to verify the degree of accuracy of the third party results, especially if results exceeding the contract limits, or fall outside of the range of those normally anticipated.

Issues with delivery times from the lab was a problem and this could be easily remedied by spending time with the lab to develop an understanding of timelines required for the Tundra Mine site project.

In addition, there were several sets of results returned from the laboratory that were confirmed as errors, as well as a few sets of results that were left unchallenged because field personnel did not have any reason to suspect a laboratory error:

- On July 19, a third party result of 30 mg/L for TSS was received and upon request for a re-test this result was changed by the laboratory to a value of 8 mg/L;
- An August 5 raw sample taken from Lower Pond was accidentally labelled as a treated sample by the laboratory;
- June 12 (first day of discharge) the third party laboratory reported treated results of .725 and .705 mg/L total arsenic. This was initially thought to be an error in labelling and is more fully detailed in Sections 11.9 and 11.10 of this report; and
- June 18 and June 19: Third party high raw and treated lead results were received (Raw = 2.00 mg/L, Treated = .059 and .070 respectively for June 19th – in fact the plant was shut down during this period due to concerns over adequate onsite detection of zinc), however SNP results from Appendix D outline June 19th lead results in raw water of .0019 mg/L and lead in treated water end of discharge pipe as .0007 mg/L, both well within the discharge limits. At the time, onsite operations believed a 'lead anomaly' had occurred and only upon review of information provided in the SNC reports does it point to the possibility of a laboratory error; and

Communication and Sharing of Third Party Resutls

Only upon review of the Seasonal SNP reports did some of the questions relating to third party laboratory analysis come to light. If, in fact, the SNP results and other public results of water analysis' can be shared upon receipt with field operations' at the Tundra Mine site, this could serve as partial third party QA-QC and quickly help confirm validity of laboratory results.

14.2 Operations

- **System Failure Preparation Plan (system redundancy)** :

Ensuring a back-up plan is in place in the event of primary equipment failure, specifically for raw intake supply and discharge pumps will allow for smooth process operations and unnecessary or unexpected shutdowns. This would involve evaluating the "what-if's" for the various operational issues and also should include emergency operations and procedures to take in the event of process or equipment failure; and

- **Primary TSS Reduction**:

The remainder of the water to be treated from the tailings ponds is high in TSS. In fact near the end of the 2012 treatment season the raw supply TSS exceeded 300 mg/L and it was decided to shut down the process. There are low volumes of outlying shallow water which will need to be pumped from a variety of locations for treatment. It would alleviate the possibility of TSS contract exceedances if this water was pumped to one holding location, and then delivered through a minimum one day retention clarification stage to the water treatment plant intake (by gravity, if possible). This will effectively reduce the TSS to a level where it can be treated further to ensure it remains within contract discharge limits. Another (and probably less expensive) option to primary settling is the introduction of high throughput filters which can be combined in a header to provide the suspended solids reduction desired. These filters are disposable and can be changed as required. They are a low capital cost item with a small footprint which could be easily introduced on the raw supply end, (and also on the discharge end, if deemed necessary) in order to overcome this challenge.

14.3 Environmental

- **<u>Sludge Handling Program</u>**:

  Perhaps the largest challenge for water treatment operations is what is left behind when all the water is treated, combined with limited timelines introduced by seasonal constraints and equipment availability.

  Once the tailings water is treated, there will be approximately 1.5 million kilograms of sludge to dispose of. We suggest that in order to safely, efficiently and effectively dispose of this sludge, pilot testing and development of a sludge handling program be developed as soon as possible to allow for the proper de-watering and disposal of the sludge remaining in Geotubes. There are many ways of dealing with the sludge however it will be challenging to find a method that is easy, safe, effective and efficient; and

- **<u>Water Plant De-Commissioning Plan</u>**:

Like the remainder of the sludge in the Geotubes, there will also be remaining sludge and chemical in the reactor and batch tanks to deal with. Simple shut-down and winterization during the final treatment season will not be possible. A plan should be developed that can easily and effectively be carried out onsite for the proper removal, disposal and/or decommissioning of the water treatment plant and associated components and chemicals. An advance plan that all parties have agreed with and approved will ensure smooth onsite future operations while minimizing any elements of surprise and/or unnecessary project costs or delays.

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15.1 Appendix A – Tundra 2011 – End of Season Tailings Water Treatment Report WESA

15.2 Appendix B – Analysis of Treatment Chemicals

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15.4 Appendix D – 2012 SNP Results – Tundra Mine Remediation

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15.1 Appendix A – Tundra 2011 – End of Season Tailings Water Treatment Report WESA

Appendix A

Tundra Mine 2011
Tailings Water Treatment Report

WESA

WASTEWATER TREATMENT PLANT
SEASONAL REPORT 2011

PHASE 2 REMEDIATION
TUNDRA MINE SITE, NT

Prepared for:

Aboriginal Engineering
100 Archibald Street
Yellowknife, NT X1A 2N1

Prepared by:

A Better Environment For Business

WESA Technologies Inc.
The Tower, The Woolen Mill
4 Cataraqui Street
Kingston, ON K7K 1Z7

WESAtech Project#: W-T8603

December 2011

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1.0 CORPORATE PROFILE

WESA Group Inc. is an employee-owned consulting firm specializing in the fields of contaminant and water supply hydrogeology, engineering, earth sciences, industrial hygiene and occupational health & safety. WESA Group Inc. (WGI) is composed of WESA Inc. (WESA), WESA Technologies Inc. (WESAtech), and OEL.

- WESAtech provides water and wastewater treatment expertise, which includes design, build, and operation services, culminating in training owner representatives.
- WESA provides expertise in environmental engineering and assessment, project management, contract management, health and safety and quality controls.
- OEL provides knowledge in hydroelectric systems, design, tendering and project construction management including environmental assessments and associated components.

The company has a staff of over 140 highly qualified scientists, engineers, industrial hygienists, environmental auditors, project managers, environmental risk specialists, financial specialists and support personnel. Most of the members of the senior management team have worked for WESA for more than 10 years. The company work ethic is focussed on service, innovation and integrity. This is reflected in the company's broad client base; many clients have relied on WGI's services for over two decades.

2.0 INTRODUCTION

WESAtech was retained by Aboriginal Engineering Ltd. (AEL) to design, build, and operate a wastewater treatment plant (WWTP) capable of removing contaminants from water contained in the Tailings Containment Area (TCA) at the Tundra Mine site, Northwest Territories.

The WWTP was designed to remove arsenic and associated metals, described in **Table 1**, through chemical precipitation. The precipitation of the metals was executed using ferric sulfate ($Fe_2(SO_4)_3$) and hydrated lime ($Ca(OH)_2$), at a minimum iron to arsenic ratio of five to one by weight. A flocculent (floc) is then formed by adding a polymer flocculating agent (flocculent) to trap the precipitated metals in a filterable particle. The particle is then removed from the water using Geotube® geocontainment technology.

Table 1: Discharge criteria as found PWGSC's original tender document

Parameter	Unit	Maximum allowable concentration
Metals		
Total arsenic	mg/L	0.2
Total copper	mg/L	0.01
Total lead	mg/L	0.01
Total nickel	mg/L	0.05
Total zinc	mg/L	0.02
Anions		
Nitrate as nitrogen	mg/L	5
Nitrite as nitrogen	mg/L	0.4
Conventional Parameters		
Total ammonia as nitrogen	mg/L	5
Total suspended solids (TSS)	mg/L	15
pH	-	6 – 9

3.0 WASTEWATER TREATMENT PLANT CHEMICAL PROCESS DESIGN

The design of the WWTP relies on the principles of the physical-chemical entrapment of metals, by converting them from an aqueous dissolved state to a solid state. The treatment process is comprised of four steps which are coagulation, pH adjustment, flocculation and solid entrapment.

3.1. COAGULATION

The first step in the arsenic removal process, coagulation, was performed in the first reactor by the injection of a $Fe_2(SO_4)_3$ solution at a minimum ratio by weight of five to one $Fe_2(SO_4)_3$ to arsenic. In this process, soluble arsenic reacts with the coagulant to form a precipitate.

The removal of lead and zinc below the water license discharge criteria was attained by targeting the suspended solids; a strong linear correlation was found between the total suspended solids (TSS) concentration, and the total concentrations of both lead and zinc. The removal of these metal particulates was facilitated by the agglomeration of the suspended and colloidal solids with the chemically induced flocs formed during the coagulation and flocculation steps. These flocs are physically removed from the water by entrapping them in the Geotubes®. When an increase in the soluble fractions of lead and zinc were observed, the injection of a sodium metabisulfite (SMBS) solution was used to assist in the precipitation of these elements as metal sulfides.

3.2. pH Adjustment

The optimum removal of soluble arsenic (as a hydroxide precipitate), as well as lead and zinc (as sulfide precipitates) is achieved at a pH of 8.5; this is the point at which the solubility of these chemically induced precipitates are at their lowest. For this reason, a $Ca(OH)_2$ solution was injected into the second reactor in the treatment process in order to increase the pH to 8.5 following the addition of the $Fe_2(SO_4)_3$, to optimize metals removal.

3.3. Flocculation

To aggregate the metal precipitate colloids and the particulates into a heavy and suspended floc, a polymer flocculent solution was injected into in the third rector of the treatment process. This polymer, which has a high molecular weight, allowed the colloids to aggregate together into flocs which results in a high removal efficiency of solids.

3.4. Solids Removal

The flocs containing both metal precipitate and suspended solids was removed as the wastewater with the addition of chemicals passes through the Geotube® geocontainment bags; the Geotubes® acted as filter. The flocs were captured in the matrix of the Geotubes®, while the filtrate, free of metal solids, was pumped to Hambone Lake for environmental discharge.

4.0 PLANT DESIGN AND CONSTRUCTION

The 2011 Tundra Mine WWTP was designed based upon existing knowledge, and past operational experiences encountered in the previous two project seasons. The WWTP built and operated during the 2010 project season underwent an extensive review, and deviances from the proposed design upgrades at the end of the 2010 project season are discussed in Section 4.8. The 2011 treatment facility was designed to operate as a triple train system, with each train capable of operating at a maximum capacity of 150 m^3/hr. The PWGSC water license issued by the MVLWB dictates that the plant can discharge to Hambone Lake at a maximum daily average of 275 m^3/hr. The chemically treated water exiting the WWTP was sent to a set of six Geotubes® contained within a bermed and lined area. The discharge from the Geotubes® was collected in a discharge sump prior to being pumped to the final discharge location, which is directly into Hambone Lake as per the Crown request. This is a change from the previous 2009 and 2010 seasons, where discharge was performed in Hambone lake wetlands area.

4.1. Platform Construction

WESAtech arrived at Tundra Mine site on the 27 April to begin the construction of the WWTP. The treatment system was erected on a site-assembled plywood platform, approximately 27 m by 45 m, and is located entirely within the containment area of the Upper Pond. The platform was divided into three steps, each successive step decreased in elevation by approximately 150 mm; the changes in elevation were introduced to provide enough hydraulic head to achieve the target treatment flow rate. Any overflow or spills from the WWTP flowed by gravity into Upper Pond. The site was powered using a fuel powered generator designated to solely provide power to the WWTP. The frame work used to support the WWTP equipment was a "Sikla" system is made from hot dip galvanized steel for outside use, and can remain in place. The Sikla steel framing system was lagged into the plywood platform. Throughout the construction phase, delays were encountered due to material shortages and civil construction limitations.

4.2. Chemical Reaction Tanks

The 37.85 m^3 Onion tanks were installed in series for each of the three trains. These HDPE tanks were placed on protective lay down mats. The piping for air agitation, process flow, and chemical injection was installed in each tank as required. The tanks were connected to each other with 305 mm schedule 80 PVC pipes, and flow between the tanks was controlled using 305mm wafer butterfly valves. Individual tank levels were controlled by adjusting valve between tanks.

4.3. Influent Distribution

The influent distribution header of the plant was made of schedule 80 PVC pipes and provisions had been implemented to control flow to the header using two 150mm butterfly valves. Flow to each train was controlled using two 200mm butterfly valves. A flow meter was mounted on each treatment train to enable the operator to balance the flow between the trains, and totalize the total amount of water entering the WWTP. The influent flow to the plant was supplied using two 150 mm diesel powered Godwin pumps, located in the Southwest corner of Lower Pond except near the end of the season when one of the intake pump was moved into Upper Pond. The untreated water was transferred from the pumps to the plant using two 150 mm layflat hoses. In the event that one of the pumps was taken offline, the influent header was designed such that one pump could supply a reduced flow rate to all treatment trains.

4.4. pH Control

The process piping exiting the first and second process tanks, where $Fe_2(SO_4)_3$ and $Ca(OH)_2$ were added respectively, had online pH monitoring to observe individual tank performance. The pH meter following the $Fe_2(SO_4)_3$ was installed as a method to indirectly monitor the $Fe_2(SO_4)_3$

dosage between calibrations of the $Fe_2(SO_4)_3$ dosing pumps; this was evaluated by ensuring the pH exiting the ferric tank was between 4.5 and 6. The pH meter following the $Ca(OH)_2$ addition was used to ensure the target pH of 8.5 was maintained to meet discharge criteria and to achieve the correct solubility of the metal fractions.

4.5. Chemical Agitation and Flow

All chemical solution makeup tanks were installed on the West end of the platform, and were plumbbed such that chemicals could be dosed to each of the treatment trains. Mixing in the $Fe_2(SO_4)_3$ and $Ca(OH)_2$ makeup tanks was achieved using a combination of both air and two mechanical agitators per tank. The air was provided by two 5 Hp positive displacement blowers. Each of the three polymer makeup tanks were agitated using one VFD controled mixer. The first and second process tanks were agitated with air supplied by two 10 Hp positive displacement blowers mounted between the treatment trains. Each of the blowers were complete with environmental enclosures, inlet filter, and discharge silencers. Air from the blowers was directed into a valved control manifold that can direct and control air flow individually to each diffuser drop in the appropriate process tanks or the chemical makeup tanks. Each drop is fitted with a neoprene capped durlin body hydro check diffuser, to allow forward air flow and then to close to prevent reverse flow into the drop to prevent clogging. The third and final process tank, where polymer was dosed, was agitated using two mechanical agitators.

4.6. Chemical Dosage Pumps

The chemical dosing pumps were mounted in close proximity to the appropriate chemical makeup tank they pumped from. One pump for each of the $Fe_2(SO_4)_3$, $Ca(OH)_2$, and polymer makeup tanks was dedicated to each train; a secondary pump for the dosing of the $Ca(OH)_2$ was also installed. The pumps were selected such that the target dosing rate fell in the middle of its maximum pumping capacity. The pumping rate for each pump could be manipulated by adjusting its stroke length and frequency.

4.7. Geotube Laydown Area

The Geotubes® were installed in a bermed containment area that was lined with a 15 mm thick polyethelene liner. The area was constructed with a slope from end to end to allow the water to drain from the tubes and flow to the central collection point. The geotubes sat on a filtration layer to allow better drainage at the bottom of the tubes. The Geotubes® were anchored to the earth outside of the berm using buried steel pipe for anchors; this prevented the Geotubes® from moving during the initial filling process. The two model GT500's for each treatment train were located adjacent to each other.

Discharge from each treatment train flowed through a manifold directing the flow into four 150mm layflat lines, which were installed into the first two inlet ports closest to the plant of each Geotubes®. During the beginning of the project season only Trains 2 and 3 were commissioned due to civil works in Upper Pond. The commissioning of Train 1 was not completed until 27 July. The construction of the three treatment trains was completed before the commissioning of Trains 2 and 3 began.

4.8. Design Upgrade Deviences

The following recommendations that were outlined in the 2010 end of season report were not adopted, or require alterations for the 2012 project season:

- Tailings disturbance at the intake pumps
- Floating intake lines to avoid tailings in the treatment system
- Silt curtain to reduce tailings capture
- Pump failure alarms
- Communal sump
- Effective weirs between laydown area and sump
- Discharge intake not floating

Each of these items will be reviewed for future design considerations for the 2012 project season.

5.0 CHEMICAL FORMULATION

Before the on-site work at the Tundra Mine could begin for the 2011 project season, the quantities of the chemicals required were calculated, purchased and delivered to the site. These calculations were based on the contaminant concentrations of the water contained in Lower Pond during the 2010 project season. It was assumed that the contaminant concentrations of Lower Pond's water during the 2011 project season would comparable. A summary of the untreated wastewater contaminant concentrations from 2010 is presented in **Table 2**.

Table 2: Summary of Lower Pond's contaminant concentrations during the 2010 Tundra Mine project season

Substances	Feed Wastewater Concentration (mg/L)
Total Arsenic	1.99
Total Copper	0.0023
Total Lead	0.0007
Total Nickel	0.0013
Total Zinc	0.0114
Total Ammonia (as N)	<0.01
Nitrate (as N)	0.29
Nitrite (as N)	0.03
TSS	8
pH	8.25

On 22 June, on-site testing of the raw contaminated wastewater began. The purpose of this testing was to characterize the raw wastewater and compare it to the 2010 data. Both on-site and off-site testing were performed[1]. Most of the contaminants meet discharge criteria with the exception of: arsenic, zinc, lead and TSS; this data is presented in **Table 3**. Laboratory results gathered prior to the plant start-up have shown significant variability in its quality; sudden increases in both the suspended solids and metal concentrations were observed. Raw data is presented in **Appendix A**. The most significant differences between the wastewater data from the 2010 season to the 2011 project season are the higher concentrations of lead, zinc, and TSS. The average zinc concentration in 2011 appears comparable to that of 2010; however, consideration of the standard deviation statistically indicates that the zinc concentration can periodically exceed discharge criteria.

It was also demonstrate that the rise of zinc and lead is attributed to the increase of suspended solids in wastewater. Indeed, sudden increases of zinc and lead in raw water can be directly correlated to the rise in suspended solids with a correlation coefficient of 61.4 % and 79% respectively. When the concentrations of suspended solids are lessened, the total zinc and lead concentrations are also lowered and consistently below discharge criteria. The soluble fraction of these metals are therefore well below discharge criteria and thus, <u>lead and zinc can be removed to discharge level by targeting the removal of suspended solids.</u> While this is not the only contributing factor the TSS is the most targetable component of the influent water. Thus by removing TSS it allows for the control of these metal concentrations.

[1] Comparison between on-site and off-site testing discussed in the *Correlation Survey* Report.

Table 3: Influent 2011 Average Feed Wastewater Characteristics*

Parameter	Units	Average Feed Wastewater Concentration	Standard Deviation	Number of samples tested (n)
Total Arsenic	mg/L	1.54	0.17	52
Total Copper	mg/L	0.0028	0.0013	49
Total Lead	mg/L	0.0081	0.0062	50
Total Nickel	mg/L	0.0052	0.0016	49
Total Zinc	mg/L	0.0097	0.0075	50
Total Ammonia (as N)	mg/L	<0.05	-	41
Nitrate (as N)	mg/L	<0.05	-	44
Nitrite (as N)	mg/L	<0.05	-	44
TSS	mg/L	30.1	40.8	49
pH	-	8.29	0.10	45

* Analytical results that are below the method detection limit (MDL) were considered to be half of the MDL value.

As part of the on-site testing program wastewater from Lower Pond was used to perform small scale experiments in the field laboratory by WESAtech's environmental monitor, with the support of a Geotube® representative. This was done to confirm the required chemistry for both the conditioning phase of the Geotubes® and normal operation.

5.1. Arsenic Removal

The dosage of $Fe_2(SO_4)_3$ and polymer during normal operation of the first two project seasons was 75 mg/L and 0.5 mg/L, respectively. $Ca(OH)_2$ was added as necessary to achieve a pH of 8.5. The dosage rates for the $Fe_2(SO_4)_3$ and polymer were optimized and yielded good results. This year's small scale experiments were first performed using the historical dosage of $Fe_2(SO_4)_3$, and polymer. The results obtained were satisfactory yielding uniform flocs, and a reduction in the turbidity. However, the size of the floc appeared smaller than previous years; this result was attributed to the higher TSS concentration that was observed. The higher observed TSS decreased the stability of the floc and prevented the formation of larger floc particles. The active sites of both the coagulant and polymer were being consumed by the suspended solids, as opposed to the dissolved metals in the wastewater.

Additional experiments were performed by using a polymer dosage range between 0.5 mg/L and 3.0 mg/L Even though good flocs were obtained at an historical average concentration of 0.5 mg/L, the best dosage to overcome the increase in suspended solids was obtained at 1.5 mg/L with great floc formation in size, uniformity and strength as well as little residual turbidity. Polymer dosage concentrations between 1.5 mg/L and 3.0 mg/L also proved to be adequate, but residual unbounded polymer was observed. However, a polymer dosing rate of 3.0 mg/L was used during the commissioning phase of the Geotubes®, as recommended by their expert, to adequately coat the interior membrane and minimize bleed through of the solid material.

To verify the $Fe_2(SO_4)_3$ dosing rate, on-site experimentation included varying the $Fe_2(SO_4)_3$ dosage from 45 mg/L to 150 mg/L. The results of the small scale laboratory experiments indicated that a $Fe_2(SO_4)_3$ dosage rate of 75 mg/L yielded the best arsenic removal, with a residual concentration of 0.03 mg/L. It was found that a higher dosage of $Fe_2(SO_4)_3$ produced similar floc formation matters as the 75 mg/L dosage; however, lower $Fe_2(SO_4)_3$ dosages yielded fair to insufficient arsenic removal, along with smaller and less stable floc.

The lime dosing rate depended on the calco-carbonic equilibrium of the wastewater. Jar tests revealed that the required lime dosage rate varied from 32 mg/L and 45 mg/L. On rare occasions did the required lime dosage increase to 50 mg/L.

5.2. Lead and Zinc Removal Sodium Metabisulphite

Even thought the zinc and lead residual concentrations were consistently below discharge criteria during the commissioning period, jar tests were nonetheless performed with the injection of sodium metabisulphite (SMBS). Small scale experiments were conducted to determine the optimal dosage rate for SMBS for the purposes of removing both lead and zinc. It was determined that the best injection point for the SMSB was the coagulation tank; this yielded good floc formation and little residual turbidity. It was found that an SMBS dosing rate of 30 mg/L to 60 mg/L yielded good removal efficiencies of both lead and zinc. Residual concentrations of these contaminants were typically less than 1 μg/L.

6.0 COMMISSIONING OF THE WWTP

6.1. Chronology of Plant Commissioning

The commissioning of the WWTP was initiated late June by WESAtech representatives, and required that the following steps be completed: dry start-up, wet start-up, and Geotube® commissioning. **Table 4** presents the chronology of the plant commissioning. The treatment trains were brought online throughout the season as soon as it was feasible.

Table 4: Chronology of plant commissioning

Initiation Date of Commissioning Step	Train 1	Train 2	Train 3
Dry start-up	27 June	27 June	27 June
Wet start-up	6 August	6 July	28 June
Geotube Conditioning	6 August	7 July	30 June
Discharge to Hambone Lake	24 August	12 July	12 July

6.2. DRY STARTUP

Dry start-up was conducted using untreated water. All electrical components were checked for rotation where necessary, and all others were checked for function. Tanks were filled with water to check for leaks, and air was introduced to ensure diffusers operated properly. Chemical pumps were primed using water and mixers were energized to ensure proper action. All mixing devices and tanks were operational and in line with the design.

6.3. WET STARTUP

As part of wet start-up, the chemical conditioning of the reaction tanks was first initiated over a period of a few days. During this step, the Geotubes® were bypassed and the chemically conditioned water exiting the flocculation tanks was sent directly into the individual discharge sumps. This water with containing flocs was not discharged to Hambone Lake, but rather pumped back to Lower Pond. Chemicals were added to condition each tank and build up a floc mass in the flocculation reactors. The chemical dosages were then optimized to confirm that the scale up from the jar tests to the plant would meet all requirements in terms of metal removal, as well as floc size, strength, and stability.

The ferric dosing concentration was initiated first at 75 mg/L. Increasing the concentration of the coagulant proved to be necessary during scale up in the field due to the flow continuum and the sudden variations in the turbidity and TSS concentrations of the wastewater. The concentrations varied from 105 mg/L to 150 mg/L as per the operator observations required to maintain great floc formation. Please note that the dosing always exceeded 75 mg/L. The lime was dosed according to the pH requirement of 8.5. The dosing rates varied considerably considering that the characteristics of the tailings wastewater varied as well. The polymer dosage varied between 1.5 and 3 mg/L upon floc requirements. The agitation of the tanks was optimized based on the tank configuration and on the positioning of the mixers/diffusers. The flocs were then consistently uniform, stronger, larger and the turbidity was considerably lower.

Further, the quality of the wastewater deteriorated as the project season progressed; gradual increases in the arsenic, lead, zinc, TSS concentrations were observed. Due to the elevation of contaminates in the influent the process water used for batching chemicals represented a secondary source of elevated contaminates. By using the wastewater to formulate the $Fe_2(SO_4)_3$ solution, some of the iron needed to precipitate metals from solution in the WWTPs influent water is being consumed before it is added. Similarly, the wastewater is being used to formulate the $Ca(OH)_2$ solution. The dosing of the $Ca(OH)_2$ effectively introduced an additional stream of untreated water, which was compensated for by increasing the $Fe_2(SO_4)_3$ dosing rate.

6.4. Geotube Commissioning

The plant flow was initiated and entered the Geotubes® upon the completion of the chemical balance in the treatment plant. Before intiating Geotube® comissioning, flow to the plant was turned off and the sump areas were inspected and cleaned of any residual floc to ensure compliance. Once completed the chemical dosage was increased to 3 mg/L as recommended by the Geotube® expert and developed during the small scale experiments. The water exited the Geotubes® and flowed over the weir and into the individual sump areas. Due to a lack of laydown space within the containment area, the Geotube® communal sump was not built. Treated water from sumps 2 and 3 overflowed into sump 1. From there, the water would overflow into Upperpond, or was pumped with an 200 mm diesel powered Godwin pump to the final discharge locaton at Hambone Lake. Prior to reaching the final discharge location, the treated water passes through a 254 mm flowmeter that displays the flowrate and records the total volume of treated water being discharged. This flowmeter was powered by a portable diesel powered light plant. Once commissioning was complete samples were taken for discharge approval by WESAtech. Upon submission of the laboratory results, AEL applied for discharge approval through the AANDC Water Inspector. Once granted, discharge began to Hambone Lake.

7.0 OPERATION SUMMARY

Overall the WWTP operated for a total of 92 days discharging into Hambone Lake 527,222 m^3 of water during the 2011 season. On October, 10th 2011 the decision was made to shutdown the WWTP due to inclement weather causing plant components to freeze. Performance in regard to compliance of the water license will be discussed in Section 9.0.

7.1. Discharge Scenarios

Prior to the commencement of the 2011 Tundra Mine remediation project season, there were discussions with regards to two potential scenarios in which water may be discharged to the

environment after treatment. Water was only discharged to Hambone Lake after written approval was received from the AANDC Water Inspector, formerly INAC, on 9 July.
The proposed Discharge Scenario A outlined that after commissioning of both the WWTP and the Geotubes® was complete, and environmental discharge approval was granted, the treated water exiting the Geotubes® would be transferred by pump, or overflow into Upper Pond. This was also provided that all civil works removing tailings from Upper Pond were completed. The proposed discharge scenario was such that the plant could be operated at its full capacity of 450 m^3/h, and all of the treated water would have been transferred to Upper Pond; its capacity is approximately 200,000 m^3. This would have offered both holding and buffering capacity, and allowed treated water to be discharged after the WWTP is shut down for the season into Hambone Lake. For Upper Pond to be converted into and effluent holding pond, all contaminated material had to be removed and baffles installed to increase its hydraulic retention time. Due to various delays, the removal of tailings from Upper Pond was not completed until 9 September. At this time, untreated water was pumped from Lower Pond into Upper Pond filling it by the end of the project season. For this reason Discharge Scenario B was implemented.

The proposed Discharge Scenario B outlined that if Upper Pond was not ready to be used as a treated water communal sump, Upper Pond would be bypassed and the treated water would be pumped from the Geotube® sump directly to Hambone Lake. Discharge Scenario B was implemented from 9 July, until 6 September; the WWTP treated water from Lower Pond at a rate of 275 m^3/h. 275 m^3/h of treated water was pumped from the Geotube® communal sump to Hambone Lake. On 6 September Discharge Scenario B was modified. The East end of Upper Pond had been cleaned of contaminated material, and an overflow weir from Geotube® Sump 1 was constructed and reinforced to minimize the effect of erosion. From 6 September until 12 October, the WWTP treated tailings water at a rate between of 280 m^3/h and 320 m^3/h. Treated water was pumped from the Geotube® communal sump at a rate of 275 m^3/h to Hambone Lake for environmental discharge, while excess water overflowed into Upper Pond. During this time, untreated tailings water from Lower Pond was also being pumped into Upper Pond.

7.2. AANDC Discharge Approval

Discrete combined effluent samples from Trains 2 and 3 were collected on 9 and 10 July during the commissioning period, and flown to Yellowknife for analysis at an accredited laboratory. The analytical results demonstrated that the two treatment trains successfully met discharge criteria with an average of 5.9 ± 2.2 mg/L suspended solids, 73.1 ± 8.6 μg/L total arsenic, 6.6 ± 4.2 μg/L total zinc, as well as 0.86 ± 0.04 μg/L total lead.

When conditioning of the Train 1 Geotubes® was completed, discrete effluent samples were collected on 14 to 16 August, and sent for anlaysis. The analytical results demonstrated that the treatment train successfully met discharge criteria with an average of 3.8 ± 2 mg/L suspended solids, an average of 29.6 ± 10.4 μg/L total arsenic, as well as non detectable levels of lead and zinc.

After each event, submissions to the AANDC Water Inspector was performed by Aboriginal Engineering Ltd. to gain approval to discharge to Hambone Lake.

7.3 PLANT WINTERIZING

The operators noticed the plant freezing on Oct 10th 2011 and therefore had to shut it down. Train 1 was officially shut down for the season on Oct 10th 2011 at which time the teardown/winterization began. The tear down/winterization of the other two (2) trains began the following day, on Oct. 11th 2011.

Start-up of the WWTP in the spring of 2012 will be much quicker and easier than in previous years. Rather than undertaking a major deconstruction/reconstruction of the plant, it was decided this year that any equipment that could be safely left in position without damage was to be left in place over the winter months. Only the equipment that must be stored indoors was removed from the plant platform. This equipment will simply have to be reconnected for the 2012 operating season.

Pictures of the WWTP winterizing phase and storage of equipment are presented at the end of text from **Figure 11** to **Figure 24**.

Chemical Tank Makeup Area

At the end of the season, some chemical injection lines had frozen. During teardown/winterizing, these lines were drained as best as possible and left in place. Chemical pumps and other equipment that had frozen were thawed out using “Frost Fighter” heaters and then drained, cleaned and dried prior to final storage. Chemical pumps and fittings, such as foot valves, etc. were placed on pallets and stored in the Seacan located next to the WWTP. Mixer motors were removed from the framing, and placed in the Seacan as well. All valves that remained in place on the platform were placed in the open position to prevent cracking over the winter.

The ferric onion tanks were drained, rolled up, wrapped up with their laydown mats and left in place on the WWTP platform where as the lime makeup onion tanks were drained and left in place on the deck.

The polymer and sodium metabisulfite makeup tanks were drained, flipped upside down and secured to the WWTP platform using lag screws. The lids were stored in the Seacan.

The chemical makeup blowers were serviced, covered with tarps and left in place on the WWTP platform. The "Sikla" framing was left mounted on the platform, ready for reuse next season.

Treatment Trains Area

All process onion tanks were drained within 6"-8" (150-200 mm) of being empty. A 30' x 100' (9m x 30m) tarp was placed over each of the (3) three rows of onion tanks. This tarp was then strapped down to the deck with wood strapping and nails. All 12"(305mm) pvc piping was disconnected. This piping was placed on top of the Ferric make-up tanks.

All valves were thawed, cleaned and dried. They were then stored in the storage room next to the operators shack. Influent flow meters were removed, thawed, cleaned and dried prior to storage in the Seacan. Transmitters and pH sensors were removed and shelved in the storage room as well as all miscellaneous fittings such as but not limited to backpressure valves, flow alarms, injection & sample port valves, etc.

All mixers, process air diffuser drops, were disconnected, removed and placed in the Seacan where as the process blowers were serviced, wrapped in tarps and left in place on the deck. The electrical control panels were left intact on the WWTP platform. A plywood enclosure was constructed around all 3 panels. The roof of this enclosure was wrapped with tarp. The discharge flow meter was removed and brought to the WWTP to be stored within the Seacan.
A complete inventory of the equipment and its location was performed by WESA personnel and submitted to AEL prior to closing up and WESA leaving the Tundra Mine site.

8.0 MAINTENANCE CHALLENGES AND RECOMMENDATIONS

8.1. BALL CHECK VALVES

During the course of the 2011 project season, one ongoing issue was the plugging of ball check valves of chemical dosing pumps. Attempts to mitigate this problem were made during the season by placing screens, or loose mesh fabrics over the suction end of the foot valves. This prevented the accumulation of grit in the ball check valves, but resulted in the complete plugging of fabric or screen stopping all flow. If the removal of suspended solids prior to entering the chemical tanks is not possible, check valves will need to be removed once per shift as regular maintenance.

8.2. INFLUENT FEED LINES

During the 2011 project season, when one of the influent feed lines to the WWTP developed a large leak, the water entering the WWTP from an influent line that was intact would short circuit the WWTP and return down the blown line. To prevent this from happening, it is recommended that check valves be installed on the inlet pipes to the WWTP.

8.3. Lime Chemical Addition

It is also recommended that the dosing of the $Ca(OH)_2$ solution into the WWTP be automated. This would not eliminate the requirement of checking the pH entering the flocculation tank, but would minimize the amount of manipulation of the $Ca(OH)_2$ dosing pump and potential operator error.

8.4. Plant Lighting

At the beginning and end of the project season, when it is dark during the night shift, it was very difficult to see into the flocculation tanks and assess the quality of the floc, even with the use of headlamps and flashlights. For this reason, it is recommended that halogen flood lights be installed over the flocculation tanks.

8.5. Electrical

In the middle of the project season, an electrical problem within the panel arose. The 60 amp breaker on blower B-2000 became very sensitive, and should be replaced. The generator used to supply power to the plant had a series of maintenance and mechanical issues in the latter half of the season. Repair or replacement should be considered.

8.6. Hydraulic Considerations

After the commissioning of Train 1 of the WWTP, it was found that its influent flow rate could not be increased beyond 125 m^3/h without overflowing the process tanks. After approximately 1.5 months of operation, the influent flow rate of Train 1 could not exceed 100 m^3/h without overflowing the process tanks. The restriction of the influent flow rate and the deterioration of the hydraulic performance of Train 1 are attributed to the slope that developed along the North side of the platform, as well as the use of rubber discharge hose to feed the Geotube® inlets from the Train 1 Geotube header. The unlevelled platform allowed for the accumulation of sludge and floc in half of the tank, which effectively reduces the size of the tank. Solids also accumulated around the tank outlet restricting its flow. Further, the rubber discharge hose did not expand fully while the treated wastewater flowed through it, adding another flow restriction to the process. It is recommended that the WWTP be repaired and levelled, and that the rubber discharge hose be replaced with rigid green suction hose.

8.7. Geotube Relaxation

As the project season progressed, it was noted that the relaxation of the Geotubes became more and more difficult to relax even after the frequency with which the Geotubes® were relaxed was increased. This may be mitigated by increasing the number of inlets to the Geotubes®. Under its current configuration, green rigid suction hoses are being used to connect the hose from the Geotube® header to the Geotube® inlet. This rigid suction hose extends three feet into the Geotube® and is often sitting on the bottom of the Geotube®. It is suspected that this configuration does not allow for dispersion of the floc allowing it to accumulate at the inlet. It is recommended that PVC connections be used in lieu of the rigid suction hose in order to keep the inlet off the bottom of the Geotube® to promote better dispersion.

9.0 DISCHARGE MONITORING AND QUALITY CONTROL PROGRAM

The Discharge Monitoring and Quality Control Program (DMQCP) was developed to ensure that the performance of the WWTP assessed and recorded properly, during the course of the environmental remediation project at the Tundra Mine, NWT. The DMQCP was implemented to ensure that all on-site practices and procedures, execution of the chain of custody, and off-site laboratory analyses adhere to quality assurance and quality control (QA/QC) policies, relevant territorial and federal regulations and standards, and the quality objectives for the project procedure and deliverables.

9.1. Documentation and Records

For the duration of the on-site work at the Tundra Mine, the documentation requirements, as outlined in the DMQCP, were followed. These tasks include:

- Storing all electronic documents and data (field data, off-site laboratory results, daily and weekly reports, etc.) on both the on-site computer's hard drive and external hard drive;
- All electronic data was periodically archived throughout the project season on CD-ROMs;
- All samples that were collected in the field were labelled with the project number, sampling location, time and date of collection, and sample number, and recorded in both field notebooks and electronic databases;
- All off-site laboratory data was stored and filed, and transcribed to the appropriate electronic database;
- The QA/QC data received for both duplicate analyses and inter-laboratory comparisons were stored and filed, and transcribed to the appropriate electronic database;
- Electronic charts were updated and reviewed regularly, to monitor both the WWTP's influent and effluent water quality;

- Deviations from approved protocols and standard operating procedures (SOPs) were documented in field notebooks;
- Completed chain of custody (COC) forms for all sample shipments were filed, stored and transcribed to the appropriate electronic database.

9.2. SAMPLING

For the duration of the 2011 project season, Discharge Scenario B was employed. For this reason, compliant samples were taken from a sample port installed in the influent pipe feeding the WWTP, and a sample port on the discharge line sending treated water to Hambone Lake. The Geotube® communal sump was considered equivalent to the sample port on the discharge line. Samples from the individual Geotube® sumps were taken as necessary throughout the 2011 project season. For each sampling event, all samples were taken in triplicate; one sample was analyzed on-site, while the remaining two samples were sent to an off-site accredited laboratory for analysis.

As outlined in the DMQCP, compliant effluent samples were taken every six hours per 24 hour period. The sampling frequency for the WWTP's effluent stream was increased as necessary during the project season. One compliant influent sample was taken for every 24 hour period. However, the frequency of the influent sampling increased to as much as every hour as required during the project season.

During the 2011 project season, two different phases in the DMQCP were outlined as the *Correlation Survey* and the *Monitoring Plan*. For both phases, the number of sampling events and the on-site analyses remained the same; however, the number of samples that were analyzed off-site decreased.

Table 5: Summary of both on-site and off-site sampling during the correlation survey

Sampling location	Samples collected per day	Analyses	On-site analysis per day	Off-site analysis per day
Plant inlet	1	As, TSS, pH	1	1
		Pb, Zn, Cu, Ni, NO_2^{-1}, NO_3^{-1}, NH_3	1	1
Discharge port	4	As, TSS, pH	4	4
		Pb, Zn, Cu, Ni, NO_2^{-1}, NO_3^{-1}, NH_3	1	1

Table 6: Summary of both on-site and off-site sampling during the monitoring plan

Sampling location	Samples collected per day	Analyses	On-site analysis per day	Off-site analysis per day
Plant inlet	1	As, TSS, pH	1	Once per week
		Pb, Zn, Cu, Ni, NO_2^{-1}, NO_3^{-1}, NH_3	1	Once per week
Discharge port	4	As, TSS, pH	4	4
		Pb, Zn	1	4
		Cu, Ni, NO_2^{-1}, NO_3^{-1}, NH_3	1	Once per week

9.3. Correlation Survey

As outlined in the DMQCP, a correlation survey was performed for the purposes of developing a correlation between the on-site field instruments, and off-site results from accredited laboratories. This correlation survey began at the start of the commissioning phase of the WWTP on the June 25th, and continued until August 6th. During this time, an intensive sampling and monitoring program was executed. A correlation survey report was submitted to AEL August 17th. Comments in response to the correlation survey from PWGSC, dated September 2nd, were received by WESAtech September 4th. A response to PWGSC's comments was submitted September 11th to their satisfaction; no additional comments in response were received.

For the analysis of arsenic on-site, *Orebecco Arsenic Test Strips* were used. This method was originally to be used as verification of the *PDV6000 plus*, but was used as the primary analytical method due to problems with the *PDV6000 plus*. The field analyses using the test strips were conducted in duplicate. During the correlation survey, the average on-site and off-site arsenic concentrations were measured to be 51.5 μg/L and 46.8 μg/L, respectively. The correlation coefficient that was calculated using both the on-site and off-site arsenic concentration data sets was 0.98, which indicates there was a strong positive linear correlation. Further, the relative percent difference (RPD) was, on average, ±6%. This indicates that there was a small variance between the two data sets.

Due to the detection limits of the *Hach DR2700* spectrophotometer, it was not able to measure accurately the lead and zinc concentrations in the effluent water. The standard operating procedures (SOPs) of the *DR2700* published by the manufacturer were adhered to judiciously, and the instrument itself was operating properly. However, the lead and zinc concentrations in the effluent water were too low for the instrument to measure. For this reason, a correlation could not be developed using the on-site and off-site lead and zinc concentration data. However, it was found that the correlation coefficient between the off-site TSS and lead measurements was 0.79, indicating that there was a strong positive linear correlation between the data sets. Further, the correlation coefficient between the off-site TSS and zinc measurements was 0.614, indicating that there was a good positive linear correlation between the data sets. The on-site TSS data was plotted against the off-site TSS data. A linear regression was performed by setting the y-intercept as zero. The resulting linear function had a slope of 1.21 which indicates that the on-site TSS measurements were higher, or more conservative, than the off-site results. The correlation coefficient was calculated to be 0.93 for the off-site and on-site TSS data; this indicates there is a strong positive linear correlation between the two data sets. From the empirical data that was collected and analyzed, it was concluded that it is adequate to infer the total lead and zinc concentrations using the on-site TSS measurements.

A *PDV6000 plus* metal detector, which employs anodic stripping voltammetry, was introduced at the beginning of the DMQCP for the purposes of measuring arsenic, lead, and zinc in trace concentrations. The *PDV6000 plus* was expected to be the primary instrument for on-site field analyses; however, it was brought offline to overcome variability in its analytical signals. For this reason, the methods originally listed as secondary verification in the DMQCP, were used as the primary field analytical methods. Furthermore, as a complementary arsenic monitoring tool, the arsenic test strips were part of the DMQCP (monitoring plan) and were therefore used as the main arsenic testing tool in lieu of the PDV 6000 plus. This initiative was taken with the approval of all parties involved. Duplicate analyses were performed to introduce QA for the technique as described below. With the support of the manufacturer, the “standard operating procedures” were optimized and the electrodes were revitalized which allowed the instrument to measure, with good precision, the lead, zinc and arsenic concentrations of the effluent when the instrument was brought back on-site September 22th. In conclusion, the PDV 6000 plus metal detector proves to be very accurate when measuring trace levels of heavy metals as a field screening tool.

A memorandum regarding the redeployment of the *PDV6000 plus* dated October 11th was issued. A response by AECOM was issued October 14th for which WESAtech presented an additional memo November 15th.

9.4. Monitoring Plan

The on-site monitoring plan, as outlined in the DMQCP, began August 6th and ended at the conclusion of the project season October 10th. The outlined monitoring plan was adhered with the exception of the late redeployment of the *PDV6000 plus*, as discussed in the previous section.

Throughout the monitoring program, there was no parameter that exceeded the contractual discharge limits. The plant effluent was consistently below the discharge limits.

A summary of the average effluent concentrations of parameters that were monitored as part of the contractual requirements that were measured at the off-site laboratories is presented in **Table 7**. **Figures 1 to 10** represent the trending daily results over the course of the 2011 discharge season. Please note that the results that are below detection limit are represented to be at detection limit. However, when calculating the average concentration and standard deviation, results below detection limit were assumed to be half of the MDL value as it is standard practice.

Table 7: Effluent 2011 Average Wastewater Characteristics*

Parameter	Unit	Average effluent concentration	Standard deviation	Number of samples tested (n)
Total arsenic	mg/L	0.0431	0.0142	178
Total copper	mg/L	0.0022	0.0012	62
Total lead	mg/L	0.0004	0.0002	112
Total nickel	mg/L	0.0029	0.0005	59
Total zinc	mg/L	0.0037	0.0018	110
Total ammonia (as N)	mg/L	<0.05	-	54
Nitrate (as N)	mg/L	0.05	0.05	53
Nitrite (as N)	mg/L	<0.05	-	53
TSS	mg/L	3.0	2.3	89
pH	-	8.21	0.17	96

* Analytical results that are below the method detection limit (MDL) were considered to be half of the MDL value.

9.5. Quality Assurance and Quality Control

The DMQCP outlined a number of quality assurance and quality control (QA/QC) requirements in order to ensure the sampling procedure and handling is executed properly to mitigate the risk of sample corruption, and to ensure that both on-site and off-site laboratory results are accurate.

As described above, all sampling events were conducted in triplicate; one sample was kept on-site for field analyses, and two samples were sent to the off-site laboratory. In the event of an anomalous result, the other two samples collected during the same sampling event could be analyzed by the off-site laboratory. During this season a sample collected September 27th at 8:00 was measured at Taiga to have an elevated zinc concentration of 17.3 µg/L, as demonstrated in **Figure 5**. The off-site duplicate sample was shipped from the Taiga lab in Yellowknife to ALS

Laboratories in Edmonton. The off-site duplicate sample was collected at the same time, and in the same fashion as the primary off-site sample. The duplicate sample was measured to have a zinc concentration of 6.9 μg/L, which indicates that the primary off-site sample was corrupted.

Further, the QA/QC requirements outlined in the DMQCP include the analysis of travel blanks, duplicates, equipment rinses, and inter-laboratory samples. Travel blanks were sent with every shipment, and were used to determine if there was any background contamination during the transport and handling of the samples from the site to the laboratory. Sample bottles were filled with deionised water on site.
Duplicate off-site samples were sent to the laboratory each time; they were only analyzed periodically as per the DMQCP. The collection of duplicate samples provides a measure of precision of the sampling procedure and analytical technique, the heterogeneity of the sample, and was representative of the sampling event and location. As outlined in the DMQCP, 10% of all samples analyzed were to be analyzed in duplicate; 10.4% of samples analyzed were analyzed in duplicate exceeding the QA/QC requirements. The remaining duplicate samples were archived in the off-site laboratory for further analysis when required. All but one set of duplicate samples were within control limits.

Equipment rinses were sent for off-site analysis to verify that all field sampling and analytical equipment was cleaned properly. Cleaned equipment and glassware was rinsed with deionised water; the resulting rinse water was sent off-site for analysis. As outlined in the DMQCP, one equipment rinse will be analyzed for every 20 samples analyzed. During the 2011 project season, approximately one equipment rinse was analyzed every 15 samples, exceeding the QA/QC requirements.

During the 2011 project season, both Taiga Laboratory and ALS Laboratories Edmonton were retained to analyze off-site samples. Inter-laboratory samples involve sending samples to both laboratories from the same sampling event to verify their respective results. As outlined in the DMQCP, 2% of all samples analyzed were to be analyzed at the secondary laboratory; inter-laboratory samples were analyzed at a rate of 2.6%, exceeding the QA/QC requirements. All inter-laboratory analyses returned results that were within acceptable control limits.

10.0 CONCLUSION

The observations, results and design recommendations were based on the conditions encountered during the operation of the Wastewater Treatment Plant during the 2011 discharge period. The implementation of the recommendations provided for the operation and design of the WWTP will allow for a reduced risk of producing water out of compliance, and addresses the past years maintenance issues.

WESAtech has used its professional judgment in analyzing this information and formulating its conclusions. No other warranty or representation, expressed or implied, as to the accuracy of the information or recommendations is included or intended in this report. This report has been prepared for the exclusive use of the Aboriginal Engineering Limited. No other party may use or rely upon this report without the express written permission of WESAtech.

Respectfully submitted,

Wayne Ingham, HED, Ph.D.
Vice-President, Business Development
Principal and Senior Consultant
WESA Inc.

Corinne Proux, M.Eng, Eng
Chemical Engineer
WESA Inc.

TABLES

Sample ID nomenclature:

Location	Purpose	Date	Totalizer Number
A: Influent B1-B2-B3: Flocculation Tanks C1-C2-C3: Individual Sumps D: Communal Sump E1-E2: Upper Pond F: Effluent Discharge Port	ON: On-site OFF: Off-site INT: Inter-lab comparison DOF: Off-site Duplicate EQ: Equipment Rinse Blank TR: Travel Blank	(dd/mm/hh) HH 8AM: 08 2PM: 14 8PM: 20 2AM: 02	xxx

Table 8 : 2011 Off-site Influent Wastewater Characteristics

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
A-ON/OFF-18-06-1130-02	1.25	0.00301	0.0058	0.0017	0.00598	-	-	-	10	-
A-ON/OFF-18-06-1130-03	1.24	0.00296	0.006	0.0018	0.00592	-	-	-	7	-
A-ON/OFF-18-06-1130-04	1.24	0.00302	0.0064	0.0018	0.00592	-	-	-	6	-
A-ON/OFF-18-06-1130-05	1.23	0.00301	0.0067	0.0018	0.00585	-	-	-	8	-
A-OFF-23-06-14-07	1.47	0.00729	0.013	0.0025	0.00571	-	<0.05	<0.05	16	8.25
A-OFF-23-06-14-10	2.16	0.0365	0.0518	0.0085	0.0125	-	<0.05	0.095	166	8.17
A-OFF-24-06-1120-14	1.41	0.00512	0.0118	0.0019	0.00511	-	<0.05	<0.05	7	8.22
A-OFF-25-06-08-18	1.43	0.00862	0.0112	0.0024	0.00556	<0.05	<0.05	0.087	13	8.18
A-OFF-26-06-09-21	1.48	0.0109	0.0123	0.0027	0.00611	<0.05	<0.05	<0.05	30	8.23
A-OFF-26-06-09-24	1.54	0.0128	0.0139	0.003	0.00639	<0.05	<0.05	<0.05	43	8.21
A-OFF-29-06-11-28	1.49	0.0117	0.013	0.0028	0.00587	<0.05	<0.05	<0.05	27	8.2
A-OFF-30-06-18-31	1.52	0.017	0.0164	0.0028	0.00595	<0.05	<0.05	<0.05	69	8.26
A-OFF-01-07-14-35	1.46	0.0143	0.0126	0.0024	0.00548	<0.05	<0.05	<0.05	66	8.27
A-OFF-07-07-02-61	1.37	0.00627	0.0061	0.002	0.00439	<0.05	<0.05	<0.05	14	8.33
A-OFF-09-07-23-93	1.44	0.00496	0.0056	0.002	0.00442	<0.05	<0.05	<0.05	12	8.26
A-OFF-10-07-20-108	1.63	0.0221	0.0189	0.0038	0.00718	<0.05	<0.05	<0.05	134	8.38
A-OFF-11-07-20-125	1.38	0.00408	0.0051	0.002	0.00419	<0.05	<0.05	<0.05	<3	8.33
A-OFF-12-07-20-137	1.39	0.00585	0.0072	0.0023	0.0046	<0.05	<0.05	<0.05	18	8.34
A-OFF-13-07-20-157	1.4	0.00463	0.0054	0.0021	0.00432	<0.05	<0.05	<0.05	8	8.33
A-OFF-14-07-20-174	1.42	0.00499	0.0054	0.0021	0.00445	<0.05	<0.05	<0.05	14	8.35
A-OFF-15-07-20-196	1.72	0.0176	0.0166	0.0041	0.00685	<0.05	<0.05	<0.05	183	8.28
A-OFF-16-07-20-215	1.47	-	-	-	-	-	-	-	-	-
A-OFF-18-07-20-258	1.54	0.00472	0.0061	0.0022	0.0044	<0.05	<0.05	<0.05	11	8.31
A-OFF-19-07-20-284	1.68	-	-	-	-	-	-	-	-	-
A-OFF-20-07-20-308	1.63	0.0112	0.0149	0.0034	0.00568	<0.05	<0.05	<0.05	38	8.43
A-OFF-21-07-20-329	1.55	0.00724	0.0086	0.0026	0.00461	-	-	-	-	-
A-OFF-22-07-02-336	1.5	0.00661	0.0028	0.0045	0.00464	<0.05	<0.05	<0.05	14	8.36
A-OFF-23-07-02-354	1.45	0.00584	0.0051	0.0065	0.00468	<0.05	<0.05	<0.05	6	8.37
A-OFF-24-07-02-375	1.5	0.00474	0.0058	0.0021	0.00394	<0.05	<0.05	<0.05	6	8.39
A-OFF-25-07-02-395	1.62	0.00456	0.006	0.0023	0.00423	<0.05	<0.05	<0.05	7	8.3
A-OFF-26-07-02-412	1.54	0.00349	0.0079	0.0031	0.00441	<0.05	<0.05	<0.05	5	8.35
A-OFF-27-07-02-432	1.6	0.00598	0.0108	0.0034	0.00496	<0.05	<0.05	<0.05	18	8.37
A-OFF-28-07-02-451	1.65	0.00473	0.0063	0.0023	0.00439	<0.05	<0.05	<0.05	10	8.38

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
A-OFF-29-07-02-468	1.62	0.00392	0.0048	0.0022	0.00429	<0.05	<0.05	<0.05	<3	8.4
A-OFF-30-07-02-485	1.69	0.00549	0.0077	0.0024	0.00448	<0.05	<0.05	<0.05	13	8.4
A-OFF-31-07-02-503	1.69	0.00479	0.0081	0.0023	0.00435	<0.05	<0.05	<0.05	9	8.41
A-OFF-01-08-02-521	1.7	0.00392	0.0048	0.002	0.00411	<0.05	<0.05	<0.05	5	8.39
A-OFF-02-08-02-540	1.69	0.005	0.0057	0.0021	0.005	<0.05	<0.05	<0.05	10	8.35
A-OFF-03-08-02-558	1.63	0.00403	0.0055	0.0023	0.00435	<0.05	<0.05	<0.05	16	8.38
A-OFF-04-08-02-577	1.65	0.00456	0.0065	0.0021	0.00418	<0.05	<0.05	<0.05	12	8.36
A-OFF-05-08-02-596	1.66	0.00339	0.0044	0.0019	0.00369	<0.05	<0.05	<0.05	4	8.4
A-OFF-06-08-02-614	1.7	0.00324	0.0044	0.0019	0.00386	<0.05	<0.05	<0.05	5	8.43
A-OFF-13-08-02-748	1.72	0.0042	0.0025	0.0021	0.0037	0.01	<0.01	0.13	8	8.25
A-OFF-20-08-02-957	1.73	0.0067	0.008	0.0025	0.0039	< 0.01	<0.01	0.12	38	8.14
A-OFF-26-08-02-1105	1.65	-	0.007	0.0028	0.0038	<0.01	<0.01	0.11	16	8.15
A-OFF-03-09-02-1290	1.65	0.007	0.007	0.0025	0.0036	0.01	<0.01	0.12	22	8.2
A-OFF-10-09-02-1514	1.8	0.0082	0.0073	0.0023	0.0036	0.01	<0.01	0.11	22	8.2
A-OFF-16-09-20-1736	1.75	0.012	0.014	0.004	0.0047	<0.01	<0.01	0.12	36	8.16
A-OFF-22-09-16-1943	1.53	0.0192	0.022	0.006	0.0098	0.18	<0.01	0.09	90	8.1
A-OFF-26-09-0730-2069	1.36	0.0128	0.014	-	-	-	-	-	108	8.09
A-OFF-27-09-14-2112	1.34	0.0125	0.014	0.0044	0.0076	0.15	<0.01	0.16	48	8.06
A-OFF-04-10-08-2366	1.29	0.0111	0.014	0.0041	0.007	0.14	<0.01	0.19	42	-

Table 9: 2011 Off-site Effluent Wastewater Characteristics

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-09-07-18-85	0.088	0.00097	0.0072	0.0016	0.00309	<0.05	<0.05	<0.05	7	8.22
F-OFF-09-07-23-90	0.0753	0.0015	0.0116	0.0061	0.00295	<0.05	<0.05	<0.05	7	8.21
F-OFF-10-07-04-96	0.0696	0.00105	0.0058	0.002	0.00298	<0.05	<0.05	<0.05	5	8.25
F-OFF-10-07-09-99	0.0619	0.00038	<0.004	0.0012	0.00269	<0.05	<0.05	<0.05	<3	8.29
F-OFF-10-07-13-102	0.0752	0.00036	0.0052	0.0011	0.00283	<0.05	<0.05	<0.05	8	8.28
F-OFF-10-07-20-105	0.0864	0.00059	0.0059	0.0032	0.00287	<0.05	<0.05	<0.05	3	8.32
F-OFF-11-07-02-113	0.0852	-	-	-	-	-	-	-	-	-
F-OFF-11-07-08-116	0.0765	-	-	-	-	-	-	-	-	-
F-OFF-11-07-14-119	0.0557	-	-	-	-	-	-	-	-	-
F-OFF-11-07-20-122	0.0441	0.00052	0.0047	0.0017	0.00259	<0.05	<0.05	<0.05	-	8.22
F-OFF-12-07-02-128	0.0497	-	-	-	-	-	-	-	-	-
F-OFF-12-07-08-131	0.0515	-	-	-	-	-	-	-	-	-
F-OFF-12-07-14-134	0.0535	-	-	-	-	-	-	-	-	-
F-OFF-12-07-02-140	0.0525	0.00088	0.0051	0.0022	0.00236	<0.05	<0.05	<0.05	-	8.31
F-OFF-13-07-02-143	0.0494	-	-	-	-	-	-	-	-	-
F-OFF-13-07-08-146	0.0561	-	-	-	-	-	-	-	-	-
F-OFF-13-07-14-151	0.054	-	-	-	-	-	-	-	-	-
F-OFF-13-07-20-154	0.0526	0.00042	<0.004	0.0015	0.00239	<0.05	<0.05	<0.05	-	8.29
F-OFF-14-07-02-160	0.0478	-	-	-	-	-	-	-	-	-
F-OFF-14-07-08-163	0.0846	-	-	-	-	-	-	-	-	-
F-OFF-14-07-14-167	0.0454	0.0004	0.0079	0.0012	0.00256	<0.05	<0.05	<0.05	-	8.28
F-OFF-14-07-20-171	0.0369	-	-	-	-	-	-	-	-	-
F-OFF-15-07-02-177	0.0366	-	-	-	-	-	-	-	-	-
F-OFF-15-07-08-180	0.0414	0.00038	<0.004	0.0012	0.00252	<0.05	<0.05	<0.05	-	8.23
F-OFF-15-07-15-189	0.0313	-	-	-	-	-	-	-	-	-
F-OFF-15-07-20-193	0.0317	0.0004	<0.004	0.0012	0.00282	<0.05	<0.05	<0.05	-	8.2

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-16-07-02-199	0.0338	-	-	-	-	-	-	-	-	-
F-OFF-16-07-08-203	0.0438	-	-	-	-	-	-	-	-	-
F-OFF-16-07-14-209	0.0479	0.00046	-	0.0014	0.00303	<0.05	<0.05	<0.05	5	8.21
F-OFF-16-07-20-212	0.0323	-	-	-	-	-	-	-	-	-
F-OFF-17-07-02-219	0.032	0.00046	<0.004	0.0015	0.0025	<0.05	<0.05	<0.05	<3	8.32
F-OFF-17-07-08-224	0.039	-	-	-	-	-	-	-	-	-
F-OFF-17-07-14-229	0.0391	0.00037	<0.004	0.0016	0.0024	<0.05	<0.05	<0.05	<3	8.39
F-OFF-18-07-08-244	0.0672	0.0003	<0.004	0.0012	0.0025	<0.05	<0.05	<0.05	3	8.39
F-OFF-18-07-14-249	0.0599	0.00034	<0.004	0.0014	0.0029	<0.05	<0.05	<0.05	4	8.31
F-OFF-19-07-03-262	0.0615	-	-	-	-	-	-	-	-	-
F-OFF-19-07-08-267	0.0682	-	-	-	-	-	-	-	-	-
F-OFF-19-07-14-275	0.0526	-	-	-	-	-	-	-	-	-
F-OFF-19-07-20-281	0.0474	-	-	-	-	-	-	-	-	-
F-OFF-20-07-02-291	0.0501	-	-	-	-	-	-	-	-	-
F-OFF-20-07-08-296	0.0569	0.00038	<0.004	0.0013	0.0029	<0.05	<0.05	<0.05	4	8.34
F-OFF-20-07-14-301	0.0478	0.00036	<0.004	0.0013	0.00262	<0.05	<0.05	<0.05	<3	8.34
F-OFF-20-07-20-305	0.0419	-	-	-	-	-	-	-	-	-
F-OFF-21-07-02-312	0.041	-	-	-	-	-	-	-	-	-
F-OFF-21-07-08-316	0.0365	-	-	-	-	-	-	-	-	-
F-OFF-21-07-16-322	0.0407	-	-	-	-	-	-	-	-	-
F-OFF-21-07-20-326	0.0436	0.00088	0.0055	0.0024	0.00291	<0.05	<0.05	<0.05	4	8.3
F-OFF-22-07-02-333	0.0464	0.00045	0.0041	0.0017	0.00275	<0.05	<0.05	<0.05	<3	8.38
F-OFF-22-07-08-340	0.0592	-	-	-	-	-	-	-	-	-
F-OFF-22-07-1330-345	0.0479	-	-	-	-	-	-	-	-	-
F-OFF-22-07-20-349	0.0508	-	-	-	-	-	-	-	-	-
F-OFF-23-07-02-357	0.0551	-	-	-	-	-	-	-	-	-
F-OFF-23-07-08-360	0.0567	0.00031	<0.004	0.0012	0.0024	<0.05	<0.05	<0.05	<3	8.33

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-23-07-14-364	0.0704	-	-	-	-	-	-	-	-	-
F-OFF-23-07-20-371	0.0428	0.00043	0.0056	0.0018	0.00227	<0.05	<0.05	<0.05	<3	8.34
F-OFF-24-07-02-378	0.0375	0.00054	0.0064	0.0026	0.00221	<0.05	<0.05	<0.05	3	8.41
F-OFF-24-07-08-381	0.0339	0.00029	<0.004	0.0015	0.00221	<0.05	<0.05	<0.05	<3	8.41
F-OFF-24-07-14-387	0.0382	-	-	-	-	-	-	-	-	-
F-OFF-24-07-20-391	0.0463	0.00039	0.0051	0.0023	0.00232	<0.05	<0.05	<0.05	<3	8.25
F-OFF-25-07-02-398	0.0464	-	-	-	-	-	-	-	-	-
F-OFF-25-07-08-401	0.0343	-	-	-	-	-	-	-	-	-
F-OFF-25-07-14-404	0.0391	-	-	-	-	-	-	-	-	-
F-OFF-25-07-20-408	0.047	0.00038	0.005	0.0019	0.00268	<0.05	<0.05	<0.05	<3	8.25
F-OFF-26-07-02-415	0.0459	-	-	-	-	-	-	-	-	-
F-OFF-26-07-08-420	0.0466	-	-	-	-	-	-	-	-	-
F-OFF-26-07-25-424	0.0404	-	-	-	-	-	-	-	-	-
F-OFF-26-07-20-428	0.0512	0.00064	0.0078	0.005	0.00229	<0.05	<0.05	<0.05	5	8.29
F-OFF-27-07-02-435	0.042	-	-	-	-	-	-	-	-	-
F-OFF-27-07-08-438	0.0365	-	-	-	-	-	-	-	-	-
F-OFF-27-07-15-443	0.0302	-	-	-	-	-	-	-	-	-
F-OFF-27-07-20-447	0.0241	0.0004	0.0043	0.0027	0.00189	<0.05	<0.05	<0.05	<3	8.31
F-OFF-28-07-02-454	0.0266	-	-	-	-	-	-	-	-	8.16
F-OFF-28-07-08-457	0.0278	-	-	-	-	-	-	-	-	-
F-OFF-28-07-14-462	0.0396	0.00036	<0.004	0.0015	0.00233	<0.05	<0.05	<0.05	<3	8.36
F-OFF-28-07-20-466	0.046	0.00041	0.0068	0.0037	0.00259	<0.05	<0.05	<0.05	8	8.35
F-OFF-29-07-02-471	0.0329	-	-	-	-	-	-	-	-	-
F-OFF-29-07-08-474	0.0309	-	-	-	-	-	-	-	-	-
F-OFF-29-07-14-477	0.0388	-	-	-	-	-	-	-	-	-
F-OFF-29-07-20-481	0.0482	0.00053	0.0068	0.004	0.00267	<0.05	<0.05	<0.05	<3	8.31
F-OFF-30-07-02-488	0.0383	-	-	-	-	-	-	-	-	-

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-30-07-08-491	0.0369	-	-	-	-	-	-	-	-	-
F-OFF-30-07-14-495	0.0399	-	-	-	-	-	-	-	-	-
F-OFF-30-07-20-499	0.0428	0.00052	0.0058	0.0048	0.00266	<0.05	<0.05	<0.05	<3	8.37
F-OFF-31-07-02-506	0.0344	-	-	-	-	-	-	-	-	-
F-OFF-31-07-08-509	0.0294	-	-	-	-	-	-	-	-	-
F-OFF-31-07-20-517	0.0431	0.00057	0.0054	0.0031	0.00286	<0.05	<0.05	<0.05	<3	8.35
F-OFF-01-08-02-524	0.048	-	-	-	-	-	-	-	-	-
F-OFF-01-08-08-527	0.0394	-	-	-	-	-	-	-	-	-
F-OFF-01-08-14-532	0.033	-	-	-	-	-	-	-	-	-
F-OFF-02-08-02-543	0.0369	0.00032	0.0043	0.0015	0.00292	<0.05	<0.05	<0.05	3	8.3
F-OFF-02-08-08-546	0.0464	-	-	-	-	-	-	-	-	-
F-OFF-02-08-14-549	0.0527	-	-	-	-	-	-	-	-	-
F-OFF-02-08-20-553	0.039	0.00044	0.0057	0.0039	0.00336	<0.05	<0.05	<0.05	<3	8.32
F-OFF-03-08-02-561	0.0364	-	-	-	-	-	-	-	-	-
F-OFF-03-08-08-564	0.0336	-	-	-	-	-	-	-	-	-
F-OFF-03-08-14-567	0.0325	-	-	-	-	-	-	-	-	-
F-OFF-03-08-20-570	0.0287	0.00029	<0.004	0.0017	0.00301	<0.05	<0.05	<0.05	<3	8.32
F-OFF-04-08-02-574	0.0284	-	-	-	-	-	-	-	-	-
F-OFF-04-08-08-582	0.0379	-	-	-	-	-	-	-	-	-
F-OFF-04-08-14-585	0.0354	0.00033	<0.004	0.0016	0.00296	-	-	-	-	-
F-OFF-04-08-20-588	0.0412	0.00031	<0.004	0.0015	0.00334	<0.05	<0.05	<0.05	4	8.32
F-OFF-05-08-02-593	0.0374	-	-	-	-	-	-	-	-	-
F-OFF-05-08-08-599	0.055	-	-	-	-	-	-	-	-	-
F-OFF-05-08-14-603	0.06	-	-	-	-	-	-	-	-	-
F-OFF-05-08-20-608	0.0629	0.00039	<0.004	0.0024	0.00298	<0.05	<0.05	<0.05	4	8.37
F-OFF-06-08-02-611	0.0788	-	-	-	-	-	-	-	-	-
F-OFF-06-08-20-625	0.0481	0.00032	<0.004	0.0017	0.00278	-	-	-	5	8.33

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-07-08-20-643	0.0576	0.00025	<0.004	0.0012	0.00262	-	-	-	<3	8.36
F-OFF-08-08-15-656	0.0485	0.00039	0.0064	0.0019	0.00378	-	-	-	<3	8.25
F-OFF-09-08-20-686	0.036	0.00015	<0.004	0.0011	0.00312	-	-	-	<3	8.28
F-OFF-10-08-02-695	0.0483	0.0004	<0.005	-	-	-	-	-	-	-
F-OFF-11-08-02-710	0.0419	0.0007	<0.005	-	-	-	-	-	-	-
F-OFF-12-08-02-727	0.0391	0.0002	<0.005	-	-	-	-	-	-	-
F-OFF-13-08-02-745	0.0591	0.0007	<0.005	0.0021	0.003	0.02	<0.01	0.13	<3	8.29
F-OFF-14-08-02-772	0.0419	0.0002	<0.005	-	-	-	-	-	-	-
F-OFF-15-08-02-800	0.0362	0.0003	<0.005	-	-	-	-	-	-	-
F-OFF-16-08-02-831	0.0375	0.0003	<0.005	-	-	-	-	-	-	-
F-OFF-17-08-02-863	0.0506	0.0004	<0.005	-	-	-	-	-	-	-
F-OFF-18-08-02-893	0.0418	0.0003	<0.005	-	-	-	-	-	-	-
F-OFF-19-08-20-947	0.0236	0.0002	<0.005	0.0014	0.0029	<0.01	<0.01	0.13	<3	8.11
F-OFF-20-08-20-979	0.0342	0.0002	<0.005	-	-	-	-	-	-	-
F-OFF-21-08-20-1010	0.0397	0.0002	<0.005	-	-	-	-	-	-	-
F-OFF-22-08-20-1040	0.0339	0.0002	0.0027	-	-	-	-	-	-	-
F-OFF-23-08-20-1062	0.0313	0.0002	0.002	-	-	-	-	-	-	-
F-OFF-25-08-20-1098	0.0302	0.0002	<0.005	-	-	-	-	-	-	-
F-OFF-26-08-08-1108	0.034	0.0002	<0.005	-	-	-	-	-	-	-
F-OFF-27-08-02-1120	0.0472	0.0004	<0.005	0.0023	0.0028	<0.01	<0.01	0.1	<3	8.11
F-OFF-28-08-20-1138	0.0533	0.0005	0.0045	-	-	-	-	-	-	-
F-OFF-29-08-02-1156	0.0357	0.0003	0.0028	-	-	-	-	-	-	-
F-OFF-29-08-20-1171	0.0687	0.0005	<0.005	-	-	-	-	-	<3	8.17
F-OFF-30-08-08-1181	0.0399	0.0003	<0.005	-	-	-	-	-	4	8.30
F-OFF-31-08-18-1222	0.0219	0.0004	0.007	-	-	-	-	-	4	8.15
F-OFF-01-09-20-1263	0.0448	0.001	<0.005	-	-	-	-	-	<3	8.2
F-OFF-02-09-20-1285	0.0493	0.0006	<0.005	0.0024	0.0029	0.01	-	-	<3	8.36

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-03-09-08-1298	0.0341	0.0004	<0.005	0.0026	0.003	0.02	<0.01	0.11	4	8.21
F-OFF-03-09-20-1311	0.0392	0.0013	0.0033	-	-	-	-	-	12	8.32
F-OFF-04-09-20-1331	0.041	0.001	0.0032	-	-	-	-	-	<3	8.39
F-OFF-05-09-20-1355	0.0343	0.0008	0.0033	-	-	-	-	-	<3	8.36
F-OFF-06-09-20-1417	0.0389	0.0005	0.0042	-	-	-	-	-	<3	8.22
F-OFF-07-09-08-1433	0.0376	0.0004	0.0028	0.0017	0.0023	<0.01	<0.01	0.17	<3	8.38
F-OFF-08-09-02-1461	0.031	0.0004	0.004	0.0024	-	-	-	-	<3	8.12
F-OFF-08-09-20-1484	0.0253	0.0004	0.0034	0.0024	-	-	-	-	<3	8.11
F-OFF-09-09-20-1508	0.0481	0.0004	0.0038	0.002	0.0033	<0.01	<0.01	0.11	<3	8.18
F-OFF-11-09-20-1579	0.0355	0.0005	<0.005	0.0019	-	-	-	-	<3	8.06
F-OFF-12-09-10-1603	0.079	0.0006	0.0045	0.0021	0.0041	<0.01	<0.01	0.13	4	8.02
F-OFF-12-09-10-1607	0.0767	0.00043	<0.004	0.0013	0.00416	<0.05	<0.05	<0.05	<3	8.12
F-OFF-12-09-20-1624	0.0487	0.0004	0.0038	-	-	-	-	-	4	8.06
F-OFF-13-09-20-1655	0.0686	0.0006	0.0064	-	-	-	-	-	8	8.04
F-OFF-14-09-22-1670	0.0394	0.0004	0.0035	-	-	-	-	-	6	8.01
F-OFF-15-09-20-1703	0.0279	0.0002	0.0033	-	-	-	-	-	<3	8.19
F-OFF-17-09-08-1751	0.0292	0.0003	0.0024	0.0014	0.0029	<0.01	<0.01	0.09	<3	8.25
F-OFF-17-09-20-1773	0.0232	0.0004	0.0027	-	-	-	-	-	3	8.15
F-OFF-18-09-20-1809	0.0376	0.0005	0.004	-	-	-	-	-	<3	7.97
F-OFF-20-09-02-1857	0.0302	0.0004	0.002	-	-	-	-	-	<3	8.13
F-OFF-20-09-20-1879	0.029	0.0004	0.0025	-	-	-	-	-	<3	8.3
F-OFF-21-09-20-1913	0.0231	0.0002	0.0023	-	-	-	-	-	6	8.19
F-OFF-22-9-20-1948	0.0224	0.0002	0.0034	-	-	-	-	-	4	8.24
F-OFF-23-09-08-1967	0.0243	0.0005	0.0035	0.002	0.0029	<0.01	<0.01	0.12	8	8.13
F-OFF-23-09-20-1984	0.0273	0.0003	0.0027	-	-	-	-	-	8	7.65
F-OFF-24-09-14-2013	0.0278	0.0005	0.0043	-	-	-	-	-	8	8.23
F-OFF-25-09-14-2051	0.0263	0.0002	0.0041	-	-	-	-	-	6	8.03

Sample ID	Parameter									
	As (total), mg/L	Pb (total), mg/L	Zn (total), mg/L	Cu (total), mg/L	Ni (total), mg/L	TAN, mg/L as N	Nitrite, mg/L as N	Nitrate, mg/L as N	TSS, mg/L	pH
F-OFF-26-09-20-2083	0.0212	0.0004	0.0057	-	-	-	-	-	<3	7.99
F-OFF-27-09-08-2104	0.0304	0.0003	0.0173 (0.0069)	0.0014	0.0039	0.11	<0.01	0.15	6	7.27
F-OFF-27-09-20-2126	0.021	0.0004	0.0031	0.0024	0.0037	0.11	<0.01	0.15	<3	8.07
F-OFF-28-09-08-2144	0.0237	0.0004	0.0038	-	-	-	-	-	<3	8.16
F-OFF-29-09-0830-2180	0.0254	0.0002	0.0087 (0.0087)	-	-	-	-	-	<3	7.62
F-OFF-30-09-0815-2216	0.0278	0.0002	0.0041	-	-	-	-	-	<3	8.14
F-OFF-01-10-0920-2259	0.0404	0.0004	0.0047	-	-	-	-	-	<3	7.97
F-OFF-02-10-0830-2297	0.0289	0.0003	<0.005	-	-	-	-	-	<3	8.1
F-OFF-03-10-0830-2334	0.0318	0.0002	0.0033	-	-	-	-	-	<3	8.18
F-OFF-04-10-0930-2370	0.0402	0.0004	0.0059	-	-	-	-	-	<3	7.93
F-OFF-04-10-15-2378	0.0395	0.0003	0.0046	0.0015	0.0047	0.11	<0.01	0.18	<3	8.08
F-OFF-05-10-09-2410	0.0251	<0.0004	-	-	-	-	-	-	<3	8.14
F-OFF-06-10-0830-2444	0.0298	0.0002	0.0029	-	-	-	-	-	<3	8.21
F-OFF-07-10-0830-2481	0.0306	0.0002	0.0035	-	-	-	-	-	<3	8.09
F-OFF-08-10-0830-2517	0.0326	0.0004	0.0044	-	-	-	-	-	<3	8.11
F-OFF-09-10-09-2552	0.0386	0.0005	0.005	-	-	-	-	-	4	8.26
F-OFF-10-10-0830-2585	0.0323	0.0022 (0.00014)	0.011 (0.0045)	0.0077	0.0042	0.1	<0.01	0.19	<3	8.42

* () samples that were reanalyzed because considered anomalous laboratory results; the values used for the average and standard deviation calculations were those in ().

FIGURES

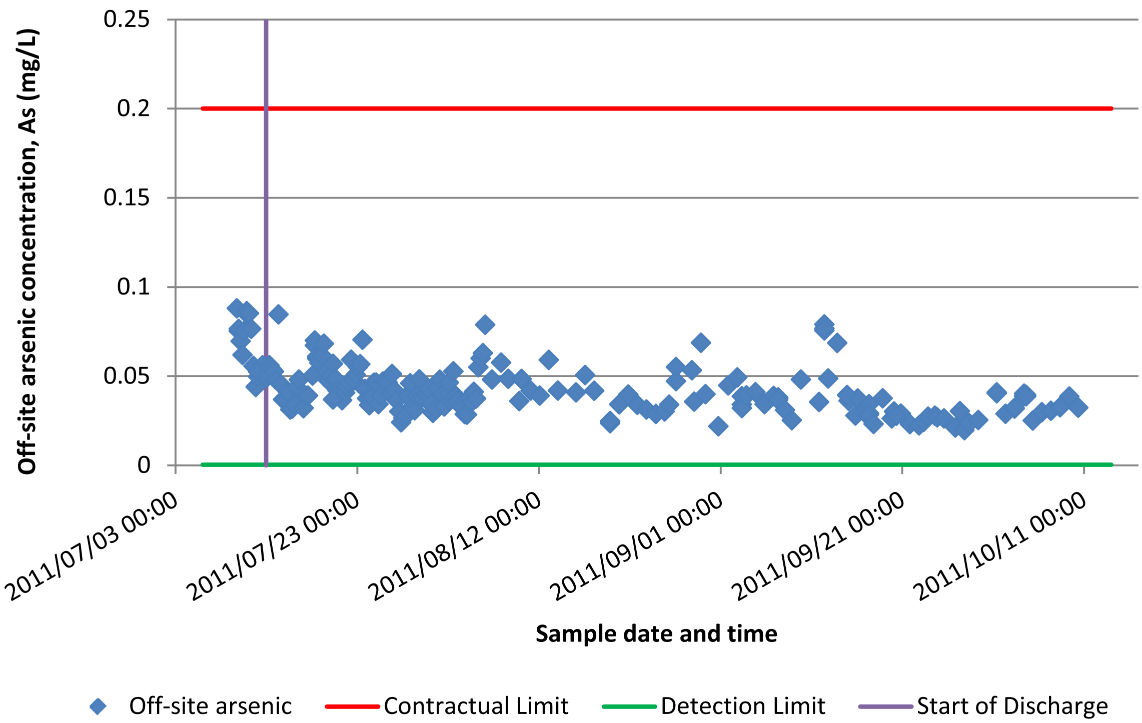

Figure 1: Summary of off-site arsenic concentration measurements for the 2011 project season

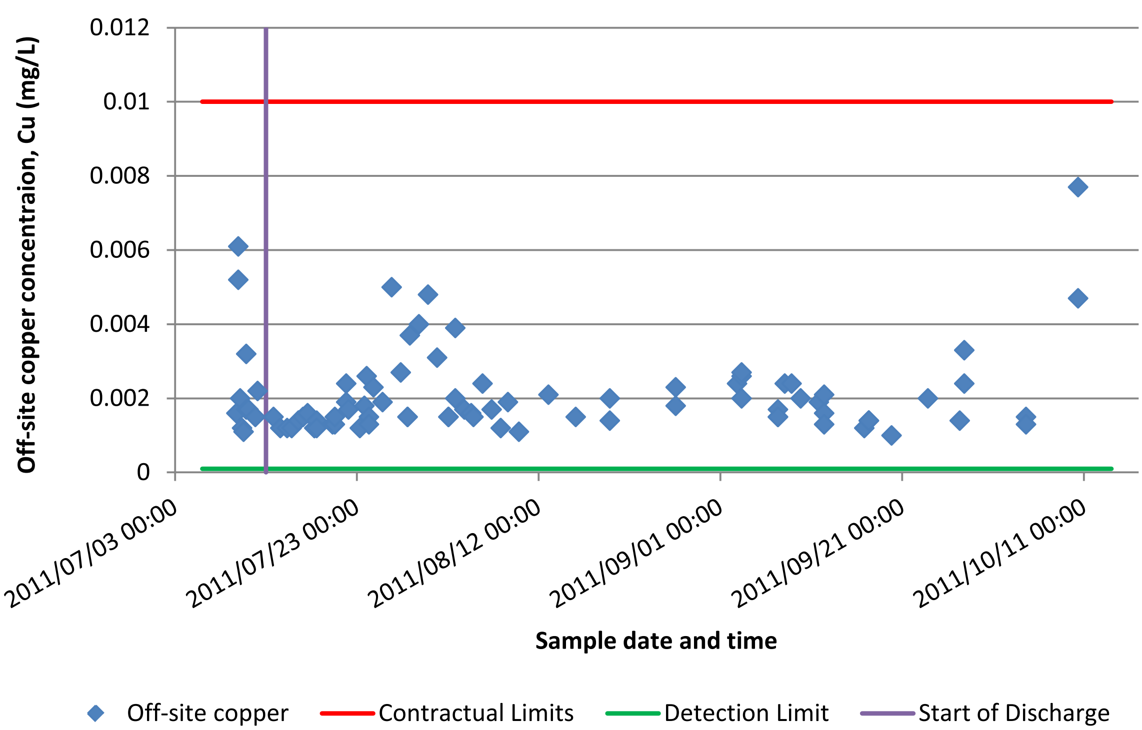

Figure 2: Summary of off-site copper concentration measurements for the 2011 project season

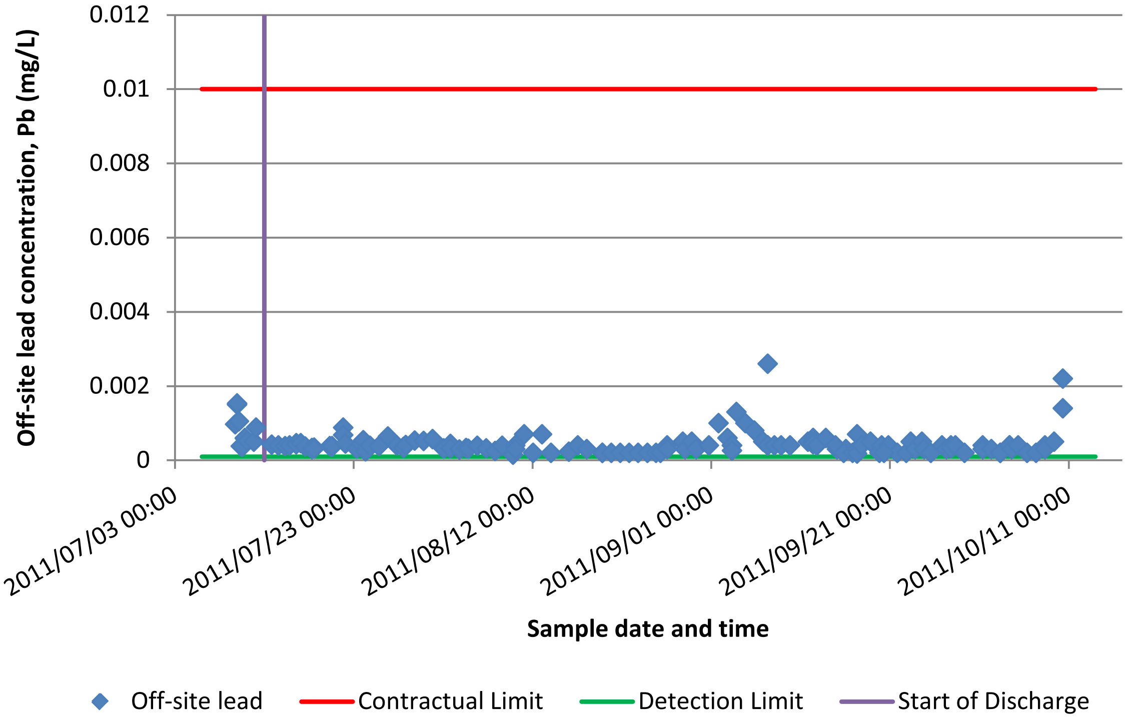

Figure 3: Summary of off-site lead concentration measurements for the 2011 project season

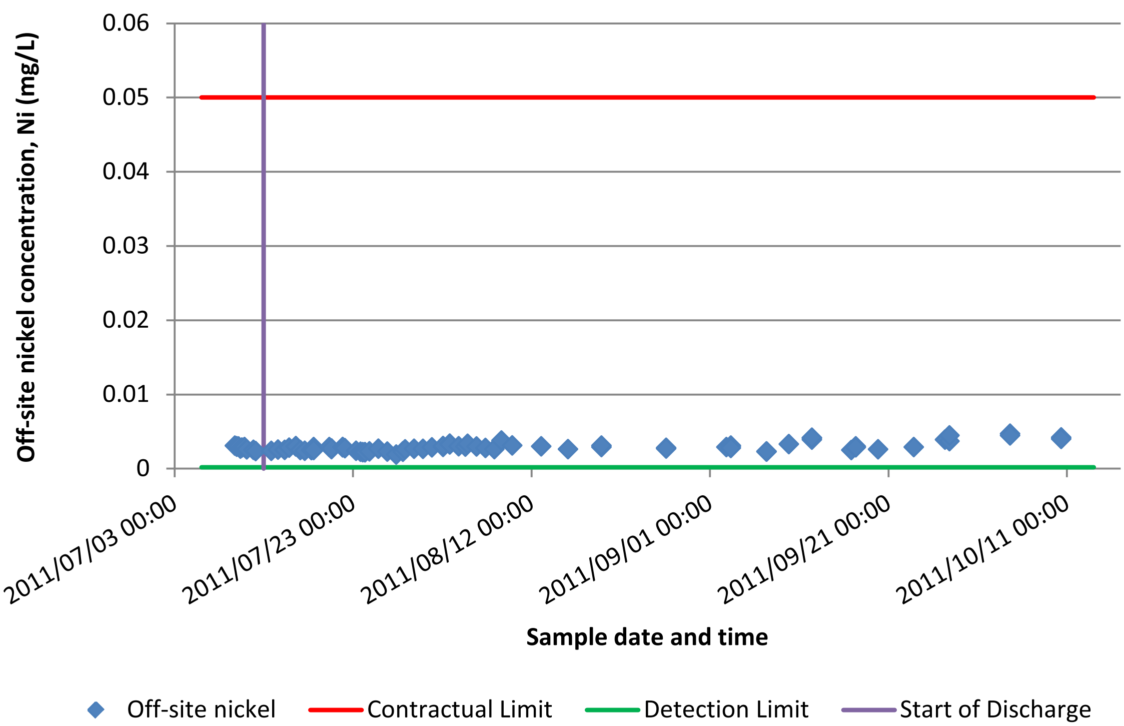

Figure 4: Summary of off-site nickel concentration measurements for the 2011 project season

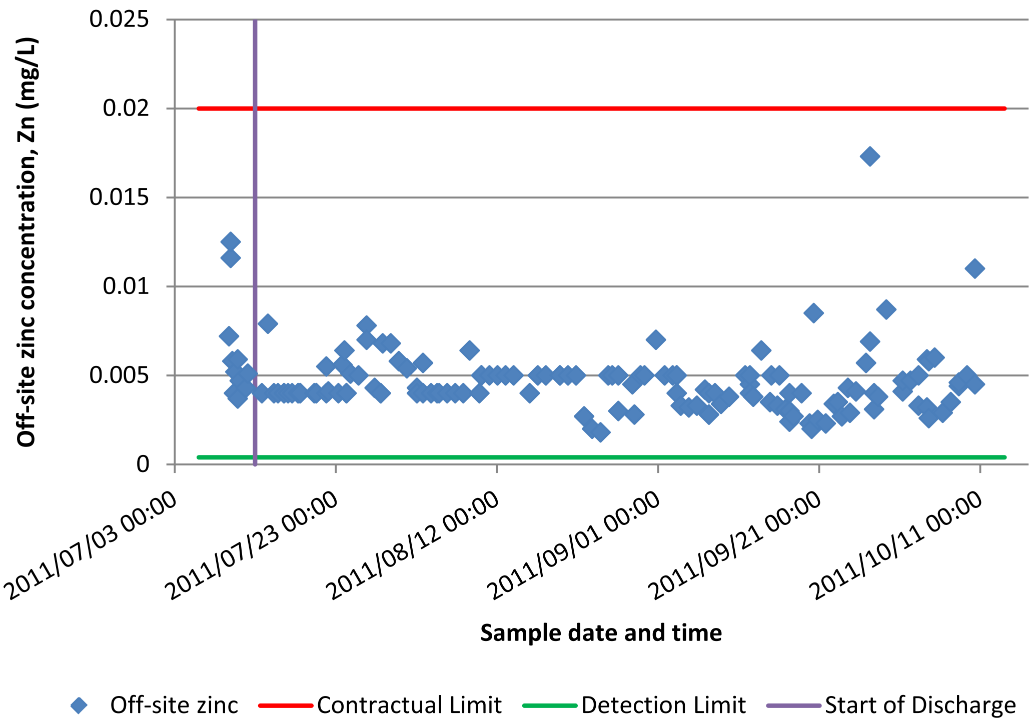

Figure 5: Summary of off-site zinc concentration measurements for the 2011 project season

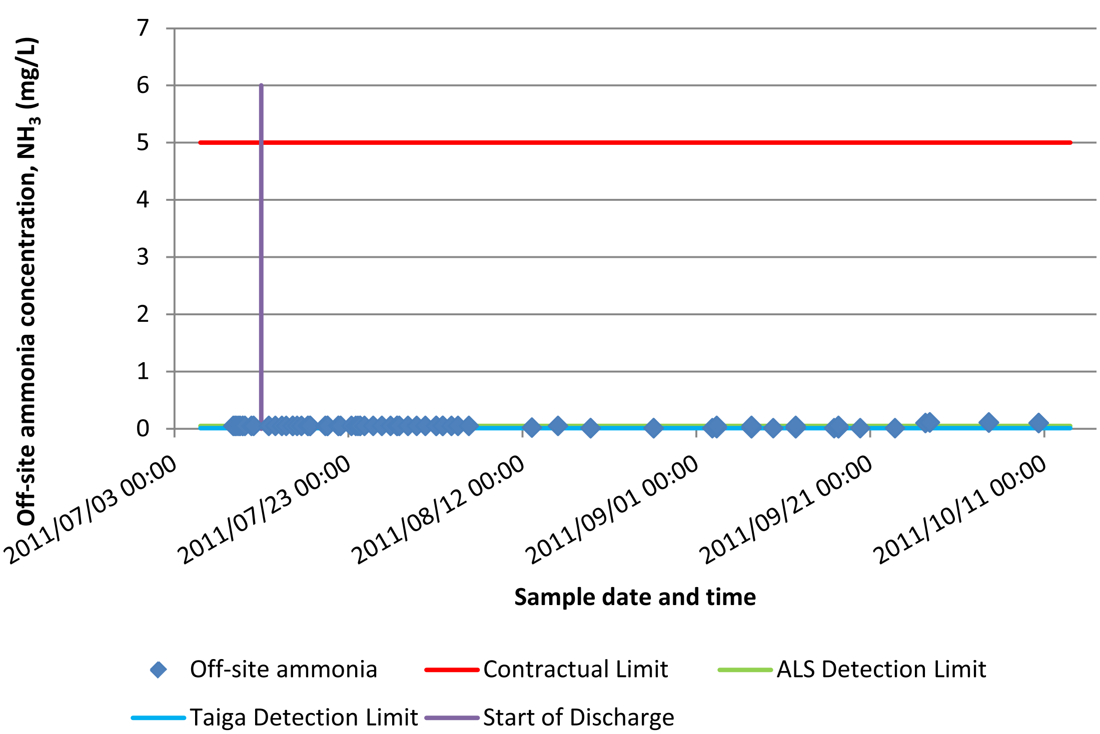

Figure 6: Summary of off-site ammonia concentration measurements for the 2011 project season

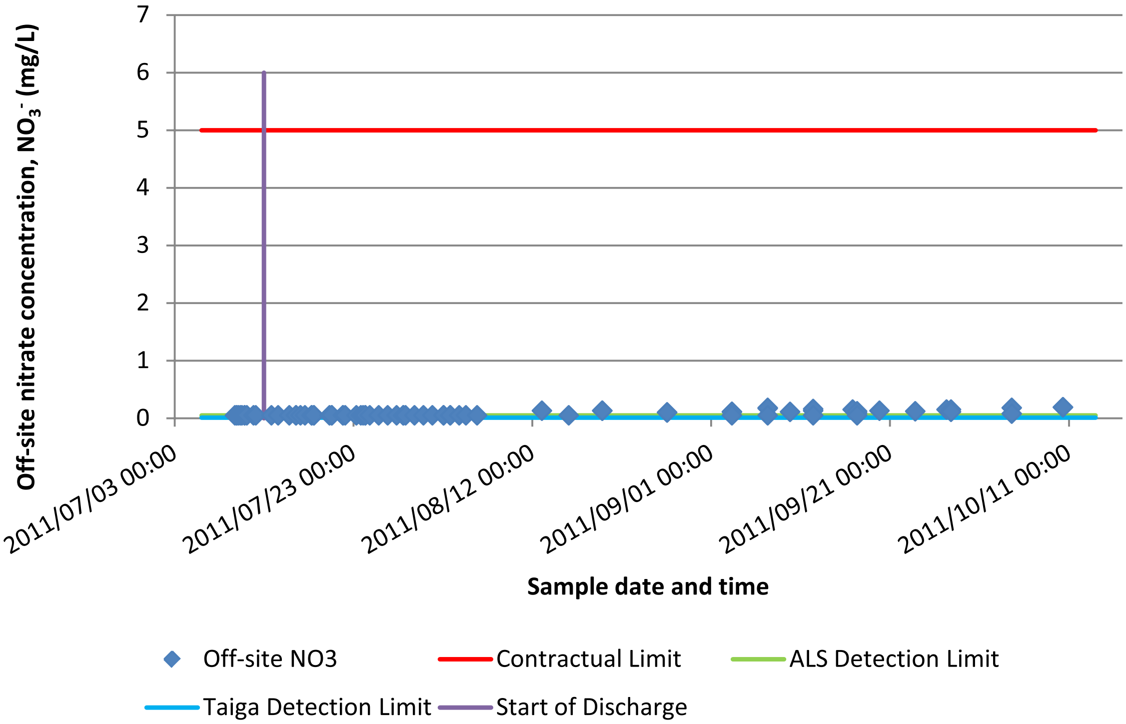

Figure 7: Summary of off-site nitrate concentration measurements for the 2011 project season

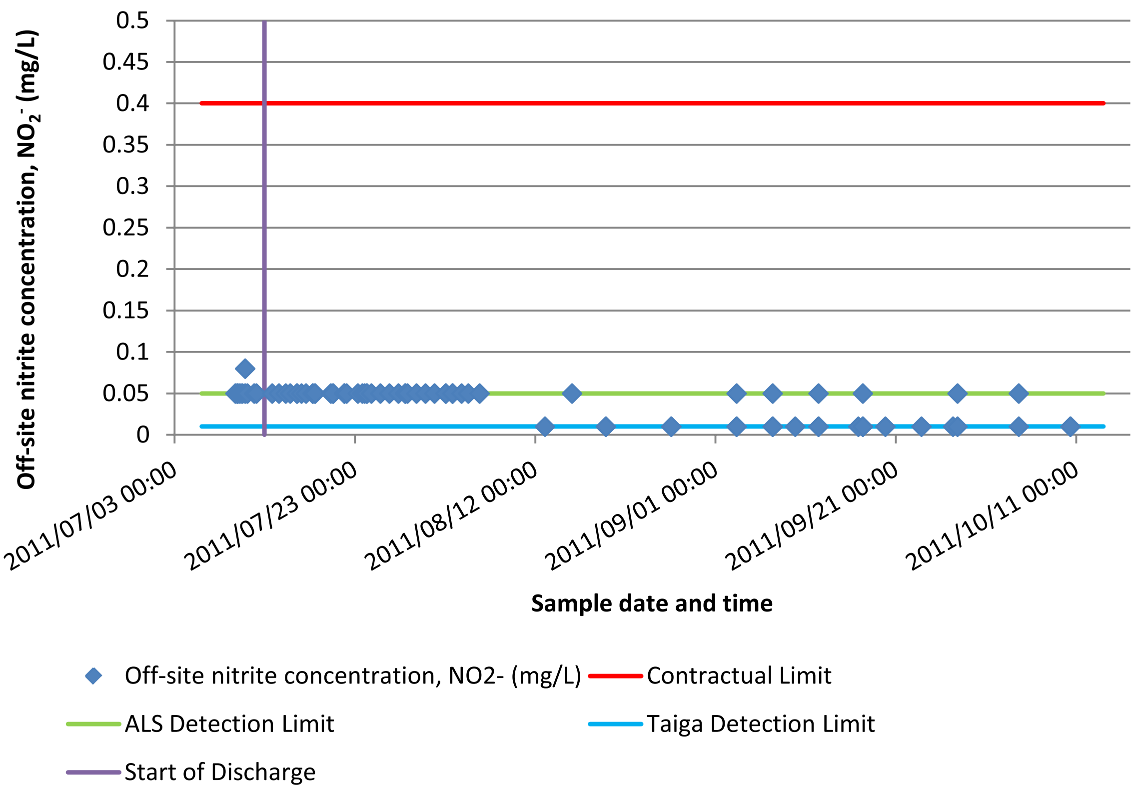

Figure 8: Summary of off-site nitrite concentration measurements for the 2011 project season

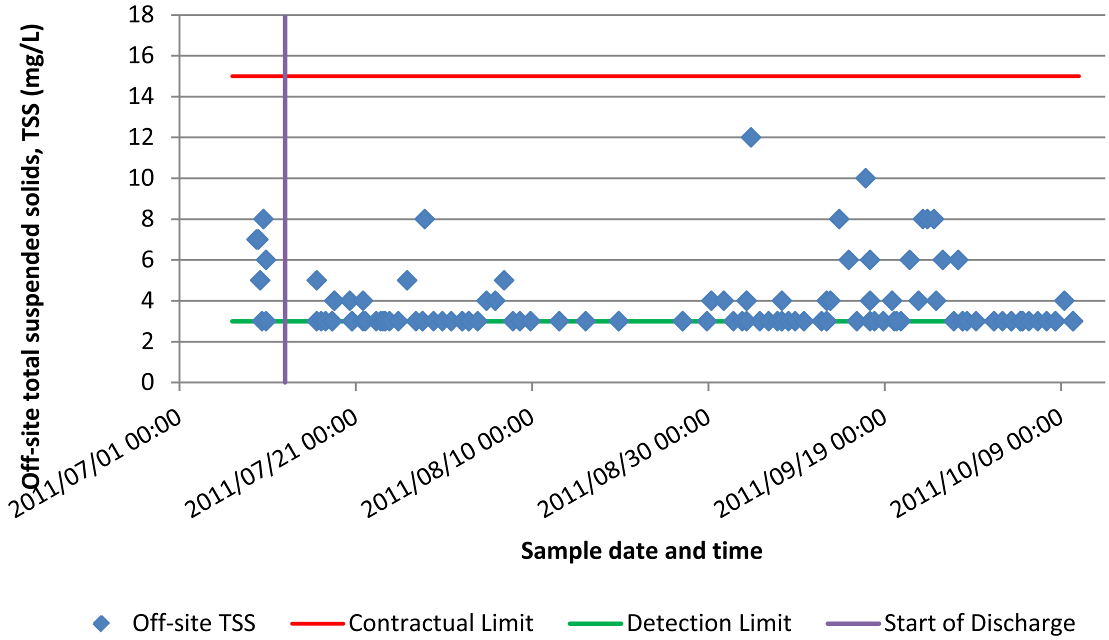

Figure 9: Summary of off-site TSS concentration measurements for the 2011 project season

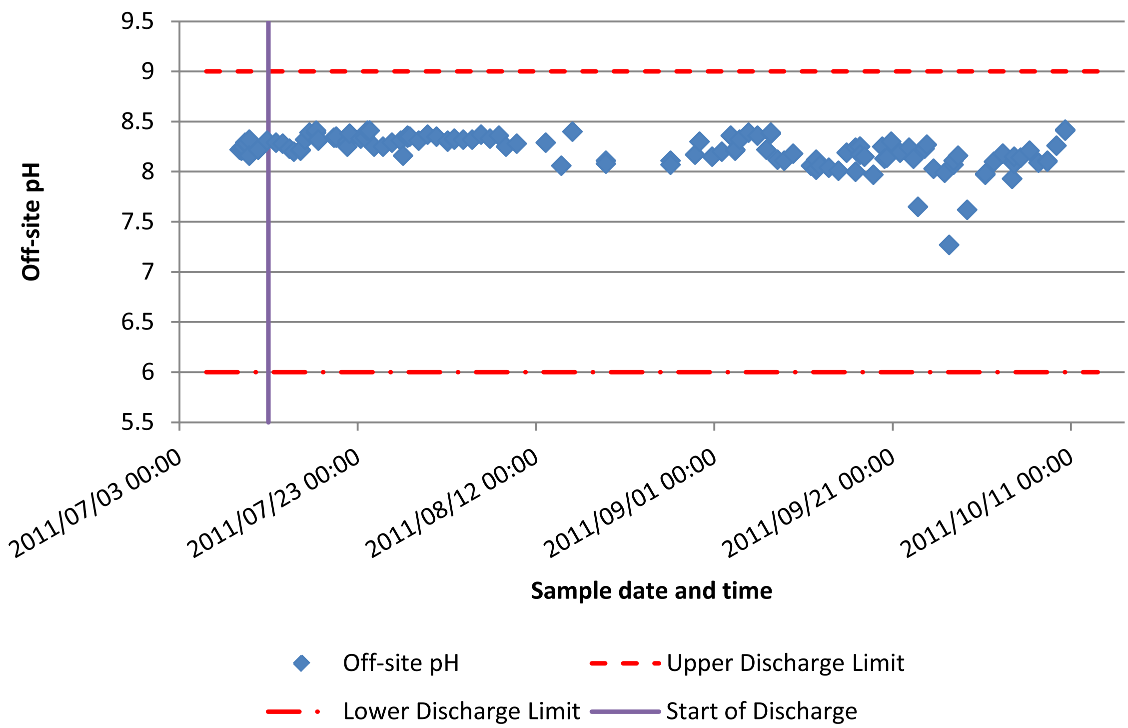

Figure 10: Summary of off-site pH measurements for the 2011 project season

Figure 11: Plant Winterizing Phase – Frost Fighter

Figure 12: Plant Winterizing Phase – Tanks Freezing

Figure 13: Chemical Pump and Fitting Storage (Seacan)

Figure 14: Chemical Mixer Storage (Seacan)

Figure 15: Ferric Onion Tank Storage (Platform)

Figure 16: Lime Onion Tank Storage (Platform)

Figure 17: Polymer and Sodium Metabisulfite Tank Storage (Platform)

Figure 18: Chemical Makeup Blower Storage (Platform)

Figure 19: Process Onion Tank Storage (Platform)

Figure 20: Flow Meter Storage (Seacan)

Figure 21: Transmitter and pH Sensor Storage (Storage Room)

Figure 22: Miscellaneous Fitting and Flow Alarm Storage (Storage Room)

Figure 23: Electrical Control Panel Storage (Platform)

Figure 24: Electrical Control Panel Plywood Enclosure (Platform)

15.2 Appendix B – Analysis of Treatment Chemicals

Appendix B

Tundra Mine 2012
Analysis' of Treatment Chemicals

pure elements
environmental solutions

TESTING OF LIME PRODUCTS

for Level of Trace Metals

Samples collected on: **January 28, 2009**

CHEMICAL LIME
LANGLEY PLANT

Analysis Report by: CANTEST Ltd.

