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Teck

October 17, 2014

Phyllis Beaulieu
Manager of Licensing
Nunavut Water Board
P.O Box 119
Gjoa Haven, NU
X0B 1J0

Re: Technical Meeting Commitment #1 - Submission of 2014 Post Closure Monitoring Report, and Response to the Nunavut Water Board Pre-Hearing Conference Decision.

Dear Ms. Beaulieu;

Teck Resources Limited (Teck) is pleased to submit the attached report *Post Reclamation Geotechnical Inspection, Former Polaris Mine* (Golder October 2014) and *Water Quality Summary Report* (Azimuth October 2014) and supporting lab results. These submissions address Commitment #1 from the Nunavut Water Board (NWB) technical meeting held via teleconference on August 18, 2014 concerning the water licence renewal for the former Polaris mine site. Commitment #1 was as follows:

> *Commitment requested by AANDC and EC of Teck to undertake site inspection, conduct sampling in August/September 2014 and provide a report of the results at least 30 days prior to the Public Hearing. (NOTE: Geotechnical inspection will include review of areas showing potential subsidence as identified by AANDC on-site inspector in July).*

The Geotechnical Engineer's inspection was carried out by Darrin Johnson P.Eng. (Golder) and water sampling of Garrow Creek (SRK) were conducted on September 2, 2014. These programs were carried out in accordance with the plans submitted to the NWB[1]. Two local Inuit residents (Simon Idlout and Sampson Simeonie) of Resolute Bay participated in the site inspection. Simon has participated in virtually every site inspection as part of the Project's Monitoring Program since reclamation was completed. Simon also worked on the site during the reclamation project.

The 2014 post closure geotechnical monitoring report noted some minor changes related to some borehole culvert sections. A few sections were protruding slightly more than at the previous inspections, having undergone minor freeze-thaw settling of soils within the culvert sections. These are considered a low risk and no current action is proposed beyond this year's detailed recording of

[1] Former Polaris Mine Site, Nunavut, Proposed Long-Term Geotechnical Monitoring Program. Golder Associates May 28, 2013. Long Term Monitoring Program of Garrow Creek, Polaris Mine, Nunavut. Azimuth Consulting April 4, 2013.

the locations, photographic documentation and risk assessment records which will allow future monitoring to be more definitive in identifying any future changes if they occur. These observations are relatively consistent with AANDC's impressions when they did an inspection in August, however it is important to note that they do not appear to be the result of subsidence but rather normal freeze-thaw cycles. Also of importance, there were no indications of any new subsidence movement which confirms that the site continues to be stable with only minor changes to the borehole culvert features. Water quality results from Garrow Creek demonstrate that water quality continues to be good and is similar to previous sampling results. All parameters were compliant with the criteria set in the water licence.

Water quality results and geotechnical results were discussed with Environment Canada (EC) and Aboriginal Affairs and Northern Development Canada (AANDC) by teleconference on October 14, 2014. Teck is pleased to report that all Parties were satisfied with the findings and in combination with the reconfirming Teck's commitment to add Garrow Lake vertical limnology to the 2019 monitoring program. The Parties are in agreement on the monitoring program, frequency and the licence term.

Teck and AANDC also discussed the potential future process of licence cancellation and Teck understands that AANDC plans to submit a preliminary overview of how that may unfold in 2029-2030. Teck is satisfied that the path forward leading to cancellation will be detailed further over the course of the forthcoming 15-year licence term and does not expect full resolution on this policy issue via the current renewal process.

Finally, Teck and AANDC have arranged to address the security amount accounting for licence term in early November.

Considering the findings of the attached reports, the resolutions with EC and AANDC, and the lack of community concern expressed during the Technical Meeting/ Pre-Hearing Conference (PHC) related to the monitoring approach or issues of water and waste, Teck is requesting that the NWB revisit the form of hearing, and further consider the option of a hearing via teleconference or other means.

In considering this request, it is important to note that an in-person hearing is not necessary to settle any outstanding items between Teck, regulators and the public. The few items discussed during the technical meeting and PHC had clear paths forward and have since been discussed without substantial issue remaining that would warrant the high cost of an in-person hearing.

Teck also notes its Public Engagement Report submitted to the NWB with the renewal application (Item 16) detailing the 2013 public meetings in Resolute Bay and Grise Fiord to update communities and receive feedback on the Project's history, post closure monitoring progress and results, as well as the water licence renewal application. As summarized in the Public Engagement Report, no public concerns related to proposed Project activities were expressed. This is consistent with the technical meeting and PHC turnout where no public concern was expressed related to the application, water or waste. It is also important to take in to account that the site is located 120 km from Resolute and generally visited by Teck and the community members that accompany inspections, therefore the additional interest and applicable input with respect to the scope of the renewal application is limited.