Group No.:	902160193
CanTest ID:	#100216072

Element:		Hydrate [$Ca(OH)_2$] (micro-g./g) ppm		Detection Limit (micro-g./g) ppm
Aluminum	Al	478		10
Antimony	Sb	<		10
Arsenic	As	<		30
Barium	Ba	2.1		0.1
Beryllium	Be	<		1
Boron	B	<		1
Cadmium	Cd	<		3
Calcium	Ca	*536,300*	*	1
Chromium	Cr	<		2
Cobalt	Co	<		1
Copper	Cu	<		1
Iron	Fe	482		2
Lead	Pb	<		1
Magnesium	Mg	3,910		1
Manganese	Mn	40.1		0.2
Mercury	Hg	<		0.001
Molybdenum	Mo	<		2
Nickel	Ni	<		2
Phosphorus	P	75.0		20
Potassium	K	63		15
Silicon	Si	1,050		1
Silver	Ag	<		2
Sodium	Na	49		5
Strontium	Sr	1,050		1
Suphur	S	0.06%		0.01%
Tin	Sn	<		5
Titanium	Ti	24		1
Vanadium	V	8		1
Zinc	Zn	2		1
Zirconium	Zr	<		1

< = Less than detection limit

* = an approximate values calculated *(the Ca concentration is too high for a trace analysis)*

micro-gram / gram = ppm

micro-gram = $1x10^{-6}$ gram = $1x10^{-9}$ kg

ppm = grams / mt = grams / $1x10^{6}$ grams

Samples: January 28, 2009 - Trace Metals
C:/QC Plant/Special Analysis/File: Trace Metals-CanTest
Report: February 24, 2008, Andrew Grzymek

TESTING OF LIME PRODUCTS

for Level of Trace Metals

Samples collected on: **February 07, 2008**

CHEMICAL LIME

LANGLEY PLANT

Analysis Report by: CANTEST Ltd.

Group No.:	90214011
CanTest ID:	#802140019

Element:		Hydrate [$Ca(OH)_2$] (micro-g./g) ppm		Detection Limit (micro-g./g) ppm
Aluminum	Al	440		10
Antimony	Sb	<		10
Arsenic	As	<		30
Barium	Ba	1.8		0.1
Beryllium	Be	<		1
Boron	B	<		1
Cadmium	Cd	<		3
Calcium	Ca	*510,000*	*	1
Chromium	Cr	<		2
Cobalt	Co	<		1
Copper	Cu	<		1
Iron	Fe	437		2
Lead	Pb	<		4
Magnesium	Mg	2,220		1
Manganese	Mn	32.2		0.2
Mercury	Hg	<		0.01
Molybdenum	Mo	<		2
Nickel	Ni	<		2
Phosphorus	P	59		20
Potassium	K	202		15
Silicon	Si	957		1
Silver	Ag	<		2
Sodium	Na	106		5
Strontium	Sr	1,260		1
Suphur	S	0.09%		0.01%
Tin	Sn	<		5
Titanium	Ti	25		1
Vanadium	V	9		1
Zinc	Zn	2		1
Zirconium	Zr	1		1

< = Less than detection limit

* = approximate values for the Ca *(too high concentration for a trace analysis)*

micro-gram / gram = ppm

micro-gram = $1x10^{-6}$ gram = $1x10^{-9}$ kg

ppm = grams / mt = grams / $1x10^{6}$ grams

CHEMICAL LIME
LANGLEY PLANT

TESTING OF LIME PRODUCTS

for Level of Trace Metals

Samples collected on: **February 14, 2007**

Analysis Report by: CANTEST Ltd.

Group No.:	80216006
CanTest ID:	#702160012

Element:		Hydrate [$Ca(OH)_2$] (micro-g./g) ppm		Detection Limit (micro-g./g) ppm
Aluminum	Al	335		10
Antimony	Sb	<		10
Arsenic	As	<		30
Barium	Ba	1.6		0.1
Beryllium	Be	<		1
Boron	B	<		1
Cadmium	Cd	<		3
Calcium	Ca	532,000	*	1
Chromium	Cr	<		2
Cobalt	Co	<		1
Copper	Cu	<		1
Iron	Fe	531		2
Lead	Pb	<		4
Magnesium	Mg	2,410		1
Manganese	Mn	62.7		0.2
Mercury	Hg	<		0.001
Molybdenum	Mo	<		2
Nickel	Ni	<		2
Phosphorus	P	99		20
Potassium	K	49		15
Silicon	Si	720		1
Silver	Ag	<		2
Sodium	Na	16		5
Strontium	Sr	1,220		1
Suphur	S	0.02%		0.01%
Tin	Sn	<		5
Titanium	Ti	15		1
Vanadium	V	11		1
Zinc	Zn	7		1
Zirconium	Zr	<		1

< = Less than detection limit
* = approximate values for the Ca

micro-gram / gram = ppm
micro-gram = 1×10^{-6} gram = 1×10^{-9} kg
ppm = grams / mt = grams / 1×10^{6} grams

Samples: Feb.14, 2007 Trace Metals
C:/QC Plant/Special Analysis/File: Trace Metals-CanTest
Report: May 9, 2007, Andrew Grzymek

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 438-0396
E: Edmonton@exova.com
W: www.exova.com

Analytical Report

Bill To:	Pure Elements Environmental	Project:		Lot ID:	**876492**
Report To:	Pure Elements Environmental	ID:		Control Number:	
	Box 77	Name:	Tundra2	Date Received:	Jun 18, 2012
	RR1 Site 1	Location:		Date Reported:	Jun 19, 2012
	DeWinton, AB, Canada	LSD:		Report Number:	1744963
	T0L 0X0	P.O.:			
Attn:	Trina Comartin	Acct code:			
Sampled By:					
Company:					

Reference Number	876492-1
Sample Date	June 18, 2012
Sample Time	NA
Sample Location	
Sample Description	DI Water / 23.1°C
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Total						
Aluminum	Total	mg/L	<0.02	0.02		
Calcium	Total	mg/L	<0.2	0.2		
Iron	Total	mg/L	<0.05	0.05		
Magnesium	Total	mg/L	<0.1	0.1		
Manganese	Total	mg/L	<0.005	0.005		
Potassium	Total	mg/L	<0.4	0.4		
Silicon	Total	mg/L	<0.05	0.05		
Sodium	Total	mg/L	<0.4	0.4		
Sulfur	Total	mg/L	<0.3	0.3		
Antimony	Total	mg/L	<0.0002	0.0002		
Arsenic	Total	mg/L	<0.0002	0.0002		
Barium	Total	mg/L	<0.001	0.001		
Beryllium	Total	mg/L	<0.0001	0.0001		
Bismuth	Total	mg/L	<0.0005	0.0005		
Boron	Total	mg/L	<0.002	0.002		
Cadmium	Total	mg/L	<0.00001	0.00001		
Chromium	Total	mg/L	<0.0005	0.0005		
Cobalt	Total	mg/L	<0.0001	0.0001		
Copper	Total	mg/L	<0.001	0.001		
Lead	Total	mg/L	<0.0001	0.0001		
Lithium	Total	mg/L	<0.001	0.001		
Molybdenum	Total	mg/L	<0.001	0.001		
Nickel	Total	mg/L	<0.0005	0.0005		
Selenium	Total	mg/L	<0.0002	0.0002		
Silver	Total	mg/L	<0.00001	0.00001		
Strontium	Total	mg/L	<0.001	0.001		
Thallium	Total	mg/L	<0.00005	0.00005		
Tin	Total	mg/L	<0.001	0.001		
Titanium	Total	mg/L	<0.0005	0.0005		
Uranium	Total	mg/L	<0.0005	0.0005		
Vanadium	Total	mg/L	<0.0001	0.0001		
Zinc	Total	mg/L	<0.001	0.001		
Zirconium	Total	mg/L	<0.001	0.001		

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 438-0396
E: Edmonton@exova.com
W: www.exova.com

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Analytical Report

Bill To:	Pure Elements Environmental	Project:		Lot ID:	**876492**
Report To:	Pure Elements Environmental	ID:		Control Number:	
	Box 77	Name:	Tundra2	Date Received:	Jun 18, 2012
	RR1 Site 1	Location:		Date Reported:	Jun 19, 2012
	DeWinton, AB, Canada	LSD:		Report Number:	1744963
	T0L 0X0	P.O.:			
Attn:	Trina Comartin	Acct code:			
Sampled By:					
Company:					

Reference Number	876492-2
Sample Date	June 18, 2012
Sample Time	NA
Sample Location	
Sample Description	Texlime / 23.1°C
Sample Matrix	Water

Analyte		**Units**	**Result**	**Nominal Detection Limit**	**Guideline Limit**	**Guideline Comments**
Metals Total						
Aluminum	Total	mg/L	0.28	0.02		
Calcium	Total	mg/L	487	0.2		
Iron	Total	mg/L	0.29	0.05		
Magnesium	Total	mg/L	2.8	0.1		
Manganese	Total	mg/L	0.066	0.005		
Potassium	Total	mg/L	<0.4	0.4		
Silicon	Total	mg/L	0.72	0.05		
Sodium	Total	mg/L	<0.4	0.4		
Sulfur	Total	mg/L	<0.3	0.3		
Antimony	Total	mg/L	0.0004	0.0002		
Arsenic	Total	mg/L	0.0032	0.0002		
Barium	Total	mg/L	0.002	0.001		
Beryllium	Total	mg/L	<0.0001	0.0001		
Bismuth	Total	mg/L	<0.0005	0.0005		
Boron	Total	mg/L	<0.002	0.002		
Cadmium	Total	mg/L	0.00003	0.00001		
Chromium	Total	mg/L	0.0006	0.0005		
Cobalt	Total	mg/L	<0.0001	0.0001		
Copper	Total	mg/L	<0.001	0.001		
Lead	Total	mg/L	0.0026	0.0001		
Lithium	Total	mg/L	<0.001	0.001		
Molybdenum	Total	mg/L	<0.001	0.001		
Nickel	Total	mg/L	<0.0005	0.0005		
Selenium	Total	mg/L	0.0004	0.0002		
Silver	Total	mg/L	<0.00001	0.00001		
Strontium	Total	mg/L	1.27	0.001		
Thallium	Total	mg/L	<0.00005	0.00005		
Tin	Total	mg/L	<0.001	0.001		
Titanium	Total	mg/L	0.0054	0.0005		
Uranium	Total	mg/L	0.0021	0.0005		
Vanadium	Total	mg/L	0.0137	0.0001		
Zinc	Total	mg/L	0.008	0.001		
Zirconium	Total	mg/L	<0.001	0.001		

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
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	RR1 Site 1	Location:		Date Reported:	Jun 19, 2012
	DeWinton, AB, Canada	LSD:		Report Number:	1744963
	T0L 0X0	P.O.:			
Attn:	Trina Comartin	Acct code:			
Sampled By:					
Company:					

Reference Number	876492-3
Sample Date	June 18, 2012
Sample Time	NA
Sample Location	
Sample Description	Ferix-3 / 23.1°C
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Total						
Aluminum	Total	mg/L	<0.02	0.02		
Calcium	Total	mg/L	<0.2	0.2		
Iron	Total	mg/L	188	0.05		
Magnesium	Total	mg/L	6.8	0.1		
Manganese	Total	mg/L	0.657	0.005		
Potassium	Total	mg/L	<0.4	0.4		
Silicon	Total	mg/L	<0.05	0.05		
Sodium	Total	mg/L	<0.4	0.4		
Sulfur	Total	mg/L	170	0.3		
Antimony	Total	mg/L	<0.0002	0.0002		
Arsenic	Total	mg/L	<0.0002	0.0002		
Barium	Total	mg/L	<0.001	0.001		
Beryllium	Total	mg/L	<0.0001	0.0001		
Bismuth	Total	mg/L	<0.0005	0.0005		
Boron	Total	mg/L	<0.002	0.002		
Cadmium	Total	mg/L	<0.00001	0.00001		
Chromium	Total	mg/L	0.0048	0.0005		
Cobalt	Total	mg/L	0.0388	0.0001		
Copper	Total	mg/L	0.001	0.001		
Lead	Total	mg/L	<0.0001	0.0001		
Lithium	Total	mg/L	<0.001	0.001		
Molybdenum	Total	mg/L	<0.001	0.001		
Nickel	Total	mg/L	0.0461	0.0005		
Selenium	Total	mg/L	<0.0002	0.0002		
Silver	Total	mg/L	<0.00001	0.00001		
Strontium	Total	mg/L	0.001	0.001		
Thallium	Total	mg/L	<0.00005	0.00005		
Tin	Total	mg/L	<0.001	0.001		
Titanium	Total	mg/L	0.993	0.0005		
Uranium	Total	mg/L	<0.0005	0.0005		
Vanadium	Total	mg/L	0.0070	0.0001		
Zinc	Total	mg/L	0.064	0.001		
Zirconium	Total	mg/L	<0.001	0.001		

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 438-0396
E: Edmonton@exova.com
W: www.exova.com

Analytical Report

Bill To:	Pure Elements Environmental	Project:		Lot ID:	**876492**
Report To:	Pure Elements Environmental	ID:		Control Number:	
	Box 77	Name:	Tundra2	Date Received:	Jun 18, 2012
	RR1 Site 1	Location:		Date Reported:	Jun 19, 2012
	DeWinton, AB, Canada	LSD:		Report Number:	1744963
	T0L 0X0	P.O.:			
Attn:	Trina Comartin	Acct code:			
Sampled By:					
Company:					

Approved by: Anthony Neumann

Anthony Neumann, MSc
Laboratory Operations Manager

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 438-0396
E: Edmonton@exova.com
W: www.exova.com

Exova

Methodology and Notes

Bill To:	Pure Elements Environmental	Project:		Lot ID:	**876492**
Report To:	Pure Elements Environmental	ID:		Control Number:	
	Box 77	Name:	Tundra2	Date Received:	Jun 18, 2012
	RR1 Site 1	Location:		Date Reported:	Jun 19, 2012
	DeWinton, AB, Canada	LSD:		Report Number:	1744963
	T0L 0X0	P.O.:			
Attn:	Trina Comartin	Acct code:			
Sampled By:					
Company:					

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Metals ICP-MS (Total) in water	APHA/USEPA	* Metals By Inductively Coupled Plasma/Mass Spectrometry, APHA 3125 B / USEPA 200.8	19-Jun-12	Exova Edmonton
Metals Trace (Total) in water	APHA	* Inductively Coupled Plasma (ICP) Method, 3120 B	19-Jun-12	Exova Edmonton

** Reference Method Modified*

References

APHA	Standard Methods for the Examination of Water and Wastewater
US EPA	US Environmental Protection Agency Test Methods

Comments:

Please direct any inquiries regarding this report to our Client Services group.
Results relate only to samples as submitted.
The test report shall not be reproduced except in full, without the written approval of the laboratory.

15.3 Appendix C – Removing and Stabilizing Arsenic in Acid Mine Water

Appendix C

Removing and Stabilizing Arsenic in Acid Mine Water

R. W. Lawrence and T. W. Higgs
September, 1999 - Journal of Mining

Removing and Stabilizing As in Acid Mine Water

R.W. Lawrence and T.W. Higgs

Arsenic is often present in a variety of forms in sulfide mineral deposits and can become a soluble constituent of mine drainage due to oxidation reactions taking place in mine workings and waste deposits. Its removal from solution must be carried out to meet water-quality discharge criteria, and it must be fixed in a solid form that is environmentally stable. The preferred form of arsenic for disposal is as a basic ferric arsenate, $FeAsO_4 \cdot xFe(OH)_3$, which can be readily produced by coprecipitation with iron in a high-density sludge process. High-density sludge plants are simple to operate and can be designed to meet stringent water-quality specifications and produce stable sludges over long periods of continuous operation.

INTRODUCTION

Mine water and the drainage from waste rock piles and tailings impoundments at mines exploiting sulfide ore deposits are often contaminated with metals due to the oxidation of residual sulfides. The minerals pyrite, FeS_2, and pyrrhotite, $Fe_{1-x}S$, are the sulfides most commonly present in waste rock, tailings, and the mine workings due to their common association with base-metal sulfides and their relative abundance. The oxidation of these minerals produces acidity as well as ferrous and ferric ions, which can promote the oxidation and dissolution of other sulfide minerals. Mine water and drainages that contain the products of oxidation are usually referred to as acid rock drainage (ARD). The environmental impacts caused by ARD are the most significant environmental concern at many mine sites.

Arsenic is frequently found in many types of mineral deposits. It can occur in a large number of sulfides, sulfosalts, oxides, arsenites, and arsenates and is most commonly associated with sulfidic base metal and gold ores. Arsenic is, therefore, often present in small or large concentrations in the waste rock and tailings produced by mining and milling operations and is a common constituent of ARD. Removing arsenic and other contaminants to low residual dissolved concentrations is often necessary to meet water-quality discharge criteria.

One of the most critical aspects of arsenic removal from ARD is its fixation in an environmentally stable form to allow safe, long-term disposal. Precipitation of metals from ARD using lime is widely used, but in the absence of competing cations, the formation of calcium arsenate, $Ca_3(AsO_4)_2$, is favored. This compound, however, has a minimum stability at a high pH (>12), and its long-term stability has been shown to be unsatisfactory due to its interaction with carbon dioxide in air.[1,2] It is now generally accepted that precipitation of arsenic as a basic ferric arsenate, $FeAsO_4 \cdot xFe(OH)_3$, formed by coprecipitation with ferric ion is preferred. While simple ferric arsenate, $FeAsO_4$, formed with a 1:1 Fe/As molar ratio, is relatively soluble at neutral pH, basic ferric arsenates with Fe/As ratios of three or more are stable in a wide pH range.[3–5]

Many processes have been proposed to remove arsenic and other metals from contaminated mine waters, although coprecipitation with iron combined with lime neutralization remains the process of choice for most operations to produce satisfactory effluent and to form stable sludges for disposal. While theoretical considerations of arsenic removal and the stability of the precipitates produced are an important aspect of process design, treatment plants need to be designed to provide simple yet reliable, low-cost performance. Operational experience at a large number of plants has shown that the high-density sludge (HDS) process is the best available technology to meet these design objectives and satisfy environmental criteria.

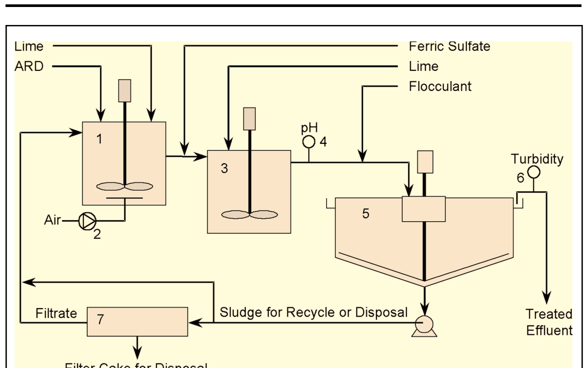

Figure 1. A treatment system for ARD containing arsenic. 1—reactor for partial neutralization; 2—air blower; 3—reactor to complete precipitation; 4—pH measurement and control; 5—clarifier; 6—turbidity measurement; 7—filter press.

REMOVING ARSENIC FROM ARD

Removing arsenic from ARD and other process streams in the mining and metallurgical industries has been investigated using a wide range of processes.[7] Processes that have been used and proposed include precipitation with lime; coprecipitation using ferric ion, copper, zinc, lead, and other metals; precipitation at high temperature and pressure; adsorption with ferric hydroxide, aluminum hydroxide, carbon, and other absorbents; electrolysis; hydrogen reduction; ion exchange; solvent extraction; membrane separations; precipitate flotation; ion flotation; and various passive and active biological processes. Of all the processes evaluated, coprecipitation with ferric ion using ferric sulfate or ferric chloride as a reagent is the process of choice for most applications based on cost, relatively simple engineering and control, reliable performance, and production of environmentally satisfactory effluent and solid residue (sludge).

Lime, CaO, which is usually converted to slaked lime $Ca(OH)_2$ as part of the treatment process, is the most widely used neutralizing agent due to its rapid kinetics and ability to raise the pH to high values. Other reagents can be used and might be preferred in specific cases, including sodium hydroxide, which has the advantage of not forming gypsum, $CaSO_4 \cdot 2H_2O$, as is the case with lime. Gypsum formation can, in some cases, cause scaling problems in treatment-plant equipment. Avoidance of gypsum formation also reduces the volume of sludge for disposal. However, sodium hydroxide is much more costly than lime. Limestone is usually available at a low cost, but has relatively low reactivity and can not be used to increase pH above 5.0 without excessive reagent consumption and subsequent sludge disposal problems. Its use might be applicable where the feed streams are very acidic and where sludge disposal is available at a low cost, but it can only function in combination with another reagent, such as lime or caustic soda, to achieve the final pH needed to precipitate all metals to achieve regulatory compliance.

The addition of slaked lime and ferric ion to ARD precipitates the contained arsenic as ferric arsenate (Equation 1). The ferric ion is precipitated as ferric hydroxide (Equation 2).

$$2H_3AsO_4 + Fe_2(SO_4)_3 + 3Ca(OH)_2 \rightarrow 2FeAsO_4{\cdot}2H_2O + 3CaSO_4{\cdot}2H_2O \quad (1)$$

$$Fe_2(SO_4)_3 + 3Ca(OH)_2 + 6H_2O \rightarrow 2Fe(OH)_3 + 3CaSO_4{\cdot}2H_2O \quad (2)$$

It has been shown[10] that with Fe/As molar ratios greater than one, the coprecipitation of As(V) and Fe(III) does not produce a mixture of ferric arsenate and ferric hydroxide, but forms chemical compounds termed basic ferric arsenates, $FeAsO_4{\cdot}xFe(OH)_3$. The binding of arsenic by absorption on amorphous ferric hydroxide has also been reported to be an effective mechanism of arsenic removal.[11] It should be noted that the presence of other cations, such as copper, zinc, or aluminum, in ARD can assist in the fixation of arsenic in the precipitates due to the formation of corresponding basic-metal arsenates.[11]

Arsenic can also precipitate with lime to form calcium arsenate (Equation 3), but this reaction should be avoided due to the instability of the precipitate.[1]

$$2\ H_3AsO_4 + 3\ Ca(OH)_2 \rightarrow Ca_3(AsO_4)_2 + 6\ H_2O \quad (3)$$

THE HDS PROCESS

Conventional practice for the removal of arsenic from ARD involves ferric-arsenate precipitation followed by flocculation and solids removal. This is carried out in a lime treatment plant in which part of the sludge produced by precipitation is recycled to the process to increase sludge density, which, in turn, increases the efficiency of metal removal and reduces the volume of the sludge produced; this configuration is called a HDS process. Apart from the importance of efficiently removing metals to meet water-quality discharge criteria, the reduction of sludge volumes can have significant economic implications as the cost of sludge storage and maintenance can often exceed the initial capital cost of the treatment plant in the long term.

A hypothetical process flow sheet for a treatment plant for ARD containing arsenic is presented in Figure 1. In this case, two reactors are provided, as it is assumed that the concentration of arsenic in the feed is high (>50 mg/l), but the required concentrations of other metals necessary to precipitate arsenic, particularly iron, are low. If arsenic concentrations are low, a single reactor is usually adequate.

In the flow sheet, ARD is fed to the first reactor, where partial neutralization with lime is carried out to enhance the formation of ferric arsenate. Aeration is provided to oxidize any ferrous iron present. The pH of the first reactor is controlled between 4.5 and 6.5, depending on the feed characteristics. If the feed is deficient in iron (or other metals, such as copper), it might be necessary to add ferric sulfate to the first reactor. Additional ferric sulfate can be added to the overflow launder of the first reactor and lime can be added to the second reactor to adjust the pH to 7–8 to complete the coprecipitation of ferric arsenate with ferric hydroxide. Selection of the final pH will be dependent on the requirements to remove other metals.

Polyelectrolyte (flocculant) is added as a very dilute solution to promote improved settling of the precipitates. It can be added directly to the discharge launder from the second reactor or to a flocculating feed-well of the clarifier. Figure 1 shows the use of a conventional clarifier, in which flocculated precipitates and other suspended solids settle to produce a sludge and the treated effluent overflows for discharge. An arsenic effluent concentration of <0.05 mg/l can be achieved in most well designed plants. If the feed concentration of arsenic is high, however, particulate carryover with the treated effluent can result in exceedance of discharge criteria with respect to total (soluble + dissolved) arsenic. In this case, a final filtration step could be required. Alternatively, a high-efficiency clarification device, such as a lamella clarifier, can produce the required effluent quality, but at a higher capital cost than the cost of a conventional clarifier.

The thickened sludge from the clarifier is recycled back to the first reactor. Sludge recycle promotes and maintains a high sludge density and creates a higher surface area to assist in the removal of colloidal metal. A portion of the recycled sludge is removed periodically for disposal to maintain a constant sludge inventory. A filtration stage allows the removal of sludge from the system as a filter cake. This is an optional step, and its inclusion will depend on factors such as the disposal site characteristics and local regulatory requirements. The density of sludges discharged without filtering will typically be in the range of 20% to 45% solids. Final settled sludge densities in the sludge impoundment can reach 55% solids.

Factors that affect arsenic removal and

SOURCES AND CHEMISTRY OF ARSENIC

Arsenic is widely distributed in nature and occurs in a large number of minerals either as a primary constituent of the crystal structure or in small amounts in arsenic-carrier minerals. More than 300 arsenic and arsenic-carrier minerals are known.[6] Arsenopyrite, FeAsS, is the most abundant arsenic mineral associated with sulfidic mineral deposits. Other prominent arsenic minerals include enargite, Cu_3AsS_4; realgar, AsS; orpiment, As_2S_3; tennantite, $(Cu,Fe)_{12}As_4S_{13}$; niccolite, NiAs; and cobaltite, CoAsS.

Natural background concentrations of arsenic in groundwater and surface water are generally very low. Acidic drainage from mines, waste rock, and tailings, however, can contain significant concentrations of arsenic if the sulfides and other minerals that contain arsenic are present. The oxidation of these minerals can release arsenic into solution. Arsenic may also be present in mine waste as an oxide mineral such as scorodite, $FeAsO_4{\cdot}2H_2O$, or olivenite, $Cu_2(AsO_4)OH$. Since waste rock may contain mixtures of oxides and sulfides, arsenic mobilization may also occur when acid generated by sulfide oxidation contacts the oxide minerals.

Arsenic is a Group VA element and has a chemical behavior considerably different than the heavy metals, such as zinc and copper, with which it is commonly associated in ARD. It chemically resembles phosphorous and, in fact, competes with phosphorous for chemical-binding sites. The chemistry of arsenic is also quite similar to that of antimony, and the same treatment processes are used for removing both metals. Arsenic can be present as a soluble anion or a colloidal particle in ARD and requires separate attention in the design of ARD treatment processes.

The aqueous chemistry of arsenic related to hydrometallurgical processes has been well reviewed.[7,8] In ARD, both arsenic (III) and arsenic (V) can exist, with the relative proportions of each dependent on the source of the dissolved arsenic and on the characteristics of the ARD, particularly with respect to the iron concentration and its valency state [i.e., Fe(II) of Fe(III)].

Equations A–E illustrate reactions that can occur. Iron is usually the principal cation present in ARD due to the oxidation of pyrite, FeS_2, and/or pyrrhotite, $Fe_{1-x}S$. The initial oxidation products of these iron sulfides are acidity (H^+) and Fe(II) (Equation A), which can be oxidized to Fe(III) (Equation B) in the neutral pH range, if solutions are well aerated, or under acidic conditions by chemoautotrophic bacteria that use Fe(II) as an energy source. The ferric ions produced will promote the further oxidation of pyrite (Equation C), pyrrhotite, and other sulfide minerals producing additional acidity, causing the dissolution of the contained metals and Fe(II), which can then be re-oxidized as shown in Equation B.

$$FeS_2 + 3.5O_2 + H_2O \rightarrow Fe^{2+} + 2SO_4^{2-} + 2H^+ \quad (A)$$

$$Fe^{2+} + 0.25O_2 + H^+ \rightarrow Fe^{3+} + 0.5H_2O \quad (B)$$

$$FeS_2 + Fe^{3+} + 8H_2O \rightarrow 15Fe^{2+} + 2SO_4^{2-} + 16H^+ \quad (C)$$

Using arsenopyrite, FeAsS, as an example, the oxidation of arsenic minerals can initially result in the appearance of As (III) in solution (Equation D). In acidic conditions, As (III) is not oxidized to As (V) by air (oxygen) except under pressure and elevated temperatures.[9] Fe (III), if present in ARD, can, however, oxidize As (III) (Equation E).

$$FeAsS + 2.75O_2 + 0.5H_2O \rightarrow HAsO_2 + Fe^{2+} + SO_4^{2-} \quad (D)$$

$$HAsO_2 + 2Fe^{3+} + 2H_2O \rightarrow H_3AsO_4 + 2Fe^{2+} + 2H^+ \quad (E)$$

sludge stability include the oxidation state of iron and arsenic, the Fe/As ratios, pH, polyelectrolytes, sludge recycle and solids inventory, and process and plant considerations.

Oxidation State of Iron and Arsenic

Iron is usually present in mine drainage or other effluents as both Fe(II) and Fe(III). The oxidation of Fe(II) is essential to maximize the Fe(III) content for As(III) oxidation and ferric-arsenate precipitation and to prevent the formation of ferrous arsenate, which is more soluble than basic ferric arsenate. In addition, the precipitation of ferrous hydroxide should be avoided as lime consumption is much higher and the resulting sludge is less stable and more difficult to handle and de-water than ferric hydroxide. The use of air in the arsenic precipitation reactor will ensure that all ferrous iron is oxidized to ferric iron. It should be noted that commercial-grade ferric sulfate added to the process often contains a significant percentage of iron as Fe(II).

As discussed, arsenic should be present as As(V), since the precipitated arsenate compounds generally have a lower solubility than the equivalent As(III) form. If As(III) is high, oxidation using oxidizing agents, such as hydrogen peroxide, might be necessary.

Fe/As Ratios

Operating experience in a large number of plants has shown that the ferric-sulfate addition rate should be set to maintain the Fe/As molar ratio greater than 5:1. This ratio maximizes removal efficiency and ensures that the resultant sludge will be stable. This minimum ratio might be higher than actually required to produce a stable sludge, but the incremental cost of over-addition of the reagent is more than offset by operational simplicity and the elimination of the monitoring costs that would be incurred to demonstrate that the lower ratio is meeting objectives for sludge stability.

pH

The flow sheet in Figure 1 illustrates the neutralization of the arsenic-containing feed in two reactors. Performing neutralization in steps can benefit the precipitation of arsenic by ensuring that ferric arsenate, and not calcium arsenate, is formed. Since calcium-arsenate formation is favored under alkaline conditions, maintaining the pH of the first reactor between 4.5 and 6.5 will favor ferric-arsenate formation. In the second step, neutralization to pH 7–8 takes place over a range where ferric hydroxide has a minimum solubility, and the coprecipitation of ferric arsenate is optimal.

In cases where the arsenic content of the feed is very high, a two-stage arsenic removal system incorporating two separate reactors and clarifiers with interstage solids separation might be considered. Operating experience indicates that treatment efficiency is not overly sensitive to pH fluctuations if the Fe/As molar ratio is above 5:1.

Polyelectrolyte

Proper polyelectrolyte feed is essential in meeting stringent effluent specifications. A number of factors influence the selection and effectiveness of polyelectrolyte addition, including type, charge, charge densities, feed-solution concentration, dosage, air entrainment, and floc shear and dosage.

Solids Inventory

Maintaining a high-solids inventory using recycle and controlled sludge removal can produce low dissolved arsenic and suspended-solids concentrations if coupled with an effective flocculant. Recycled sludge yields maximum settling rates and sludge densities. These factors, in turn, improve overall process stability and result in lower total arsenic concentrations in the effluent. Although ferric-hydroxide floc has a low density, the recycle of ferric hydroxide builds density by incorporating inert components, such as gypsum, into the sludge. In addition, ferric-arsenate precipitates can be colloidal and sludge recycle will provide a high surface area to aid in the removal of these colloids from suspension.

Process and Plant Design

Process and plant design are site specific and depend on a number of factors, including feed volume and composition, effluent discharge criteria, selected neutralizing reagent, storage capacity for the ARD feed, and the sludge disposal method. In all cases, the process fundamentals, with respect to oxidation, precipitation, and sludge stability, must be considered in design, but the plant must also have low capital and operating costs, be simple to operate, and mechanically reliable. Designs should be practical and take into account the selection of construction materials and plant equipment, and the need to supply system back-ups in the event of mechanical and control system failures. Back-up equipment is especially important if the feed-storage capacity is limited.

Although the plant is designed to carry out chemical reactions, it is the physical set-up of the plant that will determine its reliability over long periods of continuous operation and provide assurance that the effluents and sludges will meet the required chemical specifications. The operating conditions of the plant, particularly with respect to reagent dosage, should be selected to allow the plant to produce effluent with significant lower concentrations than the discharge standard. This will reduce the need for costly monitoring and analyses required to check that the plant discharge is in compliance.

SLUDGE STABILITY AND DISPOSAL

In addition to the ferric and other metal arsenates formed in an ARD treatment plant, treatment sludges will contain mixtures of gypsum, heavy-metal hydroxides, heavy-metal carbonates, antimonates, and heavy-metal basic sulfates. The impact of exposure to water and air on the chemical nature of the sludge components and how this might affect their stability must be considered.

The evaluation of ARD sludge stability requires a comprehensive understanding of the physical and chemical behavior of these compounds. The physical characteristics are influenced by the unit processes involved in the treatment—specifically, neutralization, oxidation, and precipitation. The long-term chemical stability of these sludges also depends on a number of factors, including process design and control in the water-treatment process; disposal-site physical characteristics; in-place permeability; particle-size distribution; and the presence of oxygen, sulfides, and complexing agents, such as cyanide, chloride, or naturally occurring organic ions.

Sludge-disposal options include deposition in tailings ponds, separate sludge ponds, marine and lake disposal, and landfills. Although careful selection of the disposal site is essential, HDS sludges are typically stable under neutral leaching conditions and usually contain significant excess residual alkalinity to prevent acidification and resolubilization under most site conditions. As previously discussed, basic ferric arsenates are stable over a wide pH range.

References

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R.W. Lawrence is with Simons Perú, S.A. T.W. Higgs is with H.A. Simons Ltd.

For more information, contact R.W. Lawrence, Simons Perú, S.A., Aramburú 166, Piso 5, Miraflores, Lima 18, Perú; telephone 51-1-221-3130; fax 51-1-221-3143; e-mail rwlawrence@ibm.net.

15.4 Appendix D – 2012 SNP Results – Tundra Mine Remediation

Appendix D

Tundra Mine 2012
Seasonal SNP Reports

Robin Staples, Aquatic Quality Specialist
Water Resources Division, AANDC
Aboriginal Affairs and Northern Development Canada

NOTE: This document is too large to be included within this report and therefore it is attached as a separate, stand-alone .pdf document.

15.5 Appendix E – 2010 Tundra Aquatic Ecology Baseline & Construction Monitoring Report

Appendix E

Tundra Mine 2010
Aquatic Ecology Baseline Studies and Construction Activity Monitoring Program

Rescan™ Environmental Services Ltd.

NOTE: This document is too large to be included within this report and therefore it is attached as a separate, stand-alone .pdf document.

15.6 Appendix F – 2012 Off-site Test Results

Appendix F

Tundra Mine 2012
Off-site Test Results

pure elements
environmental solutions

Date	Sample ID	Lab	Lab ID	Sample Type	Arsenic	Copper	Lead	Nickel	Zinc	Ammonia (as N)	Nitrate (as N)	Nitrite (as N)	TSS	pH	sampled by	NOTES
NO Discharge	over WL criteria		Water Licence Criteria		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			
Min. Discharge	within 20% of limit				0.5	0.01	0.01	0.05	0.02	5	5	0.4	15	6 to 9		
12-Jun-12	Raw - Upper Pond	Taiga	120338-001	Raw	0.723	0.0023	0.0014	0.0068	0.005						R Comartin	
13-Jun-12	Raw - Upper Pond	ALS	L1164270-1	Raw	0.686	0.0018	0.00124	0.00624	0.0055						R Comartin	
14-Jun-12	Raw - Upper Pond	ALS	L1164270-4	Raw	0.702	0.002	0.00129	0.00649	0.0069						R Comartin	
15-Jun-12	Raw - Upper Pond	ALS	L1164270-7	Raw	0.713	0.0021	0.00162	0.00692	0.007						R Comartin	
16-Jun-12	Raw - Upper Pond	ALS	L1164270-11	Raw	0.677	0.0019	0.00124	0.00654	0.0055						R Comartin	
17-Jun-12	Raw - Upper Pond	Taiga	120379-001	Raw	0.747	0.002	0.0014	0.0067	0.006						R Comartin	
18-Jun-12	Raw - Upper Pond	Taiga	120379-004	Raw	0.704	0.0019	0.0081	0.0065	0.006						R Comartin	
19-Jun-12	Raw - Upper Pond	Taiga	120379-007	Raw	0.721	0.0021	2	0.0069	0.042						R Comartin	Note 1
20-Jun-12	Raw - Upper Pond	Taiga	120379-010	Raw	0.737	0.0021	0.0021	0.007	0.008						R Comartin	
21-Jun-12	Raw - Upper Pond	Taiga	120404-002	Raw	0.689	0.0023	0.0019	0.0067	0.0068						T Comartin	
22-Jun-12	Raw - Upper Pond	Taiga	120404-005	Raw	0.651	0.0026	0.0013	0.0064	< 0.005						T Comartin	
23-Jun-12	Raw - Upper Pond	Taiga	120404-008	Raw	0.664	0.002	0.0011	0.0063	< 0.005						T Comartin	
24-Jun-12	Raw - Upper Pond	Taiga	120404-011	Raw	0.652	0.0019	0.0009	0.0058	< 0.005						T Comartin	
25-Jun-12	Raw - Upper Pond	Taiga	120402-001	Raw	0.684	0.002	0.0011	0.006	< 0.005						T Comartin	
26-Jun-12	Raw - Upper Pond	Taiga	120410-001	Raw	0.734	0.0027	0.0015	0.0065	0.0034						T Comartin	
27-Jun-12	Raw - Upper Pond	Taiga	120410-005	Raw	0.736	0.0021	0.0011	0.0056	0.0027						T Comartin	
28-Jun-12	Raw - Upper Pond	Taiga	120434-006	Raw	0.784	0.002	0.0012	0.0066	< 0.005						T Comartin	
29-Jun-12	Raw - Upper Pond	Taiga	120434-013	Raw	0.768	0.0018	0.0011	0.0052	< 0.005						T Comartin	
29-Jun-12	Raw - Upper Pond	Taiga	120434-020	Raw	0.787	0.0018	0.001	0.0053	< 0.005						T Comartin	
30-Jul-12	Raw - Upper Pond	Taiga	120608-002	Raw	1.450	0.0019	0.0007	0.004	0.0008						T Comartin	
31-Jul-12	Raw - Upper Pond	Taiga	120608-007	Raw	1.460	0.0018	0.0007	0.0039	0.0028						T Comartin	
3-Aug-12	Raw - Upper Pond	Taiga	120631-003	Raw	1.440	0.0024	0.0005	0.004	0.0033						T Comartin	
5-Aug-12	Raw - Lower Pond	Taiga	120648-006	Lower Pond	3.100	0.0211	0.0357	0.0132	0.066						T Comartin	Note 2
29-Aug-12	Raw - Upper Pond	Taiga	120756-008	Raw	1.940	0.0023	0.0013	0.0042	0.0018						T Comartin	
5-Jun-12	Train #3 Effluent	ALS	L1157516-1	Treated	< 0.20	< 0.0010	< 0.0050	0.0025	< 0.0040	0.37	0.08	< 0.050	< 3.0	8.09	J Bunz	Note 3
6-Jun-12	Train #2 Effluent	ALS	L1158652-1	Treated	0.014	< 0.0010	< 0.0050	< 0.0020	< 0.0040	0.279	0.099	< 0.050	8	8.1	J Bunz	Note 3
12-Jun-12	Comp A	Taiga	120338-002	Treated	0.725	0.0023	0.0014	0.0069	0.005	0.1	0.21	0.21	6	8.12	R Comartin	Note 4
12-Jun-12	Comp B	Taiga	120338-003	Treated	0.705	0.0022	0.0013	0.0066	0.005	0.1	0.21	0.21	8	8.14	R Comartin	Note 4
13-Jun-12	Comp A	ALS	L1164270-2	Treated	0.031	< 0.0010	0.00012	0.00426	< 0.0040	0.1	0.26	< 0.050	< 3.0	8.05	R Comartin	
13-Jun-12	Comp B	ALS	L1164270-3	Treated	0.031	0.0014	0.00019	0.00333	0.0047	0.12	0.268	< 0.050	4	8.02	R Comartin	
14-Jun-12	Comp A	ALS	L1164270-5	Treated	0.025	0.0011	0.00025	0.0031	< 0.0040	0.136	0.272	< 0.050	< 3.0	8.12	R Comartin	
14-Jun-12	Comp B	ALS	L1164270-6	Treated	0.026	0.0011	0.00025	0.0031	< 0.0040	0.068	0.252	< 0.050	< 3.0	8	R Comartin	
15-Jun-12	Comp A	ALS	L1164270-8	Treated	0.024	0.0013	0.00023	0.00274	< 0.0040	0.083	0.252	< 0.050	3	8.09	R Comartin	
15-Jun-12	Comp B	ALS	L1164270-9	Treated	0.016	< 0.0010	0.00029	0.00297	< 0.0040	0.069	0.254	< 0.050	< 3.0	8.02	R Comartin	
15-Jun-12	Sump 2	ALS	L1164270-10	Treated	0.021	< 0.0010	< 0.0001	0.00312	< 0.0040	0.103	0.284	< 0.050	< 3.0	8.26	R Comartin	
16-Jun-12	Comp A	ALS	L1164270-12	Treated	0.020	< 0.0010	< 0.0001	0.00331	0.004	0.126	0.256	< 0.050	< 3.0	8.16	R Comartin	
16-Jun-12	Sump 1	ALS	L1164270-13	Treated	0.022	0.0011	0.0001	0.00312	< 0.0040						R Comartin	
17-Jun-12	Comp A	ALS	L1164270-15	Treated	0.020	< 0.0010	0.00011	0.00406	< 0.0040	0.126	0.262	< 0.050	< 3.0	8.16	R Comartin	
17-Jun-12	Comp B	ALS	L1164270-16	Treated	0.020	< 0.0010	0.00012	0.00382	< 0.0040	0.131	0.26	< 0.050	6	8.17	R Comartin	
18-Jun-12	Comp A Sump 1	Taiga	120357-001	Treated	0.023	0.0012	< 0.001	0.0033	< 0.005						R Comartin	
18-Jun-12	Comp A	Taiga	120379-002	Treated	0.021	0.0005	0.127	0.0032	0.0063	0.08	0.23	< 0.01	6	8.18	R Comartin	Note 5
18-Jun-12	Comp B	Taiga	120379-003	Treated	0.021	0.0006	0.0028	0.0031	0.0017	0.08	0.23	< 0.01	3	8.17	R Comartin	
19-Jun-12	Comp A	Taiga	120379-005	Treated	0.020	0.0005	0.059	0.0032	0.0029	0.08	0.23	< 0.01	6	8.13	R Comartin	Note 5
19-Jun-12	Comp B	Taiga	120379-006	Treated	0.021	0.0005	0.0704	0.0031	0.0022	0.08	0.23	< 0.01	4	8.08	R Comartin	Note 5
20-Jun-12	Comp A	Taiga	120379-008	Treated	0.017	0.0005	0.0004	0.0029	0.0006	0.09	0.22	< 0.01	4	8.11	R Comartin	
20-Jun-12	Comp B	Taiga	120379-009	Treated	0.018	0.0005	0.0002	0.003	0.0017	0.09	0.22	< 0.01	4	8.13	R Comartin	
21-Jun-12	Comp A	Taiga	120404-003	Treated	0.019	0.0006	< 0.0010	0.0031	0.0007	0.07	0.23	< 0.01	6	7.99	T Comartin	
21-Jun-12	Comp B	Taiga	120404-004	Treated	0.020	0.0006	< 0.0010	0.0032	0.0006	0.08	0.24	< 0.01	6	8.11	T Comartin	
22-Jun-12	Comp A	Taiga	120404-006	Treated	0.017	0.0007	< 0.0010	0.0035	0.0057	0.08	0.24	< 0.01	8	8.04	T Comartin	
22-Jun-12	Comp B	Taiga	120404-007	Treated	0.017	0.0006	< 0.0010	0.0032	0.001	0.06	0.23	< 0.01	8	8.05	T Comartin	
23-Jun-12	Comp A	Taiga	120404-009	Treated	0.015	0.0005	< 0.0010	0.0031	0.0064	0.08	0.23	< 0.01	4	8.05	T Comartin	

Date	Sample ID	Lab	Lab ID	Sample Type	Arsenic	Copper	Lead	Nickel	Zinc	Ammonia (as N)	Nitrate (as N)	Nitrite (as N)	TSS	pH	sampled by	NOTES
NO Discharge	over WL criteria		Water Licence Criteria		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			
Min. Discharge	within 20% of limit				0.5	0.01	0.01	0.05	0.02	5	5	0.4	15	6 to 9		
23-Jun-12	Comp B	Taiga	120404-010	Treated	0.015	0.0005	< 0.0010	0.0031	0.0018	0.09	0.22	< 0.01	< 3.0	8.1	T Comartin	
24-Jun-12	Comp A	Taiga	120404-012	Treated	0.014	0.0008	0.0003	0.0026	0.0035	0.07	0.22	< 0.01	4	7.97	T Comartin	
24-Jun-12	Comp B	Taiga	120404-013	Treated	0.014	0.0005	< 0.0010	0.0026	0.0017	0.08	0.23	< 0.01	4	8.14	T Comartin	
25-Jun-12	B-OFF-0625-1945-P	Taiga	120403-001	Treated	0.020	0.0018	0.0001	0.0027	0.002						T Comartin	
25-Jun-12	B-OFF-0625-1945-P	Taiga	120402-002	Treated						0.05	0.2	< 0.01		8.35	T Comartin	
26-Jun-12	B-OFF-0626-0145-P	Taiga	120403-002	Treated	0.019	0.0019	0.0002	0.0031	0.0024						T Comartin	
26-Jun-12	B-OFF-0626-0745-P	Taiga	120403-003	Treated	0.017	0.0011	0.0001	0.0028	0.0017						T Comartin	
26-Jun-12	B-OFF-0626-0745-P	Taiga	120402-003	Treated						0.05	0.2	< 0.01		8.23	T Comartin	
26-Jun-12	B-OFF-0626-1345-P	Taiga	120410-002	Treated	0.017	0.0024	0.0002	0.0031	0.0027						T Comartin	
26-Jun-12	B-OFF-0626-1945-P	Taiga	120410-003	Treated	0.018	0.0011	0.0001	0.0028	0.0017						T Comartin	
27-Jun-12	B-OFF-0627-0745-P	Taiga	120410-006	Treated	0.018	0.0006	< 0.0010	0.0026	0.0015	0.04	0.18	< 0.01	4	8.21	T Comartin	
27-Jun-12	B-OFF-0627-0745-P	Taiga	120410-009	Treated	0.020	0.0049	0.0003	0.0029	0.003						T Comartin	
27-Jun-12	B-OFF-0627-1945-P	Taiga	120434-001	Treated	0.023	0.0005	0.0002	0.0028	0.0017						T Comartin	
28-Jun-12	B-OFF-0628-0145-P	Taiga	120434-002	Treated	0.022	0.0007	0.0002	0.0029	0.0014						T Comartin	
28-Jun-12	B-OFF-0628-0845-P	Taiga	120434-003	Treated	0.030	< 0.0002	< 0.0001	0.0032	0.0004						T Comartin	
28-Jun-12	B-OFF-0628-0845	Taiga	120434-004	Treated							0.18	< 0.01	4	8.24	T Comartin	
28-Jun-12	B-OFF-0628-0845	Taiga	120434-005	Treated						0.04					T Comartin	
28-Jun-12	B-OFF-0628-1345	Taiga	120434-007	Treated	0.030	0.0008	0.0002	0.0032	0.0022						T Comartin	
28-Jun-12	B-OFF-0628-1945-P	Taiga	120434-008	Treated	0.034	0.008	0.0005	0.003	0.0042						T Comartin	
28-Jun-12	B-OFF-0628-0845-dup	Taiga	120437-001	Treated	0.030	< 0.0002	< 0.0001	0.0033	0.0013	0.04	0.17	< 0.01	6	8.26	T Comartin	
29-Jun-12	B-OFF-0629-0145-P	Taiga	120434-009	Treated	0.036	0.0003	0.0001	0.0029	0.0007						T Comartin	
29-Jun-12	B-OFF-0629-0745-P	Taiga	120434-010	Treated	0.030	0.0003	< 0.0001	0.003	0.0006						T Comartin	
29-Jun-12	B-OFF-0629-0745-P	Taiga	120434-011	Treated							0.17	< 0.01	6	8.4	T Comartin	
29-Jun-12	B-OFF-0629-0745	Taiga	120434-012	Treated						0.02					T Comartin	
29-Jun-12	B-OFF-0629-1345-P	Taiga	120434-014	Treated	0.032	0.0003	0.0001	0.003	0.0008						T Comartin	
29-Jun-12	B-OFF-0629-1945-P	Taiga	120434-015	Treated	0.039	0.0003	0.0001	0.0031	0.0013						T Comartin	
29-Jun-12	B-OFF-0630-0145-P	Taiga	120434-016	Treated	0.038	0.0003	0.0001	0.003	0.0012						T Comartin	
29-Jun-12	B-OFF-0630-0745-P	Taiga	120434-017	Treated	0.030	0.0009	0.0001	0.0031	0.0007						T Comartin	
29-Jun-12	B-OFF-0630-0745	Taiga	120434-018	Treated							0.16	< 0.01	4	8.32	T Comartin	
29-Jun-12	B-OFF-0630-0745	Taiga	120434-019	Treated						0.02					T Comartin	
29-Jun-12	B-OFF-0629-0745-dup	Taiga	120437-002	Treated	0.030	0.0004	0.0001	0.003	0.0008	0.02	0.17	< 0.01	6	8.41	T Comartin	
30-Jun-12	B-OFF-0630-0745-dup	Taiga	120437-003	Treated	0.030	0.0008	0.0014	0.0031	0.0009	0.02	0.16	< 0.01	8	8.36	T Comartin	
1-Jul-12	B-OFF-0701-0745-dup	Taiga	120447-001	Treated	0.030	0.0051	0.0003	0.0031	0.0012	0.02	0.15	< 0.01	4	8.38	T Comartin	
2-Jul-12	B-OFF-0702-0745-dup	Taiga	120447-002	Treated	0.043	0.0004	< 0.0001	0.003	0.0007	0.02	0.12	< 0.01	8	8.41	T Comartin	
3-Jul-12	B-OFF-0703-0745-dup	Taiga	120447-003	Treated	0.047	0.001	0.0002	0.0035	0.001	0.02	0.1	< 0.01	4	8.2	T Comartin	
4-Jul-12	B-OFF-0704-0745-dup	Taiga	120447-004	Treated	0.037	0.001	< 0.0001	0.003	< 0.0004	0.02	0.09	< 0.01	4	8.34	T Comartin	
5-Jul-12	B-OFF-0705-0745-dup	Taiga	120467-001	Treated	0.043	< 0.0002	< 0.0001	0.0036	< 0.0004	0.03	0.08	< 0.01	3	8.04	T Comartin	
6-Jul-12	B-OFF-0706-0745-dup	Taiga	120467-002	Treated	0.049	0.0002	< 0.0001	0.0032	0.0005	0.02	0.06	< 0.01	<3	8.22	T Comartin	
7-Jul-12	B-OFF-0707-0745-dup	Taiga	120491-001	Treated	0.080	0.0011	0.0002	0.0034	0.0015	0.03	0.07	< 0.01	4	8.06	T Comartin	
8-Jul-12	B-OFF-0708-0745-dup	Taiga	120491-002	Treated	0.085	0.0011	0.0002	0.003	0.0015	0.02	0.05	< 0.01	6	8.16	T Comartin	
9-Jul-12	B-OFF-0709-0745-dup	Taiga	120491-003	Treated	0.066	0.0006	< 0.0001	0.0032	0.0006	0.02	0.05	< 0.01	4	8	T Comartin	
10-Jul-12	B-OFF-0710-0745-dup	Taiga	120491-004	Treated	0.038	0.0005	< 0.0001	0.003	0.0005	0.02	0.04	< 0.01	4	8	T Comartin	
11-Jul-12	B-OFF-0711-0745-dup	Taiga	120491-005	Treated	0.075	0.0008	0.0001	0.0028	0.0014	0.02	0.03	< 0.01	4	8.22	T Comartin	
12-Jul-12	B-OFF-0712-0745-dup	Taiga	120513-001	Treated	0.054	0.0009	0.0002	0.0047	0.0029	0.03	466	< 0.01	4	1.73	R Comartin	Note 6
12-Jul-12	B-OFF-0712-0745	Taiga	120552-001	Treated	0.054	0.0009	0.0002	0.0047	0.0029	0.03	0.03	< 0.01	4	7.87	R Comartin	
13-Jul-12	B-OFF-0713-0745-dup	Taiga	120513-003	Treated	0.053	0.0006	0.0002	0.0033	0.0013	0.02	0.02	< 0.01	4	8.13	R Comartin	
14-Jul-12	B-OFF-0714-0745-dup	Taiga	120513-004	Treated	0.062	0.0006	0.0001	0.0033	0.0009	0.02	< 0.01	< 0.01	<3	8.21	R Comartin	
15-Jul-12	B-OFF-0715-0745-dup	Taiga	120513-002	Treated	0.082	0.0008	0.0001	0.0033	0.0008	0.02	0.02	< 0.01	4	8.25	R Comartin	
16-Jul-12	B-OFF-0716-0845	Taiga	120532-001	Treated	0.067	0.0009	< 0.0001	0.0029	0.0006	0.02	< 0.01	< 0.01	8	8.37	R Comartin	
17-Jul-12	B-OFF-0717-0745	Taiga	120532-002	Treated	0.076	0.001	0.0001	0.0034	0.0015	0.03	< 0.01	< 0.01	6	8.22	R Comartin	
18-Jul-12	B-OFF-0718-0745	Taiga	120532-003	Treated	0.129	0.001	< 0.0001	0.0033	0.0005	0.02	< 0.01	< 0.01	8	8.31	R Comartin	

Date	Sample ID	Lab	Lab ID	Sample Type	Arsenic	Copper	Lead	Nickel	Zinc	Ammonia (as N)	Nitrate (as N)	Nitrite (as N)	TSS	pH	sampled by	NOTES
NO Discharge	over WL criteria		Water Licence Criteria		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			
Min. Discharge	within 20% of limit				0.5	0.01	0.01	0.05	0.02	5	5	0.4	15	6 to 9		
19-Jul-12	B-OFF-0719-0745-DUP	Taiga	120551-001	Treated	0.065	0.0011	< 0.0001	0.0029	0.0006	0.02	< 0.01	< 0.01	8	8.25	R Comartin	Note 7
20-Jul-12	B-OFF-0720-0745-DUP	Taiga	120551-002	Treated	0.068	0.001	< 0.0001	0.0027	0.001	0.02	< 0.01	< 0.01	10	8.33	R Comartin	
21-Jul-12	B-OFF-0721-0745-DUP	Taiga	120551-003	Treated	0.089	0.0009	< 0.0001	0.0026	0.0006	0.02	< 0.01	< 0.01	10	8.41	R Comartin	
22-Jul-12	B-OFF-0722-0745-DUP	Taiga	120576-001	Treated	0.059	0.0014	0.0001	0.0025	0.0028	0.02	< 0.01	< 0.01	10	8.26	R Comartin	
23-Jul-12	B-OFF-0723-0745-DUP	Taiga	120576-002	Treated	0.074	0.0011	< 0.0001	0.003	0.0023	0.02	< 0.01	< 0.01	6	8.23	R Comartin	
24-Jul-12	B-OFF-0724-0745-DUP	Taiga	120576-003	Treated	0.084	0.0012	< 0.0001	0.003	0.0034	0.02	< 0.01	< 0.01	8	8.3	R Comartin	
25-Jul-12	B-OFF-0725-0745-DUP	Taiga	120576-004	Treated	0.063	0.0012	< 0.0001	0.0028	0.0016	0.02	< 0.01	< 0.01	8	8.29	R Comartin	
26-Jul-12	B-OFF-0726-0745-DUP	Taiga	120607-001	Treated	0.076	0.0005	< 0.0001	0.0031	0.0009	0.02	< 0.01	< 0.01	8	8.17	T Comartin	
27-Jul-12	B-OFF-0727-0745-DUP	Taiga	120607-002	Treated	0.070	0.0006	0.0003	0.0032	0.0018	0.02	< 0.01	< 0.01	8	8.16	T Comartin	
28-Jul-12	B-OFF-0728-0745-DUP	Taiga	120607-003	Treated	0.063	0.0004	< 0.0001	0.0032	0.0009	0.02	< 0.01	< 0.01	6	8.14	T Comartin	
29-Jul-12	B-OFF-0729-0745-DUP	Taiga	120607-004	Treated	0.088	0.0006	0.0001	0.0032	0.0019	0.02	< 0.01	< 0.01	6	8.22	T Comartin	
30-Jul-12	B-OFF-0730-0745-DUP	Taiga	120607-005	Treated						< 0.01	< 0.01	< 0.01	6	8.17	T Comartin	
30-Jul-12	B-OFF-0730-0745-DUP	Taiga	120608-001	Treated	0.071	0.0057	0.0003	0.0033	0.0019						T Comartin	
30-Jul-12	B-OFF-0730-1345	Taiga	120608-003	Treated	0.064	0.0005	< 0.0001	0.0031	0.001						T Comartin	
30-Jul-12	B-OFF-0730-1945	Taiga	120608-004	Treated	0.063	0.0013	< 0.0001	0.0031	0.0026						T Comartin	
31-Jul-12	B-OFF-0731-0745-DUP	Taiga	120607-006	Treated						0.01	< 0.01	< 0.01	6	8.23	T Comartin	
31-Jul-12	B-OFF-0731-0745-DUP	Taiga	120608-006	Treated	0.106	0.0005	0.0002	0.0033	0.0056						T Comartin	
31-Jul-12	B-OFF-0731-0145	Taiga	120608-005	Treated	0.062	0.0006	< 0.0001	0.0032	0.0036						T Comartin	
31-Jul-12	B-OFF-0731-1345	Taiga	120608-008	Treated	0.078	0.0004	< 0.0001	0.0037	0.0012						T Comartin	
1-Aug-12	B-OFF-0801-0745-DUP	Taiga	120617-001	Treated	0.086	0.0007	0.0002	0.0035	0.0013	< 0.01	0.04	< 0.01	10	8.21	T Comartin	
2-Aug-12	B-OFF-0802-0745-DUP	Taiga	120631-001	Treated	0.134	0.0011	< 0.0001	0.0031	0.0016	0.02	< 0.01	< 0.01	4	8.4	T Comartin	
3-Aug-12	B-OFF-0803-0745-DUP	Taiga	120631-002	Treated	0.134	0.0011	< 0.0001	0.0033	0.0012	0.02	0.35	< 0.01	8	8.29	T Comartin	
4-Aug-12	B-OFF-0804-0745-DUP	Taiga	120648-001	Treated	0.139	0.0009	< 0.0001	0.0037	0.0021	0.02	< 0.01	< 0.01	6	8.16	T Comartin	
5-Aug-12	B-OFF-0805-0745-DUP	Taiga	120648-002	Treated	0.133	0.0009	0.0004	0.0035	0.0013	0.02	< 0.01	< 0.01	4	8.32	T Comartin	
6-Aug-12	B-OFF-0806-0745-DUP	Taiga	120648-003	Treated	0.110	0.0009	< 0.0001	0.003	0.0008	0.02	< 0.01	< 0.01	6	8.4	T Comartin	
7-Aug-12	B-OFF-0807-0745-DUP	Taiga	120648-004	Treated	0.110	0.001	0.0001	0.0031	0.0018	0.01	< 0.01	< 0.01	8	8.4	I Ricketts	
8-Aug-12	B-OFF-0808-0745-DUP	Taiga	120648-005	Treated	0.142	0.0018	< 0.0001	0.0032	0.0014	0.02	< 0.01	< 0.01	6	8.42	R Comartin	
9-Aug-12	B-OFF-0809-0745-DUP	Taiga	120664-001	Treated	0.158	0.0015	< 0.0001	0.0032	0.0015	< 0.01	< 0.01	< 0.01	6	8.17	R Comartin	
10-Aug-12	B-OFF-0810-0745-DUP	Taiga	120664-002	Treated	0.141	0.0014	< 0.0001	0.0031	0.0013	< 0.01	< 0.01	< 0.01	8	8.26	R Comartin	
11-Aug-12	B-OFF-0811-0745-DUP	Taiga	120664-003	Treated	0.085	0.0013	0.0002	0.0035	0.003	< 0.01	< 0.01	< 0.01	6	8.14	R Comartin	
12-Aug-12	B-OFF-0812-0745-DUP	Taiga	120664-004	Treated	0.083	0.0012	0.0002	0.0046	0.0028	< 0.01	< 0.01	< 0.01	6	7.99	R Comartin	
13-Aug-12	B-OFF-0813-0745-DUP	Taiga	120664-005	Treated	0.096	0.0015	0.0002	0.0044	0.0023	0.01	< 0.01	< 0.01	6	7.97	R Comartin	
14-Aug-12	B-OFF-0814-0745-DUP	Taiga	120681-001	Treated	0.089	0.0012	< 0.0001	0.0048	0.0022	0.02	< 0.01	< 0.01	8	7.96	R Comartin	
15-Aug-12	B-OFF-0815-0745-DUP	Taiga	120681-002	Treated	0.070	0.0011	< 0.0001	0.0045	0.0024	0.02	< 0.01	< 0.01	4	8.06	R Comartin	
16-Aug-12	B-OFF-0816-0745-DUP	Taiga	120719-006	Treated	0.053	< 0.0002	< 0.0001	0.0033	< 0.0004	0.02	0.02	< 0.01	6	8.36	T Comartin	
17-Aug-12	B-OFF-0817-0745-DUP	Taiga	120719-007	Treated	0.056	< 0.0002	< 0.0001	0.0032	< 0.0004	0.01	0.02	< 0.01	6	8.36	T Comartin	
18-Aug-12	B-OFF-0818-0745-DUP	Taiga	120719-008	Treated	0.050	< 0.0002	< 0.0001	0.003	< 0.0004	0.01	< 0.01	< 0.01	6	8.4	T Comartin	
19-Aug-12	B-OFF-0819-0745-DUP	Taiga	120719-001	Treated	0.058	< 0.0002	< 0.0001	0.003	< 0.0004	< 0.01	< 0.01	< 0.01	6	8.36	T Comartin	
20-Aug-12	B-OFF-0820-0745-DUP	Taiga	120719-002	Treated	0.068	< 0.0002	< 0.0001	0.0032	0.001	< 0.01	< 0.01	< 0.01	6	8.45	T Comartin	
21-Aug-12	B-OFF-0821-0745-DUP	Taiga	120719-003	Treated	0.059	< 0.0002	< 0.0001	0.003	< 0.0004	0.01	< 0.01	< 0.01	4	8.41	T Comartin	
22-Aug-12	B-OFF-0822-0745-DUP	Taiga	120719-004	Treated	0.065	< 0.0002	< 0.0001	0.003	< 0.0004	0.01	0.08	< 0.01	4	8.39	T Comartin	
23-Aug-12	B-OFF-0823-0745-DUP	Taiga	120756-001	Treated	0.081	0.0009	0.0003	0.0033	0.0014	0.02	< 0.01	< 0.01	6	8.27	T Comartin	
24-Aug-12	B-OFF-0824-0745-DUP	Taiga	120756-002	Treated	0.073	0.0009	0.0002	0.0032	0.0014	0.01	< 0.01	< 0.01	6	8.35	T Comartin	
25-Aug-12	B-OFF-0825-0745-DUP	Taiga	120756-003	Treated	0.071	0.0009	0.0002	0.0031	0.001	0.02	0.13	< 0.01	8	8.31	T Comartin	
26-Aug-12	B-OFF-0826-0745-DUP	Taiga	120756-004	Treated	0.067	0.001	0.0002	0.003	0.0016	0.01	< 0.01	< 0.01	6	8.41	T Comartin	
27-Aug-12	B-OFF-0827-0745-DUP	Taiga	120756-005	Treated	0.075	0.0009	0.0002	0.003	0.0008	0.02	< 0.01	< 0.01	6	8.4	T Comartin	
28-Aug-12	B-OFF-0828-0745-DUP	Taiga	120756-006	Treated	0.071	0.0009	0.0002	0.0031	0.0009	0.01	< 0.01	< 0.01	6	8.44	T Comartin	
29-Aug-12	B-OFF-0829-0745-DUP	Taiga	120756-007	Treated	0.066	0.0009	0.0002	0.0033	0.003	0.01	< 0.01	< 0.01	6	8.48	T Comartin	
30-Aug-12	B-OFF-0830-0745-DUP	Taiga	120782-001	Treated	0.107	0.0009	< 0.0001	0.0032	0.0016	0.02	0.05	< 0.01	10	8.3	T Comartin	
31-Aug-12	B-OFF-0831-0745-DUP	Taiga	120782-002	Treated	0.078	0.0009	< 0.0001	0.0026	0.0014	0.02	0.03	< 0.01	8	8.38	T Comartin	

Date	Sample ID	Lab	Lab ID	Sample Type	Arsenic	Copper	Lead	Nickel	Zinc	Ammonia (as N)	Nitrate (as N)	Nitrite (as N)	TSS	pH	sampled by	NOTES
NO Discharge	over WL criteria		Water Licence Criteria		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			
Min. Discharge	within 20% of limit				0.5	0.01	0.01	0.05	0.02	5	5	0.4	15	6 to 9		
1-Sep-12	B-OFF-0901-0745-DUP	Taiga	120782-003	Treated	0.093	0.0009	0.0001	0.0028	0.0014	0.02	0.02	< 0.01	10	8.45	T Comartin	
2-Sep-12	B-OFF-0902-0745-DUP	Taiga	120782-004	Treated	0.072	0.0007	< 0.0001	0.0037	0.0012	0.02	0.02	< 0.01	6	8.24	T Comartin	
3-Sep-12	B-OFF-0903-0745-DUP	Taiga	120782-005	Treated	0.066	0.0008	< 0.0001	0.0038	0.0012	0.02	0.02	< 0.01	4	8.2	T Comartin	
4-Sep-12	B-OFF-0904-0745-DUP	Taiga	120782-006	Treated	0.091	0.0008	< 0.0001	0.0043	0.0016	0.02	0.02	< 0.01	8	8.12	T Comartin	
5-Sep-12	B-OFF-0905-0745-DUP	Taiga	120782-007	Treated	0.062	0.0008	< 0.0001	0.0042	0.0012	0.02	0.05	< 0.01	4	8.14	I Ricketts	
6-Sep-12	B-OFF-0906-0745-DUP	Taiga	120819-001	Treated	0.067	0.0011	0.0002	0.0042	0.0017	0.128	0.03	< 0.01	6	8.11	R Comartin	
7-Sep-12	B-OFF-0907-0745-DUP	Taiga	120819-002	Treated	0.072	0.0011	0.0002	0.0034	0.0014	0.075	0.03	< 0.01	4	8.23	R Comartin	
8-Sep-12	B-OFF-0908-0745-DUP	Taiga	120819-003	Treated	0.075	0.0012	0.0002	0.0028	0.0007	0.025	0.02	< 0.01	6	8.45	R Comartin	
9-Sep-12	B-OFF-0909-0745-DUP	Taiga	120819-004	Treated	0.093	0.0014	0.0002	0.0044	0.0018	0.036	0.1	< 0.01	6	8.23	R Comartin	
10-Sep-12	B-OFF-0910-0745-DUP	Taiga	120819-005	Treated	0.082	0.0012	0.0001	0.0039	0.0007	0.096	0.03	< 0.01	10	8.32	R Comartin	
11-Sep-12	B-OFF-0911-0745-DUP	Taiga	120819-006	Treated	0.112	0.0011	0.0002	0.0043	0.0014	0.201	0.09	< 0.01	10	8.21	R Comartin	
12-Sep-12	B-OFF-0912-0745-DUP	Taiga	120819-007	Treated	0.068	0.001	0.0001	0.0034	0.0007	0.095	0.02	< 0.01	6	8.44	R Comartin	
13-Sep-12	B-OFF-0913-0745-DUP	Taiga	120862-001	Treated	0.071	0.001	0.0008	0.0043	0.002	< 0.005	0.02	< 0.01	8	8.21	R Comartin	
14-Sep-12	B-OFF-0914-0745-DUP	Taiga	120862-002	Treated	0.062	0.0009	0.0006	0.0044	0.0018	0.016	0.02	< 0.01	6	8.3	R Comartin	
15-Sep-12	B-OFF-0915-0745-DUP	Taiga	120862-003	Treated	0.107	0.0011	0.0008	0.0062	0.0029	< 0.005	0.04	< 0.01	10	8.12	R Comartin	
16-Sep-12	B-OFF-0916-0745-DUP	Taiga	120862-004	Treated	0.094	0.0013	0.0009	0.0056	0.003	< 0.005	0.03	< 0.01	8	8.21	R Comartin	
17-Sep-12	B-OFF-0917-0745-DUP	Taiga	120862-005	Treated	0.087	0.0011	0.0008	0.0048	0.002	< 0.005	0.04	< 0.01	10	8.37	R Comartin	
18-Sep-12	B-OFF-0918-0745-DUP	Taiga	120862-006	Treated	0.082	0.001	0.0011	0.0056	0.0021	< 0.005	0.04	< 0.01	6	8.31	R Comartin	
19-Sep-12	B-OFF-0919-0745-DUP	Taiga	120862-007	Treated	0.076	0.0008	0.0012	0.005	0.0028	0.033	0.03	< 0.01	8	8.43	R Comartin	
20-Sep-12	B-OFF-0920-0745-DUP	Taiga	120881-001	Treated	0.061	0.001	0.0003	0.0064	0.0026	0.1	0.07	< 0.01	8	8.38	T Comartin	

EXPLANATION OF NOTATIONS

NOTE 1: Lead and Zinc anamoly in raw/treated water from undetermined source. Treated samples have not been included in graphical presentation because no discharge occurred these days.

NOTE 2 Labelled incorrectly by the lab, this is water sample of lower pond water taken from lower pond pump. Have not asked lab to re-label this one.
Sample has not been included in graphical presentation because it is not indicative of the raw water at the water treatment plant intake.

NOTE 3 Samples are from ends of treatment trains and have not been included in graphical presentation since this water was not directly discharged. These results are prior to final clarification.

NOTE 4 High treated arsenic attributed to a mix up with sample labelling. This was the first day of discharge and samples were being labelled too quickly, pending take-off of an unexpected airplane.
These are actually RAW values and therefore these results for June 12 have been excluded from the graphical data presentation as a result of the error.

NOTE 5 See Note 1

NOTE 6 Nitric acid preservative and sulfuric acid preservative were accidentally added to the wrong sample bottles during sampling therefore the alternate sample was tested.

NOTE 7 Results from sample ID B-OFF-0712-0745-dup have been excluded from the graphical presentation as a result of the error.
Report amended by Taiga outlining TSS = 8mg/L after a re-test was requested. Original report outlined a TSS = 30 mg/L

15.7 Appendix G – 2012 On-site Test Results

Appendix G

Tundra Mine 2012
On-site Test Results

pure elements
environmental solutions

Date	Sample ID	Lab	Sample Type	Arsenic	Copper	Lead	Nickel	**Zinc	Ammonia (as N)	*Nitrate (as N)	*Nitrite (as N)	TSS	pH	analysed by	NOTES
No Discharge	over WL criteria	Water Licence Criteria		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		Rob	
Min. Discharge	within 20% of limit			0.5	0.01	0.01	0.05	0.02	5	5	0.4	15	6 to 9	Trina	
11-Jun-12	Comp A	Onsite	Treated	0.073	0.001	<.003	0.013							Rob	^^
12-Jun-12	Comp A	Onsite	Treated	0.072	<.001	<.003	<.006	0.010	< 2	<.23	< .015	< 5	8.41	Rob	
12-Jun-12	Comp B	Onsite	Treated	0.065	<.001	<.003	0.006	0.090	< 2	<.23	0.016	< 5	8.42	Rob	
13-Jun-12	Comp A	Onsite	Treated	0.000	<.001	<.003	<.006	0.010	< 2	<.23	0.015	< 5	8.40	Rob	
13-Jun-12	Comp B	Onsite	Treated	0.000	<.001	<.003	0.008	0.040	< 2	<.23	< .015	< 5	8.36	Rob	
14-Jun-12	Comp A	Onsite	Treated	0.004	<.001	<.003	0.009	0.020	< 2	0.331	0.019	< 5	8.44	Rob	
14-Jun-12	Comp B	Onsite	Treated		<.001	<.003	0.007	0.010	< 2	0.330	0.032	< 5	8.38	Rob	
15-Jun-12	Comp A	Onsite	Treated	0.001	<.001	<.003	<.006	0.020	< 2	<.23	0.025	< 5	8.49	Rob	
15-Jun-12	Comp B	Onsite	Treated		<.001	<.003	<.006	0.010	< 2	<.23	0.031	< 5	8.21	Rob	
16-Jun-12	Comp A	Onsite	Treated	0.007	<.001	<.003	<.006	0.040	< 2	<.23	< .015	< 5	8.35	Rob	
16-Jun-12	Comp B	Onsite	Treated					0.050						Rob	
17-Jun-12	Comp A	Onsite	Treated	0.000	<.001	<.003	0.019	0.060	< 2	0.292	0.023	< 5	8.44	Rob	
17-Jun-12	Comp B	Onsite	Treated		<.001	<.003	0.009	0.070	< 2	0.263	0.043	< 5	8.50	Rob	
18-Jun-12	Comp A	Onsite	Treated	0.024	<.001	<.003	<.006	0.190	< 2	0.397	0.039	< 5	8.25	Rob	** Internal
18-Jun-12	Comp B	Onsite	Treated		<.001	<.003	<.006	0.220	< 2	0.285	0.078	< 5	8.40	Rob	Shut down
19-Jun-12	Comp A	Onsite	Treated	0.007	<.001	<.003	0.016	0.140	< 2	<.23	0.053	< 5	8.38	Rob	due to high
19-Jun-12	Comp B	Onsite	Treated		<.001	<.003	<.006	0.180	< 2	<.23	0.065	< 5	8.51	Rob	onsite zinc
20-Jun-12	Comp A	Onsite	Treated	0.002	0.002	<.003	<.006	0.480	< 2	<.23	0.035	< 5	8.41	Rob/Trina	results
20-Jun-12	Comp B	Onsite	Treated		0.002	<.003	<.006	0.320	< 2	<.23	0.041	< 5	8.49	Rob/Trina	** ^^
21-Jun-12	Comp A	Onsite	Treated	0.009	<.001	<.003	<.006	0.020	< 2	0.460	0.017	6	8.19	Trina	
22-Jun-12	Comp A	Onsite	Treated	0.008	<.001	<.003	0.008	0.070	< 2	0.354	0.022	< 5	8.12	Trina	
23-Jun-12	Comp A	Onsite	Treated	0.008	<.001	0.004	0.012	0.040	< 2	0.284	0.015	< 5	8.31	Trina	
24-Jun-12	Comp A	Onsite	Treated	0.019	0.011	0.004	0.013	0.020	< 2	<.23	0.020	< 5	8.26	Trina	^Retested
24-Jun-12	Comp B	Onsite	Treated		<.001	0.005						< 5	8.53	Trina	Retest results
25-Jun-12	B-ON-0625-0745-DUP	Onsite	Treated	0.021	<.001	0.011	0.008	0.090	< 2	<.23	0.020	< 5	8.79	Trina	^Retested
25-Jun-12	B-ON-0625-0745-DUP	Onsite	Treated			<.003								Trina	Retest results
26-Jun-12	B-ON-0626-0745-DUP	Onsite	Treated	0.025	<.001	0.003	0.012	0.000	< 2	<.23	0.017	< 5	8.60	Trina	
27-Jun-12	B-ON-0627-0745-DUP	Onsite	Treated	0.022	<.001	0.009	0.015	0.020	< 2	<.23	0.022	< 5	8.50	Trina	
28-Jun-12	B-ON-0628-0745-DUP	Onsite	Treated	0.024	<.001	0.015	0.008	0.010	< 2	0.401	0.020	< 5	8.69	Trina	^Retested
28-Jun-12	B-ON-0628-0745-DUP	Onsite	Treated			<.003								Trina	Retest results
29-Jun-12	B-ON-0629-0745-DUP	Onsite	Treated	0.021	<.001	0.008	0.041	0.040	< 2	<.23	< .015	< 5	8.77	Trina	
30-Jun-12	B-ON-0630-0745-DUP	Onsite	Treated	0.018	<.001	<.003	<.006	0.080	< 2	<.23	0.016	< 5	8.66	Trina	
1-Jul-12	B-ON-0701-0745-DUP	Onsite	Treated	0.022	<.001	<.003	<.006	0.020	<2	0.241	0.024	5	8.92	Trina C.	
2-Jul-12	B-ON-0702-0745-DUP	Onsite	Treated	0.021	<.001	<.003	0.010	<0.01	<2	<0.23	0.018	7	8.88	Trina C.	
3-Jul-12	B-ON-0703-0745-DUP	Onsite	Treated	0.026	<.001	<.003	0.030	0.090	<2	no reagents	no reagents	< 5	8.54	Trina C.	
4-Jul-12	B-ON-0704-0745-DUP	Onsite	Treated	0.022	<.001	<.003	<.006	0.120	<2	no reagents	no reagents	< 5	8.72	Trina C.	**
5-Jul-12	B-ON-0705-0745-DUP	Onsite	Treated	0.019	0.001	<.003	0.016	0.136	<2	no reagents	no reagents	< 5	8.38	Trina C.	**
6-Jul-12	B-ON-0706-0745-DUP	Onsite	Treated	0.028	<.001	<.003	0.012	0.032	<2	no reagents	no reagents	< 5	8.50	Trina C.	
7-Jul-12	B-ON-0707-0745-DUP	Onsite	Treated	0.024	<.001	<.003	0.009	0.240	<2	no reagents	no reagents	< 5	8.53	Trina C.	**
8-Jul-12	B-ON-0708-0745-DUP	Onsite	Treated	0.020	<.001	<.003	0.011	0.088	<2	no reagents	no reagents	< 5	8.55	Trina C.	
9-Jul-12	B-ON-0709-0745-DUP	Onsite	Treated	0.012	<.001	<.003	0.013	0.028	<2	no reagents	no reagents	< 5	7.86	Trina C.	
10-Jul-12	B-ON-0710-0745-DUP	Onsite	Treated	0.006	<.001	<.003	0.012	0.099	<2	no reagents	no reagents	< 5	7.89	Trina C.	
11-Jul-12	B-ON-0711-0745-DUP	Onsite	Treated	0.038	<.001	0.006	<.006	0.067	<2	no reagents	no reagents	7	8.23	Trina C.	

Date	Sample ID	Lab	Sample Type	Arsenic	Copper	Lead	Nickel	**Zinc	Ammonia (as N)	*Nitrate (as N)	*Nitrite (as N)	TSS	pH	analysed by	NOTES
No Discharge	over WL criteria	Water Licence Criteria		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		Rob	
Min. Discharge	within 20% of limit			0.5	0.01	0.01	0.05	0.02	5	5	0.4	15	6 to 9	Trina	
12-Jul-12	B-ON-0712-0745-DUP	Onsite	Treated	0.003	<.001	<.003	<.006	0.070	<2	no reagents	no reagents	< 5	7.7	Rob C.	
13-Jul-12	B-ON-0713-0745-DUP	Onsite	Treated	0.01	<.001	0.007	0.014	0.020	<2	no reagents	no reagents	< 5	7.78	Rob C.	
14-Jul-12	B-ON 0714-0745-DUP	Onsite	Treated	0.011	<.001	0.003	<.006	0.040	<2	no reagents	no reagents	< 5	8.18	Rob C.	
15-Jul-12	B-ON 0715-0745-DUP	Onsite	Treated	0.031	0.006	<.003	<.006	0.040	<2	no reagents	no reagents	< 5	8.2	Rob C.	
16-Jul-12	B-ON 0716-0745-DUP	Onsite	Treated	0.018	<.001	<.003	<.006	0.080	<2	no reagents	no reagents	< 5	8.24	Rob C.	
17-Jul-12	B-ON 0717-0745-DUP	Onsite	Treated	0.018	0.003	<.003	<.006	0.080	<2	no reagents	no reagents	< 5	8.31	Rob C.	
18-Jul-12	B-ON-0718-0745-DUP	Onsite	Treated	0.013	0.002	<.003	<.006	0.090	<2	no reagents	no reagents	< 5	8.26	Rob C.	
19-Jul-12	B-ON-0719-0745-DUP	Onsite	Treated	0.02	0.004	<.003	<.006	0.070	<2	no reagents	no reagents	6	8.28	Rob C.	
20-Jul-12	B-ON-0720-0745-DUP	Onsite	Treated	0.005	0.001	<.003	<.006	0.090	<2	no reagents	no reagents	10	8.26	Rob C.	
21-Jul-12	B-ON-0721-0745-DUP	Onsite	Treated	0.031	0.003	<.003	<.006	0.050	<2	no reagents	no reagents	6	8.1	Rob C.	
22-Jul-12	B-ON-0722-0745-DUP	Onsite	Treated	0.028	0.003	<.003	<.006	0.070	<2	no reagents	no reagents	5	8.66	Rob C.	
23-Jul-12	B-ON-0723-0745-DUP	Onsite	Treated	0.013	<.001	<.003	<.006	0.070	<2	no reagents	no reagents	9	8.37	Rob C.	
24-Jul-12	B-ON-0724-0745-DUP	Onsite	Treated	0.009	0.003	<.003	<.006	0.080	<2	no reagents	no reagents	5	8.06	Rob C.	
25-Jul-12	B-ON-0725-0745-DUP	Onsite	Treated	0.007	<.001	<.003	<.006	0.070	<2	no reagents	no reagents	9	8.09	Rob C.	
26-Jul-12	B-ON-0726-0745-DUP	Onsite	Treated	0.048	<.001	<.003	0.008	0.110	<2	no reagents	no reagents	7	7.62	Trina C.	
27-Jul-12	B-ON-0727-0745-DUP	Onsite	Treated	0.023	<.001	<.003	0.01	0.030	<2	no reagents	no reagents	7	8.1	Trina C.	
28-Jul-12	B-ON-0728-0745-DUP	Onsite	Treated	0.003	<.001	<.003	<.006	0.030	<2	no reagents	no reagents	< 5	7.85	Trina C.	
29-Jul-12	B-ON-0729-0745-DUP	Onsite	Treated	0.027	<.001	<.003	<.006	0.030	<2	no reagents	no reagents	< 5	8.68	Trina C.	
30-Jul-12	B-ON-0730-0745-DUP	Onsite	Treated	0.03	<.001	<.003	<.006	0.026	<2	no reagents	no reagents	6	8.6	Trina C.	
31-Jul-12	B-ON-0731-0745-DUP	Onsite	Treated	0.005	<.001	<.003	0.015	0.042	<2	no reagents	no reagents	5	8.47	Trina C.	
1-Aug-12	B-ON-0801-0745-DUP	Onsite	Treated	0.001	<.001	0.005	<.006	0.045	<2	no reagents	no reagents	7	8.59	Trina C.	
2-Aug-12	B-ON-0802-0745-DUP	Onsite	Treated	0.072	<.001	<.003	<.006	0.086	<2	no reagents	no reagents	7	8.66	Trina C.	
3-Aug-12	B-ON-0803-0745-DUP	Onsite	Treated	0.065	<.001	<.003	<.006	0.093	<2	no reagents	no reagents	7	8.10	Trina C.	
4-Aug-12	B-ON-0804-0745-DUP	Onsite	Treated	0.095	<.001	<.003	<.006	0.035	<2	<0.23	<.015	6	8.08	Trina C.	
5-Aug-12	B-ON-0805-0745-DUP	Onsite	Treated	0.028	<.001	<.003	<.006	0.013	<2	<0.23	<.015	6	8.13	Trina C.	
6-Aug-12	B-ON-0806-0745-DUP	Onsite	Treated	0.044	<.001	<.003	0.012	0.036	<2	<0.23	<.015	6	8.67	Trina C.	
7-Aug-12	B-ON-0807-0745-DUP	Onsite	Treated	0.043	<.001	<.003	0.012	0.012	<2	<0.23	<.015	7	8.45	Trina C.	
8-Aug-12	B-ON-0808-0745-DUP	Onsite	Treated	0.018	<.001	<.003	<.006	0.027	<2	<0.23	0.016	5	8.48	Rob C	
9-Aug-12	B-ON-0809-0745-DUP	Onsite	Treated	0.030	<.001	<.003	<.006	0.049	<2	<0.23	0.022	< 5	8.28	Rob C	
10-Aug-12	B-ON-0810-0745-DUP	Onsite	Treated	0.069	<.001	<.003	<.006	0.061	<2	0.39	0.022	6	7.95	Rob C	
11-Aug-12	B-ON-0811-0745-DUP	Onsite	Treated	0.044	<.001	<.003	<.006	0.037	<2	0.401	0.037	5	7.90	Rob C	
12-Aug-12	B-ON-0812-0745-DUP	Onsite	Treated	0.032	<.001	<.003	<.006	0.033	<2	0.974	<.015	5	7.90	Rob C	
13-Aug-12	B-ON-0813-0745-DUP	Onsite	Treated	0.060	<.001	0.009	<.006	0.069	<2	0.439	0.017	< 5	7.95	Rob C	
14-Aug-12	B-ON-0814-0745-DUP	Onsite	Treated	0.061	0.001	<.003	<.006	0.048	<2	<0.23	0.054	5	7.95	Rob C	
15-Aug-12	B-ON-0815-0745-DUP	Onsite	Treated	0.026	<.001	<.003	<.006	0.082	<2	<0.23	<.015	5	7.92	Trina C.	
16-Aug-12	B-ON-0816-0745-DUP	Onsite	Treated	0.061	<.001	<.003	<.006	0.041	<2	<0.23	<.015	5	8.37	Trina C.	
17-Aug-12	B-ON-0817-0745-DUP	Onsite	Treated	0.041	<.001	<.003	0.016	0.012	<2	<0.23	<.015	< 5	8.10	Trina C.	
18-Aug-12	B-ON-0818-0745-DUP	Onsite	Treated	0.037	<.001	<.003	<.006	0.022	<2	<0.23	<.015	7	8.44	Trina C.	
19-Aug-12	B-ON-0819-0745-DUP	Onsite	Treated	0.040	<.001	<.003	0.009	0.063	<2	<0.23	<.015	< 5	8.67	Trina C.	
20-Aug-12	B-ON-0820-0745-DUP	Onsite	Treated	0.050	<.001	<.003	0.017	0.013	<2	<0.23	<.015	< 5	8.60	Trina C.	
21-Aug-12	B-ON-0821-0745-DUP	Onsite	Treated	0.030	0.001	<.003	<.006	0.022	<2	<0.23	<.015	< 5	8.73	Trina C.	
22-Aug-12	B-ON-0822-0745-DUP	Onsite	Treated	0.017	<.001	<.003	<.006	0.028	<2	<0.23	<.015	7	8.50	Trina C.	
23-Aug-12	B-ON-0823-0745-DUP	Onsite	Treated	0.013	<.001	<.003	<.006	0.018	<2	<0.23	<.015	< 5	8.49	Trina C.	

Date	Sample ID	Lab	Sample Type	Arsenic	Copper	Lead	Nickel	**Zinc	Ammonia (as N)	*Nitrate (as N)	*Nitrite (as N)	TSS	pH	analysed by	NOTES
No Discharge	over WL criteria	Water Licence Criteria		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		Rob	
Min. Discharge	within 20% of limit			0.5	0.01	0.01	0.05	0.02	5	5	0.4	15	6 to 9	Trina	
24-Aug-12	B-ON-0824-0745-DUP	Onsite	Treated	0.031	<.001	<.003	0.016	0.082	<2	<0.23	<.015	5	8.49	Trina C.	
25-Aug-12	B-ON-0825-0745-DUP	Onsite	Treated	0.035	<.001	<.003	0.010	0.060	<2	<0.23	<.015	6	8.72	Trina C.	
26-Aug-12	B-ON-0826-0745-DUP	Onsite	Treated	0.021	<.001	<.003	0.008	0.068	<2	<0.23	<.015	6	8.73	Trina C.	
27-Aug-12	B-ON-0827-0745-DUP	Onsite	Treated	0.044	<.001	<.003	0.012	0.042	<2	<0.23	<.015	9	8.59	Trina C.	
28-Aug-12	B-ON-0828-0745-DUP	Onsite	Treated	0.045	<.001	<.003	<.006	0.028	<2	<0.23	<.015	10	8.67	Trina C.	
29-Aug-12	B-ON-0829-0745-DUP	Onsite	Treated	0.023	<.001	<.003	0.01	0.057	<2	<0.23	<.015	8	8.81	Trina C.	
30-Aug-12	B-ON-0830-0745-DUP	Onsite	Treated	0.039	<.001	<.003	0.009	0.042	<2	<0.23	<.015	7	8.54	Trina C.	
31-Aug-12	B-ON-0831-0745-DUP	Onsite	Treated	0.042	<.001	<.003	<.006	0.067	<2	<0.23	<.015	11	8.82	Trina C.	
1-Sep-12	B-ON-0901-0745-DUP	Onsite	Treated	0.041	<.001	<.003	<.006	0.055	<2	<0.23	<.015	13	8.61	Trina C.	
2-Sep-12	B-ON-0902-0745-DUP	Onsite	Treated	0.038	<.001	<.003	<.006	0.061	<2	<0.23	<.015	7	8.28	Trina C.	
3-Sep-12	B-ON-0903-0745-DUP	Onsite	Treated	0.044	<.001	<.003	0.009	0.069	<2	<0.23	<.015	5	8.24	Trina C.	
4-Sep-12	B-ON-0904-0745-DUP	Onsite	Treated	0.053	<.001	<.003	<.006	0.024	<2	<0.23	0.017	6	8.10	Trina C.	
5-Sep-12	B-ON-0905-0745-DUP	Onsite	Treated	0.189	<.001	<.003	<.006	0.073	<2	<0.23	<.015	< 5	8.22	Rob C.	
6-Sep-12	B-ON-0906-0745-DUP	Onsite	Treated	0.115	<.001	<.003	<.006	0.025	<2	<0.23	0.027	5	8.23	Rob C.	
7-Sep-12	B-ON-0907-0745-DUP	Onsite	Treated	0.050	<.001	<.003	<.006	0.053	<2	<0.23	<.015	5	8.41	Rob C.	
8-Sep-12	B-ON-0908-0745-DUP	Onsite	Treated	0.070	<.001	<.003	<.006	0.058	<2	<0.23	0.025	6	8.71	Rob C.	
9-Sep-12	B-ON-0909-0745-DUP	Onsite	Treated	0.042	<.001	<.003	<.006	0.049	<2	<0.23	0.023	< 5	8.30	Rob C.	
10-Sep-12	B-ON-0910-0745-DUP	Onsite	Treated	0.056	<.001	<.003	<.006	0.026	<2	<0.23	0.023	< 5	8.42	Rob C.	
11-Sep-12	B-ON-0911-0745-DUP	Onsite	Treated	0.091	<.001	<.003	<.006	0.017	<2	<0.23	0.017	< 5	8.36	Rob C.	
12-Sep-12	B-ON-0912-0745-DUP	Onsite	Treated	0.063	<.001	<.003	<.006	0.022	<2	<0.23	0.022	< 5	8.65	Rob C.	
13-Sep-12	B-ON-0913-0745-DUP	Onsite	Treated	0.055	<.001	<.003	<.006	0.020	<2	<0.23	0.025	< 5	8.40	Rob C.	
14-Sep-12	B-ON-0914-0745-DUP	Onsite	Treated	0.006	<.001	<.003	<.006	0.033	<2	<0.23	0.039	< 5	8.50	Rob C.	
15-Sep-12	B-ON-0915-0745-DUP	Onsite	Treated	0.062	<.001	<.003	<.006	0.010	<2	<0.23	0.222	< 5	8.08	Rob C.	
16-Sep-12	B-ON-0916-0745-DUP	Onsite	Treated	0.043	<.001	<.003	0.015	0.026	<2	<0.23	0.023	5	8.34	Rob C.	
17-Sep-12	B-ON-0917-0745-DUP	Onsite	Treated	0.098	<.001	<.003	0.006	0.031	<2	0.378	0.027	< 5	8.62	Rob C.	
18-Sep-12	B-ON-0918-0745-DUP	Onsite	Treated	0.047	<.001	<.003	0.006	0.020	<2	0.231	0.024	< 5	8.43	Rob C.	
19-Sep-12	B-ON-0919-0745-DUP	Onsite	Treated	0.009	<.001	<.003	<.006	0.020	<2	<0.23	0.019	7	8.64	Rob C.	
20-Sep-12	B-ON-0920-0745-DUP	Onsite	Treated	0.029	<.001	<.003	<.006	0.057	<2	<0.23	0.017	6	8.89	Trina C.	