Teck notes that all of the parties to the PHC agreed, if not preferred, to hold the hearing by teleconference. While the sole community member in attendance at the PHC, Mr, Jaypete Akeagok of Grise Fiord (HTO), made the general observation that in-person meetings are ideal, no request for

an in-person meeting was made, and we respectfully note that this general observation was accompanied by an acknowledgment that a teleconference was agreeable in these circumstances.

In this particular circumstance, public involvement and consultation is best met through other means than an in-person hearing. Teck is committed to the ongoing involvement of community members in post closure monitoring and is also committed to information sharing and dialogue with Grise Fiord and Resolute on an on-going basis. Until 2029, the monitoring approach remains in effect as per the plans agreed upon. With the efforts made to date by Teck with communities and regulators to successfully address items along with the commitments made to engage communities, the costs and logistics of an in-person hearing are not warranted at this time and would be an inefficient use of resources for all parties.

Considering the above, Teck respectfully suggests that the hearing, if required, could be carried out more efficiently, but just as effectively, by way of a teleconference and asks that the PHC decision be revisited given the information and clarification before the NWB.

Sincerely,

Bruce Donald
Manager Legacy Properties, Environment

C.c. David Hohnstein, Nunavut Water Board (david.hohnstein@nwb-oen.ca)
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Attachments: 1) 2014 Post Closure Geotechnical Monitoring Report
2) Garrow Creek Water Quality Laboratory Results

October 9, 2014

Post-Reclamation Geotechnical Inspection

FORMER POLARIS MINE, NUNAVUT

Submitted to:
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Report Number: 1408454
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2 Copies – Teck Resources Ltd.
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REPORT

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2014 Polaris Geotechnical Inspection Photographs

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by Teck Metals Ltd. (Teck) to conduct a post-reclamation geotechnical inspection of the former Polaris mine located on Little Cornwallis Island, Nunavut. The geotechnical inspection was carried out by Mr. Darrin Johnson, P.Eng., on September 2, 2014.

The decommissioned Polaris mine site is located on Little Cornwallis Island approximately 120 km northwest of Resolute, Nunavut. Figure 1 presents the general arrangement of the decommissioned former Polaris mine site (the Site).

The following areas were inspected during the 2014 geotechnical inspection:

- Subsidence Area;
- Garrow Lake Dam (Decommissioned Dam on Figure 1);
- Little Red Dog Quarry Landfill;
- Operational Landfill;
- Conveyor and Main Mine Portals; and
- Marine Foreshore (Reclaimed Shoreline on Figure 1).

The last geotechnical inspection was carried out by Golder in 2011 and current conditions were compared with conditions observed during previous post-reclamation geotechnical inspections. A summary of site conditions observed during the 2014 geotechnical inspection are presented in the following sections of this report.

2.0 SITE HISTORY

The Polaris mine was operated by Teck between 1981 and 2002 and decommissioned in 2003 and 2004. Site facilities comprised an underground mine, concentrator plant, concentrate storage shed, dock, airstrip, tailings impoundment, freshwater intake on Frustration Lake, various site access roads, a limestone quarry, a shale quarry, and support infrastructure including fuel storage, camp, warehouse, etc. Decommissioning and reclamation of the site involved demolition of all structures and excavation of all soils contaminated by metals and hydrocarbons to pre-approved risk-based concentrations. All demolition waste and contaminated soil was either placed underground or in engineered landfills. Access roads around the mine site were decommissioned by rounding the shoulders of each road, removing culverts, and re-establishing natural drainage patterns. Facilities related to the airstrip were removed during decommissioning but the landing surface remains intact and has been used during the post-reclamation monitoring period. Little Cornwallis Island airstrip (referred to as LCI by local pilots) is also used occasionally by passing airplanes for emergency landings. Teck maintained a small portable camp near Loon Lake during the post-reclamation monitoring period that was removed from the Site in September 2011.

The marine foreshore area and slope in the vicinity of the former concentrate storage shed on the west side of the island were regraded to relatively gentle slopes during decommissioning. Four portals for mine access and exploration activities have been sealed, backfilled and graded to match the surrounding slopes.

Little Red Dog Quarry, located at the northwest end of the airstrip was backfilled partially with demolition debris and metals contaminated soils and subsequently capped with rockfill. The remnant quarry walls above the level of the capping layer are benched and serve to catch ravelling material as the slopes gradually weather. Safety berms extend around the quarry perimeter, and additional safety measures in the form of a ditch and a high berm exist at the end of the airstrip. The Operational Landfill, located at the south end of the former mine facility area, was regraded and capped with rockfill during decommissioning. Thermistors were installed through the rockfill capping layer into the underlying landfilled materials at Little Red Dog Quarry and Operational Landfill. Thermistors equipped with dataloggers were used to monitor ground temperature in the Little Red Dog Quarry Landfill and Operational Landfill from 2006 through 2011. Ground temperature data previously measured by thermistors installed at the Little Red Dog Quarry Landfill and Operational Landfill indicated that permafrost has extended up through the waste into the overlying rockfill cover effectively encapsulating waste materials as designed. The thermistors remain in place but the datalogger batteries have not been changed since 2011 therefore they are no longer recording ground temperature measurements.