EXPLANATION OF NOTES

*Nitrite and Nitrate reagents on back-order at this time. Field Engineer reported this information new delivery date was accepted.

**Field method for zinc developed such that if on-site field testing for zinc fell below a certain threshold, the water plant would continue operations, at the discretion of the Field Engineer. The threshold was set at 0.100 mg/L for onsite results.

^Retest results included in graphical presentation. Paramaters re-tested for have not been included in graphical presentation.

^^No discharge these days therefore results not included in graphiccal presentation since water not discharged.

15.8 Appendix H – Onsite Testing Methods

Appendix H

Tundra Mine 2012
On-site Testing Methods

pure elements
environmental solutions

Nitrogen, Ammonia

DOC316.53.01083

Salicylate Method **Method 10205**

HR (2 to 47 mg/L NH_3–N) **TNTplus™ 832**

Scope and Application: For surface waters, municipal and industrial wastewaters.

Test preparation

How to use instrument-specific information

The *Instrument-specific information* table displays requirements that may vary between instruments. To use this table, select an instrument then read across to find the corresponding information required to perform this test.

Table 1 Instrument-specific information

Instrument	Light shield
DR 3900	LZV849
DR 3800, DR 2800	LZV646

Before starting the test:

DR 3900, DR 3800, DR 2800: Install the light shield in Cell Compartment #2 before performing this test.
Please read Safety Advice and Expiration Date on the reagent package.
Recommended sample pH is 4–8.
Recommended sample and reagent temperature is 20–23 °C (68–73.4 °F). Incorrect results may be obtained if test is not performed at the recommended temperature.
Recommended reagent storage is 2–8 °C (35.6–46.4 °F).
Analyze samples as soon as possible for best results.
TNTplus methods are activated from the Main Menu screen when the sample vial is inserted into the sample cell holder.

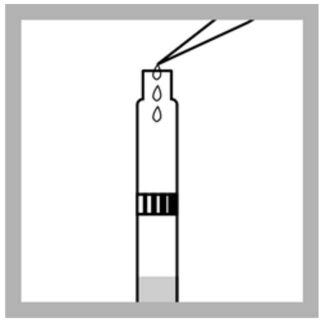
Collect the following items:

Description	Quantity
Ammonia, HR TNT832 Reagent Set	1 vial
Light Shield (see *Instrument-specific information*)	1
Pipet for 0.2 mL sample	1
Pipet Tip	varies

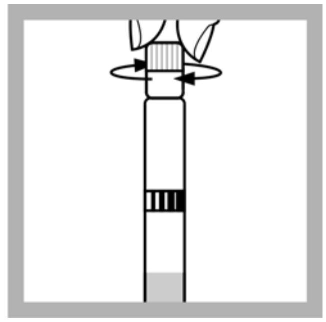
See *Consumables and replacement items* for reorder information.

Salicylate method, TNTplus 832

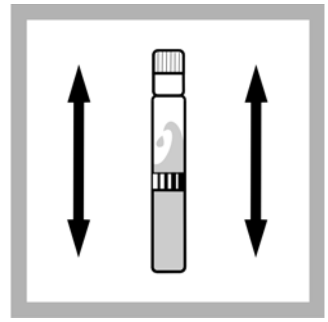
1. Carefully remove the protective foil lid from the DosiCap™ ***Zip***. Unscrew the cap from the vial.



2. Carefully pipet 0.2 mL (200 µL) of sample into the vial. Immediately proceed to step 3.



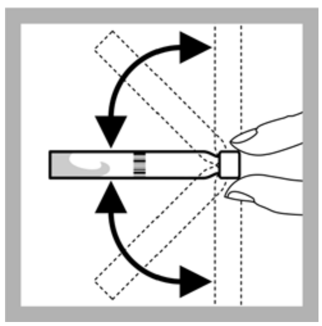
3. Flip the DosiCap ***Zip*** over so that the reagent side faces the vial. Screw the cap tightly onto the vial.



4. Shake the capped vial 2–3 times to dissolve the reagent in the cap.

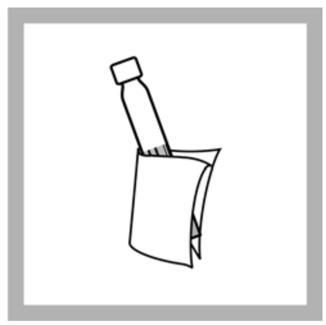
Verify that the reagent has dissolved by looking down through the open end of the DosiCap ***Zip***.

5. Wait 15 minutes.



6. After 15 minutes, invert the sample an additional 2–3 times to mix.

The color remains constant for an additional 15 minutes after the timer expires.



7. Thoroughly clean the outside of the vial.

8. Insert the prepared vial into the cell holder. The instrument reads the barcode, then selects and performs the correct test. Results are in mg/L NH_3–N.

Reagent blanks

A reagent blank can be measured and the value subtracted from the results of each test performed in same reagent lot. Use deionized water in place of sample in the *Salicylate method, TNTplus 832* test.

To subtract the value of the blank from a series of measurements:

1. Measure the blank per step 8.
2. Turn on the reagent blank option.
3. The measured value of the blank should be displayed in the highlighted box. Accept this value.

The reagent blank value will now be subtracted from all results until the function is turned off or a different method is selected. Alternately, the blank can be recorded and entered at any later time by pressing the highlighted box and using the keypad to enter the value.

Sample blanks

Colored or turbid samples can cause high results. To compensate for color or turbidity the procedure is repeated without the addition of the color forming reagent that is present in the DosiCap ***Zip***.

To determine the sample blank:

1. Run the *Salicylate method, TNTplus 832* test, but do not remove the foil from the DosiCap ***Zip*** in step 1.
2. Replace the cap in its original position in step 3.
3. Subtract the value obtained in step 8 from the value obtained on the original sample to give the corrected sample concentration.

Alternatively, samples that contain turbidity only may be first filtered through a membrane filter and then analyzed. Samples without color or turbidity do not require sample blanks.

Interferences

The ions listed in the *Interfering substances* table have been individually tested up to the given concentrations and do not cause interference. The cumulative effects of these ions or the influence of other ions have not been determined.

Primary amines are determined and cause high-bias results. A 10,000-fold excess of urea does not interfere. All reducing agents interfere and cause low-bias results.

Important Note: *An analyte concentration greatly in excess of the stated range will adversely affect color formation, resulting in a false reading within the method range.*

Measurement results can be verified using sample dilutions or standard additions.

Samples with severe interferences require distillation. Perform the distillation procedure using the Hach General Purpose Distillation Set.

Table 2 Interfering substances

Interfering substance	Interference level
Cl^-, SO_4^{2-}	1000 mg/L
K^+, Na^+, Ca^{2+}	500 mg/L
CO_3^{2-}, NO_3^-, Fe^{3+}, Cr^{3+}, Cr^{6+}, Zn^{2+}, Cu^{2+}, Co^{2+}, Ni^{2+}, Hg^{2+}	50 mg/L
Fe^{2+}	25 mg/L
Sn^{2+}	10 mg/L
Pb^{2+}	5 mg/L
Ag^+	2 mg/L

Sample collection, preservation and storage

- Collect samples in clean plastic or glass bottles. Best results are obtained with immediate analysis.
- Preserve the samples by reducing the pH to 2 or less with at least 2 mL of Hydrochloric Acid.
- Store at 4 °C (39 °F) or less.
- Preserved samples may be stored up to 28 days.
- Before analysis, warm stored samples to 20–23 °C (68–73.4 °F) and neutralize to pH 7.0 with 5.0 N Sodium Hydroxide.
- Correct the test result for volume additions.

Accuracy check

Standard solution method

Note: *Refer to the instrument user manual for specific software navigation instructions.*

- Use 0.2 mL of a 10-mg/L ammonia nitrogen standard in place of the sample in step 2 of the *Salicylate method, TNTplus 832* procedure.

  OR

- Use 0.2 mL of a Wastewater Influent Mixed Parameters Inorganics Standard in place of the sample in step 2 of the *Salicylate method, TNTplus 832* procedure. This standard contains 15 mg/L ammonia nitrogen in the presence of other ions such as nitrate, phosphate and sulfate.

Summary of method

Ammonium ions react at pH 12.6 with hypochlorite ions and salicylate ions in the presence of sodium nitroprusside as a catalyst to form indophenol. The amount of color formed is directly proportional to the ammonia nitrogen present in the sample. Test results are measured at 690 nm.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Ammonia, HR TNT832 Reagent Set	1	25 tests	TNT832

Required apparatus

Description	Quantity	Unit	Catalog number
Pipettor, 0.2–1.0 mL	1	each	BBP078
Pipettor Tips, for BBP078 pipettor	1	100/pkg	BBP079

Recommended standards and apparatus

Description	Unit	Catalog number
Nitrogen Ammonia Standard Solution, 10 mg/L NH_3–N	500 mL	15349
Nitrogen Ammonia Standard Solution, 100 mg/L NH_3–N	500 mL	2406549
Wastewater, Influent Inorganics Standard, for NH_3–N, NO_3–N, PO_4, COD, SO_4, TOC	500 mL	2833149
Water, deionized	4 L	27256

Optional reagents and apparatus

Description	Unit	Catalog number
Bottle, sampling, low density poly, w/cap, 500 mL, 12/pkg	12/pkg	2087079
Distillation Set, general purpose	each	2265300
Filter Holder, glass for vacuum filtration	each	234000
Filter membrane, 47-mm, 0.45-micron	each	2894700
Flask, filtering, glass, 1000-mL	each	54653
Heater and Support Apparatus, 115 VAC, 60 Hz	each	2274400
Heater and Support Apparatus, 230 VAC, 50 Hz	each	2274402
Hydrochloric Acid Standard Solution, 1 N	1 L	2321353
Hydrochloric Acid, concentrated ACS	500 mL	13449
Sodium Hydroxide Standard Solution, 1 N	100 mL MDB	104532
Sodium Hydroxide Standard Solution, 5.0 N	50 mL SCDB	245026
Stopper, No. 7, one hole	6/pkg	211907
Test Tube Rack for 13-mm vial	each	2497900
Tubing, rubber	12-ft	56019

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Edition 6

Arsenic

DOC316.53.01005

Silver Diethyldithiocarbamate Method[1]

Method 8013

(0 to 0.200 mg/L As)

Scope and Application: For water, wastewater, and seawater; distillation is required; USEPA accepted[2] for reporting for drinking and wastewater analysis (distillation required)

[1] Adapted from *Standard Methods for the Examination of Water and Wastewater.*

[2] Procedure is equivalent to Standard Method 3500-As for drinking water analysis.

Test preparation

How to use instrument-specific information

The *Instrument-specific information* table displays requirements that may vary between instruments. To use this table, select an instrument then read across to find the corresponding DR 3800, DR 2800, DR 2700information required to perform this test.

Table 1 Instrument-specific information

Instrument	Sample cell	Cell orientation
DR 5000	2612602	Fill line faces user
DR 3900	2612602	Fill line faces user
DR 3800, DR 2800, DR 2700	2612602	Fill line faces right

Before starting the test:

Create a user-entered program for arsenic. See step 1 and *User programming*.
Prepare the arsenic absorber solution as directed in *Reagent preparation*.
Perform a user-entered calibration for each new lot of arsenic absorber solution. See the *Calibration* section. Some variations of the calibration procedure are possible.
In bright light conditions (e.g. direct sunlight) it may be necessary to close the cell compartment with the protective cover during measurements.
Do not use the Pour-Thru Cell with this test.
The arsenic absorber in this test is a silver solution in pyridine. Both silver (D011) and pyridine (D038) are regulated by the Federal RCRA as hazardous waste. In addition, the cotton ball soaked in lead acetate (D008) solution is a hazardous waste. These materials should not be poured down the drain. Refer to a current MSDS sheet for proper disposal.

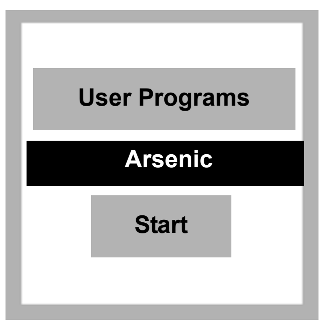
Collect the following items :

Description	Quantity
Apparatus (see *Required apparatus*)	—
Arsenic Standard Solution, 1000-mg/L As	varies
Hydrochloric Acid, ACS	25 mL
Lead Acetate Solution, 10%	1 mL
Potassium Iodide Solution, 20%	3 mL
Pyridine, ACS	50 mL
Sample Cells (see *Instrument-specific information*)	2
Silver Diethyldithiocarbamate	1 g
Stannous Chloride Solution	1 mL
Water, deionized	varies
Zinc, 20-mesh, ACS	6 g

See *Consumables and replacement items* for reorder information.

Silver Diethyldithiocarbamate

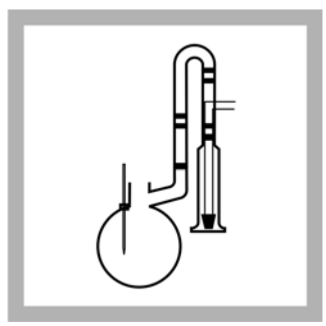
1. Perform the *User programming* procedure. Make note of the program number.



2. To run the test, press **USER PROGRAMS**.

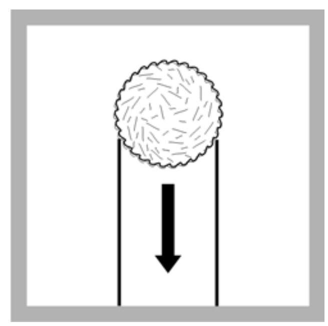
Select the test.

Insert an adapter if required (Table 1). Refer to the user manual for orientation.



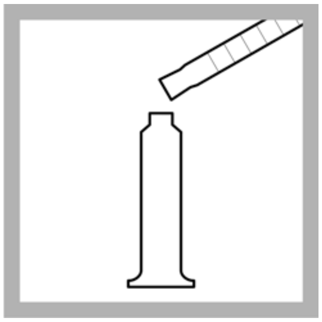
3. Prepare the distillation apparatus for arsenic recovery. See the *Distillation Manual* for assembly instructions. **Do not connect to the aspirator.**

Place the distillation apparatus under a fume hood to vent toxic fumes.



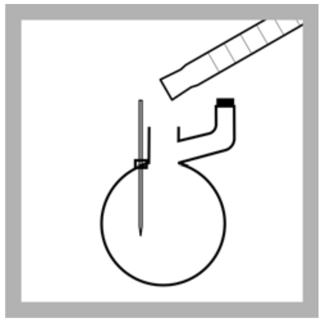
4. Dampen a cotton ball with 10% Lead Acetate Solution. Insert it in the gas scrubber. Be certain that the cotton seals against the glass.

Silver Diethyldithiocarbamate



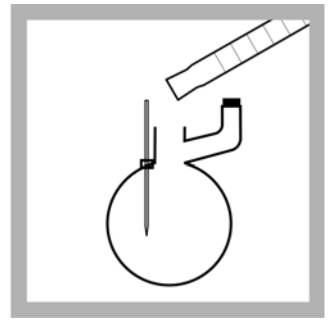
5. Using a graduated cylinder, pour 25-mL of prepared arsenic absorber solution (*Reagent preparation*) into the cylinder/gas bubbler assembly.

Attach it to the distillation apparatus.

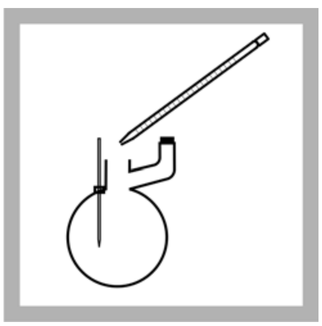


6. Using a graduated cylinder, pour 250 mL of sample into the distillation flask.

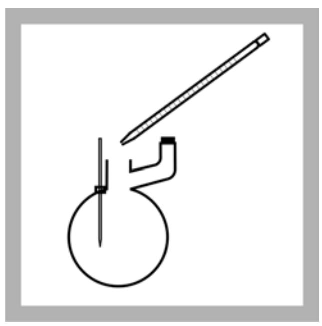
7. Turn on the power switch. Set the stir control to 5. Set the heat control to 0.



8. Using a graduated cylinder, add 25 mL of Hydrochloric Acid, ACS, to the distillation flask.



9. Use a serological pipet to add 1 mL of Stannous Chloride Solution to the flask.



10. Use a serological pipet to add 3 mL of Potassium Iodide Solution to the flask. Cap.

11. Start the instrument timer.

A 15-minute reaction period will begin.

12. When the timer expires, weigh and add 6.0 g of 20-mesh zinc to the flask. **Cap immediately.**

13. Set the heat control to 3.

14. Start the instrument timer.

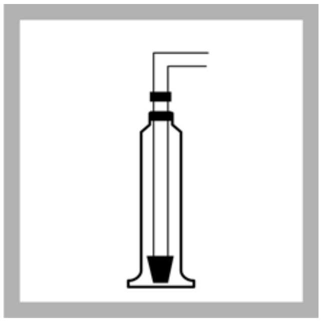
A second 15-minute reaction period will begin.

15. When the timer expires, set the heat control to 1.

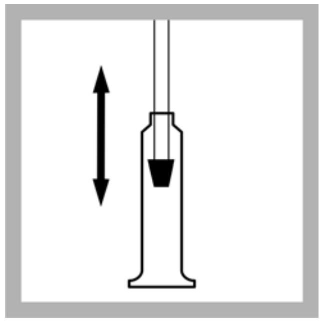
16. Start the instrument timer.

A third 15-minute reaction period will begin.

Silver Diethyldithiocarbamate



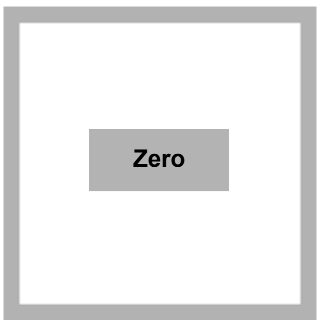
17. When the timer expires, turn off the heater. Remove the cylinder/gas bubbler assembly as a unit.



18. Rinse the gas bubbler by moving it up and down in the arsenic absorber solution.

19. Blank Preparation: Fill a dry, 10-mL sample cell with untreated arsenic absorber solution. Stopper.

20. Wipe the blank and insert it into the cell holder.



21. ZERO the instrument. The display will show the intercept as calculated from the user-entered calibration curve. This will probably be a non-zero intercept.

22. Prepared Sample: Pour the reacted arsenic absorber sample into a sample cell.

Close the sample cell.

23. Wipe the prepared sample and insert it into the cell holder.

READ the results.

Interferences

Table 2 Interfering substances

Interfering substance	Interference level
Antimony Salts	May interfere with color development.

Sample collection, preservation and storage

Collect samples in acid washed glass or plastic bottles. Adjust the pH to 2 or less with sulfuric acid (about 2 mL per liter)*. Preserved samples may be stored up to six months at room temperature. Correct the test result for volume additions.

* See *Optional reagents and apparatus*.

Reagent preparation

Prepare the arsenic absorber solution as follows:

1. Weigh 1.00 g of silver diethyldithiocarbamate on an analytical balance.
2. Transfer the powder to a 200-mL volumetric flask. Dilute to volume with pyridine. **Use pyridine only in a fume hood and wear chemical resistant gloves.** Read the MSDS before using pyridine.
3. Mix well to dissolve. Store the reagent, tightly sealed, in an amber bottle. The reagent is stable for one month if stored in this manner. Larger volumes of reagent can be prepared if the reagent is used within one month.

Calibration

Standard preparation
Perform a new calibration for each lot of arsenic absorber solution.

1. Prepare a 10.0-mg/L arsenic working standard by pipetting 10.0 mL of Arsenic Standard Solution, 1000 mg/L As into a 1000-mL volumetric flask.
2. Dilute to volume with deionized water.
3. Into three different 500-mL volumetric flasks, pipet 1.0, 2.0, and 10.0 mL of the 10.0 mg/L As stock solution using Class A glassware.
4. Dilute to the mark with deionized water and mix thoroughly. These standards have concentrations of 0.02, 0.04 and 0.20 mg/L As.

   Note: *Distill standards before making the calibration curve.*

User programming

1. Press **USER PROGRAMS** on the main menu.
2. Press **PROGRAM OPTIONS** and **NEW**. Key any available program number (950–999) to use for arsenic testing. Press **OK**.
3. Fill in the appropriate fields using the touch screen when the field is highlighted. Use the alphanumeric keys to name the User Program **ARSENIC**. Press **NEXT** to move to the next screen. Set up the rest of the parameters as follows:

   •Program Type: Single Wavelength
   •Units: mg/L
   •Concentration Resolution: 0.001
   •Chemical Form: As
   •Wavelength: 520 nm
   •Calibration: Read Standards

4. After entering Read Standards, press **NEXT>EXIT**. Fill in the appropriate fields for each of the following. Use the touch screen to activate the parameter and press **EDIT** to enter the data entry screen. Set up the rest of the parameters as follows:

   •Timer1: 15 minutes
   •Timer2: 15 minutes
   •Timer3: 15 minutes
   •Upper Limit: 0.220 mg/L
   •Lower Limit: –0.020 mg/L

5. Press **CALIBRATION: C = A + BA**. Press **EDIT**.

6. The Read Standards will be indicated. Enter the standard concentration values to be used to perform the calibration: 0.00, 0.02, 0.04, and 0.20. To enter the concentration values press **+** and enter the value followed by **OK** for each concentration value.
7. After the values are entered, press the **UP** arrow four times to move the cursor to the 0.00 concentration line.
8. Insert the 25-mL sample cell containing only unreacted arsenic absorber solution into the cell holder. Press **ZERO.**
9. Press the **DOWN** arrow once to move to the next concentration. Insert the prepared sample in the cell holder. Press **READ** to accept the absorbance value. Repeat steps for each standard.

   Note: *Standards must be distilled before absorbance values are measured.*
10. Press **GRAPH**. Make sure **FORCE ZERO** is off.
11. If the graph is acceptable press **DONE>EXIT**.
12. “Store Program?” will appear on the display. Press **YES**.

The program is ready for use.

Some variations of the calibration procedure are possible. See the user manual for details.

Summary of method

Arsenic is reduced to arsine gas by a mixture of zinc, stannous chloride, potassium iodide, and hydrochloric acid in a specially equipped distillation apparatus. The arsine is passed through a scrubber containing cotton saturated with lead acetate for sulfide removal, and then into an absorber tube containing silver diethyldithiocarbamate in pyridine. The arsenic reacts to form a red complex which is read colorimetrically. This procedure requires a manual calibration. Test results are measured at 520 nm.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Arsenic Standard Solution, 1000-mg/L As	varies	100 mL	1457142
Hydrochloric Acid, ACS	25 mL	500 mL	13449
Lead Acetate Solution, 10%	1 mL	100 mL	1458042
Potassium Iodide Solution, 20%	3 mL	100 mL	1456842
Pyridine, ACS	50 mL	500 mL	1446949
Silver Diethyldithiocarbamate	1 g	25 g	1447624
Stannous Chloride Solution	1 mL	100 mL	1456942
Water, deionized	varies	4 liters	27256
Zinc, 20-mesh, ACS	6 g	454 g	79501

Required apparatus

Description	Quantity	Unit	Catalog number
Balance, analytical, Zeta series, 80-g capacity	1	each	2936701
Balls, cotton	1	100/pkg	257201
Boat, weighing, 8.9-cm square	2	500/pkg	2179000

Required apparatus (continued)

Description	Quantity	Unit	Catalog number
Bottle, amber, 237-mL, glass	1	6/pkg	714441
Cap, polypropylene, for amber bottle	1	6/pkg	2166706
Cylinder, graduated, 25-mL	2	each	50840
Cylinder, graduated, 250-mL	1	each	50846
Distillation Apparatus, arsenic accessories	1	set	2265400
Distillation Apparatus, general purpose accessories	1	set	2265300
Flask, volumetric, Class A, 1000-mL, with glass stopper	1	each	1457453
Flask, volumetric, Class A, 200-mL	1	each	1457445
Flask, volumetric, Class A, 500-mL	6	each	1457449
Pipet Filler, safety bulb	1	each	1465100
Pipet, serological, 5-mL	2	each	53237
Pipet, volumetric, Class A, 1.00-mL	2	each	1451535
Pipet, volumetric, Class A, 2.00-mL	1	each	1451536
Pipet, volumetric, Class A, 4.00-mL	1	each	1451504
Pipet, volumetric, Class A, 6.00-mL	1	each	1451506
Pipet, volumetric, Class A, 8.00-mL	1	each	1451508
Pipet, volumetric, Class A, 10.00-mL	1	each	1451538
Select one based on available voltage:			
Distillation Apparatus Heater, 115 VAC, 60 Hz	1	each	2274400
Distillation Apparatus Heater, 230 VAC, 50 Hz	1	each	2274402

Optional reagents and apparatus

Description	Unit	Catalog number
Cylinder, mixing, 25-mL	each	189640
Sulfuric Acid, 1.00 N	100 mL	127032
Gloves, chemical resistant, size 9[1]	pair	2410104

[1] Other sizes available.

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Edition 6

Copper

DOC316.53.01038

Porphyrin Method[1] **Method 8143**

LR (1 to 210 µg/L) **Powder Pillows**

Scope and Application: For water, wastewater and sea water

[1] Adapted from Ishii and Koh, *Bunseki Kagaku*, 28 (473), 1979

Test preparation

How to use instrument-specific information

The *Instrument-specific information* table displays requirements that may vary between instruments. To use this table, select an instrument then read across to find the corresponding information required to perform this test.

Table 1 Instrument-specific information

Instrument	Sample cell	Cell orientation
DR 5000	2495402	Fill line faces user
DR 3900	2495402	Fill line faces user
DR 3800, DR 2800, DR 2700	2495402	Fill line faces right

Before starting the test:

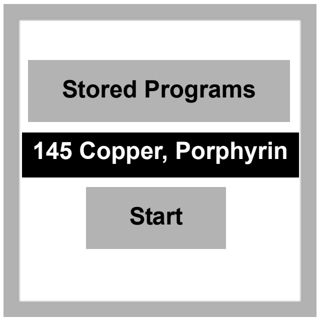
Digestion is required for determining total copper.
For more accurate results, determine a reagent blank value for each new lot of reagent. Follow the procedure using deionized water instead of the sample. Subtract the reagent blank value from the final results or perform a reagent blank adjust.
Wash all glassware with detergent. Rinse with tap water. Rinse again with 1:1 Nitric Acid Solution. Rinse a third time with copper-free, deionized water.
If samples contain high levels of metals, a slight metallic deposit or yellow buildup may form in the sample cell. Wash the cell as described above.

Collect the following items:

Description	Quantity
Copper Masking Reagent Powder Pillows	1
Porphyrin 1 Reagent Powder Pillows	2
Porphyrin 2 Reagent Powder Pillows	2
Nitric Acid Solution, 1:1	varies
Sample Cells (*Instrument-specific information*)	2

See *Consumables and replacement items* for reorder information.

Porphyrin method



1. Select the test.

Insert an adapter if required (*Instrument-specific information*).

Refer to the user manual for orientation.

2. FIll two sample cells with 10 mL of sample.

3. Blank Preparation: Add the contents of one Copper Masking Reagent powder pillow to one of the sample cells to create the blank. Swirl to dissolve.

4. Add the contents of one Porphyrin 1 Reagent powder pillow to each sample cell.

Swirl to dissolve.

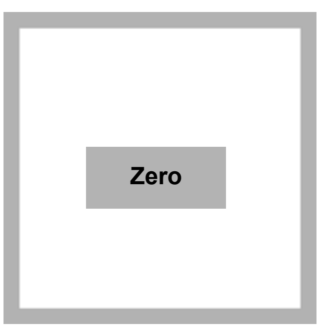
5. Add the contents of one Porphyrin 2 Reagent powder pillow to each sample cell.

6. Swirl to dissolve.

If copper is present the sample will briefly turn blue, then return to yellow.

7. Start the instrument timer. A three-minute reaction period will begin.

8. When the timer expires insert the blank into the cell holder.

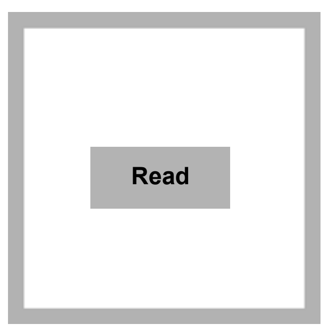


9. **ZERO** the instrument.

The display will show:

0 µg/L Cu

10. Insert the prepared sample into the cell holder.



11. **READ** the results in µg/L Cu.

Interferences

Table 2 Interfering substances and levels

Interfering substance	Interference levels and treatments
Aluminum, Al^{3+}	60 mg/L
Cadmium, Cd^{2+}	10 mg/L
Calcium, Ca^{2+}	1500 mg/L
Chelating agents	Interfere at all levels unless either the Digesdahl or vigorous digestion is performed
Chloride, Cl^{-}	90,000 mg/L
Chromium, Cr^{6+}	110 mg/L
Cobalt, Co^{2+}	100 mg/L
Fluoride, F^{-}	30,000 mg/L
Iron, Fe^{2+}	6 mg/L
Lead, Pb^{2+}	3 mg/L
Magnesium	10,000 mg/L
Manganese	140 mg/L
Mercury, Hg^{2+}	3 mg/L
Molybdenum	11 mg/L
Nickel, Ni^{2+}	60 mg/L
Potassium, K^{+}	60,000 mg/L
Sodium, Na^{+}	90,000 mg/L
Zinc, Zn^{2+}	9 mg/L
Highly buffered samples or extreme sample pH	May exceed the buffering capacity of the reagents and require sample pretreatment.

Sample collection, preservation and storage

- Collect samples in acid-washed plastic bottles.
- To preserve, adjust the pH to 2 or less with nitric acid (about 5 mL per liter).
- Store preserved samples up to six months at room temperature.
- Before testing, adjust the pH of the preserved sample to between 2 and 6. If the sample is too acidic, adjust the pH with 5.0 N Sodium Hydroxide Standard Solution*.
- Correct test results for volume additions.

Accuracy check

Required for accuracy check:

- Copper Standard Solution, 4 mg/L Cu Pour-Rite Ampules
- TenSette Pipet and Pipet Tips

* See *Optional reagents and apparatus*.

Standard additions method (sample spike)

1. After reading test results, leave the sample cell (unspiked sample) in the instrument.
2. Select Options>More>Standard additions from the instrument menu.
3. Default values for standard concentration, sample volume and spike volumes can be accepted or edited. After values are accepted, the unspiked sample reading will appear in the top row. See the user manual for more information.
4. Fill eight sample cells with 10 mL of sample. Use the TenSette® Pipet to add 0.1 mL from a 4-mg/L Pour-Rite Ampule, to two of the sample cells. Then pipet 0.2 mL of the standard solution into two more cells. Finally, pipet 0.3 mL of the standard solution into two more cells.
5. Analyze each standard addition sample as described in the procedure above, using one of the two spiked samples in each set as the blank. Accept each standard additions reading by pressing **READ**. The copper concentration reading should reflect approximately 100% recovery.
6. After completing the sequence, press **GRAPH** to view the best-fit line through the standard additions data points, accounting for the matrix interferences. Press **IDEAL LINE** to view the relationship between the sample spikes and the "Ideal Line" of 100% recovery.

Standard solution method
Note: *Refer to the instrument user manual for specific software navigation instructions.*

1. To assure the accuracy of the test, prepare a 150-µg/L copper standard by pipetting 15.00 mL of Copper Standard Solution, 10.0-mg/L Cu, into a 1000-mL volumetric flask.
2. Dilute to the mark with copper-free, reagent-grade water. Prepare this solution daily. Perform the copper procedure as described above.
3. To adjust the calibration curve using the reading obtained with the 150-µg/L Standard Solution, select Options>More>Standard Adjust from the instrument menu.
4. Turn on the Standard Adjust feature and accept the displayed concentration. If an alternate concentration is used, enter the concentration and adjust the curve to that value.

Method performance

Program	Standard	Precision 95% Confidence Limits of Distribution	Sensitivity Concentration change per 0.010 Abs change
145	50 µg/L Cu	47–53 µg/L Cu	1 µg/L Cu

Summary of method

The porphyrin method is very sensitive to trace amounts of free copper. The method is free from most interferences and does not require any sample extraction or concentration before analysis. Interferences from other metals are eliminated by the copper masking reagent. The porphyrin indicator forms an intense, yellow-colored complex with any free copper present in sample. Test results are measured at 425 nm.

Consumables and replacement items

Required reagents and apparatus

Description	Quantity/Test	Unit	Catalog number
Copper Reagent Set (100 tests), includes:	—	—	2603300
(1) Copper Masking Reagent Powder Pillows	1	100/pkg	2603449
(2) Porphyin 1 Reagent Powder Pillows	2	100/pkg	2603549
(2) Porphyrin 2 Reagent Powder Pillows	2	100/pkg	2603649
Nitric Acid Solution, 1:1	varies	500 mL	254049
Sample cell, 10 mL square, matched pair	2	2/pkg	2495402

Recommended standards

Description	Unit	Catalog number
Copper Standard Solution, 4 mg/L, 2 mL Pour-Rite Ampules	20/pkg	2605720
Copper Standard Solution, 10-mg/L Cu	100 mL	12932
Water, deionized	4 L	27256

Optional reagents and apparatus

Description	Unit	Catalog number
Sodium Hydroxide Standard Solution, 5.0 N MDB	100 mL	245032
Tensette Pipet, 0.1–1.0	each	1970001
Tips for Tensette Pipet	50/pkg	2185696
Pipet, Volumetric, Class A, 15 mL	each	1451539
Flask, Volumetric, Class A, 1000 mL	each	1457453
Pipet Filler, Safety Bulb	each	1465100
Sample Cells, 1" square matched set	8/pkg	2495408
pH paper	100/pkg	2601300

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Edition 6

Iron, TNTplus

DOC316.53.01249

Phenanthroline Method[1] **Method 10229**

(0.2 to 6.0 mg/L Fe) **TNTplus™ 858**

Scope and Application: For drinking water and wastewater. Digestion may be required for determining total iron.

[1] Adapted from *Standard Methods for the Examination of Water and Wastewater.*

Test preparation

How to use instrument-specific information

The *Instrument-specific information* table displays requirements that may vary between instruments. To use this table, select an instrument then read across to find the corresponding information required to perform this test.

Table 1 Instrument-specific information

Instrument	Light shield
DR 3900	LZV849
DR 3800, DR 2800	LZV646

Before starting the test:

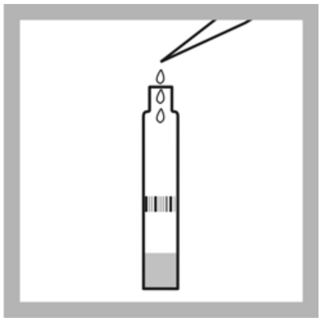
Install the light shield if applicable (see *Instrument-specific information*).
Read the safety information and expiration date on the package label.
Color or turbidity in the sample can cause incorrect results. To correct for color or turbidity, measure a *Sample blank*.
Perform this test at 15–25 °C (59–77 °F) and store reagents at 2–8 °C (35–46 °F) for best results.
The recommended sample pH is 3–10.
A sample digestion may be necessary to measure undissolved iron or iron bound in complexes. The digestion can be performed with the Metals Prep Set TNT890 or by the USEPA mild or vigorous digestion procedure.
TNTplus methods are activated from the Main Menu when a vial is inserted into the sample cell holder.

Collect the following items:

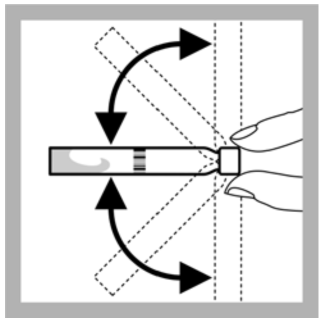
Description	Quantity
Light Shield (see *Instrument-specific information*)	1
Iron TNT858 Reagent Set	1
Pipette, variable volume, 1-5 mL	1
Pipette Tips for 1-5 mL Pipette	1
Disposable wipes	1

See *Consumables and replacement items* for reorder information.

Iron TNTplus method



1. Pipet 2.0 mL of sample into the vial.



2. Cap and invert the vial until the contents are completely dissolved.

3. Wait 15 minutes.

4. After the timer expires, wipe the sample vial and insert it into the cell holder.

The instrument reads the barcode, selects the method and makes the measurement. No zero is necessary.

Results are in mg/L Fe.

Interferences

Ions that do not cause an interference up to the concentrations that were tested are shown in Table 2. Combinations of ions were not tested.

Table 2 Interfering substances and levels

Interfering substance	Interference levels and treatments
Cadmium, Cd^{2+}	No effect at 70 mg/L.
Calcium, Ca^{2+}	No effect at 500 mg/L.
Carbonate, CO_3^{2-}	No effect at 50 mg/L.
Chloride, $Cl^{–}$	No effect at 1000 mg/L.
Chromium, Cr^{3+}, Cr^{6+}	No effect at 50 mg/L.
Cobalt, Co^{2+}	No effect at 50 mg/L.
Color	Can cause high results. To make a correction for the interference, measure a *Sample blank*.
Copper, Cu^{2+}	No effect at 10 mg/L. Higher concentrations cause high results.
Lead, Pb^{2+}	No effect at 50 mg/L.
Mercury, Hg^{2+}	No effect at 50 mg/L.
Nickel, Ni^{2+}	No effect at 25 mg/L. Higher concentrations cause high results.
Nitrate, NO^{3-}	No effect at 50 mg/L.
Potassium, K^{+}	No effect at 500 mg/L.
Sodium, Na^{+}	No effect at 500 mg/L.
Silver, Ag^{+}	No effect at 100 mg/L.
Sulfate, SO_4^{2-}	No effect at 1000 mg/L.
Tin, Sn^{2+}	No effect at 5 mg/L. Higher concentrations cause high results.
Turbidity	Can cause high results. To make a correction for the interference, measure a *Sample blank*.

Table 2 Interfering substances and levels (continued)

Interfering substance	Interference levels and treatments
Zinc, Zn^{2+}	No effect at 50 mg/L.

Sample blank

If the sample has color or turbidity, measure a sample blank to correct the test result for the interference.

Required:

- TNTplus 919 sample blank vial

Procedure

1. Complete the test procedure for iron.
2. Pipet 2.0 mL of fresh sample into a TNTplus 919 sample blank vial.
3. Wipe the vial and insert it into the cell holder. The instrument will read the barcode of the sample blank vial and subtract the value from the original test result.

Sample collection, preservation and storage

- Collect samples in acid-cleaned glass or plastic containers. No acid addition is necessary if analyzing the sample immediately.
- To preserve samples, adjust the pH to 2 or less with concentrated nitric acid (about 2 mL per liter). Preserved samples may be stored up to six months at room temperature.
- Before analysis, adjust the pH to between 3 and 5 with 5.0 N Sodium Hydroxide Standard Solution. Correct the test result for volume additions.
- If only dissolved iron is to be determined, filter the sample before acid addition.

Accuracy check

To validate the method, use a standard solution in place of the sample. The standard solution must be prepared by dilution.

Required for accuracy check*:

- Iron Standard Solution, 100 mg/L Fe
- Volumetric Flask, 100-mL glass
- Pipet, variable volume
- Pipet tip
- Deionized water

Standard solution method

1. Prepare a 2.00-mg/L Fe standard solution as follows:
   a. Use a pipet to add 2.0 mL of the 100-mg/L standard solution into the volumetric flask.
   b. Dilute to the mark with deionized water. Stopper and mix well. Prepare this solution daily.
2. Follow the test procedure to measure the concentration of the diluted standard (refer to the *Iron TNTplus method*). Use the diluted standard solution in place of the sample.

* See *Optional reagents and apparatus*.

3. Compare the measured concentration to the expected concentration. Acceptable results are typically within 10% of the expected.

Summary of method

Ferrous iron (Fe^{2+}) forms an orange-red complex with the 1,10-phenanthroline indicator in the reagent. Any ferric iron (Fe^{3+}) present in the water sample is reduced to ferrous iron (Fe^{2+}) by ascorbic acid before the complex is formed. Test results are measured at 510 nm.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Iron TNT 858 Reagent Set	1	25/pkg	TNT858

Required apparatus

Description	Unit	Catalog number
Light Shield (DR2800)	each	LZV646
Pipet, variable volume, 1.0–5.0 mL	each	BBP065
Pipet Tips, for variable volume pipet	75/pkg	BBP068
Wipes, disposable, 11 x 22 cm	280/pkg	2097000

Recommended standards and apparatus

Description	Unit	Catalog number
Iron Standard Solution, 100 mg/L	100 mL	1417542
Iron Standard Solution, 1 mg/L	500 mL	13949
Water, deionized	4L	27256

Optional reagents and apparatus

Description	Unit	Catalog number
Flask, volumetric, Class A, glass, 100 mL, w/ stopper	each	1457442
Nitric Acid, ACS	500 mL	254049
Sodium Hydroxide, 5.0 N	100 mL	245032
TNT 890 Metals Prep Set for digestions	50/pkg	TNT890
TNTplus 919 sample blank vials	5/pkg	TNT919

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Telephone: (970) 669-3050
FAX: (970) 669-2932

Lead

DOC316.53.01055

USEPA[1] Dithizone Method[2]

Method 8033

3 to 300 µg/L

Powder Pillows

Scope and Application: For water and wastewater

[1] USEPA accepted for reporting for wastewater analysis (digestion is required)

[2] Procedure is equivalent to Standard Method 3500-Pb D for wastewater analysis.

Test preparation

How to use instrument-specific information

The *Instrument-specific information* table displays requirements that may vary between instruments. To use this table, select an instrument then read across to find the corresponding information required to perform this test.

Table 1 Instrument-specific information

Instrument	Sample cell	Cell orientation
DR 5000	2612602	Fill line faces user
DR 3900	2612602	Fill line faces user
DR 3800, DR 2800, DR 2700	2612602	Fill line faces right

Before starting the test:

For more accurate results, determine a reagent blank value for each new lot of reagent. Follow the procedure using deionized water instead of the sample.
Clean all glassware with a 1:1 Nitric Acid Solution. Rinse with deionized water.
Cloudy and turbid samples may require filtering before running the test. Report results as µg/L soluble lead. Use glass membrane type filter to avoid loss of lead by adsorption onto the filter paper.
If samples cannot be analyzed immediately, see *Sample collection, preservation and storage*. Adjust the pH of preserved samples before analysis.
For more accurate results, adjust the sample to pH 11.0–11.5 using a pH meter in step 11. Omit the five additional drops of Sodium Hydroxide Standard Solution in step 12
The DithiVer powder will not completely dissolve in the chloroform. For further notes see *DithiVer solution preparation, storage and reagent blank*.
Read the MSDS before testing. Spilled reagent will affect test accuracy and is hazardous to skin and other materials.
In bright light conditions (e.g. direct sunlight) it may be necessary to close the cell compartment with the protective cover during measurements.
Digestion is required to for determine the total lead for EPA reporting purposes. Use mild or vigorous digestion.

Collect the following items:

Description	Quantity
Citrate Buffer Powder Pillows	1
Chloroform	50 mL
DithiVer Metals Reagent Powder Pillows	1
Potassium Cyanide	2 g
Sodium Hydroxide Standard Solution, 5.0 N	varies
Cotton Balls	1
Clippers	1
Cylinder, 50 mL graduated mixing	1
Cylinder, 5 mL graduated	1
Cylinder, 50 mL graduated	1
Cylinder, 250 mL graduated	1
Funnel, 500 mL separatory	1
Sample Cells (see *Instrument-specific information*)	2
Spoon, measuring, 1.0 g	1
Support Ring (4 inch) and Stand (5 x 8 inch base)	1

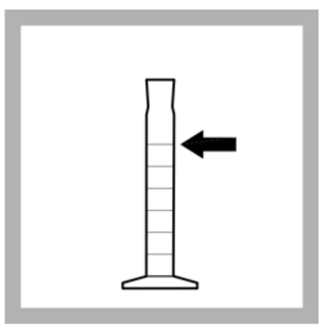
See *Consumables and replacement items* for reorder information.

Dithizone method for powder pillows

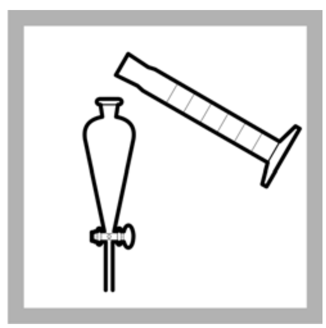
1 Select the test.

Insert an adapter if required (see *Instrument-specific information*).

Refer to the user manual for orientation.



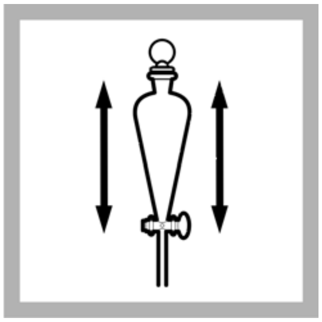
2 Fill a 250 mL graduated cylinder to the 250 mL mark with sample.



3 Transfer the sample into 500 mL separatory funnel.

4 Add the contents of one Buffer Powder Pillow, citrate type.

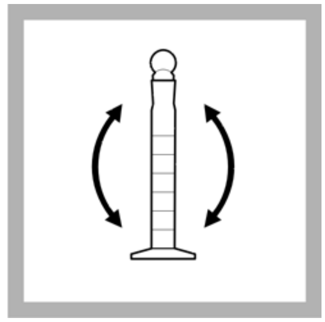
Dithizone method for powder pillows (continued)



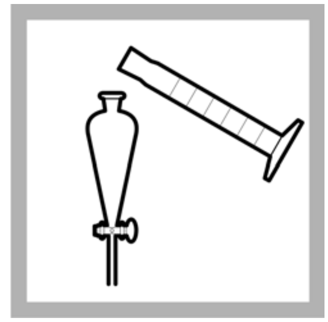
5 Insert the stopper into the funnel and shake to dissolve.

6 **DithiVer Solution preparation:**

Add 50 mL of chloroform to a 50-mL mixing graduated cylinder. Add the contents of one DithiVer Metals Reagent Powder Pillow.

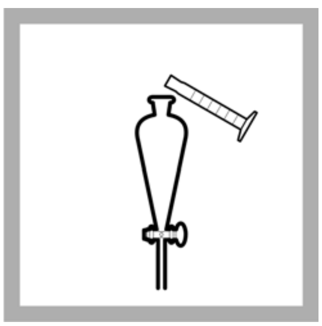


7 Stopper the cylinder. Invert several times to mix.

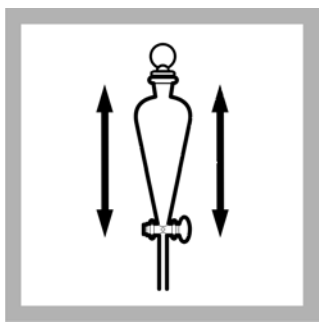


8 Measure 30 mL of the prepared dithizone solution with a second graduated cylinder and add to the separatory funnel.

Insert the stopper and invert to mix. Open stopcock to vent. Close the stopcock.



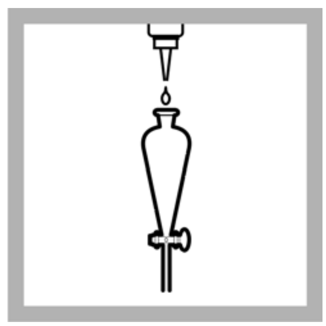
9 Add 5 mL of 5.0 N Sodium Hydroxide Standard Solution.



10 Stopper. Invert. Open stopcock to vent. Close the stopcock and shake the funnel once or twice and vent again.

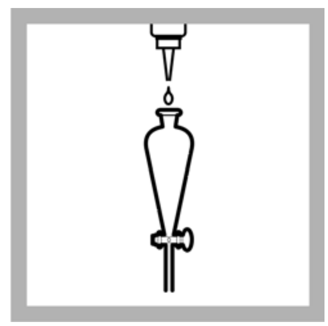
If the solution turns orange after shaking, the pH is too high. Add a few drops of 5.25 N Sulfuric Acid to the solution to decrease the pH.

The blue-green color will reappear (alternatively, to avoid higher blanks, repeat on new sample and use less sodium hydroxide in step 9).



11 Continue adding 5.0 N Sodium Hydroxide Standard Solution dropwise and shaking the funnel after every few drops until the color of the solution being shaken changes from blue-green to orange.

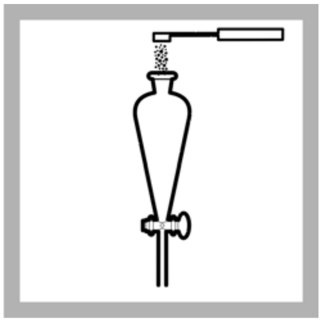
Large amounts of zinc cause the color transition at the end point to be indistinct.



12 Add 5 more drops of 5.0 N Sodium Hydroxide Standard Solution.

A pink color in the bottom (chloroform) layer at this point does not necessarily indicate lead is present. Only after adding the potassium cyanide in the next step will the presence of lead be confirmed by a pink color.

Dithizone method for powder pillows (continued)



13 Add 2 heaping 1.0 g scoops of potassium cyanide to the funnel. Stopper.

Shake vigorously until the potassium cyanide is all dissolved (about 15 seconds).

14 Wait one minute for the layers to separate. The bottom (chloroform) layer will be pink if lead is present.

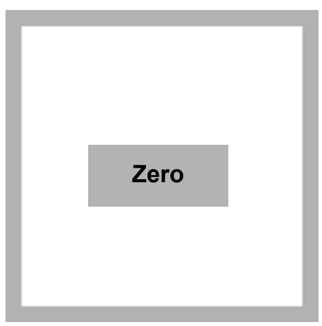
15 **Prepared sample:** Insert a cotton plug the size of a pea into the delivery tube of the funnel and slowly drain the bottom (chloroform) layer into a dry sample cell. Insert the stopper.

The lead-dithizone complex is stable for at least thirty minutes if the sample cell is kept tightly capped and out of direct sunlight.

16 **Blank preparation:** Measure 10 mL of chloroform into another sample cell.

Insert the stopper.

17 Insert the blank into the cell holder.

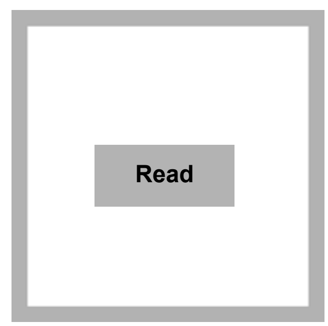


18 **ZERO** the instrument.

The display will show:

0 µg/L Pb^{2+}

19 Insert the prepared sample into the cell holder



20 **READ** the results in µg/L Pb^{2+}.

Interferences

Table 2 Substances that do not interfere

Non-interfering substance	Non-interfering substance
Aluminum	Lead
Antimony	Magnesium
Arsenic	Manganese
Calcium	Nickel
Chromium	Tin
Cobalt	Zinc
Iron	

Interference from the metals in the *Interfering substances* table can be eliminated by inserting the *Interference treatment for metals* procedure after step 6 of the *Dithizone method for powder pillows* procedure.

Table 3 Interfering substances

Interfering substance	Interference level
Highly buffered samples or extreme sample pH	All levels. See *Interference treatment for metals*.
Bismuth	All levels. See *Interference treatment for metals*.
Copper	All levels. See *Interference treatment for metals*.
Mercury	All levels. See *Interference treatment for metals*.
Silver	All levels. See *Interference treatment for metals*.
Tin	All levels. See *Interference treatment for metals*.

Interference treatment for metals

1. Measure about 5 mL of the DithiVer solution into the separatory funnel. Stopper the funnel, invert and open the stopcock to vent. Close the stopcock and shake the solution vigorously for 15 seconds. Allow the funnel to stand undisturbed until the layers separate (about 30 seconds). A yellow, red or bronze color in the bottom (chloroform) layer confirms the presence of interfering metals. Draw off and collect the bottom (chloroform) layer for proper disposal.

2. Repeat extraction with fresh 5 mL portions of prepared dithizone solution (collecting the bottom layer each time in appropriate waste collection vessel) until the bottom layer shows a pure dark green color for three successive extracts. Extractions can be repeated a number of times without appreciably affecting the amount of lead in the sample.

3. Extract the solution with several 2 or 3 mL portions of pure chloroform to remove any remaining dithizone, again collecting the bottom layer each time for proper disposal.

4. Continue the procedure, substituting 28.5 mL of prepared dithizone solution for the 30 mL in step 8.

DithiVer solution preparation, storage and reagent blank

- Store DithiVer Powder Pillows away from light and heat.
- A convenient way to prepare this solution is to add the contents of 10 DithiVer Metals Reagent Powder Pillows to a 500 mL bottle of chloroform.
- Invert several times until well mixed (carrier powder may not dissolve).
- Store dithizone solution in an amber glass bottle. This solution is stable for 24 hours.
- Carry out a reagent blank using deionized water through the entire method to obtain the most accurate results.

Sample collection, preservation and storage

- Collect samples in an acid-washed glass or plastic containers.
- Adjust the pH to 2 or less with nitric acid (about 2 mL per liter).
- Store preserved samples up to six months at room temperature.
- Adjust the pH to 2.5 with 5.0 N sodium hydroxide before analysis.
- Correct the test result for volume additions.

Accuracy check

Standard additions method (sample spike)
Required for accuracy check:

- Lead Voluette Ampule Standard, 50 mg/L Pb
- Ampule breaker
- TenSette Pipet and Pipet Tips

1. After reading test results, leave the sample cell (unspiked sample) in the instrument.Verify that units are in µg/L.
2. Select Options>More>Standard Additions from the instrument menu.
3. Accept the default values for standard concentration, sample volume and spike volumes. After the values are accepted, the unspiked sample reading will appear in the top row. See the user manual for more information.
4. Open the standard solution ampule.
5. Use the TenSette Pipet to prepare spiked samples: add 0.1 mL, 0.2 mL and 0.3 mL of standard to three 250 mL portions of fresh sample.
6. Follow the *Dithizone method for powder pillows* test procedure for each of the spiked samples starting with the 0.1 mL sample spike. Measure each of the spiked samples in the instrument.
7. Select **GRAPH** to view the results. Select **IDEAL LINE** (or best-fit) to compare the standard addition results to the theoretical 100% recovery.

Standard solution method
Note: *Refer to the instrument user manual for specific software navigation instructions.*

Required for accuracy check:

- Lead Standard Solution, 100 mg/L
- Deionized water
- 100 mL Class A volumetric flask

- Class A volumetric pipet, 10 mL
- Pipet filler

1. Prepare a 10 mg/L lead standard solution as follows:
   a. Pipet 10.00 mL of Lead Standard, 100 mg/L, into a 100 mL volumetric flask.
   b. Dilute to the mark with deionized water. Mix well.
2. Prepare a 200 µg/L lead standard solution as follows:

   Use a graduated cylinder to measure 245 mL of deionized water into the 500 mL separatory funnel (step 3 of the *Dithizone method for powder pillows* test). Pipet 5.00 mL of the 10.0 mg/L Lead standard into the funnel.
3. Follow the *Dithizone method for powder pillows* test procedure.
4. To adjust the calibration curve using the reading obtained with the 200 µg/L Standard Solution, select Options>More>Standard Adjust from the instrument menu.
5. Turn on the Standard Adjust feature and accept the displayed concentration. If an alternate concentration is used, enter the concentration and adjust the curve to that value.

Method performance

Program	Standard	Precision 95% Confidence Limits of Distribution	Sensitivity Concentration change per 0.010 Abs change
280	150 µg/L Pb	140–160 µg/L Pb	2.3 µg/L

Summary of method

The dithizone method is designed for the determination of lead in water and wastewater. The DithiVer Metals Reagent is a stable powder form of dithizone. Lead ions in basic solution react with dithizone to form a pink to red lead-dithizonate complex, which is extracted with chloroform. Test results are measured at 515 nm.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Lead Reagent Set (100 Tests)	—	—	2243100
Includes: (1) 1420299, (2) 1445817, (1) 1261699, (2) 76714, (1) 245053, (2) 245026			
Buffer Powder Pillows, citrate	1	100/pkg	1420299
Chloroform, ACS	30 mL	4 L	1445817
DithiVer Metals Reagent Powder Pillows	1	100/pkg	1261699
Potassium Cyanide	0.1 g	125 g	76714
Sodium Hydroxide Solution, 5.0 N	5 mL	1000 mL	245053
Sodium Hydroxide Standard Solution, 5.0 N	varies	59 mL DB	245026

Required apparatus

Description	Quantity	Unit	Catalog number
Clippers, for opening powder pillows	1	each	96800
Cotton Balls, absorbent	1	100/pkg	257201
Cylinder, graduated, 5 mL	1	each	50837
Cylinder, graduated, 50 mL	1	each	50841
Cylinder, graduated, 250 mL	1	each	50846
Cylinder, graduated, mixing, 50 mL	1	each	189641
Funnel, separatory, 500 mL	1	each	52049
pH Meter, sens***ion***™1, portable, with electrode	1	each	5170010
Spoon, measuring,1 g	1	each	51000
Support Ring, 4"	1	each	58001
Support Ring Stand, 5" x 8" base	1	each	56300
Sample Cell, 1-inch square, w/stopper, matched pair	2	2/pkg	2612602

Recommended standards

Description	Unit	Catalog number
Lead Standard Solution, 100 mg/L Pb	100 mL	1261742
Lead Standard Solution, 10 mL Voluette Ampules, 50 mg/L Pb	16/pkg	1426210

Optional reagents and apparatus

Description	Unit	Catalog number
Ampule Breaker Kit	each	2196800
Chloroform, ACS	500 mL	1445849
Filter Discs, glass, 47 mm	100/pkg	253000
Filter Holder, glass, for 47-mm filter	each	234000
Flask, Erlenmeyer, 500 mL	each	50549
Flask, filtering, 500 mL	each	54649
Flask, volumetric, Class A, 100 mL	each	1457442
Nitric Acid Solution, 1:1	500 mL	254049
Nitric Acid, ACS	500 mL	15249
pH Paper, pH 1.0 to 11.0	5 rolls/pkg	39133
Pipet, serological, 2 mL	each	53236
Pipet, TenSette®, 0.1 to 1.0 mL	each	1970001
Pipet Tips, for TenSette Pipet 1970001	50/pkg	2185696
Pipet, volumetric, 5.00 mL, Class A	each	1451537
Pipet, volumetric, 10.00 mL, Class A	each	1451538
Pipet Filler, safety bulb	each	1465100
Sulfuric Acid, 5.25 N	100 mL MDB	244932
Water, deionized	4 L	27256

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Nickel

DOC316.53.01063

1-(2 Pyridylazo)-2-Napthol (PAN) Method[1]

Method 8150

0.006 to 1.000 mg/L Ni

Powder Pillows

Scope and Application: For water and wastewater; digestion is required for determining total nickel

[1] Adapted from Watanabe, H., *Talanta*, 21 295 (1974)

Test preparation

How to use instrument-specific information

The *Instrument-specific information* table displays requirements that may vary between instruments. To use this table, select an instrument then read across to find the corresponding information required to perform this test.

Table 1 Instrument-specific information

Instrument	Sample cell	Cell orientation
DR 5000	2495402	Fill line faces user
DR 3900	2495402	Fill line faces user
DR 3800, DR 2800, DR 2700	2495402	Fill line faces right

Before starting the test:

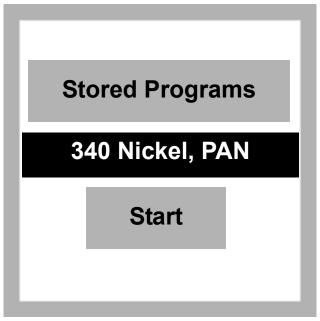
Cobalt concentration can be determined with the same sample by using Program Number 110.
If the sample is less than 10 °C (50 °F), warm to room temperature before analysis. Adjust the pH of acidified stored samples.

Collect the following items:

Description	Quantity
EDTA Powder Pillow	2
Phthalate-Phosphate Reagent Powder Pillow	2
PAN Indicator Solution, 0.3%	1 mL
Deionized Water	25 mL
Sample Cells (see *Instrument-specific information*)	2
Stoppers	2

See *Consumables and replacement items* for reorder information.

PAN method for powder pillows

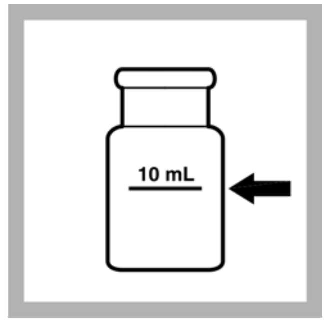


1. Select the test.

Insert an adapter if required (see *Instrument-specific information*).

Refer to the user manual for orientation.

2. Prepared Sample: Fill a sample cell to the 10-mL mark with sample.



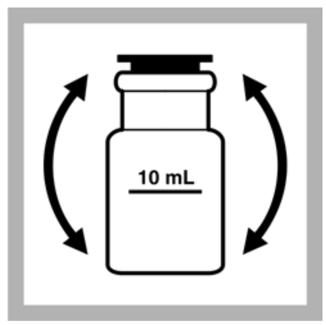
3. Blank Preparation: Fill a second sample cell to the 10-mL mark with deionized water.

4. Add the contents of one Phthalate-Phosphate Reagent Powder Pillow to each cell.

5. Stopper the cells. Immediately shake to dissolve.

If the sample contains iron, make sure that all the powder is dissolved before proceeding to step 6.

6. Using the plastic dropper provided, add 0.5 mL of 0.3% PAN Indicator Solution to each cell.



7. Insert stoppers into the cells. Invert several times to mix.

8. Start the instrument timer.

A 15-minute reaction period will begin.

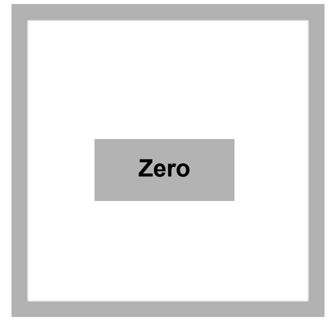
During color development, the sample solution color may vary from yellowish-orange to dark red, depending on the chemical makeup of the sample. The blank should be yellow.

PAN method for powder pillows (continued)

9. When the timer expires, add the contents of one EDTA Reagent Powder Pillow to each cell.

10. Stopper the cells and shake to dissolve.

11. Wipe the blank and insert it into the cell holder



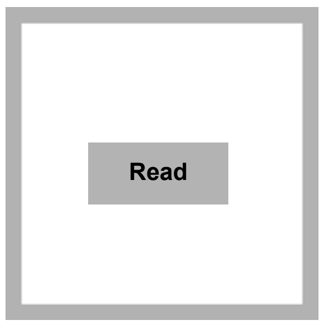
12. **ZERO** the instrument.

The display will show:

0.00 mg/L Ni

The instrument will zero at 560 and 620 nm.

13. Wipe the sample cell and insert it into the cell holder.



14. **READ** the results in mg/L Ni and Co.

Interferences

Table 2 Interfering substances

Interfering substance	Interference level
Al^{3+}	32 mg/L
Ca^{2+}	1000 mg/L as ($CaCO_3$)
Cd^{2+}	20 mg/L
Cl^{-}	8000 mg/L
Chelating agents (e.g., EDTA)	Interfere at all levels. Use either the Digesdahl or vigorous digestion to eliminate this interference.
Cr^{3+}	20 mg/L
Cr^{6+}	40 mg/L
Cu^{2+}	15 mg/L
F^{-}	20 mg/L
Fe^{3+}	10 mg/L

Table 2 Interfering substances (continued)

Interfering substance	Interference level
Fe^{2+}	Interferes directly and must not be present.
K^{+}	500 mg/L
Mg^{2+}	400 mg/L
Mn^{2+}	25 mg/L
Mo^{6+}	60 mg/L
Na^{+}	5000 mg/L
Pb^{2+}	20 mg/L
Zn^{2+}	30 mg/L
Highly buffered samples or extreme sample pH	May exceed the buffering capacity of the reagents and require sample pretreatment.

Sample collection, preservation and storage

- Collect samples in acid-washed plastic bottles.
- Adjust the sample pH to 2 or less with Nitric Acid*, about 5 mL per liter. Preserved samples can be stored up to six months at room temperature.
- Before analysis, adjust the sample pH to between 3 and 8 with 5.0 N Sodium Hydroxide Standard Solution*. Do not exceed pH 8 as this may cause some loss of nickel as a precipitate.
- If the sample is less than 10 °C, warm it to room temperature.
- Correct test results for volume additions.

Accuracy check

Standard additions method (sample spike)
Required for accuracy check:

- Nickel Standard solution, 1000-mg/L Ni
- 25 mL mixing cylinders (3)
- 5-mL Volumetric Pipet, Class A
- TenSette Pipet and Pipet Tips
- 100 mL Volumetric Flask
- Pipet Filler
- Deionized Water

1. Prepare a 50 mg/L Nickel standard by pipetting 5.00 mL of 1000 mg/L Ni standard solution into a 100 mL volumetric flask. Dilute the solution to the required volume and mix well.
2. After reading test results, leave the sample cell (unspiked sample) in the instrument.
3. Select **Options>More>Standard Additions** from the instrument menu.
4. Accept the default values for standard concentration, sample volume and spike volumes. After the values are accepted, the unspiked sample reading will appear in the top row. See the user manual for more information.

* See *Optional reagents and apparatus*.

5. Use the TenSette Pipet to prepare spiked samples: add 0.1 mL, 0.2 mL and 0.3 mL of standard to three 25-mL portions of fresh sample. Mix well.
6. Transfer 10-mL of each solution into sample cells. Follow the *PAN method for powder pillows* test procedure for each of the spiked samples using the powder pillows, starting with the 0.1 mL sample spike. Measure each of the spiked samples in the instrument.
7. Select **GRAPH** to view the results. Select **IDEAL LINE** (or best-fit) to compare the standard addition results to the theoretical 100% recovery.

Standard solution method

Note: *Refer to the instrument user manual for specific software navigation instructions.*

Required for accuracy check:

- Nickel Standard Solution, 1000-mg/L as Ni
- Deionized water
- 1-L volumetric flask, Class A
- 100-mL Volumetric flask
- Volumetric pipets, 5 mL and 10 mL
- Pipet filler

1. Prepare a 5.00 mg/L nickel stock solution as follows:
   a. Pipet 5.00 mL of Nickel Standard Solution, 1000-mg/L as Ni, into a 1000-mL (1 liter) volumetric flask.
   b. Dilute to the mark with deionized water. Mix well. Prepare this solution daily.
2. Prepare a 0.5 mg/L nickel working solution as follows:
   a. 10.0 mL of the 5.00-mg/L nickel stock solution into a 100-mL volumetric flask.
   b. Dilute to the mark with deionized water. Mix well. Prepare this solution daily.
3. Use the working solution in place of the sample. Follow the *PAN method for powder pillows* test procedure.
4. To adjust the calibration curve using the reading obtained with the standard solution, select **Options>More>Standard Adjust** from the instrument menu.
5. Turn on the Standard Adjust feature and accept the displayed concentration. If an alternate concentration is used, enter the concentration and adjust the curve to that value.

Method performance

Program	Standard	Precision 95% Confidence Limits of Distribution	Sensitivity Concentration change per 0.010 Abs change
340	0.500 mg/L Ni	0.492–0.508 mg.L Ni	0.006 mg/L Ni

Summary of method

After buffering the sample and masking any Fe^{3+} with pyrophosphate, the nickel is reacted with 1-(2-Pyridylazo)-2-Naphthol indicator. The indicator forms complexes with most metals present. After color development, EDTA is added to destroy all metal-PAN complexes except nickel and cobalt. The instrument automatically adjusts for cobalt interference by measuring the absorbance of the sample at both 560 nm and 620 nm. This method is unique because both nickel and cobalt can be determined on the same sample when using a spectrophotometer.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Nickel Reagent Set (100 Tests), includes:	—	—	2651600
(2) EDTA Reagent Powder Pillows	2	100/pkg	700599
(2) Phthalate-Phosphate Reagent Powder Pillows	2	100/pkg	2615199
(1) PAN Indicator Solution, 0.3%	1 mL	100 mL MDB	2150232
Water, deionized	25 mL	4 L	27256

Required apparatus

Description	Quantity	Unit	Catalog number
Sample cell, 10 mL square, matched pair	2	2/pkg	2495402
Stoppers	2	6/pkg	173106

Recommended standards

Description	Unit	Catalog number
Nickel Standard Solution, 1000-mg/L Ni (NIST)	100 mL	1417642

Optional reagents and apparatus

Description	Unit	Catalog number
Cylinder, mixing, 25 mL	each	189640
Flask, Volumetric, Class A, 100 mL	each	1457442
Pipet, Volumetric, Class A, 5 mL	each	1451537
Pipet Filler, Safety Bulb	each	1465100
Pipet, volumetric, Class A, 10 mL	each	1451538
Flask, volumetric, Class A, 1000 mL	each	1457453
Water, deionized	4 L	27256
Nitric Acid 1:1	500 mL	254049
Sodium Hydroxide Standard Solution, 5.0 N	100 mL MDB	245032

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Nitrate

DOC316.53.01070

Dimethylphenol Method **Method 10206**

LR (0.23 to 13.50 mg/L NO_3^-–N or 1.00 to 60.00 mg/L NO_3)

TNTplus 835

Scope and Application: For wastewater, drinking water, surface water and process water

Test preparation

How to use instrument-specific information

The *Instrument-specific information* table displays requirements that may vary between instruments. To use this table, select an instrument then read across to find the corresponding information required to perform this test.

Table 1 Instrument-specific information

Instrument	Light shield
DR 3900	LZV849
DR 3800, DR 2800	LZV646

Before starting the test:

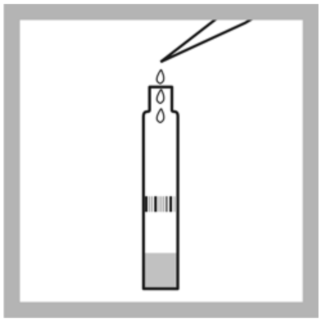
Install the light shield if applicable (see *Instrument-specific information*).
Always read the Safety Advice and Expiration Date on package.
Perform this test at the recommended temperature to avoid an incorrect result. Recommended sample and reagent temperature is 20–23 °C (68–73.4 °F). Analyze samples as soon as possible.
Recommended sample pH is 3–10.
Recommended reagent storage is 15–25 °C (59–77 °F).
TNTplus methods are activated from the Main Menu when the sample vial is inserted into the sample cell holder.

Collect the following items:

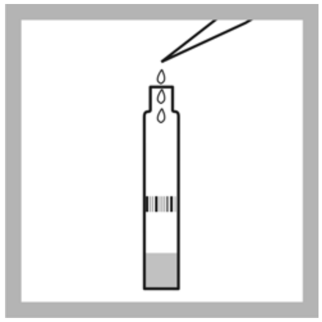
Description	Quantity
Light Shield (see *Instrument-specific information*)	1
Nitrate LR TNT 835 Reagent Set	1
Pipet, variable, 0.2–1.0 mL	1
Pipet Tip, for 0.2–1.0 mL pipet	2

See *Consumables and replacement items* for reorder information.

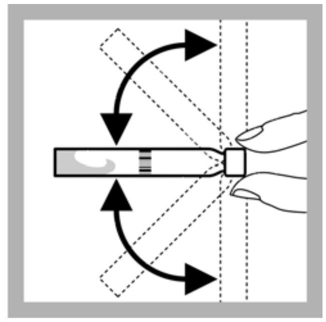
Dimethylphenol method



1. Pipet 1.0 mL of sample into the reagent vial.



2. Pipet 0.2 mL of Solution A into the vial.



3. Cap and invert the reaction tube 2–3 times until no more streaks can be seen in the reaction tube solution.

4. Wait 15 minutes.

5. After the timer expires wipe the vial and insert the prepared vial into the cell holder. The instrument reads the barcode, then selects and performs the correct test.

No Zero is required. Results are in mg/L NO_3–N

Interferences

The items listed in the *Interfering substances* table have been individually checked up to the given concentrations and do not cause interference. The cumulative effects and influence of other ions have not been determined. High loads of oxidizable organic substances (COD) cause the reagent to change color and to give high-bias results. The test can thus only be used for wastewater analyses if the COD is less than 500 mg/L. Measurement results can be verified using sample dilutions or standard additions.

Nitrite concentrations of more than 2.0 mg/L interfere (high-bias results). Add 50 mg of sulfamic acid (amidosulfonic acid) to 5.0 mL of sample, dissolve and wait for 10 minutes. Analyze the prepared sample as described in the procedure above.

Table 2 Interfering substances

Interfering substance	Interference level	Interfering substance	Interference level
Ag^+	100 mg/L	Cu^{2+}	50 mg/L
$Cl^–$	500 mg/L	Ca^{2+}	50 mg/L
Fe^{3+}	50 mg/L	$NO_2^–$	2 mg/L
K^+	500 mg/L	Cd^{2+}	50 mg/L
Na^+	500 mg/L	Sn^{2+}	50 mg/L
Ni^{2+}	50 mg/L	Cr^{6+}	5 mg/L
Pb^{2+}	50 mg/L	Fe^{2+}	10 mg/L
Zn^{2+}	50 mg/L	Co^{2+}	10 mg/L

Reagent blanks

A reagent blank can be measured and the value subtracted from the results of each test performed using the same reagent lot number. Use deionized water in place of sample and run the *Dimethylphenol method* procedure as described.

To subtract the value of the blank from a series of measurements:

1. Measure the blank per step 5.
2. Turn on the reagent blank function. The measured value of the blank should be displayed in the highlighted box.
3. Accept the blank value. The reagent blank value will be subtracted from all results until the function is turned off or a different method is selected.

Alternately, the blank can be recorded and entered at any later time by pressing the highlighted reagent blank box and using the keypad to enter the value.

Sample blanks

Colored or turbid samples can cause high results. To compensate for color or turbidity, the procedure is repeated and the color forming reagent that is present in Solution A is not added.

To determine the sample blank:

1. Perform the *Dimethylphenol method* with 0.2 mL of deionized water in place of the 0.2 mL of Solution A in step 2. Use the original cap to cap the sample vial.
2. Subtract the value obtained in step 5 from the value obtained on the original sample to give the corrected sample concentration.

Alternatively, samples that contain only turbidity may be first filtered through a membrane filter and then analyzed.

Samples without color or turbidity do not require sample blanks.

Sample collection, preservation and storage

- Collect samples in clean plastic or glass bottles.
- Analyze samples as soon as possible to prevent bacterial degradation of the nitrate. If immediate analysis is not possible, store at 4 °C (39 °F) or lower if the sample is to be analyzed within 24 to 48 hours. For longer storage periods (up to 14 days), adjust sample pH to 2 or less with Sulfuric Acid, ACS* (about 2 mL per liter). Sample refrigeration is still required.
- Before testing the stored sample, warm to 20–23 °C and neutralize with 5.0 N Sodium Hydroxide Standard Solution*. Do not use mercury compounds as preservatives.
- Correct the test result for volume additions.

Accuracy check

Standard solution method

Note: *Refer to the instrument user manual for specific software navigation instructions.*

Required for accuracy check:

- Nitrate Nitrogen Standard, 10 mg/L, NO_3–N

  or

- Wastewater Influent Mixed Parameters Inorganics Standard

1. Use 1.0 mL of Nitrate nitrogen standard, 10 mg/L in place of the sample in step 1.

   or

1. Use 1.0 mL of Wastewater Influent Mixed Parameters Inorganics Standard in place of the sample in step 1. This standard contains 10 mg/L nitrate nitrogen combined with ammonia, phosphate, sulfate and organic material.
2. Follow the *Dimethylphenol method* test procedure.

Summary of method

Nitrate ions in solutions containing sulfuric and phosphoric acids react with 2,6-dimethylphenol to form 4-nitro-2,6-dimethylphenol. Test results are measured at the wavelengths in the *Test wavelengths* table.

Table 3 Test wavelengths

Instrument	Wavelength
DR 5000	370 nm
DR 3900, DR 3800, DR 2800	345 nm

* See *Optional reagents and apparatus*.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Nitrate TNTplus, LR TNT 835	1	25/pkg	TNT835

Required apparatus

Description	Quantity	Unit	Catalog number
Pipet, variable volume, 0.2–1.0 mL	1	each	BBP078
Pipet Tips, for BBP078 pipet	2	100/pkg	BBP079

Recommended standards

Description	Unit	Catalog number
Nitrate Nitrogen Standard Solution, 10-mg/L	500 mL	30749
Nitrate Nitrogen Standard Solution, 1000 mg/L	500 mL	1279249
Wastewater Influent Inorganics Standard for NH_3–N, NO_3–N, PO_4, COD, SO_4, TOC	500 mL	2833149
Water, deionized	4 L	27256

Optional reagents and apparatus

Description	Unit	Catalog number
Balance, AccuLab VI–Series, 120 g capacity	each	2694700
Bottle, sampling, low density poly, w/cap, 500 mL, 12/pkg	12/pkg	2087079
Filter Holder, glass, for vacuum filtration	each	234000
Filter, membrane, 47 mm; 0.45-micron	each	2894700
Flask, filtering, glass	1000 mL	54653
Sodium Hydroxide, 5.0 N	50 mL SCDB	245026
Sulfamic Acid	454 g	234401
Sulfuric Acid ACS, concentrated	500 mL	97949
Test Tube Rack for 13-mm vials	each	2497900
Tubing, rubber	12-ft	56019
Aspirator	each	213100

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Edition 6

Nitrite

DOC316.53.01076

USEPA[1] Diazotization Method **Method 10207**

LR (0.015 to 0.600 mg/L NO_2^-–N or 0.05 to 2.00 mg/L NO_2)

TNTplus™ 839

Scope and Application: For wastewater. drinking water, surface water and mineral water

1 Approved

Test preparation

How to use instrument-specific information

The *Instrument-specific information* table displays requirements that may vary between instruments. To use this table, select an instrument then read across to find the corresponding information required to perform this test.

Table 1 Instrument-specific information

Instrument	Light shield
DR 3900	LZV849
DR 3800, DR 2800,	LZV646

Before starting the test:

DR 3900, DR 3800, DR 2800: Install the light shield in Cell Compartment #2 before performing this test.
Please read Safety Advice and Expiration Date on the reagent package.
Recommended sample and reagent temperature is 15–25 °C (59–77 °F).
Recommended sample pH is between 3–10.
Recommended reagent storage temperature is 15–25°C (59–77 °F).
TNTplus methods are activated directly from the Main Menu when the sample vial is inserted into the sample cell holder.

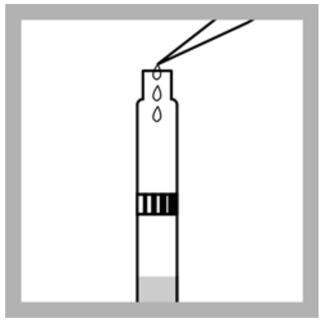
Collect the following items:

Description	Quantity
TNT 839 Reagent Set	1
Light Shield (see *Instrument-specific information*)	1
Pipet for 2.0 mL Sample	1
Pipet Tip	1

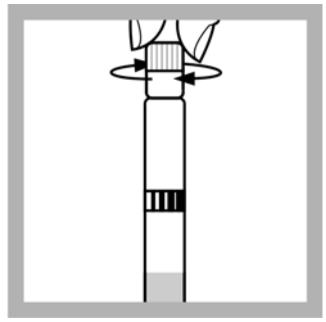
See *Consumables and replacement items* for reorder information.

Diazotization method, TNTplus 839

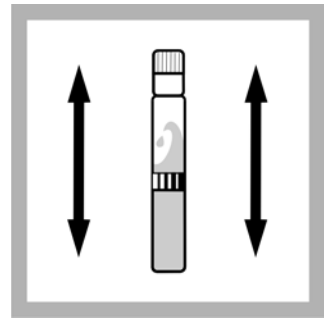
1. Carefully remove the protective foil lid from the DosiCap™ ***Zip***. Unscrew the cap from the vial.



2. Carefully pipet 2.0 mL of sample into the vial. Immediately proceed to step 3.



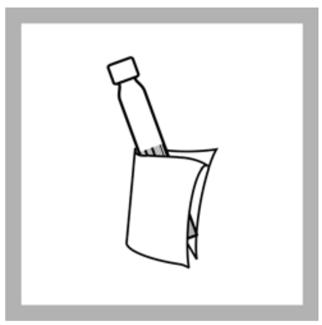
3. Flip the DosiCap ***Zip*** over so that the reagent side faces the vial. Screw the cap tightly onto the vial.



4. Shake the capped vial 2–3 times to dissolve the reagent in the cap.

Verify that the reagent has dissolved by looking down through the open end of the DosiCap ***Zip***.

5. Wait 10 minutes.



6. After 10 minutes, thoroughly clean the outside of the vial.

7. Insert the prepared vial into the cell holder. The instrument reads the barcode, then selects and performs the correct test. Results are in mg/L NO_2^-–N.

Refer to the user manual to show the results in the alternate chemical form.

Reagent blanks

A reagent blank can be measured and the value subtracted from the results of each test performed in same reagent lot. Use deionized water in place of sample in the *Diazotization method, TNTplus 839* test.

To subtract the value of the blank from a series of measurements:

1. Measure the blank per step 7.
2. Turn on the reagent blank option.
3. The measured value of the blank should be displayed in the highlighted box. Accept this value.

The reagent blank value will now be subtracted from all results until the function is turned off or a different method is selected. Alternately, the blank can be recorded and entered at any later time by pressing the highlighted box and using the keypad to enter the value.

Sample blanks

Color or turbid samples can cause high results. To compensate for color or turbidity the procedure is repeated without the addition of the color forming reagent that is present in the DosiCap ***Zip***.

To determine the sample blank:

1. Run the *Diazotization method, TNTplus 839* test, but do not remove the foil from the DosiCap ***Zip*** in step 1.
2. Replace the cap in its original position in step 3.
3. Subtract the value obtained in step 7 from the value obtained on the original sample to give the corrected sample concentration.

Samples without color or turbidity do not require sample blanks.

Interferences

The ions listed in the *Interfering substances* table have been individually tested up to the given concentrations and do not cause interference. The cumulative effects of these ions or the influence of other ions have not been determined.

Table 2 Interfering substances

Interfering substance	Interference level
Cl^{-}, SO_4^{2-}	2000 mg/L
K^{+}, NO_3^{-}	1000 mg/L
NH_4^{+}, PO_4^{3-}, Ca^{2+}	500 mg/L
Mg^{2+}	100 mg/L
Cr^{3+}	50 mg/L
Co^{2+}, Zn^{2+}, Cd^{2+}, Mn^{2+}, Hg^{2+}	25 mg/L
Ni^{2+}	12 mg/L
Ag^{+}, Fe^{2+}	10 mg/L
Sn^{4+}, Fe^{3+}	5 mg/L
Cu^{2+}	< 1 mg/L

Sample collection, preservation and storage

- Collect samples in clean plastic or glass bottles.
- Store at 4 °C (39 °F) or lower if the sample is to be analyzed within 24 to 48 hours.
- Warm to 15–25 °C (59–77 °F) before running the test.
- Do not use acid preservatives.

Accuracy check

Standard solution method

Note: *Refer to the instrument user manual for specific software navigation instructions.*

1. Preparing nitrite standards is difficult. Use the standard preparation instructions in *Standard Methods for the Examination of Water and Wastewater*, Method 4500—NO_2^-B. Prepare a 0.30-mg/L NO_2^-–N standard.
2. Use the 0.30-mg/L solution in place of the sample. Follow the *Diazotization method, TNTplus 839* test procedure.

Summary of method

Nitrite in the sample reacts with a primary aromatic amine in acidic solution to form a diazonium salt. This couples with an aromatic compound to form a colored complex that is directly proportional to the amount of nitrite present. Test results are measured at 515 nm.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Nitrite, TNT 839 TNTplus™ Reagent Set	1	25/pkg	TNT839

Required apparatus

Description	Quantity	Unit	Catalog number
Pipet, variable volume, 1–5 mL	1	each	BBP065
Pipet Tips, for BBP065 Pipet	1	75/pkg	BBP068

Recommended standards and apparatus

Description	Unit	Catalog number
Balance, analytical, 80 g capacity	each	2936701
Handbook, Standard Methods for the Examination of Water and Wastewater	each	2270800
Sodium Nitrite, ACS	454 g	245201
Water, deionized	4 L	27256

Optional reagents and apparatus

Description	Unit	Catalog number
Bottle, sampling, low density poly, w/cap, 500 mL	12/pkg	2087079
Test Tube Rack for 13-mm vials	each	2497900

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Updated March 2011, Edition 6

Nitrite

DOC316.53.01253

Diazotization Method[1]

Method 10237

HR (0.6 to 6.0 mg/L NO_2-N or 2.0 to 20.0 mg/L NO_2^-)

TNTplus™ 840

Scope and Application: For wastewater, drinking water, surface water and process water.

[1] Adapted from *Standard Methods for the Examination of Water and Wastewater*.

Test preparation

How to use instrument-specific information

The *Instrument-specific information* table displays requirements that may vary from instrument to instrument. To use this table, select an instrument then read across to find the corresponding information required to perform this test.

Table 1 Instrument-specific information

Instrument	Light shield	Adapter
DR 5000	—	—
DR 2800	LZV646	—

Before starting the test:

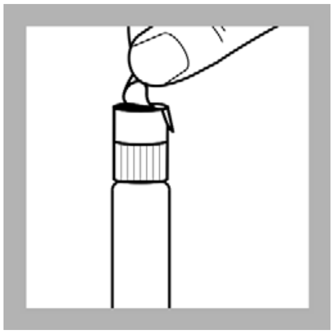
DR 2800 only: Install the light shield in cell compartment #2 before performing this test.
Read the safety advice and expiration date on the reagent package.
The recommended sample and reagent temperature is 15 to 25 °C (59 to 77 °F).
The recommended reagent storage temperature is 15 to 25 °C (59 to 77 °F).
The recommended sample pH is 3 to 10.
TNTplus methods are activated from the main menu when the sample vial is inserted into the sample cell holder.

Collect the following items:

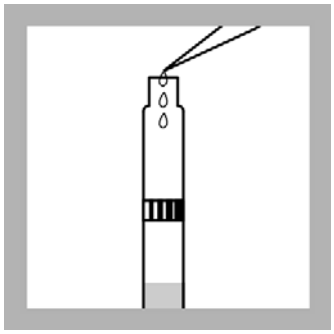
Description	Quantity
TNT840 HR nitrite reagent set	1
Light shield (*Instrument-specific information*)	1
Pipette for 0.2 mL sample	1
Pipette tips	varies

Refer to Consumables and replacement items on page 4 for reorder information.

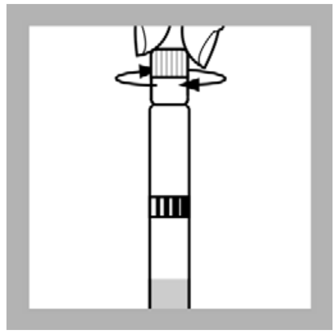
Diazotization Method, TNTplus™ 840



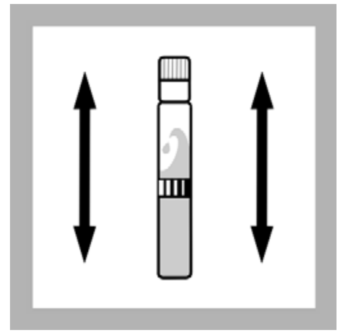
1. Carefully remove the protective foil lid from the DosiCap™ ***Zip***. Unscrew the cap from the vial.



2. Carefully pipet 0.2 mL of sample into the vial. Immediately proceed to step 3.



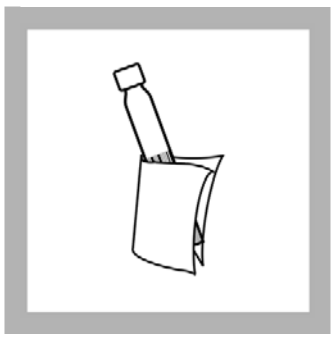
3. Flip the DosiCap ***Zip*** over so that the reagent side faces the vial. Screw the cap tightly on the vial.



4. Shake the capped vial 2 to 3 times to dissolve the reagent in the cap.

Verify that the reagent has dissolved by looking down through the open end of the DosiCap ***Zip***.

5. Wait 10 minutes.



6. After 10 minutes, thoroughly clean the outside of the vial.

7. Insert the prepared vial into the cell holder. The instrument reads the barcode, then selects and performs the correct test. Results are in mg/L NO_2-N.

Reagent blanks

A reagent blank can be measured and the value subtracted from the results of each test performed with the same reagent lot. Use nitrite-free deionized water in place of sample in the *Diazotization Method, TNTplus™ 840* procedure.

To subtract the value of the blank from a series of measurements:

1. Measure the blank as described in step 7.
2. Turn on the reagent blank option.
3. The measured value of the blank should be displayed in the highlighted box. Accept the value.

The reagent blank value will now be subtracted from all results until the function is turned off or a different method is selected. Alternately, the blank can be recorded and entered at any later time by pressing the highlighted box and using the keypad to enter the value.

Sample blanks

Colored or turbid samples can cause high results. To compensate for color or turbidity the procedure is repeated without the addition of the color forming reagent that is present in the DosiCap ***Zip***. Samples without color or turbidity do not require sample blanks.

To determine the sample blank:

1. Perform the *Diazotization Method, TNTplus™ 840* procedure on page 2, but do not remove the foil from the DosiCap ***Zip*** in step 1.
2. Replace the cap in its original position in step 3.
3. Subtract the value obtained in step 7 from the value obtained on the original sample to give the corrected sample concentration.

Interferences

The ions listed in *Interfering substances and levels* have been individually tested up to the given concentrations and do not cause interference. The cumulative effects of these ions or the influence of other ions have not been determined.

Chromium (VI) ions interfere with the determination. Copper (II) ions interfere with the determination even at concentrations below 1 mg/L.

Table 2 Interfering substances and levels

Interfering substance	Interference level
Tin (Sn^{4+})	10 mg/L
Iron (Fe^{2+}, Fe^{3+}), Nickel (Ni^{2+}), Silver (Ag^{+})	20 mg/L
Cobalt (Co^{2+}), Zinc (Zn^{2+}), Cadmium (Cd^{2+}), Manganese (Mn^{2+})	50 mg/L
Chromium (Cr^{3+}), Mercury (Hg^{2+})	100 mg/L
Magnesium (Mg^{2+})	200 mg/L
Ammonium (NH_4^{+}), Phosphate (PO_4^{3-})	1000 mg/L
Potassium (K^{+}), Nitrate (NO_3^{-}), Calcium (Ca^{2+}), Chloride (Cl^{-})	2000 mg/L
Sulfate (SO_4^{2-})	4000 mg/L

Sample collection, preservation and storage

- Collect samples in clean plastic or glass bottles.
- Store at 4 °C (39 °F) or lower if the sample is to be analyzed within 24 to 48 hours.
- Warm to 15 to 25 °C (59 to 77 °F) before running the test.
- Do not use acid preservatives.

Accuracy check

Standard solution method

Preparing a nitrite standard is difficult. Use the standard preparation instructions in *Standard Methods for the Examination of Water and Wastewater*, Method 4500-NO_2^{-} B. Prepare a 3.0 mg/L NO_2-N standard.

Use the 3.0 mg/L solution in place of the sample. Perform the *Diazotization Method, TNTplus™ 840* procedure.

Method performance

Instrument	Standard	Precision 95%Confidence Limits of Distribution	Sensitivity Concentration change per 0.010 Abs change
DR 5000	10.0 mg/L NO_2-	9.8 - 10.2 mg/L NO_2-	0.05 mg/L NO_2-
DR 2800	10.0 mg/L NO_2-	9.8 - 10.2 mg/L NO_2-	0.05 mg/L NO_2-

Summary of method

Nitrite in the sample reacts with a primary aromatic amine in acidic solution to form a diazonium salt. This couples with an aromatic compound to form a colored complex that is directly proportional to the amount of nitrite present. Test results are measured at 515 nm.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Nitrite, HR TNT840 reagent set	1	25/pkg	TNT840

Required apparatus

Description	Quantity/Test	Unit	Catalog number
Light shield (DR 2800 only)	1	each	LZV646
Pipette, variable volume, 0.2 to 1.0 mL	1	each	BBP078
Pipette tips, for BBP078 pipette	varies	100/pkg	BBP079

Recommended standards and apparatus

Description	Unit	Catalog number
Balance, analytical	each	2936701
Handbook, *Standard Methods for the Examination of Water and Wastewater*	each	2270800
Sodium nitrite, ACS	454 g	245201
Water, deionized	4 L	27256

Optional reagents and apparatus

Description	Unit	Catalog number
Bottle, sampling, low density poly, w/cap, 500 mL	12/pkg	2087079
Test tube rack for 13 mm vials	each	2497900

Suspended Solids

DOC316.53.01139

Photometric Method[1] **Method 8006**

(5 to 750 mg/L)

Scope and Application: For water and wastewater.

[1] *Adapted from Sewage and Industrial Wastes, 31, 1159 (1959).*

Test preparation

How to use instrument-specific information

The *Instrument-specific information* table displays information that may vary from instrument to instrument. Select your spectrophotometer from the instrument column on the left. Read across to find the corresponding sample cells and adapters required to perform this test on your spectrophotometer.

Table 1 Instrument-specific information

Instrument	Sample cell	Cell orientation
DR 5000	2495402	Fill line faces user
DR 3900	2495402	Fill line faces user
DR 3800, DR 2800, DR 2700	2495402	Fill line faces right

Before starting the test:

The Pour-Thru Cell cannot be used with this procedure.

Collect the following items:

Description	Quantity
Beaker, 600-mL, polypropylene	1
Blender	1
Cylinder, 500-mL polypropylene, graduated	1
Sample Cells (see the *Instrument-specific information* table)	2

See *Consumables and replacement items* for reorder information.

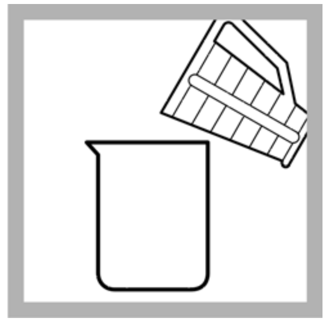
Photometric Method

1. Select the test.

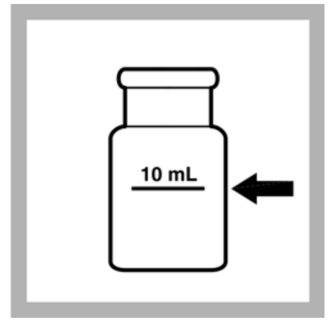
Insert an adapter if required (see the *Instrument-specific information* table).

Refer to the user manual for orientation.

2. Blend 500 mL of sample in a blender at high speed for exactly two minutes.



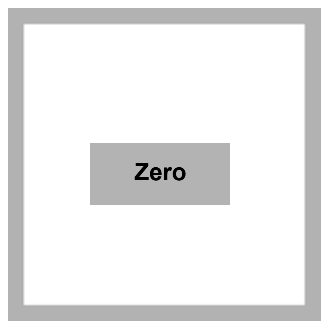
3. Pour the blended sample into a 600-mL beaker.



4. **Prepared Sample:** Stir the sample and immediately pour 10 mL of the blended sample into a sample cell.

5. **Blank Preparation:** Fill a second sample cell with 10 mL of tap water or deionized water.

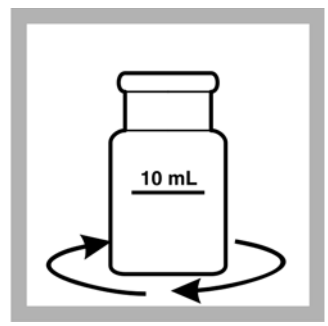
6. Wipe and insert the blank into the cell holder.



7. **ZERO** the instrument.

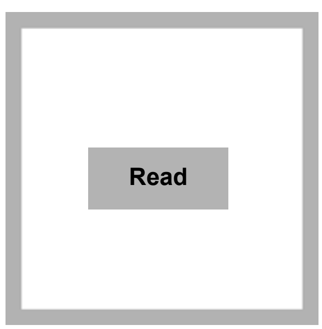
The display will show:

0 mg/L TSS



8. Swirl the prepared sample to remove any gas bubbles and uniformly suspend any residue.

9. Wipe and insert the prepared sample into the cell holder.



10. **READ** the results in mg/L TSS.

Interferences

Samples that absorb strongly at 810 nm, such as blue dyes, may give false, high-bias readings. A user-entered calibration is advised for these samples.

Sample collection, preservation and storage

Collect samples in clean plastic or glass bottles. Analyze samples as soon as possible after collection. The sample may be stored for seven days by cooling to 4 °C (39 °F).

Accuracy check

Calibration for this test is based on parallel samples using the gravimetric technique on sewage samples from a municipal sewage plant. For most samples, this calibration will provide satisfactory results. When higher accuracy is required, run parallel spectrophotometric and gravimetric determinations with portions of the same sample. Make the new calibration on the particular sample using a gravimetric technique as a basis.

Summary of method

This method of determining suspended solids is a simple, direct measurement which does not require the filtration or ignition/weighing steps that gravimetric procedures do. The USEPA specifies the gravimetric method for solids determinations, while this method is often used for checking in-plant processes. Test results as mg/L total suspended solids (TSS) are measured at 810 nm.

Consumables and replacement items

Required apparatus

Description	Quantity	Unit	Catalog number
Beaker, 600-mL, polypropylene	1	each	108052
Blender, 1.2-L, 120 VAC	1	each	2616100
Blender, 1.2 L, 240 VAC	1	each	2616102
Cylinder, 500-mL graduated, polypropylene	1	each	108149

FOR TECHNICAL ASSISTANCE, PRICE INFORMATION AND ORDERING:
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Outside the U.S.A. – **Contact the HACH office or distributor serving you.**
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WORLD HEADQUARTERS
Telephone: (970) 669-3050
FAX: (970) 669-2932

Edition 6

Zinc

DOC316.53.01145

USEPA[1] Zincon Method[2]

Method 8009

(0.01 to 3.00 mg/L)

Powder Pillows

Scope and Application: For water and wastewater. Digestion is required for a total zinc analysis (see *Digestion*).

[1] USEPA approved for wastewater analyses 3500 Zn B: Federal Register, 45(105) 36166 (May 29, 1980).

[2] Adapted from *Standard Methods for the Examination of Water and Wastewater.*

Test preparation

How to use instrument-specific information

The *Instrument-specific information* table displays information that may vary from instrument to instrument. Select the spectrophotometer from the instrument column on the left. Read across to find the corresponding sample cells and adapters required to perform this test on the spectrophotometer.

Table 1 Instrument-specific information

Instrument	Powder pillows	
	Sample cell	Cell orientation
DR 5000	2495402	Fill line faces user
DR 3900	2495402	Fill line faces user
DR 3800, DR 2800, DR 2700	2495402	Fill line faces right

Before starting the test:

Use only glass-stoppered mixing cylinders in this procedure.
Wash glassware with 1:1 HCl[1] and rinse with deionized water before use.
Use a plastic dropper in step **6** of this procedure. Droppers with rubber bulbs may contaminate the reagent.
ZincoVer® 5 reagent contains potassium cyanide. Cyanide solutions are regulated as hazardous waste by the Federal RCRA. Cyanide should be collected for disposal as a reactive (D003) waste. Be sure that cyanide solutions are stored in a caustic solution with pH >11 to prevent release of hydrogen cyanide gas. Refer to the current MSDS for handling and disposal information.
The Pour-Thru Cell cannot be used with this test.

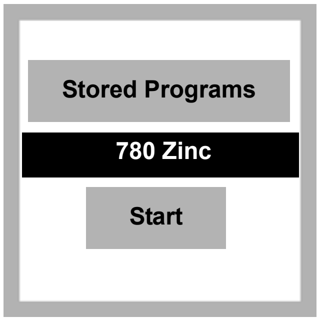
[1] See *Optional reagents and apparatus*.

Collect the following items:

Description	Quantity
Cyclohexanone	0.5 mL
ZincoVer 5 Reagent Powder Pillow	1
Cylinder, graduated mixing, 25-mL	1

See *Consumables and replacement items* for reorder information.

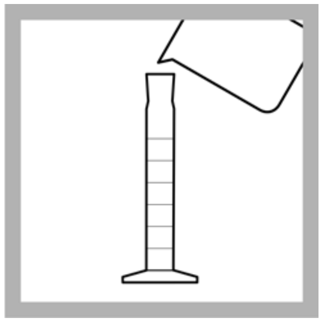
Zincon method



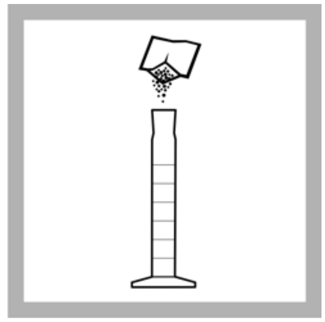
1. Select the test.

Insert an adapter if required (the *Instrument-specific information* table).

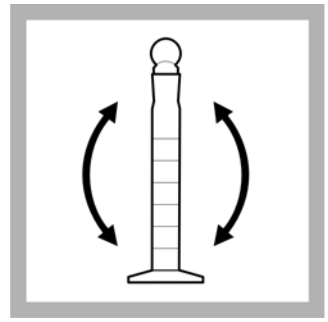
Refer to the user manual for orientation.



2. Fill a 25-mL graduated mixing cylinder with 20 mL of sample.



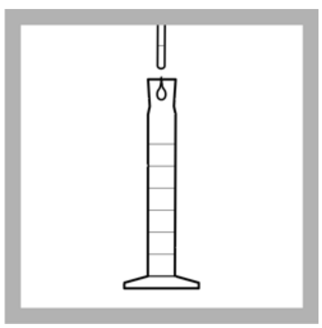
3. Add the contents of one ZincoVer 5 Reagent Powder Pillow to the mixing cylinder. Stopper.



4. Invert several times to dissolve the powder completely. Inconsistent readings may result if all the particles are not dissolved.

The sample should be orange. If the sample is brown or blue, the zinc concentration is too high or an interfering metal is present. Dilute the sample and repeat the test.

5. Blank preparation: Pour 10 mL of the solution into a sample cell.



6. Prepared sample: Use a plastic dropper to add 0.5 mL of cyclohexanone to the remaining solution in the mixing cylinder.

7. Start the instrument timer. A 30-second reaction period will begin.

During the reaction period, stopper the mixing cylinder and vigorously shake the prepared sample.

The sample will be reddish-orange, brown, or blue, depending on the zinc concentration.

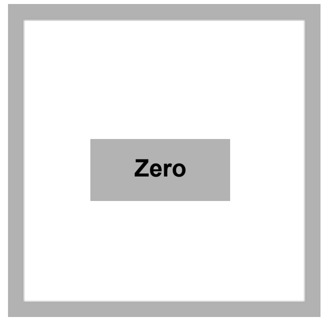
8. Start the instrument timer.

A three-minute reaction period will begin. During this reaction period, complete step **9**.

Zincon method

9. Pour the prepared sample solution from the mixing cylinder into a second sample cell.

10. When the timer expires, wipe the blank and insert it into the cell holder.



11. **ZERO** the instrument.

The display will show:

0.00 mg/L Zn

12. Wipe the prepared sample and insert it into the cell holder.

READ the results in mg/L Zn.

Interferences

Table 2 Interfering substances

Interfering substance	Interference level
Aluminum	Greater than 6 mg/L
Cadmium	Greater than 0.5 mg/L
Copper	Greater than 5 mg/L
Iron (ferric)	Greater than 7 mg/L
Manganese	Greater than 5 mg/L
Nickel	Greater than 5 mg/L
Organic Material	Large amounts may interfere. Pretreat the sample with a mild digestion.
Highly buffered or extreme sample pH	May exceed the buffering capacity of the reagents and require sample pretreatment. Adjust pH to 4–5.
Amino-tri(methylene phosphonic acid) (AMP)	Samples containing AMP cause a negative interference. Digest the sample to eliminate this interference (follow the total phosphorus hot plate digestion, Method 8190). ***Important Note:*** *Be sure to adjust the pH of the sample after the digestion to pH 4–5 with sodium hydroxide before the zinc analysis. Correct the pH level for volume changes.*

Sample collection, preservation and storage

Collect samples in acid-cleaned plastic or glass bottles. If prompt analysis is impossible, preserve the sample by adjusting to pH 2 or less with nitric acid (about 2 mL per liter). Preserved samples may be stored up to six months at room temperature.

Before analysis, adjust the pH to 4–5 with 5.0 N Sodium Hydroxide. Do not exceed pH 5 as zinc may precipitate. Correct the test result for volume additions.

Accuracy check

Standard additions method (sample spike)
Required for accuracy check:

- Zinc Voluette® Ampule Standard, 25 mg/L Zn
- Ampule breaker
- TenSette Pipet 0.1 - 1.0 mL and tips
- 25-mL mixing cylinders

1. After reading test results, leave the sample cell (unspiked sample) in the instrument.
2. Select **OPTIONS>MORE>STANDARD ADDITIONS** from the instrument menu.
3. Press **OK** to accept the default values for standard concentration, sample volume, and spike volumes. Press **EDIT** to change these values. After values are accepted, the unspiked sample reading will appear in the top row.
4. Open one Voluette ampule standard.
5. Use the TenSette Pipet to prepare spiked samples: add 0.1 mL, 0.2 mL, and 0.3 mL of standard to three 20-mL portions of fresh sample.
6. Follow the test procedure for each of the spiked samples starting with the 0.1 mL sample spike. Measure each of the spiked samples in the instrument.
7. Select **GRAPH** to view the results. Select **IDEAL LINE** (or best-fit) to compare the standard addition results to the theoretical 100% recovery.

Standard solution method

Note: *Refer to the instrument user manual for specific software navigation instructions.*

Required for accuracy check:

- 100 mg/L zinc standard solution
- 10.00 mL Class A pipet
- 1000-mL Class A volumetric flask

1. Prepare a 1.00-mg/L zinc standard solution as follows. Pipet 10.00 mL of Zinc Standard Solution, 100-mg/L, into a 1000-mL volumetric flask. Dilute to the mark with deionized water. Prepare this solution daily.
2. Follow the zinc procedure.
3. To adjust the calibration curve using the reading obtained with the 1.00-mg/L standard solution, navigate to Standard Adjust in the software (**OPTIONS**>(**MORE**)>**STANDARD ADJUST**).
4. Turn on the Standard Adjust feature and accept the displayed concentration. If an alternate concentration is used, enter the concentration and adjust the curve to that value.

Digestion

A sample digestion is required before an analysis for total zinc can be started. A digestion will make sure that all zinc compounds in the sample are in a chemical form that will be measured. Complete the following steps to digest the sample.

Note: *The following procedure is the USEPA mild digestion. See the Water Analysis Guide for more digestion procedures.*

1. If nitric acid has not been added to the sample previously, add 5 mL of concentrated nitric acid to one liter of sample (use a glass serological pipet and pipet filler). If the sample was acidified at collection, add 3 mL of nitric acid to one liter of sample.
2. Transfer 100 mL of acidified sample to a 250-mL Erlenmeyer flask.

3. Add 5 mL of 1:1 hydrochloric acid*.
4. Heat the sample on a hot plate* at 95 °C (203 °F) until 15-20 mL remain. Make sure the sample does not boil.
5. Filter the cooled sample with 0.45 µm filter to remove any insoluble material.
6. Adjust the pH of the digested sample to pH 4–5 with 5.0 N sodium hydroxide. See *Sample collection, preservation and storage* for instructions.
7. Quantitatively transfer the sample to a 100-mL volumetric flask and dilute to the mark with deionized water.

Method performance

Program	Standard	Precision 95% Confidence Limits of Distribution	Sensitivity Concentration change per 0.010 Abs change
780	1.00 mg/L Zn	0.97–1.03 mg/L Zn	0.013 mg/L Zn

Summary of method

Zinc and other metals in the sample are complexed with cyanide. Adding cyclohexanone causes a selective release of zinc. The zinc reacts with 2-carboxy-2'-hydroxy-5'-sulfoformazyl benzene (zincon) indicator to form a blue-colored species. The blue color is masked by the brown color from the excess indicator. The intensity of the blue color is proportional to the amount of zinc present. Test results are measured at 620 nm.

* See *Optional reagents and apparatus*.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Zinc Reagent Set, 20-mL sample size, includes:	—	—	2429300
Cyclohexanone	0.5 mL	100 mL MDB	1403332
ZincoVer® 5 Reagent Powder Pillows	1	100/pkg	2106669

Required apparatus

Description	Quantity	Unit	Catalog number
Cylinder, graduated, mixing, 25-mL	1	each	2088640
Sample cell, 10 mL, square, matched pair	2	2/pkg	2495402

Recommended standards

Description	Unit	Catalog number
Water, deionized	4 L	27256
Zinc Standard Solution, 100-mg/L	100 mL	237842
Zinc Standard Solution, 10-mg/L Voluette® Ampule, 25-mL as Zn	16/pkg	1424610
Zinc Standard Solution, 1000-mg/L	100 mL	1417742

Optional reagents and apparatus

Description	Unit	Catalog number
Flask, Erlenmeyer, 250 mL	each	50546
Hot Plate, 120 V	each	1206701
Hydrochloric Acid 6.0 N, 1:1	500 mL	88449
Nitric Acid, concentrated, ACS	500 mL	15249
Sodium Hydroxide 5.0 N	50 mL SCDB	245026
Tensette Pipet, 0.1–1.0	each	1970001
Tips for Tensette Pipet 1970001	50/pkg	2185696
Ampule Breaker	each	2196800
Pipet, volumetric, Class A, 10 mL	each	1451538
Pipet, Filter, Safety bulb	each	1465100
Flask, volumetric, Class A, 1000 mL	each	1457453
Filter paper 0.45 µm	100/pkg	1353000
pH paper test strips, 3.0–5.5 pH range	15’ roll	37333
Filtration apparatus, glass	each	234000

Edition 6

15.9 Appendix I – Daily Discharge Volumes and Chemical Usage Data

Appendix I

Tundra Mine 2012
Daily Discharge Volumes
and Chemical Usage Data

pure elements
environmental solutions

Day	Date	Treated	Discharged	License Limit	CHEMICAL USAGE, kg Ferric	Lime	Poly	CHEMICAL DOSAGE, mg/L Ferix-3	Lime	Poly	18% Ferric Component
1	9-Jun	6528	0	6600	908	681	12	139	104	1.84	25
2	10-Jun	6528	0	6600	908	681	12	139	104	1.84	25
3	11-Jun	6528	0	6600	908	681	12	139	104	1.84	25
4	12-Jun	6528	649	6600	908	681	12	139	104	1.84	25
5	13-Jun	6528	6232	6600	908	681	12	139	104	1.84	25
6	14-Jun	6528	6372	6600	908	681	12	139	104	1.84	25
7	15-Jun	6528	5824	6600	908	681	12	139	104	1.84	25
8	16-Jun	6528	4124	6600	363.2	113	4	56	17	0.61	10
9	17-Jun	6528	1530	6600	908	681	12	139	104	1.84	25
10	18-Jun	6528	0	6600	908	681	12	139	104	1.84	25
11	19-Jun	6528	0	6600	908	681	12	139	104	1.84	25
12	20-Jun	6528	0	6600	363.2	338	8	56	52	1.23	10
13	21-Jun	6576	4782	6600	817.2	338	16	124	51	2.43	22
14	22-Jun	6576	5664	6600	908	338	12	138	51	1.82	25
15	23-Jun	6576	6324	6600	908	563	12	138	86	1.82	25
16	24-Jun	6098	6177	6600	817.2	450	12	134	74	1.97	24
17	25-Jun	6552	5874	6600	908	450	16	139	69	2.44	25
18	26-Jun	6600	6090	6600	999	563	12	151	85	1.82	27
19	27-Jun	6816	6349	6600	1021.5	225	12	150	33	1.76	27
20	28-Jun	7152	6353	7200	908	450	12	127	63	1.68	23
21	29-Jun	6576	6561	7200	726.4	450	8	110	68	1.22	20
22	30-Jun	7776	6063	7200	726.4	338	12	93	43	1.54	17
23	1-Jul	7776	5982	7200	817.2	450	12	105	58	1.54	19
24	2-Jul	7872	6647	7200	726.4	450	12	92	57	1.52	17
25	3-Jul	7680	7143	7200	726	270	12	95	35	1.56	17
26	4-Jul	7680	7170	7200	1021.5	270	12	133	35	1.56	24
27	5-Jul	7680	7158	7200	612.9	270	12	80	35	1.56	14
28	6-Jul	7440	7178	7200	612.9	2790	12	82	375	1.61	15
29	7-Jul	7836	7150	7200	545	225	8	70	29	1.02	13
30	8-Jul	8064	7178	7200	908	338	12	113	42	1.49	20
31	9-Jul	7932	7197	7200	953	428	8	120	54	1.01	22
32	10-Jul	8004	6810	7200	1022	450	12	128	56	1.50	23
33	11-Jul	7896	7165	7200	1021.5	225	12	129	28	1.52	23
34	12-Jul	7956	7133	7200	908	338	12	114	42	1.51	21
35	13-Jul	8076	7190	7200	726.4	450	12	90	56	1.49	16
36	14-Jul	7944	7180	7200	794.5	450	12	100	57	1.51	18
37	15-Jul	7896	6671	7200	794.5	450	12	101	57	1.52	18
38	16-Jul	8028	7142	7200	1135	338	12	141	42	1.49	25
39	17-Jul	8064	7171	7200	772	450	16	96	56	1.98	17
40	18-Jul	7945	7173	7200	817.2	675	12	103	85	1.51	19
41	19-Jul	8013	7140	7200	817.2	675	12	102	84	1.50	18
42	20-Jul	7999	7101	7200	726.4	675	12	91	84	1.50	16
43	21-Jul	7944	7110	7200	817.2	675	12	103	85	1.51	19
44	22-Jul	7944	7174	7200	817.2	675	12	103	85	1.51	19
45	23-Jul	7964	7187	7200	999	675	12	125	85	1.51	23
46	24-Jul	7946	7147	7200	999	675	12	126	85	1.51	23
47	25-Jul	8544	7165	7200	908	540	12	106	63	1.40	19
48	26-Jul	8064	7143	7200	908	450	12	113	56	1.49	20
49	27-Jul	7872	7158	7200	998.8	450	12	127	57	1.52	23
50	28-Jul	7944	7164	7200	908	450	12	114	57	1.51	21
51	29-Jul	7872	7167	7200	908	450	12	115	57	1.52	21
52	30-Jul	7968	7163	7200	908	450	12	114	56	1.51	21
53	31-Jul	7848	7171	7200	908	360	12	116	46	1.53	21
54	1-Aug	8040	7173	7200	817.2	540	12	102	67	1.49	18
55	2-Aug	7992	7163	7200	817.2	360	12	102	45	1.50	18
56	3-Aug	7800	7190	7200	635.6	360	12	81	46	1.54	15
57	4-Aug	7800	7107	7200	817.2	360	12	105	46	1.54	19
58	5-Aug	7728	7177	7200	817.2	450	12	106	58	1.55	19
59	6-Aug	7728	7154	7200	726.4	450	12	94	58	1.55	17
60	7-Aug	7848	7184	7200	726	360	12	93	46	1.53	17
61	8-Aug	7584	6796	7200	817.2	540	12	108	71	1.58	19

Day	Date	Treated	Discharged	License Limit	CHEMICAL USAGE, kg Ferric	Lime	Poly	CHEMICAL DOSAGE, mg/L Ferix-3	Lime	Poly	18% Ferric Component
62	9-Aug	7992	7171	7200	726.4	360	12	91	45	1.50	16
63	10-Aug	7800	7165	7200	726.4	360	12	93	46	1.54	17
64	11-Aug	7560	7159	7200	817.2	544.8	12	108	72	1.59	19
65	12-Aug	7740	7183	7200	908	522.1	12	117	67	1.55	21
66	13-Aug	7620	7193	7200	930.7	522.1	12	122	69	1.57	22
67	14-Aug	7632	7190	7200	1362	6132	12	178	803	1.57	32
68	15-Aug	7548	7185	7200	1157.7	567.5	12	153	75	1.59	28
69	16-Aug	7644	7181	7200	1135	681	8	148	89	1.05	27
70	17-Aug	7620	7179	7200	1135	681	12	149	89	1.57	27
71	18-Aug	7464	7183	7200	1135	681	12	152	91	1.61	27
72	19-Aug	7404	7184	7200	1021.5	681	12	138	92	1.62	25
73	20-Aug	7728	6690	7200	1248.5	681	12	162	88	1.55	29
74	21-Aug	7296	7190	7200	1135	681	8	156	93	1.10	28
75	22-Aug	7872	7183	7200	1135	567.5	12	144	72	1.52	26
76	23-Aug	7656	7193	7200	1021.5	681	12	133	89	1.57	24
77	24-Aug	7944	7190	7200	1135	681	12	143	86	1.51	26
78	25-Aug	7968	7188	7200	1135	681	16	142	85	2.01	26
79	26-Aug	8064	7179	7200	1135	476.7	12	141	59	1.49	25
80	27-Aug	8004	7190	7200	1248.5	567.5	12	156	71	1.50	28
81	28-Aug	7764	7189	7200	1135	568	12	146	73	1.55	26
82	29-Aug	7704	7187	7200	1021.5	454	8	133	59	1.04	24
83	30-Aug	8016	7182	7200	1135	681	12	142	85	1.50	25
84	31-Aug	8236	7192	7200	1135	567.5	12	138	69	1.46	25
85	1-Sep	8090	7139	7200	1210	500	12	150	62	1.48	27
86	2-Sep	8064	7187	7200	1100	550	12	136	68	1.49	25
87	3-Sep	7920	7194	7200	1320	625	12	167	79	1.52	30
88	4-Sep	7812	7151	7200	1452	700	12	186	90	1.54	33
89	5-Sep	7788	7075	7200	1320	650	12	169	83	1.54	31
90	6-Sep	7800	7191	7200	1100	625	12	141	80	1.54	25
91	7-Sep	7812	6950	7200	1100	775	12	141	99	1.54	25
92	8-Sep	7949	7150	7200	1100	500	8	138	63	1.01	25
93	9-Sep	7793	7055	7200	1210	675	12	155	87	1.54	28
94	10-Sep	8312	7192	7200	1100	500	12	132	60	1.44	24
95	11-Sep	8018	7170	7200	1100	625	12	137	78	1.50	25
96	12-Sep	8088	7073	7200	1100	500	8	136	62	0.99	24
97	13-Sep	8002	7189	7200	1320	625	12	165	78	1.50	30
98	14-Sep	7750	7191	7200	1210	625	8	156	81	1.03	28
99	15-Sep	7956	7188	7200	1135	562.5	8	143	71	1.01	26
100	16-Sep	7980	7190	7200	1248.5	562.5	12	156	70	1.50	28
101	17-Sep	7692	7183	7200	1248.5	562.5	8	162	73	1.04	29
102	18-Sep	7740	7191	7200	1248.5	562.5	8	161	73	1.03	29
103	19-Sep	7620	7189	7200	1362	675	12	179	89	1.57	32
104	20-Sep	1252	7158	7200	113.5	112.5	4	91	90	3.19	16

15.10 Appendix J – Downstream Effects

Appendix J

Tundra Mine 2012 Downstream Effects

pure elements
environmental solutions

2012 Offsite Monthly Average Results, mg/L

	Total Arsenic		Total Copper		Total Lead		Total Nickel		Total Zinc	
Month	WTP TTD Discharged	SNC Report Hambone	WTP TTD Discharged	SNC Report Hambone	WTP TTD Discharged	SNC Report Hambone	WTP TTD Discharged	SNC Report Hambone	WTP TTD Discharged	SNC Report Hambone
Jun.	0.0240	0.03135	0.0012	0.00115	0.0000	<.0001	0.0031	0.00335	0.0020	<.0004
Jul.	0.0670	0.03200	0.0011	0.00070	0.0000	<.0001	0.0032	0.00260	0.0016	0.0004
Aug.	0.0910	0.03900	0.0011	0.00070	0.0000	<.0001	0.0034	0.00250	0.0016	**0.0008**
Sep.	0.0800	0.03360	0.0010	0.00080	0.0000	<.0001	0.0044	0.00290	0.0017	<.0004
		Powder Mag		Powder Mag		Powder Mag		Powder Mag		Powder Mag
Jun.	0.0240	0.00830	0.0012	0.00210	0.0000	<.0001	0.0031	0.00470	0.0020	0.0004
Jul.	0.0670	0.01030	0.0011	0.00100	0.0000	<.0001	0.0032	0.00350	0.0016	<.0004
Aug.	0.0910	0.01320	0.0011	0.00060	0.0000	<.0001	0.0034	0.00210	0.0016	**0.0006**
Sep.	0.0800	0.00970	0.0010	**0.00070**	0.0000	<.0001	0.0044	0.00250	0.0017	<.0004

	Total Suspended Solids		pH *(Field Results)*		Calcium		Iron		Sulphate	
Month	WTP TTD Discharged	SNC Report Hambone	WTP TTD Discharged	SNC Report Hambone	WTP TTD Discharged	SNC Report Hambone	WTP TTD Discharged	SNC Report Hambone	WTP TTD Discharged	SNC Report Hambone
Jun.	5.4	6.0	8.16	7.81	not available	57.2	not available	0.227	not available	153
Jul.	6.1	3.0	8.01	7.83	not available	76.0	not available	0.223	not available	199
Aug.	6.3	3.0	8.30	8.08	not available	82.0	not available	0.262	not available	211
Sep.	7.2	5.5	8.27	7.87	not available	92.5	not available	0.363	not available	230
		Powder Mag		Powder Mag		Powder Mag		Powder Mag		Powder Mag
Jun.	5.4	**50.0**	8.16	7.66	not available	71.5	not available	0.141	not available	61
Jul.	6.1	<3	8.01	7.51	not available	41.5	not available	0.134	not available	105
Aug.	6.3	<3	8.30	8.08	not available	57.9	not available	0.048	not available	149
Sep.	7.2	**5.0**	8.27	7.55	not available	69.8	not available	0.089	not available	180

NOTE: Items bolded and blue noted by author as being re-analyzed by the laboratory. September monthly results include samples taken August 29 and August 30.
Hambone' refers to both "Hambone Lake" or "Hambone Lake Outlet" sampling. 'Powder Mag' refers to both "Powder Mag Lake" or "Powder Mag Lake Outlet" sampling

REPORT

2013 SEASONAL REPORT

TUNDRA PHASE II REMEDIATION ACTIVITIES WATER TREATMENT OPERATION

Submitted to:

TLICHO Engineering & Environmental Services
88 Archibald Street
P.O. Box 133
Yellowknife, NT

Submitted by:

WESA, a division of BluMetric Environmental Inc.
4901 – 48 Street
Ground Floor
Yellowknife, NT X1A 2P9

February 2014

Project Number: Y-B11192-13-00

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1. INTRODUCTION

The aim of this treatment season was to build and operate a primary water treatment facility capable of removing contaminants from water drawn from lower pond at the Tundra Mine site, Northwest Territories. The final stages of construction in the Tailings Containment Area (TCA) can occur once all the water has been removed.

The plant is designed to produce treated water for discharge with a time weighted daily average concentration of less than 0.2 mg/L of total arsenic. The tailing effluent must also comply with all the terms and conditions of the Contract Specifications and Water Licence Criteria which include the additional discharge criteria presented in **Table 1**.

The plant is designed, as shown in **Figure 1**, to precipitate arsenic from solution by chemical reaction with ferric sulphate and lime using a minimum ratio of iron to arsenic (by weight) of five (5) to one (1). Arsenic and other heavy metals will precipitate as metal hydroxide and adsorb on flocs. In the event that additional polishing treatment of zinc and lead is required when degraded influent quality is encountered, the injection of a sulphure compound in the solution will be used to assist in the precipitation of those elements as metal sulphides which display lower solubilites. The precipitate and other solids are then separated from the water by dewatering using geotubes contained within a bermed and lined area. The discharge from the geotubes was then collected in a discharge sump prior to being recirculated back into Upper Pond until treatment is completed and validated with offsite analysis such that discharge is subsequently granted to Hambone Lake.

The treatment of the contaminated wastewater was first initiated in 2009 with a small scale treatment system. Phase 2 remediation work continued the following years with the design, construction and operation of a system that could reach a treatment capacity of up to 450 m^3 per hour. The original design of the treatment facility consisted of a triple train system with each train capable of operating at a maximum of 150 m^3/hr. However, as shown in **Figure 2**, only two (2) of the three (3) trains were in operation. As such, the current treatment capacity of the system was equal to 300 m^3/hr.

Table 1: Discharge Criteria as per the Contract Specifications and Water Licence Criteria

Parameter	Unit	Effluent Criteria		
		Contract Specifications: Maximum Daily Average Concentration	Water License Criteria: Monthly Average Concentration	Water Licence Criteria: Maximum Concentration of Any Grab Sample
Metals				
Total arsenic	mg/L	0.20	0.50	1.00
Total copper	mg/L	0.01	0.01	0.02
Total lead	mg/L	0.01	0.01	0.02
Total nickel	mg/L	0.05	0.05	0.10
Total zinc	mg/L	0.02	0.02	0.04
Anions				
Nitrate (as N)	mg/L	5.00	5.00	10.0
Nitrite (as N)	mg/L	0.40	0.40	0.80
Conventional Parameters				
Total ammonia nitrogen	mg/L	5.00	5.00	10.00
Total suspended solids	mg/L	15.0	15.0	30.0
pH	-	6 - 9	6 - 9	6 - 9

2. 2013 TREATMENT STRATEGY

The 2013 project objective was to treat and compliantly discharge water from upper and lower ponds; hence, the project objective was met.

In previous years, water contained within lower and upper ponds was treated and subsequently discharged into Hambone Lake in one continuous motion. This year's *modus operandi* was different; water from both ponds was treated in batch mode. As such, instead of pumping the effluent directly into Hambone Lake, treated water was recirculated back into upper pond which acted as a holding reservoir as shown on **Figures 3** and **4**. This strategy allowed for the water contained within upper and lower ponds to be treated in multiple batches in a closed loop until sufficient treatment is performed and effluent discharge criteria are met.

It was planned at the beginning of the season that water contained within lower pond would be transferred into upper pond such that only a single volume of water needs to be treated. However, due to the limited holding capacity of upper pond, all of the water contained in lower pond was not transfer immediately. The remaining water in lower pond was transferred into upper pond after the first batch was discharged.

Three (3) sampling events occurred during the 2013 treatment season. During approval of each treated batch, samples were grabbed at different depths and locations of upper pond as sown on **Figure 5**. Samples will be sent offsite to a CALA accredited external laboratory for analysis. When results were conclusive, discharge permission was granted and site conditions fulfilled, the delineated treated water contained within Upper Pond was then being discharged from the sump area into Hambone Lake, at the authorized flow rate 300 m3/hr, averaged over 24 hours for continuous discharge.

2.1 Work Chronology

The 2013 treatment chronology is detailed below and is summarized in **Table 2**.

Step1: WWTP construction held from May 29th to June 4th. Only two (2) out of three (3) treatment trains were commissioned.

Step2: The raw water contained within upper pond was treated in a recirculation loop. The effluent was always redirected into the southern portion of upper pond.

Step3: Water contained in upper and lower ponds was treated separately. One treatment train was dedicated to upper pond while the second train was dedicated to lower pond. Chemical dosages were therefore adjusted depending on the water quality of each source. The treated water was recirculated back to upper pond. As the water level of upper pond was rising, treatment of lower pond was interrupted when the maximum holding capacity of upper pond was reached.

By targeting the treatment of lower pond prior to discharge into upper pond, this allowed to reduce its metal concentrations before it was mixed with water from upper pond which had lowered concentrations. This way, no new contaminants were introduced into upper pond, contributing to the rapid decrease of residual concentrations in this pond.

Step4: A first sampling event of upper pond was performed on July 3rd.

Step5: While awaiting the analytical results, water contained in upper pond was continued to be treated in a recirculation loop.

Step6: The AANDC water inspector gave the authorization to discharge a first batch into Hambone Lake corresponding to 50,000 m^3.

Step7: Compliant water was pumped from upper pond and sent once more through the WTP for a final polishing prior to discharge into Hambone Lake. This polishing step ensured that all contaminants of concern are well below the contract specifications and the water license criteria.

Step8: When discharge of the first batch was completed, treatment was resumed. Both trains were treating water from lower pond until it was emptied. Since the water from lower pond was heavily contaminated, both trains were used for treatment in order to have a lower flow rate in each train and thus ensure a more efficient treatment.

Step9: A second sampling event of upper pond was performed on July 28th.

Step10: While awaiting the analytical results, water contained in upper pond was treated within a recirculation loop.

Step11: The AANDC water inspector gave the authorization to discharge a second batch into Hambone Lake corresponding to 29,000 m^3.

Step12: Compliant water was pumped from upper pond and sent once more through the WWTP for a final polishing prior to discharge into Hambone Lake. This polishing step ensured that all contaminants of concern are well below the contract specifications and the water license criteria.

Step13: A third sampling event of upper pond was performed on August 6th.

Step14: While awaiting the analytical results, water contained in upper pond was treated within a recirculation loop.

Step15: The AANDC water inspector gave the authorization to discharge a third batch into Hambone Lake corresponding to a volume of 29,000 m^3 with a variance of 2,000 m^3. The actual volume treated was measured to be 28,352 m^3.

Step16: Compliant water was pumped from upper pond and sent once more through the WTP for a final polishing prior to discharge into Hambone Lake. A very stringent onsite monitoring was applied (TSS field screening every hour instead of every six hours) to quickly detect a potential increase in TSS as upper pond water level decreased. Water treatment was completed on August 20th.

Step17: WWTP decommissioning from August 18th to 24th.

Step18: WWTP pad demolition from September 18th to 24th.

Summarized in **Table 2** are the water treatment steps and the corresponding volume treated and discharged at each step. Note that the volume treated does not correspond to the volume discharged as the water was treated in a recirculation loop.

Table 2: Treatment Steps and the Corresponding Volume Treated and Discharged

Step	Description	Starting Date	End date	Volume Treated (m^3)	Volume Discharged (m^3)
1	WTP construction	2013-05-29	2013-06-04	0	0
2	Water treatment: UP* to UP	2013-06-05	2013-06-10	134130	0
3	Water treatment: UP&LP** to UP	2013-06-10	2013-07-01	137192	0
4	First sampling event of UP	2013-07-03		137192	0
5	Water treatment: UP to UP	2013-07-04	2013-07-10	181264	0
6	Authorization to discharge	2013-07-10		181264	0

Step	Description	Starting Date	End date	Volume Treated (m^3)	Volume Discharged (m^3)
7	Water treatment : UP to Hambone Lake (1st batch discharge)***	2013-07-10	2013-07-20	242359	50000
8	Water treatment: LP to UP	2013-07-20	2013-07-28	263682	50000
9	Second sampling event of UP	2013-07-28		263682	50000
10	Water treatment: UP to UP	2013-07-28	2013-08-02	298295	50000
11	Authorization to discharge	2013-08-02		298295	50000
12	Water treatment : UP to Hambone Lake (2nd batch discharge)***	2013-08-02	2013-08-07	328821	79000
13	Third sampling event of UP	2013-08-06		328821	79000
14	Water treatment: UP to UP	2013-08-07	2013-08-12	348619	79000
15	Authorization to discharge	2013-08-12		348619	79000
16	Water treatment : UP to Hambone Lake (3rd batch discharge) ***	2013-08-12	2013-08-20	379537	107352
17	WTP decommissioning	2013-08-18	2013-08-24	379537	107352
18	WTP pad demolition	2013-09-18	2013-09-24	379537	107352

* UP : upper pond
** LP: lower pond
*** A sampling event of upper pond was performed to seek approval for batch discharge.

3. TREATMENT PROCESS

The design of the WWTP relies on the principles of the physical-chemical entrapment of metals, by converting them from an aqueous dissolved state to a solid state. The treatment process is comprised of four steps which are coagulation, pH adjustment, flocculation and solid entrapment.

3.1 COAGULATION

The first step in the arsenic removal process, coagulation, was performed in the first reactor by the injection of a $Fe_2(SO_4)_3$ solution at a minimum ratio of iron to arsenic (by weight) of five (5) to one (1). In this process, soluble arsenic reacts with the coagulant to form a precipitate.

The removal of lead and zinc below the water license discharge criteria was attained by targeting the suspended solids. The removal of these metal particulates was facilitated by the agglomeration of the suspended and colloidal solids with the chemically induced flocs formed during the coagulation and flocculation steps. These flocs are physically removed from the water by entrapment in the geotubes. To avoid an increase in the soluble fractions of lead and zinc, the injection of a sulphide compound (SMBS) solution was used to assist in the precipitation of these elements as metal sulfides.

3.2 pH ADJUSTMENT

The optimum removal of metal hydroxides and metal sulphide is achieved at a pH of 8.5; this is the point at which the solubility of these chemically induced precipitates are at their lowest. For this reason, a $Ca(OH)_2$ solution was injected into the second reactor in the treatment process in order to increase the pH to approximately 8.5 following the addition of the $Fe_2(SO_4)_3$.

3.3 FLOCCULATION

To aggregate the metal precipitate colloids and the particulates into a heavy and suspended floc, a polymer flocculent solution was injected in the third rector of the treatment process. This polymer, which has a high molecular weight, allowed the colloids to aggregate together into flocs which results in a higher removal efficiency of solids.

3.4 SOLIDS REMOVAL

The flocs containing both metal precipitates and suspended solids were removed as the conditioned water passes through the geotube geocontainment bags; the geotubes acted as filter. The flocs were captured in the matrix of the geotubes, while the filtrate, free of metal solids, was pumped to Hambone Lake for environmental discharge.

3.5 TREATMENT REGIME

Before the beginning of the treatment season, the quantities of chemicals required were calculated, purchased and delivered to the site. These calculations were based on treatment regime applied in previous years and also on the contaminant concentrations of the water contained in both lower and upper ponds. Prior to the commissioning of the treatment plant, a sampling event was performed in the ponds to determine the concentration of the raw untreated water. The summary results are tabulated in **Table 3** and the certificate of analysis is included in **Appendix B**.

The dissolved metal concentrations of copper, nickel, zinc and lead are below the discharge criteria whereas the dissolved arsenic concentration is a little above 1 mg/L. Arsenic must therefore be precipitated using chemical conditioning. While it is true that the total metal concentrations are higher than their dissolved counterpart values, the treatment mechanism at play for the metal removal consists at the agglomeration of the suspended and colloidal solids with the chemically induced flocs formed during the coagulation and flocculation steps. These flocs are physically removed from the water by entrapment in the geotubes.

Assuming a concentration of 1.2 mg/L of As and based on an applied ratio of iron to arsenic (by weight) of five (5) to one (1), the minimum ferric sulphate dosing concentration was estimated to be around 22 mg/L. Based on experience, it is required to have higher dosage to build a sizeable floc for adsorption and solid entrapment purposes; the actual dosing concentration was at least three (3) times higher.

As such, ferric sulphate dosing concentration started at 75 mg/L and was increased up to 125 mg/L at times, with an average of 84 mg/L throughout the season. Considering that the targeted mechanism is to build a good settleable floc, increasing the ferric dosing range above 75 mg/L was left to the operator to evaluate based on his visual appreciation of the floc maturation in the flocculation tank. When required, the operator increased the strokes of the chemical pumps in increments of 10 to 15 strokes every hour until they were satisfied with the floc size in the last reaction tank.

The other chemicals were also adjusted when ferric dosage was changed. Lime was dosed to maintain a pH around 8.5. The polymer dosage was set at 1.5 mg/L but could be increased up to 3.2 mg/L with an average concentration of 1.5 mg/L throughout the season. The average dosing rate of the sulphide compound (SMBS) was estimated to range from 30 to 50 mg/L throughout the season.

Table 3: Raw Untreated Water Quality in Lower and Upper Pond

Sample ID	Dissolved arsenic	Dissolved copper	Dissolved lead	Dissolved nickel	Dissolved zinc	Nitrate (as N)	Nitrite (as N)	Ammonia	TSS	pH
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	-
LPSS	0.917	0.0058	< 0.0001	0.0066	0.0041	0.24	0.04	0.792	74	-
LPSN	0.928	0.0060	< 0.0001	0.0068	0.0042	0.32	0.05	0.791	64	-
LPIM	1.110	0.0050	0.0002	0.0074	0.0037	0.35	0.11	0.542	10,400	-
UPSS	0.148	0.0010	0.0001	0.0059	0.0009	0.19	0.01	0.168	22	-
UPSN	0.170	0.0008	0.0001	0.0044	0.0006	0.17	0.01	0.171	14	-
UP3M	0.170	0.0010	0.0002	0.0040	< 0.0004	0.18	0.02	0.177	364	-

3.6 CHANGES TO TREATMENT REGIME OR SET-UP

One (1) significant change was done to the treatment regime of the plant over the course of the season. The sulphide compounds (SMBS) was injected when the influent TSS concentration was equal or above 50 mg/L. However, to avoid any sudden rise in heavy metal concentration, it was decided by mid-June that SMBS would be injected on a continuous basis.

One (1) set up change was done on July 7th were a second set of brand new geotubes were installed and commissioned. This set of geotubes was working alongside the existing set of geotubes dated since 2011.

4. VOLUME TREATED AND REAGENTS USED

4.1 VOLUME TREATED

Based on the flowmeter readings at the end of the season, a total of **107,352 cubic meters** of water contained in both upper and lower ponds was successfully **discharged** in Hambone Lake. At the end of the season when the treatment plant was brought to a stop, both ponds had been largely emptied with the exception of a few pockets of water, from which it was difficult to pump considering the small volumes. Since then, there was a recharge of groundwater in lower pond. When including snow and rain precipitation over the course of the last seasons, it is expected that the volume of water will accumulate to approximately 75,000 cubic meters in 2014. On three (3) different occasions, permission for discharge was granted by the water inspector for specific volume of water, which are summarized in **Table 4**.

Table 4: Total Volume Discharged

Discharge Event	Period	Discharged Volume
1st discharge	July 10th to July 20th 2013	50,000 m^3
2nd discharge	August 2nd to 7th 2013	29,000 m^3
3rd discharge	August 12th to 20th 2013	28,352 m^3
Total Volume Discharged		**107,352 m^3**

It is important to note that the volume treated does not correspond to the volume discharged as the water was treated in a recirculation loop. A total of **379,537 cubic meters** of water was **treated** which correspond to a recirculation ratio of 3.5. It was originally estimated that 2.5 to 3 treatment loops would be required, which does not include the polishing step.

4.2 REAGENTS USED

The wastewater treatment plant requires the injection of four (4) different chemical reagents: ferric sulphate, lime, SMBS and polymer. The amount of reagents used this season is presented in **Table 5**.

Table 5: Total Chemical Reagents Used

Reagents	Number of Bags	Total Weight
Ferric Sulphate	1,400	31,780 kg
Lime	770	19,250 kg
Sodium Metabisulfite	450	10,215 kg
Polymer	21	477 kg

5. LABORATORY ANALYSIS

5.1 UPPER POND SAMPLING EVENTS

As aforementioned, water contained within upper pond was treated in a closed loop until the effluent discharge criteria were met. Sampling events occurred at different depths and locations of the pond to demonstrate that concentrations in the water were below the contract specifications and water license criteria, after which discharge was granted for specific volumes of water at a time.

On three (3) different occasions, permission for discharge was granted by the water inspector for specific volume of water:

- Sampling event # 1: held July 3rd, 2013
- Sampling event # 2: held July 28th, 2013
- Sampling event # 3: held August 6th, 2013

The analytical results, for each sampling event, are summarized in **Tables 6, 7** and **8**. The accredited laboratory COAs (certificates of analysis), for all three sampling events, are compiled in **Appendix C**.

All three (3) sampling events confirm that the water contained within upper pond met the regulatory requirements from the water license with concentrations well below criteria. All contract specifications are also met at the exception of arsenic, for all 3 sampling events. To ensure all contaminants, and more specifically arsenic concentrations, are well below contractual specifications during discharge to Hambone Lake, it was proposed to add a polishing treatment step.

5.2 DISCHARGE EVENTS

When discharge permission was granted for each batch, compliant water was pumped from upper pond into the geotubes with the chemical dosing system being active as a polishing step to reduce the arsenic concentration furthermore. The effluent was then pumped from the sump area of the geotubes into Hambone Lake's pipeline. Field screening influent and effluent TSS, arsenic and pH measurements were performed on a regular basis to ensure the concentrations were consistently low as presented in **Section 5.3**.

To demonstrate the efficiency of the treatment system, four (4) daily duplicate effluent samples were collected when possible during each discharge events. Only one (1) sample was analyzed for all parameters and the results were used to demonstrate the effluent water quality continues to meet contractual and regulatory requirements. The other three (3) daily samples were stored at the laboratory facility and were available when validation of offsite results was required.

Table 6: Analytical Results – Sampling Event # 1 held July 3rd, 2013

Sample ID	Total arsenic	Total copper	Total lead	Total nickel	Total zinc	Nitrate (as N)	Nitrite (as N)	Ammonia	TSS	pH
Discharge criteria Contract Specifications (CS) and Water License Criteria (WLC)										
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	-
CS: Maximum Daily Average Concentration	0.20	0.01	0.01	0.05	0.02	5.00	0.40	5.00	15.00	6-9
WLC: Monthly Average Concentration	0.50	0.01	0.01	0.05	0.02	5.00	0.40	5.00	15.00	6-9
WLC: Maximum Conc. of Any Grab Sample	1.00	0.02	0.02	0.10	0.04	10.00	0.80	10.00	30.00	6-9
Analytical results										
UP1-S-OFF	0.197	0.00275	0.000828	0.00656	0.0039	0.293	<0.050	0.166	3.0	8.04
UP1-S-DOF	0.192	0.00269	0.000832	0.0065	0.0042	0.296	<0.050	0.169	5.0	8.06
UP1-M-OFF	0.199	0.003	0.000837	0.0069	0.0046	0.293	<0.050	0.168	8.0	8.06
UP2-S-OFF	0.199	0.003	0.000866	0.00666	0.0088	0.296	<0.050	0.171	< 3.0	8.06
UP2-M-OFF	0.198	0.00305	0.000816	0.00669	0.0045	0.298	<0.050	0.169	5.0	8.07
UP3-S-OFF	0.208	0.00314	0.000871	0.00682	0.0043	0.304	<0.050	0.169	6.0	8.07
UP3-M-OFF	0.202	0.00317	0.000895	0.00663	0.0053	0.309	<0.050	0.169	< 3.0	8.06
UP3-S-DOF	0.208	0.0036	0.000882	0.00663	0.0047	0.301	<0.050	0.167	4.0	8.03
UP4-S-OFF	0.206	0.0028	0.000933	0.00658	0.0051	0.303	<0.050	0.166	5.0	8.07
UP4-M-OFF	0.202	0.00294	0.000904	0.00687	0.0053	0.305	<0.050	0.173	< 3.0	8.06
UP5-S-OFF	0.204	0.00296	0.0009	0.00664	0.004	0.302	<0.050	0.172	7.0	8.06
UP5-M-OFF	0.209	0.00301	0.000917	0.00681	0.0052	0.305	<0.050	0.17	5.0	8.06
UP6-S-OFF	0.213	0.00286	0.000926	0.00657	0.0045	0.308	<0.050	0.168	5.0	8.05
UP6-M-OFF	0.212	0.00285	0.000922	0.00653	0.0043	0.303	<0.050	0.166	5.0	8.06
Average Concentrations	**0.204**	**0.0030**	**0.0009**	**0.0067**	**0.0049**	**0.301**	**<0.050**	**0.169**	**4.5**	**8.06**

Legend
Parameter does not pass the CS criteria (yellow)
Parameter does not pass the WL criteria (red)

Table 7: Analytical Results – Sampling Event # 2 held July 28th, 2013

Sample ID	Total arsenic	Total copper	Total lead	Total nickel	Total zinc	Nitrate (as N)	Nitrite (as N)	Ammonia	TSS	pH
Discharge criteria Contract Specifications (CS) and Water License Criteria (WLC)										
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	-
CS: Maximum Daily Average Concentration	0.20	0.01	0.01	0.05	0.02	5.00	0.40	5.00	15.00	6-9
WLC: Monthly Average Concentration	0.50	0.01	0.01	0.05	0.02	5.00	0.40	5.00	15.00	6-9
WLC: Maximum Conc. of Any Grab Sample	1.00	0.02	0.02	0.10	0.04	10.00	0.80	10.00	30.00	6-9
Analytical results										
UP1-S	0.227	0.00187	0.000472	0.00741	0.0043	0.148	<0.050	0.102	6.0	7.83
UP1-M	0.235	0.00213	0.000514	0.00827	0.0058	0.153	<0.050	0.08	<3.0	7.84
UP1-B	0.268	0.00223	0.000849	0.00806	0.0056	0.130	<0.050	0.073	7.0	7.83
UP2-S	0.235	0.00191	0.000511	0.00745	0.0421	0.166	<0.050	0.12	5.0	7.84
UP2-M	0.24	0.00199	0.000525	0.00796	0.0061	0.151	<0.050	0.066	3.0	7.85
UP2-B	0.227	0.00185	0.000483	0.00769	0.0048	0.154	<0.050	0.104	4.0	7.84
UP3-S	0.249	0.00198	0.000511	0.00757	0.0046	0.146	<0.050	0.075	8.0	7.85
UP3-M	0.257	0.00226	0.000559	0.00842	0.0052	0.153	<0.050	0.085	6.0	7.85
UP3-B	0.243	0.0022	0.000514	0.00759	0.0048	0.159	<0.050	0.109	3.0	7.86
UP4-S	0.244	0.00189	0.000507	0.00755	0.0046	0.164	<0.050	0.092	8.0	7.86
UP4-M	0.237	0.00194	0.000532	0.00744	0.0058	0.154	<0.050	0.088	6.0	7.86
UP4-B	0.247	0.002	0.000536	0.00829	0.0054	0.149	<0.050	0.078	4.0	7.86
UP5-S	0.275	0.00203	0.000578	0.0081	0.0063	0.150	<0.050	0.066	6.0	7.85
UP5-M	0.268	0.00201	0.000594	0.00796	0.0048	0.146	<0.050	<0.050	7.0	7.85
UP5-B	0.269	0.00201	0.000594	0.00781	0.0049	0.142	<0.050	<0.050	6.0	7.86
UP6-S	0.273	0.00192	0.00064	0.00758	0.0051	0.167	<0.050	<0.050	4.0	7.85
UP6-M	0.276	0.00198	0.000597	0.00816	0.0049	0.157	<0.050	0.07	9.0	7.85
Average Concentrations	**0.251**	**0.00201**	**0.00056**	**0.00784**	**0.0074**	**0.152**	**<0.050**	**0.086**	**5.5**	**7.85**

Legend
Parameter does not pass the CS criteria
Parameter does not pass the WL criteria

Table 8: Analytical Results – Sampling Event # 3 held August 6th, 2013

Sample ID	Total arsenic	Total copper	Total lead	Total nickel	Total zinc	Nitrate (as N)	Nitrite (as N)	Ammonia	TSS	pH
Discharge criteria Contract Specifications (CS) and Water License Criteria (WLC)										
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	-
CS: Maximum Daily Average Concentration	0.20	0.01	0.01	0.05	0.02	5.00	0.40	5.00	15.00	6-9
WLC: Monthly Average Concentration	0.50	0.01	0.01	0.05	0.02	5.00	0.40	5.00	15.00	6-9
WLC: Maximum Conc. of Any Grab Sample	1.00	0.02	0.02	0.10	0.04	10.00	0.80	10.00	30.00	6-9
Analytical results										
UP1-S	0.180	0.00184	0.00039	0.00782	<0.015	0.100	<0.050	<0.050	< 3.0	7.72
UP1-B	0.185	0.00205	0.00053	0.00936	<0.015	0.105	<0.050	<0.050	3.0	7.86
UP2-S	0.187	0.00180	0.00037	0.00862	<0.015	0.104	<0.050	<0.050	< 3.0	7.87
UP2-B	0.179	0.00185	0.00038	0.00891	<0.015	0.100	<0.050	0.078	< 3.0	7.88
UP3-S	0.224	0.00190	0.00045	0.00818	<0.015	0.096	<0.050	0.063	< 3.0	7.88
UP3-B	0.219	0.00179	0.00045	0.00837	<0.015	0.095	<0.050	<0.050	< 3.0	7.88
UP4-S	0.179	0.00176	0.00034	0.00859	<0.015	0.104	<0.050	<0.050	< 3.0	7.86
UP4-B	0.177	0.00181	0.00037	0.00856	<0.015	0.102	<0.050	<0.050	3.0	7.86
UP5-S	0.246	0.00192	0.00048	0.00792	<0.015	0.098	<0.050	<0.050	< 3.0	7.87
UP5-B	0.252	0.00195	0.00050	0.00817	<0.015	0.091	<0.050	<0.050	< 3.0	7.87
UP6-S	0.276	0.00202	0.00052	0.00827	<0.015	0.088	<0.050	<0.050	< 3.0	7.86
UP6-B	0.264	0.00195	0.00052	0.00845	<0.015	0.086	<0.050	<0.050	< 3.0	7.86
Average Concentrations	**0.214**	**0.00189**	**0.00044**	**0.00844**	**<0.015**	**0.097**	**<0.050**	**<0.050**	**<3.0**	**7.86**

Legend
Parameter does not pass the CS criteria (yellow)
Parameter does not pass the WL criteria (red)

On three (3) different occasions, permission for discharge was granted by the water inspector for specific volume of water:

- Discharge event # 1: held July 10th to July 20th 2013
- Discharge event # 2: held August 2nd to 7th 2013
- Discharge event # 3: held August 12th to 20th 2013

All three (3) discharge events confirmed that the average daily concentrations of the effluent met the regulatory requirements for both the contract specifications and the water license with concentrations below criteria. The analytical results, for each discharge event, are presented in **Tables 9, 10** and **11**. The accredited laboratory COAs (certificates of analysis), for all three discharge events, are compiled in **Appendix D**.

Table 9: Analytical Results – Discharge Event # 1 held July 10th to July 20th 2013

Sample ID	Date	Total arsenic	Total copper	Total lead	Total nickel	Total zinc	Nitrate (as N)	Nitrite (as N)	Ammonia	TSS	pH
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	-
CS: Maximum Daily Average Concentration		0.20	0.01	0.01	0.05	0.02	5.00	0.40	5.00	15.00	6-9
WLC: Monthly Average Concentration		0.50	0.01	0.01	0.05	0.02	5.00	0.40	5.00	15.00	6-9
WLC: Maximum Conc. of Any Grab Sample		1.00	0.02	0.02	0.10	0.04	10.00	0.80	10.00	30.00	6-9
EFF86	07-10	0.0270	0.0015	0.0001	0.0039	0.0038	0.360	0.02	0.100	6.0	7.87
EFF87	07-11	0.0352	0.0018	0.0001	0.0038	0.0033	0.340	0.02	0.103	16.0	8.17
EFF89	07-11	0.0237	0.0028	0.0002	0.0041	0.0039	0.350	0.02	0.107	8.0	7.87
EFF91	07-12	0.0336	0.0059	0.0004	0.0055	0.0047	0.310	0.02	0.106	10.0	7.65
EFF93	07-13	0.0268	0.0008	<0.0001	0.0070	0.0063	0.340	0.02	0.108	8.0	7.37
EFF96	07-14	0.0265	0.0048	0.0002	0.0047	0.0069	0.360	0.02	0.107	8.0	7.88
EFF100	07-15	0.0264	0.0098	0.0004	0.0076	<0.015	0.261	<0.050	0.151	5.0	7.63
EFF104	07-16	0.0311	0.0060	<0.00025	0.0091	<0.015	0.267	<0.050	0.143	6.0	7.18
EFF108	07-17	0.0344	0.0059	0.0003	0.0069	<0.015	0.264	<0.050	0.089	9.0	7.66
EFF112	07-18	0.0345	0.0010	0.0001	0.0049	0.0031	0.330	0.02	0.940	12.0	8.06
EFF116	07-19	0.0366	0.0004	0.0002	0.0058	0.0037	0.340	0.02	0.970	12.0	7.70
EFF120	07-20	0.0403	0.0041	0.0002	0.0061	0.006	0.330	0.02	-	12.0	7.70

Legend
Parameter does not pass the CS criteria
Parameter does not pass the WL criteria

Table 10: Analytical Results – Discharge Event # 2 held August 2nd to 7th 2013

Sample ID	Date	Total arsenic	Total copper	Total lead	Total nickel	Total zinc	Nitrate (as N)	Nitrite (as N)	Ammonia	TSS	pH
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	-
CS: Maximum Daily Average Concentration		0.20	0.01	0.01	0.05	0.02	5.00	0.40	5.00	15.00	6-9
WLC: Monthly Average Concentration		0.50	0.01	0.01	0.05	0.02	5.00	0.40	5.00	15.00	6-9
WLC: Maximum Conc. of Any Grab Sample		1.00	0.02	0.02	0.10	0.04	10.00	0.80	10.00	30.00	6-9
EFF154	08-02	0.0306	0.00372	0.000213	0.00676	0.0082	0.143	<0.050	0.089	4	7.68
EFF156	08-03	0.0212	0.00396	0.000207	0.00546	0.0064	0.133	<0.050	0.088	<3.0	7.80
EFF158	08-04	-	0.00116	-	-	-	-	-	-	-	-
EFF159	08-04	0.0210	0.0112	0.000585	0.00630	0.0088	0.125	<0.050	0.089	4.0	7.73
EFF160	08-04	-	0.00367	-	-	-	-	-	-	-	-
EFF161	08-04	-	0.00174	-	-	-	-	-	-	-	-
EFF163	08-05	0.0208	0.00127	0.000071	0.00571	0.0043	0.118	<0.050	0.091	6.0	7.60
EFF167	08-06	0.0223	0.00183	<0.00025	0.00559	<0.015	0.110	<0.050	0.114	<3.0	7.91
EFF171	08-07	0.0257	0.00092	<0.00025	0.00575	<0.015	0.090	<0.050	0.066	<3.0	7.92

Legend
Parameter does not pass the CS criteria
Parameter does not pass the WL criteria

Table 11: Analytical Results – Discharge Event # 3 held August 12th to 20th 2013

Sample ID	Date	Total arsenic	Total copper	Total lead	Total nickel	Total zinc	Nitrate (as N)	Nitrite (as N)	Ammonia	TSS	pH
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	-
CS: Maximum Daily Average Concentration		0.20	0.01	0.01	0.05	0.02	5.00	0.40	5.00	15.00	6-9
WLC: Monthly Average Concentration		0.50	0.01	0.01	0.05	0.02	5.00	0.40	5.00	15.00	6-9
WLC: Maximum Conc. of Any Grab Sample		1.00	0.02	0.02	0.10	0.04	10.00	0.80	10.00	30.00	6-9
EFF178	08-12	0.0692	0.00201	<0.00025	0.00699	<0.015	<0.050	<0.050	0.105	7.0	7.89
EFF196	08-13	0.0247	0.00158	<0.00025	0.00587	<0.015	<0.050	<0.050	0.077	5.0	7.88
EFF214	08-14	0.0305	0.00139	<0.00025	0.00600	<0.015	0.053	<0.050	0.081	5.0	7.92
EFF229	08-15	-	-	-	-	-	-	-	-	<3.0	-
EFF234	08-15	0.0546	0.00177	<0.00025	0.00657	<0.015	<0.050	<0.050	0.082	21.0	8.01
EFF239	08-15	-	-	-	-	-	-	-	-	6.0	-
EFF242	08-15	-	-	-	-	-	-	-	-	<3.0	-
EFF253	08-16	0.0464	0.00152	<0.00025	0.00682	<0.015	<0.050	<0.050	0.094	7.0	7.97
EFF272	08-17	0.0510	0.00142	<0.00025	0.00650	<0.015	<0.050	<0.050	0.095	7.0	8.02
EFF278	08-17	0.0471	0.00130	<0.00025	0.00658	<0.015	<0.050	<0.050	0.103	6.0	8.03
EFF289	08-18	0.0324	0.00119	<0.00025	0.00622	<0.015	<0.050	<0.050	0.156	10.0	8.00
EFF303	08-19	0.0220	0.00096	<0.00025	0.00907	<0.015	<0.050	<0.050	0.269	8.0	7.72
EFF305	08-20	0.0162	<0.0005	<0.00025	0.00845	<0.015	<0.050	<0.050	0.564	6.0	7.97

Legend
Parameter does not pass the CS criteria
Parameter does not pass the WL criteria

5.3 FIELD RESULTS

In order to monitor the degree of treatment of the water and adjust chemicals accordingly, screening tests were performed onsite by using field analytical instruments. Screening tests were also performed during the discharge phases. These tests were for internal quality control of the water treatment plant only and not for regulatory compliance.

For the first two discharge events, the plant monitor was required to do field screening of the water by following this schedule:

1. Field measurements of TSS concentration every 6 hours at both influent and effluent using either the Hach spectrophotometer DR2700 or filtration apparatus;
2. Field measurement of arsenic concentration range every 6 hours at the effluent using arsenic test strips;
3. Field measurement of pH every 6 hours at the effluent using the Thermo Scientific Orion 5-start handheld multi-meter or equivalent;

This schedule applied unless results did not meet criteria in which case, more samples were collected and tested. Lead and zinc test were also performed onsite by the operator, at the beginning of the season using the PDV 6000 Heavy Metal Analyzer.

For the third discharge event, the plant monitor was required to do field screening of the water by following this schedule:

1. Field measurement of TSS concentration hourly at both the influent and effluent using either the Hach spectrophotometer DR2700 or filtration apparatus;
2. Field measurement of arsenic concentration range every 6 hours at the effluent using arsenic test strips;
3. Field measurement of pH every 6 hours at the effluent using the Thermo Scientific Orion 5-start handheld multi-meter or equivalent;

As third discharge drew closer to the end, it was decided on August 16th that arsenic, pH and TSS were being analyzed every hour. The field results, for each discharge event, are summarized in **Tables 12, 13** and **14**.

Table 12: Effluent Field Screening Results During Discharge Event (Held July 10th to July 20th, 2013)

Sample ID	Date	Total arsenic	TSS	pH	Total lead	Total zinc
Units		mg/L	mg/L	mg/L	mg/L	mg/L
EFF85	07-10	0,01	6,4	8,33	-	-
EFF86	07-10	0,01	3,0	8,19	0,001	0,008
EFF87	07-11	0,03	5,2	8,26	0	0,005
EFF88	07-11	0,1	17,3	8,48	0	0,024
EFF89	07-11	0,03	5,7	8,17	0	0,006
EFF90	07-11	0,03	1,6	7,28	-	-
EFF91	07-12	0,03	4,0	7,31	-	-
EFF92	07-12	0,09	1,2	7,42	-	-
EFF93	07-13	0,03	5,9	7,09	-	-
EFF94	07-13	0,03	6,8	6,66	-	-
EFF95	07-13	0,02	4,0	7,14	-	-
EFF96	07-14	0,03	4,8	7,71	-	-
EFF97	07-14	0,05	5,7	7,05	-	-
EFF98	07-14	0,03	3,1	6,92	-	-
EFF99	07-14	0,02	4,8	7,22	-	-
EFF100	07-15	0,01	5,6	7,36	-	-
EFF101	07-15	0,05		6,95	-	-
EFF102	07-15	0,04	6,8	6,77	-	-
EFF103	07-16	0,04	8,0	6,78	-	-
EFF104	07-16	0,05	8,0	7,20	-	-
EFF105	07-16	0,03	4,3	7,47	0,001	0,008
EFF106	07-16	0,03	4,0	7,56	0	0,009
EFF107	07-17	0,03	4,8	7,04	0	0,012
EFF108	07-17	0,05	6,0	7,60	0	0,01
EFF109	07-17	0,03	3,7	7,99	0	0,008
EFF110	07-17	0,05	6,8	7,51	0	0,007
EFF111	07-18	0,03	8.0	7,33	0	0,008
EFF112	07-18	0,03	6,4	7,96	0	0,011
EFF113	07-18	0,03	3,4	7,45	0	0,006
EFF114	07-18	0,04	8,4	7,37	0	0,009
EFF115	07-19	0,02	6,0	7,57	0	0,01
EFF116	07-19	0,05	8,4	7,96	0	0,008
EFF117	07-19	0,03	6,9	7,51	0	0,008

Legend

TSS result above TSS-Threshold-Value

Table 13: Effluent Field Screening Results During Discharge Event (Held August 2nd to August 7th, 2013)

Sample ID	Date	Total arsenic	TSS	pH	Total lead	Total zinc
Units		mg/L	mg/L	mg/L	mg/L	mg/L
EFF154	08-02	0,03	5,5	7,85	-	-
EFF155	08-03	0,07	10,1	7,91	-	-
EFF156	08-03	0,07	5,7	7,80	-	-
EFF157	08-03	0,05	5,3	7,76	-	-
EFF158	08-04	0,05	3,4	7,77	-	-
EFF159	08-04	0,07	7,2	7,84	-	-
EFF160	08-04	0,07	1,7	3,02	-	-
EFF161	08-04	0,07	4,2	7,82	-	-
EFF162	08-05	0,07	4,8	7,84	-	-
EFF163	08-05	0,05	3,7	8,03	-	-
EFF164	08-05	0,05	3,4	7,93	-	-
EFF165	08-05	0,05	5,7	7,90	-	-
EFF166	08-06	0,07	4,8	8,01	-	-
EFF167	08-06	0,07	5,7	8,06	-	-
EFF168	08-06	0,01	8,4	8,04	-	-
EFF169	08-06	0,05	5,8	7,98	-	-
EFF170	08-07	0,03	7,0	8,27	-	-
EFF171	08-07	0,03	6,9	8,11	-	-
EFF172	08-07	0,03	4,6	8,21	-	-

Legend

One TSS result above TSS-Threshold-Value

Two consecutive result above TSS-Threshold-Value

Table 14: Effluent Field Screening Results During Discharge Event (Held August 12th to August 20th, 2013)

Sample ID	Date	Total arsenic	TSS	pH	Total lead	Total zinc
Units		mg/L	mg/L	mg/L	mg/L	mg/L
EFF178	08-12	0,07	4,8	8,05	-	-
EFF179	08-12	-	10,5	-	-	-
EFF180	08-12	-	9,0	-	-	-
EFF181	08-13	-	8,9	-	-	-
EFF182	08-13	-	13,6	-	-	-
EFF183	08-13	-	4,5	-	-	-
EFF184	08-13	0,03	9,7	8,07	-	-
EFF185	08-13	-	9,5	-	-	-
EFF186	08-13	-	6,8	-	-	-
EFF187	08-13	-	6,8	-	-	-
EFF188	08-13	-	2,9	-	-	-
EFF189	08-13	-	6,4	-	-	-
EFF190	08-13	0,03	7,3	7,83	-	-
EFF191	08-13	-	4,0	-	-	-
EFF192	08-13	-	7,2	-	-	-
EFF193	08-13	-	5,1	-	-	-
EFF194	08-13	-	6,9	-	-	-
EFF195	08-13	-	5,5	-	-	-
EFF196	08-13	0,03	6,8	7,99	-	-
EFF197	08-13	-	5,5	-	-	-
EFF198	08-13	-	7,0	-	-	-
EFF199	08-13	-	5,6	-	-	-
EFF200	08-13	-	5,1	-	-	-
EFF201	08-13	-	3,4	-	-	-
EFF202	08-13	0,03	2,5	8,24	-	-
EFF203	08-13	-	2,9	-	-	-
EFF204	08-13	-	4,8	-	-	-
EFF205	08-14	-	5,2	-	-	-
EFF206	08-14	-	6,1	-	-	-
EFF207	08-14	-	5,1	-	-	-
EFF208	08-14	0,03	4,3	8,11	-	-
EFF209	08-14	-	5,4	-	-	-
EFF210	08-14	-	2,8	-	-	-

Legend

One TSS result above TSS-Threshold-Value

Two consecutive result above TSS-Threshold-Value

Cont'd Table 14: Effluent Field Screening Results During Discharge Event Held August 12th to August 20th, 2013

Sample ID	Date	Total arsenic	TSS	pH	Total lead	Total zinc
Units		mg/L	mg/L	mg/L	mg/L	mg/L
EFF211	08-14	-	4,2	-	-	-
EFF212	08-14	-	3,3	-	-	-
EFF213	08-14	-	5,4	-	-	-
EFF214	08-14	-	4,3	8,19	-	-
EFF215	08-14	-	7,6	-	-	-
EFF216	08-14	-	10,0	-	-	-
EFF217	08-14	-	5,0	-	-	-
EFF218	08-14	-	6,2	-	-	-
EFF219	08-14	-	11,7	-	-	-
EFF220	08-14	0,07	11,3	8,24	-	-
EFF221	08-14	-	5,6	-	-	-
EFF222	08-14	-	3,2	-	-	-
EFF223	08-14	-	6,5	-	-	-
EFF224	08-14	0,07	6,9	8,18	-	-
EFF225	08-14	-	6,6	-	-	-
EFF226	08-15	-	6,8	-	-	-
EFF227	08-15	-	7,0	-	-	-
EFF228	08-15	-	5,9	-	-	-
EFF229	08-15	0,03	5,8	8,35	-	-
EFF230	08-15	-	6,8	-	-	-
EFF231	08-15	-	6,6	-	-	-
EFF232	08-15	-	9,1	-	-	-
EFF233	08-15	-	6,9	-	-	-
EFF234	08-15	-	8,2	8,33	-	-
EFF235	08-15	0,03	9,3	-	-	-
EFF236	08-15	-	6,8	-	-	-
EFF237	08-15	-	4,9	-	-	-
EFF238	08-15	-	6,6	-	-	-
EFF239	08-15	-	6,3	8,22	-	-
EFF240	08-15	0,05	10,1	-	-	-
EFF241	08-15	-	6,8	-	-	-
EFF242	08-15	-	5,3	8,20	-	-
EFF243	08-15	0,05	-	-	-	-

Legend
One TSS result above TSS-Threshold-Value
Two consecutive result above TSS-Threshold-Value

Cont'd Table 14: Effluent Field Screening Results During Discharge Event Held August 12th to August 20th, 2013

Sample ID	Date	Total arsenic	TSS	pH	Total lead	Total zinc
Units		mg/L	mg/L	mg/L	mg/L	mg/L
EFF244	08-16	-	6,3	-	-	-
EFF245	08-16	-	5,9	-	-	-
EFF246	08-16	-	7,2	-	-	-
EFF247	08-16	-	5,4	8,21	-	-
EFF248	08-16	0,03	6,8	-	-	-
EFF249	08-16	-	8,6	-	-	-
EFF250	08-16	-	7,5	-	-	-
EFF251	08-16	-	4,7	-	-	-
EFF252	08-16	-	4,9	-	-	-
EFF253	08-16	-	7,8	8,16	-	-
EFF254	08-16	0,07	8,7	-	-	-
EFF255	08-16	-	6,9	8,11	-	-
EFF256	08-16	0,05	6,1	8.24	-	-
EFF257	08-16	0,03	5,5	8,22	-	-
EFF258	08-16	0,03	7,4	8,22	-	-
EFF259	08-16	0,03	5,8	8,16	-	-
EFF260	08-16	0,03	5,9	8,23	-	-
EFF261	08-16	0,03	6,7	8,23	-	-
EFF262	08-16	0,03	5,6	8,23	-	-
EFF263	08-17	0,03	4,1	8,24	-	-
EFF264	08-17	0,03	5,8	8,16	-	-
EFF265	08-17	0,03	5,8	8,19	-	-
EFF266	08-17	0,03	8,6	8,27	-	-
EFF267	08-17	0,03	6,2	8,21	-	-
EFF268	08-17	-	7,4	-	-	-
EFF269	08-17	-	5,7	-	-	-
EFF270	08-17	0,05	6,8	-	-	-
EFF271	08-17	0,03	6,3	8,27	-	-
EFF272	08-17	0,03	7,8	8,28	-	-
EFF273	08-17	0,05	8,6	8,22	-	-
EFF274	08-17	0,07	5,9	8,21	-	-
EFF275	08-17	0,07	12,1	8,26	-	-
EFF276	08-17	0,03	10,1	8,23	-	-

Legend

One TSS result above TSS-Threshold-Value	(yellow)
Two consecutive result above TSS-Threshold-Value	(red)

Cont'd Table 14: Effluent Field Screening Results During Discharge Event Held August 12th to August 20th, 2013

Sample ID	Date	Total arsenic	TSS	pH	Total lead	Total zinc
Units		mg/L	mg/L	mg/L	mg/L	mg/L
EFF277	08-17	0,07	6,0	8,25	-	-
EFF278	08-17	0,03	4,1	8,28	-	-
EFF279	08-17	0,07	4,7	8,24	-	-
EFF280	08-17	0,05	6,8	8,19	-	-
EFF281	08-17	0,05	6,1	8,19	-	-
EFF282	08-17	0,03	7,0	8,13	-	-
EFF283	08-18	0,04	5,6	8,12	-	-
EFF284	08-18	0,04	7,1	8,10	-	-
EFF285	08-18	0,03	6,1	8,10	-	-
EFF286	08-18	0,03	4,5	8,12	-	-
EFF287	08-18	0,01	6,8	8,12	-	-
EFF288	08-18	0,03	6,0	8,16	-	-
EFF289	08-18	0,05	6,2	8,20	-	-
EFF290	08-18	0,05	6,3	8,19	-	-
EFF291	08-18	0,05	2,0	8,27	-	-
EFF292	08-18	0,03	4,4	8,23	-	-
EFF293	08-18	0,04	7,1	8,27	-	-
EFF294	08-18	0,03	8,8	8,18	-	-
EFF295	08-18	0,03	5,4	8,17	-	-
EFF296	08-18	0,04	5,9	8,10	-	-
EFF297	08-19	0,03	5,5	8,11	-	-
EFF298	08-19	0,05	6,6	8,05	-	-
EFF299	08-19	-	6,6	7,87	-	-
EFF300	08-19	0,03	5,8	7,71	-	-
EFF301	08-19	0,03	8,3	7,86	-	-
EFF302	08-19	0,07	10,6	-	-	-
EFF303	08-19	-	5,8	7,71	-	-

Legend

One TSS result above TSS-Threshold-Value

Two consecutive result above TSS-Threshold-Value

During all discharge events, a corrective action plan was put in place in order to have a fast and accurate response from onsite staff should field screening had demonstrated TSS measurements higher than the *TSS-discharge-threshold* (10 mg/L) in the sump area.

When two (2) consecutive field screen sample results were higher than the *TSS-discharge-threshold*, the corrective action plan was executed which consisted mainly to immediately stop discharge to Hambone Lake and communicate the situation to the relevant parties. The treatment was to continue in a recirculation mode while the source of the TSS rise was investigated. The detailed corrective action plan is presented in the *2013 Discharge and Monitoring Plan*.

The corrective action plan was enforced on two (2) occasions during the 2013 season: on August 14th and August 17th. On both occasion, discharge to Hambone Lake was immediately ceased. The treatment system was put in a recirculation loop and the process flow was decreased while the chemical dosages were maintained.

After investigation, the TSS exceedances on August 14th were believed to be a laboratory error and therefore false positives. The electronic balance was moved while running which had affected its measuring accuracy.

On August 17th, the poor quality of water coming in the plant was believed to be the cause. All consecutive samples taken after the recirculation mode was initiated, demonstrated that the water treatment efficiency was back to steady state with effluent TSS concentrations well below TSS-Threshold-Value.

6. UPSETS, ISSUES AND CORRECTIVE ACTIONS

6.1 OPERATIONAL UPSETS AND ISSUES AT THE TREATMENT PLANT

The operation of the wastewater treatment plant was overall good during the discharge events at the exception of a few upsets and issues which are described in the following sections.
Discharge was interrupted on a few occasions during the three (3) discharge events. Onsite field screening showed high TSS results on two (2) occasions as mentioned in the previous section. As such, the corrective action plan as described in the *2013 Discharge and Monitoring Plan* was executed which consisted in stopping discharge into Hambone Lake, putting the system in recirculation mode, slowing the process flow and increasing the ferric dosage, until the TSS effluent concentrations were under the TSS-threshold value of 10 mg/L.

Reasons for interruptions to discharge also included a few preventative maintenance shut downs on the discharge pump. These were short interruptions and discharge to Hambone Lake was ceased for less than one hour on each occurrence. Other reasons for interruptions during discharge to Hambone Lake included maintenance of intake pumps (repair fuel leak and flat tire) and moving the influent and effluent pumps as the level of water in the pond lowered. Low levels of water in the sump did also come up as an issue on a few occasions. As a precautionary action, discharge was stopped to allow water to come up in the sump and avoid the intake of the discharge pump to touch the bottom of the sump.

The bottom liner of the sump was also problematic and caused the interruption of discharge on a few occurrences. An increase in the flow of water coming from the geotubes most probably caused the bottom liner to lift and release settled flocs in the sump. Discharge was immediately stopped and the liner was put back in place using sand bags as anchors. Once onsite screening tests showed acceptable results, the discharge pump was turned back on.

6.2 ENVIRONMENTAL SPILLS

Over the course of the season, two (2) events of environmental spills were recorded on site as presented in **Table 15**. The first environmental spill was documented on June 9th, 2013. An onion tank overflowed, spilling between 1,500 and 3,000 litres of untreated water. The second spill occurred on July 15th, 2013 and was caused by a leak in the treated water discharge pipe. A patch had been placed at that particular location approximately two (2) weeks prior to the spill event, but did not hold in place. Between 800 and 1,000 litres of treated water was spilled. The spilled treated water was drained back into upper pond.

Table 15: Environmental Spills

SR Number	Date of SR	Env.	Brief Description	NWT Spill Report Required?	Risk Matrix Probability	Risk Matrix Consequence	Risk Matrix Risk Ratir
SR-2014-02	June 9, 2013	Env.	Onion tanks over flowed spilling between 1,500-3,000 liters	Yes	2-Unlikely	B-Minor First Aid/Damage	Low
SR-2014-09	July 15, 2013	Env.	Treated water leaked out of treated water 8" discharge pipe approx. 800 – 1,000 litres.	No	3-Possible	A-Couldn't cause injury/damage	Low

The environmental spill reports are included in **Appendix E**.

Health and Safety Incidents

Four (4) incident reports were filled during the treatment season as shown in **Table 16**.

Table 16: H&S Incidents

IR Number	Date of IR	Injury/Damage/Loss of Process/Near Miss/Non-Conformance	Brief Description	Risk Matrix Probability	Risk Matrix Consequence	Risk Matrix Risk Rating
IR-2014-09	June 15, 2013	Equipment Damage	Mixer fell into onion skin tank-WTP	3-Possible	B-Minor First Aid/Damage	Moderate
IR-2014-14	July 1, 2013	First Aid	Minor thumb injury-bent back	3-Possible	B-Minor First Aid/Damage	Moderate
IR-2014-16	July 12, 2013	Equipment Damage	Mixer fell into onion skin tank-WTP	2-Unlikely	B-Minor First Aid/Damage	Low
IR-2014-19	July 12, 2013	First Aid	Minor right knee injury	3-Possible	B-Minor First Aid/Damage	Moderate

On two (2) different occasions, the wastewater treatment site experienced similar equipment damaged. The wastewater treatment plant had issues with a mixer falling into an onion skin tank. On the first occurrence, the mixer's wires had been pulled out as it fell; hence the plant operator tripped the breaker to prevent the wires from being electrified. Other mixers from that train were shut off as well while the fallen mixer was fished out of the onion tank using a plastic pole with a built in plastic hook. Since maintenance a week prior to the first incident, the mixer shaft had been wobbling putting stress on the bracket holding the mixer. The incident was most probably due to the failure of the bracket holding the mixer in place. The mixer was repaired and put back in place.

The mixer involved in the first incident fell a second time in an onion skin tank and caused a 16 inch rip at the bottom of the tank. Power was shut off completely on train # 3 to allow the removal of the mixer. A submersible pump was used to drain water from the tank to the other tank on train # 2 to avoid a potential spill. Once again, a piece of equipment holding the mixer in place, more specifically the bolt holding the mixer to the clamp, had broken which caused the incident. After the second incident, all mixers in operation in the WTP were secured to the support beams to prevent other incidents of the sort. Ongoing inspections of the equipment were required.

Two (2) minor injuries requiring first aid were reported at the wastewater treatment plant. The first one was a knee injury and was caused by a fall on a slippery surface while trying to move a replacement tank. Due to the rainy weather, the worker was rushing his task which might have contributed to the incident. The worker was spoken to about the importance of not rushing a task and about reporting near misses and incidents promptly so that the issues can be dealt with appropriately. The second event was a thumb injury which happened when the worker tried to lift a wooden hose support when it broke apart and a piece of the structure landed on his thumb. The worker was instructed to ask for help to lift unstable objects.

The H&S Incident Reports are included in **Appendix F**.

7. FUEL CONSUMPTION

The wastewater treatment plant was in operation from June 5th to August 20th, 2013.

The plant was equipped with two (2) Isuzu diesel generators, one being in standby/backup while the other was running. The generators were switched back and forth for maintenance or operation purposes. Considering that the engine has a fuel consumption rate of 7 LPH at half load and that the wastewater treatment was running almost constantly, the 2013 fuel consumption is estimated to be approximately of 3,420 USG of diesel.

8. SYSTEM OVERALL PERFORMANCE AND DOWNSTREAM EFFECTS

During the 2013 treatment season, the treatment system operated within its range, with an effluent always meeting both the contract specifications and the water license criteria with concentrations below criteria.

The discharge and monitoring plan put in place help guide the operation of the treatment plant with surveillance mechanisms and a corrective action plan that allowed for a fast and accurate response from the onsite staff to avoid any spills into the environment.

The system operation and maintenance was flexible and effective. The wastewater treatment plant proved effective within its design capabilities. Its overall performance was satisfactory compared upon the contract specifications and water license criteria. As such, no downstream effects in Hambone Lake have been observed, measured or estimated as a result of the wastewater treatment plant activities.

Given that the *2014 Discharge and Monitoring Plan*, which includes all recommendations for next season, is currently being submitted for review, recommendations were therefore not recorded in this report.

9. CLOSURE

WESAtech has used its professional judgment in analyzing this information and formulating its conclusions. No other warranty or representation, expressed or implied, as to the accuracy of the information or recommendations is included or intended in this report. This report has been prepared for the use of the TLICHO Engineering and Environmental Services Ltd.

Should you have any questions regarding this report, please feel free to contact the undersigned.

Respectfully submitted,
WESA, a division of BluMetric Environmental Inc.

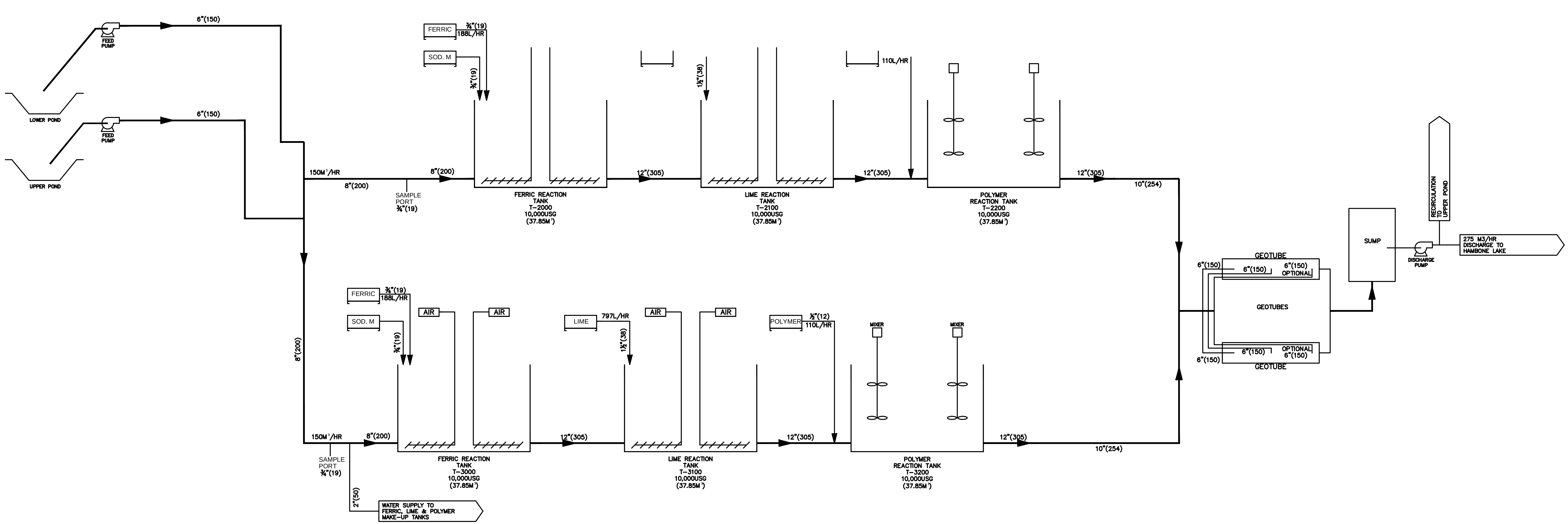
T. Beckenham

Corinne Proux, Ing., M.Sc.
Water Treatment Specialist

Tim Beckenham, B.Env. Mgmt (Hons)
Senior Consultant/Northern Project Manager

APPENDIX A

Figures



LEGEND

REV.	DESCRIPTION	DATE	BY	CHK

REFERENCE :

NOTE :

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WESAtech, a division of BluMetric Environmental Inc.

WESAtech™

a BluMetric™ company

4 Cataraqui Street
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725 FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca
BluMetric includes WESA, Seprotech, WESAtech, Envir-Eau, OEL-HydroSys, WESAtecnologias.

CLIENT

Tlicho Engineering and Environmental Services Ltd

PROJECT

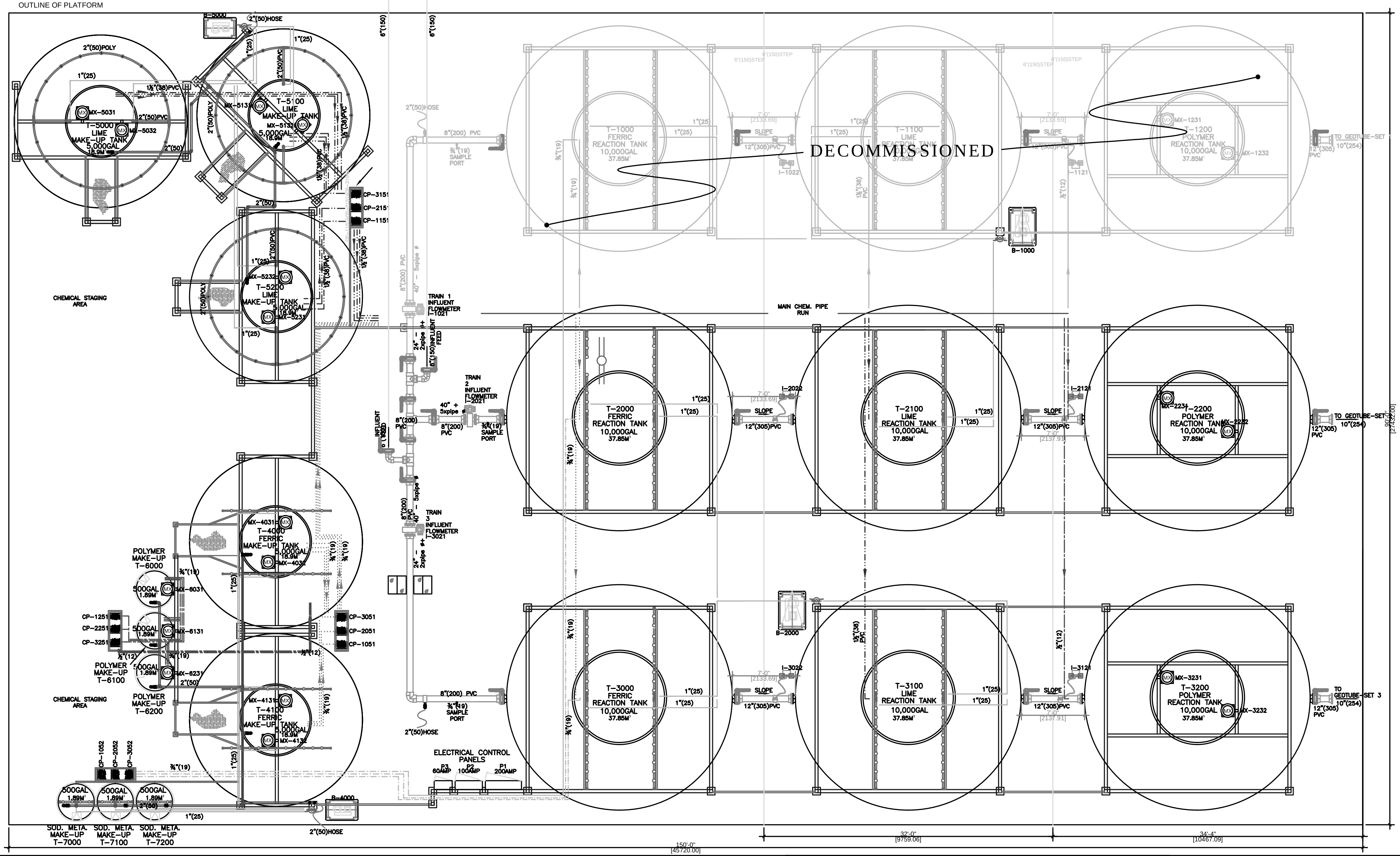
Tundra Phase II Remediation Activities
Water Treatment Plant Operation

TITLE

Process Flow Diagram

PROJECT #	DATE	REV.	FIG.
YB11192-13-00	2014-02-26	-	1

DRAWN	DESIGNED	CHECKED	CAD DRAWING
R.E.M.,K.T.	DSc,H.M.	C.P.,M.S.	YB11192-13-00-FIG1.DWG



LEGEND

FERRIC PIPING

LIME PIPING

POLYMER PIPING

SOD. M PIPING

REV.	DESCRIPTION	DATE	BY	CHK

REFERENCE :

NOTE :
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a BluMetric™ company

4 Cataraqui Street
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725 FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca
BluMetric includes WESA, Seprotech, WESAtech, Envir-Eau, OEL-HydroSys, WESAtecnologias.

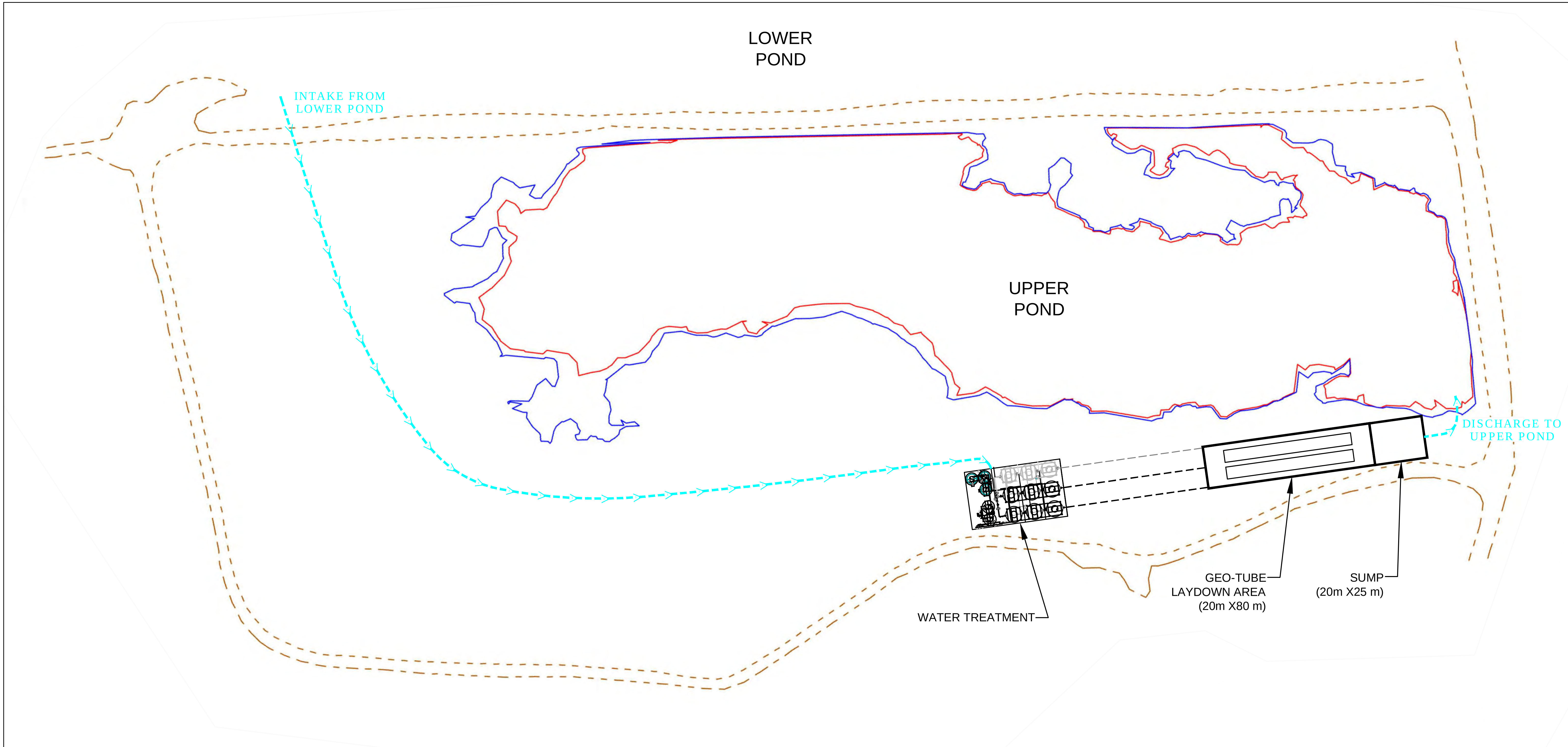
CLIENT
Tlicho Engineering and Environmental Services Ltd

PROJECT
Tundra Phase II Remediation Activities
Water Treatment Plant Operation

TITLE
Platform Layout

PROJECT #	DATE	REV.	FIG.
YB11192-13-00	2014-02-26	-	2

DRAWN	DESIGNED	CHECKED	CAD DRAWING
R.E.M.,K.T.	DSc,H.M.	C.P.,M.S.	YB11192-13-00-FIG2.DWG



LEGEND

ACCESS ROAD

PIPELINE

REV.	DESCRIPTION	DATE	BY	CHK

REFERENCE :
SUB-ARTIC SURVEYS LTD., 2013.

NOTE :
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a BluMetric™ company

4 Cataraqui Street
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725 FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca
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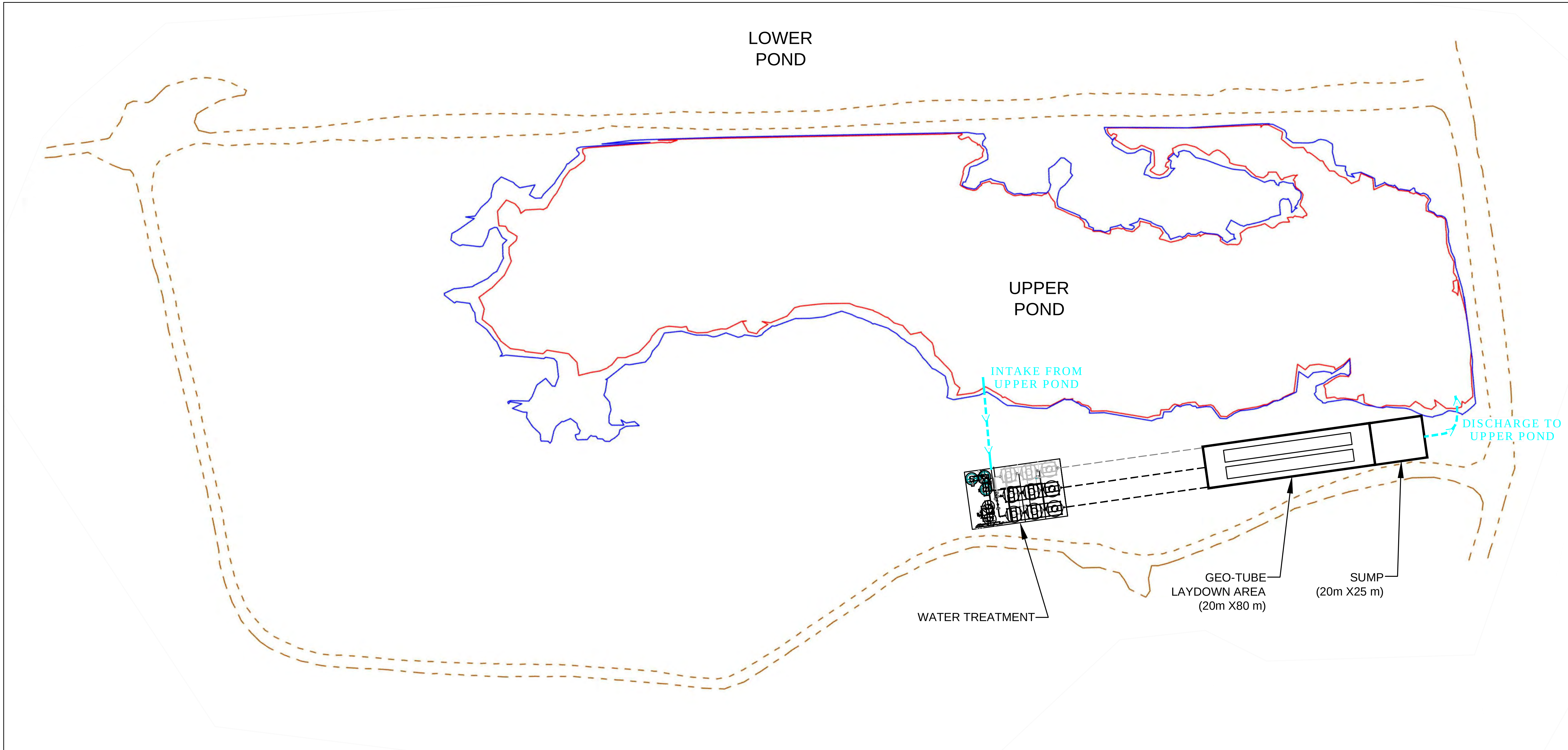
CLIENT
Tlicho Engineering and Environmental Services Ltd

PROJECT
Tundra Phase II Remediation Activities
Water Treatment Plant Operation

TITLE
Treatment of Lower Pond
Process Schematic

PROJECT #	DATE	REV.	FIG.
YB11192-13-00	2014-02-26	-	3

DRAWN	DESIGNED	CHECKED	CAD DRAWING
R.E.M.,K.T.	DSc,H.M.	C.P.,M.S.	YB11192-13-00-FIG3.DWG



LEGEND

ACCESS ROAD

PIPELINE

REV.	DESCRIPTION	DATE	BY	CHK

REFERENCE :
SUB-ARTIC SURVEYS LTD., 2013.

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a BluMetric™ company

4 Cataraqui Street
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725 FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca
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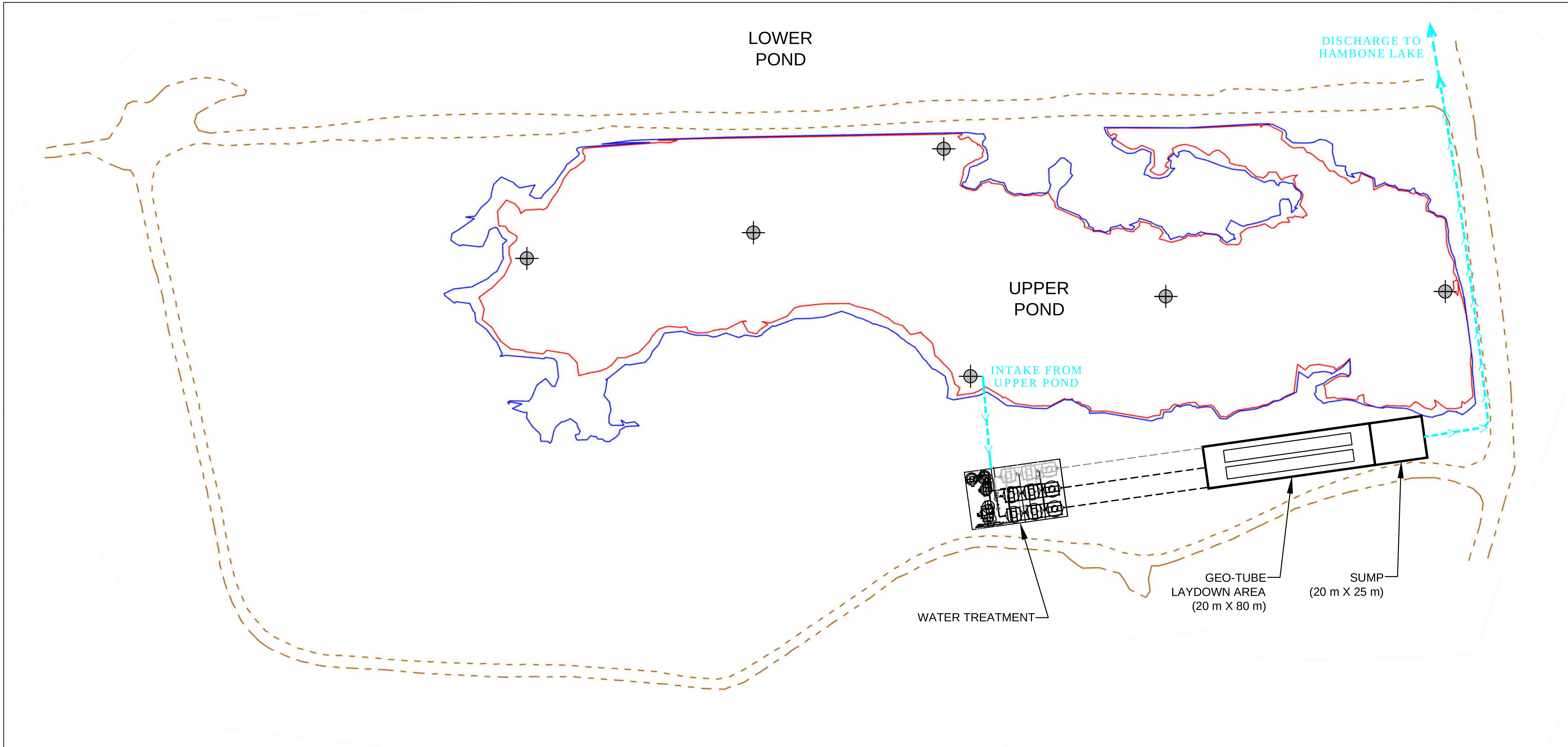
CLIENT
Tlicho Engineering and
Environmental Services Ltd

PROJECT
Tundra Phase II Remediation Activities
Water Treatment Plant Operation

TITLE
Treatment of Upper Pond
Process Schematic

PROJECT #	DATE	REV.	FIG.
YB11192-13-00	2014-02-26	-	4

DRAWN	DESIGNED	CHECKED	CAD DRAWING
R.E.M.,K.T.	DSc,H.M.	C.P.,M.S.	YB11192-13-00-FIG4.DWG



LEGEND

ACCESS ROAD

SAMPLING LOCATION

PIPELINE

REV.	DESCRIPTION	DATE	BY	CHK

REFERENCE :
SUB-ARTIC SURVEYS LTD., 2013.

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WESAtech™ a BluMetric™ company

4 Cataraqui Street
Kingston, Ontario K7K 1Z7
TEL: (613) 531-2725 FAX: (613) 531-1852
Email: info@blumetric.ca
Web: http://www.blumetric.ca
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CLIENT
Tlicho Engineering and Environmental Services Ltd

PROJECT
Tundra Phase II Remediation Activities
Water Treatment Plant Operation

TITLE
Discharge Phase
Sampling Locations

PROJECT #	DATE	REV.	FIG.
YB11192-13-00	2014-02-26	-	5

DRAWN	DESIGNED	CHECKED	CAD DRAWING
R.E.M.,K.T.	DSc,H.M.	C.P.,M.S.	YB11192-13-00-FIG5.DWG

APPENDIX B

Accredited Laboratory Certificate of Analysis – Untreated Upper and Lower Ponds

Taiga Batch No.: 130349

Taiga Environmental Laboratory

4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3

Tel: (867)-669-2788   Fax: (867)-669-2718

- FINAL REPORT -

Prepared For: WESA

Address: 4901 - 48 Street
P.O. Box 11086
Yellowknife, NT
X1A 3X7

Attn: **Tim Beckenham**   **Facsimile: (867) 873-3499**

Final report has been reviewed and approved by:

Hélène Harper

Helene Harper
Manager

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
  - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
  - Environment Canada
  - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Wednesday, June 12, 2013
Print Date: Wednesday, June 12, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130349

- CERTIFICATE OF ANALYSIS -

Client Sample ID: LPSS **Taiga Sample ID:** 001

Client Project: Tundra 2013
Sample Type: Surface Water
Received Date: 06-Jun-13
Sampling Date: 05-Jun-13
Sampling Time:
Location: Tundra Mine Site
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH			pH units	06-Jun-13	SM4500-H:B	85
Solids, Total Suspended	74	3	mg/L	06-Jun-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as Nitrogen	0.792	0.005	mg/L	10-Jun-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.24	0.01	mg/L	07-Jun-13	SM4110:B	
Nitrite as Nitrogen	0.04	0.01	mg/L	07-Jun-13	SM4110:B	
Trace Metals, Dissolved						
Arsenic	917	0.2	µg/L	06-Jun-13	EPA200.8	
Copper	5.8	0.2	µg/L	06-Jun-13	EPA200.8	
Lead	< 0.1	0.1	µg/L	06-Jun-13	EPA200.8	
Nickel	6.6	0.1	µg/L	06-Jun-13	EPA200.8	
Zinc	4.1	0.4	µg/L	06-Jun-13	EPA200.8	
Trace Metals, Total						

ReportDate: Wednesday, June 12, 2013
Print Date: Wednesday, June 12, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130349

- CERTIFICATE OF ANALYSIS -

Client Sample ID: **LPSS** **Taiga Sample ID:** **001**

Arsenic	1460	0.2	µg/L	06-Jun-13	EPA200.8
Copper	37.8	0.2	µg/L	06-Jun-13	EPA200.8
Lead	23.6	0.1	µg/L	06-Jun-13	EPA200.8
Nickel	16.2	0.1	µg/L	06-Jun-13	EPA200.8
Zinc	137	5	µg/L	06-Jun-13	EPA200.8

ReportDate: Wednesday, June 12, 2013
Print Date: Wednesday, June 12, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130349

- CERTIFICATE OF ANALYSIS -

Client Sample ID: LPSN **Taiga Sample ID:** 002

Client Project: Tundra 2013
Sample Type: Surface Water
Received Date: 06-Jun-13
Sampling Date: 05-Jun-13
Sampling Time:
Location: Tundra Mine Site
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH			pH units	06-Jun-13	SM4500-H:B	85
Solids, Total Suspended	64	3	mg/L	06-Jun-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as Nitrogen	0.791	0.005	mg/L	10-Jun-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.32	0.01	mg/L	07-Jun-13	SM4110:B	
Nitrite as Nitrogen	0.05	0.01	mg/L	07-Jun-13	SM4110:B	
Trace Metals, Dissolved						
Arsenic	928	0.2	µg/L	06-Jun-13	EPA200.8	
Copper	6.0	0.2	µg/L	06-Jun-13	EPA200.8	
Lead	< 0.1	0.1	µg/L	06-Jun-13	EPA200.8	
Nickel	6.8	0.1	µg/L	06-Jun-13	EPA200.8	
Zinc	4.2	0.4	µg/L	06-Jun-13	EPA200.8	
Trace Metals, Total						

ReportDate: Wednesday, June 12, 2013
Print Date: Wednesday, June 12, 2013

Taiga Environmental Laboratory

4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130349

- CERTIFICATE OF ANALYSIS -

Client Sample ID: LPSN **Taiga Sample ID:** 002

Arsenic	1460	0.2	µg/L	06-Jun-13	EPA200.8
Copper	36.8	0.2	µg/L	06-Jun-13	EPA200.8
Lead	22.7	0.1	µg/L	06-Jun-13	EPA200.8
Nickel	15.4	0.1	µg/L	06-Jun-13	EPA200.8
Zinc	130	5	µg/L	06-Jun-13	EPA200.8

ReportDate: Wednesday, June 12, 2013
Print Date: Wednesday, June 12, 2013

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Taiga Batch No.: 130349

- CERTIFICATE OF ANALYSIS -

Client Sample ID: LPIM **Taiga Sample ID:** 003

Client Project: Tundra 2013
Sample Type: Surface Water
Received Date: 06-Jun-13
Sampling Date: 05-Jun-13
Sampling Time:

Location: Tundra Mine Site
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH			pH units	06-Jun-13	SM4500-H:B	85
Solids, Total Suspended	10400	3	mg/L	06-Jun-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as Nitrogen	0.542	0.005	mg/L	10-Jun-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.35	0.01	mg/L	07-Jun-13	SM4110:B	
Nitrite as Nitrogen	0.11	0.01	mg/L	07-Jun-13	SM4110:B	
Trace Metals, Dissolved						
Arsenic	1110	0.2	µg/L	06-Jun-13	EPA200.8	
Copper	5.0	0.2	µg/L	06-Jun-13	EPA200.8	
Lead	0.2	0.1	µg/L	06-Jun-13	EPA200.8	
Nickel	7.4	0.1	µg/L	06-Jun-13	EPA200.8	
Zinc	3.7	0.4	µg/L	06-Jun-13	EPA200.8	
Trace Metals, Total						

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Taiga Batch No.: 130349

- CERTIFICATE OF ANALYSIS -

Client Sample ID: LPIM **Taiga Sample ID:** 003

Arsenic	47300	0.2	µg/L	06-Jun-13	EPA200.8
Copper	652	0.2	µg/L	06-Jun-13	EPA200.8
Lead	964	0.1	µg/L	06-Jun-13	EPA200.8
Nickel	413	0.1	µg/L	06-Jun-13	EPA200.8
Zinc	2310	5	µg/L	06-Jun-13	EPA200.8

ReportDate: Wednesday, June 12, 2013
Print Date: Wednesday, June 12, 2013

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Taiga Batch No.: 130349

- CERTIFICATE OF ANALYSIS -

Client Sample ID: UPSS **Taiga Sample ID:** 004

Client Project: Tundra 2013
Sample Type: Surface Water
Received Date: 06-Jun-13
Sampling Date: 05-Jun-13
Sampling Time:
Location: Tundra Mine Site
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH			pH units	06-Jun-13	SM4500-H:B	85
Solids, Total Suspended	22	3	mg/L	06-Jun-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as Nitrogen	0.168	0.005	mg/L	10-Jun-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.19	0.01	mg/L	07-Jun-13	SM4110:B	
Nitrite as Nitrogen	0.01	0.01	mg/L	07-Jun-13	SM4110:B	
Trace Metals, Dissolved						
Arsenic	148	0.2	µg/L	06-Jun-13	EPA200.8	
Copper	1.0	0.2	µg/L	06-Jun-13	EPA200.8	
Lead	0.1	0.1	µg/L	06-Jun-13	EPA200.8	
Nickel	5.9	0.1	µg/L	06-Jun-13	EPA200.8	
Zinc	0.9	0.4	µg/L	06-Jun-13	EPA200.8	
Trace Metals, Total						

ReportDate: Wednesday, June 12, 2013
Print Date: Wednesday, June 12, 2013

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Taiga Batch No.: 130349

- CERTIFICATE OF ANALYSIS -

Client Sample ID: UPSS **Taiga Sample ID:** 004

Arsenic	336	0.2	µg/L	06-Jun-13	EPA200.8
Copper	3.5	0.2	µg/L	06-Jun-13	EPA200.8
Lead	4.1	0.1	µg/L	06-Jun-13	EPA200.8
Nickel	7.5	0.1	µg/L	06-Jun-13	EPA200.8
Zinc	8.6	5	µg/L	06-Jun-13	EPA200.8

ReportDate: Wednesday, June 12, 2013
Print Date: Wednesday, June 12, 2013

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Taiga Batch No.: 130349

- CERTIFICATE OF ANALYSIS -

Client Sample ID: UPSN **Taiga Sample ID:** 005

Client Project: Tundra 2013
Sample Type: Surface Water
Received Date: 06-Jun-13
Sampling Date: 05-Jun-13
Sampling Time:
Location: Tundra Mine Site
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH			pH units	06-Jun-13	SM4500-H:B	85
Solids, Total Suspended	14	3	mg/L	06-Jun-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as Nitrogen	0.171	0.005	mg/L	10-Jun-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.17	0.01	mg/L	07-Jun-13	SM4110:B	
Nitrite as Nitrogen	0.01	0.01	mg/L	07-Jun-13	SM4110:B	
Trace Metals, Dissolved						
Arsenic	170	0.2	µg/L	06-Jun-13	EPA200.8	
Copper	0.8	0.2	µg/L	06-Jun-13	EPA200.8	
Lead	0.1	0.1	µg/L	06-Jun-13	EPA200.8	
Nickel	4.4	0.1	µg/L	06-Jun-13	EPA200.8	
Zinc	0.6	0.4	µg/L	06-Jun-13	EPA200.8	
Trace Metals, Total						

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- CERTIFICATE OF ANALYSIS -

Client Sample ID: UPSN **Taiga Sample ID:** 005

Arsenic	319	0.2	µg/L	06-Jun-13	EPA200.8
Copper	2.6	0.2	µg/L	06-Jun-13	EPA200.8
Lead	3.3	0.1	µg/L	06-Jun-13	EPA200.8
Nickel	6.0	0.1	µg/L	06-Jun-13	EPA200.8
Zinc	5.9	5	µg/L	06-Jun-13	EPA200.8

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Taiga Batch No.: 130349

- CERTIFICATE OF ANALYSIS -

Client Sample ID: UP3M **Taiga Sample ID:** 006

Client Project: Tundra 2013
Sample Type: Surface Water
Received Date: 06-Jun-13
Sampling Date: 05-Jun-13
Sampling Time:

Location: Tundra Mine Site
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH			pH units	06-Jun-13	SM4500-H:B	85
Solids, Total Suspended	364	3	mg/L	06-Jun-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as Nitrogen	0.177	0.005	mg/L	10-Jun-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.18	0.01	mg/L	07-Jun-13	SM4110:B	
Nitrite as Nitrogen	0.02	0.01	mg/L	07-Jun-13	SM4110:B	
Trace Metals, Dissolved						
Arsenic	170	0.2	µg/L	06-Jun-13	EPA200.8	
Copper	1.0	0.2	µg/L	06-Jun-13	EPA200.8	
Lead	0.2	0.1	µg/L	06-Jun-13	EPA200.8	
Nickel	4.0	0.1	µg/L	06-Jun-13	EPA200.8	
Zinc	< 0.4	0.4	µg/L	06-Jun-13	EPA200.8	
Trace Metals, Total						

Taiga Environmental Laboratory
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Taiga Batch No.: 130349

- CERTIFICATE OF ANALYSIS -

Client Sample ID: UP3M **Taiga Sample ID:** 006

Arsenic	750	0.2	µg/L	06-Jun-13	EPA200.8
Copper	11.0	0.2	µg/L	06-Jun-13	EPA200.8
Lead	17.2	0.1	µg/L	06-Jun-13	EPA200.8
Nickel	15.3	0.1	µg/L	06-Jun-13	EPA200.8
Zinc	38.3	5	µg/L	06-Jun-13	EPA200.8

ReportDate: Wednesday, June 12, 2013
Print Date: Wednesday, June 12, 2013

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Taiga Batch No.: 130349

- CERTIFICATE OF ANALYSIS -

Client Sample ID: UP3M **Taiga Sample ID:** 006

- DATA QUALIFERS -

Data Qualifier Descriptions:

85 *Equipment/supply failure, insufficient sample to repeat measurement.*

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

APPENDIX C

Accredited Laboratory Certificate of Analysis – Sampling Events

WESA Inc.
ATTN: Tim Beckenham/Melanie St-Jean
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9

Date Received: 04-JUL-13
Report Date: 07-JUL-13 17:07 (MT)
Version: FINAL

Client Phone: 867-446-2346

Certificate of Analysis

Lab Work Order #:	**L1327443**
Project P.O. #:	NOT SUBMITTED
Job Reference:	YB11192-00-00
C of C Numbers:	1, 2
Legal Site Desc:	

Cath Evaristo Cordero

Catherine Evaristo-Cordero
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-1 UP1 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 09:00							
Matrix: Surface Water							
Miscellaneous Parameters							
Ammonia, Total (as N)	0.166		0.050	mg/L		06-JUL-13	R2644431
Color, True	7.2		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	3.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	3.54		0.10	NTU		06-JUL-13	R2644448
pH	8.04		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0592		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00073		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.197		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0154		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484
Bismuth (Bi)-Total	0.000073		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.032		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	0.000011		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	105		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00031		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00292		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00275		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.714		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000828		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	7.31		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.135		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00227		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00656		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.42		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.822		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	24.8		0.050	mg/L		07-JUL-13	R2644484
Strontium (Sr)-Total	0.172		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00325		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000265		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00039		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0039		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0237		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00067		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.102		0.00010	mg/L		06-JUL-13	R2644492
Barium (Ba)-Dissolved	0.0151		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.029		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	104		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	0.00013		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00218		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00115		0.00010	mg/L		06-JUL-13	R2644492

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-1 UP1 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 09:00							
Matrix: Surface Water							
Dissolved Metals in Water by CRC ICPMS							
Iron (Fe)-Dissolved	0.054		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	0.000095		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	7.01		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.101		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00203		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00530		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	5.89		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.755		0.050	mg/L		06-JUL-13	R2644492
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	21.5		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.166		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	0.00030		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000240		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0023		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							
Nitrate (as N)	0.293		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.293		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-2 UP1 - S - DOF							
Sampled By: M. St. Jean on 03-JUL-13 @ 09:00							
Matrix: Surface Water							
Miscellaneous Parameters							
Ammonia, Total (as N)	0.169		0.050	mg/L		06-JUL-13	R2644431
Color, True	7.9		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	5.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	3.51		0.10	NTU		06-JUL-13	R2644448
pH	8.06		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0570		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00071		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.192		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0155		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.032		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	106		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00039		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00293		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00269		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.708		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000832		0.000050	mg/L		07-JUL-13	R2644484

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-2 UP1 - S - DOF							
Sampled By: M. St. Jean on 03-JUL-13 @ 09:00							
Matrix: Surface Water							
Total Metals in Water by CRC ICPMS							
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	7.47		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.132		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00226		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00650		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.32		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.819		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	24.2		0.050	mg/L		07-JUL-13	R2644484
Strontium (Sr)-Total	0.172		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00340		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000266		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00040		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0042		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0228		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00068		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.102		0.00010	mg/L		06-JUL-13	R2644492
Barium (Ba)-Dissolved	0.0148		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.030		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	105		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	0.00014		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00222		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00129		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	0.050		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	0.000093		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	7.27		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.101		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00207		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00522		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	6.18		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.753		0.050	mg/L		06-JUL-13	R2644492
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	21.7		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.165		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000248		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0036		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-2 UP1 - S - DOF							
Sampled By: M. St. Jean on 03-JUL-13 @ 09:00							
Matrix: Surface Water							
Nitrate as N by IC							
Nitrate (as N)	0.296		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.296		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-3 UP1 - M - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 09:00							
Matrix: Surface Water							
Miscellaneous Parameters							
Ammonia, Total (as N)	0.168		0.050	mg/L		06-JUL-13	R2644431
Color, True	6.5		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	8.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	2.82		0.10	NTU		06-JUL-13	R2644448
pH	8.06		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0622		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00076		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.199		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0158		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.033		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	0.000011		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	110		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00050		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00297		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00300		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.709		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000837		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	7.63		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.135		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00238		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00690		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.43		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.839		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	24.8		0.050	mg/L		07-JUL-13	R2644484
Strontium (Sr)-Total	0.176		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00374		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000275		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00040		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0046		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0227		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00065		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.102		0.00010	mg/L		06-JUL-13	R2644492

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-3 UP1 - M - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 09:00							
Matrix: Surface Water							
Dissolved Metals in Water by CRC ICPMS							
Barium (Ba)-Dissolved	0.0149		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.029		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	101		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	0.00014		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00216		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00135		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	0.041		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	0.000070		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	6.94		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.101		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00200		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00543		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	6.06		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.756		0.050	mg/L		06-JUL-13	R2644492
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	22.2		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.161		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000243		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0027		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							
Nitrate (as N)	0.293		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.293		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-4 UP2 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 09:30							
Matrix: Surface Water							
Miscellaneous Parameters							
Ammonia, Total (as N)	0.171		0.050	mg/L		06-JUL-13	R2644431
Color, True	7.2		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	<3.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	3.56		0.10	NTU		06-JUL-13	R2644448
pH	8.06		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0607		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00073		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.199		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0161		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-4 UP2 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 09:30							
Matrix: Surface Water							
Total Metals in Water by CRC ICPMS							
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.034		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	0.000011		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	112		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00067		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00293		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00300		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.733		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000866		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	7.80		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.136		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00239		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00666		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.57		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.848		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	25.0		0.050	mg/L		07-JUL-13	R2644484
Strontium (Sr)-Total	0.181		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00352		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000279		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00041		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0088		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0245		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00066		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.102		0.00010	mg/L		06-JUL-13	R2644492
Barium (Ba)-Dissolved	0.0149		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.030		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	105		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	0.00014		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00221		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00141		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	0.062		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	0.000122		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	7.22		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.102		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00201		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00529		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	6.00		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.746		0.050	mg/L		06-JUL-13	R2644492

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-4 UP2 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 09:30							
Matrix: Surface Water							
Dissolved Metals in Water by CRC ICPMS							
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	21.9		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.163		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	0.00341		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000250		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0041		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							
Nitrate (as N)	0.296		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.296		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-5 UP2 - M - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 09:30							
Matrix: Surface Water							
Miscellaneous Parameters							
Ammonia, Total (as N)	0.169		0.050	mg/L		06-JUL-13	R2644431
Color, True	8.0		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	5.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	3.29		0.10	NTU		06-JUL-13	R2644448
pH	8.07		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0539		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00076		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.198		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0156		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.033		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	0.000011		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	109		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00043		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00293		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00305		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.702		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000816		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	7.43		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.134		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00232		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00669		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.29		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.827		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	24.5		0.050	mg/L		07-JUL-13	R2644484

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-5 UP2 - M - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 09:30							
Matrix: Surface Water							
Total Metals in Water by CRC ICPMS							
Strontium (Sr)-Total	0.175		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	0.00017		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00483		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000267		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00042		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0045		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0243		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00066		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.101		0.00010	mg/L		06-JUL-13	R2644492
Barium (Ba)-Dissolved	0.0148		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.029		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	102		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	0.00014		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00218		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00138		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	0.050		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	0.000099		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	7.12		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.0998		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00195		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00530		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	6.06		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.731		0.050	mg/L		06-JUL-13	R2644492
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	21.7		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.161		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	0.00031		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000242		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0026		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							
Nitrate (as N)	0.298		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.298		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-6 UP3 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 07:00							
Matrix: Surface Water							
Miscellaneous Parameters							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-6 UP3 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 07:00							
Matrix: Surface Water							
Ammonia, Total (as N)	0.169		0.050	mg/L		06-JUL-13	R2644431
Color, True	8.5		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	6.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	3.65		0.10	NTU		06-JUL-13	R2644448
pH	8.07		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0655		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00077		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.208		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0164		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.033		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	0.000011		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	112		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00035		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00299		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00314		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.722		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000871		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	7.93		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.139		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00232		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00682		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.68		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.853		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	24.8		0.050	mg/L		07-JUL-13	R2644484
Strontium (Sr)-Total	0.179		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00383		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000274		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00042		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0043		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0219		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00069		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.104		0.00010	mg/L		06-JUL-13	R2644492
Barium (Ba)-Dissolved	0.0155		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.030		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	107		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	0.00014		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00221		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00141		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	0.031		0.010	mg/L		06-JUL-13	R2644492

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-6 UP3 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 07:00							
Matrix: Surface Water							
Dissolved Metals in Water by CRC ICPMS							
Lead (Pb)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	7.22		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.101		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00206		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00529		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	6.04		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.748		0.050	mg/L		06-JUL-13	R2644492
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	22.5		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.167		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000247		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0015		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							
Nitrate (as N)	0.304		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.304		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-7 UP3 - M - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 07:00							
Matrix: Surface Water							
Miscellaneous Parameters							
Ammonia, Total (as N)	0.169		0.050	mg/L		06-JUL-13	R2644431
Color, True	7.7		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	<3.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	4.35		0.10	NTU		06-JUL-13	R2644448
pH	8.06		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0613		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00079		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.202		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0160		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.033		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	0.000017		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	107		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00053		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00297		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00317		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.712		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000895		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-7 UP3 - M - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 07:00							
Matrix: Surface Water							
Total Metals in Water by CRC ICPMS							
Magnesium (Mg)-Total	7.54		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.135		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00230		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00663		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.21		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.848		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	23.8		0.050	mg/L		07-JUL-13	R2644484
Strontium (Sr)-Total	0.176		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	0.00029		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00316		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000273		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00041		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0053		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0235		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00071		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.105		0.00010	mg/L		06-JUL-13	R2644492
Barium (Ba)-Dissolved	0.0149		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.029		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	105		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	0.00015		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00217		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00142		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	0.042		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	0.000058		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	7.17		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.102		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00214		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00553		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	6.20		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.755		0.050	mg/L		06-JUL-13	R2644492
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	22.1		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.169		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000247		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0019		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-7 UP3 - M - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 07:00							
Matrix: Surface Water							
Nitrate as N by IC							
Nitrate (as N)	0.309		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.309		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-8 UP3 - S - DOF							
Sampled By: M. St. Jean on 03-JUL-13 @ 07:00							
Matrix: Surface Water							
Miscellaneous Parameters							
Ammonia, Total (as N)	0.167		0.050	mg/L		06-JUL-13	R2644431
Color, True	8.3		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	4.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	3.58		0.10	NTU		06-JUL-13	R2644448
pH	8.03		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0626		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00079		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.208		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0157		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484
Bismuth (Bi)-Total	0.000292		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.032		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	0.000012		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	108		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00038		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00300		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00360		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.759		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000882		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	7.54		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.141		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00231		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00663		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.95		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.878		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	25.6		0.050	mg/L		07-JUL-13	R2644484
Strontium (Sr)-Total	0.177		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00352		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000292		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00047		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0047		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0234		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00071		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.102		0.00010	mg/L		06-JUL-13	R2644492

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-8 UP3 - S - DOF							
Sampled By: M. St. Jean on 03-JUL-13 @ 07:00							
Matrix: Surface Water							
Dissolved Metals in Water by CRC ICPMS							
Barium (Ba)-Dissolved	0.0152		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.029		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	105		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	0.00017		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00212		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00146		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	0.035		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	0.000052		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	7.11		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.0996		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00204		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00523		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	5.91		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.755		0.050	mg/L		06-JUL-13	R2644492
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	21.6		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.166		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000245		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0021		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							
Nitrate (as N)	0.301		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.301		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-9 UP4 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 10:00							
Matrix: Surface Water							
Miscellaneous Parameters							
Ammonia, Total (as N)	0.166		0.050	mg/L		06-JUL-13	R2644431
Color, True	8.4		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	5.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	3.19		0.10	NTU		06-JUL-13	R2644448
pH	8.07		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0648		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00071		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.206		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0160		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-9 UP4 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 10:00							
Matrix: Surface Water							
Total Metals in Water by CRC ICPMS							
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.033		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	0.000013		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	108		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00034		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00296		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00280		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.709		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000933		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	7.47		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.136		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00233		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00658		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.39		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.842		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	24.7		0.050	mg/L		07-JUL-13	R2644484
Strontium (Sr)-Total	0.175		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00307		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000273		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00042		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0051		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0240		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00065		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.108		0.00010	mg/L		06-JUL-13	R2644492
Barium (Ba)-Dissolved	0.0151		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.029		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	101		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00216		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00138		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	0.047		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	0.000094		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	6.90		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.100		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00197		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00528		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	6.11		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.755		0.050	mg/L		06-JUL-13	R2644492

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-9 UP4 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 10:00							
Matrix: Surface Water							
Dissolved Metals in Water by CRC ICPMS							
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	21.9		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.162		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000244		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0017		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							
Nitrate (as N)	0.303		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.303		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-10 UP4 - M- OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 10:00							
Matrix: Surface Water							
Miscellaneous Parameters							
Ammonia, Total (as N)	0.173		0.050	mg/L		06-JUL-13	R2644431
Color, True	7.6		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	<3.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	3.65		0.10	NTU		06-JUL-13	R2644448
pH	8.06		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0595		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00074		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.202		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0159		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.033		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	0.000014		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	110		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00048		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00284		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00294		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.705		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000904		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	7.31		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.134		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00234		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00687		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.44		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.828		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	24.4		0.050	mg/L		07-JUL-13	R2644484

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-10 UP4 - M- OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 10:00							
Matrix: Surface Water							
Total Metals in Water by CRC ICPMS							
Strontium (Sr)-Total	0.174		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00361		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000268		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00043		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0053		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0245		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00066		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.110		0.00010	mg/L		06-JUL-13	R2644492
Barium (Ba)-Dissolved	0.0149		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.029		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	104		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	0.00013		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00221		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00144		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	0.059		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	0.000129		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	7.21		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.101		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00201		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00539		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	6.13		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.759		0.050	mg/L		06-JUL-13	R2644492
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	21.6		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.163		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	0.00038		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000247		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0015		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							
Nitrate (as N)	0.305		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.305		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-11 UP5 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 06:30							
Matrix: Surface Water							
Miscellaneous Parameters							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-11 UP5 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 06:30							
Matrix: Surface Water							
Ammonia, Total (as N)	0.172		0.050	mg/L		06-JUL-13	R2644431
Color, True	6.0		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	7.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	3.56		0.10	NTU		06-JUL-13	R2644448
pH	8.06		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0652		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00072		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.204		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0162		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.034		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	112		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00031		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00298		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00296		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.713		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000900		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	7.55		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.136		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00229		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00664		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.41		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.855		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	24.8		0.050	mg/L		07-JUL-13	R2644484
Strontium (Sr)-Total	0.178		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00452		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000281		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00042		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0040		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0246		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00066		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.107		0.00010	mg/L		06-JUL-13	R2644492
Barium (Ba)-Dissolved	0.0151		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.029		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	0.000012		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	105		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00220		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00141		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	0.044		0.010	mg/L		06-JUL-13	R2644492

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-11 UP5 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 06:30							
Matrix: Surface Water							
Dissolved Metals in Water by CRC ICPMS							
Lead (Pb)-Dissolved	0.000082		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	7.06		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.101		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00200		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00524		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	6.19		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.769		0.050	mg/L		06-JUL-13	R2644492
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	21.6		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.168		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000245		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0030		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							
Nitrate (as N)	0.302		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.302		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-12 UP5 - M - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 06:30							
Matrix: Surface Water							
Miscellaneous Parameters							
Ammonia, Total (as N)	0.170		0.050	mg/L		06-JUL-13	R2644431
Color, True	7.4		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	5.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	3.60		0.10	NTU		06-JUL-13	R2644448
pH	8.06		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0671		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00074		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.209		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0161		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.034		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	0.000018		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	113		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00040		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00295		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00301		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.715		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000917		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-12 UP5 - M - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 06:30							
Matrix: Surface Water							
Total Metals in Water by CRC ICPMS							
Magnesium (Mg)-Total	7.65		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.137		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00240		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00681		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.50		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.879		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	24.6		0.050	mg/L		07-JUL-13	R2644484
Strontium (Sr)-Total	0.180		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	0.00045		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00349		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000278		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00044		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0052		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0242		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00065		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.109		0.00010	mg/L		06-JUL-13	R2644492
Barium (Ba)-Dissolved	0.0148		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.028		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	99.5		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	0.00012		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00222		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00144		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	0.043		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	0.000087		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	7.12		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.101		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00200		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00528		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	6.07		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.759		0.050	mg/L		06-JUL-13	R2644492
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	22.0		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.160		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	0.00012		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000243		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0024		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-12 UP5 - M - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 06:30							
Matrix: Surface Water							
Nitrate as N by IC							
Nitrate (as N)	0.305		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.305		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-13 UP6 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 10:30							
Matrix: Surface Water							
Miscellaneous Parameters							
Ammonia, Total (as N)	0.168		0.050	mg/L		06-JUL-13	R2644431
Color, True	8.2		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	5.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	3.10		0.10	NTU		06-JUL-13	R2644448
pH	8.05		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0655		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00073		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.213		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0163		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484
Bismuth (Bi)-Total	0.000094		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.033		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	0.000011		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	108		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00035		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00291		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00286		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.701		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000926		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	7.58		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.134		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00231		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00657		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.32		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	0.00011		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.842		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	24.6		0.050	mg/L		07-JUL-13	R2644484
Strontium (Sr)-Total	0.180		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00289		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000285		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00043		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0045		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0243		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00067		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.116		0.00010	mg/L		06-JUL-13	R2644492

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-13 UP6 - S - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 10:30							
Matrix: Surface Water							
Dissolved Metals in Water by CRC ICPMS							
Barium (Ba)-Dissolved	0.0154		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.028		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	101		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	0.00011		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00221		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00138		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	0.048		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	0.000093		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	6.88		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.101		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00198		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00520		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	5.88		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.767		0.050	mg/L		06-JUL-13	R2644492
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	21.9		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.160		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000244		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0014		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							
Nitrate (as N)	0.308		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.308		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-14 UP6 - M - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 10:30							
Matrix: Surface Water							
Miscellaneous Parameters							
Ammonia, Total (as N)	0.166		0.050	mg/L		06-JUL-13	R2644431
Color, True	7.8		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	5.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	3.53		0.10	NTU		06-JUL-13	R2644448
pH	8.06		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.0659		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	0.00073		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.212		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	0.0158		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-14 UP6 - M - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 10:30							
Matrix: Surface Water							
Total Metals in Water by CRC ICPMS							
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	0.034		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	0.000012		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	111		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	0.00047		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	0.00294		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00285		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	0.701		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	0.000922		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	7.50		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.134		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	0.00233		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00653		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	6.43		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	0.828		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	24.1		0.050	mg/L		07-JUL-13	R2644484
Strontium (Sr)-Total	0.179		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	0.00024		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	0.00268		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	0.000274		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	0.00043		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	0.0043		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	0.0236		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	0.00066		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.113		0.00010	mg/L		06-JUL-13	R2644492
Barium (Ba)-Dissolved	0.0152		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	0.028		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	98.2		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	0.00215		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	0.00138		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	0.042		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	0.000086		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	6.82		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.0999		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	0.00199		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	0.00515		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	5.94		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	0.770		0.050	mg/L		06-JUL-13	R2644492

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-14 UP6 - M - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 10:30							
Matrix: Surface Water							
Dissolved Metals in Water by CRC ICPMS							
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	21.7		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.162		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	0.00033		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	0.000244		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0018		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							
Nitrate (as N)	0.303		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	0.303		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-15 UP - EQ - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 11:00							
Matrix: Surface Water							
Miscellaneous Parameters							
Ammonia, Total (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644431
Color, True	<2.0		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	<3.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	0.25		0.10	NTU		06-JUL-13	R2644448
pH	5.95		0.10	pH		06-JUL-13	R2644445
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	<0.0030		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	0.00082		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	<0.010		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	0.078		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	0.00012		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	<0.010		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	0.000151		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	0.00018		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	<0.050		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	<0.050		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	<0.050		0.050	mg/L		07-JUL-13	R2644484

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-15 UP - EQ - OFF							
Sampled By: M. St. Jean on 03-JUL-13 @ 11:00							
Matrix: Surface Water							
Total Metals in Water by CRC ICPMS							
Strontium (Sr)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	<0.00030		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	<0.0030		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	<0.0010		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	0.00053		0.00010	mg/L		06-JUL-13	R2644492
Barium (Ba)-Dissolved	0.000080		0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	<0.010		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	0.089		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	<0.010		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	<0.0050		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	0.000148		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	<0.050		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	<0.050		0.050	mg/L		06-JUL-13	R2644492
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	<0.050		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	0.00013		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	0.0066		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							
Nitrate (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	<0.071		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
L1327443-16 TBLANK							
Sampled By: M. St. Jean on 03-JUL-13 @ 12:00							
Matrix: Surface Water							
Miscellaneous Parameters							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-16 TBLANK							
Sampled By: M. St. Jean on 03-JUL-13 @ 12:00							
Matrix: Surface Water							
Ammonia, Total (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644431
Color, True	<2.0		2.0	C.U.		06-JUL-13	R2644496
Total Suspended Solids	<3.0		3.0	mg/L		06-JUL-13	R2644442
Turbidity	0.18		0.10	NTU		06-JUL-13	R2644448
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	<0.0030		0.0030	mg/L		07-JUL-13	R2644484
Antimony (Sb)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Arsenic (As)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Barium (Ba)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Beryllium (Be)-Total	<0.00050		0.00050	mg/L		07-JUL-13	R2644484
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Boron (B)-Total	<0.010		0.010	mg/L		07-JUL-13	R2644484
Cadmium (Cd)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Calcium (Ca)-Total	<0.020		0.020	mg/L		07-JUL-13	R2644484
Chromium (Cr)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Cobalt (Co)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Copper (Cu)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Iron (Fe)-Total	<0.010		0.010	mg/L		07-JUL-13	R2644484
Lead (Pb)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Lithium (Li)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Magnesium (Mg)-Total	<0.0050		0.0050	mg/L		07-JUL-13	R2644484
Manganese (Mn)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Molybdenum (Mo)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Nickel (Ni)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Phosphorus (P)-Total	<0.30		0.30	mg/L		07-JUL-13	R2644484
Potassium (K)-Total	<0.050		0.050	mg/L		07-JUL-13	R2644484
Selenium (Se)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Silicon (Si)-Total	<0.050		0.050	mg/L		07-JUL-13	R2644484
Silver (Ag)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Sodium (Na)-Total	<0.050		0.050	mg/L		07-JUL-13	R2644484
Strontium (Sr)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Thallium (Tl)-Total	<0.000050		0.000050	mg/L		07-JUL-13	R2644484
Tin (Sn)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Titanium (Ti)-Total	<0.00030		0.00030	mg/L		07-JUL-13	R2644484
Uranium (U)-Total	<0.000010		0.000010	mg/L		07-JUL-13	R2644484
Vanadium (V)-Total	<0.00010		0.00010	mg/L		07-JUL-13	R2644484
Zinc (Zn)-Total	<0.0030		0.0030	mg/L		07-JUL-13	R2644484
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	<0.0010		0.0010	mg/L		06-JUL-13	R2644492
Antimony (Sb)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Arsenic (As)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Barium (Ba)-Dissolved	0.000153	RRV	0.000050	mg/L		06-JUL-13	R2644492
Beryllium (Be)-Dissolved	<0.00050		0.00050	mg/L		06-JUL-13	R2644492
Bismuth (Bi)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Boron (B)-Dissolved	<0.010		0.010	mg/L		06-JUL-13	R2644492
Cadmium (Cd)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Calcium (Ca)-Dissolved	<0.020		0.020	mg/L		06-JUL-13	R2644492
Chromium (Cr)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Cobalt (Co)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Copper (Cu)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Iron (Fe)-Dissolved	<0.010		0.010	mg/L		06-JUL-13	R2644492
Lead (Pb)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1327443-16 TBLANK							
Sampled By: M. St. Jean on 03-JUL-13 @ 12:00							
Matrix: Surface Water							
Dissolved Metals in Water by CRC ICPMS							
Lithium (Li)-Dissolved	<0.0030		0.0030	mg/L		06-JUL-13	R2644492
Magnesium (Mg)-Dissolved	<0.0050		0.0050	mg/L		06-JUL-13	R2644492
Manganese (Mn)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Molybdenum (Mo)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Nickel (Ni)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Phosphorus (P)-Dissolved	<0.30		0.30	mg/L		06-JUL-13	R2644492
Potassium (K)-Dissolved	<0.050		0.050	mg/L		06-JUL-13	R2644492
Selenium (Se)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Silicon (Si)-Dissolved	<0.050		0.050	mg/L		06-JUL-13	R2644492
Silver (Ag)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Sodium (Na)-Dissolved	<0.050		0.050	mg/L		06-JUL-13	R2644492
Strontium (Sr)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Thallium (Tl)-Dissolved	<0.000050		0.000050	mg/L		06-JUL-13	R2644492
Titanium (Ti)-Dissolved	<0.00030		0.00030	mg/L		06-JUL-13	R2644492
Tin (Sn)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Uranium (U)-Dissolved	<0.000010		0.000010	mg/L		06-JUL-13	R2644492
Vanadium (V)-Dissolved	<0.00010		0.00010	mg/L		06-JUL-13	R2644492
Zinc (Zn)-Dissolved	<0.0010		0.0010	mg/L		06-JUL-13	R2644492
NO2, NO3, & (NO2+NO3) in Water							
Nitrate as N by IC							
Nitrate (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	<0.071		0.071	mg/L		07-JUL-13	
Nitrite as N by IC							
Nitrite (as N)	<0.050		0.050	mg/L		06-JUL-13	R2644651

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
COL-TRU-ED	Water	Color, True	APHA 2120
The reported color applies to the pH of the sample as submitted unless otherwise noted on the report.			
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A
MET-T-CCMS-ED	Water	Total Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A
NH3-CFA-ED	Water	Ammonia in Water by Colour	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.			
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite	CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
PH-ED	Water	pH	APHA 4500 H-Electrode
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)			
SOLIDS-TOTSUS-ED	Water	Total Suspended Solids	APHA 2540 D-Gravimetric
TURBIDITY-ED	Water	Turbidity	APHA 2130 B-Nephelometer

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

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

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

1	2

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1327443 Report Date: 07-JUL-13

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9
Contact: Tim Beckenham/Melanie St-Jean

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
COL-TRU-ED	**Water**							
Batch R2644496								
WG1702198-3 DUP		**L1327443-1**						
Color, True		7.2	7.9		C.U.	8.7	20	06-JUL-13
WG1702198-2 LCS								
Color, True			103.5		%		85-115	06-JUL-13
WG1702198-1 MB								
Color, True			<2.0		C.U.		2	06-JUL-13
MET-D-CCMS-ED	**Water**							
Batch R2644492								
WG1702089-2 CRM		**ED-HIGH-WATRM**						
Aluminum (Al)-Dissolved			103.9		%		80-120	06-JUL-13
Antimony (Sb)-Dissolved			102.1		%		80-120	06-JUL-13
Arsenic (As)-Dissolved			103.0		%		80-120	06-JUL-13
Barium (Ba)-Dissolved			103.5		%		80-120	06-JUL-13
Beryllium (Be)-Dissolved			98.8		%		80-120	06-JUL-13
Bismuth (Bi)-Dissolved			92.7		%		80-120	06-JUL-13
Boron (B)-Dissolved			94.2		%		80-120	06-JUL-13
Cadmium (Cd)-Dissolved			102.3		%		80-120	06-JUL-13
Calcium (Ca)-Dissolved			98.5		%		80-120	06-JUL-13
Chromium (Cr)-Dissolved			102.7		%		80-120	06-JUL-13
Cobalt (Co)-Dissolved			102.1		%		80-120	06-JUL-13
Copper (Cu)-Dissolved			98.4		%		80-120	06-JUL-13
Lead (Pb)-Dissolved			97.7		%		80-120	06-JUL-13
Lithium (Li)-Dissolved			98.2		%		80-120	06-JUL-13
Magnesium (Mg)-Dissolved			110.0		%		80-120	06-JUL-13
Manganese (Mn)-Dissolved			101.8		%		80-120	06-JUL-13
Molybdenum (Mo)-Dissolved			95.0		%		80-120	06-JUL-13
Nickel (Ni)-Dissolved			101.6		%		80-120	06-JUL-13
Phosphorus (P)-Dissolved			97.4		%		80-120	06-JUL-13
Potassium (K)-Dissolved			101.9		%		80-120	06-JUL-13
Selenium (Se)-Dissolved			105.9		%		80-120	06-JUL-13
Silicon (Si)-Dissolved			95.9		%		80-120	06-JUL-13
Silver (Ag)-Dissolved			97.8		%		80-120	06-JUL-13
Sodium (Na)-Dissolved			100.0		%		80-120	06-JUL-13
Strontium (Sr)-Dissolved			100.0		%		80-120	06-JUL-13
Thallium (Tl)-Dissolved			101.6		%		80-120	06-JUL-13

Quality Control Report

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9
Contact: Tim Beckenham/Melanie St-Jean

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED	**Water**							
Batch R2644492								
WG1702089-2 CRM		**ED-HIGH-WATRM**						
Titanium (Ti)-Dissolved			91.3		%		80-120	06-JUL-13
Tin (Sn)-Dissolved			93.5		%		80-120	06-JUL-13
Uranium (U)-Dissolved			91.2		%		80-120	06-JUL-13
Vanadium (V)-Dissolved			101.4		%		80-120	06-JUL-13
Zinc (Zn)-Dissolved			105.6		%		80-120	06-JUL-13
WG1702089-3 DUP		**L1328059-8**						
Aluminum (Al)-Dissolved		0.0381	0.0401		mg/L	5.1	20	06-JUL-13
Antimony (Sb)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	06-JUL-13
Arsenic (As)-Dissolved		0.00134	0.00131		mg/L	1.6	20	06-JUL-13
Barium (Ba)-Dissolved		0.0558	0.0570		mg/L	2.2	20	06-JUL-13
Beryllium (Be)-Dissolved		<0.0025	<0.0025	RPD-NA	mg/L	N/A	20	06-JUL-13
Bismuth (Bi)-Dissolved		<0.00025	<0.00025	RPD-NA	mg/L	N/A	20	06-JUL-13
Boron (B)-Dissolved		0.467	0.471		mg/L	0.8	20	06-JUL-13
Cadmium (Cd)-Dissolved		0.000638	0.000635		mg/L	0.5	20	06-JUL-13
Calcium (Ca)-Dissolved		437	443		mg/L	1.3	20	06-JUL-13
Chromium (Cr)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	06-JUL-13
Cobalt (Co)-Dissolved		0.0163	0.0163		mg/L	0.2	20	06-JUL-13
Copper (Cu)-Dissolved		0.00331	0.00352		mg/L	6.2	20	06-JUL-13
Iron (Fe)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	06-JUL-13
Lead (Pb)-Dissolved		<0.00025	<0.00025	RPD-NA	mg/L	N/A	20	06-JUL-13
Lithium (Li)-Dissolved		0.659	0.646		mg/L	2.0	20	06-JUL-13
Magnesium (Mg)-Dissolved		463	464		mg/L	0.2	20	06-JUL-13
Manganese (Mn)-Dissolved		7.46	7.38		mg/L	1.1	20	06-JUL-13
Molybdenum (Mo)-Dissolved		0.00904	0.00884		mg/L	2.3	20	06-JUL-13
Nickel (Ni)-Dissolved		0.0736	0.0740		mg/L	0.6	20	06-JUL-13
Phosphorus (P)-Dissolved		<1.5	<1.5	RPD-NA	mg/L	N/A	20	06-JUL-13
Potassium (K)-Dissolved		11.4	11.4		mg/L	0.1	20	06-JUL-13
Selenium (Se)-Dissolved		0.00539	0.00586		mg/L	8.3	20	06-JUL-13
Silicon (Si)-Dissolved		13.6	13.3		mg/L	1.9	20	06-JUL-13
Silver (Ag)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-JUL-13
Sodium (Na)-Dissolved		272	267		mg/L	2.1	20	06-JUL-13
Strontium (Sr)-Dissolved		2.10	2.13		mg/L	1.6	20	06-JUL-13
Thallium (Tl)-Dissolved		<0.00025	<0.00025	RPD-NA	mg/L	N/A	20	06-JUL-13

Quality Control Report

Workorder: L1327443 Report Date: 07-JUL-13

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9

Contact: Tim Beckenham/Melanie St-Jean

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED	**Water**							
Batch R2644492								
WG1702089-3 DUP		**L1328059-8**						
Titanium (Ti)-Dissolved		<0.0015	<0.0015	RPD-NA	mg/L	N/A	20	06-JUL-13
Tin (Sn)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	06-JUL-13
Uranium (U)-Dissolved		0.410	0.418		mg/L	1.9	20	06-JUL-13
Vanadium (V)-Dissolved		0.00056	0.00065		mg/L	15	20	06-JUL-13
Zinc (Zn)-Dissolved		0.0335	0.0322		mg/L	4.0	20	06-JUL-13
WG1702089-1 MB								
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	06-JUL-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	06-JUL-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	06-JUL-13
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	06-JUL-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	06-JUL-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	06-JUL-13
Boron (B)-Dissolved			<0.010		mg/L		0.01	06-JUL-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	06-JUL-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	06-JUL-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	06-JUL-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	06-JUL-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	06-JUL-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	06-JUL-13
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	06-JUL-13
Lithium (Li)-Dissolved			<0.0030		mg/L		0.003	06-JUL-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	06-JUL-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	06-JUL-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	06-JUL-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	06-JUL-13
Phosphorus (P)-Dissolved			<0.30		mg/L		0.3	06-JUL-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	06-JUL-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	06-JUL-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	06-JUL-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	06-JUL-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	06-JUL-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	06-JUL-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	06-JUL-13
							0.0003	

Quality Control Report

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9
Contact: Tim Beckenham/Melanie St-Jean

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED	**Water**							
Batch R2644492								
WG1702089-1 MB								
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	06-JUL-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	06-JUL-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	06-JUL-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	06-JUL-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	06-JUL-13
MET-T-CCMS-ED	**Water**							
Batch R2644484								
WG1702175-3 DUP		**L1328087-1**						
Aluminum (Al)-Total		1.09	1.35	DUP-H	mg/L	21	20	07-JUL-13
Antimony (Sb)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	07-JUL-13
Arsenic (As)-Total		0.00270	0.00303		mg/L	12	20	07-JUL-13
Barium (Ba)-Total		0.162	0.170		mg/L	4.5	20	07-JUL-13
Beryllium (Be)-Total		<0.0025	<0.0025	RPD-NA	mg/L	N/A	20	07-JUL-13
Bismuth (Bi)-Total		<0.00025	<0.00025	RPD-NA	mg/L	N/A	20	07-JUL-13
Boron (B)-Total		0.054	0.053		mg/L	1.7	20	07-JUL-13
Cadmium (Cd)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	07-JUL-13
Calcium (Ca)-Total		47.6	47.5		mg/L	0.2	20	07-JUL-13
Chromium (Cr)-Total		0.00477	0.00565		mg/L	17	20	07-JUL-13
Cobalt (Co)-Total		0.00166	0.00183		mg/L	9.8	20	07-JUL-13
Copper (Cu)-Total		0.0113	0.0113		mg/L	0.1	20	07-JUL-13
Iron (Fe)-Total		2.65	3.42	DUP-H	mg/L	25	20	07-JUL-13
Lead (Pb)-Total		0.00310	0.00330		mg/L	6.0	20	07-JUL-13
Lithium (Li)-Total		0.025	0.025		mg/L	0.2	20	07-JUL-13
Magnesium (Mg)-Total		5.00	5.05		mg/L	1.0	20	07-JUL-13
Manganese (Mn)-Total		0.119	0.126		mg/L	6.0	20	07-JUL-13
Molybdenum (Mo)-Total		0.0115	0.0123		mg/L	6.9	20	07-JUL-13
Nickel (Ni)-Total		0.00720	0.00784		mg/L	8.6	20	07-JUL-13
Phosphorus (P)-Total		<1.5	<1.5	RPD-NA	mg/L	N/A	20	07-JUL-13
Potassium (K)-Total		1.50	1.54		mg/L	2.9	20	07-JUL-13
Selenium (Se)-Total		0.00105	0.00111		mg/L	5.6	20	07-JUL-13
Silicon (Si)-Total		4.62	5.21		mg/L	12	20	07-JUL-13
Silver (Ag)-Total		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	07-JUL-13
Sodium (Na)-Total		126	124		mg/L	1.9	20	07-JUL-13

Quality Control Report

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9
Contact: Tim Beckenham/Melanie St-Jean

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2644484								
WG1702175-3 DUP		**L1328087-1**						
Strontium (Sr)-Total		0.282	0.289		mg/L	2.4	20	07-JUL-13
Thallium (Tl)-Total		<0.00025	<0.00025	RPD-NA	mg/L	N/A	20	07-JUL-13
Tin (Sn)-Total		0.00273	0.00284		mg/L	4.0	20	07-JUL-13
Titanium (Ti)-Total		0.0369	0.0404		mg/L	9.1	20	07-JUL-13
Uranium (U)-Total		0.00998	0.00977		mg/L	2.1	20	07-JUL-13
Vanadium (V)-Total		0.00431	0.00466		mg/L	7.7	20	07-JUL-13
Zinc (Zn)-Total		0.043	0.051		mg/L	16	20	07-JUL-13
WG1702178-2 DUP		**L1327405-1**						
Aluminum (Al)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	07-JUL-13
Antimony (Sb)-Total		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	07-JUL-13
Arsenic (As)-Total		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	07-JUL-13
Barium (Ba)-Total		0.0548	0.0548		mg/L	0.0	20	07-JUL-13
Beryllium (Be)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	07-JUL-13
Bismuth (Bi)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	07-JUL-13
Boron (B)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	07-JUL-13
Cadmium (Cd)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	07-JUL-13
Calcium (Ca)-Total		76.8	73.4		mg/L	4.6	20	07-JUL-13
Chromium (Cr)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	07-JUL-13
Cobalt (Co)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	07-JUL-13
Copper (Cu)-Total		0.0030	0.0030		mg/L	0.4	20	07-JUL-13
Iron (Fe)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	07-JUL-13
Lead (Pb)-Total		0.00016	0.00015		mg/L	3.2	20	07-JUL-13
Lithium (Li)-Total		0.0098	0.0087		mg/L	12	20	07-JUL-13
Magnesium (Mg)-Total		23.1	23.3		mg/L	0.8	20	07-JUL-13
Manganese (Mn)-Total		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	07-JUL-13
Molybdenum (Mo)-Total		0.00156	0.00141		mg/L	10	20	07-JUL-13
Nickel (Ni)-Total		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	07-JUL-13
Phosphorus (P)-Total		<0.30	<0.30	RPD-NA	mg/L	N/A	20	07-JUL-13
Potassium (K)-Total		1.32	1.34		mg/L	1.1	20	07-JUL-13
Selenium (Se)-Total		0.00056	0.00058		mg/L	3.4	20	07-JUL-13
Silicon (Si)-Total		1.79	1.74		mg/L	3.0	20	07-JUL-13
Silver (Ag)-Total		0.00040	<0.00040	RPD-NA	mg/L	N/A	20	07-JUL-13
Sodium (Na)-Total		14.7	14.7		mg/L	0.2	20	07-JUL-13

Quality Control Report

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9
Contact: Tim Beckenham/Melanie St-Jean

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2644484								
WG1702178-2 DUP		**L1327405-1**						
Strontium (Sr)-Total		0.359	0.338		mg/L	6.0	20	07-JUL-13
Thallium (Tl)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	07-JUL-13
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	07-JUL-13
Titanium (Ti)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	07-JUL-13
Uranium (U)-Total		0.00080	0.00079		mg/L	1.0	20	07-JUL-13
Vanadium (V)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	07-JUL-13
Zinc (Zn)-Total		0.0046	0.0048		mg/L	4.2	20	07-JUL-13
WG1702175-2 LCS								
Aluminum (Al)-Total			97.4		%		80-120	07-JUL-13
Antimony (Sb)-Total			101.0		%		80-120	07-JUL-13
Arsenic (As)-Total			95.7		%		80-120	07-JUL-13
Barium (Ba)-Total			95.1		%		80-120	07-JUL-13
Beryllium (Be)-Total			96.2		%		80-120	07-JUL-13
Bismuth (Bi)-Total			96.3		%		80-120	07-JUL-13
Boron (B)-Total			99.6		%		80-120	07-JUL-13
Cadmium (Cd)-Total			98.9		%		80-120	07-JUL-13
Calcium (Ca)-Total			96.9		%		80-120	07-JUL-13
Chromium (Cr)-Total			95.8		%		80-120	07-JUL-13
Cobalt (Co)-Total			95.1		%		80-120	07-JUL-13
Copper (Cu)-Total			92.0		%		80-120	07-JUL-13
Iron (Fe)-Total			91.7		%		80-120	07-JUL-13
Lead (Pb)-Total			99.0		%		80-120	07-JUL-13
Lithium (Li)-Total			96.5		%		80-120	07-JUL-13
Magnesium (Mg)-Total			90.5		%		80-120	07-JUL-13
Manganese (Mn)-Total			93.4		%		80-120	07-JUL-13
Molybdenum (Mo)-Total			98.7		%		80-120	07-JUL-13
Nickel (Ni)-Total			93.9		%		80-120	07-JUL-13
Potassium (K)-Total			92.4		%		80-120	07-JUL-13
Selenium (Se)-Total			106.0		%		80-120	07-JUL-13
Silicon (Si)-Total			118.4		%		80-120	07-JUL-13
Silver (Ag)-Total			95.1		%		80-120	07-JUL-13
Sodium (Na)-Total			101.7		%		80-120	07-JUL-13
Strontium (Sr)-Total			96.5		%		80-120	07-JUL-13

Quality Control Report

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9
Contact: Tim Beckenham/Melanie St-Jean

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2644484								
WG1702175-2 LCS								
Thallium (Tl)-Total			105.4		%		80-120	07-JUL-13
Tin (Sn)-Total			93.2		%		80-120	07-JUL-13
Titanium (Ti)-Total			86.7		%		80-120	07-JUL-13
Uranium (U)-Total			92.4		%		80-120	07-JUL-13
Vanadium (V)-Total			92.9		%		80-120	07-JUL-13
Zinc (Zn)-Total			99.98		%		80-120	07-JUL-13
WG1702175-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	07-JUL-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	07-JUL-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	07-JUL-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	07-JUL-13
Boron (B)-Total			<0.010		mg/L		0.01	07-JUL-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	07-JUL-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	07-JUL-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Iron (Fe)-Total			<0.010		mg/L		0.01	07-JUL-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	07-JUL-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	07-JUL-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	07-JUL-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	07-JUL-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	07-JUL-13
Potassium (K)-Total			<0.050		mg/L		0.05	07-JUL-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Silicon (Si)-Total			<0.050		mg/L		0.05	07-JUL-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	07-JUL-13
Sodium (Na)-Total			<0.050		mg/L		0.05	07-JUL-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	07-JUL-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	07-JUL-13

Quality Control Report

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9
Contact: Tim Beckenham/Melanie St-Jean

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2644484								
WG1702175-1 MB								
Uranium (U)-Total			<0.000010		mg/L		0.00001	07-JUL-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	07-JUL-13
WG1702178-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	07-JUL-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	07-JUL-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	07-JUL-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	07-JUL-13
Boron (B)-Total			<0.010		mg/L		0.01	07-JUL-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	07-JUL-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	07-JUL-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Iron (Fe)-Total			<0.010		mg/L		0.01	07-JUL-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	07-JUL-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	07-JUL-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	07-JUL-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	07-JUL-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	07-JUL-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	07-JUL-13
Potassium (K)-Total			<0.050		mg/L		0.05	07-JUL-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Silicon (Si)-Total			<0.050		mg/L		0.05	07-JUL-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	07-JUL-13
Sodium (Na)-Total			<0.050		mg/L		0.05	07-JUL-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	07-JUL-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	07-JUL-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	07-JUL-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	07-JUL-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	07-JUL-13

ALS Environmental

Quality Control Report

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9

Contact: Tim Beckenham/Melanie St-Jean

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2644484								
WG1702178-1 MB								
Zinc (Zn)-Total			<0.0030		mg/L		0.003	07-JUL-13
NH3-CFA-ED	**Water**							
Batch R2644431								
WG1702137-3 DUP		**L1327443-16**						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	06-JUL-13
WG1702137-2 LCS								
Ammonia, Total (as N)			101.6		%		85-115	06-JUL-13
WG1702137-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	06-JUL-13
WG1702137-4 MS		**L1327443-16**						
Ammonia, Total (as N)			108.9		%		75-125	06-JUL-13
NO2-IC-ED	**Water**							
Batch R2644651								
WG1702224-2 LCS								
Nitrite (as N)			91.8		%		85-115	06-JUL-13
WG1702224-1 MB								
Nitrite (as N)			<0.050		mg/L		0.05	06-JUL-13
NO3-IC-ED	**Water**							
Batch R2644651								
WG1702224-2 LCS								
Nitrate (as N)			98.6		%		85-115	06-JUL-13
WG1702224-1 MB								
Nitrate (as N)			<0.050		mg/L		0.05	06-JUL-13
SOLIDS-TOTSUS-ED	**Water**							
Batch R2644442								
WG1702042-3 DUP		**L1327443-16**						
Total Suspended Solids		<3.0	<3.0	RPD-NA	mg/L	N/A	20	06-JUL-13
WG1702042-4 DUP		**L1327438-50**						
Total Suspended Solids		4.0	8.0	J	mg/L	4.0	6	06-JUL-13
WG1702042-1 MB								
Total Suspended Solids			<3.0		mg/L		3	06-JUL-13
TURBIDITY-ED	**Water**							

Quality Control Report

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9

Contact: Tim Beckenham/Melanie St-Jean

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TURBIDITY-ED	**Water**							
Batch R2644448								
WG1702135-3 DUP		**L1327438-49**						
Turbidity		4.22	4.24		NTU	0.5	15	06-JUL-13
WG1702135-4 DUP		**L1327443-14**						
Turbidity		3.53	3.55		NTU	0.6	15	06-JUL-13
WG1702135-2 LCS								
Turbidity			97.8		%		70-130	06-JUL-13
WG1702135-1 MB								
Turbidity			<0.10		NTU		0.1	06-JUL-13

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9
Contact: Tim Beckenham/Melanie St-Jean

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1327443 Report Date: 07-JUL-13

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9
Contact: Tim Beckenham/Melanie St-Jean

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Color, True							
	1	03-JUL-13 09:00	06-JUL-13 15:22	48	78	hours	EHTL
	2	03-JUL-13 09:00	06-JUL-13 15:22	48	78	hours	EHTL
	3	03-JUL-13 09:00	06-JUL-13 15:22	48	78	hours	EHTL
	4	03-JUL-13 09:30	06-JUL-13 15:22	48	78	hours	EHTL
	5	03-JUL-13 09:30	06-JUL-13 15:22	48	78	hours	EHTL
	6	03-JUL-13 07:00	06-JUL-13 15:22	48	80	hours	EHTL
	7	03-JUL-13 07:00	06-JUL-13 15:22	48	80	hours	EHTL
	8	03-JUL-13 07:00	06-JUL-13 15:22	48	80	hours	EHTL
	9	03-JUL-13 10:00	06-JUL-13 15:22	48	77	hours	EHTL
	10	03-JUL-13 10:00	06-JUL-13 15:22	48	77	hours	EHTL
	11	03-JUL-13 06:30	06-JUL-13 15:22	48	81	hours	EHTL
	12	03-JUL-13 06:30	06-JUL-13 15:22	48	81	hours	EHTL
	13	03-JUL-13 10:30	06-JUL-13 15:22	48	77	hours	EHTL
	14	03-JUL-13 10:30	06-JUL-13 15:22	48	77	hours	EHTL
	15	03-JUL-13 11:00	06-JUL-13 15:22	48	76	hours	EHTL
	16	03-JUL-13 12:00	06-JUL-13 15:22	48	75	hours	EHTL
Turbidity							
	1	03-JUL-13 09:00	06-JUL-13 00:00	48	63	hours	EHTL
	2	03-JUL-13 09:00	06-JUL-13 00:00	48	63	hours	EHTL
	3	03-JUL-13 09:00	06-JUL-13 00:00	48	63	hours	EHTL
	4	03-JUL-13 09:30	06-JUL-13 00:00	48	62	hours	EHTL
	5	03-JUL-13 09:30	06-JUL-13 00:00	48	62	hours	EHTL
	6	03-JUL-13 07:00	06-JUL-13 00:00	48	65	hours	EHTL
	7	03-JUL-13 07:00	06-JUL-13 00:00	48	65	hours	EHTL
	8	03-JUL-13 07:00	06-JUL-13 00:00	48	65	hours	EHTL
	9	03-JUL-13 10:00	06-JUL-13 00:00	48	62	hours	EHTL
	10	03-JUL-13 10:00	06-JUL-13 00:00	48	62	hours	EHTL
	11	03-JUL-13 06:30	06-JUL-13 00:00	48	66	hours	EHTL
	12	03-JUL-13 06:30	06-JUL-13 00:00	48	66	hours	EHTL
	13	03-JUL-13 10:30	06-JUL-13 00:00	48	61	hours	EHTL
	14	03-JUL-13 10:30	06-JUL-13 00:00	48	61	hours	EHTL
	15	03-JUL-13 11:00	06-JUL-13 00:00	48	61	hours	EHTL
	16	03-JUL-13 12:00	06-JUL-13 00:00	48	60	hours	EHTL
pH							
	1	03-JUL-13 09:00	06-JUL-13 10:00	0.25	73	hours	EHTR-FM
	2	03-JUL-13 09:00	06-JUL-13 10:04	0.25	73	hours	EHTR-FM
	3	03-JUL-13 09:00	06-JUL-13 10:07	0.25	73	hours	EHTR-FM
	4	03-JUL-13 09:30	06-JUL-13 10:11	0.25	73	hours	EHTR-FM
	5	03-JUL-13 09:30	06-JUL-13 10:14	0.25	73	hours	EHTR-FM
	6	03-JUL-13 07:00	06-JUL-13 10:18	0.25	75	hours	EHTR-FM
	7	03-JUL-13 07:00	06-JUL-13 10:22	0.25	75	hours	EHTR-FM
	8	03-JUL-13 07:00	06-JUL-13 10:25	0.25	75	hours	EHTR-FM
	9	03-JUL-13 10:00	06-JUL-13 10:29	0.25	72	hours	EHTR-FM
	10	03-JUL-13 10:00	06-JUL-13 10:33	0.25	72	hours	EHTR-FM
	11	03-JUL-13 06:30	06-JUL-13 10:36	0.25	76	hours	EHTR-FM
	12	03-JUL-13 06:30	06-JUL-13 10:40	0.25	76	hours	EHTR-FM
	13	03-JUL-13 10:30	06-JUL-13 10:44	0.25	72	hours	EHTR-FM
	14	03-JUL-13 10:30	06-JUL-13 10:51	0.25	72	hours	EHTR-FM
	15	03-JUL-13 11:00	06-JUL-13 11:39	0.25	73	hours	EHTR-FM
Anions and Nutrients							
Nitrate as N by IC							

Quality Control Report

Workorder: L1327443 Report Date: 07-JUL-13

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9

Contact: Tim Beckenham/Melanie St-Jean

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Anions and Nutrients							
Nitrate as N by IC							
	1	03-JUL-13 09:00	06-JUL-13 08:00	48	71	hours	EHTL
	2	03-JUL-13 09:00	06-JUL-13 08:00	48	71	hours	EHTL
	3	03-JUL-13 09:00	06-JUL-13 08:00	48	71	hours	EHTL
	4	03-JUL-13 09:30	06-JUL-13 08:00	48	71	hours	EHTL
	5	03-JUL-13 09:30	06-JUL-13 08:00	48	71	hours	EHTL
	6	03-JUL-13 07:00	06-JUL-13 08:00	48	73	hours	EHTL
	7	03-JUL-13 07:00	06-JUL-13 08:00	48	73	hours	EHTL
	8	03-JUL-13 07:00	06-JUL-13 08:00	48	73	hours	EHTL
	9	03-JUL-13 10:00	06-JUL-13 08:00	48	70	hours	EHTL
	10	03-JUL-13 10:00	06-JUL-13 08:00	48	70	hours	EHTL
	11	03-JUL-13 06:30	06-JUL-13 08:00	48	73	hours	EHTL
	12	03-JUL-13 06:30	06-JUL-13 08:00	48	73	hours	EHTL
	13	03-JUL-13 10:30	06-JUL-13 08:00	48	70	hours	EHTL
	14	03-JUL-13 10:30	06-JUL-13 08:00	48	70	hours	EHTL
	15	03-JUL-13 11:00	06-JUL-13 08:00	48	69	hours	EHTL
	16	03-JUL-13 12:00	06-JUL-13 08:00	48	68	hours	EHTL
Nitrite as N by IC							
	1	03-JUL-13 09:00	06-JUL-13 08:00	48	71	hours	EHTL
	2	03-JUL-13 09:00	06-JUL-13 08:00	48	71	hours	EHTL
	3	03-JUL-13 09:00	06-JUL-13 08:00	48	71	hours	EHTL
	4	03-JUL-13 09:30	06-JUL-13 08:00	48	71	hours	EHTL
	5	03-JUL-13 09:30	06-JUL-13 08:00	48	71	hours	EHTL
	6	03-JUL-13 07:00	06-JUL-13 08:00	48	73	hours	EHTL
	7	03-JUL-13 07:00	06-JUL-13 08:00	48	73	hours	EHTL
	8	03-JUL-13 07:00	06-JUL-13 08:00	48	73	hours	EHTL
	9	03-JUL-13 10:00	06-JUL-13 08:00	48	70	hours	EHTL
	10	03-JUL-13 10:00	06-JUL-13 08:00	48	70	hours	EHTL
	11	03-JUL-13 06:30	06-JUL-13 08:00	48	73	hours	EHTL
	12	03-JUL-13 06:30	06-JUL-13 08:00	48	73	hours	EHTL
	13	03-JUL-13 10:30	06-JUL-13 08:00	48	70	hours	EHTL
	14	03-JUL-13 10:30	06-JUL-13 08:00	48	70	hours	EHTL
	15	03-JUL-13 11:00	06-JUL-13 08:00	48	69	hours	EHTL
	16	03-JUL-13 12:00	06-JUL-13 08:00	48	68	hours	EHTL

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1327443 were received on 04-JUL-13 17:40.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

Quality Control Report

Workorder: L1327443 Report Date: 07-JUL-13

Client: WESA Inc.
4901-48 St. Ground Floor
Yellowknife NT X1A 2P9
Contact: Tim Beckenham/Melanie St-Jean

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To	
Company:	Blu Hemic Environmental Inc.
Contact:	Mélanie St.Jean/Tim Beckenham
Address:	4 Cataraqui Street The Tower, Kingston, ON K7K 1Z7
Phone:	Fax: (613) 531-1852
Invoice To	Same as Report ? (circle) Yes or No (if No, provide details) — No
	Copy of Invoice with Report? (circle) Yes or No — Yes
Company:	TEES Ltd.
Contact:	Leigh Gauthier
Address:	98 Archibald Street, Box 133, Yellowknife, NT X1A 2N1
Phone: (867) 669-9481	Fax: (867) 669-9482
Lab Work Order # (lab use only)	L1327443

Report Format / Distribution	
Standard: ✓	Other (specify):
Select: PDF ✓ Excel ✓ Digital	Fax
Email 1:	ppoirier@envireau.ca
Email 2:	mstjean@envireau.ca
Email 3:	cproux@envireau.ca
Client / Project Information	
Job #:	YB 11192-00-00
PO / AFE:	
LSD:	
Quote #:	
ALS Contact:	Sampler: Melanie St Jean

Service Request: (Rush subject to availability - Contact ALS to confirm TAT)	
	Regular (Standard Turnaround Times - Business Days)
	Priority (2-4 Business Days)-50% surcharge - Contact ALS to confirm TAT
X	Emergency (1-2 Business Days)-100% Surcharge - Contact ALS to confirm TAT
X	Same Day or Weekend Emergency - Contact ALS to confirm TAT

Analysis Request (Indicate Filtered or Preserved, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metals (As, Cu, Pb, Ni, Zn) P	Dissolved metals (As, Cu, Pb, Ni, Zn) F P	Total Ammonia (NH3) P	Nitrite/Nitrate (NO2/NO3)	TSS, Color, Turbidity	pH							Number of Containers
	UP1-S-OFF	03-07-2013	9am	surface water	X	X	X	X	X	X							5
	UP1-S-DOF	03-07-2013	9am	"	X	X	X	X	X	X							5
	UP1-~~M~~-OFF	"	9am	"	X	X	X	X	X	X							5
	UP2-S-OFF	"	9:30 am	"	X	X	X	X	X	X							5
	UP2-M-OFF	"	9:30 am	"	X	X	X	X	X	X							5
	UP3-S-OFF	"	7:00am	"	X	X	X	X	X	X							5
	UP3-M-OFF	"	7:00	"	X	X	X	X	X	X							5
	UP3-S-DOF	"	7:00am	"	X	X	X	X	X	X							5
	UP4-S-OFF	"	10:00am	"	X	X	X	X	X	X							5
	UP4-M-OFF	"	10:00am	"	X	X	X	X	X	X							5
	UP5-S-OFF	"	6:30am	"	X	X	X	X	X	X							5
	UP5-M-OFF	"	6:30am	"	X	X	X	X	X	X							5

Special Instructions / Regulation with water or land use (CCME- Freshwater Aquatic Life/BC CSR-Commercial/AB Tier 1

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

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				
Released by:	Date:	Time:	Received by: [signature]	Date: July 4/13	Time: 5:40	Temperature: 6.8, 4.0 / 7.3, 4.0 °C	Verified

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW

7.7, 2.0
4.9, 2.0

L1327443-COFC

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To

Company: BluMetric Environmental Inc.

Contact: Mélanie St Jean / Tim Beckenham

Address: 4 Cataraqui Street, The Tower, Kingston, ON

Phone: Fax: (613)531-1852

Report Format / Distribution

Standard: ✓ Other (specify):

Select: PDF ✓ Excel ✓ Digital Fax

Email 1: ppoirier@envireau.ca

Email 2: mstjean@envireau.ca

Email 3: cproux@envireau.ca

Service Request (Rush subject to availability - Contact ALS to confirm TAT)

- Regular (Standard Turnaround Times - Business Days)
- Priority (2-4 Business Days)-50% surcharge - Contact ALS to confirm TAT
- Emergency (1-2 Business Days)-100% Surcharge - Contact ALS to confirm TAT
- X Same Day or Weekend Emergency - Contact ALS to confirm TAT

Invoice To Same as Report ? (circle) Yes or No (if No, provide details)

Copy of Invoice with Report? (circle) Yes or No

Company: TEES Ltd.

Contact: Leigh Gauthier

Address: 98 Archibald Street, Box 133, Yellowknife, NT X1A2N

Phone: (867)669-9481 Fax: (867)669-9482

Client / Project Information

Job #: VB1192-00-00

PO / AFE:

LSD:

Quote #:

Lab Work Order # (lab use only)

ALS Contact:

Sampler: Melanie St-Jean

Analysis Request (Indicate Filtered or Preserved, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total metals (As, Cu, Ni, Pb, Zn) P	Dissolved metals (As, Cu, Ni, Pb, Zn) F P	Total ammonia (NH3) P	Nitrite, Nitrate (NO2, NO3) P	TSS, color, Turbidity	pH	Number of Containers
	UP6-S-OFF	03-07-2013	10:30am	Surface water	X	X	X	X	X	+	5
	UP6-M-OFF	"	10:30am	"	X	X	X	X	X	+	5
	UP-EQ-OFF	"	11:00am	"	X	X	X	X	X	X	5
	TBlank	—		—	X	X	X	X	X		3

L1327443-COFC

Special Instructions / Regulation with water or land use (CCME- Freshwater Aquatic Life/BC CSR-Commercial/AI

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

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date:	Time:	Received by:	Date: July 4/13	Time: 5:40	Temperature: 4.9 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326e v06 Front/22 May 2013

WESA Inc.
ATTN: Tim Beckenham
4 Cataraqui Street
The Tower
Kingston ON K7K 1Z7

Date Received: 29-JUL-13
Report Date: 01-AUG-13 16:19 (MT)
Version: FINAL

Client Phone: --

Certificate of Analysis

Lab Work Order #:	**L1339689**
Project P.O. #:	NOT SUBMITTED
Job Reference:	ABORIGINAL 15929
C of C Numbers:	1, 2
Legal Site Desc:	

Cath Evaristo Cordero

Catherine Evaristo-Cordero
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1339689-1	L1339689-2	L1339689-3	L1339689-4	L1339689-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13
	Sampled Time	14:00	14:00	14:00	14:00	14:00
	Client ID	UP1-S	UP1-M	UP1-B	UP2-S	UP2-M
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.83	7.84	7.83	7.84	7.85
	Total Suspended Solids (mg/L)	6.0	<3.0	7.0	5.0	3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.102	0.080	0.073	0.120	0.066
	Nitrate and Nitrite (as N) (mg/L)	0.148	0.153	0.130	0.166	0.151
	Nitrate (as N) (mg/L)	0.148	0.153	0.130	0.166	0.151
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Total Metals	Aluminum (Al)-Total (mg/L)	0.0597	0.0716	0.157	0.0648	0.0696
	Antimony (Sb)-Total (mg/L)	0.00073	0.00074	0.00077	0.00072	0.00074
	Arsenic (As)-Total (mg/L)	0.227	0.235	0.268	0.235	0.240
	Barium (Ba)-Total (mg/L)	0.0164	0.0169	0.0178	0.0166	0.0164
	Beryllium (Be)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	0.000052	<0.000050
	Boron (B)-Total (mg/L)	0.032	0.033	0.033	0.031	0.032
	Cadmium (Cd)-Total (mg/L)	0.000012	0.000015	0.000016	0.000100	0.000016
	Calcium (Ca)-Total (mg/L)	116	120	120	115	117
	Chromium (Cr)-Total (mg/L)	0.00026	0.00064	0.00075	0.00028	0.00037
	Cobalt (Co)-Total (mg/L)	0.00383	0.00396	0.00409	0.00396	0.00400
	Copper (Cu)-Total (mg/L)	0.00187	0.00213	0.00223	0.00191	0.00199
	Iron (Fe)-Total (mg/L)	0.748	0.816	1.10	0.759	0.776
	Lead (Pb)-Total (mg/L)	0.000472	0.000514	0.000849	0.000511	0.000525
	Lithium (Li)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Magnesium (Mg)-Total (mg/L)	8.46	8.81	8.93	8.50	8.75
	Manganese (Mn)-Total (mg/L)	0.131	0.136	0.142	0.134	0.137
	Molybdenum (Mo)-Total (mg/L)	0.00233	0.00244	0.00238	0.00231	0.00238
	Nickel (Ni)-Total (mg/L)	0.00741	0.00827	0.00806	0.00745	0.00796
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)	7.17	7.28	7.32	7.16	7.20
	Selenium (Se)-Total (mg/L)	<0.00010	0.00011	<0.00010	0.00011	0.00010
	Silicon (Si)-Total (mg/L)	0.653	0.691	0.790	0.701	0.692
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	28.1	29.3	29.4	28.6	28.9
	Strontium (Sr)-Total (mg/L)	0.194	0.194	0.197	0.188	0.193
	Thallium (Tl)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Tin (Sn)-Total (mg/L)	<0.00010	0.00026	0.00014	<0.00010	0.00026
	Titanium (Ti)-Total (mg/L)	0.00275	0.00271	0.00610	0.00241	0.00265
	Uranium (U)-Total (mg/L)	0.000305	0.000315	0.000323	0.000311	0.000308
	Vanadium (V)-Total (mg/L)	0.00035	0.00036	0.00064	0.00038	0.00037

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1339689-6	L1339689-7	L1339689-8	L1339689-9	L1339689-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13
	Sampled Time	14:00	14:00	14:00	14:00	14:00
	Client ID	UP2-B	UP3-S	UP3-M	UP3-B	UP4-S
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.84	7.85	7.85	7.86	7.86
	Total Suspended Solids (mg/L)	4.0	8.0	6.0	3.0	8.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.104	0.075	0.085	0.109	0.092
	Nitrate and Nitrite (as N) (mg/L)	0.154	0.146	0.153	0.159	0.164
	Nitrate (as N) (mg/L)	0.154	0.146	0.153	0.159	0.164
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Total Metals	Aluminum (Al)-Total (mg/L)	0.0575	0.0645	0.0672	0.0652	0.0707
	Antimony (Sb)-Total (mg/L)	0.00069	0.00075	0.00075	0.00075	0.00073
	Arsenic (As)-Total (mg/L)	0.227	0.249	0.257	0.243	0.244
	Barium (Ba)-Total (mg/L)	0.0164	0.0163	0.0173	0.0169	0.0164
	Beryllium (Be)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	0.031	0.033	0.033	0.032	0.032
	Cadmium (Cd)-Total (mg/L)	0.000015	0.000011	0.000014	0.000012	0.000011
	Calcium (Ca)-Total (mg/L)	109	121	117	115	117
	Chromium (Cr)-Total (mg/L)	0.00037	0.00026	0.00099	0.00031	0.00030
	Cobalt (Co)-Total (mg/L)	0.00381	0.00386	0.00405	0.00385	0.00389
	Copper (Cu)-Total (mg/L)	0.00185	0.00198	0.00226	0.00220	0.00189
	Iron (Fe)-Total (mg/L)	0.740	0.733	0.766	0.711	0.724
	Lead (Pb)-Total (mg/L)	0.000483	0.000511	0.000559	0.000514	0.000507
	Lithium (Li)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Magnesium (Mg)-Total (mg/L)	8.18	8.59	8.97	8.32	8.48
	Manganese (Mn)-Total (mg/L)	0.129	0.133	0.137	0.131	0.134
	Molybdenum (Mo)-Total (mg/L)	0.00225	0.00240	0.00252	0.00240	0.00236
	Nickel (Ni)-Total (mg/L)	0.00769	0.00757	0.00842	0.00759	0.00755
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)	6.71	7.46	7.10	6.95	7.38
	Selenium (Se)-Total (mg/L)	<0.00010	0.00010	0.00010	<0.00010	0.00011
	Silicon (Si)-Total (mg/L)	0.658	0.670	0.700	0.664	0.691
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	0.000011	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	27.4	28.7	29.1	27.9	28.5
	Strontium (Sr)-Total (mg/L)	0.187	0.189	0.198	0.191	0.191
	Thallium (Tl)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Tin (Sn)-Total (mg/L)	0.00015	<0.00010	0.00015	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	0.00256	0.00263	0.00277	0.00279	0.00259
	Uranium (U)-Total (mg/L)	0.000291	0.000315	0.000320	0.000315	0.000311
	Vanadium (V)-Total (mg/L)	0.00031	0.00036	0.00040	0.00037	0.00039

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1339689-11	L1339689-12	L1339689-13	L1339689-14	L1339689-15
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13
	Sampled Time	14:00	14:00	14:00	14:00	14:00
	Client ID	UP4-M	UP4-B	UP5-S	UP5-M	UP5-B
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.86	7.86	7.85	7.85	7.86
	Total Suspended Solids (mg/L)	6.0	4.0	6.0	7.0	6.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.088	0.078	0.066	<0.050	<0.050
	Nitrate and Nitrite (as N) (mg/L)	0.154	0.149	0.150	0.146	0.142
	Nitrate (as N) (mg/L)	0.154	0.149	0.150	0.146	0.142
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Total Metals	Aluminum (Al)-Total (mg/L)	0.0732	0.0704	0.0676	0.0892	0.0712
	Antimony (Sb)-Total (mg/L)	0.00072	0.00073	0.00078	0.00077	0.00073
	Arsenic (As)-Total (mg/L)	0.237	0.247	0.275	0.268	0.269
	Barium (Ba)-Total (mg/L)	0.0163	0.0168	0.0172	0.0171	0.0167
	Beryllium (Be)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	0.032	0.034	0.034	0.032	0.033
	Cadmium (Cd)-Total (mg/L)	0.000017	0.000014	0.000022	0.000013	0.000013
	Calcium (Ca)-Total (mg/L)	113	121	119	114	117
	Chromium (Cr)-Total (mg/L)	0.00042	0.00089	0.00029	0.00091	0.00038
	Cobalt (Co)-Total (mg/L)	0.00378	0.00400	0.00409	0.00381	0.00393
	Copper (Cu)-Total (mg/L)	0.00194	0.00200	0.00203	0.00201	0.00201
	Iron (Fe)-Total (mg/L)	0.723	0.741	0.737	0.733	0.708
	Lead (Pb)-Total (mg/L)	0.000532	0.000536	0.000578	0.000594	0.000594
	Lithium (Li)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Magnesium (Mg)-Total (mg/L)	8.13	8.73	8.59	8.23	8.40
	Manganese (Mn)-Total (mg/L)	0.130	0.136	0.140	0.135	0.135
	Molybdenum (Mo)-Total (mg/L)	0.00234	0.00247	0.00251	0.00247	0.00243
	Nickel (Ni)-Total (mg/L)	0.00744	0.00829	0.00810	0.00796	0.00781
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)	7.00	7.66	7.59	7.30	7.26
	Selenium (Se)-Total (mg/L)	<0.00010	0.00012	0.00012	<0.00010	0.00012
	Silicon (Si)-Total (mg/L)	0.666	0.674	0.693	0.701	0.688
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	28.0	28.8	29.3	28.0	28.0
	Strontium (Sr)-Total (mg/L)	0.187	0.198	0.200	0.188	0.193
	Thallium (Tl)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	0.00016
	Titanium (Ti)-Total (mg/L)	0.00325	0.00273	0.00244	0.00316	0.00234
	Uranium (U)-Total (mg/L)	0.000309	0.000323	0.000326	0.000318	0.000328
	Vanadium (V)-Total (mg/L)	0.00037	0.00039	0.00041	0.00043	0.00041

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1339689-16	L1339689-17	L1339689-18	L1339689-19	L1339689-20
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13
	Sampled Time	14:00	14:00	14:00	14:00	14:00
	Client ID	UP6-S	UP6-M	DUP 6	DUP 7	UP-EQ
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.85	7.85	7.85	7.86	6.62
	Total Suspended Solids (mg/L)	4.0	9.0	4.0	5.0	<3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.050	0.070	0.066	0.059	<0.050
	Nitrate and Nitrite (as N) (mg/L)	0.167	0.157	0.155	0.162	<0.071
	Nitrate (as N) (mg/L)	0.167	0.157	0.155	0.162	<0.050
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Total Metals	Aluminum (Al)-Total (mg/L)	0.0717	0.0774	0.0616	0.0645	0.0086
	Antimony (Sb)-Total (mg/L)	0.00077	0.00074	0.00074	0.00073	<0.00010
	Arsenic (As)-Total (mg/L)	0.273	0.276	0.232	0.240	0.00271
	Barium (Ba)-Total (mg/L)	0.0165	0.0166	0.0168	0.0164	0.000094
	Beryllium (Be)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	0.033	0.034	0.034	0.032	<0.010
	Cadmium (Cd)-Total (mg/L)	0.000013	0.000014	0.000014	0.000011	<0.000010
	Calcium (Ca)-Total (mg/L)	117	118	121	114	0.059
	Chromium (Cr)-Total (mg/L)	0.00030	0.00122	0.00030	0.00026	0.00046
	Cobalt (Co)-Total (mg/L)	0.00382	0.00382	0.00387	0.00377	<0.00010
	Copper (Cu)-Total (mg/L)	0.00192	0.00198	0.00189	0.00196	<0.00010
	Iron (Fe)-Total (mg/L)	0.698	0.718	0.791	0.712	0.018
	Lead (Pb)-Total (mg/L)	0.000640	0.000597	0.000507	0.000520	0.000063
	Lithium (Li)-Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Magnesium (Mg)-Total (mg/L)	8.20	8.48	8.40	7.97	0.0055
	Manganese (Mn)-Total (mg/L)	0.133	0.135	0.137	0.131	0.000513
	Molybdenum (Mo)-Total (mg/L)	0.00241	0.00254	0.00233	0.00229	<0.000050
	Nickel (Ni)-Total (mg/L)	0.00758	0.00816	0.00750	0.00729	0.00036
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)	7.23	7.32	7.37	7.26	<0.050
	Selenium (Se)-Total (mg/L)	0.00010	0.00011	0.00011	0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	0.671	0.685	0.692	0.682	<0.050
	Silver (Ag)-Total (mg/L)	<0.000010	0.000018	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	27.8	27.9	29.0	27.4	<0.050
	Strontium (Sr)-Total (mg/L)	0.192	0.195	0.195	0.186	0.00014
	Thallium (Tl)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Tin (Sn)-Total (mg/L)	<0.00010	0.00048	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	0.00296	0.00312	0.00293	0.00284	0.00034
	Uranium (U)-Total (mg/L)	0.000321	0.000321	0.000316	0.000313	<0.000010
	Vanadium (V)-Total (mg/L)	0.00038	0.00044	0.00039	0.00037	<0.00010

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1339689-21 Surface Water 28-JUL-13 14:00 TBLANK				
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	5.91				
	Total Suspended Solids (mg/L)	<3.0				
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.050				
	Nitrate and Nitrite (as N) (mg/L)	<0.071				
	Nitrate (as N) (mg/L)	<0.050				
	Nitrite (as N) (mg/L)	<0.050				
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0030				
	Antimony (Sb)-Total (mg/L)	<0.00010				
	Arsenic (As)-Total (mg/L)	<0.00010				
	Barium (Ba)-Total (mg/L)	<0.000050				
	Beryllium (Be)-Total (mg/L)	<0.00050				
	Bismuth (Bi)-Total (mg/L)	<0.000050				
	Boron (B)-Total (mg/L)	<0.010				
	Cadmium (Cd)-Total (mg/L)	<0.000010				
	Calcium (Ca)-Total (mg/L)	<0.020				
	Chromium (Cr)-Total (mg/L)	<0.00010				
	Cobalt (Co)-Total (mg/L)	<0.00010				
	Copper (Cu)-Total (mg/L)	<0.00010				
	Iron (Fe)-Total (mg/L)	<0.010				
	Lead (Pb)-Total (mg/L)	<0.000050				
	Lithium (Li)-Total (mg/L)	<0.0050				
	Magnesium (Mg)-Total (mg/L)	<0.0050				
	Manganese (Mn)-Total (mg/L)	<0.000050				
	Molybdenum (Mo)-Total (mg/L)	<0.000050				
	Nickel (Ni)-Total (mg/L)	<0.00010				
	Phosphorus (P)-Total (mg/L)	<0.30				
	Potassium (K)-Total (mg/L)	<0.050				
	Selenium (Se)-Total (mg/L)	<0.00010				
	Silicon (Si)-Total (mg/L)	<0.050				
	Silver (Ag)-Total (mg/L)	<0.000010				
	Sodium (Na)-Total (mg/L)	<0.050				
	Strontium (Sr)-Total (mg/L)	<0.00010				
	Thallium (Tl)-Total (mg/L)	<0.000050				
	Tin (Sn)-Total (mg/L)	<0.00010				
	Titanium (Ti)-Total (mg/L)	<0.00030				
	Uranium (U)-Total (mg/L)	<0.000010				
	Vanadium (V)-Total (mg/L)	<0.00010				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1339689-1	L1339689-2	L1339689-3	L1339689-4	L1339689-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13
	Sampled Time	14:00	14:00	14:00	14:00	14:00
	Client ID	UP1-S	UP1-M	UP1-B	UP2-S	UP2-M
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	0.0043	0.0058	0.0056	0.0421	0.0061
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)	0.0238	0.0247	0.0246	0.0222	0.0270
	Antimony (Sb)-Dissolved (mg/L)	0.00063	0.00065	0.00062	0.00066	0.00065
	Arsenic (As)-Dissolved (mg/L)	0.121	0.119	0.115	0.129	0.129
	Barium (Ba)-Dissolved (mg/L)	0.0169	0.0171	0.0160	0.0169	0.0168
	Beryllium (Be)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.029	0.031	0.031	0.030	0.030
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	RRV 0.000036	<0.000010	0.000018	0.000011
	Calcium (Ca)-Dissolved (mg/L)	114	118	120	117	114
	Chromium (Cr)-Dissolved (mg/L)	0.00010	0.00017	0.00014	0.00013	0.00014
	Cobalt (Co)-Dissolved (mg/L)	0.00335	0.00330	0.00326	0.00345	0.00343
	Copper (Cu)-Dissolved (mg/L)	0.00154	RRV 0.00451	0.00138	0.00149	0.00147
	Iron (Fe)-Dissolved (mg/L)	0.051	0.055	0.039	0.048	0.054
	Lead (Pb)-Dissolved (mg/L)	0.000279	0.000595	0.000090	0.000332	0.000306
	Lithium (Li)-Dissolved (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Magnesium (Mg)-Dissolved (mg/L)	8.62	8.72	8.65	9.00	8.52
	Manganese (Mn)-Dissolved (mg/L)	0.111	0.109	0.109	0.113	0.111
	Molybdenum (Mo)-Dissolved (mg/L)	0.00201	0.00223	0.00222	0.00218	0.00219
	Nickel (Ni)-Dissolved (mg/L)	0.00681	0.00722	0.00684	0.00700	0.00699
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	7.17	7.14	7.04	7.20	6.85
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	0.00011	0.00011
	Silicon (Si)-Dissolved (mg/L)	0.630	0.615	0.613	0.613	0.617
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	28.8	28.8	29.2	29.1	28.9
	Strontium (Sr)-Dissolved (mg/L)	0.181	0.194	0.191	0.191	0.188
	Thallium (Tl)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Tin (Sn)-Dissolved (mg/L)	<0.00010	0.00041	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	0.00093	<0.00030	<0.00030	0.00037
	Uranium (U)-Dissolved (mg/L)	0.000287	0.000293	0.000298	0.000285	0.000297
	Vanadium (V)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Zinc (Zn)-Dissolved (mg/L)	0.0120	RRV 0.0156	0.0066	0.0236	0.0090

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1339689-6	L1339689-7	L1339689-8	L1339689-9	L1339689-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13
	Sampled Time	14:00	14:00	14:00	14:00	14:00
	Client ID	UP2-B	UP3-S	UP3-M	UP3-B	UP4-S
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	0.0048	0.0046	0.0052	0.0048	0.0046
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)	0.0262	0.0307	0.0441	0.0321	0.0293
	Antimony (Sb)-Dissolved (mg/L)	0.00063	0.00065	0.00065	0.00066	0.00069
	Arsenic (As)-Dissolved (mg/L)	0.128	0.146	0.203	0.147	0.138
	Barium (Ba)-Dissolved (mg/L)	0.0160	0.0170	0.0172	0.0171	0.0160
	Beryllium (Be)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.031	0.030	0.029	0.030	0.030
	Cadmium (Cd)-Dissolved (mg/L)	0.000011	<0.000010	<0.000010	<0.000010	0.000020
	Calcium (Ca)-Dissolved (mg/L)	116	112	114	118	116
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	0.00018	<0.00010	0.00010
	Cobalt (Co)-Dissolved (mg/L)	0.00338	0.00327	0.00450	0.00323	0.00323
	Copper (Cu)-Dissolved (mg/L)	0.00159	0.00141	0.00195	0.00144	0.00136
	Iron (Fe)-Dissolved (mg/L)	0.112	0.047	0.056	0.066	0.045
	Lead (Pb)-Dissolved (mg/L)	0.000257	0.000092	0.000089	0.000218	0.000101
	Lithium (Li)-Dissolved (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Magnesium (Mg)-Dissolved (mg/L)	8.48	8.67	11.7	8.55	8.57
	Manganese (Mn)-Dissolved (mg/L)	0.110	0.106	0.145	0.106	0.105
	Molybdenum (Mo)-Dissolved (mg/L)	0.00223	0.00221	0.00219	0.00223	0.00218
	Nickel (Ni)-Dissolved (mg/L)	0.00691	0.00676	0.00923	0.00676	0.00656
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	7.07	7.09	7.16	7.23	7.24
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	0.00011
	Silicon (Si)-Dissolved (mg/L)	0.620	0.594	0.595	0.612	0.611
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	28.3	28.4	30.0	27.3	28.3
	Strontium (Sr)-Dissolved (mg/L)	0.190	0.186	0.187	0.187	0.189
	Thallium (Tl)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	0.00032	0.00037	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000292	0.000300	0.000296	0.000300	0.000295
	Vanadium (V)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Zinc (Zn)-Dissolved (mg/L)	0.0067	0.0068	0.0036	0.0104	RRV 0.0122

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1339689-11	L1339689-12	L1339689-13	L1339689-14	L1339689-15
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13	28-JUL-13
	Sampled Time	14:00	14:00	14:00	14:00	14:00
	Client ID	UP4-M	UP4-B	UP5-S	UP5-M	UP5-B
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	0.0058	0.0054	0.0063	0.0048	0.0049
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)	0.0312	0.0316	0.0313	0.0276	0.0252
	Antimony (Sb)-Dissolved (mg/L)	0.00064	0.00065	0.00065	0.00065	0.00066
	Arsenic (As)-Dissolved (mg/L)	0.142	0.139	0.158	0.159	0.158
	Barium (Ba)-Dissolved (mg/L)	0.0165	0.0168	0.0166	0.0166	0.0169
	Beryllium (Be)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.029	0.029	0.029	0.030	0.030
	Cadmium (Cd)-Dissolved (mg/L)	0.000013	<0.000010	0.000014	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	118	115	114	115	114
	Chromium (Cr)-Dissolved (mg/L)	0.00029	0.00015	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Dissolved (mg/L)	0.00334	0.00333	0.00333	0.00336	0.00335
	Copper (Cu)-Dissolved (mg/L)	0.00143	0.00176	0.00142	0.00150	0.00153
	Iron (Fe)-Dissolved (mg/L)	0.054	0.056	0.039	0.044	0.035
	Lead (Pb)-Dissolved (mg/L)	0.000159	0.000134	0.000333	0.000195	0.000067
	Lithium (Li)-Dissolved (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Magnesium (Mg)-Dissolved (mg/L)	8.62	8.42	8.39	8.55	8.42
	Manganese (Mn)-Dissolved (mg/L)	0.106	0.108	0.109	0.108	0.108
	Molybdenum (Mo)-Dissolved (mg/L)	0.00210	0.00211	0.00214	0.00220	0.00217
	Nickel (Ni)-Dissolved (mg/L)	0.00692	0.00698	0.00793	0.00699	0.00696
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	7.03	7.04	6.89	7.16	7.12
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	0.608	0.604	0.603	0.596	0.603
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	28.5	28.2	27.8	27.8	28.3
	Strontium (Sr)-Dissolved (mg/L)	0.183	0.180	0.184	0.184	0.184
	Thallium (Tl)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000298	0.000299	0.000299	0.000253	0.000279
	Vanadium (V)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Zinc (Zn)-Dissolved (mg/L)	0.0025	0.0032	RRV 0.0183	RRV 0.0176	RRV 0.0165

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1339689-16 Surface Water 28-JUL-13 14:00 UP6-S	L1339689-17 Surface Water 28-JUL-13 14:00 UP6-M	L1339689-18 Surface Water 28-JUL-13 14:00 DUP 6	L1339689-19 Surface Water 28-JUL-13 14:00 DUP 7	L1339689-20 Surface Water 28-JUL-13 14:00 UP-EQ
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	0.0051	0.0049	0.0075	0.0056	<0.0030
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)	0.0292	0.0249	0.0308	0.0268	
	Antimony (Sb)-Dissolved (mg/L)	0.00065	0.00066	0.00062	0.00063	
	Arsenic (As)-Dissolved (mg/L)	0.162	0.164	0.129	0.137	
	Barium (Ba)-Dissolved (mg/L)	0.0166	0.0161	0.0161	0.0164	
	Beryllium (Be)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Boron (B)-Dissolved (mg/L)	0.029	0.029	0.029	0.029	
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	0.000015	0.000012	
	Calcium (Ca)-Dissolved (mg/L)	111	113	112	112	
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	0.00010	0.00015	0.00019	
	Cobalt (Co)-Dissolved (mg/L)	0.00319	0.00328	0.00336	0.00331	
	Copper (Cu)-Dissolved (mg/L)	0.00141	0.00143	0.00143	0.00145	
	Iron (Fe)-Dissolved (mg/L)	0.035	0.039	0.057	0.052	
	Lead (Pb)-Dissolved (mg/L)	0.000410	0.000066	RRV 0.000710	0.000190	
	Lithium (Li)-Dissolved (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	
	Magnesium (Mg)-Dissolved (mg/L)	8.48	8.49	8.16	8.20	
	Manganese (Mn)-Dissolved (mg/L)	0.106	0.107	0.109	0.106	
	Molybdenum (Mo)-Dissolved (mg/L)	0.00216	0.00218	0.00171	0.00217	
	Nickel (Ni)-Dissolved (mg/L)	0.00663	0.00685	0.00669	0.00676	
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	
	Potassium (K)-Dissolved (mg/L)	7.27	6.94	6.90	7.09	
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Silicon (Si)-Dissolved (mg/L)	0.585	0.593	0.608	0.600	
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Sodium (Na)-Dissolved (mg/L)	27.2	27.0	27.6	27.8	
	Strontium (Sr)-Dissolved (mg/L)	0.180	0.183	0.185	0.182	
	Thallium (Tl)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	0.00059	<0.00030	
	Uranium (U)-Dissolved (mg/L)	0.000299	0.000285	0.000268	0.000282	
	Vanadium (V)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Zinc (Zn)-Dissolved (mg/L)	0.0092	0.0083	0.0083	0.0055	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1339689-21				
	Description	Surface Water				
	Sampled Date	28-JUL-13				
	Sampled Time	14:00				
	Client ID	TBLANK				
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	<0.0030				
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)					
	Antimony (Sb)-Dissolved (mg/L)					
	Arsenic (As)-Dissolved (mg/L)					
	Barium (Ba)-Dissolved (mg/L)					
	Beryllium (Be)-Dissolved (mg/L)					
	Bismuth (Bi)-Dissolved (mg/L)					
	Boron (B)-Dissolved (mg/L)					
	Cadmium (Cd)-Dissolved (mg/L)					
	Calcium (Ca)-Dissolved (mg/L)					
	Chromium (Cr)-Dissolved (mg/L)					
	Cobalt (Co)-Dissolved (mg/L)					
	Copper (Cu)-Dissolved (mg/L)					
	Iron (Fe)-Dissolved (mg/L)					
	Lead (Pb)-Dissolved (mg/L)					
	Lithium (Li)-Dissolved (mg/L)					
	Magnesium (Mg)-Dissolved (mg/L)					
	Manganese (Mn)-Dissolved (mg/L)					
	Molybdenum (Mo)-Dissolved (mg/L)					
	Nickel (Ni)-Dissolved (mg/L)					
	Phosphorus (P)-Dissolved (mg/L)					
	Potassium (K)-Dissolved (mg/L)					
	Selenium (Se)-Dissolved (mg/L)					
	Silicon (Si)-Dissolved (mg/L)					
	Silver (Ag)-Dissolved (mg/L)					
	Sodium (Na)-Dissolved (mg/L)					
	Strontium (Sr)-Dissolved (mg/L)					
	Thallium (Tl)-Dissolved (mg/L)					
	Tin (Sn)-Dissolved (mg/L)					
	Titanium (Ti)-Dissolved (mg/L)					
	Uranium (U)-Dissolved (mg/L)					
	Vanadium (V)-Dissolved (mg/L)					
	Zinc (Zn)-Dissolved (mg/L)					

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

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A
MET-T-CCMS-ED	Water	Total Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A
NH3-CFA-ED	Water	Ammonia in Water by Colour	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.			
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite	CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
PH-ED	Water	pH	APHA 4500 H-Electrode
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)			
SOLIDS-TOTSUS-ED	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

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

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

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

1 2

GLOSSARY OF REPORT TERMS

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

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: WESA Inc.
4 Cataraqui Street The Tower
Kingston ON K7K 1Z7

Contact: Tim Beckenham

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED	**Water**							
Batch R2663013								
WG1717768-2 CRM		**ED-HIGH-WATRM**						
Aluminum (Al)-Dissolved			102.0		%		80-120	31-JUL-13
Antimony (Sb)-Dissolved			102.6		%		80-120	31-JUL-13
Arsenic (As)-Dissolved			102.7		%		80-120	31-JUL-13
Barium (Ba)-Dissolved			100.3		%		80-120	31-JUL-13
Beryllium (Be)-Dissolved			97.0		%		80-120	31-JUL-13
Bismuth (Bi)-Dissolved			93.2		%		80-120	31-JUL-13
Boron (B)-Dissolved			97.0		%		80-120	31-JUL-13
Cadmium (Cd)-Dissolved			101.5		%		80-120	31-JUL-13
Calcium (Ca)-Dissolved			99.2		%		80-120	31-JUL-13
Chromium (Cr)-Dissolved			102.3		%		80-120	31-JUL-13
Cobalt (Co)-Dissolved			99.6		%		80-120	31-JUL-13
Copper (Cu)-Dissolved			97.7		%		80-120	31-JUL-13
Lead (Pb)-Dissolved			94.9		%		80-120	31-JUL-13
Lithium (Li)-Dissolved			95.2		%		80-120	31-JUL-13
Magnesium (Mg)-Dissolved			100.3		%		80-120	31-JUL-13
Manganese (Mn)-Dissolved			101.5		%		80-120	31-JUL-13
Molybdenum (Mo)-Dissolved			96.9		%		80-120	31-JUL-13
Nickel (Ni)-Dissolved			102.3		%		80-120	31-JUL-13
Phosphorus (P)-Dissolved			117.4		%		80-120	31-JUL-13
Potassium (K)-Dissolved			102.2		%		80-120	31-JUL-13
Selenium (Se)-Dissolved			101.5		%		80-120	31-JUL-13
Silicon (Si)-Dissolved			103.3		%		80-120	31-JUL-13
Sodium (Na)-Dissolved			101.2		%		80-120	31-JUL-13
Strontium (Sr)-Dissolved			100.8		%		80-120	31-JUL-13
Thallium (Tl)-Dissolved			96.6		%		80-120	31-JUL-13
Titanium (Ti)-Dissolved			97.9		%		80-120	31-JUL-13
Tin (Sn)-Dissolved			95.6		%		80-120	31-JUL-13
Uranium (U)-Dissolved			98.0		%		80-120	31-JUL-13
Vanadium (V)-Dissolved			100.6		%		80-120	31-JUL-13
Zinc (Zn)-Dissolved			98.4		%		80-120	31-JUL-13
WG1717768-1 MB								
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	31-JUL-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	31-JUL-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	31-JUL-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED	**Water**							
Batch R2663013								
WG1717768-1 MB								
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	31-JUL-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	31-JUL-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	31-JUL-13
Boron (B)-Dissolved			<0.010		mg/L		0.01	31-JUL-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	31-JUL-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	31-JUL-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	31-JUL-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	31-JUL-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	31-JUL-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	31-JUL-13
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	31-JUL-13
Lithium (Li)-Dissolved			<0.0030		mg/L		0.003	31-JUL-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	31-JUL-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	31-JUL-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	31-JUL-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	31-JUL-13
Phosphorus (P)-Dissolved			<0.30		mg/L		0.3	31-JUL-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	31-JUL-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	31-JUL-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	31-JUL-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	31-JUL-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	31-JUL-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	31-JUL-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	31-JUL-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	31-JUL-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	31-JUL-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	31-JUL-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	31-JUL-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	31-JUL-13
Batch R2663853								
WG1718563-2 CRM		**ED-HIGH-WATRM**						
Barium (Ba)-Dissolved			103.2		%		80-120	01-AUG-13
Cadmium (Cd)-Dissolved			103.8		%		80-120	01-AUG-13
Chromium (Cr)-Dissolved			97.1		%		80-120	01-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED	**Water**							
Batch R2663853								
WG1718563-2 CRM		**ED-HIGH-WATRM**						
Copper (Cu)-Dissolved			96.2		%		80-120	01-AUG-13
Lead (Pb)-Dissolved			94.1		%		80-120	01-AUG-13
Potassium (K)-Dissolved			97.9		%		80-120	01-AUG-13
Sodium (Na)-Dissolved			106.5		%		80-120	01-AUG-13
Zinc (Zn)-Dissolved			101.8		%		80-120	01-AUG-13
WG1718563-1 MB								
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	01-AUG-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	01-AUG-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	01-AUG-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	01-AUG-13
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	01-AUG-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	01-AUG-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	01-AUG-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	01-AUG-13
MET-T-CCMS-ED	**Water**							
Batch R2663003								
WG1717679-3 LCS								
Aluminum (Al)-Total			100.4		%		80-120	31-JUL-13
Antimony (Sb)-Total			103.4		%		80-120	31-JUL-13
Arsenic (As)-Total			104.4		%		80-120	31-JUL-13
Barium (Ba)-Total			99.9		%		80-120	31-JUL-13
Beryllium (Be)-Total			92.5		%		80-120	31-JUL-13
Bismuth (Bi)-Total			99.7		%		80-120	31-JUL-13
Boron (B)-Total			92.4		%		80-120	31-JUL-13
Cadmium (Cd)-Total			101.6		%		80-120	31-JUL-13
Calcium (Ca)-Total			98.1		%		80-120	31-JUL-13
Chromium (Cr)-Total			103.1		%		80-120	31-JUL-13
Cobalt (Co)-Total			100.3		%		80-120	31-JUL-13
Copper (Cu)-Total			98.3		%		80-120	31-JUL-13
Iron (Fe)-Total			100.1		%		80-120	31-JUL-13
Lead (Pb)-Total			100.3		%		80-120	31-JUL-13
Lithium (Li)-Total			87.6		%		80-120	31-JUL-13
Magnesium (Mg)-Total			100.2		%		80-120	31-JUL-13
Manganese (Mn)-Total			98.8		%		80-120	31-JUL-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2663003								
WG1717679-3 LCS								
Molybdenum (Mo)-Total			94.9		%		80-120	31-JUL-13
Nickel (Ni)-Total			102.0		%		80-120	31-JUL-13
Potassium (K)-Total			101.5		%		80-120	31-JUL-13
Selenium (Se)-Total			107.3		%		80-120	31-JUL-13
Silicon (Si)-Total			98.2		%		80-120	31-JUL-13
Silver (Ag)-Total			99.3		%		80-120	31-JUL-13
Sodium (Na)-Total			102.4		%		80-120	31-JUL-13
Strontium (Sr)-Total			97.2		%		80-120	31-JUL-13
Thallium (Tl)-Total			101.0		%		80-120	31-JUL-13
Tin (Sn)-Total			98.0		%		80-120	31-JUL-13
Titanium (Ti)-Total			103.4		%		80-120	31-JUL-13
Uranium (U)-Total			103.4		%		80-120	31-JUL-13
Vanadium (V)-Total			100.2		%		80-120	31-JUL-13
Zinc (Zn)-Total			102.8		%		80-120	31-JUL-13
WG1717679-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	31-JUL-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	31-JUL-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	31-JUL-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	31-JUL-13
Boron (B)-Total			<0.010		mg/L		0.01	31-JUL-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	31-JUL-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	31-JUL-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Iron (Fe)-Total			<0.010		mg/L		0.01	31-JUL-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	31-JUL-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	31-JUL-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	31-JUL-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	31-JUL-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	31-JUL-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	31-JUL-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2663003								
WG1717679-1 MB								
Phosphorus (P)-Total			<0.30		mg/L		0.3	31-JUL-13
Potassium (K)-Total			<0.050		mg/L		0.05	31-JUL-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Silicon (Si)-Total			<0.050		mg/L		0.05	31-JUL-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	31-JUL-13
Sodium (Na)-Total			<0.050		mg/L		0.05	31-JUL-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	31-JUL-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	31-JUL-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	31-JUL-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	31-JUL-13
WG1717787-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	31-JUL-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	31-JUL-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	31-JUL-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	31-JUL-13
Boron (B)-Total			<0.010		mg/L		0.01	31-JUL-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	31-JUL-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	31-JUL-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Iron (Fe)-Total			<0.010		mg/L		0.01	31-JUL-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	31-JUL-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	31-JUL-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	31-JUL-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	31-JUL-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	31-JUL-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	31-JUL-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2663003								
WG1717787-1 MB								
Potassium (K)-Total			<0.050		mg/L		0.05	31-JUL-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Silicon (Si)-Total			<0.050		mg/L		0.05	31-JUL-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	31-JUL-13
Sodium (Na)-Total			<0.050		mg/L		0.05	31-JUL-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	31-JUL-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	31-JUL-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	31-JUL-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	31-JUL-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	31-JUL-13
NH3-CFA-ED	**Water**							
Batch R2662605								
WG1717907-11 DUP		**L1339689-11**						
Ammonia, Total (as N)		0.088	0.081		mg/L	8.2	20	31-JUL-13
WG1717907-2 LCS								
Ammonia, Total (as N)			99.2		%		85-115	31-JUL-13
WG1717907-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	31-JUL-13
WG1717907-10 MS		**L1339260-11**						
Ammonia, Total (as N)			104.0		%		75-125	31-JUL-13
WG1717907-3 MS		**L1338603-8**						
Ammonia, Total (as N)			100.0		%		75-125	31-JUL-13
WG1717907-7 MS		**L1336733-2**						
Ammonia, Total (as N)			101.6		%		75-125	31-JUL-13
NO2-IC-ED	**Water**							
Batch R2661320								
WG1716524-2 LCS								
Nitrite (as N)			97.7		%		90-110	29-JUL-13
WG1716524-1 MB								
Nitrite (as N)			<0.050		mg/L		0.05	29-JUL-13
WG1716524-4 MS		**L1336259-2**						
Nitrite (as N)			100.8		%		75-125	29-JUL-13
WG1716524-6 MS		**L1337681-7**						
Nitrite (as N)			107.6		%		75-125	29-JUL-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-ED	**Water**							
Batch R2661320								
WG1716524-2 LCS								
Nitrate (as N)			100.4		%		90-110	29-JUL-13
WG1716524-1 MB								
Nitrate (as N)			<0.050		mg/L		0.05	29-JUL-13
WG1716524-4 MS		**L1336259-2**						
Nitrate (as N)			106.6		%		75-125	29-JUL-13
WG1716524-6 MS		**L1337681-7**						
Nitrate (as N)			100.9		%		75-125	29-JUL-13
PH-ED	**Water**							
Batch R2662637								
WG1717698-6 DUP		**L1339689-13**						
pH		7.85	7.84	J	pH	0.00	0.3	31-JUL-13
WG1717698-3 LCS								
pH			7.03		pH		6.9-7.1	31-JUL-13
SOLIDS-TOTSUS-ED	**Water**							
Batch R2662709								
WG1717663-3 DUP		**L1339689-1**						
Total Suspended Solids		6.0	6.0		mg/L	0.0	20	31-JUL-13
WG1717663-2 LCS								
Total Suspended Solids			90.0		%		85-115	31-JUL-13
WG1717663-1 MB								
Total Suspended Solids			<3.0		mg/L		3	31-JUL-13

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH							
	1	28-JUL-13 14:00	31-JUL-13 10:46	0.25	69	hours	EHTR-FM
	2	28-JUL-13 14:00	31-JUL-13 10:49	0.25	69	hours	EHTR-FM
	3	28-JUL-13 14:00	31-JUL-13 10:53	0.25	69	hours	EHTR-FM
	4	28-JUL-13 14:00	31-JUL-13 10:56	0.25	69	hours	EHTR-FM
	5	28-JUL-13 14:00	31-JUL-13 11:00	0.25	69	hours	EHTR-FM
	6	28-JUL-13 14:00	31-JUL-13 11:04	0.25	69	hours	EHTR-FM
	7	28-JUL-13 14:00	31-JUL-13 11:08	0.25	69	hours	EHTR-FM
	8	28-JUL-13 14:00	31-JUL-13 11:11	0.25	69	hours	EHTR-FM
	9	28-JUL-13 14:00	31-JUL-13 11:15	0.25	69	hours	EHTR-FM
	10	28-JUL-13 14:00	31-JUL-13 11:18	0.25	69	hours	EHTR-FM
	11	28-JUL-13 14:00	31-JUL-13 11:22	0.25	69	hours	EHTR-FM
	12	28-JUL-13 14:00	31-JUL-13 11:26	0.25	69	hours	EHTR-FM
	13	28-JUL-13 14:00	31-JUL-13 11:29	0.25	70	hours	EHTR-FM
	14	28-JUL-13 14:00	31-JUL-13 11:37	0.25	70	hours	EHTR-FM
	15	28-JUL-13 14:00	31-JUL-13 11:40	0.25	70	hours	EHTR-FM
	16	28-JUL-13 14:00	31-JUL-13 11:44	0.25	70	hours	EHTR-FM
	17	28-JUL-13 14:00	31-JUL-13 11:48	0.25	70	hours	EHTR-FM
	18	28-JUL-13 14:00	31-JUL-13 11:51	0.25	70	hours	EHTR-FM
	19	28-JUL-13 14:00	31-JUL-13 11:55	0.25	70	hours	EHTR-FM
	20	28-JUL-13 14:00	31-JUL-13 11:58	0.25	70	hours	EHTR-FM
	21	28-JUL-13 14:00	31-JUL-13 12:02	0.25	70	hours	EHTR-FM
Anions and Nutrients							
Nitrate as N by IC							
	1	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	2	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	3	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	4	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	5	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	6	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	7	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	8	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	9	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	10	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	11	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	12	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	13	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	14	28-JUL-13 14:00	31-JUL-13 17:57	48	76	hours	EHTL
	15	28-JUL-13 14:00	31-JUL-13 17:57	48	76	hours	EHTL
	16	28-JUL-13 14:00	31-JUL-13 17:57	48	76	hours	EHTL
	17	28-JUL-13 14:00	31-JUL-13 19:11	48	77	hours	EHTL
	18	28-JUL-13 14:00	31-JUL-13 19:11	48	77	hours	EHTL
	19	28-JUL-13 14:00	31-JUL-13 19:11	48	77	hours	EHTL
	20	28-JUL-13 14:00	31-JUL-13 19:11	48	77	hours	EHTL
	21	28-JUL-13 14:00	31-JUL-13 19:11	48	77	hours	EHTL
Nitrite as N by IC							
	1	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	2	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	3	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	4	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	5	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	6	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	7	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	8	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	9	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	10	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	11	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	12	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Anions and Nutrients							
Nitrite as N by IC							
	13	28-JUL-13 14:00	31-JUL-13 14:24	48	72	hours	EHTL
	14	28-JUL-13 14:00	31-JUL-13 17:57	48	76	hours	EHTL
	15	28-JUL-13 14:00	31-JUL-13 17:57	48	76	hours	EHTL
	16	28-JUL-13 14:00	31-JUL-13 17:57	48	76	hours	EHTL
	17	28-JUL-13 14:00	31-JUL-13 19:11	48	77	hours	EHTL
	18	28-JUL-13 14:00	31-JUL-13 19:11	48	77	hours	EHTL
	19	28-JUL-13 14:00	31-JUL-13 19:11	48	77	hours	EHTL
	20	28-JUL-13 14:00	31-JUL-13 19:11	48	77	hours	EHTL
	21	28-JUL-13 14:00	31-JUL-13 19:11	48	77	hours	EHTL

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1339689 were received on 29-JUL-13 16:00.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To

Company: BluMetric

Contact: 4 Cataraqui St Tim Beckenham

Address: 4 Cataraqui St

The Tower, Kingstone, On, K7K 1Z7

Phone: (613) 531-2725 Fax:

Report Format / Distribution

Standard: ✓ Other (specify):

Select: PDF ✓ Excel ✓ Digital Fax

Email 1: cproux@enviréau.ca

Email 2: tbeckenham@wesa.ca

Service Request (Rush subject to availability - Contact ALS to confirm TAT)

- Regular (Standard Turnaround Times - Business Days)
- Priority(2-4 Business Days)-50% surcharge - Contact ALS to confirm TAT
- Emergency (1-2 Business Days)-100% Surcharge - Contact ALS to confirm TAT
- Same Day or Weekend Emergency - Contact ALS to confirm TAT

Invoice To Same as Report ? (circle) Yes or No (if No, provide details)

Copy of Invoice with Report? (circle) Yes or No

Company: TEES Ltd

Contact:

Address: 98 Archibald St. Box 133 Yellowknife, NT X1A 2N1

Phone: (867) 669-9481 Fax: (867) 669-9482

Client / Project Information

Job #:

PO / AFE:

LSD:

Quote #:

ALS Contact: Catherine Evaristo

Sampler: Pascal Poirier

Lab Work Order # (lab use only)

Analysis Request (Indicate Filtered or Preserved, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS, pH	P Total metal (As, Zn, Cu, Pb, Ni)	F/P Dissolved metal (As, Zn, Cu, Pb, Ni)	P NO3 + NO2	P Total ammonia nitrogen	Number of Containers
	UP1-S	28/07/13	14:00	Surface water	X	X	X	X	X	
	UP1-M									
	UP1-B									
	UP2-S									
	UP2-M									
	UP2-B									
	UP3-S									
	UP3-M									
	UP3-B									
	UP4-S									
	UP4-M									
	UP4-B									

L1339689-COFC

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

Keep the extra bottles on hold. Bottles indicating diss. metal have been Filtered and preserved and they are for dissolved metals.

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

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Pascal Poirier	Date: 29/07/13	Time: 11:00	Received by: [signature]	Date: July 29th	Time: 4:00 pm	Temperature: Max 9.8 Avg 8 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326e v08 Front/22 May 2013

Temp Max 8.8 Avg 8.0

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To	
Company:	
Contact:	
Address:	
Phone:	Fax:

Report Format / Distribution	
Standard:	Other (specify):
Select: PDF ___ Excel ___ Digital ___ Fax ___	
Email 1:	
Email 2:	

Service Request (Rush subject to availability - Contact ALS to confirm TAT)
Regular (Standard Turnaround Times - Business Days)
Priority (2-4 Business Days)-50% surcharge - Contact ALS to confirm TAT
Emergency (1-2 Business Days)-100% Surcharge - Contact ALS to confirm TAT
Same Day or Weekend Emergency - Contact ALS to confirm TAT

Invoice To	Same as Report ? (circle) Yes or No (if No, provide details)
	Copy of Invoice with Report? (circle) Yes or No
Company:	
Contact:	
Address:	
Phone:	Fax:

Client / Project Information	
Job #:	
PO / AFE:	
LSD:	
Quote #:	
ALS Contact:	Sampler:

Lab Work Order # (lab use only)

Analysis Request (Indicate Filtered or Preserved, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS pH	P Total metal (As, Zn, Pb, Cu, Ni)	F Dissolved metal (As, Zn, Pb, Cu, Ni)	P NO_3 + NO_2	P total ammonia nitrogen							Number of Containers
	UP5-S	28/07/13	14:00	Surface water	X	X	X	X	X							
	UP5-M															
	UP5-B															
	UP6-S															
	UP6-M															
	Dup 6															
	Dup 7															
	UP-EQ															
	TBlank					X		X								
					X	X	X	X								

L1339689-COFC

Special Instructions / Regulation with water or land use (CCME- Freshwater Aquatic Life/BC CSR-Commercial/AB Tier 1-Natural/etc) / H…

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

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date:	Time:	Received by: [signature]	Date: July 29th	Time: 4:00pm	Temperature: Max 10.1 Avg 9.8C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

WESA Inc.
ATTN: Tim Beckenham
4 Cataraque Street
The Tower
Kingston ON K7K 1Z7

Date Received: 07-AUG-13
Report Date: 12-AUG-13 16:49 (MT)
Version: FINAL

Client Phone: 613-531-2725

Certificate of Analysis

Lab Work Order #: L1344178

Project P.O. #: NOT SUBMITTED
Job Reference: ABORIGINAL 15929
C of C Numbers: 1, 2, 3
Legal Site Desc:

Cath Evaristo Cordero

Catherine Evaristo-Cordero
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1344178-1	L1344178-2	L1344178-3	L1344178-4	L1344178-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13
	Sampled Time	10:00	10:00	10:00	10:00	10:00
	Client ID	UP1-S	UP1-B	UP2-S	UP2-B	UP3-S
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.72	7.86	7.87	7.88	7.88
	Total Suspended Solids (mg/L)	<3.0	3.0	<3.0	<3.0	<3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.050	<0.050	<0.050	0.078	0.063
	Nitrate and Nitrite (as N) (mg/L)	0.100	0.105	0.104	0.100	0.096
	Nitrate (as N) (mg/L)	0.100	0.105	0.104	0.100	0.096
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Total Metals	Aluminum (Al)-Total (mg/L)	DLM 0.044	DLM 0.068	DLM 0.047	DLM 0.046	DLM 0.047
	Antimony (Sb)-Total (mg/L)	DLM 0.00052	DLM 0.00059	DLM 0.00054	DLM 0.00060	DLM <0.00050
	Arsenic (As)-Total (mg/L)	DLM 0.180	DLM 0.185	DLM 0.187	DLM 0.179	DLM 0.224
	Barium (Ba)-Total (mg/L)	DLM 0.0193	DLM 0.0190	DLM 0.0184	DLM 0.0180	DLM 0.0181
	Beryllium (Be)-Total (mg/L)	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025
	Bismuth (Bi)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Boron (B)-Total (mg/L)	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050
	Cadmium (Cd)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Calcium (Ca)-Total (mg/L)	DLM 133	DLM 138	DLM 141	DLM 136	DLM 140
	Chromium (Cr)-Total (mg/L)	DLM <0.00050	DLM 0.00078	DLM <0.00050	DLM 0.00086	DLM <0.00050
	Cobalt (Co)-Total (mg/L)	DLM 0.00438	DLM 0.00458	DLM 0.00466	DLM 0.00446	0.00420
	Copper (Cu)-Total (mg/L)	DLM 0.00184	DLM 0.00205	DLM 0.00180	DLM 0.00185	0.00190
	Iron (Fe)-Total (mg/L)	DLM 1.07	DLM 1.20	DLM 1.16	DLM 1.06	1.12
	Lead (Pb)-Total (mg/L)	DLM 0.00039	DLM 0.00053	DLM 0.00037	DLM 0.00038	0.00045
	Lithium (Li)-Total (mg/L)	DLM <0.025	DLM <0.025	DLM <0.025	DLM <0.025	DLM <0.025
	Magnesium (Mg)-Total (mg/L)	DLM 8.77	DLM 8.92	DLM 9.16	DLM 8.71	DLM 8.86
	Manganese (Mn)-Total (mg/L)	DLM 0.137	DLM 0.142	DLM 0.143	DLM 0.137	DLM 0.134
	Molybdenum (Mo)-Total (mg/L)	DLM 0.00217	DLM 0.00283	DLM 0.00224	DLM 0.00241	DLM 0.00223
	Nickel (Ni)-Total (mg/L)	DLM 0.00782	DLM 0.00936	DLM 0.00862	DLM 0.00891	DLM 0.00818
	Phosphorus (P)-Total (mg/L)	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5
	Potassium (K)-Total (mg/L)	DLM 6.88	DLM 7.00	DLM 7.13	DLM 6.82	DLM 6.91
	Selenium (Se)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Silicon (Si)-Total (mg/L)	DLM 0.50	DLM 0.57	DLM 0.50	DLM 0.48	DLM 0.49
	Silver (Ag)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Sodium (Na)-Total (mg/L)	DLM 31.6	DLM 32.7	DLM 33.5	DLM 31.2	DLM 32.4
	Strontium (Sr)-Total (mg/L)	DLM 0.216	DLM 0.220	DLM 0.220	DLM 0.219	DLM 0.218
	Thallium (Tl)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Tin (Sn)-Total (mg/L)	DLM <0.00050	DLM 0.00073	DLM <0.00050	DLM 0.00103	DLM <0.00050
	Titanium (Ti)-Total (mg/L)	DLM 0.0052	DLM 0.0060	DLM 0.0040	DLM 0.0036	DLM 0.0038
	Uranium (U)-Total (mg/L)	DLM 0.000271	DLM 0.000295	DLM 0.000283	DLM 0.000277	DLM 0.000287
	Vanadium (V)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1344178-6	L1344178-7	L1344178-8	L1344178-9	L1344178-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13
	Sampled Time	10:00	10:00	10:00	10:00	10:00
	Client ID	UP3-B	UP4-S	UP4-B	UP5-S	UP5-B
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.88	7.86	7.86	7.87	7.87
	Total Suspended Solids (mg/L)	<3.0	<3.0	3.0	<3.0	<3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Nitrate and Nitrite (as N) (mg/L)	0.095	0.104	0.102	0.098	0.091
	Nitrate (as N) (mg/L)	0.095	0.104	0.102	0.098	0.091
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Total Metals	Aluminum (Al)-Total (mg/L)	DLM 0.050	DLM 0.044	DLM 0.041	DLM 0.048	DLM 0.061
	Antimony (Sb)-Total (mg/L)	DLM 0.00052	DLM 0.00052	DLM 0.00051	DLM 0.00054	DLM 0.00059
	Arsenic (As)-Total (mg/L)	DLM 0.219	DLM 0.179	DLM 0.177	DLM 0.246	DLM 0.252
	Barium (Ba)-Total (mg/L)	DLM 0.0177	DLM 0.0180	DLM 0.0183	DLM 0.0177	DLM 0.0187
	Beryllium (Be)-Total (mg/L)	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025
	Bismuth (Bi)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Boron (B)-Total (mg/L)	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050
	Cadmium (Cd)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Calcium (Ca)-Total (mg/L)	DLM 138	DLM 137	DLM 135	DLM 139	DLM 141
	Chromium (Cr)-Total (mg/L)	DLM 0.00199	DLM <0.00050	DLM 0.00055	DLM <0.00050	DLM 0.00072
	Cobalt (Co)-Total (mg/L)	DLM 0.00424	DLM 0.00491	DLM 0.00495	DLM 0.00399	DLM 0.00404
	Copper (Cu)-Total (mg/L)	DLM 0.00179	DLM 0.00176	DLM 0.00181	DLM 0.00192	DLM 0.00195
	Iron (Fe)-Total (mg/L)	DLM 1.10	DLM 1.15	DLM 1.13	DLM 1.03	DLM 1.10
	Lead (Pb)-Total (mg/L)	DLM 0.00045	DLM 0.00034	DLM 0.00037	DLM 0.00048	DLM 0.00050
	Lithium (Li)-Total (mg/L)	DLM <0.025	DLM <0.025	DLM <0.025	DLM <0.025	DLM <0.025
	Magnesium (Mg)-Total (mg/L)	DLM 8.72	8.94	DLM 8.83	DLM 8.65	DLM 8.86
	Manganese (Mn)-Total (mg/L)	DLM 0.131	0.153	DLM 0.151	DLM 0.131	DLM 0.132
	Molybdenum (Mo)-Total (mg/L)	DLM 0.00229	0.00210	DLM 0.00217	DLM 0.00212	DLM 0.00233
	Nickel (Ni)-Total (mg/L)	DLM 0.00837	0.00859	DLM 0.00856	DLM 0.00792	DLM 0.00817
	Phosphorus (P)-Total (mg/L)	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5
	Potassium (K)-Total (mg/L)	DLM 6.76	DLM 6.89	DLM 6.80	DLM 6.74	DLM 6.87
	Selenium (Se)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Silicon (Si)-Total (mg/L)	DLM 0.49	DLM 0.50	DLM 0.50	DLM 0.49	DLM 0.53
	Silver (Ag)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Sodium (Na)-Total (mg/L)	DLM 32.0	DLM 31.9	DLM 32.1	DLM 30.6	DLM 32.1
	Strontium (Sr)-Total (mg/L)	DLM 0.215	DLM 0.217	DLM 0.211	DLM 0.225	DLM 0.216
	Thallium (Tl)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Tin (Sn)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Titanium (Ti)-Total (mg/L)	DLM 0.0040	DLM 0.0042	DLM 0.0051	DLM 0.0046	DLM 0.0039
	Uranium (U)-Total (mg/L)	DLM 0.000290	DLM 0.000266	DLM 0.000274	DLM 0.000281	DLM 0.000295
	Vanadium (V)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1344178-11	L1344178-12	L1344178-13	L1344178-14	L1344178-15
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13
	Sampled Time	10:00	10:00	10:00	10:00	10:00
	Client ID	UP6-S	UP6-B	TBLANK	UP-EQ	DUP 9
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.86	7.86	5.62	5.34	7.77
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0	4.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Nitrate and Nitrite (as N) (mg/L)	0.088	0.086	<0.071	<0.071	0.104
	Nitrate (as N) (mg/L)	0.088	0.086	<0.050	<0.050	0.104
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Total Metals	Aluminum (Al)-Total (mg/L)	DLM 0.055	DLM 0.051	<0.0030	0.019	DLM 0.044
	Antimony (Sb)-Total (mg/L)	DLM 0.00053	DLM 0.00055	<0.00010	DLM <0.00050	DLM 0.00052
	Arsenic (As)-Total (mg/L)	DLM 0.276	DLM 0.264	<0.00010	DLM 0.00203	DLM 0.184
	Barium (Ba)-Total (mg/L)	DLM 0.0182	DLM 0.0192	<0.000050	DLM <0.00025	DLM 0.0179
	Beryllium (Be)-Total (mg/L)	DLM <0.0025	DLM <0.0025	<0.00050	DLM <0.0025	DLM <0.0025
	Bismuth (Bi)-Total (mg/L)	DLM <0.00025	DLM <0.00025	<0.000050	DLM <0.00025	DLM <0.00025
	Boron (B)-Total (mg/L)	DLM <0.050	DLM <0.050	<0.010	DLM <0.050	DLM <0.050
	Cadmium (Cd)-Total (mg/L)	DLM <0.000050	DLM <0.000050	<0.000010	DLM <0.000050	DLM <0.000050
	Calcium (Ca)-Total (mg/L)	DLM 144	DLM 136	<0.020	DLM <0.10	DLM 137
	Chromium (Cr)-Total (mg/L)	DLM <0.00050	DLM 0.00075	<0.00010	DLM <0.00050	DLM <0.00050
	Cobalt (Co)-Total (mg/L)	DLM 0.00412	DLM 0.00416	<0.00010	DLM <0.00050	DLM 0.00454
	Copper (Cu)-Total (mg/L)	DLM 0.00202	DLM 0.00195	<0.00010	DLM <0.00050	DLM 0.00174
	Iron (Fe)-Total (mg/L)	DLM 1.15	DLM 1.14	<0.010	DLM <0.050	DLM 1.10
	Lead (Pb)-Total (mg/L)	DLM 0.00052	DLM 0.00052	<0.000050	DLM <0.00025	DLM 0.00034
	Lithium (Li)-Total (mg/L)	DLM <0.025	DLM <0.025	<0.0050	DLM <0.025	DLM <0.025
	Magnesium (Mg)-Total (mg/L)	DLM 9.12	DLM 9.11	<0.0050	DLM <0.025	DLM 9.03
	Manganese (Mn)-Total (mg/L)	DLM 0.139	DLM 0.139	<0.000050	DLM 0.00073	DLM 0.138
	Molybdenum (Mo)-Total (mg/L)	DLM 0.00227	DLM 0.00229	<0.000050	DLM <0.00025	DLM 0.00215
	Nickel (Ni)-Total (mg/L)	DLM 0.00827	DLM 0.00845	<0.00010	DLM 0.00123	DLM 0.00801
	Phosphorus (P)-Total (mg/L)	DLM <1.5	DLM <1.5	<0.30	DLM <1.5	DLM <1.5
	Potassium (K)-Total (mg/L)	DLM 7.05	DLM 7.03	<0.050	DLM <0.25	DLM 6.93
	Selenium (Se)-Total (mg/L)	DLM <0.00050	DLM <0.00050	<0.00010	DLM <0.00050	DLM <0.00050
	Silicon (Si)-Total (mg/L)	DLM 0.49	DLM 0.51	<0.050	DLM <0.25	DLM 0.51
	Silver (Ag)-Total (mg/L)	DLM <0.000050	DLM 0.000101	<0.000010	DLM <0.000050	DLM <0.000050
	Sodium (Na)-Total (mg/L)	DLM 32.9	DLM 32.6	<0.050	DLM <0.25	DLM 32.0
	Strontium (Sr)-Total (mg/L)	DLM 0.219	DLM 0.220	<0.00010	DLM <0.00050	DLM 0.212
	Thallium (Tl)-Total (mg/L)	DLM <0.00025	DLM <0.00025	<0.000050	DLM <0.00025	DLM <0.00025
	Tin (Sn)-Total (mg/L)	DLM <0.00050	DLM 0.00400	<0.00010	DLM <0.00050	DLM <0.00050
	Titanium (Ti)-Total (mg/L)	DLM 0.0046	DLM 0.0039	<0.00030	DLM <0.0015	DLM 0.0040
	Uranium (U)-Total (mg/L)	DLM 0.000290	DLM 0.000306	<0.000010	DLM <0.000050	DLM 0.000267
	Vanadium (V)-Total (mg/L)	DLM <0.00050	DLM <0.00050	<0.00010	DLM <0.00050	DLM <0.00050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1344178-16	L1344178-20	L1344178-24		
	Description	Surface Water	Surface Water	Surface Water		
	Sampled Date	06-AUG-13	06-AUG-13	07-AUG-13		
	Sampled Time	10:00	09:00	09:00		
	Client ID	DUP 10	EFF 167	EFF 171		
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.84	7.91	7.92		
	Total Suspended Solids (mg/L)	3.0	<3.0	<3.0		
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.056	0.114	0.066		
	Nitrate and Nitrite (as N) (mg/L)	0.106	0.110	0.090		
	Nitrate (as N) (mg/L)	0.106	0.110	0.090		
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050		
Total Metals	Aluminum (Al)-Total (mg/L)	DLM 0.043	DLM <0.015	DLM <0.015		
	Antimony (Sb)-Total (mg/L)	DLM 0.00050	DLM <0.00050	DLM <0.00050		
	Arsenic (As)-Total (mg/L)	DLM 0.182	DLM 0.0223	DLM 0.0257		
	Barium (Ba)-Total (mg/L)	DLM 0.0184	DLM 0.0150	DLM 0.0153		
	Beryllium (Be)-Total (mg/L)	DLM <0.0025	DLM <0.0025	DLM <0.0025		
	Bismuth (Bi)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025		
	Boron (B)-Total (mg/L)	DLM <0.050	DLM <0.050	DLM <0.050		
	Cadmium (Cd)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050		
	Calcium (Ca)-Total (mg/L)	DLM 137	DLM 143	DLM 145		
	Chromium (Cr)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050		
	Cobalt (Co)-Total (mg/L)	DLM 0.00493	DLM 0.00313	DLM 0.00306		
	Copper (Cu)-Total (mg/L)	DLM 0.00172	DLM 0.00183	DLM 0.00092		
	Iron (Fe)-Total (mg/L)	DLM 1.15	DLM 1.90	DLM 2.00		
	Lead (Pb)-Total (mg/L)	DLM 0.00035	DLM <0.00025	DLM <0.00025		
	Lithium (Li)-Total (mg/L)	DLM <0.025	DLM <0.025	DLM <0.025		
	Magnesium (Mg)-Total (mg/L)	DLM 9.06	DLM 8.87	DLM 9.09		
	Manganese (Mn)-Total (mg/L)	DLM 0.156	DLM 0.0725	DLM 0.0737		
	Molybdenum (Mo)-Total (mg/L)	DLM 0.00215	DLM 0.00141	DLM 0.00141		
	Nickel (Ni)-Total (mg/L)	DLM 0.00877	DLM 0.00559	DLM 0.00575		
	Phosphorus (P)-Total (mg/L)	DLM <1.5	DLM <1.5	DLM <1.5		
	Potassium (K)-Total (mg/L)	DLM 6.99	DLM 6.33	DLM 6.44		
	Selenium (Se)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050		
	Silicon (Si)-Total (mg/L)	DLM 0.53	DLM 0.33	DLM 0.30		
	Silver (Ag)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050		
	Sodium (Na)-Total (mg/L)	DLM 32.6	DLM 36.4	DLM 37.3		
	Strontium (Sr)-Total (mg/L)	DLM 0.224	DLM 0.222	DLM 0.227		
	Thallium (Tl)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025		
	Tin (Sn)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050		
	Titanium (Ti)-Total (mg/L)	DLM 0.0044	DLM 0.0085	DLM 0.0091		
	Uranium (U)-Total (mg/L)	DLM 0.000273	DLM 0.000151	DLM 0.000159		
	Vanadium (V)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte					
	Sample ID	L1344178-1	L1344178-2	L1344178-3	L1344178-4	L1344178-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13
	Sampled Time	10:00	10:00	10:00	10:00	10:00
	Client ID	UP1-S	UP1-B	UP2-S	UP2-B	UP3-S
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)	DLM 0.0209	DLM 0.0193	DLM 0.0188	DLM 0.0177	DLM 0.0197
	Antimony (Sb)-Dissolved (mg/L)	DLM 0.00051	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM 0.00052
	Arsenic (As)-Dissolved (mg/L)	DLM 0.0499	DLM 0.0468	DLM 0.0474	DLM 0.0476	DLM 0.0760
	Barium (Ba)-Dissolved (mg/L)	DLM 0.0165	DLM 0.0166	DLM 0.0165	DLM 0.0163	DLM 0.0167
	Beryllium (Be)-Dissolved (mg/L)	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025
	Bismuth (Bi)-Dissolved (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Boron (B)-Dissolved (mg/L)	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050
	Cadmium (Cd)-Dissolved (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Calcium (Ca)-Dissolved (mg/L)	DLM 128	DLM 129	DLM 132	DLM 128	DLM 130
	Chromium (Cr)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Cobalt (Co)-Dissolved (mg/L)	DLM 0.00341	DLM 0.00341	DLM 0.00343	DLM 0.00338	DLM 0.00313
	Copper (Cu)-Dissolved (mg/L)	DLM 0.00132	DLM 0.00124	DLM 0.00121	DLM 0.00120	DLM 0.00124
	Iron (Fe)-Dissolved (mg/L)	DLM 0.065	DLM 0.052	DLM <0.050	DLM 0.055	DLM <0.050
	Lead (Pb)-Dissolved (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Lithium (Li)-Dissolved (mg/L)	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015
	Magnesium (Mg)-Dissolved (mg/L)	DLM 8.60	DLM 8.63	DLM 8.71	DLM 8.53	DLM 8.61
	Manganese (Mn)-Dissolved (mg/L)	DLM 0.0992	DLM 0.100	DLM 0.100	DLM 0.101	DLM 0.0959
	Molybdenum (Mo)-Dissolved (mg/L)	DLM 0.00205	DLM 0.00251	DLM 0.00213	DLM 0.00228	DLM 0.00205
	Nickel (Ni)-Dissolved (mg/L)	DLM 0.00658	DLM 0.00745	DLM 0.00670	DLM 0.00783	DLM 0.00666
	Phosphorus (P)-Dissolved (mg/L)	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5
	Potassium (K)-Dissolved (mg/L)	DLM 7.19	DLM 7.20	DLM 7.27	DLM 7.06	DLM 7.12
	Selenium (Se)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Silicon (Si)-Dissolved (mg/L)	DLM 0.44	DLM 0.46	DLM 0.45	DLM 0.44	DLM 0.43
	Silver (Ag)-Dissolved (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Sodium (Na)-Dissolved (mg/L)	DLM 29.7	DLM 29.3	DLM 29.3	DLM 29.3	DLM 29.6
	Strontium (Sr)-Dissolved (mg/L)	DLM 0.202	DLM 0.196	DLM 0.203	DLM 0.201	DLM 0.202
	Thallium (Tl)-Dissolved (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Tin (Sn)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Titanium (Ti)-Dissolved (mg/L)	DLM <0.0015	DLM <0.0015	DLM <0.0015	DLM <0.0015	DLM <0.0015
	Uranium (U)-Dissolved (mg/L)	DLM 0.000243	DLM 0.000255	DLM 0.000240	DLM 0.000253	DLM 0.000261
	Vanadium (V)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Zinc (Zn)-Dissolved (mg/L)	DLM <0.0050	DLM <0.0050	DLM <0.0050	DLM <0.0050	DLM <0.0050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1344178-6	L1344178-7	L1344178-8	L1344178-9	L1344178-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13
	Sampled Time	10:00	10:00	10:00	10:00	10:00
	Client ID	UP3-B	UP4-S	UP4-B	UP5-S	UP5-B
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)	DLM 0.0250	DLM 0.0175	DLM 0.0177	DLM 0.0204	DLM 0.0202
	Antimony (Sb)-Dissolved (mg/L)	DLM 0.00051	DLM 0.00051	DLM <0.00050	DLM 0.00051	DLM 0.00053
	Arsenic (As)-Dissolved (mg/L)	DLM 0.0755	DLM 0.0433	DLM 0.0432	DLM 0.0955	DLM 0.0945
	Barium (Ba)-Dissolved (mg/L)	DLM 0.0171	DLM 0.0162	DLM 0.0168	DLM 0.0172	DLM 0.0170
	Beryllium (Be)-Dissolved (mg/L)	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025
	Bismuth (Bi)-Dissolved (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Boron (B)-Dissolved (mg/L)	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050
	Cadmium (Cd)-Dissolved (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Calcium (Ca)-Dissolved (mg/L)	DLM 131	DLM 130	DLM 128	DLM 130	DLM 128
	Chromium (Cr)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Cobalt (Co)-Dissolved (mg/L)	DLM 0.00316	DLM 0.00384	DLM 0.00385	DLM 0.00313	DLM 0.00297
	Copper (Cu)-Dissolved (mg/L)	DLM 0.00115	DLM 0.00124	DLM 0.00118	DLM 0.00127	DLM 0.00124
	Iron (Fe)-Dissolved (mg/L)	DLM 0.052	DLM <0.050	DLM <0.050	DLM 0.065	DLM 0.052
	Lead (Pb)-Dissolved (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Lithium (Li)-Dissolved (mg/L)	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015
	Magnesium (Mg)-Dissolved (mg/L)	DLM 8.62	DLM 8.72	DLM 8.72	DLM 8.59	DLM 8.61
	Manganese (Mn)-Dissolved (mg/L)	DLM 0.0967	DLM 0.116	DLM 0.116	DLM 0.0957	DLM 0.0944
	Molybdenum (Mo)-Dissolved (mg/L)	DLM 0.00218	DLM 0.00201	DLM 0.00208	DLM 0.00206	DLM 0.00208
	Nickel (Ni)-Dissolved (mg/L)	DLM 0.00656	DLM 0.00722	DLM 0.00754	DLM 0.00646	DLM 0.00651
	Phosphorus (P)-Dissolved (mg/L)	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5
	Potassium (K)-Dissolved (mg/L)	DLM 7.12	DLM 7.24	DLM 7.31	DLM 7.18	DLM 7.16
	Selenium (Se)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Silicon (Si)-Dissolved (mg/L)	DLM 0.43	DLM 0.46	DLM 0.45	DLM 0.43	DLM 0.42
	Silver (Ag)-Dissolved (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Sodium (Na)-Dissolved (mg/L)	DLM 29.3	DLM 30.0	DLM 30.4	DLM 29.6	DLM 29.6
	Strontium (Sr)-Dissolved (mg/L)	DLM 0.206	DLM 0.205	DLM 0.195	DLM 0.202	DLM 0.201
	Thallium (Tl)-Dissolved (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Tin (Sn)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Titanium (Ti)-Dissolved (mg/L)	DLM <0.0015	DLM <0.0015	DLM <0.0015	DLM <0.0015	DLM <0.0015
	Uranium (U)-Dissolved (mg/L)	DLM 0.000258	DLM 0.000247	DLM 0.000237	DLM 0.000270	DLM 0.000256
	Vanadium (V)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Zinc (Zn)-Dissolved (mg/L)	DLM <0.0050	DLM <0.0050	DLM <0.0050	DLM <0.0050	DLM <0.0050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1344178-11 Surface Water 06-AUG-13 10:00 UP6-S	L1344178-12 Surface Water 06-AUG-13 10:00 UP6-B	L1344178-13 Surface Water 06-AUG-13 10:00 TBLANK	L1344178-14 Surface Water 06-AUG-13 10:00 UP-EQ	L1344178-15 Surface Water 06-AUG-13 10:00 DUP 9
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	DLM <0.015	DLM <0.015	<0.0030	DLM 0.159	DLM <0.015
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)	DLM 0.0202	DLM 0.0213			
	Antimony (Sb)-Dissolved (mg/L)	DLM 0.00052	DLM <0.00050			
	Arsenic (As)-Dissolved (mg/L)	DLM 0.105	DLM 0.101			
	Barium (Ba)-Dissolved (mg/L)	DLM 0.0172	DLM 0.0161			
	Beryllium (Be)-Dissolved (mg/L)	DLM <0.0025	DLM <0.0025			
	Bismuth (Bi)-Dissolved (mg/L)	DLM <0.00025	DLM <0.00025			
	Boron (B)-Dissolved (mg/L)	DLM <0.050	DLM <0.050			
	Cadmium (Cd)-Dissolved (mg/L)	DLM <0.000050	DLM <0.000050			
	Calcium (Ca)-Dissolved (mg/L)	DLM 125	DLM 127			
	Chromium (Cr)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050			
	Cobalt (Co)-Dissolved (mg/L)	DLM 0.00310	DLM 0.00313			
	Copper (Cu)-Dissolved (mg/L)	DLM 0.00128	DLM 0.00131			
	Iron (Fe)-Dissolved (mg/L)	DLM 0.054	DLM 0.059			
	Lead (Pb)-Dissolved (mg/L)	DLM <0.00025	DLM <0.00025			
	Lithium (Li)-Dissolved (mg/L)	DLM <0.015	DLM <0.015			
	Magnesium (Mg)-Dissolved (mg/L)	DLM 8.69	DLM 8.68			
	Manganese (Mn)-Dissolved (mg/L)	DLM 0.103	DLM 0.103			
	Molybdenum (Mo)-Dissolved (mg/L)	DLM 0.00207	DLM 0.00203			
	Nickel (Ni)-Dissolved (mg/L)	DLM 0.00669	DLM 0.00683			
	Phosphorus (P)-Dissolved (mg/L)	DLM <1.5	DLM <1.5			
	Potassium (K)-Dissolved (mg/L)	DLM 7.18	DLM 7.13			
	Selenium (Se)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050			
	Silicon (Si)-Dissolved (mg/L)	DLM 0.43	DLM 0.43			
	Silver (Ag)-Dissolved (mg/L)	DLM <0.000050	DLM <0.000050			
	Sodium (Na)-Dissolved (mg/L)	DLM 30.0	DLM 29.5			
	Strontium (Sr)-Dissolved (mg/L)	DLM 0.204	DLM 0.196			
	Thallium (Tl)-Dissolved (mg/L)	DLM <0.00025	DLM <0.00025			
	Tin (Sn)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050			
	Titanium (Ti)-Dissolved (mg/L)	DLM <0.0015	DLM <0.0015			
	Uranium (U)-Dissolved (mg/L)	DLM 0.000269	DLM 0.000256			
	Vanadium (V)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050			
	Zinc (Zn)-Dissolved (mg/L)	DLM <0.0050	DLM <0.0050			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1344178-16 Surface Water 06-AUG-13 10:00 DUP 10	L1344178-20 Surface Water 06-AUG-13 09:00 EFF 167	L1344178-24 Surface Water 07-AUG-13 09:00 EFF 171		
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	<0.015 DLM	<0.015 DLM	<0.015 DLM		
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)					
	Antimony (Sb)-Dissolved (mg/L)					
	Arsenic (As)-Dissolved (mg/L)					
	Barium (Ba)-Dissolved (mg/L)					
	Beryllium (Be)-Dissolved (mg/L)					
	Bismuth (Bi)-Dissolved (mg/L)					
	Boron (B)-Dissolved (mg/L)					
	Cadmium (Cd)-Dissolved (mg/L)					
	Calcium (Ca)-Dissolved (mg/L)					
	Chromium (Cr)-Dissolved (mg/L)					
	Cobalt (Co)-Dissolved (mg/L)					
	Copper (Cu)-Dissolved (mg/L)					
	Iron (Fe)-Dissolved (mg/L)					
	Lead (Pb)-Dissolved (mg/L)					
	Lithium (Li)-Dissolved (mg/L)					
	Magnesium (Mg)-Dissolved (mg/L)					
	Manganese (Mn)-Dissolved (mg/L)					
	Molybdenum (Mo)-Dissolved (mg/L)					
	Nickel (Ni)-Dissolved (mg/L)					
	Phosphorus (P)-Dissolved (mg/L)					
	Potassium (K)-Dissolved (mg/L)					
	Selenium (Se)-Dissolved (mg/L)					
	Silicon (Si)-Dissolved (mg/L)					
	Silver (Ag)-Dissolved (mg/L)					
	Sodium (Na)-Dissolved (mg/L)					
	Strontium (Sr)-Dissolved (mg/L)					
	Thallium (Tl)-Dissolved (mg/L)					
	Tin (Sn)-Dissolved (mg/L)					
	Titanium (Ti)-Dissolved (mg/L)					
	Uranium (U)-Dissolved (mg/L)					
	Vanadium (V)-Dissolved (mg/L)					
	Zinc (Zn)-Dissolved (mg/L)					

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

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A
MET-T-CCMS-ED	Water	Total Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A
NH3-CFA-ED	Water	Ammonia in Water by Colour	APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.

ALS Test Code	Matrix	Test Description	Method Reference**
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite	CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
PH-ED	Water	pH	APHA 4500 H-Electrode

All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

ALS Test Code	Matrix	Test Description	Method Reference**
SOLIDS-TOTSUS-ED	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

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

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

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

1 2 3

GLOSSARY OF REPORT TERMS

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

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1344178 Report Date: 12-AUG-13

Client: WESA Inc.
4 Cataraque Street The Tower
Kingston ON K7K 1Z7

Contact: Tim Beckenham

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED	**Water**							
Batch R2669339								
WG1723421-2 CRM		**ED-HIGH-WATRM**						
Aluminum (Al)-Dissolved			100.6		%		80-120	09-AUG-13
Antimony (Sb)-Dissolved			98.4		%		80-120	09-AUG-13
Arsenic (As)-Dissolved			103.1		%		80-120	09-AUG-13
Barium (Ba)-Dissolved			102.2		%		80-120	09-AUG-13
Beryllium (Be)-Dissolved			101.3		%		80-120	09-AUG-13
Bismuth (Bi)-Dissolved			100.6		%		80-120	09-AUG-13
Boron (B)-Dissolved			98.2		%		80-120	09-AUG-13
Cadmium (Cd)-Dissolved			104.4		%		80-120	09-AUG-13
Calcium (Ca)-Dissolved			105.0		%		80-120	09-AUG-13
Chromium (Cr)-Dissolved			103.6		%		80-120	09-AUG-13
Cobalt (Co)-Dissolved			100.2		%		80-120	09-AUG-13
Copper (Cu)-Dissolved			99.2		%		80-120	09-AUG-13
Lead (Pb)-Dissolved			100.2		%		80-120	09-AUG-13
Lithium (Li)-Dissolved			101.5		%		80-120	09-AUG-13
Magnesium (Mg)-Dissolved			100.1		%		80-120	09-AUG-13
Manganese (Mn)-Dissolved			99.4		%		80-120	09-AUG-13
Molybdenum (Mo)-Dissolved			102.3		%		80-120	09-AUG-13
Nickel (Ni)-Dissolved			102.6		%		80-120	09-AUG-13
Phosphorus (P)-Dissolved			111.0		%		80-120	09-AUG-13
Potassium (K)-Dissolved			105.9		%		80-120	09-AUG-13
Selenium (Se)-Dissolved			104.1		%		80-120	09-AUG-13
Silicon (Si)-Dissolved			106.0		%		80-120	09-AUG-13
Silver (Ag)-Dissolved			102.3		%		80-120	09-AUG-13
Sodium (Na)-Dissolved			97.2		%		80-120	09-AUG-13
Strontium (Sr)-Dissolved			104.2		%		80-120	09-AUG-13
Thallium (Tl)-Dissolved			102.7		%		80-120	09-AUG-13
Titanium (Ti)-Dissolved			108.2		%		80-120	09-AUG-13
Tin (Sn)-Dissolved			97.5		%		80-120	09-AUG-13
Uranium (U)-Dissolved			102.7		%		80-120	09-AUG-13
Vanadium (V)-Dissolved			100.5		%		80-120	09-AUG-13
Zinc (Zn)-Dissolved			99.9		%		80-120	09-AUG-13
WG1723421-1 MB								
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	09-AUG-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED	**Water**							
Batch R2669339								
WG1723421-1 MB								
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	09-AUG-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-13
Boron (B)-Dissolved			<0.010		mg/L		0.01	09-AUG-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	09-AUG-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	09-AUG-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	09-AUG-13
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-13
Lithium (Li)-Dissolved			<0.0030		mg/L		0.003	09-AUG-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	09-AUG-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Phosphorus (P)-Dissolved			<0.30		mg/L		0.3	09-AUG-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	09-AUG-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	09-AUG-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	09-AUG-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	09-AUG-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	09-AUG-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	09-AUG-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	09-AUG-13
MET-T-CCMS-ED	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2668991								
WG1723752-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	10-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	10-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	10-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	10-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	10-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	10-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	10-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	10-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	10-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	10-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	10-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	10-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	10-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2669616								
WG1723768-3 LCS								
Aluminum (Al)-Total			100.7		%		80-120	10-AUG-13
Antimony (Sb)-Total			101.4		%		80-120	10-AUG-13
Arsenic (As)-Total			102.7		%		80-120	10-AUG-13
Barium (Ba)-Total			101.4		%		80-120	10-AUG-13
Beryllium (Be)-Total			102.5		%		80-120	10-AUG-13
Bismuth (Bi)-Total			103.8		%		80-120	10-AUG-13
Boron (B)-Total			103.1		%		80-120	10-AUG-13
Cadmium (Cd)-Total			104.7		%		80-120	10-AUG-13
Calcium (Ca)-Total			106.9		%		80-120	10-AUG-13
Chromium (Cr)-Total			104.1		%		80-120	10-AUG-13
Cobalt (Co)-Total			101.9		%		80-120	10-AUG-13
Copper (Cu)-Total			99.3		%		80-120	10-AUG-13
Iron (Fe)-Total			95.4		%		80-120	10-AUG-13
Lead (Pb)-Total			107.3		%		80-120	10-AUG-13
Lithium (Li)-Total			107.8		%		80-120	10-AUG-13
Magnesium (Mg)-Total			105.2		%		80-120	10-AUG-13
Manganese (Mn)-Total			100.8		%		80-120	10-AUG-13
Molybdenum (Mo)-Total			104.5		%		80-120	10-AUG-13
Nickel (Ni)-Total			100.3		%		80-120	10-AUG-13
Potassium (K)-Total			98.2		%		80-120	10-AUG-13
Selenium (Se)-Total			108.6		%		80-120	10-AUG-13
Silicon (Si)-Total			108.6		%		80-120	10-AUG-13
Silver (Ag)-Total			94.1		%		80-120	10-AUG-13
Sodium (Na)-Total			102.4		%		80-120	10-AUG-13
Strontium (Sr)-Total			113.1		%		80-120	10-AUG-13
Thallium (Tl)-Total			106.2		%		80-120	10-AUG-13
Tin (Sn)-Total			94.8		%		80-120	10-AUG-13
Titanium (Ti)-Total			106.1		%		80-120	10-AUG-13
Uranium (U)-Total			101.2		%		80-120	10-AUG-13
Vanadium (V)-Total			103.6		%		80-120	10-AUG-13
Zinc (Zn)-Total			103.7		%		80-120	10-AUG-13
WG1723768-4 LCS								
Aluminum (Al)-Total			118.5		%		80-120	10-AUG-13
Antimony (Sb)-Total			106.9		%		80-120	10-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2669616								
WG1723768-4 LCS								
Arsenic (As)-Total			101.8		%		80-120	10-AUG-13
Barium (Ba)-Total			101.7		%		80-120	10-AUG-13
Beryllium (Be)-Total			98.4		%		80-120	10-AUG-13
Bismuth (Bi)-Total			98.5		%		80-120	10-AUG-13
Boron (B)-Total			100.5		%		80-120	10-AUG-13
Cadmium (Cd)-Total			101.5		%		80-120	10-AUG-13
Calcium (Ca)-Total			103.0		%		80-120	10-AUG-13
Chromium (Cr)-Total			101.1		%		80-120	10-AUG-13
Cobalt (Co)-Total			99.3		%		80-120	10-AUG-13
Copper (Cu)-Total			99.5		%		80-120	10-AUG-13
Iron (Fe)-Total			105.7		%		80-120	10-AUG-13
Lead (Pb)-Total			104.0		%		80-120	10-AUG-13
Lithium (Li)-Total			97.6		%		80-120	10-AUG-13
Magnesium (Mg)-Total			107.3		%		80-120	10-AUG-13
Manganese (Mn)-Total			99.6		%		80-120	10-AUG-13
Molybdenum (Mo)-Total			102.2		%		80-120	10-AUG-13
Nickel (Ni)-Total			98.2		%		80-120	10-AUG-13
Potassium (K)-Total			96.8		%		80-120	10-AUG-13
Selenium (Se)-Total			106.1		%		80-120	10-AUG-13
Silver (Ag)-Total			96.9		%		80-120	10-AUG-13
Sodium (Na)-Total			101.9		%		80-120	10-AUG-13
Strontium (Sr)-Total			107.1		%		80-120	10-AUG-13
Thallium (Tl)-Total			105.4		%		80-120	10-AUG-13
Tin (Sn)-Total			96.5		%		80-120	10-AUG-13
Titanium (Ti)-Total			114.6		%		80-120	10-AUG-13
Uranium (U)-Total			98.4		%		80-120	10-AUG-13
Vanadium (V)-Total			101.4		%		80-120	10-AUG-13
Zinc (Zn)-Total			102.1		%		80-120	10-AUG-13
WG1723752-2 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	10-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	10-AUG-13

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2669616								
WG1723752-2 MB								
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	10-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	10-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	10-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	10-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	10-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	10-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	10-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	10-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	10-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	10-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	10-AUG-13
WG1723768-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	10-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	10-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	10-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2669616								
WG1723768-1 MB								
Boron (B)-Total			<0.010		mg/L		0.01	10-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	10-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	10-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	10-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	10-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	10-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	10-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	10-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	10-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	10-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	10-AUG-13
WG1723768-2 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	10-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	10-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	10-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	10-AUG-13

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2669616								
WG1723768-2 MB								
Calcium (Ca)-Total			<0.020		mg/L		0.02	10-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	10-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	10-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	10-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	10-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	10-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	10-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	10-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	10-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	10-AUG-13
NH3-CFA-ED	**Water**							
Batch R2668937								
WG1723203-2 LCS								
Ammonia, Total (as N)			99.7		%		85-115	09-AUG-13
WG1723203-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	09-AUG-13
WG1723203-6 MS		**L1344178-13**						
Ammonia, Total (as N)			96.6		%		75-125	09-AUG-13
WG1723203-9 MS		**L1342019-4**						
Ammonia, Total (as N)			98.5		%		75-125	09-AUG-13
NO2-IC-ED	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-ED	**Water**							
Batch R2669522								
WG1723929-1 MB								
Nitrite (as N)			<0.050		mg/L		0.05	09-AUG-13
NO3-IC-ED	**Water**							
Batch R2669522								
WG1723929-1 MB								
Nitrate (as N)			<0.050		mg/L		0.05	09-AUG-13
PH-ED	**Water**							
Batch R2668867								
WG1723395-7 DUP		**L1344178-11**						
pH		7.86	7.86	J	pH	0.00	0.3	09-AUG-13
WG1723395-3 LCS								
pH			7.05		pH		6.9-7.1	09-AUG-13
Batch R2670354								
WG1724551-3 LCS								
pH			7.03		pH		6.9-7.1	12-AUG-13
SOLIDS-TOTSUS-ED	**Water**							
Batch R2669161								
WG1723215-2 LCS								
Total Suspended Solids			100.0		%		85-115	09-AUG-13
WG1723215-1 MB								
Total Suspended Solids			<3.0		mg/L		3	09-AUG-13

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH							
	1	06-AUG-13 10:00	09-AUG-13 14:34	0.25	77	hours	EHTR-FM
	2	06-AUG-13 10:00	09-AUG-13 14:38	0.25	77	hours	EHTR-FM
	3	06-AUG-13 10:00	09-AUG-13 14:41	0.25	77	hours	EHTR-FM
	4	06-AUG-13 10:00	09-AUG-13 14:45	0.25	77	hours	EHTR-FM
	5	06-AUG-13 10:00	09-AUG-13 14:49	0.25	77	hours	EHTR-FM
	6	06-AUG-13 10:00	09-AUG-13 14:52	0.25	77	hours	EHTR-FM
	7	06-AUG-13 10:00	09-AUG-13 14:56	0.25	77	hours	EHTR-FM
	8	06-AUG-13 10:00	09-AUG-13 14:59	0.25	77	hours	EHTR-FM
	9	06-AUG-13 10:00	09-AUG-13 15:03	0.25	77	hours	EHTR-FM
	10	06-AUG-13 10:00	09-AUG-13 15:07	0.25	77	hours	EHTR-FM
	11	06-AUG-13 10:00	09-AUG-13 15:10	0.25	77	hours	EHTR-FM
	12	06-AUG-13 10:00	09-AUG-13 15:18	0.25	77	hours	EHTR-FM
	13	06-AUG-13 10:00	12-AUG-13 16:24	0.25	150	hours	EHTR-FM
	14	06-AUG-13 10:00	12-AUG-13 16:24	0.25	150	hours	EHTR-FM
	15	06-AUG-13 10:00	09-AUG-13 15:29	0.25	78	hours	EHTR-FM
	16	06-AUG-13 10:00	09-AUG-13 15:32	0.25	78	hours	EHTR-FM
	20	06-AUG-13 09:00	09-AUG-13 15:36	0.25	79	hours	EHTR-FM
	24	07-AUG-13 09:00	09-AUG-13 15:39	0.25	55	hours	EHTR-FM
Anions and Nutrients							
Nitrate as N by IC							
	1	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	2	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	3	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	4	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	5	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	6	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	7	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	8	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	9	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	10	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	11	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	12	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	13	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	14	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	15	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	16	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	20	06-AUG-13 09:00	09-AUG-13 08:00	48	71	hours	EHTL
Nitrite as N by IC							
	1	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	2	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	3	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	4	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	5	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	6	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	7	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	8	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	9	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	10	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	11	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	12	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	13	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	14	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	15	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	16	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	20	06-AUG-13 09:00	09-AUG-13 08:00	48	71	hours	EHTL

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1344178 were received on 07-AUG-13 17:20.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To	
Company:	BluMetric
Contact:	Tim Beckenham
Address:	4 Cataraqui St. The Tower, Kingston, On, K7K 1Z7
Phone:	(613) 531-2725
Fax:	
Invoice To Same as Report?	☐ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☐ No
Company:	KEES Ltd
Contact:	
Address:	98 Archibald St. Box 133 Yellowknife, NT X1A 2N1
Phone:	(867) 669-9481
Fax:	(867) 669-9482
Lab Work Order # (lab use only)	L1344178

Report Format / Distribution	
☒ Standard ☐ Other	
☒ PDF ☒ Excel ☐ Digital ☐ Fax	
Email 1:	cproux@envireau.ca
Email 2:	tbeckenham@wesa.ca
Email 3:	
Client / Project Information	
Job #:	
PO / AFE:	
LSD:	
Quote #:	
ALS Contact:	Catherine Evaristo
Sampler:	Alexandra Duchesne

Service Requested (Rush for routine analysis subject to availability)
◉ Regular (Standard Turnaround Times - Business Days)
○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
~~● Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT~~
○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

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

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS, pH	Total metal (As, Zn, Cu, Pb, Ni) (P)	Dissolved metals (As, Zn, Cu, Pb, Ni) (F/P)	NO_2; NO_3	Total ammonia nitrogen (P)								Number of Containers
	UP1-S	06/08/13	10:00	surface water	X	X	X	X	X								
	UP1-B	↓	↓	↓													
	UP2-S																
	UP2-B																
	UP3-S																
	UP3-B																
	UP4-S																
	UP4-B																
→	UP5-S																
	UP5-B																
	UP6-S																
	UP6-B																

L1344178-COFC

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

keep the extra bottles on hold. Bottles indicating dissolved metals have been filtered and preserved and they are for dissolved metals.

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

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

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

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Alexandra Duchesne	Date (dd-mmm-yy) 07/08/13	Time (hh-mm) 14:00	Received by: [signature]	Date: Aug 7/13	Time: 5:20	Temperature: ① Max 13 avg 12 °C ② max 13 avg 11	Verified by: ⑥ max 13 avg 11	Date:	Time:	Observations: Yes / No ? If Yes add SIF

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC #

Report To	Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company:	☐ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business Days) EFF167
Contact:	☐ PDF ☐ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	Email 1:	⊗ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT EFF171
	Email 2:	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone: Fax:	Email 3:	

Invoice To	Client / Project Information
Same as Report ? ☐ Yes ☐ No	Job #:
Hardcopy of Invoice with Report? ☐ Yes ☐ No	PO / AFE:
Company:	LSD:
Contact:	
Address:	Quote #:
Phone: Fax:	ALS Contact: / Sampler:
Lab Work Order # (lab use only)	

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

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS, pH	P Total metals (As, Zn, Cu, Pb, Ni)	NO2 and NO3	P Total ammonia nitrogen								Number of Containers
	EFF164	05/08/13	15:00	surface water												
	EFF165	05/08/13	21:00													
	EFF166	06/08/13	3:00													
	EFF167	06/08/13	9:00		X	X	X	X								
	EFF168	06/08/13	15:00													
	EFF169	06/08/13	21:00													
	EFF170	07/08/13	3:00													
	EFF171	07/08/13	9:00		X	X	X	X								

L1344178-COFC

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

keep the extra bottles on hold. EFF171 emergency turn over, EFF167 → normal turnover.

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

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

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

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

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC #

Report To	Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company:	☐ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business Days)
Contact:	☐ PDF ☐ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	Email 1:	◉ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Email 2:	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone: Fax:	Email 3:	Analysis Request
Invoice To Same as Report ? ☐ Yes ☐ No	Client / Project Information	Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report? ☐ Yes ☐ No	Job #:	
Company:	PO / AFE:	
Contact:	LSD:	
Address:		
Phone: Fax:	Quote #:	
Lab Work Order # (lab use only)	ALS Contact: / Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS, pH	Total metal (As, Zn, Cu, Pb, Ni) (P)	NO_2, NO_3	Total ammonia nitrogen (P)								Number of Containers
	T Blank	06/08/13	10:00		X	X	X	X								
	UP-EQ	"	"		X	X	X	X								
	DUP 9	"	"		/	/	/	/								
	DUP 10	"	"		/	/	/	/								

L1344178-COFC

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

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

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

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Alexandra Duchesne	Date (dd-mmm-yy) 07/08/13	Time (hh-mm) 14:00	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

APPENDIX D

Accredited Laboratory Certificate of Analysis – Discharge Events

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.:
130476

- FINAL REPORT -

Prepared For: Tlicho Engineering & Environmental Ser.

Address: 98 Archibald Street
Yellowknife, NT
X1A 2N1

Attn: **Melanie St Jean** **Facsimile:** **(867) 669-9482**

Final report has been reviewed and approved by:

Angelique Ruzindana
Quality Assurance Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
  - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
  - Environment Canada
  - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Monday, July 15, 2013
Print Date: Monday, July 15, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130476

- CERTIFICATE OF ANALYSIS -

Client Sample ID: UP3-S-INT **Taiga Sample ID:** 001

Client Project: YB11192-00-00
Sample Type: Surface Water
Received Date: 05-Jul-13
Sampling Date: 03-Jul-13
Sampling Time: 6:30
Location: Upper Pond & WTP
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
Colour, Apparent	44	5	CU	05-Jul-13	SM2120:B	
Colour, True	< 5	5	TCU	05-Jul-13	SM2120:B	
Solids, Total Suspended	4	3	mg/L	07-Jul-13	SM2540:D	
Turbidity	2.16	0.05	NTU	06-Jul-13	SM2130:B	
Inorganics - Nutrients						
Ammonia as Nitrogen	0.151	0.005	mg/L	11-Jul-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.39	0.01	mg/L	06-Jul-13	SM4110:B	
Nitrite as Nitrogen	0.02	0.01	mg/L	06-Jul-13	SM4110:B	
Trace Metals, Dissolved						
Arsenic	96.1	0.2	µg/L	05-Jul-13	EPA200.8	
Copper	0.8	0.2	µg/L	05-Jul-13	EPA200.8	
Lead	< 0.1	0.1	µg/L	05-Jul-13	EPA200.8	
Nickel	5.4	0.1	µg/L	05-Jul-13	EPA200.8	

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130476

- CERTIFICATE OF ANALYSIS -

Client Sample ID: UP3-S-INT **Taiga Sample ID:** 001

Zinc	1.1	0.4	µg/L	05-Jul-13	EPA200.8
Trace Metals, Total					
Arsenic	185	0.2	µg/L	05-Jul-13	EPA200.8
Copper	1.2	0.2	µg/L	05-Jul-13	EPA200.8
Lead	0.9	0.1	µg/L	05-Jul-13	EPA200.8
Nickel	6.3	0.1	µg/L	05-Jul-13	EPA200.8
Zinc	3.3	0.4	µg/L	05-Jul-13	EPA200.8

ReportDate: Monday, July 15, 2013
Print Date: Monday, July 15, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130476

- CERTIFICATE OF ANALYSIS -

Client Sample ID: AFF-INT-13 **Taiga Sample ID:** 002

Client Project: YB11192-00-00
Sample Type: Surface Water
Received Date: 05-Jul-13
Sampling Date: 04-Jul-13
Sampling Time: 13:00
Location: Upper Pond & WTP
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
Solids, Total Suspended	8	3	mg/L	07-Jul-13	SM2540:D	
Turbidity	3.75	0.05	NTU	06-Jul-13	SM2130:B	

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130476

- CERTIFICATE OF ANALYSIS -

Client Sample ID: EFF-INT-13 **Taiga Sample ID:** 003

Client Project: YB11192-00-00
Sample Type: Surface Water
Received Date: 05-Jul-13
Sampling Date: 04-Jul-13
Sampling Time: 13:00
Location: Upper Pond & WTP
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
Solids, Total Suspended	4	3	mg/L	07-Jul-13	SM2540:D	
Turbidity	3.68	0.05	NTU	06-Jul-13	SM2130:B	

ReportDate: Monday, July 15, 2013
Print Date: Monday, July 15, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130476

- CERTIFICATE OF ANALYSIS -

Client Sample ID: Tblank **Taiga Sample ID:** 004

Client Project: YB11192-00-00
Sample Type: Travel Blank
Received Date: 05-Jul-13
Sampling Date: 04-Jul-13
Sampling Time: 13:00
Location:
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
Colour, Apparent	< 5	5	CU	05-Jul-13	SM2120:B	
Colour, True	< 5	5	TCU	05-Jul-13	SM2120:B	
Turbidity	0.07	0.05	NTU	08-Jul-13	SM2130:B	
Inorganics - Nutrients						
Ammonia as Nitrogen	< 0.005	0.005	mg/L	11-Jul-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	< 0.01	0.01	mg/L	06-Jul-13	SM4110:B	
Nitrite as Nitrogen	< 0.01	0.01	mg/L	06-Jul-13	SM4110:B	
Trace Metals, Dissolved						
Arsenic	No Container		µg/L		EPA200.8	
Copper	No Container		µg/L		EPA200.8	
Lead	No Container		µg/L		EPA200.8	
Nickel	No Container		µg/L		EPA200.8	
Zinc	No Container		µg/L		EPA200.8	

ReportDate: Monday, July 15, 2013
Print Date: Monday, July 15, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.:
130476

- CERTIFICATE OF ANALYSIS -

Client Sample ID: Tblank **Taiga Sample ID:** 004

Trace Metals, Total

Arsenic	< 0.2	0.2	µg/L	05-Jul-13	EPA200.8
Copper	< 0.2	0.2	µg/L	05-Jul-13	EPA200.8
Lead	< 0.1	0.1	µg/L	05-Jul-13	EPA200.8
Nickel	< 0.1	0.1	µg/L	05-Jul-13	EPA200.8
Zinc	< 0.4	0.4	µg/L	05-Jul-13	EPA200.8

ReportDate: Monday, July 15, 2013
Print Date: Monday, July 15, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130476

- CERTIFICATE OF ANALYSIS -

Client Sample ID: Tblank **Taiga Sample ID:** 004

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater
EPA - United States Environmental Protection Agency

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.:
130630

- FINAL REPORT -

Prepared For: WESA

Address: 4901 - 48 Street
P.O. Box 11086
Yellowknife, NT
X1A 3X7

Attn: **Tim Beckenham** **Facsimile:** **(867) 873-3499**

Final report has been reviewed and approved by:

Angelique Ruzindana
Quality Assurance Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
  - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
  - Environment Canada
  - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Friday, August 16, 2013
Print Date: Friday, August 16, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130630

- CERTIFICATE OF ANALYSIS -

Client Sample ID: UP5-S **Taiga Sample ID:** 001

Client Project: YB11192 Tundra
Sample Type: Surface Water
Received Date: 08-Aug-13
Sampling Date: 06-Aug-13
Sampling Time: 10:00
Location: Tundra Mine Site
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	7.77		pH units	08-Aug-13	SM4500-H:B	
Solids, Total Suspended	8	3	mg/L	13-Aug-13	SM2540:D	
Inorganics - Nutrients						
Nitrate+Nitrite as Nitrogen	0.22	0.01	mg/L	08-Aug-13	SM4110:B	
Trace Metals, Total						
Arsenic	246	0.2	µg/L	12-Aug-13	EPA200.8	
Copper	1.7	0.2	µg/L	12-Aug-13	EPA200.8	
Lead	0.4	0.1	µg/L	12-Aug-13	EPA200.8	
Nickel	7.9	0.1	µg/L	12-Aug-13	EPA200.8	
Zinc	3.3	0.4	µg/L	12-Aug-13	EPA200.8	

ReportDate: Friday, August 16, 2013
Print Date: Friday, August 16, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130630

- CERTIFICATE OF ANALYSIS -

Client Sample ID: UP5-S **Taiga Sample ID:** 001

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

ReportDate: Friday, August 16, 2013
Print Date: Friday, August 16, 2013

WESA Inc.
ATTN: Tim Beckenham
4 Cataraque Street
The Tower
Kingston ON K7K 1Z7

Date Received: 14-AUG-13
Report Date: 23-AUG-13 16:11 (MT)
Version: FINAL

Client Phone: 613-531-2725

Certificate of Analysis

Lab Work Order #: **L1347781**
Project P.O. #: NOT SUBMITTED
Job Reference: ABORIGINAL 15929
C of C Numbers: 1
Legal Site Desc:

Cath Evaristo Cordero

Catherine Evaristo-Cordero
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1347781-1	L1347781-4	L1347781-7
	Description	Surface Water	Surface Water	Surface Water
	Sampled Date	12-AUG-13	13-AUG-13	14-AUG-13
	Sampled Time	21:15	15:00	09:00
	Client ID	EFF 178	EFF 196	EFF 214
Grouping	**Analyte**			
WATER				
Physical Tests	pH (pH)	7.89	7.88	7.92
	Total Suspended Solids (mg/L)	7.0	5.0	5.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.105	0.077	0.081
	Nitrate and Nitrite (as N) (mg/L)	<0.071	<0.071	<0.071
	Nitrate (as N) (mg/L)	<0.050	<0.050	0.053
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050
Total Metals	Aluminum (Al)-Total (mg/L)	DLM 0.019	DLM <0.015	DLM <0.015
	Antimony (Sb)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Arsenic (As)-Total (mg/L)	DLM 0.0692	DLM 0.0247	DLM 0.0305
	Barium (Ba)-Total (mg/L)	DLM 0.0169	DLM 0.0153	DLM 0.0176
	Beryllium (Be)-Total (mg/L)	DLM <0.0025	DLM <0.0025	DLM <0.0025
	Bismuth (Bi)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Boron (B)-Total (mg/L)	DLM <0.050	DLM <0.050	DLM <0.050
	Cadmium (Cd)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Calcium (Ca)-Total (mg/L)	DLM 133	DLM 147	DLM 150
	Chromium (Cr)-Total (mg/L)	DLM 0.00055	DLM <0.00050	DLM 0.00051
	Cobalt (Co)-Total (mg/L)	DLM 0.00343	DLM 0.00296	DLM 0.00287
	Copper (Cu)-Total (mg/L)	DLM 0.00201	DLM 0.00158	DLM 0.00139
	Iron (Fe)-Total (mg/L)	DLM 1.86	DLM 1.69	DLM 1.81
	Lead (Pb)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Lithium (Li)-Total (mg/L)	DLM <0.025	DLM <0.025	DLM <0.025
	Magnesium (Mg)-Total (mg/L)	DLM 10.2	DLM 10.4	DLM 10.8
	Manganese (Mn)-Total (mg/L)	DLM 0.150	DLM 0.0880	DLM 0.0827
	Molybdenum (Mo)-Total (mg/L)	DLM 0.00186	DLM 0.00150	DLM 0.00154
	Nickel (Ni)-Total (mg/L)	DLM 0.00699	DLM 0.00587	DLM 0.00600
	Phosphorus (P)-Total (mg/L)	DLM <1.5	DLM <1.5	DLM <1.5
	Potassium (K)-Total (mg/L)	DLM 7.08	DLM 7.00	DLM 7.60
	Selenium (Se)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Silicon (Si)-Total (mg/L)	DLM 0.33	DLM 0.27	DLM 0.27
	Silver (Ag)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Sodium (Na)-Total (mg/L)	DLM 36.3	DLM 39.1	DLM 38.9
	Strontium (Sr)-Total (mg/L)	DLM 0.208	DLM 0.213	DLM 0.225
	Thallium (Tl)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Tin (Sn)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Titanium (Ti)-Total (mg/L)	DLM 0.0087	DLM 0.0084	DLM 0.0102
	Uranium (U)-Total (mg/L)	DLM 0.000227	DLM 0.000160	DLM 0.000181
	Vanadium (V)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1347781-1	L1347781-4	L1347781-7		
	Description	Surface Water	Surface Water	Surface Water		
	Sampled Date	12-AUG-13	13-AUG-13	14-AUG-13		
	Sampled Time	21:15	15:00	09:00		
	Client ID	EFF 178	EFF 196	EFF 214		
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	<0.015 DLM	<0.015 DLM	<0.015 DLM		

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Barium (Ba)-Total	B	L1347781-7
Method Blank	Manganese (Mn)-Total	B	L1347781-7
Duplicate	Aluminum (Al)-Total	DLM	L1347781-1, -4
Duplicate	Antimony (Sb)-Total	DLM	L1347781-1, -4
Duplicate	Arsenic (As)-Total	DLM	L1347781-1, -4
Duplicate	Barium (Ba)-Total	DLM	L1347781-1, -4
Duplicate	Beryllium (Be)-Total	DLM	L1347781-1, -4
Duplicate	Bismuth (Bi)-Total	DLM	L1347781-1, -4
Duplicate	Boron (B)-Total	DLM	L1347781-1, -4
Duplicate	Cadmium (Cd)-Total	DLM	L1347781-1, -4
Duplicate	Calcium (Ca)-Total	DLM	L1347781-1, -4
Duplicate	Chromium (Cr)-Total	DLM	L1347781-1, -4
Duplicate	Cobalt (Co)-Total	DLM	L1347781-1, -4
Duplicate	Copper (Cu)-Total	DLM	L1347781-1, -4
Duplicate	Iron (Fe)-Total	DLM	L1347781-1, -4
Duplicate	Lead (Pb)-Total	DLM	L1347781-1, -4
Duplicate	Lithium (Li)-Total	DLM	L1347781-1, -4
Duplicate	Magnesium (Mg)-Total	DLM	L1347781-1, -4
Duplicate	Manganese (Mn)-Total	DLM	L1347781-1, -4
Duplicate	Molybdenum (Mo)-Total	DLM	L1347781-1, -4
Duplicate	Nickel (Ni)-Total	DLM	L1347781-1, -4
Duplicate	Phosphorus (P)-Total	DLM	L1347781-1, -4
Duplicate	Potassium (K)-Total	DLM	L1347781-1, -4
Duplicate	Selenium (Se)-Total	DLM	L1347781-1, -4
Duplicate	Silicon (Si)-Total	DLM	L1347781-1, -4
Duplicate	Silver (Ag)-Total	DLM	L1347781-1, -4
Duplicate	Sodium (Na)-Total	DLM	L1347781-1, -4
Duplicate	Strontium (Sr)-Total	DLM	L1347781-1, -4
Duplicate	Thallium (Tl)-Total	DLM	L1347781-1, -4
Duplicate	Tin (Sn)-Total	DLM	L1347781-1, -4
Duplicate	Titanium (Ti)-Total	DLM	L1347781-1, -4
Duplicate	Uranium (U)-Total	DLM	L1347781-1, -4
Duplicate	Vanadium (V)-Total	DLM	L1347781-1, -4
Duplicate	Zinc (Zn)-Total	DLM	L1347781-1, -4
Method Blank	Vanadium (V)-Total	MB-LOR	L1347781-7

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. All associated sample results are at least 5 times greater than blank levels and are considered reliable.
DLM	Detection Limit Adjusted For Sample Matrix Effects
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-T-CCMS-ED	Water	Total Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A
NH3-CFA-ED	Water	Ammonia in Water by Colour	APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.

NO2+NO3-CALC-ED	Water	Nitrate+Nitrite	CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC	APHA 4110 B-ION CHROMATOGRAPHY

Reference Information

PH-ED	Water	pH	APHA 4500 H-Electrode

All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

SOLIDS-TOTSUS-ED	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

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

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

Laboratory Definition Code	**Laboratory Location**
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

1

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

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: WESA Inc.
4 Cataraque Street The Tower
Kingston ON K7K 1Z7

Contact: Tim Beckenham

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2673800								
WG1727898-3 LCS								
Aluminum (Al)-Total			101.8		%		80-120	16-AUG-13
Antimony (Sb)-Total			99.8		%		80-120	16-AUG-13
Arsenic (As)-Total			104.9		%		80-120	16-AUG-13
Barium (Ba)-Total			101.8		%		80-120	16-AUG-13
Beryllium (Be)-Total			94.0		%		80-120	16-AUG-13
Bismuth (Bi)-Total			101.2		%		80-120	16-AUG-13
Boron (B)-Total			100.7		%		80-120	16-AUG-13
Cadmium (Cd)-Total			104.5		%		80-120	16-AUG-13
Calcium (Ca)-Total			100.0		%		80-120	16-AUG-13
Chromium (Cr)-Total			105.1		%		80-120	16-AUG-13
Cobalt (Co)-Total			101.3		%		80-120	16-AUG-13
Copper (Cu)-Total			99.4		%		80-120	16-AUG-13
Iron (Fe)-Total			97.3		%		80-120	16-AUG-13
Lead (Pb)-Total			105.9		%		80-120	16-AUG-13
Lithium (Li)-Total			101.7		%		80-120	16-AUG-13
Magnesium (Mg)-Total			107.8		%		80-120	16-AUG-13
Manganese (Mn)-Total			102.4		%		80-120	16-AUG-13
Molybdenum (Mo)-Total			93.4		%		80-120	16-AUG-13
Nickel (Ni)-Total			104.5		%		80-120	16-AUG-13
Potassium (K)-Total			103.5		%		80-120	16-AUG-13
Selenium (Se)-Total			106.6		%		80-120	16-AUG-13
Silicon (Si)-Total			109.6		%		80-120	16-AUG-13
Silver (Ag)-Total			96.9		%		80-120	16-AUG-13
Sodium (Na)-Total			106.3		%		80-120	16-AUG-13
Strontium (Sr)-Total			95.3		%		80-120	16-AUG-13
Thallium (Tl)-Total			108.3		%		80-120	16-AUG-13
Tin (Sn)-Total			96.8		%		80-120	16-AUG-13
Titanium (Ti)-Total			112.7		%		80-120	16-AUG-13
Uranium (U)-Total			99.4		%		80-120	16-AUG-13
Vanadium (V)-Total			103.3		%		80-120	16-AUG-13
Zinc (Zn)-Total			99.8		%		80-120	16-AUG-13
WG1727898-4 LCS								
Aluminum (Al)-Total			95.4		%		80-120	17-AUG-13
Antimony (Sb)-Total			95.9		%		80-120	17-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2673800								
WG1727898-4 LCS								
Arsenic (As)-Total			99.2		%		80-120	17-AUG-13
Barium (Ba)-Total			101.6		%		80-120	17-AUG-13
Beryllium (Be)-Total			91.6		%		80-120	17-AUG-13
Bismuth (Bi)-Total			104.4		%		80-120	17-AUG-13
Boron (B)-Total			83.4		%		80-120	17-AUG-13
Cadmium (Cd)-Total			97.4		%		80-120	17-AUG-13
Calcium (Ca)-Total			98.8		%		80-120	17-AUG-13
Chromium (Cr)-Total			96.9		%		80-120	17-AUG-13
Cobalt (Co)-Total			96.5		%		80-120	17-AUG-13
Copper (Cu)-Total			97.4		%		80-120	17-AUG-13
Iron (Fe)-Total			97.3		%		80-120	17-AUG-13
Lead (Pb)-Total			100.2		%		80-120	17-AUG-13
Lithium (Li)-Total			109.2		%		80-120	17-AUG-13
Magnesium (Mg)-Total			100.7		%		80-120	17-AUG-13
Manganese (Mn)-Total			96.2		%		80-120	17-AUG-13
Molybdenum (Mo)-Total			95.5		%		80-120	17-AUG-13
Nickel (Ni)-Total			100.5		%		80-120	17-AUG-13
Potassium (K)-Total			100.9		%		80-120	17-AUG-13
Selenium (Se)-Total			107.1		%		80-120	17-AUG-13
Silicon (Si)-Total			109.8		%		80-120	17-AUG-13
Silver (Ag)-Total			92.9		%		80-120	17-AUG-13
Sodium (Na)-Total			102.7		%		80-120	17-AUG-13
Strontium (Sr)-Total			97.5		%		80-120	17-AUG-13
Thallium (Tl)-Total			107.1		%		80-120	17-AUG-13
Tin (Sn)-Total			93.1		%		80-120	17-AUG-13
Titanium (Ti)-Total			100.2		%		80-120	17-AUG-13
Uranium (U)-Total			98.4		%		80-120	17-AUG-13
Vanadium (V)-Total			98.2		%		80-120	17-AUG-13
Zinc (Zn)-Total			99.2		%		80-120	17-AUG-13
WG1727898-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	16-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	16-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	16-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	16-AUG-13

Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2673800								
WG1727898-1 MB								
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	16-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	16-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	16-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	16-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	16-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	16-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	16-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	16-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	16-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	16-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	16-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	16-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	16-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	16-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	16-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	16-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	16-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	16-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	16-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	16-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	16-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	16-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	16-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	16-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	16-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	16-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	16-AUG-13
WG1727898-2 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	17-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	17-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	17-AUG-13
Barium (Ba)-Total			0.000077	B	mg/L		0.00005	17-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	17-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	17-AUG-13

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2673800								
WG1727898-2 MB								
Boron (B)-Total			<0.010		mg/L		0.01	17-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	17-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	17-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	17-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	17-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	17-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	17-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	17-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	17-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	17-AUG-13
Manganese (Mn)-Total			0.000182	B	mg/L		0.00005	17-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	17-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	17-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	17-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	17-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	17-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	17-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	17-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	17-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	17-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	17-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	17-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	17-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	17-AUG-13
Vanadium (V)-Total			0.00022	MB-LOR	mg/L		0.0001	17-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	17-AUG-13
Batch R2674438								
WG1728243-5 DUP		**L1347781-1**						
Aluminum (Al)-Total		0.019	0.017		mg/L	9.3	20	18-AUG-13
Antimony (Sb)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	18-AUG-13
Arsenic (As)-Total		0.0692	0.0672		mg/L	3.0	20	18-AUG-13
Barium (Ba)-Total		0.0169	0.0162		mg/L	4.1	20	18-AUG-13
Beryllium (Be)-Total		<0.0025	<0.0025	RPD-NA	mg/L	N/A	20	18-AUG-13
Bismuth (Bi)-Total		<0.00025	<0.00025	RPD-NA	mg/L	N/A	20	18-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2674438								
WG1728243-5 DUP		**L1347781-1**						
Boron (B)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	18-AUG-13
Cadmium (Cd)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	18-AUG-13
Calcium (Ca)-Total		133	141		mg/L	6.0	20	18-AUG-13
Chromium (Cr)-Total		0.00055	<0.00050	RPD-NA	mg/L	N/A	20	18-AUG-13
Cobalt (Co)-Total		0.00343	0.00341		mg/L	0.5	20	18-AUG-13
Copper (Cu)-Total		0.00201	0.00201		mg/L	0.3	20	18-AUG-13
Iron (Fe)-Total		1.86	1.82		mg/L	2.1	20	18-AUG-13
Lead (Pb)-Total		<0.00025	<0.00025	RPD-NA	mg/L	N/A	20	18-AUG-13
Lithium (Li)-Total		<0.025	<0.025	RPD-NA	mg/L	N/A	20	18-AUG-13
Magnesium (Mg)-Total		10.2	9.94		mg/L	2.7	20	18-AUG-13
Manganese (Mn)-Total		0.150	0.145		mg/L	2.7	20	18-AUG-13
Molybdenum (Mo)-Total		0.00186	0.00190		mg/L	2.3	20	18-AUG-13
Nickel (Ni)-Total		0.00699	0.00677		mg/L	3.1	20	18-AUG-13
Phosphorus (P)-Total		<1.5	<1.5	RPD-NA	mg/L	N/A	20	18-AUG-13
Potassium (K)-Total		7.08	6.84		mg/L	3.6	20	18-AUG-13
Selenium (Se)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	18-AUG-13
Silicon (Si)-Total		0.33	0.34		mg/L	3.8	20	18-AUG-13
Silver (Ag)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	18-AUG-13
Sodium (Na)-Total		36.3	35.1		mg/L	3.2	20	18-AUG-13
Strontium (Sr)-Total		0.208	0.207		mg/L	0.5	20	18-AUG-13
Thallium (Tl)-Total		<0.00025	<0.00025	RPD-NA	mg/L	N/A	20	18-AUG-13
Tin (Sn)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	18-AUG-13
Titanium (Ti)-Total		0.0087	0.0080		mg/L	8.4	20	18-AUG-13
Uranium (U)-Total		0.000227	0.000236		mg/L	4.1	20	18-AUG-13
Vanadium (V)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	18-AUG-13
Zinc (Zn)-Total		<0.015	<0.015	RPD-NA	mg/L	N/A	20	18-AUG-13
WG1728243-4 LCS								
Aluminum (Al)-Total			97.8		%		80-120	18-AUG-13
Antimony (Sb)-Total			102.7		%		80-120	18-AUG-13
Arsenic (As)-Total			100.6		%		80-120	18-AUG-13
Barium (Ba)-Total			96.1		%		80-120	18-AUG-13
Beryllium (Be)-Total			96.6		%		80-120	18-AUG-13
Bismuth (Bi)-Total			98.7		%		80-120	18-AUG-13
Boron (B)-Total			92.6		%		80-120	18-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2674438								
WG1728243-4 LCS								
Cadmium (Cd)-Total			99.0		%		80-120	18-AUG-13
Calcium (Ca)-Total			97.6		%		80-120	18-AUG-13
Chromium (Cr)-Total			98.5		%		80-120	18-AUG-13
Cobalt (Co)-Total			95.0		%		80-120	18-AUG-13
Copper (Cu)-Total			95.6		%		80-120	18-AUG-13
Iron (Fe)-Total			90.8		%		80-120	18-AUG-13
Lead (Pb)-Total			104.6		%		80-120	18-AUG-13
Lithium (Li)-Total			103.3		%		80-120	18-AUG-13
Magnesium (Mg)-Total			102.6		%		80-120	18-AUG-13
Manganese (Mn)-Total			98.7		%		80-120	18-AUG-13
Molybdenum (Mo)-Total			98.1		%		80-120	18-AUG-13
Nickel (Ni)-Total			96.1		%		80-120	18-AUG-13
Potassium (K)-Total			92.0		%		80-120	18-AUG-13
Selenium (Se)-Total			103.4		%		80-120	18-AUG-13
Silicon (Si)-Total			99.0		%		80-120	18-AUG-13
Silver (Ag)-Total			96.4		%		80-120	18-AUG-13
Sodium (Na)-Total			104.2		%		80-120	18-AUG-13
Strontium (Sr)-Total			94.9		%		80-120	18-AUG-13
Thallium (Tl)-Total			101.9		%		80-120	18-AUG-13
Tin (Sn)-Total			92.8		%		80-120	18-AUG-13
Titanium (Ti)-Total			92.4		%		80-120	18-AUG-13
Uranium (U)-Total			101.7		%		80-120	18-AUG-13
Vanadium (V)-Total			95.0		%		80-120	18-AUG-13
Zinc (Zn)-Total			97.8		%		80-120	18-AUG-13
WG1728243-2 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	18-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	18-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	18-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	18-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	18-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	18-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	18-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	18-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	18-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2674438								
WG1728243-2 MB								
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	18-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	18-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	18-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	18-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	18-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	18-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	18-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	18-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	18-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	18-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	18-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	18-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	18-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	18-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	18-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	18-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	18-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	18-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	18-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	18-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	18-AUG-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	18-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	18-AUG-13
NH3-CFA-ED	**Water**							
Batch R2676584								
WG1730699-2 LCS								
Ammonia, Total (as N)			94.9		%		85-115	21-AUG-13
WG1730699-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	21-AUG-13
WG1730699-4 MS		**L1350041-1**						
Ammonia, Total (as N)			94.3		%		75-125	21-AUG-13
WG1730699-7 MS		**L1348457-2**						
Ammonia, Total (as N)			98.1		%		75-125	21-AUG-13
NO2-IC-ED	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-ED	**Water**							
Batch R2673849								
WG1727633-2 LCS								
Nitrite (as N)			91.0		%		90-110	15-AUG-13
WG1727633-1 MB								
Nitrite (as N)			<0.050		mg/L		0.05	16-AUG-13
WG1727633-6 MS		**L1347157-3**						
Nitrite (as N)			107.9		%		75-125	15-AUG-13
WG1727633-8 MS		**L1347961-2**						
Nitrite (as N)			110.9		%		75-125	15-AUG-13
Batch R2677823								
WG1728457-2 LCS								
Nitrite (as N)			98.4		%		90-110	16-AUG-13
WG1728457-1 MB								
Nitrite (as N)			<0.050		mg/L		0.05	16-AUG-13
WG1728457-4 MS		**L1347921-10**						
Nitrite (as N)			105.3		%		75-125	16-AUG-13
WG1728457-6 MS		**L1348020-8**						
Nitrite (as N)			97.9		%		75-125	16-AUG-13
NO3-IC-ED	**Water**							
Batch R2673849								
WG1727633-2 LCS								
Nitrate (as N)			103.7		%		90-110	15-AUG-13
WG1727633-1 MB								
Nitrate (as N)			<0.050		mg/L		0.05	16-AUG-13
WG1727633-6 MS		**L1347157-3**						
Nitrate (as N)			103.1		%		75-125	15-AUG-13
WG1727633-8 MS		**L1347961-2**						
Nitrate (as N)			99.8		%		75-125	15-AUG-13
Batch R2677823								
WG1728457-2 LCS								
Nitrate (as N)			94.6		%		90-110	16-AUG-13
WG1728457-1 MB								
Nitrate (as N)			<0.050		mg/L		0.05	16-AUG-13
WG1728457-4 MS		**L1347921-10**						
Nitrate (as N)			94.0		%		75-125	16-AUG-13
WG1728457-6 MS		**L1348020-8**						
Nitrate (as N)			94.6		%		75-125	16-AUG-13
PH-ED	**Water**							

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-ED	**Water**							
Batch R2673710								
WG1727932-3 LCS								
pH			7.03		pH		6.9-7.1	16-AUG-13
SOLIDS-TOTSUS-ED	**Water**							
Batch R2673779								
WG1727768-2 LCS								
Total Suspended Solids			102.0		%		85-115	16-AUG-13
WG1727768-1 MB								
Total Suspended Solids			<3.0		mg/L		3	16-AUG-13
Batch R2674375								
WG1727906-2 LCS								
Total Suspended Solids			98.0		%		85-115	16-AUG-13
WG1727906-1 MB								
Total Suspended Solids			<3.0		mg/L		3	16-AUG-13

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
B	Method Blank exceeds ALS DQO. All associated sample results are at least 5 times greater than blank levels and are considered reliable.
J	Duplicate results and limits are expressed in terms of absolute difference.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH							
	1	12-AUG-13 21:15	16-AUG-13 10:27	0.25	85	hours	EHTR-FM
	4	13-AUG-13 15:00	16-AUG-13 10:30	0.25	67	hours	EHTR-FM
	7	14-AUG-13 09:00	16-AUG-13 10:23	0.25	49	hours	EHTR-FM
Anions and Nutrients							
Nitrate as N by IC							
	1	12-AUG-13 21:15	16-AUG-13 08:00	48	83	hours	EHTL
	4	13-AUG-13 15:00	16-AUG-13 08:00	48	65	hours	EHTL
	7	14-AUG-13 09:00	16-AUG-13 15:35	48	54	hours	EHT
Nitrite as N by IC							
	1	12-AUG-13 21:15	16-AUG-13 08:00	48	83	hours	EHTL
	4	13-AUG-13 15:00	16-AUG-13 08:00	48	65	hours	EHTL
	7	14-AUG-13 09:00	16-AUG-13 15:35	48	54	hours	EHT

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1347781 were received on 14-AUG-13 16:35.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # 1

Page ___ of ___

Report To

Company: Blu Metric

Contact: Tim Beckenham

Address: 4 Cataraqui St. The Tower, Kingston, Ontario, K7K 1Z7

Phone: (613) 531-2725 Fax:

Invoice To: Same as Report? ☐ Yes ☒ No

Hardcopy of Invoice with Report? ☐ Yes ☐ No

Company: TEES Ltd.

Contact:

Address: 98 Archibald St. Box 133 Yellowknife, NT X1A 2N1

Phone: (867) 669-9481 Fax: (867) 669-9480

Lab Work Order # (lab use only): L1347781

Report Format / Distribution

☒ Standard ☐ Other

☒ PDF ☒ Excel ☐ Digital ☐ Fax

Email 1: cproux@envireau.ca

Email 2: tbeckenham@wesa.ca

Email 3:

Client / Project Information

Job #:

PO / AFE:

LSD:

Quote #:

ALS Contact: Catherine Evaristo

Sampler: Alexandra Duchesne

Service Requested (Rush for routine analysis subject to availability)

◉ Regular (Standard Turnaround Times - Business Days)

○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT

☒ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT EFF214

○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

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

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS, pH	Total metal (As, Cu, Pb, Ni, Zn)	NO_3 and NO_2	Total amonia nitrogen	Number of Containers
	EFF178	12/08/13	21:15	surface water	X	X	X	X	5
	EFF184	13/08/13	3:00						5
	EFF190	13/08/13	9:00						5
	EFF196	13/08/13	15:00		X	X	X	X	5
	EFF202	13/08/13	21:00						5
	EFF208	14/08/13	3:00						5
	EFF214	14/08/13	9:00		X	X	X	X	5

L1347781-COFC

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

keep the extra bottles on hold. Emergency turnover for EFF214. Normal turnover for EFF178 and EFF196

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

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

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

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Alexandra Duchesne	Date (dd-mmm-yy): 14-08-13	Time (hh-mm): 12:00	Received by: [signature]	Date: Aug 14th 2013	Time: 4:35pm	Temperature: Max 13.6 Avg 12.0 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

WESA Inc.
ATTN: Tim Beckenham / Melanie St-Jean
4 Cataraqui Street
The Tower
Kingston ON K7K 1Z7

Date Received: 19-AUG-13
Report Date: 03-SEP-13 14:34 (MT)
Version: FINAL REV. 3

Client Phone: 613-531-2725

Certificate of Analysis

Lab Work Order #:	**L1349723**
Project P.O. #:	NOT SUBMITTED
Job Reference:	ABORIGINAL 15929
C of C Numbers:	3
Legal Site Desc:	

Comments: ADDITIONAL 30-AUG-13 13:35

L1349723-1, -2, -5, -6 and -8; There was a uploading problem with original metals data, correct data has now been imported to report. Metals data for L1349723-3 all confirmed recheck, except for Zinc, correct result for Zinc has been added to report. Metals data for L1349723-4 all confirmed recheck.

31-AUG-13: ..
03-SEP-13: Fixed sample date and time on L1349723-9, -12 and -22 as well as added metals results back on L1349723-8

Catherine Evaristo-Cordero
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1349723-1	L1349723-2	L1349723-3	L1349723-4	L1349723-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	15-AUG-13	16-AUG-13	17-AUG-13	17-AUG-13	18-AUG-13
	Sampled Time	09:00	10:15	09:00	15:00	15:00
	Client ID	EFF234	EFF253	EFF272	EFF278	EFF289
WATER						
Physical Tests	pH (pH)	8.01	7.97	8.02	8.03	8.00
	Total Suspended Solids (mg/L)	21.0	7.0	7.0	6.0	10.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.082	0.094	0.095	0.103	0.156
	Nitrate (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Total Metals	Aluminum (Al)-Total (mg/L)	DLM 0.017	DLM 0.021	DLM 0.019	DLM <0.015	DLM 0.016
	Antimony (Sb)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Arsenic (As)-Total (mg/L)	DLM 0.0546	DLM 0.0464	DLM 0.0510	DLM 0.0471	DLM 0.0324
	Barium (Ba)-Total (mg/L)	DLM 0.0180	DLM 0.0182	DLM 0.0199	DLM 0.0192	DLM 0.0189
	Beryllium (Be)-Total (mg/L)	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025
	Bismuth (Bi)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Boron (B)-Total (mg/L)	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050
	Cadmium (Cd)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Calcium (Ca)-Total (mg/L)	DLM 140	DLM 149	DLM 146	DLM 150	DLM 156
	Chromium (Cr)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM 0.00051	DLM <0.00050	DLM <0.00050
	Cobalt (Co)-Total (mg/L)	DLM 0.00296	DLM 0.00314	DLM 0.00310	DLM 0.00299	DLM 0.00301
	Copper (Cu)-Total (mg/L)	DLM 0.00177	DLM 0.00152	DLM 0.00142	DLM 0.00130	DLM 0.00119
	Iron (Fe)-Total (mg/L)	DLM 2.05	DLM 1.97	DLM 2.09	DLM 1.88	DLM 1.93
	Lead (Pb)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Lithium (Li)-Total (mg/L)	DLM <0.025	DLM <0.025	DLM <0.025	DLM <0.025	DLM <0.025
	Magnesium (Mg)-Total (mg/L)	DLM 10.4	DLM 10.4	DLM 11.5	DLM 10.4	DLM 12.0
	Manganese (Mn)-Total (mg/L)	DLM 0.0986	DLM 0.117	DLM 0.134	DLM 0.130	DLM 0.130
	Molybdenum (Mo)-Total (mg/L)	DLM 0.00194	DLM 0.00192	DLM 0.00203	DLM 0.00185	DLM 0.00157
	Nickel (Ni)-Total (mg/L)	DLM 0.00657	DLM 0.00682	DLM 0.00650	DLM 0.00658	DLM 0.00622
	Phosphorus (P)-Total (mg/L)	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5
	Potassium (K)-Total (mg/L)	DLM 7.59	DLM 7.53	DLM 7.71	DLM 7.25	DLM 7.65
	Selenium (Se)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Silicon (Si)-Total (mg/L)	DLM 0.31	DLM 0.33	DLM 0.34	DLM 0.32	DLM 0.30
	Silver (Ag)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Sodium (Na)-Total (mg/L)	DLM 39.4	DLM 39.0	DLM 39.4	DLM 36.5	DLM 42.2
	Strontium (Sr)-Total (mg/L)	DLM 0.222	DLM 0.236	DLM 0.244	DLM 0.238	DLM 0.272
	Thallium (Tl)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Tin (Sn)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Titanium (Ti)-Total (mg/L)	DLM 0.0083	DLM 0.0084	DLM 0.0093	DLM 0.0092	DLM 0.0082
	Uranium (U)-Total (mg/L)	DLM 0.000240	DLM 0.000221	DLM 0.000283	DLM 0.000275	DLM 0.000240
	Vanadium (V)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Zinc (Zn)-Total (mg/L)	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1349723-6	L1349723-7	L1349723-8	L1349723-9	L1349723-12
	Description	Surface Water	Surface Water	Surface Water	Water	Water
	Sampled Date	19-AUG-13	15-AUG-13	17-AUG-13	15-AUG-13	15-AUG-13
	Sampled Time	09:20	09:00	09:00	21:30	16:00
	Client ID	EFF303	TBLANK	DUP11	EFF242	EFF239
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.72	6.15	7.96		
	Total Suspended Solids (mg/L)	8.0	<3.0	9.0	<3.0	6.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.269	<0.050	0.104		
	Nitrate (as N) (mg/L)	<0.050	<0.050	<0.050		
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050		
Total Metals	Aluminum (Al)-Total (mg/L)	DLM 0.019	<0.0030	DLM 0.020		
	Antimony (Sb)-Total (mg/L)	DLM <0.00050	<0.00010	DLM <0.00050		
	Arsenic (As)-Total (mg/L)	DLM 0.0220	<0.00010	DLM 0.0526		
	Barium (Ba)-Total (mg/L)	DLM 0.0222	<0.000050	DLM 0.0188		
	Beryllium (Be)-Total (mg/L)	DLM <0.0025	<0.00050	DLM <0.0025		
	Bismuth (Bi)-Total (mg/L)	DLM <0.00025	<0.000050	DLM <0.00025		
	Boron (B)-Total (mg/L)	DLM <0.050	<0.010	DLM <0.050		
	Cadmium (Cd)-Total (mg/L)	DLM <0.000050	<0.000010	DLM <0.000050		
	Calcium (Ca)-Total (mg/L)	DLM 168	0.025	DLM 148		
	Chromium (Cr)-Total (mg/L)	DLM <0.00050	<0.00010	DLM <0.00050		
	Cobalt (Co)-Total (mg/L)	DLM 0.00492	<0.00010	DLM 0.00321		
	Copper (Cu)-Total (mg/L)	DLM 0.00096	<0.00010	DLM 0.00133		
	Iron (Fe)-Total (mg/L)	DLM 2.20	<0.010	DLM 2.21		
	Lead (Pb)-Total (mg/L)	DLM <0.00025	<0.000050	DLM <0.00025		
	Lithium (Li)-Total (mg/L)	DLM <0.025	<0.0050	DLM <0.025		
	Magnesium (Mg)-Total (mg/L)	DLM 13.8	<0.0050	DLM 11.1		
	Manganese (Mn)-Total (mg/L)	DLM 0.220	<0.000050	DLM 0.130		
	Molybdenum (Mo)-Total (mg/L)	DLM 0.00098	<0.000050	DLM 0.00193		
	Nickel (Ni)-Total (mg/L)	DLM 0.00907	<0.00010	DLM 0.00719		
	Phosphorus (P)-Total (mg/L)	DLM <1.5	<0.30	DLM <1.5		
	Potassium (K)-Total (mg/L)	DLM 8.00	<0.050	DLM 7.68		
	Selenium (Se)-Total (mg/L)	DLM <0.00050	<0.00010	DLM <0.00050		
	Silicon (Si)-Total (mg/L)	DLM 0.39	<0.050	DLM 0.34		
	Silver (Ag)-Total (mg/L)	DLM <0.000050	<0.000010	DLM <0.000050		
	Sodium (Na)-Total (mg/L)	DLM 44.6	<0.050	DLM 39.5		
	Strontium (Sr)-Total (mg/L)	DLM 0.294	<0.00010	DLM 0.245		
	Thallium (Tl)-Total (mg/L)	DLM <0.00025	<0.000050	DLM <0.00025		
	Tin (Sn)-Total (mg/L)	DLM <0.00050	<0.00010	DLM <0.00050		
	Titanium (Ti)-Total (mg/L)	DLM 0.0088	<0.00030	DLM 0.0100		
	Uranium (U)-Total (mg/L)	DLM 0.000177	<0.000010	DLM 0.000244		
	Vanadium (V)-Total (mg/L)	DLM <0.00050	<0.00010	DLM <0.00050		
	Zinc (Zn)-Total (mg/L)	DLM <0.015	<0.0030	DLM <0.015		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1349723-22				
	Description	Water				
	Sampled Date	15-AUG-13				
	Sampled Time	15:00				
	Client ID	EFF229				
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)					
	Total Suspended Solids (mg/L)	<3.0				
Anions and Nutrients	Ammonia, Total (as N) (mg/L)					
	Nitrate (as N) (mg/L)					
	Nitrite (as N) (mg/L)					
Total Metals	Aluminum (Al)-Total (mg/L)					
	Antimony (Sb)-Total (mg/L)					
	Arsenic (As)-Total (mg/L)					
	Barium (Ba)-Total (mg/L)					
	Beryllium (Be)-Total (mg/L)					
	Bismuth (Bi)-Total (mg/L)					
	Boron (B)-Total (mg/L)					
	Cadmium (Cd)-Total (mg/L)					
	Calcium (Ca)-Total (mg/L)					
	Chromium (Cr)-Total (mg/L)					
	Cobalt (Co)-Total (mg/L)					
	Copper (Cu)-Total (mg/L)					
	Iron (Fe)-Total (mg/L)					
	Lead (Pb)-Total (mg/L)					
	Lithium (Li)-Total (mg/L)					
	Magnesium (Mg)-Total (mg/L)					
	Manganese (Mn)-Total (mg/L)					
	Molybdenum (Mo)-Total (mg/L)					
	Nickel (Ni)-Total (mg/L)					
	Phosphorus (P)-Total (mg/L)					
	Potassium (K)-Total (mg/L)					
	Selenium (Se)-Total (mg/L)					
	Silicon (Si)-Total (mg/L)					
	Silver (Ag)-Total (mg/L)					
	Sodium (Na)-Total (mg/L)					
	Strontium (Sr)-Total (mg/L)					
	Thallium (Tl)-Total (mg/L)					
	Tin (Sn)-Total (mg/L)					
	Titanium (Ti)-Total (mg/L)					
	Uranium (U)-Total (mg/L)					
	Vanadium (V)-Total (mg/L)					
	Zinc (Zn)-Total (mg/L)					

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Aluminum (Al)-Total	DLM	L1349723-3, -4
Duplicate	Antimony (Sb)-Total	DLM	L1349723-3, -4
Duplicate	Arsenic (As)-Total	DLM	L1349723-3, -4
Duplicate	Barium (Ba)-Total	DLM	L1349723-3, -4
Duplicate	Beryllium (Be)-Total	DLM	L1349723-3, -4
Duplicate	Bismuth (Bi)-Total	DLM	L1349723-3, -4
Duplicate	Boron (B)-Total	DLM	L1349723-3, -4
Duplicate	Cadmium (Cd)-Total	DLM	L1349723-3, -4
Duplicate	Calcium (Ca)-Total	DLM	L1349723-3, -4
Duplicate	Chromium (Cr)-Total	DLM	L1349723-3, -4
Duplicate	Cobalt (Co)-Total	DLM	L1349723-3, -4
Duplicate	Copper (Cu)-Total	DLM	L1349723-3, -4
Duplicate	Iron (Fe)-Total	DLM	L1349723-3, -4
Duplicate	Lead (Pb)-Total	DLM	L1349723-3, -4
Duplicate	Lithium (Li)-Total	DLM	L1349723-3, -4
Duplicate	Magnesium (Mg)-Total	DLM	L1349723-3, -4
Duplicate	Manganese (Mn)-Total	DLM	L1349723-3, -4
Duplicate	Molybdenum (Mo)-Total	DLM	L1349723-3, -4
Duplicate	Nickel (Ni)-Total	DLM	L1349723-3, -4
Duplicate	Phosphorus (P)-Total	DLM	L1349723-3, -4
Duplicate	Potassium (K)-Total	DLM	L1349723-3, -4
Duplicate	Selenium (Se)-Total	DLM	L1349723-3, -4
Duplicate	Silicon (Si)-Total	DLM	L1349723-3, -4
Duplicate	Silver (Ag)-Total	DLM	L1349723-3, -4
Duplicate	Sodium (Na)-Total	DLM	L1349723-3, -4
Duplicate	Strontium (Sr)-Total	DLM	L1349723-3, -4
Duplicate	Thallium (Tl)-Total	DLM	L1349723-3, -4
Duplicate	Tin (Sn)-Total	DLM	L1349723-3, -4
Duplicate	Titanium (Ti)-Total	DLM	L1349723-3, -4
Duplicate	Uranium (U)-Total	DLM	L1349723-3, -4
Duplicate	Vanadium (V)-Total	DLM	L1349723-3, -4
Duplicate	Zinc (Zn)-Total	DLM	L1349723-3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-T-CCMS-ED	Water	Total Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A
NH3-CFA-ED	Water	Ammonia in Water by Colour	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.			
NO2-IC-ED	Water	Nitrite as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
PH-ED	Water	pH	APHA 4500 H-Electrode
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)			
SOLIDS-TOTSUS-ED	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

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

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

Reference Information

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

3

GLOSSARY OF REPORT TERMS

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

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: WESA Inc.
4 Cataraqui Street The Tower
Kingston ON K7K 1Z7

Contact: Tim Beckenham / Melanie St-Jean

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2676775								
WG1730772-2 LCS								
Aluminum (Al)-Total			88.6		%		80-120	21-AUG-13
Antimony (Sb)-Total			100.4		%		80-120	21-AUG-13
Arsenic (As)-Total			103.4		%		80-120	21-AUG-13
Barium (Ba)-Total			92.0		%		80-120	21-AUG-13
Beryllium (Be)-Total			82.4		%		80-120	21-AUG-13
Bismuth (Bi)-Total			87.5		%		80-120	21-AUG-13
Boron (B)-Total			94.5		%		80-120	21-AUG-13
Cadmium (Cd)-Total			93.9		%		80-120	21-AUG-13
Calcium (Ca)-Total			89.5		%		80-120	21-AUG-13
Chromium (Cr)-Total			91.7		%		80-120	21-AUG-13
Cobalt (Co)-Total			91.1		%		80-120	21-AUG-13
Copper (Cu)-Total			89.7		%		80-120	21-AUG-13
Iron (Fe)-Total			89.4		%		80-120	21-AUG-13
Lead (Pb)-Total			86.1		%		80-120	21-AUG-13
Lithium (Li)-Total			80.5		%		80-120	21-AUG-13
Magnesium (Mg)-Total			94.1		%		80-120	21-AUG-13
Manganese (Mn)-Total			89.4		%		80-120	21-AUG-13
Molybdenum (Mo)-Total			98.7		%		80-120	21-AUG-13
Nickel (Ni)-Total			89.7		%		80-120	21-AUG-13
Potassium (K)-Total			86.0		%		80-120	21-AUG-13
Selenium (Se)-Total			112.5		%		80-120	21-AUG-13
Silicon (Si)-Total			99.4		%		80-120	21-AUG-13
Silver (Ag)-Total			94.6		%		80-120	21-AUG-13
Sodium (Na)-Total			88.7		%		80-120	21-AUG-13
Strontium (Sr)-Total			100.7		%		80-120	21-AUG-13
Thallium (Tl)-Total			93.3		%		80-120	21-AUG-13
Tin (Sn)-Total			96.1		%		80-120	21-AUG-13
Titanium (Ti)-Total			100.6		%		80-120	21-AUG-13
Uranium (U)-Total			94.2		%		80-120	21-AUG-13
Vanadium (V)-Total			90.2		%		80-120	21-AUG-13
Zinc (Zn)-Total			89.1		%		80-120	21-AUG-13
WG1730772-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	21-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	21-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2676775								
WG1730772-1 MB								
Arsenic (As)-Total			<0.00010		mg/L		0.0001	21-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	21-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	21-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	21-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	21-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	21-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	21-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	21-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	21-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	21-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	21-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	21-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	21-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	21-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	21-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	21-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	21-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	21-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	21-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	21-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	21-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	21-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	21-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	21-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	21-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	21-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	21-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	21-AUG-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	21-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	21-AUG-13
Batch R2680632								
WG1734797-2 LCS								
Aluminum (Al)-Total			92.6		%		80-120	27-AUG-13
Antimony (Sb)-Total			98.7		%		80-120	27-AUG-13

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2680632								
WG1734797-2 LCS								
Arsenic (As)-Total			102.2		%		80-120	27-AUG-13
Barium (Ba)-Total			90.9		%		80-120	27-AUG-13
Beryllium (Be)-Total			89.7		%		80-120	27-AUG-13
Bismuth (Bi)-Total			90.1		%		80-120	27-AUG-13
Boron (B)-Total			90.5		%		80-120	27-AUG-13
Cadmium (Cd)-Total			91.5		%		80-120	27-AUG-13
Calcium (Ca)-Total			92.8		%		80-120	27-AUG-13
Chromium (Cr)-Total			89.9		%		80-120	27-AUG-13
Cobalt (Co)-Total			88.8		%		80-120	27-AUG-13
Copper (Cu)-Total			89.3		%		80-120	27-AUG-13
Iron (Fe)-Total			83.9		%		80-120	27-AUG-13
Lead (Pb)-Total			89.4		%		80-120	27-AUG-13
Lithium (Li)-Total			91.3		%		80-120	27-AUG-13
Magnesium (Mg)-Total			92.9		%		80-120	27-AUG-13
Manganese (Mn)-Total			89.5		%		80-120	27-AUG-13
Molybdenum (Mo)-Total			100.5		%		80-120	27-AUG-13
Nickel (Ni)-Total			89.9		%		80-120	27-AUG-13
Potassium (K)-Total			86.5		%		80-120	27-AUG-13
Selenium (Se)-Total			104.6		%		80-120	27-AUG-13
Silicon (Si)-Total			107.8		%		80-120	27-AUG-13
Silver (Ag)-Total			87.6		%		80-120	27-AUG-13
Sodium (Na)-Total			94.4		%		80-120	27-AUG-13
Strontium (Sr)-Total			99.98		%		80-120	27-AUG-13
Thallium (Tl)-Total			87.9		%		80-120	27-AUG-13
Tin (Sn)-Total			95.2		%		80-120	27-AUG-13
Titanium (Ti)-Total			86.2		%		80-120	27-AUG-13
Uranium (U)-Total			81.4		%		80-120	27-AUG-13
Vanadium (V)-Total			90.2		%		80-120	27-AUG-13
Zinc (Zn)-Total			90.6		%		80-120	27-AUG-13
WG1734797-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	27-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	27-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	27-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	27-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2680632								
WG1734797-1 MB								
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	27-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	27-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	27-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	27-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	27-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	27-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	27-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	27-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	27-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	27-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	27-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	27-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	27-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	27-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	27-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	27-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	27-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	27-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	27-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	27-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	27-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	27-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	27-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	27-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	27-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	27-AUG-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	27-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	27-AUG-13
Batch R2681303								
WG1735194-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	28-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	28-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	28-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	28-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2681303								
WG1735194-1 MB								
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	28-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	28-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	28-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	28-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	28-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	28-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	28-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	28-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	28-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	28-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	28-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	28-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	28-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	28-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	28-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	28-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	28-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	28-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	28-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	28-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	28-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	28-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	28-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	28-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	28-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	28-AUG-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	28-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	28-AUG-13
NH3-CFA-ED	**Water**							
Batch R2676584								
WG1730699-2 LCS								
Ammonia, Total (as N)			94.9		%		85-115	21-AUG-13
WG1730699-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	21-AUG-13
WG1730699-4 MS		**L1350041-1**						

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-CFA-ED	**Water**							
Batch R2676584								
WG1730699-4 MS		**L1350041-1**						
Ammonia, Total (as N)			94.3		%		75-125	21-AUG-13
WG1730699-7 MS		**L1348457-2**						
Ammonia, Total (as N)			98.1		%		75-125	21-AUG-13
Batch R2680529								
WG1734632-3 DUP		**L1349723-8**						
Ammonia, Total (as N)		0.104	0.107		mg/L	3.2	20	27-AUG-13
WG1734632-2 LCS								
Ammonia, Total (as N)			94.5		%		85-115	27-AUG-13
WG1734632-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	27-AUG-13
WG1734632-4 MS		**L1344909-8**						
Ammonia, Total (as N)			99.9		%		75-125	27-AUG-13
WG1734632-6 MS		**L1352037-3**						
Ammonia, Total (as N)			93.2		%		75-125	27-AUG-13
WG1734632-8 MS		**L1352615-2**						
Ammonia, Total (as N)			96.8		%		75-125	27-AUG-13
NO2-IC-ED	**Water**							
Batch R2676653								
WG1730457-7 DUP		**L1349723-8**						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	20-AUG-13
WG1730457-2 LCS								
Nitrite (as N)			93.1		%		90-110	20-AUG-13
WG1730457-1 MB								
Nitrite (as N)			<0.050		mg/L		0.05	21-AUG-13
WG1730457-6 MS		**L1349749-1**						
Nitrite (as N)			91.8		%		75-125	20-AUG-13
WG1730457-8 MS		**L1349723-8**						
Nitrite (as N)			92.5		%		75-125	20-AUG-13
NO3-IC-ED	**Water**							
Batch R2676653								
WG1730457-7 DUP		**L1349723-8**						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	20-AUG-13
WG1730457-2 LCS								
Nitrate (as N)			99.1		%		90-110	20-AUG-13
WG1730457-1 MB								
Nitrate (as N)			<0.050		mg/L		0.05	20-AUG-13
WG1730457-6 MS		**L1349749-1**						

Quality Control Report

Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-ED		**Water**							
Batch	**R2676653**								
WG1730457-6	**MS**		**L1349749-1**						
Nitrate (as N)				97.9		%		75-125	20-AUG-13
WG1730457-8	**MS**		**L1349723-8**						
Nitrate (as N)				99.6		%		75-125	20-AUG-13
PH-ED		**Water**							
Batch	**R2675575**								
WG1729897-3	**LCS**								
pH				7.05		pH		6.9-7.1	20-AUG-13
SOLIDS-TOTSUS-ED		**Water**							
Batch	**R2676260**								
WG1729760-2	**LCS**								
Total Suspended Solids				98.0		%		85-115	20-AUG-13
WG1729760-1	**MB**								
Total Suspended Solids				<3.0		mg/L		3	20-AUG-13
Batch	**R2683778**								
WG1737403-2	**LCS**								
Total Suspended Solids				94.0		%		85-115	30-AUG-13
WG1737403-1	**MB**								
Total Suspended Solids				<3.0		mg/L		3	30-AUG-13

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Total Suspended Solids							
	9	15-AUG-13 21:30	30-AUG-13 00:00	7	14	days	EHT
	12	15-AUG-13 16:00	30-AUG-13 00:00	7	14	days	EHT
	22	15-AUG-13 15:00	30-AUG-13 00:00	7	14	days	EHT
pH							
	1	15-AUG-13 09:00	20-AUG-13 15:10	0.25	126	hours	EHTR-FM
	2	16-AUG-13 10:15	20-AUG-13 15:13	0.25	101	hours	EHTR-FM
	3	17-AUG-13 09:00	20-AUG-13 15:17	0.25	78	hours	EHTR-FM
	4	17-AUG-13 15:00	20-AUG-13 15:20	0.25	72	hours	EHTR-FM
	5	18-AUG-13 15:00	20-AUG-13 15:24	0.25	48	hours	EHTR-FM
	6	19-AUG-13 09:20	20-AUG-13 15:27	0.25	30	hours	EHTR-FM
	7	15-AUG-13 09:00	20-AUG-13 15:31	0.25	126	hours	EHTR-FM
	8	17-AUG-13 09:00	20-AUG-13 15:35	0.25	78	hours	EHTR-FM
Anions and Nutrients							
Nitrate as N by IC							
	1	15-AUG-13 09:00	20-AUG-13 12:08	48	123	hours	EHTR
	2	16-AUG-13 10:15	20-AUG-13 12:08	48	98	hours	EHTR
	3	17-AUG-13 09:00	20-AUG-13 12:08	48	75	hours	EHTR
	4	17-AUG-13 15:00	20-AUG-13 12:08	48	69	hours	EHTR
	7	15-AUG-13 09:00	20-AUG-13 12:08	48	123	hours	EHTR
	8	17-AUG-13 09:00	20-AUG-13 12:08	48	75	hours	EHTR
Nitrite as N by IC							
	1	15-AUG-13 09:00	20-AUG-13 12:08	48	123	hours	EHTR
	2	16-AUG-13 10:15	20-AUG-13 12:08	48	98	hours	EHTR
	3	17-AUG-13 09:00	20-AUG-13 12:08	48	75	hours	EHTR
	4	17-AUG-13 15:00	20-AUG-13 12:08	48	69	hours	EHTR
	7	15-AUG-13 09:00	20-AUG-13 12:08	48	123	hours	EHTR
	8	17-AUG-13 09:00	20-AUG-13 12:08	48	75	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1349723 were received on 19-AUG-13 15:13.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To

Company: BluMetric
Contact: Tim Beckenham
Address: 4 Cataraqui St, The Tower, Kingston On K7K 1Z7
Phone: (613) 531-2725 Fax:

Invoice To Same as Report ? ☐ Yes ☒ No
Hardcopy of Invoice with Report? ☐ Yes ☒ No
Company: Tlicho Engineering & Environmental Service Ltd.
Contact: Trevor
Address: 98 Archibald St, Box 193 Yellowknife NT X1A 2N1
Phone: (867) 669-9481 Fax: (867) 669-9482

Lab Work Order # (lab use only): L1349723

Report Format / Distribution

☒ Standard ☐ Other
☒ PDF ☒ Excel ☐ Digital ☐ Fax

Email 1: cproux@envireau.ca
Email 2: tbeckenham@wesa.ca
Email 3: ppoirier@envireau.ca

Client / Project Information

Job #:
PO / AFE:
LSD:
Quote #:

ALS Contact: Catherine Evaristo
Sampler: Pascal Poirier

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ☒ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

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

Sample #	Sample Identification (This description will ap...	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS	pH	NO_3	NO_2	Total ammonia nitrogen	As, Cu, Pb, Zn, Ni						Number of Containers
				Surface water	X	X	X	X	X	X						
	EFF234	15/08/13	9:00													
	EFF257	16/08/13	10:15													
	EFF272	17/08/13	9:00									Rush				
	EFF278	17/08/13	15:00									Rush				
	~~EFF282~~ EFF289	18/08/13	15:00													
	EFF303	19/08/13	9:20													
	TBlank															
	Dup 11	17/08/13	9:00	"	X	X	X	X	X	X						

L1349723-COFC

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

WESA Inc.
ATTN: Tim Beckenham / Melanie St-Jean
4 Cataraqui Street
The Tower
Kingston ON K7K 1Z7

Date Received: 21-AUG-13
Report Date: 31-AUG-13 13:43 (MT)
Version: FINAL

Client Phone: --

Certificate of Analysis

Lab Work Order #: L1351553

Project P.O. #:	NOT SUBMITTED
Job Reference:	Y-B11192-00-00
C of C Numbers:	1
Legal Site Desc:	

Cath Evaristo Cordero

Catherine Evaristo-Cordero
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1351553-2				
	Description	Surface Water				
	Sampled Date	20-AUG-13				
	Sampled Time	17:15				
	Client ID	EFF305				
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.97				
	Total Suspended Solids (mg/L)	6.0				
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.564				
	Nitrate and Nitrite (as N) (mg/L)	<0.071				
	Nitrate (as N) (mg/L)	<0.050				
	Nitrite (as N) (mg/L)	<0.050				
Total Metals	Aluminum (Al)-Total (mg/L)	<0.015 DLM				
	Antimony (Sb)-Total (mg/L)	<0.00050 DLM				
	Arsenic (As)-Total (mg/L)	0.0162 DLM				
	Barium (Ba)-Total (mg/L)	0.0217 DLM				
	Beryllium (Be)-Total (mg/L)	<0.0025 DLM				
	Bismuth (Bi)-Total (mg/L)	<0.00025 DLM				
	Boron (B)-Total (mg/L)	<0.050 DLM				
	Cadmium (Cd)-Total (mg/L)	<0.000050 DLM				
	Calcium (Ca)-Total (mg/L)	160 DLM				
	Chromium (Cr)-Total (mg/L)	<0.00050 DLM				
	Cobalt (Co)-Total (mg/L)	0.00420 DLM				
	Copper (Cu)-Total (mg/L)	<0.00050 DLM				
	Iron (Fe)-Total (mg/L)	1.59 DLM				
	Lead (Pb)-Total (mg/L)	<0.00025 DLM				
	Lithium (Li)-Total (mg/L)	<0.025 DLM				
	Magnesium (Mg)-Total (mg/L)	12.2 DLM				
	Manganese (Mn)-Total (mg/L)	0.281 DLM				
	Molybdenum (Mo)-Total (mg/L)	0.00088 DLM				
	Nickel (Ni)-Total (mg/L)	0.00845 DLM				
	Phosphorus (P)-Total (mg/L)	<1.5 DLM				
	Potassium (K)-Total (mg/L)	7.45 DLM				
	Selenium (Se)-Total (mg/L)	<0.00050 DLM				
	Silicon (Si)-Total (mg/L)	0.40 DLM				
	Silver (Ag)-Total (mg/L)	<0.000050 DLM				
	Sodium (Na)-Total (mg/L)	43.5 DLM				
	Strontium (Sr)-Total (mg/L)	0.319 DLM				
	Thallium (Tl)-Total (mg/L)	<0.00025 DLM				
	Tin (Sn)-Total (mg/L)	<0.00050 DLM				
	Titanium (Ti)-Total (mg/L)	0.0055 DLM				
	Uranium (U)-Total (mg/L)	0.000301 DLM				
	Vanadium (V)-Total (mg/L)	<0.00050 DLM				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1351553-2				
	Description	Surface Water				
	Sampled Date	20-AUG-13				
	Sampled Time	17:15				
	Client ID	EFF305				
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	<0.015 DLM				

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

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-T-CCMS-ED	Water	Total Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A
NH3-CFA-ED	Water	Ammonia in Water by Colour	APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.

ALS Test Code	Matrix	Test Description	Method Reference**
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite	CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
PH-ED	Water	pH	APHA 4500 H-Electrode

All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

ALS Test Code	Matrix	Test Description	Method Reference**
SOLIDS-TOTSUS-ED	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

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

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

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

1

GLOSSARY OF REPORT TERMS

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

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: WESA Inc.
4 Cataraqui Street The Tower
Kingston ON K7K 1Z7

Contact: Tim Beckenham / Melanie St-Jean

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2683386								
WG1737747-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	31-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	31-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	31-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	31-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	31-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	31-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	31-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	31-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	31-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	31-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	31-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	31-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	31-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	31-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	31-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	31-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	31-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	31-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	31-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	31-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	31-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	31-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	31-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	31-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	31-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	31-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	31-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	31-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	31-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	31-AUG-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	31-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	31-AUG-13
NH3-CFA-ED	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-CFA-ED	**Water**							
Batch R2680529								
WG1734632-2 LCS								
Ammonia, Total (as N)			94.5		%		85-115	27-AUG-13
WG1734632-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	27-AUG-13
WG1734632-4 MS		**L1344909-8**						
Ammonia, Total (as N)			99.9		%		75-125	27-AUG-13
WG1734632-6 MS		**L1352037-3**						
Ammonia, Total (as N)			93.2		%		75-125	27-AUG-13
WG1734632-8 MS		**L1352615-2**						
Ammonia, Total (as N)			96.8		%		75-125	27-AUG-13
NO2-IC-ED	**Water**							
Batch R2679673								
WG1733203-2 LCS								
Nitrite (as N)			96.1		%		90-110	23-AUG-13
WG1733203-1 MB								
Nitrite (as N)			<0.050		mg/L		0.05	23-AUG-13
WG1733203-10 MS		**L1351983-6**						
Nitrite (as N)			90.2		%		75-125	23-AUG-13
WG1733203-4 MS		**L1351453-6**						
Nitrite (as N)			100.0		%		75-125	23-AUG-13
WG1733203-6 MS		**L1351933-1**						
Nitrite (as N)			97.4		%		75-125	23-AUG-13
WG1733203-8 MS		**L1352199-5**						
Nitrite (as N)			94.5		%		75-125	23-AUG-13
NO3-IC-ED	**Water**							
Batch R2679673								
WG1733203-2 LCS								
Nitrate (as N)			100.0		%		90-110	23-AUG-13
WG1733203-1 MB								
Nitrate (as N)			<0.050		mg/L		0.05	23-AUG-13
WG1733203-10 MS		**L1351983-6**						
Nitrate (as N)			101.0		%		75-125	23-AUG-13
WG1733203-4 MS		**L1351453-6**						
Nitrate (as N)			102.7		%		75-125	23-AUG-13
WG1733203-6 MS		**L1351933-1**						
Nitrate (as N)			99.4		%		75-125	23-AUG-13
WG1733203-8 MS		**L1352199-5**						
Nitrate (as N)			99.5		%		75-125	23-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-ED	**Water**							
Batch **R2678234**								
WG1732555-3 **LCS**								
pH			7.04		pH		6.9-7.1	23-AUG-13
SOLIDS-TOTSUS-ED	**Water**							
Batch **R2679070**								
WG1732605-2 **LCS**								
Total Suspended Solids			106.0		%		85-115	23-AUG-13
WG1732605-1 **MB**								
Total Suspended Solids			<3.0		mg/L		3	23-AUG-13

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH							
	2	20-AUG-13 17:15	24-AUG-13 00:23	0.25	79	hours	EHTR-FM
Anions and Nutrients							
Nitrate as N by IC							
	2	20-AUG-13 17:15	23-AUG-13 08:00	48	63	hours	EHTL
Nitrite as N by IC							
	2	20-AUG-13 17:15	23-AUG-13 08:00	48	63	hours	EHTL

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1351553 were received on 21-AUG-13 17:30.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC #

Page 1 of 1

Report To

Company: WESA/Envir-Eau/Blumetric

Contact: ~~Corinne Proux~~, Tim Beckenham

Address: 4 Cataraqui St

The Tower Kingston On K7K 1Z7

Phone: 819-243-7555 x 228 Fax:

Invoice To Same as Report ? ☐ Yes ☒ No

Hardcopy of Invoice with Report? ☐ Yes ☒ No

Company: Tlicho Engineering & Environmental Service Ltd

Contact: Trevor Herd

Address: 98 Archibald St, Box 133 Yellowknife NT X1A 2N

Phone: (867) 669-9981 Fax: (867) 669-9482

Lab Work Order # (lab use only)

Report Format / Distribution

☒ Standard ☐ Other

☒ PDF ☒ Excel ☐ Digital ☐ Fax

Email 1: cproux@envireau.ca

Email 2: tbeckenham@wesa.ca

Email 3:

Client / Project Information

Job #: Y-B11192-00-00

PO / AFE:

LSD:

Quote #:

ALS Contact: Catherine Evaristo

Sampler: PP, JC

Service Requested (Rush for routine analysis subject to availability)

◉ Regular (Standard Turnaround Times - Business Days)

○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT

○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT

○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

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

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Routine (TSS, pH)	Metals (Ni, Pb, Zn, As, Cd) P	Nutrients (NH_3) P	NO_2 & NO_3								Number of Containers
	EFF117	19/07/13		~~treated water~~	~~X~~	~~X~~	~~X~~	~~–~~				On Hold				5
	EFF305	20/08/13	17:15	Surface water	X	X	X	X								5

L1351553-COFC

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

Keep the extra bottles on Hold

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

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

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

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: [signature]	Date (dd-mmm-yy) 2013/08/21	Time (hh-mm) 08:00	Received by: [signature]	Date: Aug 21st	Time: 5:30pm	Temperature: Max 12 °C Aug 21	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

WESA Inc.
ATTN: Tim Beckenham
4 Cataraque Street
The Tower
Kingston ON K7K 1Z7

Date Received: 07-AUG-13
Report Date: 12-AUG-13 16:49 (MT)
Version: FINAL

Client Phone: 613-531-2725

Certificate of Analysis

Lab Work Order #: L1344178

Project P.O. #:	NOT SUBMITTED
Job Reference:	ABORIGINAL 15929
C of C Numbers:	1, 2, 3
Legal Site Desc:	

Cath Evaristo Cordero

Catherine Evaristo-Cordero
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1344178-1	L1344178-2	L1344178-3	L1344178-4	L1344178-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13
	Sampled Time	10:00	10:00	10:00	10:00	10:00
	Client ID	UP1-S	UP1-B	UP2-S	UP2-B	UP3-S
WATER						
Physical Tests	pH (pH)	7.72	7.86	7.87	7.88	7.88
	Total Suspended Solids (mg/L)	<3.0	3.0	<3.0	<3.0	<3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.050	<0.050	<0.050	0.078	0.063
	Nitrate and Nitrite (as N) (mg/L)	0.100	0.105	0.104	0.100	0.096
	Nitrate (as N) (mg/L)	0.100	0.105	0.104	0.100	0.096
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Total Metals	Aluminum (Al)-Total (mg/L)	0.044 DLM	0.068 DLM	0.047 DLM	0.046 DLM	0.047 DLM
	Antimony (Sb)-Total (mg/L)	0.00052 DLM	0.00059 DLM	0.00054 DLM	0.00060 DLM	<0.00050 DLM
	Arsenic (As)-Total (mg/L)	0.180 DLM	0.185 DLM	0.187 DLM	0.179 DLM	0.224 DLM
	Barium (Ba)-Total (mg/L)	0.0193 DLM	0.0190 DLM	0.0184 DLM	0.0180 DLM	0.0181 DLM
	Beryllium (Be)-Total (mg/L)	<0.0025 DLM	<0.0025 DLM	<0.0025 DLM	<0.0025 DLM	<0.0025 DLM
	Bismuth (Bi)-Total (mg/L)	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM
	Boron (B)-Total (mg/L)	<0.050 DLM	<0.050 DLM	<0.050 DLM	<0.050 DLM	<0.050 DLM
	Cadmium (Cd)-Total (mg/L)	<0.000050 DLM	<0.000050 DLM	<0.000050 DLM	<0.000050 DLM	<0.000050 DLM
	Calcium (Ca)-Total (mg/L)	133 DLM	138 DLM	141 DLM	136 DLM	140 DLM
	Chromium (Cr)-Total (mg/L)	<0.00050 DLM	0.00078 DLM	<0.00050 DLM	0.00086 DLM	<0.00050 DLM
	Cobalt (Co)-Total (mg/L)	0.00438 DLM	0.00458 DLM	0.00466 DLM	0.00446 DLM	0.00420
	Copper (Cu)-Total (mg/L)	0.00184 DLM	0.00205 DLM	0.00180 DLM	0.00185 DLM	0.00190
	Iron (Fe)-Total (mg/L)	1.07 DLM	1.20 DLM	1.16 DLM	1.06 DLM	1.12
	Lead (Pb)-Total (mg/L)	0.00039 DLM	0.00053 DLM	0.00037 DLM	0.00038 DLM	0.00045
	Lithium (Li)-Total (mg/L)	<0.025 DLM	<0.025 DLM	<0.025 DLM	<0.025 DLM	<0.025 DLM
	Magnesium (Mg)-Total (mg/L)	8.77 DLM	8.92 DLM	9.16 DLM	8.71 DLM	8.86 DLM
	Manganese (Mn)-Total (mg/L)	0.137 DLM	0.142 DLM	0.143 DLM	0.137 DLM	0.134 DLM
	Molybdenum (Mo)-Total (mg/L)	0.00217 DLM	0.00283 DLM	0.00224 DLM	0.00241 DLM	0.00223 DLM
	Nickel (Ni)-Total (mg/L)	0.00782 DLM	0.00936 DLM	0.00862 DLM	0.00891 DLM	0.00818 DLM
	Phosphorus (P)-Total (mg/L)	<1.5 DLM	<1.5 DLM	<1.5 DLM	<1.5 DLM	<1.5 DLM
	Potassium (K)-Total (mg/L)	6.88 DLM	7.00 DLM	7.13 DLM	6.82 DLM	6.91 DLM
	Selenium (Se)-Total (mg/L)	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM
	Silicon (Si)-Total (mg/L)	0.50 DLM	0.57 DLM	0.50 DLM	0.48 DLM	0.49 DLM
	Silver (Ag)-Total (mg/L)	<0.000050 DLM	<0.000050 DLM	<0.000050 DLM	<0.000050 DLM	<0.000050 DLM
	Sodium (Na)-Total (mg/L)	31.6 DLM	32.7 DLM	33.5 DLM	31.2 DLM	32.4 DLM
	Strontium (Sr)-Total (mg/L)	0.216 DLM	0.220 DLM	0.220 DLM	0.219 DLM	0.218 DLM
	Thallium (Tl)-Total (mg/L)	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM
	Tin (Sn)-Total (mg/L)	<0.00050 DLM	0.00073 DLM	<0.00050 DLM	0.00103 DLM	<0.00050 DLM
	Titanium (Ti)-Total (mg/L)	0.0052 DLM	0.0060 DLM	0.0040 DLM	0.0036 DLM	0.0038 DLM
	Uranium (U)-Total (mg/L)	0.000271 DLM	0.000295 DLM	0.000283 DLM	0.000277 DLM	0.000287 DLM
	Vanadium (V)-Total (mg/L)	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1344178-6	L1344178-7	L1344178-8	L1344178-9	L1344178-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13
	Sampled Time	10:00	10:00	10:00	10:00	10:00
	Client ID	UP3-B	UP4-S	UP4-B	UP5-S	UP5-B
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.88	7.86	7.86	7.87	7.87
	Total Suspended Solids (mg/L)	<3.0	<3.0	3.0	<3.0	<3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Nitrate and Nitrite (as N) (mg/L)	0.095	0.104	0.102	0.098	0.091
	Nitrate (as N) (mg/L)	0.095	0.104	0.102	0.098	0.091
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Total Metals	Aluminum (Al)-Total (mg/L)	DLM 0.050	DLM 0.044	DLM 0.041	DLM 0.048	DLM 0.061
	Antimony (Sb)-Total (mg/L)	DLM 0.00052	DLM 0.00052	DLM 0.00051	DLM 0.00054	DLM 0.00059
	Arsenic (As)-Total (mg/L)	DLM 0.219	DLM 0.179	DLM 0.177	DLM 0.246	DLM 0.252
	Barium (Ba)-Total (mg/L)	DLM 0.0177	DLM 0.0180	DLM 0.0183	DLM 0.0177	DLM 0.0187
	Beryllium (Be)-Total (mg/L)	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025
	Bismuth (Bi)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Boron (B)-Total (mg/L)	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050
	Cadmium (Cd)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Calcium (Ca)-Total (mg/L)	DLM 138	DLM 137	DLM 135	DLM 139	DLM 141
	Chromium (Cr)-Total (mg/L)	DLM 0.00199	DLM <0.00050	DLM 0.00055	DLM <0.00050	DLM 0.00072
	Cobalt (Co)-Total (mg/L)	DLM 0.00424	DLM 0.00491	DLM 0.00495	DLM 0.00399	DLM 0.00404
	Copper (Cu)-Total (mg/L)	DLM 0.00179	DLM 0.00176	DLM 0.00181	DLM 0.00192	DLM 0.00195
	Iron (Fe)-Total (mg/L)	DLM 1.10	DLM 1.15	DLM 1.13	DLM 1.03	DLM 1.10
	Lead (Pb)-Total (mg/L)	DLM 0.00045	DLM 0.00034	DLM 0.00037	DLM 0.00048	DLM 0.00050
	Lithium (Li)-Total (mg/L)	DLM <0.025	DLM <0.025	DLM <0.025	DLM <0.025	DLM <0.025
	Magnesium (Mg)-Total (mg/L)	DLM 8.72	8.94	DLM 8.83	DLM 8.65	DLM 8.86
	Manganese (Mn)-Total (mg/L)	DLM 0.131	0.153	DLM 0.151	DLM 0.131	DLM 0.132
	Molybdenum (Mo)-Total (mg/L)	DLM 0.00229	0.00210	DLM 0.00217	DLM 0.00212	DLM 0.00233
	Nickel (Ni)-Total (mg/L)	DLM 0.00837	0.00859	DLM 0.00856	DLM 0.00792	DLM 0.00817
	Phosphorus (P)-Total (mg/L)	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5
	Potassium (K)-Total (mg/L)	DLM 6.76	DLM 6.89	DLM 6.80	DLM 6.74	DLM 6.87
	Selenium (Se)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Silicon (Si)-Total (mg/L)	DLM 0.49	DLM 0.50	DLM 0.50	DLM 0.49	DLM 0.53
	Silver (Ag)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Sodium (Na)-Total (mg/L)	DLM 32.0	DLM 31.9	DLM 32.1	DLM 30.6	DLM 32.1
	Strontium (Sr)-Total (mg/L)	DLM 0.215	DLM 0.217	DLM 0.211	DLM 0.225	DLM 0.216
	Thallium (Tl)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Tin (Sn)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Titanium (Ti)-Total (mg/L)	DLM 0.0040	DLM 0.0042	DLM 0.0051	DLM 0.0046	DLM 0.0039
	Uranium (U)-Total (mg/L)	DLM 0.000290	DLM 0.000266	DLM 0.000274	DLM 0.000281	DLM 0.000295
	Vanadium (V)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1344178-11	L1344178-12	L1344178-13	L1344178-14	L1344178-15
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13
	Sampled Time	10:00	10:00	10:00	10:00	10:00
	Client ID	UP6-S	UP6-B	TBLANK	UP-EQ	DUP 9
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.86	7.86	5.62	5.34	7.77
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0	4.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Nitrate and Nitrite (as N) (mg/L)	0.088	0.086	<0.071	<0.071	0.104
	Nitrate (as N) (mg/L)	0.088	0.086	<0.050	<0.050	0.104
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Total Metals	Aluminum (Al)-Total (mg/L)	DLM 0.055	DLM 0.051	<0.0030	0.019	DLM 0.044
	Antimony (Sb)-Total (mg/L)	DLM 0.00053	DLM 0.00055	<0.00010	DLM <0.00050	DLM 0.00052
	Arsenic (As)-Total (mg/L)	DLM 0.276	DLM 0.264	<0.00010	DLM 0.00203	DLM 0.184
	Barium (Ba)-Total (mg/L)	DLM 0.0182	DLM 0.0192	<0.000050	DLM <0.00025	DLM 0.0179
	Beryllium (Be)-Total (mg/L)	DLM <0.0025	DLM <0.0025	<0.00050	DLM <0.0025	DLM <0.0025
	Bismuth (Bi)-Total (mg/L)	DLM <0.00025	DLM <0.00025	<0.000050	DLM <0.00025	DLM <0.00025
	Boron (B)-Total (mg/L)	DLM <0.050	DLM <0.050	<0.010	DLM <0.050	DLM <0.050
	Cadmium (Cd)-Total (mg/L)	DLM <0.000050	DLM <0.000050	<0.000010	DLM <0.000050	DLM <0.000050
	Calcium (Ca)-Total (mg/L)	DLM 144	DLM 136	<0.020	DLM <0.10	DLM 137
	Chromium (Cr)-Total (mg/L)	DLM <0.00050	DLM 0.00075	<0.00010	DLM <0.00050	DLM <0.00050
	Cobalt (Co)-Total (mg/L)	DLM 0.00412	DLM 0.00416	<0.00010	DLM <0.00050	DLM 0.00454
	Copper (Cu)-Total (mg/L)	DLM 0.00202	DLM 0.00195	<0.00010	DLM <0.00050	DLM 0.00174
	Iron (Fe)-Total (mg/L)	DLM 1.15	DLM 1.14	<0.010	DLM <0.050	DLM 1.10
	Lead (Pb)-Total (mg/L)	DLM 0.00052	DLM 0.00052	<0.000050	DLM <0.00025	DLM 0.00034
	Lithium (Li)-Total (mg/L)	DLM <0.025	DLM <0.025	<0.0050	DLM <0.025	DLM <0.025
	Magnesium (Mg)-Total (mg/L)	DLM 9.12	DLM 9.11	<0.0050	DLM <0.025	DLM 9.03
	Manganese (Mn)-Total (mg/L)	DLM 0.139	DLM 0.139	<0.000050	DLM 0.00073	DLM 0.138
	Molybdenum (Mo)-Total (mg/L)	DLM 0.00227	DLM 0.00229	<0.000050	DLM <0.00025	DLM 0.00215
	Nickel (Ni)-Total (mg/L)	DLM 0.00827	DLM 0.00845	<0.00010	DLM 0.00123	DLM 0.00801
	Phosphorus (P)-Total (mg/L)	DLM <1.5	DLM <1.5	<0.30	DLM <1.5	DLM <1.5
	Potassium (K)-Total (mg/L)	DLM 7.05	DLM 7.03	<0.050	DLM <0.25	DLM 6.93
	Selenium (Se)-Total (mg/L)	DLM <0.00050	DLM <0.00050	<0.00010	DLM <0.00050	DLM <0.00050
	Silicon (Si)-Total (mg/L)	DLM 0.49	DLM 0.51	<0.050	DLM <0.25	DLM 0.51
	Silver (Ag)-Total (mg/L)	DLM <0.000050	DLM 0.000101	<0.000010	DLM <0.000050	DLM <0.000050
	Sodium (Na)-Total (mg/L)	DLM 32.9	DLM 32.6	<0.050	DLM <0.25	DLM 32.0
	Strontium (Sr)-Total (mg/L)	DLM 0.219	DLM 0.220	<0.00010	DLM <0.00050	DLM 0.212
	Thallium (Tl)-Total (mg/L)	DLM <0.00025	DLM <0.00025	<0.000050	DLM <0.00025	DLM <0.00025
	Tin (Sn)-Total (mg/L)	DLM <0.00050	DLM 0.00400	<0.00010	DLM <0.00050	DLM <0.00050
	Titanium (Ti)-Total (mg/L)	DLM 0.0046	DLM 0.0039	<0.00030	DLM <0.0015	DLM 0.0040
	Uranium (U)-Total (mg/L)	DLM 0.000290	DLM 0.000306	<0.000010	DLM <0.000050	DLM 0.000267
	Vanadium (V)-Total (mg/L)	DLM <0.00050	DLM <0.00050	<0.00010	DLM <0.00050	DLM <0.00050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1344178-16	L1344178-20	L1344178-24		
	Description	Surface Water	Surface Water	Surface Water		
	Sampled Date	06-AUG-13	06-AUG-13	07-AUG-13		
	Sampled Time	10:00	09:00	09:00		
	Client ID	DUP 10	EFF 167	EFF 171		
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.84	7.91	7.92		
	Total Suspended Solids (mg/L)	3.0	<3.0	<3.0		
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.056	0.114	0.066		
	Nitrate and Nitrite (as N) (mg/L)	0.106	0.110	0.090		
	Nitrate (as N) (mg/L)	0.106	0.110	0.090		
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050		
Total Metals	Aluminum (Al)-Total (mg/L)	DLM 0.043	DLM <0.015	DLM <0.015		
	Antimony (Sb)-Total (mg/L)	DLM 0.00050	DLM <0.00050	DLM <0.00050		
	Arsenic (As)-Total (mg/L)	DLM 0.182	DLM 0.0223	DLM 0.0257		
	Barium (Ba)-Total (mg/L)	DLM 0.0184	DLM 0.0150	DLM 0.0153		
	Beryllium (Be)-Total (mg/L)	DLM <0.0025	DLM <0.0025	DLM <0.0025		
	Bismuth (Bi)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025		
	Boron (B)-Total (mg/L)	DLM <0.050	DLM <0.050	DLM <0.050		
	Cadmium (Cd)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050		
	Calcium (Ca)-Total (mg/L)	DLM 137	DLM 143	DLM 145		
	Chromium (Cr)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050		
	Cobalt (Co)-Total (mg/L)	DLM 0.00493	DLM 0.00313	DLM 0.00306		
	Copper (Cu)-Total (mg/L)	DLM 0.00172	DLM 0.00183	DLM 0.00092		
	Iron (Fe)-Total (mg/L)	DLM 1.15	DLM 1.90	DLM 2.00		
	Lead (Pb)-Total (mg/L)	DLM 0.00035	DLM <0.00025	DLM <0.00025		
	Lithium (Li)-Total (mg/L)	DLM <0.025	DLM <0.025	DLM <0.025		
	Magnesium (Mg)-Total (mg/L)	DLM 9.06	DLM 8.87	DLM 9.09		
	Manganese (Mn)-Total (mg/L)	DLM 0.156	DLM 0.0725	DLM 0.0737		
	Molybdenum (Mo)-Total (mg/L)	DLM 0.00215	DLM 0.00141	DLM 0.00141		
	Nickel (Ni)-Total (mg/L)	DLM 0.00877	DLM 0.00559	DLM 0.00575		
	Phosphorus (P)-Total (mg/L)	DLM <1.5	DLM <1.5	DLM <1.5		
	Potassium (K)-Total (mg/L)	DLM 6.99	DLM 6.33	DLM 6.44		
	Selenium (Se)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050		
	Silicon (Si)-Total (mg/L)	DLM 0.53	DLM 0.33	DLM 0.30		
	Silver (Ag)-Total (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050		
	Sodium (Na)-Total (mg/L)	DLM 32.6	DLM 36.4	DLM 37.3		
	Strontium (Sr)-Total (mg/L)	DLM 0.224	DLM 0.222	DLM 0.227		
	Thallium (Tl)-Total (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025		
	Tin (Sn)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050		
	Titanium (Ti)-Total (mg/L)	DLM 0.0044	DLM 0.0085	DLM 0.0091		
	Uranium (U)-Total (mg/L)	DLM 0.000273	DLM 0.000151	DLM 0.000159		
	Vanadium (V)-Total (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1344178-1	L1344178-2	L1344178-3	L1344178-4	L1344178-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13
	Sampled Time	10:00	10:00	10:00	10:00	10:00
	Client ID	UP1-S	UP1-B	UP2-S	UP2-B	UP3-S
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)	DLM 0.0209	DLM 0.0193	DLM 0.0188	DLM 0.0177	DLM 0.0197
	Antimony (Sb)-Dissolved (mg/L)	DLM 0.00051	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM 0.00052
	Arsenic (As)-Dissolved (mg/L)	DLM 0.0499	DLM 0.0468	DLM 0.0474	DLM 0.0476	DLM 0.0760
	Barium (Ba)-Dissolved (mg/L)	DLM 0.0165	DLM 0.0166	DLM 0.0165	DLM 0.0163	DLM 0.0167
	Beryllium (Be)-Dissolved (mg/L)	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025	DLM <0.0025
	Bismuth (Bi)-Dissolved (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Boron (B)-Dissolved (mg/L)	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050	DLM <0.050
	Cadmium (Cd)-Dissolved (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Calcium (Ca)-Dissolved (mg/L)	DLM 128	DLM 129	DLM 132	DLM 128	DLM 130
	Chromium (Cr)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Cobalt (Co)-Dissolved (mg/L)	DLM 0.00341	DLM 0.00341	DLM 0.00343	DLM 0.00338	DLM 0.00313
	Copper (Cu)-Dissolved (mg/L)	DLM 0.00132	DLM 0.00124	DLM 0.00121	DLM 0.00120	DLM 0.00124
	Iron (Fe)-Dissolved (mg/L)	DLM 0.065	DLM 0.052	DLM <0.050	DLM 0.055	DLM <0.050
	Lead (Pb)-Dissolved (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Lithium (Li)-Dissolved (mg/L)	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015	DLM <0.015
	Magnesium (Mg)-Dissolved (mg/L)	DLM 8.60	DLM 8.63	DLM 8.71	DLM 8.53	DLM 8.61
	Manganese (Mn)-Dissolved (mg/L)	DLM 0.0992	DLM 0.100	DLM 0.100	DLM 0.101	DLM 0.0959
	Molybdenum (Mo)-Dissolved (mg/L)	DLM 0.00205	DLM 0.00251	DLM 0.00213	DLM 0.00228	DLM 0.00205
	Nickel (Ni)-Dissolved (mg/L)	DLM 0.00658	DLM 0.00745	DLM 0.00670	DLM 0.00783	DLM 0.00666
	Phosphorus (P)-Dissolved (mg/L)	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5	DLM <1.5
	Potassium (K)-Dissolved (mg/L)	DLM 7.19	DLM 7.20	DLM 7.27	DLM 7.06	DLM 7.12
	Selenium (Se)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Silicon (Si)-Dissolved (mg/L)	DLM 0.44	DLM 0.46	DLM 0.45	DLM 0.44	DLM 0.43
	Silver (Ag)-Dissolved (mg/L)	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050	DLM <0.000050
	Sodium (Na)-Dissolved (mg/L)	DLM 29.7	DLM 29.3	DLM 29.3	DLM 29.3	DLM 29.6
	Strontium (Sr)-Dissolved (mg/L)	DLM 0.202	DLM 0.196	DLM 0.203	DLM 0.201	DLM 0.202
	Thallium (Tl)-Dissolved (mg/L)	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025	DLM <0.00025
	Tin (Sn)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Titanium (Ti)-Dissolved (mg/L)	DLM <0.0015	DLM <0.0015	DLM <0.0015	DLM <0.0015	DLM <0.0015
	Uranium (U)-Dissolved (mg/L)	DLM 0.000243	DLM 0.000255	DLM 0.000240	DLM 0.000253	DLM 0.000261
	Vanadium (V)-Dissolved (mg/L)	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050	DLM <0.00050
	Zinc (Zn)-Dissolved (mg/L)	DLM <0.0050	DLM <0.0050	DLM <0.0050	DLM <0.0050	DLM <0.0050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1344178-6	L1344178-7	L1344178-8	L1344178-9	L1344178-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13
	Sampled Time	10:00	10:00	10:00	10:00	10:00
	Client ID	UP3-B	UP4-S	UP4-B	UP5-S	UP5-B
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	<0.015 DLM	<0.015 DLM	<0.015 DLM	<0.015 DLM	<0.015 DLM
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)	0.0250 DLM	0.0175 DLM	0.0177 DLM	0.0204 DLM	0.0202 DLM
	Antimony (Sb)-Dissolved (mg/L)	0.00051 DLM	0.00051 DLM	<0.00050 DLM	0.00051 DLM	0.00053 DLM
	Arsenic (As)-Dissolved (mg/L)	0.0755 DLM	0.0433 DLM	0.0432 DLM	0.0955 DLM	0.0945 DLM
	Barium (Ba)-Dissolved (mg/L)	0.0171 DLM	0.0162 DLM	0.0168 DLM	0.0172 DLM	0.0170 DLM
	Beryllium (Be)-Dissolved (mg/L)	<0.0025 DLM	<0.0025 DLM	<0.0025 DLM	<0.0025 DLM	<0.0025 DLM
	Bismuth (Bi)-Dissolved (mg/L)	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM
	Boron (B)-Dissolved (mg/L)	<0.050 DLM	<0.050 DLM	<0.050 DLM	<0.050 DLM	<0.050 DLM
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050 DLM	<0.000050 DLM	<0.000050 DLM	<0.000050 DLM	<0.000050 DLM
	Calcium (Ca)-Dissolved (mg/L)	131 DLM	130 DLM	128 DLM	130 DLM	128 DLM
	Chromium (Cr)-Dissolved (mg/L)	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM
	Cobalt (Co)-Dissolved (mg/L)	0.00316 DLM	0.00384 DLM	0.00385 DLM	0.00313 DLM	0.00297 DLM
	Copper (Cu)-Dissolved (mg/L)	0.00115 DLM	0.00124 DLM	0.00118 DLM	0.00127 DLM	0.00124 DLM
	Iron (Fe)-Dissolved (mg/L)	0.052 DLM	<0.050 DLM	<0.050 DLM	0.065 DLM	0.052 DLM
	Lead (Pb)-Dissolved (mg/L)	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM
	Lithium (Li)-Dissolved (mg/L)	<0.015 DLM	<0.015 DLM	<0.015 DLM	<0.015 DLM	<0.015 DLM
	Magnesium (Mg)-Dissolved (mg/L)	8.62 DLM	8.72 DLM	8.72 DLM	8.59 DLM	8.61 DLM
	Manganese (Mn)-Dissolved (mg/L)	0.0967 DLM	0.116 DLM	0.116 DLM	0.0957 DLM	0.0944 DLM
	Molybdenum (Mo)-Dissolved (mg/L)	0.00218 DLM	0.00201 DLM	0.00208 DLM	0.00206 DLM	0.00208 DLM
	Nickel (Ni)-Dissolved (mg/L)	0.00656 DLM	0.00722 DLM	0.00754 DLM	0.00646 DLM	0.00651 DLM
	Phosphorus (P)-Dissolved (mg/L)	<1.5 DLM	<1.5 DLM	<1.5 DLM	<1.5 DLM	<1.5 DLM
	Potassium (K)-Dissolved (mg/L)	7.12 DLM	7.24 DLM	7.31 DLM	7.18 DLM	7.16 DLM
	Selenium (Se)-Dissolved (mg/L)	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM
	Silicon (Si)-Dissolved (mg/L)	0.43 DLM	0.46 DLM	0.45 DLM	0.43 DLM	0.42 DLM
	Silver (Ag)-Dissolved (mg/L)	<0.000050 DLM	<0.000050 DLM	<0.000050 DLM	<0.000050 DLM	<0.000050 DLM
	Sodium (Na)-Dissolved (mg/L)	29.3 DLM	30.0 DLM	30.4 DLM	29.6 DLM	29.6 DLM
	Strontium (Sr)-Dissolved (mg/L)	0.206 DLM	0.205 DLM	0.195 DLM	0.202 DLM	0.201 DLM
	Thallium (Tl)-Dissolved (mg/L)	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM	<0.00025 DLM
	Tin (Sn)-Dissolved (mg/L)	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM
	Titanium (Ti)-Dissolved (mg/L)	<0.0015 DLM	<0.0015 DLM	<0.0015 DLM	<0.0015 DLM	<0.0015 DLM
	Uranium (U)-Dissolved (mg/L)	0.000258 DLM	0.000247 DLM	0.000237 DLM	0.000270 DLM	0.000256 DLM
	Vanadium (V)-Dissolved (mg/L)	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM	<0.00050 DLM
	Zinc (Zn)-Dissolved (mg/L)	<0.0050 DLM	<0.0050 DLM	<0.0050 DLM	<0.0050 DLM	<0.0050 DLM

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1344178-11	L1344178-12	L1344178-13	L1344178-14	L1344178-15
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13	06-AUG-13
	Sampled Time	10:00	10:00	10:00	10:00	10:00
	Client ID	UP6-S	UP6-B	TBLANK	UP-EQ	DUP 9
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	<0.015 DLM	<0.015 DLM	<0.0030	0.159 DLM	<0.015 DLM
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)	0.0202 DLM	0.0213 DLM			
	Antimony (Sb)-Dissolved (mg/L)	0.00052 DLM	<0.00050 DLM			
	Arsenic (As)-Dissolved (mg/L)	0.105 DLM	0.101 DLM			
	Barium (Ba)-Dissolved (mg/L)	0.0172 DLM	0.0161 DLM			
	Beryllium (Be)-Dissolved (mg/L)	<0.0025 DLM	<0.0025 DLM			
	Bismuth (Bi)-Dissolved (mg/L)	<0.00025 DLM	<0.00025 DLM			
	Boron (B)-Dissolved (mg/L)	<0.050 DLM	<0.050 DLM			
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050 DLM	<0.000050 DLM			
	Calcium (Ca)-Dissolved (mg/L)	125 DLM	127 DLM			
	Chromium (Cr)-Dissolved (mg/L)	<0.00050 DLM	<0.00050 DLM			
	Cobalt (Co)-Dissolved (mg/L)	0.00310 DLM	0.00313 DLM			
	Copper (Cu)-Dissolved (mg/L)	0.00128 DLM	0.00131 DLM			
	Iron (Fe)-Dissolved (mg/L)	0.054 DLM	0.059 DLM			
	Lead (Pb)-Dissolved (mg/L)	<0.00025 DLM	<0.00025 DLM			
	Lithium (Li)-Dissolved (mg/L)	<0.015 DLM	<0.015 DLM			
	Magnesium (Mg)-Dissolved (mg/L)	8.69 DLM	8.68 DLM			
	Manganese (Mn)-Dissolved (mg/L)	0.103 DLM	0.103 DLM			
	Molybdenum (Mo)-Dissolved (mg/L)	0.00207 DLM	0.00203 DLM			
	Nickel (Ni)-Dissolved (mg/L)	0.00669 DLM	0.00683 DLM			
	Phosphorus (P)-Dissolved (mg/L)	<1.5 DLM	<1.5 DLM			
	Potassium (K)-Dissolved (mg/L)	7.18 DLM	7.13 DLM			
	Selenium (Se)-Dissolved (mg/L)	<0.00050 DLM	<0.00050 DLM			
	Silicon (Si)-Dissolved (mg/L)	0.43 DLM	0.43 DLM			
	Silver (Ag)-Dissolved (mg/L)	<0.000050 DLM	<0.000050 DLM			
	Sodium (Na)-Dissolved (mg/L)	30.0 DLM	29.5 DLM			
	Strontium (Sr)-Dissolved (mg/L)	0.204 DLM	0.196 DLM			
	Thallium (Tl)-Dissolved (mg/L)	<0.00025 DLM	<0.00025 DLM			
	Tin (Sn)-Dissolved (mg/L)	<0.00050 DLM	<0.00050 DLM			
	Titanium (Ti)-Dissolved (mg/L)	<0.0015 DLM	<0.0015 DLM			
	Uranium (U)-Dissolved (mg/L)	0.000269 DLM	0.000256 DLM			
	Vanadium (V)-Dissolved (mg/L)	<0.00050 DLM	<0.00050 DLM			
	Zinc (Zn)-Dissolved (mg/L)	<0.0050 DLM	<0.0050 DLM			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1344178-16 Surface Water 06-AUG-13 10:00 DUP 10	L1344178-20 Surface Water 06-AUG-13 09:00 EFF 167	L1344178-24 Surface Water 07-AUG-13 09:00 EFF 171		
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	<0.015 DLM	<0.015 DLM	<0.015 DLM		
Dissolved Metals	Aluminum (Al)-Dissolved (mg/L)					
	Antimony (Sb)-Dissolved (mg/L)					
	Arsenic (As)-Dissolved (mg/L)					
	Barium (Ba)-Dissolved (mg/L)					
	Beryllium (Be)-Dissolved (mg/L)					
	Bismuth (Bi)-Dissolved (mg/L)					
	Boron (B)-Dissolved (mg/L)					
	Cadmium (Cd)-Dissolved (mg/L)					
	Calcium (Ca)-Dissolved (mg/L)					
	Chromium (Cr)-Dissolved (mg/L)					
	Cobalt (Co)-Dissolved (mg/L)					
	Copper (Cu)-Dissolved (mg/L)					
	Iron (Fe)-Dissolved (mg/L)					
	Lead (Pb)-Dissolved (mg/L)					
	Lithium (Li)-Dissolved (mg/L)					
	Magnesium (Mg)-Dissolved (mg/L)					
	Manganese (Mn)-Dissolved (mg/L)					
	Molybdenum (Mo)-Dissolved (mg/L)					
	Nickel (Ni)-Dissolved (mg/L)					
	Phosphorus (P)-Dissolved (mg/L)					
	Potassium (K)-Dissolved (mg/L)					
	Selenium (Se)-Dissolved (mg/L)					
	Silicon (Si)-Dissolved (mg/L)					
	Silver (Ag)-Dissolved (mg/L)					
	Sodium (Na)-Dissolved (mg/L)					
	Strontium (Sr)-Dissolved (mg/L)					
	Thallium (Tl)-Dissolved (mg/L)					
	Tin (Sn)-Dissolved (mg/L)					
	Titanium (Ti)-Dissolved (mg/L)					
	Uranium (U)-Dissolved (mg/L)					
	Vanadium (V)-Dissolved (mg/L)					
	Zinc (Zn)-Dissolved (mg/L)					

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

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A
MET-T-CCMS-ED	Water	Total Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A
NH3-CFA-ED	Water	Ammonia in Water by Colour	APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.

ALS Test Code	Matrix	Test Description	Method Reference**
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite	CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
PH-ED	Water	pH	APHA 4500 H-Electrode

All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

ALS Test Code	Matrix	Test Description	Method Reference**
SOLIDS-TOTSUS-ED	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

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

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

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

1 2 3

GLOSSARY OF REPORT TERMS

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

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: WESA Inc.
4 Cataraque Street The Tower
Kingston ON K7K 1Z7

Contact: Tim Beckenham

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED	**Water**							
Batch R2669339								
WG1723421-2 CRM		**ED-HIGH-WATRM**						
Aluminum (Al)-Dissolved			100.6		%		80-120	09-AUG-13
Antimony (Sb)-Dissolved			98.4		%		80-120	09-AUG-13
Arsenic (As)-Dissolved			103.1		%		80-120	09-AUG-13
Barium (Ba)-Dissolved			102.2		%		80-120	09-AUG-13
Beryllium (Be)-Dissolved			101.3		%		80-120	09-AUG-13
Bismuth (Bi)-Dissolved			100.6		%		80-120	09-AUG-13
Boron (B)-Dissolved			98.2		%		80-120	09-AUG-13
Cadmium (Cd)-Dissolved			104.4		%		80-120	09-AUG-13
Calcium (Ca)-Dissolved			105.0		%		80-120	09-AUG-13
Chromium (Cr)-Dissolved			103.6		%		80-120	09-AUG-13
Cobalt (Co)-Dissolved			100.2		%		80-120	09-AUG-13
Copper (Cu)-Dissolved			99.2		%		80-120	09-AUG-13
Lead (Pb)-Dissolved			100.2		%		80-120	09-AUG-13
Lithium (Li)-Dissolved			101.5		%		80-120	09-AUG-13
Magnesium (Mg)-Dissolved			100.1		%		80-120	09-AUG-13
Manganese (Mn)-Dissolved			99.4		%		80-120	09-AUG-13
Molybdenum (Mo)-Dissolved			102.3		%		80-120	09-AUG-13
Nickel (Ni)-Dissolved			102.6		%		80-120	09-AUG-13
Phosphorus (P)-Dissolved			111.0		%		80-120	09-AUG-13
Potassium (K)-Dissolved			105.9		%		80-120	09-AUG-13
Selenium (Se)-Dissolved			104.1		%		80-120	09-AUG-13
Silicon (Si)-Dissolved			106.0		%		80-120	09-AUG-13
Silver (Ag)-Dissolved			102.3		%		80-120	09-AUG-13
Sodium (Na)-Dissolved			97.2		%		80-120	09-AUG-13
Strontium (Sr)-Dissolved			104.2		%		80-120	09-AUG-13
Thallium (Tl)-Dissolved			102.7		%		80-120	09-AUG-13
Titanium (Ti)-Dissolved			108.2		%		80-120	09-AUG-13
Tin (Sn)-Dissolved			97.5		%		80-120	09-AUG-13
Uranium (U)-Dissolved			102.7		%		80-120	09-AUG-13
Vanadium (V)-Dissolved			100.5		%		80-120	09-AUG-13
Zinc (Zn)-Dissolved			99.9		%		80-120	09-AUG-13
WG1723421-1 MB								
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	09-AUG-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED	**Water**							
Batch R2669339								
WG1723421-1 MB								
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	09-AUG-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-13
Boron (B)-Dissolved			<0.010		mg/L		0.01	09-AUG-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	09-AUG-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	09-AUG-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	09-AUG-13
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-13
Lithium (Li)-Dissolved			<0.0030		mg/L		0.003	09-AUG-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	09-AUG-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Phosphorus (P)-Dissolved			<0.30		mg/L		0.3	09-AUG-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	09-AUG-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	09-AUG-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	09-AUG-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	09-AUG-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	09-AUG-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	09-AUG-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	09-AUG-13
MET-T-CCMS-ED	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2668991								
WG1723752-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	10-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	10-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	10-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	10-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	10-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	10-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	10-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	10-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	10-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	10-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	10-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	10-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	10-AUG-13

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2669616								
WG1723768-3 LCS								
Aluminum (Al)-Total			100.7		%		80-120	10-AUG-13
Antimony (Sb)-Total			101.4		%		80-120	10-AUG-13
Arsenic (As)-Total			102.7		%		80-120	10-AUG-13
Barium (Ba)-Total			101.4		%		80-120	10-AUG-13
Beryllium (Be)-Total			102.5		%		80-120	10-AUG-13
Bismuth (Bi)-Total			103.8		%		80-120	10-AUG-13
Boron (B)-Total			103.1		%		80-120	10-AUG-13
Cadmium (Cd)-Total			104.7		%		80-120	10-AUG-13
Calcium (Ca)-Total			106.9		%		80-120	10-AUG-13
Chromium (Cr)-Total			104.1		%		80-120	10-AUG-13
Cobalt (Co)-Total			101.9		%		80-120	10-AUG-13
Copper (Cu)-Total			99.3		%		80-120	10-AUG-13
Iron (Fe)-Total			95.4		%		80-120	10-AUG-13
Lead (Pb)-Total			107.3		%		80-120	10-AUG-13
Lithium (Li)-Total			107.8		%		80-120	10-AUG-13
Magnesium (Mg)-Total			105.2		%		80-120	10-AUG-13
Manganese (Mn)-Total			100.8		%		80-120	10-AUG-13
Molybdenum (Mo)-Total			104.5		%		80-120	10-AUG-13
Nickel (Ni)-Total			100.3		%		80-120	10-AUG-13
Potassium (K)-Total			98.2		%		80-120	10-AUG-13
Selenium (Se)-Total			108.6		%		80-120	10-AUG-13
Silicon (Si)-Total			108.6		%		80-120	10-AUG-13
Silver (Ag)-Total			94.1		%		80-120	10-AUG-13
Sodium (Na)-Total			102.4		%		80-120	10-AUG-13
Strontium (Sr)-Total			113.1		%		80-120	10-AUG-13
Thallium (Tl)-Total			106.2		%		80-120	10-AUG-13
Tin (Sn)-Total			94.8		%		80-120	10-AUG-13
Titanium (Ti)-Total			106.1		%		80-120	10-AUG-13
Uranium (U)-Total			101.2		%		80-120	10-AUG-13
Vanadium (V)-Total			103.6		%		80-120	10-AUG-13
Zinc (Zn)-Total			103.7		%		80-120	10-AUG-13
WG1723768-4 LCS								
Aluminum (Al)-Total			118.5		%		80-120	10-AUG-13
Antimony (Sb)-Total			106.9		%		80-120	10-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2669616								
WG1723768-4 LCS								
Arsenic (As)-Total			101.8		%		80-120	10-AUG-13
Barium (Ba)-Total			101.7		%		80-120	10-AUG-13
Beryllium (Be)-Total			98.4		%		80-120	10-AUG-13
Bismuth (Bi)-Total			98.5		%		80-120	10-AUG-13
Boron (B)-Total			100.5		%		80-120	10-AUG-13
Cadmium (Cd)-Total			101.5		%		80-120	10-AUG-13
Calcium (Ca)-Total			103.0		%		80-120	10-AUG-13
Chromium (Cr)-Total			101.1		%		80-120	10-AUG-13
Cobalt (Co)-Total			99.3		%		80-120	10-AUG-13
Copper (Cu)-Total			99.5		%		80-120	10-AUG-13
Iron (Fe)-Total			105.7		%		80-120	10-AUG-13
Lead (Pb)-Total			104.0		%		80-120	10-AUG-13
Lithium (Li)-Total			97.6		%		80-120	10-AUG-13
Magnesium (Mg)-Total			107.3		%		80-120	10-AUG-13
Manganese (Mn)-Total			99.6		%		80-120	10-AUG-13
Molybdenum (Mo)-Total			102.2		%		80-120	10-AUG-13
Nickel (Ni)-Total			98.2		%		80-120	10-AUG-13
Potassium (K)-Total			96.8		%		80-120	10-AUG-13
Selenium (Se)-Total			106.1		%		80-120	10-AUG-13
Silver (Ag)-Total			96.9		%		80-120	10-AUG-13
Sodium (Na)-Total			101.9		%		80-120	10-AUG-13
Strontium (Sr)-Total			107.1		%		80-120	10-AUG-13
Thallium (Tl)-Total			105.4		%		80-120	10-AUG-13
Tin (Sn)-Total			96.5		%		80-120	10-AUG-13
Titanium (Ti)-Total			114.6		%		80-120	10-AUG-13
Uranium (U)-Total			98.4		%		80-120	10-AUG-13
Vanadium (V)-Total			101.4		%		80-120	10-AUG-13
Zinc (Zn)-Total			102.1		%		80-120	10-AUG-13
WG1723752-2 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	10-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	10-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2669616								
WG1723752-2 MB								
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	10-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	10-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	10-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	10-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	10-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	10-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	10-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	10-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	10-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	10-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	10-AUG-13
WG1723768-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	10-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	10-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	10-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2669616								
WG1723768-1 MB								
Boron (B)-Total			<0.010		mg/L		0.01	10-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	10-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	10-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	10-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	10-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	10-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	10-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	10-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	10-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	10-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	10-AUG-13
WG1723768-2 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	10-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	10-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	10-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	10-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2669616								
WG1723768-2 MB								
Calcium (Ca)-Total			<0.020		mg/L		0.02	10-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	10-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	10-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	10-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	10-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	10-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	10-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	10-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	10-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	10-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	10-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	10-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	10-AUG-13
NH3-CFA-ED	**Water**							
Batch R2668937								
WG1723203-2 LCS								
Ammonia, Total (as N)			99.7		%		85-115	09-AUG-13
WG1723203-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	09-AUG-13
WG1723203-6 MS		**L1344178-13**						
Ammonia, Total (as N)			96.6		%		75-125	09-AUG-13
WG1723203-9 MS		**L1342019-4**						
Ammonia, Total (as N)			98.5		%		75-125	09-AUG-13
NO2-IC-ED	**Water**							

Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-ED	**Water**							
Batch R2669522								
WG1723929-1 MB								
Nitrite (as N)			<0.050		mg/L		0.05	09-AUG-13
NO3-IC-ED	**Water**							
Batch R2669522								
WG1723929-1 MB								
Nitrate (as N)			<0.050		mg/L		0.05	09-AUG-13
PH-ED	**Water**							
Batch R2668867								
WG1723395-7 DUP		**L1344178-11**						
pH		7.86	7.86	J	pH	0.00	0.3	09-AUG-13
WG1723395-3 LCS								
pH			7.05		pH		6.9-7.1	09-AUG-13
Batch R2670354								
WG1724551-3 LCS								
pH			7.03		pH		6.9-7.1	12-AUG-13
SOLIDS-TOTSUS-ED	**Water**							
Batch R2669161								
WG1723215-2 LCS								
Total Suspended Solids			100.0		%		85-115	09-AUG-13
WG1723215-1 MB								
Total Suspended Solids			<3.0		mg/L		3	09-AUG-13

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH							
	1	06-AUG-13 10:00	09-AUG-13 14:34	0.25	77	hours	EHTR-FM
	2	06-AUG-13 10:00	09-AUG-13 14:38	0.25	77	hours	EHTR-FM
	3	06-AUG-13 10:00	09-AUG-13 14:41	0.25	77	hours	EHTR-FM
	4	06-AUG-13 10:00	09-AUG-13 14:45	0.25	77	hours	EHTR-FM
	5	06-AUG-13 10:00	09-AUG-13 14:49	0.25	77	hours	EHTR-FM
	6	06-AUG-13 10:00	09-AUG-13 14:52	0.25	77	hours	EHTR-FM
	7	06-AUG-13 10:00	09-AUG-13 14:56	0.25	77	hours	EHTR-FM
	8	06-AUG-13 10:00	09-AUG-13 14:59	0.25	77	hours	EHTR-FM
	9	06-AUG-13 10:00	09-AUG-13 15:03	0.25	77	hours	EHTR-FM
	10	06-AUG-13 10:00	09-AUG-13 15:07	0.25	77	hours	EHTR-FM
	11	06-AUG-13 10:00	09-AUG-13 15:10	0.25	77	hours	EHTR-FM
	12	06-AUG-13 10:00	09-AUG-13 15:18	0.25	77	hours	EHTR-FM
	13	06-AUG-13 10:00	12-AUG-13 16:24	0.25	150	hours	EHTR-FM
	14	06-AUG-13 10:00	12-AUG-13 16:24	0.25	150	hours	EHTR-FM
	15	06-AUG-13 10:00	09-AUG-13 15:29	0.25	78	hours	EHTR-FM
	16	06-AUG-13 10:00	09-AUG-13 15:32	0.25	78	hours	EHTR-FM
	20	06-AUG-13 09:00	09-AUG-13 15:36	0.25	79	hours	EHTR-FM
	24	07-AUG-13 09:00	09-AUG-13 15:39	0.25	55	hours	EHTR-FM
Anions and Nutrients							
Nitrate as N by IC							
	1	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	2	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	3	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	4	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	5	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	6	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	7	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	8	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	9	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	10	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	11	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	12	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	13	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	14	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	15	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	16	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	20	06-AUG-13 09:00	09-AUG-13 08:00	48	71	hours	EHTL
Nitrite as N by IC							
	1	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	2	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	3	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	4	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	5	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	6	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	7	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	8	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	9	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	10	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	11	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	12	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	13	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	14	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	15	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	16	06-AUG-13 10:00	09-AUG-13 08:00	48	70	hours	EHTL
	20	06-AUG-13 09:00	09-AUG-13 08:00	48	71	hours	EHTL

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1344178 were received on 07-AUG-13 17:20.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # ____

Report To
Company: BluMetric
Contact: Tim Beckenham
Address: 4 Cataraqui St. The Tower, Kingston, On, K7K 1Z7
Phone: (613) 531-2725 Fax:

Invoice To Same as Report ? ☐ Yes ☐ No
Hardcopy of Invoice with Report? ☐ Yes ☐ No
Company: TEEC Ltd
Contact:
Address: 98 Archibald St. Box 133 Yellowknife, NT X1A 2N1
Phone: (867) 669-9481 Fax: (867) 669-9482

Lab Work Order # (lab use only): L1344178

Report Format / Distribution
☒ Standard ☐ Other
☒ PDF ☒ Excel ☐ Digital ☐ Fax
Email 1: cproux@envireau.ca
Email 2: tbeckenham@wesa.ca
Email 3:

Client / Project Information
Job #:
PO / AFE:
LSD:
Quote #:
ALS Contact: Catherine Evaristo
Sampler: Alexandra Duchesne

Service Requested (Rush for routine analysis subject to availability)
◉ Regular (Standard Turnaround Times - Business Days)
○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
● Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

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

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS, pH	P Total metal (As, Zn, Cu, Pb, Ni)	F/P Dissolved metals (As, Zn, Cu, Pb, Ni)	NO$_2$: NO$_3$	P Total ammonia nitrogen	Number of Containers
	UP1-S	06/08/13	10:00	surface water	X	X	X	X	X	
	UP1-B									
	UP2-S									
	UP2-B									
	UP3-S									
	UP3-B									
	UP4-S									
	UP4-B									
→	UP5-S									
	UP5-B									
	UP6-S									
	UP6-B									

L1344178-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details
keep the extra bottles on hold. Bottles indicating dissolved metals have been filtered and preserved and they are for dissolved metals.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Alexandra Duchesne	Date (dd-mmm-yy): 07/08/13	Time (hh-mm): 14:00	Received by: [signature]	Date: Aug 7/13	Time: 5:20	Temperature: ① Max 13 avg 12 °C	Verified by: ⑥ max 13 avg 11	Date:	Time:	Observations: Yes / No ? If Yes add SIF

② max 13 avg 11

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To
Company:
Contact:
Address:
Phone: Fax:

Invoice To Same as Report ? ☐ Yes ☐ No
Hardcopy of Invoice with Report? ☐ Yes ☐ No
Company:
Contact:
Address:
Phone: Fax:

Lab Work Order # (lab use only)

Report Format / Distribution
☐ Standard ☐ Other
☐ PDF ☐ Excel ☐ Digital ☐ Fax
Email 1:
Email 2:
Email 3:

Client / Project Information
Job #:
PO / AFE:
LSD:
Quote #:
ALS Contact: Sampler:

Service Requested (Rush for routine analysis subject to availability)
(●) Regular (Standard Turnaround Times - Business Days) EFF167
○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
(X) Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT EFF171
○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

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

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS, pH	P Total metals (As, Zn, Cu, Pb, Ni)	NO2 and NO3	P Total ammonia nitrogen							Number of Containers
	EFF164	05/08/13	15:00	surface water											
	EFF165	05/08/13	21:00												
	EFF166	06/08/13	3:00												
	EFF167	06/08/13	9:00		X	X	X	X							
	EFF168	06/08/13	15:00												
	EFF169	06/08/13	21:00												
	EFF170	07/08/13	3:00												
	EFF171	07/08/13	9:00		X	X	X	X							

L1344178-COFC

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

keep the extra bottles on hold. EFF171 emergency turn over, EFF167 → normal turnover.

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

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

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

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To	Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company:	☐ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business Days)
Contact:	☐ PDF ☐ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	Email 1:	◉ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Email 2:	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone: Fax:	Email 3:	**Analysis Request**
Invoice To Same as Report ? ☐ Yes ☐ No	Client / Project Information	Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report? ☐ Yes ☐ No	Job #:	
Company:	PO / AFE:	
Contact:	LSD:	
Address:		
Phone: Fax:	Quote #:	
Lab Work Order # (lab use only)	ALS Contact: / Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS, pH	P: Total metal (As, Zn, Cu, Pb, Ni)	NO_2^-, NO_3^-	P: Total ammonia nitrogen								Number of Containers
	T Blank	06/08/13	10:00		X	X	X	X								
	UP-EQ	"	"		X	X	X	X								
	DUP 9	"	"		/	/	/	/								
	DUP 10	"	"		/	/	/	/								

L1344178-COFC

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

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

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

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

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Alexandra Duchesne	Date (dd-mmm-yy) 07/08/13	Time (hh-mm) 14:00	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

WESA Inc.
ATTN: Tim Beckenham
4 Cataraqui Street
The Tower
Kingston ON K7K 1Z7

Date Received: 06-AUG-13
Report Date: 17-AUG-13 16:58 (MT)
Version: FINAL REV. 2

Client Phone: --

Certificate of Analysis

Lab Work Order #: L1342803

Project P.O. #: NOT SUBMITTED
Job Reference: ABORIGINAL 15929
C of C Numbers: 1
Legal Site Desc:

Comments: ADDITIONAL 16-AUG-13 11:21

Catherine Evaristo-Cordero
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1342803-1 Surface Water 02-AUG-13 15:45 EFF154	L1342803-2 Surface Water 03-AUG-13 15:00 EFF156	L1342803-4 Surface Water 04-AUG-13 03:00 EFF158	L1342803-5 Surface Water 04-AUG-13 09:00 EFF159	L1342803-6 Surface Water 04-AUG-13 15:00 EFF160
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.68	7.80		7.73	
	Total Suspended Solids (mg/L)	4.0	<3.0		4.0	
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.089	0.088		0.089	
	Nitrate and Nitrite (as N) (mg/L)	0.143	0.133		0.125	
	Nitrate (as N) (mg/L)	0.143	0.133		0.125	
	Nitrite (as N) (mg/L)	<0.050	<0.050		<0.050	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0113	0.0099		0.0086	
	Antimony (Sb)-Total (mg/L)	0.00034	0.00032		0.00031	
	Arsenic (As)-Total (mg/L)	0.0306	0.0212		0.0210	
	Barium (Ba)-Total (mg/L)	0.0164	0.0159		0.0165	
	Beryllium (Be)-Total (mg/L)	<0.00050	<0.00050		<0.00050	
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050		<0.000050	
	Boron (B)-Total (mg/L)	0.033	0.031		0.031	
	Cadmium (Cd)-Total (mg/L)	0.000011	<0.000010		<0.000010	
	Calcium (Ca)-Total (mg/L)	136	131		132	
	Chromium (Cr)-Total (mg/L)	0.00039	0.00039		0.00032	
	Cobalt (Co)-Total (mg/L)	0.00363	0.00293		0.00309	
	Copper (Cu)-Total (mg/L)	0.00372	0.00396	0.00116	0.0112 RRV	0.00367
	Iron (Fe)-Total (mg/L)	2.45	1.96		1.76	
	Lead (Pb)-Total (mg/L)	0.000213	0.000207		0.000585	
	Lithium (Li)-Total (mg/L)	<0.0050	<0.0050		<0.0050	
	Magnesium (Mg)-Total (mg/L)	8.50	8.66		8.70	
	Manganese (Mn)-Total (mg/L)	0.0989	0.0683		0.0691	
	Molybdenum (Mo)-Total (mg/L)	0.00116	0.00125		0.00114	
	Nickel (Ni)-Total (mg/L)	0.00676	0.00546		0.00630	
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30		<0.30	
	Potassium (K)-Total (mg/L)	7.21	7.09		7.51	
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010		<0.00010	
	Silicon (Si)-Total (mg/L)	0.443	0.370		0.375	
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010		<0.000010	
	Sodium (Na)-Total (mg/L)	36.4	36.4		36.2	
	Strontium (Sr)-Total (mg/L)	0.203	0.201		0.207	
	Thallium (Tl)-Total (mg/L)	<0.000050	<0.000050		<0.000050	
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010		0.00011	
	Titanium (Ti)-Total (mg/L)	0.0122	0.00871		0.00845	
	Uranium (U)-Total (mg/L)	0.000161	0.000158		0.000136	
	Vanadium (V)-Total (mg/L)	0.00015	0.00013		0.00013	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1342803-7 Surface Water 04-AUG-13 21:00 EFF161	L1342803-9 Surface Water 05-AUG-13 09:00 EFF163	L1342803-10 Surface Water 03-AUG-13 15:00 DUP8	L1342803-11 Surface Water 02-AUG-13 12:00 TRAVEL BLANK
Grouping	**Analyte**				
WATER					
Physical Tests	pH (pH)		7.60	7.71	5.99
	Total Suspended Solids (mg/L)		6.0	4.0	<3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)		0.091	0.094	<0.050
	Nitrate and Nitrite (as N) (mg/L)		0.118	0.138	<0.071
	Nitrate (as N) (mg/L)		0.118	0.138	<0.050
	Nitrite (as N) (mg/L)		<0.050	<0.050	<0.050
Total Metals	Aluminum (Al)-Total (mg/L)		0.0105	0.0097	<0.0030
	Antimony (Sb)-Total (mg/L)		0.00030	0.00033	<0.00010
	Arsenic (As)-Total (mg/L)		0.0208	0.0211	<0.00010
	Barium (Ba)-Total (mg/L)		0.0154	0.0154	<0.000050
	Beryllium (Be)-Total (mg/L)		<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Total (mg/L)		<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)		0.034	0.032	<0.010
	Cadmium (Cd)-Total (mg/L)		<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)		145	136	<0.020
	Chromium (Cr)-Total (mg/L)		0.00035	0.00037	<0.00010
	Cobalt (Co)-Total (mg/L)		0.00326	0.00292	<0.00010
	Copper (Cu)-Total (mg/L)	0.00174	0.00127	0.00516	<0.00010
	Iron (Fe)-Total (mg/L)		1.78	1.95	<0.010
	Lead (Pb)-Total (mg/L)		0.000071	0.000268	<0.000050
	Lithium (Li)-Total (mg/L)		<0.0050	<0.0050	<0.0050
	Magnesium (Mg)-Total (mg/L)		9.63	8.63	<0.0050
	Manganese (Mn)-Total (mg/L)		0.0765	0.0684	<0.000050
	Molybdenum (Mo)-Total (mg/L)		0.00130	0.00124	<0.000050
	Nickel (Ni)-Total (mg/L)		0.00571	0.00546	<0.00010
	Phosphorus (P)-Total (mg/L)		<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)		7.18	7.22	<0.050
	Selenium (Se)-Total (mg/L)		<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)		0.336	0.356	<0.050
	Silver (Ag)-Total (mg/L)		<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)		36.6	36.9	<0.050
	Strontium (Sr)-Total (mg/L)		0.221	0.205	<0.00010
	Thallium (Tl)-Total (mg/L)		<0.000050	<0.000050	<0.000050
	Tin (Sn)-Total (mg/L)		<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)		0.00918	0.00883	<0.00030
	Uranium (U)-Total (mg/L)		0.000142	0.000164	<0.000010
	Vanadium (V)-Total (mg/L)		0.00014	0.00014	<0.00010

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1342803-1	L1342803-2	L1342803-4	L1342803-5	L1342803-6
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	02-AUG-13	03-AUG-13	04-AUG-13	04-AUG-13	04-AUG-13
	Sampled Time	15:45	15:00	03:00	09:00	15:00
	Client ID	EFF154	EFF156	EFF158	EFF159	EFF160
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	0.0082	0.0064		0.0088	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1342803-7	L1342803-9	L1342803-10	L1342803-11	
	Description	Surface Water	Surface Water	Surface Water	Surface Water	
	Sampled Date	04-AUG-13	05-AUG-13	03-AUG-13	02-AUG-13	
	Sampled Time	21:00	09:00	15:00	12:00	
	Client ID	EFF161	EFF163	DUP8	TRAVEL BLANK	
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)		0.0043	0.0061	<0.0030	

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

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-T-CCMS-ED	Water	Total Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A
NH3-CFA-ED	Water	Ammonia in Water by Colour	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.			
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite	CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC	APHA 4110 B-ION CHROMATOGRAPHY
PH-ED	Water	pH	APHA 4500 H-Electrode
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)			
SOLIDS-TOTSUS-ED	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

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

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

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

1

GLOSSARY OF REPORT TERMS

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

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1342803 Report Date: 17-AUG-13

Client: WESA Inc.
4 Cataraqui Street The Tower
Kingston ON K7K 1Z7

Contact: Tim Beckenham

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2668413								
WG1721993-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	08-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	08-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	08-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	08-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	08-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	08-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	08-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	08-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	08-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	08-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	08-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	08-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	08-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	08-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	08-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	08-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	08-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	08-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	08-AUG-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	08-AUG-13
Batch R2668584								
WG1721993-4 DUP		**L1342803-1**						
Aluminum (Al)-Total		0.0113	0.0134		mg/L	17	20	08-AUG-13
Antimony (Sb)-Total		0.00034	0.00034		mg/L	1.0	20	08-AUG-13

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2668584								
WG1721993-4 DUP		**L1342803-1**						
Arsenic (As)-Total		0.0306	0.0304		mg/L	0.8	20	08-AUG-13
Barium (Ba)-Total		0.0164	0.0164		mg/L	0.0	20	08-AUG-13
Beryllium (Be)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	08-AUG-13
Bismuth (Bi)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	08-AUG-13
Boron (B)-Total		0.033	0.031		mg/L	6.8	20	08-AUG-13
Cadmium (Cd)-Total		0.000011	0.000010		mg/L	6.5	20	08-AUG-13
Calcium (Ca)-Total		136	125		mg/L	8.8	20	08-AUG-13
Chromium (Cr)-Total		0.00039	0.00038		mg/L	3.3	20	08-AUG-13
Cobalt (Co)-Total		0.00363	0.00366		mg/L	0.6	20	08-AUG-13
Copper (Cu)-Total		0.00372	0.00371		mg/L	0.1	20	08-AUG-13
Iron (Fe)-Total		2.45	2.44		mg/L	0.5	20	08-AUG-13
Lead (Pb)-Total		0.000213	0.000208		mg/L	2.7	20	08-AUG-13
Lithium (Li)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	08-AUG-13
Magnesium (Mg)-Total		8.50	8.77		mg/L	3.1	20	08-AUG-13
Manganese (Mn)-Total		0.0989	0.100		mg/L	1.3	20	08-AUG-13
Molybdenum (Mo)-Total		0.00116	0.00113		mg/L	2.9	20	08-AUG-13
Nickel (Ni)-Total		0.00676	0.00677		mg/L	0.2	20	08-AUG-13
Phosphorus (P)-Total		<0.30	<0.30	RPD-NA	mg/L	N/A	20	08-AUG-13
Potassium (K)-Total		7.21	7.27		mg/L	0.7	20	08-AUG-13
Selenium (Se)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	08-AUG-13
Silicon (Si)-Total		0.443	0.441		mg/L	0.3	20	08-AUG-13
Silver (Ag)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	08-AUG-13
Sodium (Na)-Total		36.4	36.0		mg/L	1.1	20	08-AUG-13
Strontium (Sr)-Total		0.203	0.194		mg/L	4.5	20	08-AUG-13
Thallium (Tl)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	08-AUG-13
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	08-AUG-13
Titanium (Ti)-Total		0.0122	0.0118		mg/L	3.8	20	08-AUG-13
Uranium (U)-Total		0.000161	0.000159		mg/L	1.4	20	08-AUG-13
Vanadium (V)-Total		0.00015	0.00015		mg/L	0.6	20	08-AUG-13
Zinc (Zn)-Total		0.0082	0.0082		mg/L	0.3	20	08-AUG-13
WG1721993-2 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	08-AUG-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	08-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2668584								
WG1721993-2 MB								
Barium (Ba)-Total			<0.000050		mg/L		0.00005	08-AUG-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	08-AUG-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	08-AUG-13
Boron (B)-Total			<0.010		mg/L		0.01	08-AUG-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	08-AUG-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	08-AUG-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Copper (Cu)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Iron (Fe)-Total			<0.010		mg/L		0.01	08-AUG-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	08-AUG-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	08-AUG-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	08-AUG-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	08-AUG-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	08-AUG-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	08-AUG-13
Potassium (K)-Total			<0.050		mg/L		0.05	08-AUG-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Silicon (Si)-Total			<0.050		mg/L		0.05	08-AUG-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	08-AUG-13
Sodium (Na)-Total			<0.050		mg/L		0.05	08-AUG-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	08-AUG-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	08-AUG-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	08-AUG-13
Vanadium (V)-Total			<0.00010		mg/L		0.0001	08-AUG-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	08-AUG-13
Batch R2668991								
WG1721993-1 MB								
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	10-AUG-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2674276								
WG1728671-2 LCS								
Copper (Cu)-Total			96.3		%		80-120	17-AUG-13
WG1728671-1 MB								
Copper (Cu)-Total			<0.00010		mg/L		0.0001	17-AUG-13
NH3-CFA-ED	**Water**							
Batch R2668120								
WG1722354-2 LCS								
Ammonia, Total (as N)			97.6		%		85-115	08-AUG-13
WG1722354-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	08-AUG-13
WG1722354-5 MS		**L1340312-2**						
Ammonia, Total (as N)			97.1		%		75-125	08-AUG-13
WG1722354-7 MS		**L1338182-16**						
Ammonia, Total (as N)			95.6		%		75-125	08-AUG-13
Batch R2671079								
WG1725225-8 DUP		**L1342803-10**						
Ammonia, Total (as N)		0.094	0.092		mg/L	2.4	20	13-AUG-13
WG1725225-2 LCS								
Ammonia, Total (as N)			95.7		%		85-115	13-AUG-13
WG1725225-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	13-AUG-13
WG1725225-7 MS		**L1342383-3**						
Ammonia, Total (as N)			92.7		%		75-125	13-AUG-13
WG1725225-9 MS		**L1343195-2**						
Ammonia, Total (as N)			97.2		%		75-125	13-AUG-13
Batch R2671953								
WG1726083-2 LCS								
Ammonia, Total (as N)			94.5		%		85-115	14-AUG-13
WG1726083-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	14-AUG-13
WG1726083-3 MS		**L1342803-11**						
Ammonia, Total (as N)			101.4		%		75-125	14-AUG-13
WG1726083-6 MS		**L1344813-3**						
Ammonia, Total (as N)			95.5		%		75-125	14-AUG-13
NO2-IC-ED	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-ED	**Water**							
Batch R2668060								
WG1722240-2 LCS								
Nitrite (as N)			109.9		%		90-110	08-AUG-13
WG1722240-1 MB								
Nitrite (as N)			<0.050		mg/L		0.05	08-AUG-13
WG1722240-4 MS		**L1342594-5**						
Nitrite (as N)			85.5		%		75-125	08-AUG-13
WG1722240-6 MS		**L1342701-5**						
Nitrite (as N)			96.2		%		75-125	08-AUG-13
NO3-IC-ED	**Water**							
Batch R2668060								
WG1722240-2 LCS								
Nitrate (as N)			98.4		%		90-110	08-AUG-13
WG1722240-1 MB								
Nitrate (as N)			<0.050		mg/L		0.05	08-AUG-13
WG1722240-4 MS		**L1342594-5**						
Nitrate (as N)			101.8		%		75-125	08-AUG-13
WG1722240-6 MS		**L1342701-5**						
Nitrate (as N)			104.3		%		75-125	08-AUG-13
PH-ED	**Water**							
Batch R2667314								
WG1721594-3 LCS								
pH			7.04		pH		6.9-7.1	07-AUG-13
SOLIDS-TOTSUS-ED	**Water**							
Batch R2667482								
WG1721558-2 LCS								
Total Suspended Solids			96.0		%		85-115	07-AUG-13
WG1721558-1 MB								
Total Suspended Solids			<3.0		mg/L		3	07-AUG-13
Batch R2668729								
WG1722884-2 LCS								
Total Suspended Solids			90.0		%		85-115	08-AUG-13
WG1722884-1 MB								
Total Suspended Solids			<3.0		mg/L		3	08-AUG-13

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH							
	1	02-AUG-13 15:45	07-AUG-13 11:43	0.25	116	hours	EHTR-FM
	2	03-AUG-13 15:00	07-AUG-13 11:46	0.25	93	hours	EHTR-FM
	5	04-AUG-13 09:00	07-AUG-13 11:50	0.25	75	hours	EHTR-FM
	9	05-AUG-13 09:00	07-AUG-13 11:39	0.25	51	hours	EHTR-FM
	10	03-AUG-13 15:00	07-AUG-13 12:10	0.25	93	hours	EHTR-FM
	11	02-AUG-13 12:00	07-AUG-13 11:35	0.25	120	hours	EHTR-FM
Anions and Nutrients							
Nitrate as N by IC							
	1	02-AUG-13 15:45	08-AUG-13 08:00	48	136	hours	EHTR
	2	03-AUG-13 15:00	08-AUG-13 08:00	48	113	hours	EHTR
	5	04-AUG-13 09:00	08-AUG-13 08:00	48	95	hours	EHTR
	9	05-AUG-13 09:00	08-AUG-13 11:59	48	75	hours	EHTL
	10	03-AUG-13 15:00	08-AUG-13 08:00	48	113	hours	EHTR
	11	02-AUG-13 12:00	08-AUG-13 08:00	48	140	hours	EHTR
Nitrite as N by IC							
	1	02-AUG-13 15:45	08-AUG-13 08:00	48	136	hours	EHTR
	2	03-AUG-13 15:00	08-AUG-13 08:00	48	113	hours	EHTR
	5	04-AUG-13 09:00	08-AUG-13 08:00	48	95	hours	EHTR
	9	05-AUG-13 09:00	08-AUG-13 11:59	48	75	hours	EHTL
	10	03-AUG-13 15:00	08-AUG-13 08:00	48	113	hours	EHTR
	11	02-AUG-13 12:00	08-AUG-13 08:00	48	140	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1342803 were received on 06-AUG-13 09:30.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # ____

Page ___ of ___

Report To	
Company:	Blu Metric
Contact:	Tim Beckenham
Address:	4 Cateraque St The Tower, Kingston, On, K7K 1Z7
Phone:	(613) 531-2725
Fax:	
Invoice To Same as Report ?	☐ Yes ☒ No
Hardcopy of Invoice with Report?	☐ Yes ☐ No
Company:	TEES Ltd
Contact:	
Address:	98 Archibald St. Box 133 Yellowknife, NT X1A 2N1
Phone:	(867) 669-9481
Fax:	(867) 669-9482
Lab Work Order # (lab use only)	L1342803

Report Format / Distribution	
☒ Standard ☐ Other	
☒ PDF ☒ Excel ☐ Digital ☐ Fax	
Email 1:	c.proux@envircan.ca
Email 2:	tbeckenham@wesa.ca
Email 3:	
Client / Project Information	
Job #:	
PO / AFE:	
LSD:	
Quote #:	
ALS Contact:	Catherine Evaristo
Sampler:	Alexandra Duchesne

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ☒ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ◯ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT EFF163
- ◯ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

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

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TSS, pH	Total metal (As, Zn, Cu, Pb, Ni) (P)	NO_2 and NO_3	Total ammonia nitrogen (P)	Number of Containers
	EFF154	02/08/13	15:45	surface water	X	X	X	X	
	EFF156	03/08/13	15:00		X	X	X	X	
	EFF157	03/08/13	21:00						
	EFF158	04/05/13	3:00						
	EFF159	04/08/13	9:00		X	X	X	X	
	EFF160	04/08/13	15:00						
	EFF161	04/08/13	21:00						
	EFF162	05/08/13	3:00						
	EFF163	05/08/13	9:00		X	X	X	X	
	DUP8	03/08/13	15:00		X	X	X	X	
	Travel blank				X	X	X	X	

L1342803-COFC

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

Keep the extra bottles on hold. Regular service for all selected samples except for EFF163 → Emergency

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

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

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

SHIPMENT RELEASE (client use)		
Released by:	Date (dd-mmm-yy)	Time (hh-mm)
Alexandra Duchesne	05/08/13	11:00

SHIPMENT RECEPTION (lab use only)			
Received by:	Date:	Time:	Temperature:
[illegible]	Aug 6/13	9:30	① 9.0 ② 10.2 °C 10.0

SHIPMENT VERIFICATION (lab use only)			
Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

Taiga Batch No.:
130553

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

- FINAL REPORT -

Prepared For: BluMetric

Address: 4 Cataraque Street
The Tower
Kingston, ON
K7K 1Z7

Attn: **Pascal Poirier** **Facsimile:** **(613) 531-1852**

Final report has been reviewed and approved by:

Angelique Ruzindana
Quality Assurance Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
  - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
  - Environment Canada
  - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Sunday, August 04, 2013
Print Date: Sunday, August 04, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130553

- CERTIFICATE OF ANALYSIS -

Client Sample ID: EFF120 **Taiga Sample ID:** 001

Client Project: Y-B11192-00-00
Sample Type: Surface Water
Received Date: 22-Jul-13
Sampling Date: 20-Jul-13
Sampling Time: 9:00
Location: Tundra Mine
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	7.70		pH units	22-Jul-13	SM4500-H:B	
Solids, Total Suspended	12	3	mg/L	22-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as N (Field Preserved)	0.092	0.005	mg/L	24-Jul-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.33	0.01	mg/L	23-Jul-13	SM4110:B	
Nitrite as Nitrogen	0.02	0.01	mg/L	23-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	40.3	0.2	µg/L	01-Aug-13	EPA200.8	
Copper	4.1	0.2	µg/L	01-Aug-13	EPA200.8	
Lead	0.2	0.1	µg/L	01-Aug-13	EPA200.8	
Nickel	6.1	0.1	µg/L	01-Aug-13	EPA200.8	
Zinc	6.0	0.4	µg/L	01-Aug-13	EPA200.8	

ReportDate: Sunday, August 04, 2013
Print Date: Sunday, August 04, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.:
130553

- CERTIFICATE OF ANALYSIS -

Client Sample ID: Dup 5 **Taiga Sample ID:** 002

Client Project: Y-B11192-00-00
Sample Type: Surface Water
Received Date: 22-Jul-13
Sampling Date: 20-Jul-13
Sampling Time: 9:00
Location: Tundra Mine
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	7.71		pH units	22-Jul-13	SM4500-H:B	
Solids, Total Suspended	12	3	mg/L	22-Jul-13	SM2540:D	
Major Ions						
Nitrate as Nitrogen	0.34	0.01	mg/L	23-Jul-13	SM4110:B	
Nitrite as Nitrogen	0.02	0.01	mg/L	23-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	42.2	0.2	µg/L	01-Aug-13	EPA200.8	
Copper	4.4	0.2	µg/L	01-Aug-13	EPA200.8	
Lead	0.3	0.1	µg/L	01-Aug-13	EPA200.8	
Nickel	6.3	0.1	µg/L	01-Aug-13	EPA200.8	
Zinc	7.4	0.4	µg/L	01-Aug-13	EPA200.8	

ReportDate: Sunday, August 04, 2013
Print Date: Sunday, August 04, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130553

- CERTIFICATE OF ANALYSIS -

Client Sample ID: Travel Blank **Taiga Sample ID:** 003

Client Project: Y-B11192-00-00
Sample Type: TB
Received Date: 22-Jul-13
Sampling Date: 20-Jul-13
Sampling Time: 9:00
Location: Tundra Mine
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	5.60		pH units	22-Jul-13	SM4500-H:B	
Solids, Total Suspended	< 3	3	mg/L	22-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as N (Field Preserved)	0.008	0.005	mg/L	24-Jul-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	< 0.01	0.01	mg/L	23-Jul-13	SM4110:B	
Nitrite as Nitrogen	< 0.01	0.01	mg/L	23-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	< 0.2	0.2	µg/L	01-Aug-13	EPA200.8	
Copper	< 0.2	0.2	µg/L	01-Aug-13	EPA200.8	
Lead	0.1	0.1	µg/L	01-Aug-13	EPA200.8	
Nickel	< 0.1	0.1	µg/L	01-Aug-13	EPA200.8	
Zinc	< 0.4	0.4	µg/L	01-Aug-13	EPA200.8	

ReportDate: Sunday, August 04, 2013
Print Date: Sunday, August 04, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130553

- CERTIFICATE OF ANALYSIS -

Client Sample ID: Travel Blank **Taiga Sample ID:** 003

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

ReportDate: Sunday, August 04, 2013
Print Date: Sunday, August 04, 2013

Taiga Batch No.:
130551

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

- AMENDED REPORT -

Prepared For: BluMetric

Address: 4 Cataraque Street
The Tower
Kingston, ON
K7K 1Z7

Attn: **Pascal Poirier** **Facsimile: (613) 531-1852**

Final report has been reviewed and approved by:

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
  - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
  - Environment Canada
  - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Sunday, August 04, 2013
Print Date: Wednesday, February 26, 2014

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130551

- CERTIFICATE OF ANALYSIS -

Client Sample ID: EFF112 **Taiga Sample ID:** 001

Client Project:
Sample Type: Water
Received Date: 22-Jul-13
Sampling Date: 18-Jul-13
Sampling Time:
Location: Tundra Mine
Report Status: **Amended**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	8.06		pH units	22-Jul-13	SM4500-H:B	
Solids, Total Suspended	12	3	mg/L	22-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as N (Field Preserved)	0.099	0.005	mg/L	24-Jul-13	SM4500-NH3:	
Nitrogen, Total	0.94	0.06	mg/L	24-Jul-13	ISO/TR 11905	
Major Ions						
Nitrate as Nitrogen	0.33	0.01	mg/L	22-Jul-13	SM4110:B	
Nitrite as Nitrogen	0.02	0.01	mg/L	22-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	34.5	0.2	µg/L	01-Aug-13	EPA200.8	
Copper	1.0	0.2	µg/L	01-Aug-13	EPA200.8	
Lead	< 0.1	0.1	µg/L	01-Aug-13	EPA200.8	
Nickel	4.9	0.1	µg/L	01-Aug-13	EPA200.8	
Zinc	3.1	0.4	µg/L	01-Aug-13	EPA200.8	

ReportDate: Sunday, August 04, 2013
Print Date: Wednesday, February 26, 2014

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130551

- CERTIFICATE OF ANALYSIS -

Client Sample ID: EFF116 **Taiga Sample ID:** 002

Client Project:
Sample Type: Water
Received Date: 22-Jul-13
Sampling Date: 19-Jul-13
Sampling Time:
Location: Tundra Mine
Report Status: **Amended**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	7.70		pH units	22-Jul-13	SM4500-H:B	
Solids, Total Suspended	12	3	mg/L	22-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as N (Field Preserved)	0.100	0.005	mg/L	24-Jul-13	SM4500-NH3:	
Nitrogen, Total	0.97	0.06	mg/L	24-Jul-13	ISO/TR 11905	
Major Ions						
Nitrate as Nitrogen	0.34	0.01	mg/L	22-Jul-13	SM4110:B	
Nitrite as Nitrogen	0.02	0.01	mg/L	22-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	36.6	0.2	µg/L	01-Aug-13	EPA200.8	
Copper	0.4	0.2	µg/L	01-Aug-13	EPA200.8	
Lead	0.2	0.1	µg/L	01-Aug-13	EPA200.8	
Nickel	5.8	0.1	µg/L	01-Aug-13	EPA200.8	
Zinc	3.7	0.4	µg/L	01-Aug-13	EPA200.8	

ReportDate: Sunday, August 04, 2013
Print Date: Wednesday, February 26, 2014

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130551

- CERTIFICATE OF ANALYSIS -

Client Sample ID: Travel Blank **Taiga Sample ID:** 003

Client Project:
Sample Type: Water
Received Date: 22-Jul-13
Sampling Date: 21-Jul-13
Sampling Time:
Location: Tundra Mine
Report Status: **Amended**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	5.60		pH units	22-Jul-13	SM4500-H:B	
Solids, Total Suspended	< 3	3	mg/L	22-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as N (Field Preserved)	0.006	0.005	mg/L	24-Jul-13	SM4500-NH3:	
Nitrogen, Total	< 0.06	0.06	mg/L	24-Jul-13	ISO/TR 11905	
Major Ions						
Nitrate as Nitrogen	< 0.01	0.01	mg/L	22-Jul-13	SM4110:B	
Nitrite as Nitrogen	< 0.01	0.01	mg/L	22-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	< 0.2	0.2	µg/L	01-Aug-13	EPA200.8	
Copper	< 0.2	0.2	µg/L	01-Aug-13	EPA200.8	
Lead	0.2	0.1	µg/L	01-Aug-13	EPA200.8	
Nickel	< 0.1	0.1	µg/L	01-Aug-13	EPA200.8	
Zinc	< 0.4	0.4	µg/L	01-Aug-13	EPA200.8	

ReportDate: Sunday, August 04, 2013
Print Date: Wednesday, February 26, 2014

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130551

- CERTIFICATE OF ANALYSIS -

Client Sample ID: Travel Blank **Taiga Sample ID:** 003

*** Taiga analytical methods are based on the following standard analytical methods**
SM - Standard Methods for the Examination of Water and Wastewater
EPA - United States Environmental Protection Agency

Comments *Sample collect dates corrected for sample -001 (EFF112) and -002 (EFF116).*

ReportDate: Sunday, August 04, 2013
Print Date: Wednesday, February 26, 2014

WESA Inc.
ATTN: Tim Beckenham
4 Cataraque Street
The Tower
Kingston ON K7K 1Z7

Date Received: 17-JUL-13
Report Date: 26-FEB-14 09:06 (MT)
Version: FINAL REV. 2

Client Phone: 613-531-2725

Certificate of Analysis

Lab Work Order #: L1334056

Project P.O. #: NOT SUBMITTED
Job Reference: Y-B11192-00-00
C of C Numbers: 1
Legal Site Desc:

Catherine Evaristo-Cordero
Senior Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1334056-1	L1334056-2	L1334056-3		
	Description	Surface Water	Surface Water	Surface Water		
	Sampled Date	16-JUL-13	17-JUL-13	17-JUL-13		
	Sampled Time	09:40	09:00	12:00		
	Client ID	EFF104	EFF108	TBLANK		
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	7.18	7.66	6.50		
	Total Suspended Solids (mg/L)	6.0	9.0	<3.0		
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.143	0.089	<0.050		
	Nitrate and Nitrite (as N) (mg/L)	0.267	0.264	<0.071		
	Nitrate (as N) (mg/L)	0.267	0.264	<0.050		
	Nitrite (as N) (mg/L)	<0.050	<0.050	<0.050		
Total Metals	Aluminum (Al)-Total (mg/L)	DLM <0.015	0.019	<0.0030		
	Antimony (Sb)-Total (mg/L)	DLM <0.00050	DLM <0.00050	<0.00010		
	Arsenic (As)-Total (mg/L)	DLM 0.0311	DLM 0.0344	<0.00010		
	Barium (Ba)-Total (mg/L)	DLM 0.0151	DLM 0.0139	<0.000050		
	Beryllium (Be)-Total (mg/L)	DLM <0.0025	DLM <0.0025	<0.00050		
	Bismuth (Bi)-Total (mg/L)	DLM <0.00025	DLM <0.00025	<0.000050		
	Boron (B)-Total (mg/L)	DLM <0.050	DLM <0.050	<0.010		
	Cadmium (Cd)-Total (mg/L)	DLM <0.000050	DLM <0.000050	<0.000010		
	Calcium (Ca)-Total (mg/L)	DLM 119	DLM 118	<0.020		
	Chromium (Cr)-Total (mg/L)	DLM <0.00050	DLM <0.00050	<0.00010		
	Cobalt (Co)-Total (mg/L)	DLM 0.00574	DLM 0.00388	<0.00010		
	Copper (Cu)-Total (mg/L)	DLM 0.00603	DLM 0.00588	0.00066		
	Iron (Fe)-Total (mg/L)	DLM 2.76	DLM 2.64	<0.010		
	Lead (Pb)-Total (mg/L)	DLM <0.00025	DLM 0.00030	<0.000050		
	Lithium (Li)-Total (mg/L)	DLM <0.025	DLM <0.025	<0.0050		
	Magnesium (Mg)-Total (mg/L)	DLM 8.30	DLM 8.24	<0.0050		
	Manganese (Mn)-Total (mg/L)	DLM 0.155	DLM 0.119	0.000091		
	Molybdenum (Mo)-Total (mg/L)	DLM 0.00068	DLM 0.00108	<0.000050		
	Nickel (Ni)-Total (mg/L)	DLM 0.00910	DLM 0.00686	<0.00010		
	Phosphorus (P)-Total (mg/L)	DLM <1.5	DLM <1.5	<0.30		
	Potassium (K)-Total (mg/L)	DLM 5.85	DLM 5.99	<0.050		
	Selenium (Se)-Total (mg/L)	DLM <0.00050	DLM <0.00050	<0.00010		
	Silicon (Si)-Total (mg/L)	DLM 0.65	DLM 0.54	<0.050		
	Silver (Ag)-Total (mg/L)	DLM <0.000050	DLM <0.000050	<0.000010		
	Sodium (Na)-Total (mg/L)	DLM 26.1	DLM 25.2	<0.050		
	Strontium (Sr)-Total (mg/L)	DLM 0.192	DLM 0.197	<0.00010		
	Thallium (Tl)-Total (mg/L)	DLM <0.00025	DLM <0.00025	<0.000050		
	Tin (Sn)-Total (mg/L)	DLM <0.00050	DLM <0.00050	<0.00010		
	Titanium (Ti)-Total (mg/L)	DLM 0.0103	DLM 0.0126	<0.00030		
	Uranium (U)-Total (mg/L)	DLM 0.000080	DLM 0.000125	<0.000010		
	Vanadium (V)-Total (mg/L)	DLM <0.00050	DLM <0.00050	0.00023		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1334056-1	L1334056-2	L1334056-3		
	Description	Surface Water	Surface Water	Surface Water		
	Sampled Date	16-JUL-13	17-JUL-13	17-JUL-13		
	Sampled Time	09:40	09:00	12:00		
	Client ID	EFF104	EFF108	TBLANK		
Grouping	**Analyte**					
WATER						
Total Metals	Zinc (Zn)-Total (mg/L)	<0.015 DLM	<0.015 DLM	<0.0030		

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Aluminum (Al)-Total	DUP-H	L1334056-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects.
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-T-CCMS-ED	Water	Total Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A
NH3-CFA-ED	Water	Ammonia in Water by Colour	APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.

ALS Test Code	Matrix	Test Description	Method Reference**
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite	CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC	APHA 4110 B-ION CHROMATOGRAPHY

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ALS Test Code	Matrix	Test Description	Method Reference**
NO3-IC-ED	Water	Nitrate as N by IC	APHA 4110 B-ION CHROMATOGRAPHY

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ALS Test Code	Matrix	Test Description	Method Reference**
PH-ED	Water	pH	APHA 4500 H-Electrode

All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)

ALS Test Code	Matrix	Test Description	Method Reference**
SOLIDS-TOTSUS-ED	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

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

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

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

1

GLOSSARY OF REPORT TERMS

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

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: WESA Inc.
4 Cataraque Street The Tower
Kingston ON K7K 1Z7

Contact: Tim Beckenham

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2652888								
WG1710210-3 LCS								
Aluminum (Al)-Total			100.7		%		70-130	19-JUL-13
Antimony (Sb)-Total			98.3		%		70-130	19-JUL-13
Arsenic (As)-Total			100.9		%		70-130	19-JUL-13
Barium (Ba)-Total			95.7		%		70-130	19-JUL-13
Beryllium (Be)-Total			90.3		%		70-130	19-JUL-13
Bismuth (Bi)-Total			95.7		%		70-130	19-JUL-13
Boron (B)-Total			86.8		%		70-130	19-JUL-13
Cadmium (Cd)-Total			102.3		%		70-130	19-JUL-13
Calcium (Ca)-Total			92.4		%		70-130	19-JUL-13
Chromium (Cr)-Total			99.0		%		70-130	19-JUL-13
Cobalt (Co)-Total			96.8		%		70-130	19-JUL-13
Copper (Cu)-Total			95.5		%		70-130	19-JUL-13
Iron (Fe)-Total			95.1		%		70-130	19-JUL-13
Lead (Pb)-Total			97.5		%		70-130	19-JUL-13
Lithium (Li)-Total			87.7		%		70-130	19-JUL-13
Magnesium (Mg)-Total			101.8		%		70-130	19-JUL-13
Manganese (Mn)-Total			96.0		%		70-130	19-JUL-13
Molybdenum (Mo)-Total			89.9		%		70-130	19-JUL-13
Nickel (Ni)-Total			101.0		%		70-130	19-JUL-13
Potassium (K)-Total			93.2		%		70-130	19-JUL-13
Selenium (Se)-Total			107.5		%		70-130	19-JUL-13
Silicon (Si)-Total			89.6		%		70-130	19-JUL-13
Silver (Ag)-Total			97.4		%		70-130	19-JUL-13
Sodium (Na)-Total			107.1		%		70-130	19-JUL-13
Strontium (Sr)-Total			96.5		%		70-130	19-JUL-13
Thallium (Tl)-Total			97.4		%		70-130	19-JUL-13
Tin (Sn)-Total			93.2		%		70-130	19-JUL-13
Titanium (Ti)-Total			86.2		%		70-130	19-JUL-13
Uranium (U)-Total			92.3		%		70-130	19-JUL-13
Vanadium (V)-Total			98.5		%		70-130	19-JUL-13
Zinc (Zn)-Total			99.8		%		70-130	19-JUL-13
WG1710210-4 LCS								
Aluminum (Al)-Total			104.5		%		70-130	20-JUL-13
Antimony (Sb)-Total			112.1		%		70-130	20-JUL-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2652888								
WG1710210-4 LCS								
Arsenic (As)-Total			107.3		%		70-130	20-JUL-13
Barium (Ba)-Total			103.3		%		70-130	20-JUL-13
Beryllium (Be)-Total			96.3		%		70-130	20-JUL-13
Bismuth (Bi)-Total			107.6		%		70-130	20-JUL-13
Boron (B)-Total			95.0		%		70-130	20-JUL-13
Cadmium (Cd)-Total			110.0		%		70-130	20-JUL-13
Calcium (Ca)-Total			99.8		%		70-130	20-JUL-13
Chromium (Cr)-Total			106.0		%		70-130	20-JUL-13
Cobalt (Co)-Total			102.6		%		70-130	20-JUL-13
Copper (Cu)-Total			104.3		%		70-130	20-JUL-13
Iron (Fe)-Total			97.9		%		70-130	20-JUL-13
Lead (Pb)-Total			104.2		%		70-130	20-JUL-13
Lithium (Li)-Total			102.8		%		70-130	20-JUL-13
Magnesium (Mg)-Total			103.8		%		70-130	20-JUL-13
Manganese (Mn)-Total			102.3		%		70-130	20-JUL-13
Molybdenum (Mo)-Total			98.3		%		70-130	20-JUL-13
Nickel (Ni)-Total			106.3		%		70-130	20-JUL-13
Potassium (K)-Total			97.0		%		70-130	20-JUL-13
Selenium (Se)-Total			115.0		%		70-130	20-JUL-13
Silicon (Si)-Total			98.4		%		70-130	20-JUL-13
Silver (Ag)-Total			106.9		%		70-130	20-JUL-13
Sodium (Na)-Total			112.5		%		70-130	20-JUL-13
Strontium (Sr)-Total			101.8		%		70-130	20-JUL-13
Thallium (Tl)-Total			108.7		%		70-130	20-JUL-13
Tin (Sn)-Total			100.1		%		70-130	20-JUL-13
Titanium (Ti)-Total			93.9		%		70-130	20-JUL-13
Uranium (U)-Total			104.3		%		70-130	20-JUL-13
Vanadium (V)-Total			104.7		%		70-130	20-JUL-13
Zinc (Zn)-Total			105.1		%		70-130	20-JUL-13
WG1710210-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	19-JUL-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	19-JUL-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	19-JUL-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	19-JUL-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2652888								
WG1710210-1 MB								
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	19-JUL-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	19-JUL-13
Boron (B)-Total			<0.010		mg/L		0.01	19-JUL-13
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	19-JUL-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	19-JUL-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	19-JUL-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	19-JUL-13
Iron (Fe)-Total			<0.010		mg/L		0.01	19-JUL-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	19-JUL-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	19-JUL-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	19-JUL-13
Manganese (Mn)-Total			<0.000050		mg/L		0.00005	19-JUL-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	19-JUL-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	19-JUL-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	19-JUL-13
Potassium (K)-Total			<0.050		mg/L		0.05	19-JUL-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	19-JUL-13
Silicon (Si)-Total			<0.050		mg/L		0.05	19-JUL-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	19-JUL-13
Sodium (Na)-Total			<0.050		mg/L		0.05	19-JUL-13
Strontium (Sr)-Total			<0.00010		mg/L		0.0001	19-JUL-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	19-JUL-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	19-JUL-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	19-JUL-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	19-JUL-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	19-JUL-13
WG1710210-2 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	20-JUL-13
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	20-JUL-13
Arsenic (As)-Total			<0.00010		mg/L		0.0001	20-JUL-13
Barium (Ba)-Total			<0.000050		mg/L		0.00005	20-JUL-13
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	20-JUL-13
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	20-JUL-13
Boron (B)-Total			<0.010		mg/L		0.01	20-JUL-13

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-ED	**Water**							
Batch R2652888								
WG1710210-2 MB								
Cadmium (Cd)-Total			<0.000010		mg/L		0.00001	20-JUL-13
Calcium (Ca)-Total			<0.020		mg/L		0.02	20-JUL-13
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	20-JUL-13
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	20-JUL-13
Iron (Fe)-Total			<0.010		mg/L		0.01	20-JUL-13
Lead (Pb)-Total			<0.000050		mg/L		0.00005	20-JUL-13
Lithium (Li)-Total			<0.0050		mg/L		0.005	20-JUL-13
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	20-JUL-13
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	20-JUL-13
Nickel (Ni)-Total			<0.00010		mg/L		0.0001	20-JUL-13
Phosphorus (P)-Total			<0.30		mg/L		0.3	20-JUL-13
Potassium (K)-Total			<0.050		mg/L		0.05	20-JUL-13
Selenium (Se)-Total			<0.00010		mg/L		0.0001	20-JUL-13
Silicon (Si)-Total			<0.050		mg/L		0.05	20-JUL-13
Silver (Ag)-Total			<0.000010		mg/L		0.00001	20-JUL-13
Sodium (Na)-Total			<0.050		mg/L		0.05	20-JUL-13
Thallium (Tl)-Total			<0.000050		mg/L		0.00005	20-JUL-13
Tin (Sn)-Total			<0.00010		mg/L		0.0001	20-JUL-13
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	20-JUL-13
Uranium (U)-Total			<0.000010		mg/L		0.00001	20-JUL-13
Zinc (Zn)-Total			<0.0030		mg/L		0.003	20-JUL-13
NH3-CFA-ED	**Water**							
Batch R2653734								
WG1711300-11 DUP		**L1334056-2**						
Ammonia, Total (as N)		0.089	0.119	J	mg/L	0.030	0.1	22-JUL-13
WG1711300-2 LCS								
Ammonia, Total (as N)			99.2		%		85-115	22-JUL-13
WG1711300-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	22-JUL-13
WG1711300-10 MS		**L1334045-2**						
Ammonia, Total (as N)			100.0		%		75-125	22-JUL-13
WG1711300-5 MS		**L1329011-5**						
Ammonia, Total (as N)			99.3		%		75-125	22-JUL-13
WG1711300-7 MS		**L1333221-8**						
Ammonia, Total (as N)			97.5		%		75-125	22-JUL-13

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-CFA-ED	**Water**							
Batch R2655258								
WG1712947-2 LCS								
Ammonia, Total (as N)			100.1		%		85-115	24-JUL-13
WG1712947-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	24-JUL-13
WG1712947-3 MS		**L1330415-3**						
Ammonia, Total (as N)			99.4		%		75-125	24-JUL-13
WG1712947-6 MS		**L1334056-3**						
Ammonia, Total (as N)			97.2		%		75-125	24-JUL-13
NO2-IC-ED	**Water**							
Batch R2653715								
WG1711217-2 LCS								
Nitrite (as N)			94.2		%		90-110	21-JUL-13
WG1711217-1 MB								
Nitrite (as N)			<0.050		mg/L		0.05	21-JUL-13
Batch R2654282								
WG1711809-2 LCS								
Nitrite (as N)			93.6		%		90-110	22-JUL-13
WG1711809-1 MB								
Nitrite (as N)			<0.050		mg/L		0.05	22-JUL-13
NO3-IC-ED	**Water**							
Batch R2653715								
WG1711217-2 LCS								
Nitrate (as N)			99.9		%		90-110	21-JUL-13
WG1711217-1 MB								
Nitrate (as N)			<0.050		mg/L		0.05	21-JUL-13
Batch R2654282								
WG1711809-2 LCS								
Nitrate (as N)			102.4		%		90-110	22-JUL-13
WG1711809-1 MB								
Nitrate (as N)			<0.050		mg/L		0.05	22-JUL-13
WG1711809-6 MS		**L1334952-11**						
Nitrate (as N)			90.7		%		75-125	22-JUL-13
PH-ED	**Water**							
Batch R2653131								
WG1710933-3 LCS								
pH			7.01		pH		6.9-7.1	20-JUL-13
SOLIDS-TOTSUS-ED	**Water**							

ALS Environmental

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SOLIDS-TOTSUS-ED	**Water**							
Batch R2652746								
WG1710213-3 DUP		**L1334056-2**						
Total Suspended Solids		9.0	7.0	J	mg/L	2.0	6	19-JUL-13
WG1710213-2 LCS								
Total Suspended Solids			102.0		%		85-115	19-JUL-13
WG1710213-1 MB								
Total Suspended Solids			<3.0		mg/L		3	19-JUL-13

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH							
	1	16-JUL-13 09:40	20-JUL-13 11:55	0.25	98	hours	EHTR-FM
	2	17-JUL-13 09:00	20-JUL-13 11:59	0.25	75	hours	EHTR-FM
	3	17-JUL-13 12:00	20-JUL-13 12:03	0.25	72	hours	EHTR-FM
Anions and Nutrients							
Nitrate as N by IC							
	1	16-JUL-13 09:40	21-JUL-13 08:00	48	118	hours	EHTL
	2	17-JUL-13 09:00	21-JUL-13 08:00	48	95	hours	EHT
	3	17-JUL-13 12:00	22-JUL-13 08:00	48	116	hours	EHT
Nitrite as N by IC							
	1	16-JUL-13 09:40	21-JUL-13 08:00	48	118	hours	EHTL
	2	17-JUL-13 09:00	21-JUL-13 08:00	48	95	hours	EHT
	3	17-JUL-13 12:00	22-JUL-13 08:00	48	116	hours	EHT

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1334056 were received on 17-JUL-13 17:20.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To

Company: BluMetric

Contact: Tim Beckenham

Address: 4 Cataraqui Street The Tower Kingston, ON K7K 1Z7

Phone: (613) 531-2725 Fax:

Invoice To Same as Report ? (circle) Yes or (No) (if No, provide details)

Copy of Invoice with Report? (circle) Yes or (No)

Company: Tlicho Engineering & Environmental Services LTD.

Contact: Leigh Gauthier

Address: 98 Archibald Street, Box 133 Yellowknife, NT X1A 2N1

Phone: (867) 669-9481 Fax: (867) 669-9487

Lab Work Order # (lab use only) L1334056

Report Format / Distribution

Standard: X Other (specify):

Select: PDF X Excel X Digital Fax

Email 1: ppoirier@envireau.ca

Email 2: "

Client / Project Information

Job #: Y-B1193-00-00

PO / AFE:

LSD:

Quote #:

ALS Contact: Catherine Evaristo

Sampler: Pascal Poirier

Service Request (Rush subject to availability - Contact ALS to confirm TAT)

X	Regular (Standard Turnaround Times - Business Days) EFF104, TBlank
	Priority (2-4 Business Days)-50% surcharge - Contact ALS to confirm TAT
X	Emergency (1-2 Business Days)-100% Surcharge - Contact ALS to confirm TAT EFF108
	Same Day or Weekend Emergency - Contact ALS to confirm TAT

Analysis Request (Indicate Filtered or Preserved, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	As Pb Zn Cu Ni	NO_2	NO_3	Total ammonia Nitrogen	pH	TSS							Number of Containers
	EFF104	17/07/13	9:40	Surface water	X	X	X	X	X	X							3
	EFF108	17/07/13	9:00	Surface water	X	X	X	X	X	X	–Rush ~~Only As & TSS~~						3
	TBlank	—	—	—	X	X	X	X	X	X							3

L1334056-COFC

Special Instructions / Regulation with water or land use (CCME- Freshwater Aquatic Life/BC CSR-Commercial/AB

Rush analysis is only on EFF108 for As & TSS

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

By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Pascal Poirier	Date: 17/07/13	Time: 11:00	Received by: [signature]	Date: July 17/13	Time: 5:20	Temperature: max 9.0 avg 7.0 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326e v06 Front/22 May 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130524

- FINAL REPORT -

Prepared For: BluMetric

Address: 4 Cataraque Street
The Tower
Kingston, ON
K7K 1Z7

Attn: **Pascal Poirier** **Facsimile:** **(613) 531-1852**

Final report has been reviewed and approved by:

Judy Mah
Client Service Officer

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
  - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
  - Environment Canada
  - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: Monday, July 29, 2013
Print Date: Friday, August 02, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130524

- CERTIFICATE OF ANALYSIS -

Client Sample ID: EFF86 **Taiga Sample ID:** 001

Client Project: Y-B11192-00-00
Sample Type: Surface Water
Received Date: 16-Jul-13
Sampling Date: 10-Jul-13
Sampling Time: 21:00
Location: Tundra Mine
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	7.87		pH units	15-Jul-13	SM4500-H:B	
Solids, Total Suspended	6	3	mg/L	17-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as N (Field Preserved)	0.100	0.005	mg/L	19-Jul-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.36	0.01	mg/L	19-Jul-13	SM4110:B	
Nitrite as Nitrogen	0.02	0.01	mg/L	19-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	27.0	0.2	µg/L	23-Jul-13	EPA200.8	
Copper	1.5	0.2	µg/L	23-Jul-13	EPA200.8	
Lead	< 0.1	0.1	µg/L	23-Jul-13	EPA200.8	
Nickel	3.9	0.1	µg/L	23-Jul-13	EPA200.8	
Zinc	3.8	0.4	µg/L	23-Jul-13	EPA200.8	

ReportDate: Monday, July 29, 2013
Print Date: Friday, August 02, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130524

- CERTIFICATE OF ANALYSIS -

Client Sample ID: EFF87 **Taiga Sample ID:** 002

Client Project: Y-B11192-00-00
Sample Type: Surface Water
Received Date: 16-Jul-13
Sampling Date: 11-Jul-13
Sampling Time: 3:00
Location: Tundra Mine
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	8.17		pH units	15-Jul-13	SM4500-H:B	
Solids, Total Suspended	16	3	mg/L	17-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as N (Field Preserved)	0.103	0.005	mg/L	19-Jul-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.34	0.01	mg/L	19-Jul-13	SM4110:B	
Nitrite as Nitrogen	0.02	0.01	mg/L	19-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	35.2	0.2	µg/L	23-Jul-13	EPA200.8	
Copper	1.8	0.2	µg/L	23-Jul-13	EPA200.8	
Lead	0.1	0.1	µg/L	23-Jul-13	EPA200.8	
Nickel	3.8	0.1	µg/L	23-Jul-13	EPA200.8	
Zinc	3.3	0.4	µg/L	23-Jul-13	EPA200.8	

ReportDate: Monday, July 29, 2013
Print Date: Friday, August 02, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130524

- CERTIFICATE OF ANALYSIS -

Client Sample ID: Dup 4

Taiga Sample ID: 003

Client Project: Y-B11192-00-00
Sample Type: Surface Water
Received Date: 16-Jul-13
Sampling Date: 11-Jul-13
Sampling Time: 13:30
Location: Tundra Mine
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	7.88		pH units	15-Jul-13	SM4500-H:B	
Solids, Total Suspended	8	3	mg/L	17-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as N (Field Preserved)	0.103	0.005	mg/L	19-Jul-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.34	0.01	mg/L	19-Jul-13	SM4110:B	
Nitrite as Nitrogen	0.02	0.01	mg/L	19-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	24.8	0.2	µg/L	23-Jul-13	EPA200.8	
Copper	5.5	0.2	µg/L	23-Jul-13	EPA200.8	
Lead	0.3	0.1	µg/L	23-Jul-13	EPA200.8	
Nickel	4.2	0.1	µg/L	23-Jul-13	EPA200.8	
Zinc	4.6	0.4	µg/L	23-Jul-13	EPA200.8	

ReportDate: Monday, July 29, 2013
Print Date: Friday, August 02, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.:
130524

- CERTIFICATE OF ANALYSIS -

Client Sample ID: EFF89 **Taiga Sample ID:** 004

Client Project: Y-B11192-00-00
Sample Type: Surface Water
Received Date: 16-Jul-13
Sampling Date: 11-Jul-13
Sampling Time: 13:30

Location: Tundra Mine
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	7.87		pH units	15-Jul-13	SM4500-H:B	
Solids, Total Suspended	8	3	mg/L	17-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as N (Field Preserved)	0.107	0.005	mg/L	19-Jul-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.35	0.01	mg/L	19-Jul-13	SM4110:B	
Nitrite as Nitrogen	0.02	0.01	mg/L	19-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	23.7	0.2	µg/L	23-Jul-13	EPA200.8	
Copper	2.8	0.2	µg/L	23-Jul-13	EPA200.8	
Lead	0.2	0.1	µg/L	23-Jul-13	EPA200.8	
Nickel	4.1	0.1	µg/L	23-Jul-13	EPA200.8	
Zinc	3.9	0.4	µg/L	23-Jul-13	EPA200.8	

ReportDate: Monday, July 29, 2013
Print Date: Friday, August 02, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130524

- CERTIFICATE OF ANALYSIS -

Client Sample ID: EFF91 **Taiga Sample ID:** 005

Client Project: Y-B11192-00-00
Sample Type: Surface Water
Received Date: 16-Jul-13
Sampling Date: 12-Jul-13
Sampling Time: 3:00
Location: Tundra Mine
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	7.65		pH units	15-Jul-13	SM4500-H:B	
Solids, Total Suspended	10	3	mg/L	17-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as N (Field Preserved)	0.106	0.005	mg/L	19-Jul-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.31	0.01	mg/L	19-Jul-13	SM4110:B	
Nitrite as Nitrogen	0.02	0.01	mg/L	19-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	33.6	0.2	µg/L	23-Jul-13	EPA200.8	
Copper	5.9	0.2	µg/L	23-Jul-13	EPA200.8	
Lead	0.4	0.1	µg/L	23-Jul-13	EPA200.8	
Nickel	5.5	0.1	µg/L	23-Jul-13	EPA200.8	
Zinc	4.7	0.4	µg/L	23-Jul-13	EPA200.8	

ReportDate: Monday, July 29, 2013
Print Date: Friday, August 02, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130524

- CERTIFICATE OF ANALYSIS -

Client Sample ID: EFF93 **Taiga Sample ID:** 006

Client Project: Y-B11192-00-00
Sample Type: Surface Water
Received Date: 16-Jul-13
Sampling Date: 13-Jul-13
Sampling Time: 9:30
Location: Tundra Mine
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	7.37		pH units	15-Jul-13	SM4500-H:B	
Solids, Total Suspended	8	3	mg/L	17-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as N (Field Preserved)	0.108	0.005	mg/L	19-Jul-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.34	0.01	mg/L	19-Jul-13	SM4110:B	
Nitrite as Nitrogen	0.02	0.01	mg/L	19-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	26.8	0.2	µg/L	23-Jul-13	EPA200.8	
Copper	0.8	0.2	µg/L	23-Jul-13	EPA200.8	
Lead	< 0.1	0.1	µg/L	23-Jul-13	EPA200.8	
Nickel	7.0	0.1	µg/L	23-Jul-13	EPA200.8	
Zinc	6.3	0.4	µg/L	23-Jul-13	EPA200.8	

ReportDate: Monday, July 29, 2013
Print Date: Friday, August 02, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130524

- CERTIFICATE OF ANALYSIS -

Client Sample ID: EFF96 **Taiga Sample ID:** 007

Client Project: Y-B11192-00-00
Sample Type: Surface Water
Received Date: 16-Jul-13
Sampling Date: 14-Jul-13
Sampling Time: 3:00
Location: Tundra Mine
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	7.88		pH units	15-Jul-13	SM4500-H:B	
Solids, Total Suspended	8	3	mg/L	17-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as N (Field Preserved)	0.107	0.005	mg/L	19-Jul-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	0.36	0.01	mg/L	19-Jul-13	SM4110:B	
Nitrite as Nitrogen	0.02	0.01	mg/L	19-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	26.5	0.2	µg/L	23-Jul-13	EPA200.8	
Copper	4.8	0.2	µg/L	23-Jul-13	EPA200.8	
Lead	0.2	0.1	µg/L	23-Jul-13	EPA200.8	
Nickel	4.7	0.1	µg/L	23-Jul-13	EPA200.8	
Zinc	6.9	0.4	µg/L	23-Jul-13	EPA200.8	

ReportDate: Monday, July 29, 2013
Print Date: Friday, August 02, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130524

- CERTIFICATE OF ANALYSIS -

Client Sample ID: TB

Taiga Sample ID: 008

Client Project: Y-B11192-00-00
Sample Type: Water
Received Date: 16-Jul-13
Sampling Date: 15-Jul-13
Sampling Time:

Location: Tundra Mine

Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Physicals						
pH	5.64		pH units	15-Jul-13	SM4500-H:B	
Solids, Total Suspended	< 3	3	mg/L	17-Jul-13	SM2540:D	
Inorganics - Nutrients						
Ammonia as N (Field Preserved)	< 0.005	0.005	mg/L	19-Jul-13	SM4500-NH3:	
Major Ions						
Nitrate as Nitrogen	< 0.01	0.01	mg/L	19-Jul-13	SM4110:B	
Nitrite as Nitrogen	< 0.01	0.01	mg/L	19-Jul-13	SM4110:B	
Trace Metals, Total						
Arsenic	< 0.2	0.2	µg/L	23-Jul-13	EPA200.8	
Copper	< 0.2	0.2	µg/L	23-Jul-13	EPA200.8	
Lead	< 0.1	0.1	µg/L	23-Jul-13	EPA200.8	
Nickel	< 0.1	0.1	µg/L	23-Jul-13	EPA200.8	
Zinc	< 0.4	0.4	µg/L	23-Jul-13	EPA200.8	

ReportDate: Monday, July 29, 2013
Print Date: Friday, August 02, 2013

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 130524

- CERTIFICATE OF ANALYSIS -

Client Sample ID: TB

Taiga Sample ID: 008

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

ReportDate: Monday, July 29, 2013

Print Date: Friday, August 02, 2013

APPENDIX E

Environmental Spill Reports

Accident - Incident
Short Report Form

TEES-SAF-FOR-041			Log #	SR-2014-09
Section #1	To be completed by FRONT LINE SUPERVISOR	Date of Accident/Incident: 15-Jul-14	Date Reported: 15-Jul-13	Date of Investigation: 15-Jul-13
PROJECT: Tundra	CONTRACTOR/DEPARTMENT: Water Treatment	Time of Accident/Incident: Noticed at 10:30am	Time Reported: 10:30am	Date Submitted: 15-Jul-13

TYPE OF MISHAP Multiple Selections Possible

DESCRIPTION OF INJURY, LOSS, POTENTIAL LOSS, OR HAZARD

ACCIDENT				INCIDENT		NEAR MISS
INJURY		PROPERTY DAMAGE LOSS TO PROCESS		POTENTIAL FOR LOSS		
FIRST AID		ENVIRONMENT		INJURY		
MEDICAL AID		EQUIPMENT	X	ENVIRONMENT	X	
LOST TIME		MATERIAL		EQUIPMENT		
OCCUPATIONAL ILLNESS		LOSS TO PROCESS		LOSS TO PROCESS		
				HAZARD		
				SHE NON-CONFORMANCE		**LOCATION OF OCCURRENCE**
						Treated Water Discharge Pipe

EMPLOYEE NAME & PAYROLL #:	Water Treatment Plant	OCCUPATION:		YRS OF EXPERIENCE IN OCCUPATIO	

DESCRIBE HOW THE MISHAP OCCURRED; Include what the person(s) was doing, trying to do and anything unusual:

Treated water leaked out of treated water 8" discharge pipe approx. 800 - 1000 litres. The leak sprung from an old patch job that was done on the pipe approx. 2 weeks ago. Material was put over the leak site and clamped and the patch gave way. The spilled treated water drained back into lower pond.

PREVENTATIVE ACTION IMPLEMENTED OR TO BE IMPLEMENTED:	PERSON RESPONSIBLE	DATE TO BE COMPLETED	DATE COMPLETED
A new patch will be placed on the pipe by days end.	Jim Way	15-Jul-13	15-Jul-13
A more vigilant watch will be done on that particular part of the pipe.	Water Treatment Plant Employees	15-Jul-13	On going

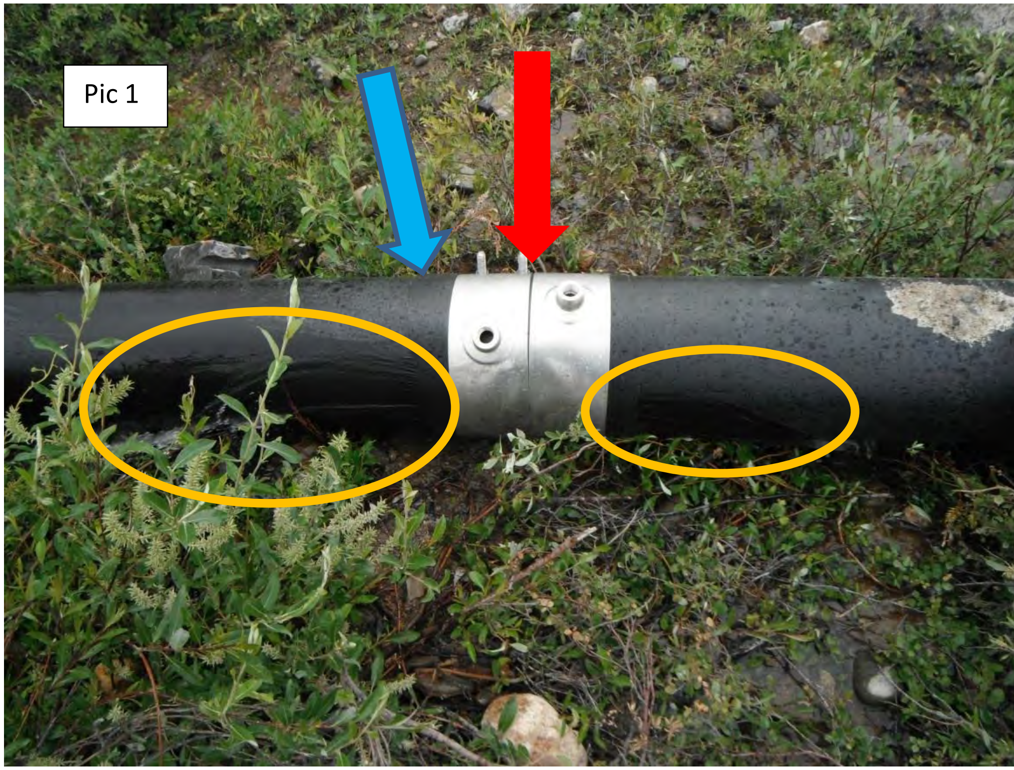
WITNESSES:

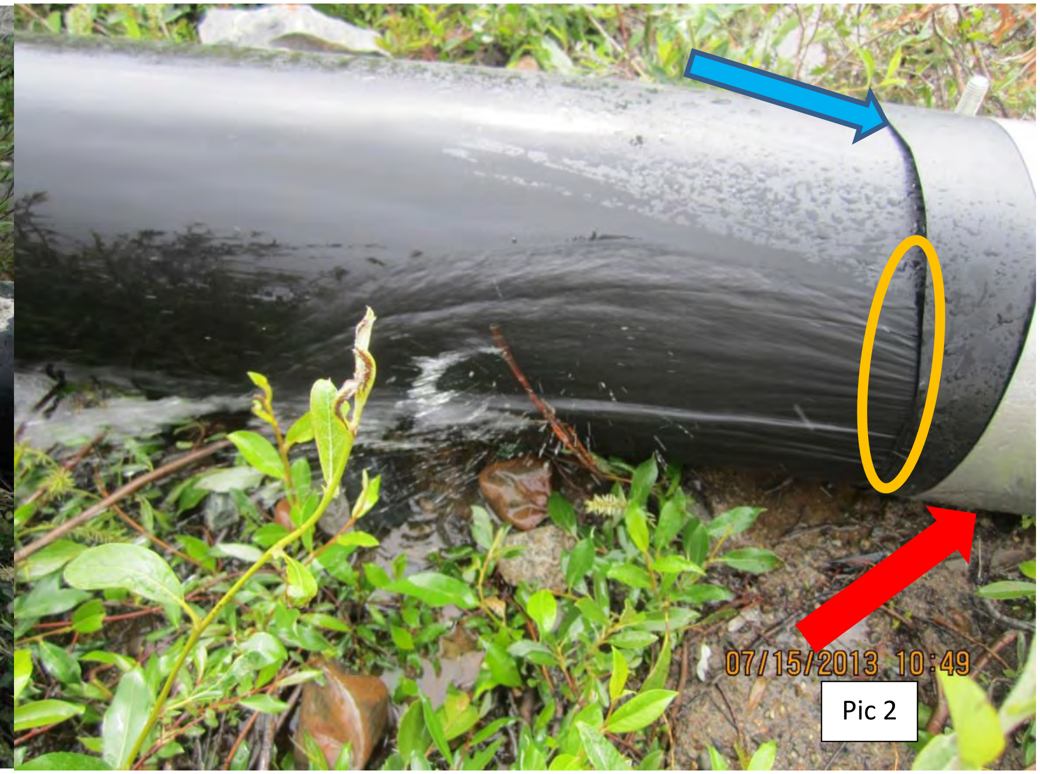
RISK ASSESSMENT RATING	PROBABILITY		HIGHEST CONSEQUENCE		RISK ASSESSMENT RATING
	3	+	A	=	Low

COMMENTS	SIGNATURE	TITLE	DATE
		Immediate Supervisor	
		Employee	
	[signature]	SAFETY	July 15/13
	[signature]	Site Spvsr or Mine Supt.	July.15/13
		OH&S rep	
		EH&S MANAGER	
		Mine/Oper Manager	

Risk Matrix					
PROBABLY	CONSEQUENCE SEVERITY				
	A - Low -Couldn't cause injury or damage	**B - Minor**-Could cause first aid injury or minor damage	**C - Moderate**-Could cause MTC/LTI or moderate damage	**D - Major**- Could cause serious injury (major LTI) or major damage	**E - Critical**- Could kill, permanently disable or cause very serious damage
5 - Almost Certain- will happen	High	High	Extreme	Extreme	Extreme
4 - Likely- will happen at some point	Moderate	High	High	Extreme	Extreme
3 - Possible- it may happen at some point	Low	Moderate	High	Extreme	Extreme
2 - Unlikely -not likely to happen	Low	Low	Moderate	High	Extreme
1 - Rare -practically impossible	Low	Low	Moderate	High	High

Any risk ranking that result in a HIGH or EXTREME rating *will* require a full "long" investigation report





SR-2014-09 Leak in Treated Water Discharge Pipe

July 15, 2013

Picture 1 – Discharge pipe liner material wrapped around pipe(blue arrow) and clamped(red arrow) with water leaking out (yellow circle)

Picture 2 – Closer look of the leak. Liner material (blue arrow), clamp (red arrow), water leaking from liner/clamp patch (yellow circle)

APPENDIX F

H&S Incident Reports

Accident - Incident
Short Report Form

TEES-SAF-FOR-041 | Log # | IR-2014-09

Section #1	To be completed by FRONT LINE SUPERVISOR	Date of Accident/Incident: 15-Jun-13	Date Reported: 16-Jun-13	Date of Investigation: 16-Jun-13
PROJECT: Tundra	CONTRACTOR/DEPARTMENT: Water Treatment Plant	Time of Accident/Incident: 3:00pm	Time Reported: 8:00am	Date Submitted: 17-Jun-13

TYPE OF MISHAP Multiple Selections Possible

DESCRIPTION OF INJURY, LOSS, POTENTIAL LOSS, OR HAZARD

ACCIDENT				INCIDENT		NEAR MISS
INJURY		PROPERTY DAMAGE LOSS TO PROCESS		POTENTIAL FOR LOSS		
FIRST AID		ENVIRONMENT		INJURY		
MEDICAL AID		EQUIPMENT	X	ENVIRONMENT		
LOST TIME		MATERIAL		EQUIPMENT	X	
OCCUPATIONAL ILLNESS		LOSS TO PROCESS		LOSS TO PROCESS		
				HAZARD		
				SHE NON-CONFORMANCE		**LOCATION OF OCCURRENCE**
						Tundra Water Treatment Plant

EMPLOYEE NAME & PAYROLL #:	Dave Davidson	OCCUPATION:	WTP Operator	YRS OF EXPERIENCE IN OCCUPATIC	

DESCRIBE HOW THE MISHAP OCCURRED; Include what the person(s) was doing, trying to do and anything unusual:

Mixer from FLOC tank (onion skin) train 3 came off its support beam and fell into the tank (onion skin). The operator's co-worker, who was walking back from the Geo-tubes at the time and heard strange noises from the plant, when he got to the plant floor he noticed that the mixer had fallen into the tank and the wires been pulled out. Please note the wires were 44 inches from tank. He notified the plant operator who then checked to see if the breaker had been tripped to prevent wires from being electrified, which it had been tripped. The other mixers on that train were shut off as well. The mixer was safely fished out using a plastic pole with a built in plastic hook, Proper PPE in the form of disposable nitrile gloves, coveralls, hard hat, CSA boots and safety glasses were worn for the retreval . Mixer shaft had been wobbling a bit since it had been welded into place during maintenance of the mixer last week. When it was welded it was not exactly centered which caused the wobble. The wobble seemed to put undue stress on the bracket holding the mixer in place which in turn failed causing the mixer to fall into the tank. The mixer is in the process of being repaired.

PREVENTATIVE ACTION IMPLEMENTED OR TO BE IMPLEMENTED:	PERSON RESPONSIBLE	DATE TO BE COMPLETED	DATE COMPLETED
During daily inspections and general walk arounds, if any noticeable wobbling is noted from any mixer, then shut the mixer down to try and safely identify why it is doing so and correct as needed.	WTP Operations	16-Jun-14	Ongoing
If any form of maintenance is done on these mixers, test the mixer and watch it for a while to ensure it is operating correctly, if it is seen or heard not to be functioning correctly, stop the test and safely identify what the issue is and correct as needed.	WTP Operations	16-Jun-14	Ongoing

WITNESSES: Clifford Kenny Wedawin (after the incident)

RISK ASSESSMENT RATING	PROBABILITY		HIGHEST CONSEQUENCE		RISK ASSESSMENT RATING
	3	+	B	=	Moderate

COMMENTS	SIGNATURE	TITLE	DATE
		Immediate Supervisor	
		Employee	
		SAFETY	
		Site Spvsr or Mine Supt.	
		OH&S rep	
		EH&S MANAGER	
		Mine/Oper Manager	

Risk Matrix

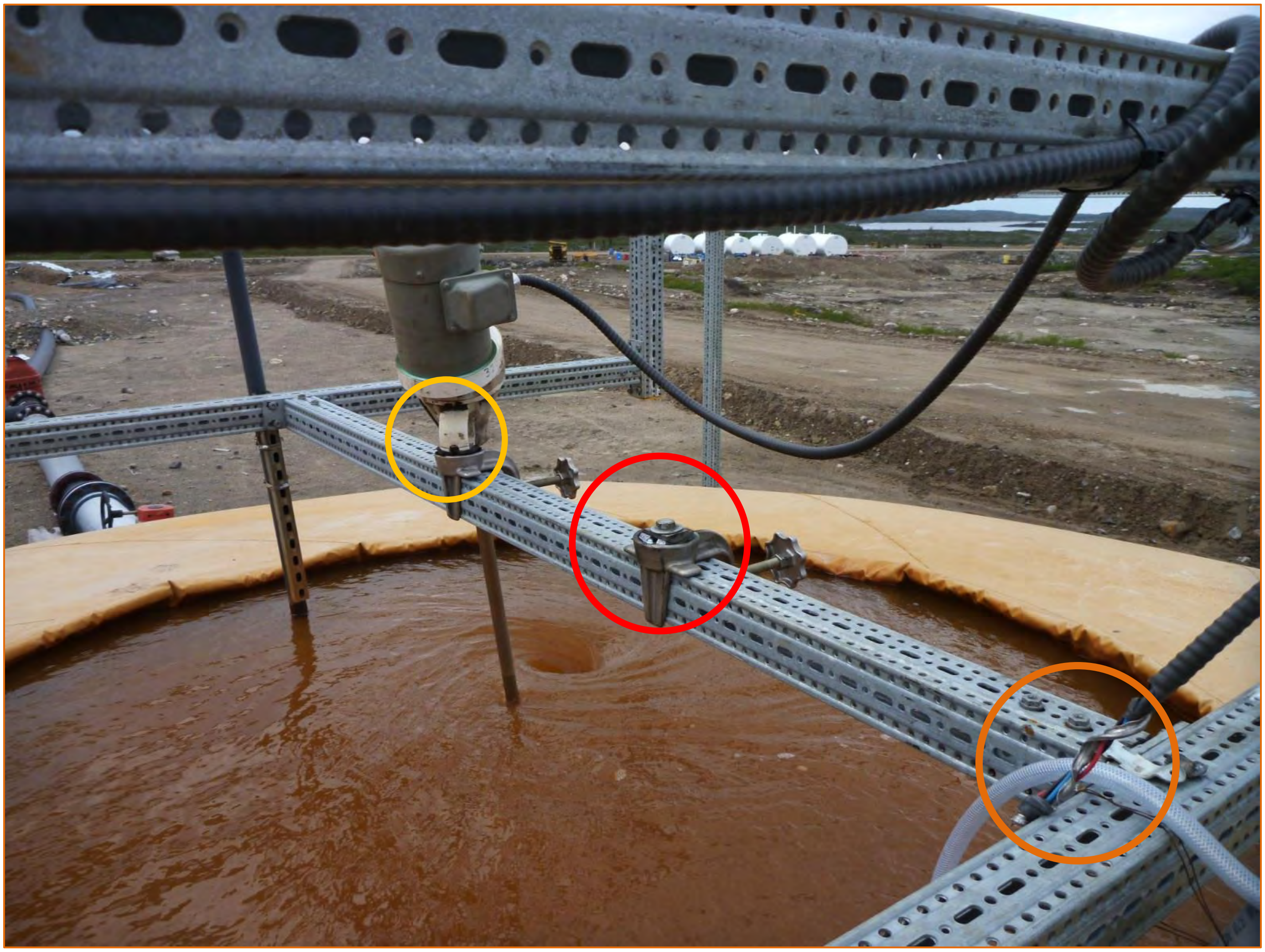
PROBABLY	CONSEQUENCE SEVERITY				
	A - Low -Couldn't cause injury or damage	**B - Minor**-Could cause first aid injury or minor damage	**C - Moderate**-Could cause MTC/LTI or moderate damage	**D - Major**- Could cause serious injury (major LTI) or major damage	**E - Critical**- Could kill, permanently disable or cause very serious damage
5 - Almost Certain- will happen	High	High	Extreme	Extreme	Extreme
4 - Likely- will happen at some point	Moderate	High	High	Extreme	Extreme
3 - Possible- it may happen at some point	Low	Moderate	High	Extreme	Extreme
2 - Unlikely -not likely to happen	Low	Low	Moderate	High	Extreme
1 - Rare -practically impossible	Low	Low	Moderate	High	High

Any risk ranking that result in a HIGH or EXTREME rating *will* require a full "long" investigation report

Picture 1

IR-2014-10 June 15, 2013

Mixer Bracket broke causing the mixer to fall into tank.



Picture 2

IR-2014-10 June 15, 2013

Mixer bracket broke causing the mixer to fall into tank.

Yellow circle – How the bracket would hold the mixer in place

Red circle – Where the bracket and mixer sat before it broke off

Orange circle – Wires that were left behind when the mixer fell into the tank (wires are 44inches from the tank)

AEL/TEES

WORKER / WITNESS STATEMENT

Date of Statement:	JUNE 16 2013	Time of Statement:	~~3:00 pm~~ 9:15AM
Date of Incident:	JUNE 15, 2013	Time of Incident:	3:00 pm
Location:	WATER TREATMENT PLANT	Person Giving Statement:	DAVE DAVISON

Please provide details (who, what, where, when, why, etc.)

MIXER FROM FLOC TANK OFF TRAIN 3 BROKE AND FELL IN THE TANK.

KENNY WAS AT GEOTUBES. I WAS BATCHING LIME. KENNY HEARD IT FALL IN AND RAN TO TELL ME. I SHUT OFF OTHER MIXER IN TANK. PASCAL CAME TO GIVE A HAND TO PULL MIXER FROM TANK. WE ENSURED BREAKER HAD TRIPPED TO PREVENT WIRES FROM BEING ELECTRIFIED.

MIXER HAD BEEN WOBBLING SINCE MY ARRIVAL AT SITE. THE SHAFT HAD BEEN WELDED IN PREVIOUSLY BECAUSE IT HAD FALLEN OUT. WHEN IT WAS WELDED, IT WAS SLIGHTLY OFF STRAIGHT, CAUSING THE WOBBLE. THIS WOBBLE EVENTUALLY CAUSED THE FAILURE OF THE METAL.

WE ARE IN THE PROCESS OF FIXING THE MIXER AND WILL RE-INSTALL ONCE REPAIRED.

SEE BACK →

I DAVID DAVISON. verify that this statement is true to the best of my knowledge and
(please print name)
understand that any fabrication of events or details may lead to disciplinary action.

SIGNATURE OF PERSON GIVING STATEMENT:

We are trying to determine all the facts associated with this incident. Please write, in your own words, what you feel were the facts leading up to the incident.

If you require more space to provide facts, please obtain another form or write on the reverse of this one. If you prefer to give your statement orally and have it recorded by someone else, please advise the investigator.

PPE WORN DURING RETRIEVAL INCLUDED:

- HARD HAT
- SAFETY GLASSES
- NITRILE GLOVES
- WORK GLOVES
- SAFETY BOOT
- COVER-ALLS

- ~~MOTOR~~ MIXER WAS ALLOWED TO DRY AFTER RETRIEVAL AND PRIOR TO DISMANTLING FOR REPAIR.

- MIXER WILL BE TESTED WITHIN TANK PRIOR TO BEING PUT BACK INTO FULL SERVICE.

AEL/TEES

WORKER / WITNESS STATEMENT

Date of Statement:	June 16	Time of Statement:	9:20 am
Date of Incident:	June 15	Time of Incident:	3:00 pm
Location:	Water treatment plant	Person Giving Statement:	Clifford Wedawin

Please provide details (who, what, where, when, why, etc.)

the mixer from the Floc tank on train 3 broke and fell in the tank, when I walk down it was good no noise nothing, went down to geotubes, stomp away when I was finish, I walked back up and heard noises from water plant, so I ran up and it was the mixer in the tank so I run to dave and shut off the two mixers right away, we fish it out with a hook and the wires attacted were ripped off. we carefully took the mixer out, Safety first.

Happen on →
June 15 about 3:00 pm and maybe it was because of poor maintance and three years the mixer has been running, the mixer had enough.

I Clifford Kenny Wedawin verify that this statement is true to the best of my knowledge and
(please print name)
understand that any fabrication of events or details may lead to disciplinary action.

SIGNATURE OF PERSON GIVING STATEMENT: Kenny Wedawin

We are trying to determine all the facts associated with this incident. Please write, in your own words, what you feel were the facts leading up to the incident.

If you require more space to provide facts, please obtain another form or write on the reverse of this one. If you prefer to give your statement orally and have it recorded by someone else, please advise the investigator.

Accident - Incident
Short Report Form

TEES-SAF-FOR-041 Log # IR-2014-14

Section #1	To be completed by FRONT LINE SUPERVISOR	Date of Accident/Incident: July 1 2013	Date Reported: July 1 2013	Date of Investigation: July 1 2013
PROJECT: Tundra	CONTRACTOR/DEPARTMENT: Site Services	Time of Accident/Incident: 10:30 AM	Time Reported: 4:00 PM	Date Submitted: July1 2013

TYPE OF MISHAP Multiple Selections Possible

DESCRIPTION OF INJURY, LOSS, POTENTIAL LOSS, OR HAZARD

ACCIDENT				INCIDENT		
INJURY		PROPERTY DAMAGE LOSS TO PROCESS		POTENTIAL FOR LOSS		NEAR MISS
FIRST AID	X	ENVIRONMENT		INJURY	X	
MEDICAL AID		EQUIPMENT		ENVIRONMENT		
LOST TIME		MATERIAL		EQUIPMENT		
OCCUPATIONAL ILLNESS		LOSS TO PROCESS		LOSS TO PROCESS		
				HAZARD		
				SHE NON-CONFORMANCE		**LOCATION OF OCCURRENCE**
						water treatment area

EMPLOYEE NAME & PAYROLL #:	Marcel Basil	OCCUPATION:	Site services	YRS OF EXPERIENCE IN OCCUPATIC	

DESCRIBE HOW THE MISHAP OCCURRED; Include what the person(s) was doing, trying to do and anything unusual:

Lifting a wooden hose support when it broke apart and a piece of the structure landed on his thumb bending it backwards.

PREVENTATIVE ACTION IMPLEMENTED OR TO BE IMPLEMENTED:	PERSON RESPONSIBLE	DATE TO BE COMPLETED	DATE COMPLETED
Will in future get help to lift unstable object.	Marcel	ASAP	

WITNESSES:

RISK ASSESSMENT RATING	PROBABILITY		HIGHEST CONSEQUENCE		RISK ASSESSMENT RATING
	low	+	Moderate	=	Moderate

COMMENTS	SIGNATURE	TITLE	DATE
		Immediate Supervisor	
	X [signature]	Employee	July 1 2013
Marcell usually works with another person But not today.	Barb Clark	SAFETY	July 1 2013
	[signature]	Site Spvsr or Mine Supt.	July 1 2013
		OH&S rep	
		EH&S MANAGER	
		Mine/Oper Manager	

Accident - Incident
Short Report Form

TEES-SAF-FOR-041 | Log # IR-2014-16

Section #1	To be completed by FRONT LINE SUPERVISOR	Date of Accident/Incident: 12-Jul-13	Date Reported: 12-Jul-13	Date of Investigation: 12-Jul-13
PROJECT: Tundra	CONTRACTOR/DEPARTMENT: Water Treatment Plant	Time of Accident/Incident: 4:30 AM	Time Reported: 5:30 AM	Date Submitted: 12-Jul-13

TYPE OF MISHAP Multiple Selections Possible

ACCIDENT				INCIDENT		DESCRIPTION OF INJURY, LOSS, POTENTIAL LOSS, OR HAZARD
INJURY		PROPERTY DAMAGE LOSS TO PROCESS		POTENTIAL FOR LOSS		NEAR MISS
FIRST AID		ENVIRONMENT	X	INJURY		
MEDICAL AID		EQUIPMENT		ENVIRONMENT		
LOST TIME		MATERIAL		EQUIPMENT		
OCCUPATIONAL ILLNESS		LOSS TO PROCESS		LOSS TO PROCESS		
				HAZARD		
				SHE NON-CONFORMANCE		**LOCATION OF OCCURRENCE**
						WTP-Train 3

EMPLOYEE NAME & PAYROLL #:	Water Treatment Plant	OCCUPATION:		YRS OF EXPERIENCE IN OCCUPATIC	

DESCRIBE HOW THE MISHAP OCCURRED; Include what the person(s) was doing, trying to do and anything unusual:

At approx. 4:30 am it was noticed by a night shift water treatment plant operator that the mixer on train 3's third tank (polymer mixing tank) fell into the tank. Upon falling into the tank the mixer caused the circuit breaker to trip so power was cut to the mixer. It should be noted that this was the same mixer involved in IR-2014-09. When doing inspections there was no need for concern on this mixer after it was reinstalled as there was no apparent wobbling or movement. Upon seeing the mixer and shaft in the tank the power was shut off completely on train 3 and the mixer disconnected from the tank and removed. A small amount of trickling water was noted at the base of the tank and a submersible pump was placed into the tank and the tank drained to train 2 tank to avoid any potential spill. It was found that the bolt holding the mixer to the clamp had broken in half, which would have caused the mixer to fall into the tank. When the tank was completely drained a 16 inch rip was found at the bottom of the tank.

PREVENTATIVE ACTION IMPLEMENTED OR TO BE IMPLEMENTED:	PERSON RESPONSIBLE	DATE TO BE COMPLETED	DATE COMPLETED
On going daily inspections of mixer equipment as per IR-2014-09 corrective.	WTP personnel	On going	On going
All mixers in operation in the Water Treatment Plant will be secured to the support beams by wire to prevent the mixers from falling into the tanks if anything fails again such as clamps or metal fatigue.	WTP personnel	19-Jul-13	

WITNESSES:

	PROBABILITY		HIGHEST CONSEQUENCE		RISK ASSESSMENT RATING
RISK ASSESSMENT RATING	2	+	B	=	Low

COMMENTS	SIGNATURE	TITLE	DATE
		Immediate Supervisor	
		Employee	
		SAFETY	
		Site Spvsr or Mine Supt.	
		OH&S rep	
		EH&S MANAGER	
		Mine/Oper Manager	

Risk Matrix					
PROBABLY	CONSEQUENCE SEVERITY				
	A - Low -Couldn't cause injury or damage	**B - Minor**-Could cause first aid injury or minor damage	**C - Moderate**-Could cause MTC/LTI or moderate damage	**D - Major**- Could cause serious injury (major LTI) or major damage	**E - Critical**- Could kill, permanently disable or cause very serious damage
5 - Almost Certain- will happen	High	High	Extreme	Extreme	Extreme
4 - Likely- will happen at some point	Moderate	High	High	Extreme	Extreme
3 - Possible- it may happen at some point	Low	Moderate	High	Extreme	Extreme
2 - Unlikely -not likely to happen	Low	Low	Moderate	High	Extreme
1 - Rare -practically impossible	Low	Low	Moderate	High	High

Any risk ranking that result in a HIGH or EXTREME rating *will* require a full "long" investigation report

IR-2014-16 July 12, 2013

Equipment Damage – mixer falls into tank and rips a hole in the bottom of tank

Picture 1

Clamp (yellow circle) that holds the mixer in place on the beam. The bolt holding the clamp and the mixer together (red arrow) broke causing the two to come apart, thus the mixer falling into the tank.

IR-2014-16 July 12, 2013

Equipment Damage – mixer falls into tank and rips a hole in the bottom of tank

Picture 2

Broken bolt still stuck in the clamp

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Equipment Damage – mixer falls into tank and rips a hole in the bottom of tank

Picture 3

When the mixer fell into the tank it caused a 16 inch rip in the bottom of the tank.

AEL/TEES

WORKER / WITNESS STATEMENT

Date of Statement:	July 12, 2013	Time of Statement:	9:00am
Date of Incident:	July 12, 2013	Time of Incident:	4:30 am
Location:	WTP	Person Giving Statement:	Aaron Barker

Please provide details (who, what, where, when, why, etc.)

At 4:30am on July 12th the mixer on train 3's third tank (polymer mixing tank) fell into the tank causing a ~~[illegible]~~ rip on the bottom of the tank. Upon falling into the tank the mixer caused the circuit breaker to switch preventing further damage to the bottom of the tank. It should be noted this was the same mixer as mentioned in the previous incident report. when I returned to site the mixer was reattached and I had no cause for concern as I ~~assumed~~ the problem was resolved. The reason for the failure on July 12th was the bolt which attaches the mixer head to the clamp which fastens the mixer to the framework ~~[illegible]~~ split in half allowing the mixer head and shaft to fall into the tank. It should also be noted the upon seeing the mixer in the tank the power was shut off to the mixer, the mixer was disconnected from the wiring and removed from tank. Train 3 was shut down and since ~~[illegible]~~ a trickle of water was leaking out of the tank a submergable pump was ~~[illegible]~~ lowered into the tank to move the water from train 3 into train 2 to avoid any potential spill.

I Aaron Barker verify that this statement is true to the best of my knowledge and
(please print name)
understand that any fabrication of events or details may lead to disciplinary action.

SIGNATURE OF PERSON GIVING STATEMENT: [signature]

We are trying to determine all the facts associated with this incident. Please write, in your own words, what you feel were the facts leading up to the incident.

If you require more space to provide facts, please obtain another form or write on the reverse of this one. If you prefer to give your statement orally and have it recorded by someone else, please advise the investigator.

Accident - Incident
Short Report Form

TEES-SAF-FOR-041				Log #	IR-2014-19
Section #1	To be completed by FRONT LINE SUPERVISOR		Date of Accident/Incident: 12-Jul-13	Date Reported: 13-Jul-13	Date of Investigation: 13-Jul-13
PROJECT: Tundra	CONTRACTOR/DEPARTMENT: WESA (Water Treatment Plant)		Time of Accident/Incident: 2:00pm	Time Reported: 8:10am	Date Submitted: 14-Jul-13

TYPE OF MISHAP — Multiple Selections Possible

ACCIDENT				INCIDENT		NEAR MISS
INJURY		PROPERTY DAMAGE LOSS TO PROCESS		POTENTIAL FOR LOSS		DESCRIPTION OF INJURY, LOSS, POTENTIAL LOSS, OR HAZARD
FIRST AID	X	ENVIRONMENT		INJURY		
MEDICAL AID		EQUIPMENT		ENVIRONMENT		
LOST TIME		MATERIAL		EQUIPMENT		
OCCUPATIONAL ILLNESS		LOSS TO PROCESS		LOSS TO PROCESS		
				HAZARD		
				SHE NON-CONFORMANCE		LOCATION OF OCCURRENCE
						Water Treatment Plant

EMPLOYEE NAME & PAYROLL #:	Daniel Tucholski	OCCUPATION:	WTP Operator	YRS OF EXPERIENCE IN OCCUPATIO	

DESCRIBE HOW THE MISHAP OCCURRED; Include what the person(s) was doing, trying to do and anything unusual:

During the attempt to move a replacement "onion" skin tank from train 1 to train 3 (where IR-2014-16 occurred), the worker lost his footing and came down on his knees, where his right knee contacted a rock. At the time the worker got up and felt no pain or discomfort and there fore felt no need to report the slip. The worker was able to carry out all duties through out the day with no issues. On July 13, 2013 when the worker woke up from sleep, he felt some discomfort/"twinge" of pain in his right knee, he reported to work then reported to the Medic at approx. 8:10am. Upon examination it was found that the right knee was slightly swollen with no discoloration (no bruising), the worker had normal range of motion of the knee with no discomfort, only if he put weight on it (as he was walking) he felt some discomfort but not actual pain. The weather conditions on the 12th of July was over cast, rainy and windy, which made for slippery ground conditions. The worker did state that because of the weather conditions, they were rushing to get the tank moved, which may have been a contributing factor to the slip.

PREVENTATIVE ACTION IMPLEMENTED OR TO BE IMPLEMENTED:	PERSON RESPONSIBLE	DATE TO BE COMPLETED	DATE COMPLETED
Worker was spoken to about the importance of not rushing a task, due to the implications and consequences that could occur if that continues. If weather is an issue, then stop the task until conditions improve (which was actually done in this case)	Safety	13-Jul-13	13-Jul-13
Worker spoken to about reporting near misses and incidents promptly so that the issues can be dealt with appropriately.	Safety	13-Jul-13	13-Jul-13

WITNESSES:

RISK ASSESSMENT RATING	PROBABILITY		HIGHEST CONSEQUENCE		RISK ASSESSMENT RATING
	3	+	B	=	Moderate

COMMENTS	SIGNATURE	TITLE	DATE
		Immediate Supervisor	
	[signature]	Employee	July 14/2013
	[signature]	SAFETY	July 14/13
	[signature]	Site Spvsr or Mine Supt	July. 14/13
		OH&S rep	
		EH&S MANAGER	
		Mine/Oper Manager	

Risk Matrix

PROBABLY	CONSEQUENCE SEVERITY				
	A - Low -Couldn't cause injury or damage	**B - Minor**-Could cause first aid injury or minor damage	**C - Moderate**-Could cause MTC/LTI or moderate damage	**D - Major**- Could cause serious injury (major LTI) or major damage	**E - Critical**- Could kill, permanently disable or cause very serious damage
5 - Almost Certain- will happen	High	High	Extreme	Extreme	Extreme
4 - Likely- will happen at some point	Moderate	High	High	Extreme	Extreme
3 - Possible- it may happen at some point	Low	Moderate	High	Extreme	Extreme
2 - Unlikely -not likely to happen	Low	Low	Moderate	High	Extreme
1 - Rare -practically impossible	Low	Low	Moderate	High	High

Any risk ranking that result in a HIGH or EXTREME rating *will* require a full “long” investigation report

AEL/TEES

WORKER / WITNESS STATEMENT

Date of Statement:	July 13, 2013	Time of Statement:	8:30 a.m.
Date of Incident:	July 12, 2013	Time of Incident:	~ 2:00 pm.
Location:	Train 1 .f	Person Giving Statement:	Daniel Tucholski

Please provide details (who, what, where, when, why, etc.)

During the attempt to move the replacement onion tank from Train 1 to Train 3, I lost my footing and landed on a rock with my right Knee. The conditions were slippery due to rainy and windy conditions. We determined the path to transport the replacement tank most safely and easily prior to the attempt to move the tank. Myself and everyone involved were wearing proper PPE - rubber boots, hard hat, safety glasses, high visibility wear, rain gear, proper gloves. After falling, ~~my~~ ~~r~~ both Knees felt fine so I felt that it wasn't necessary to report the incident. However, this morning, my right Knee, I began to feel some discomfort. After starting work, when bending the Knee moderately deeply ~~while~~ I felt a twinge of pain/discomfort in the right Knee. I then took a break and visually inspected the Knee and it looked swollen. ~~At~~ I then informed (Medic) Nicole of the incident and situation. She then ~~re~~ examined and treated me. During the incident, I was rushing which I think contributed to my loss of footing. As such, a good corrective action would be to go a little slower and not rush during tasks.

I Daniel Tucholski verify that this statement is true to the best of my knowledge and
(please print name)
understand that any fabrication of events or details may lead to disciplinary action.

SIGNATURE OF PERSON GIVING STATEMENT: Daniel Tucholski

We are trying to determine all the facts associated with this incident. Please write, in your own words, what you feel were the facts leading up to the incident.

If you require more space to provide facts, please obtain another form or write on the reverse of this one. If you prefer to give your statement orally and have it recorded by someone else, please advise the investigator.

Division of BluMetric Environmental Inc.

Envir-Eau

440, Blvd Rene-Levesque Ouest
Bureau 350
Montréal, Québec
Canada H2Z 1V7
Téléphone: 514 844.7199
Télécopieur: 514 841.9111
montreal@envireau.ca

160, boul. de l'Hôpital, #204
Gatineau, Québec
Canada J8T 8J1
Téléphone: 819 243.7555
Télécopieur: 819 243.0167
envireau@envireau.ca

WESAtech

4 Cataraqui Street
The Tower, The Woolen Mill
Kingston, Ontario
Canada K7K 1Z7
Tel: (613) 531-2725
Fax: (613) 531-1852
wesaking@wesa.ca

Seprotech

2378 Holly Lane
Ottawa, Ontario
Canada K1V 7P1
Tel: (613) 523-1641
Fax: (613) 731-0851
contact@seprotech.com

WESA Tecnologias S.A. de C.V.

Calle La Mascota, Pasaje # 4,
Casa # 3, Colonia La Mascota,
San Salvador, El Salvador
Teléfono: 011-503-2513-1335
Fax: 613-839-5376
wesasansal@wesa.ca

WESA

3108 Carp Road
PO Box 430
Ottawa, Ontario
Canada K0A 1L0
Tel: (613) 839-3053
Fax: (613) 839-5376
wesacarp@wesa.ca

4 Cataraqui Street
The Tower, The Woolen Mill
Kingston, Ontario
Canada K7K 1Z7
Tel: (613) 531-2725
Fax: (613) 531-1852
wesaking@wesa.ca

171 Victoria Street
North
Kitchener, Ontario
Canada N2H 5C5
Tel: (519) 742-6685
Fax: (519) 742-9810
wesakw@wesa.ca

273 Elm Street
Sudbury, Ontario
Canada P3C 1V5
Tel: (705) 525-6075
Fax: (705) 525-6077
wesasud@wesa.ca

4 Kern Road, Suite 1,
Toronto, Ontario,
Canada M3B 1T1
Tel: (416) 383-0957
Fax: (416) 383-0956
wesatoronto@wesa.ca

4901 – 48 Street
Ground Floor
Yellowknife, NT
Canada X1A 2P9
Tel: (867) 873-3500
Fax: (867) 873-3499
yellowknife@wesa.ca

www.blumetric.ca