The Subsidence Area is located over top of former underground mine workings and experienced significant settlement during early mine operations. During decommissioning, the Subsidence Area was backfilled with non-hazardous solid waste, covered with rockfill, and regraded. No mine subsidence related surface deformation has been detected in the Subsidence Area during the post-reclamation topographic survey monitoring carried out from 2004 through 2011. Some minor thaw related settlement has been observed during post-reclamation inspections in regraded areas where frozen backfill containing ice and/or snow was used during reclamation.

The New Quarry Area was a source of shale during mine construction, operations and decommissioning. It was reclaimed by backfilling stripped materials against the quarry perimeter walls. Access roads around the site were decommissioned and culverts were removed to restore natural drainage crossings that would not require ongoing maintenance. A rockfill jetty remains at Frustration Lake that was constructed for the freshwater supply intake during operation of the mine. Freshwater pumps and piping were removed during decommissioning.

At Garrow Lake, the former tailings disposal area, the impoundment dam and wave break structure were breached during decommissioning to return water levels to pre-development levels and to eliminate structures requiring long-term monitoring and maintenance. The central part of the main dam was breached and a rip-rap lined channel was constructed.

3.0 OBJECTIVES AND LIMITATIONS OF GEOTECHNICAL INSPECTION

The primary objective of the geotechnical inspection is to visually assess the physical condition of decommissioned mine areas for evidence of slope instability, erosion or other landform instabilities that could present a safety hazard to either humans or wildlife. The inspection involved looking for visual indications of physical instability (i.e., erosion, tension cracks, slumping, etc). The stability of underground mine openings was not assessed.

Appendix A includes a series of annotated photographs taken during the 2014 geotechnical inspection. Photograph locations were recorded using a hand-held Global Positioning System (GPS) and are shown in plan on Figure 1. A summary of inspection photographs and approximate Northing and Easting coordinates are listed in Table 1. Conditions observed during the 2014 inspection were compared to previous annual inspections to identify if any changes have occurred that may indicate instability or a potential safety hazard.

4.0 GEOTECHNICAL INSPECTION OBSERVATIONS

In general, the conditions observed during the September 2014 geotechnical inspection of the former Polaris mine site have not changed significantly from previous post-reclamation geotechnical inspections. The following sections provide a summary of conditions observed during the September 2014 geotechnical inspection by area.

4.1 Subsidence Area

There were no significant visual changes to the mine subsidence area observed during the September 2014 geotechnical inspection compared to previous post-reclamation inspections. No features were observed in the subsidence area during the September 2014 inspection that present a significant risk to either humans or wildlife. Photographs 1 through 80 document subsidence area conditions observed during the September 2014 geotechnical inspection.

Most of the photographs taken in the subsidence area during the 2014 inspection are of vent/backfill raises that extend to surface. The raise bores are about 1.5 m in diameter and were used to either provide ventilation to the underground mine or deliver rock backfill to mine stopes. Vent/backfill raises have been observed during previous inspections and were not considered a risk to either humans or wildlife so only a few photographs had been taken to document typical conditions. However, the 2014 inspection attempted to photograph and GPS locate all of the vent/backfill raises in the vicinity of the subsidence area for future reference. Most of the vent/raise locations have corrugated steel pipe (CSP) extending slightly above ground surface. This is considered to be the result of near surface thaw settlement of backfill around and inside the CSP. It is assumed that CSP sections were used as casing through the active thaw layer in overburden down to either permafrost or bedrock. It is possible that frost jacking could be pushing the CSP out of the ground at some of the raise locations. However, it is considered more likely that frozen backfill, that may have contained ice and snow, placed around the CSP and down the raise is settling as a result of seasonal thaw. In fact, the CSP sections may have extended above ground surface when they were initially installed during mine operations. The depth of settlement inside the CSP at most raise locations is less than 0.3 m. There are four locations with substantial thaw settlement adjacent to the raise resulting in exposed CSP up to 1 m high (see Photos 31,37,56,59). There is ponded water in some of these thaw settlement depressions beside vent/backfill raises. Previous inspections had observed thaw settlement beside some of the vent/backfill raises, which were assumed to be unchanged since the mine site was decommissioned. However, it appears that the depth of settlement around and inside the CSP at some raise locations may be increasing over time. Even if there has been some post-reclamation settlement at the vent/backfill raises, it is important to note that this settlement is considered to be a result of seasonal thaw of backfill and not related to underground mine subsidence. There are three vent/backfill raise locations with internal settlement (i.e., inside the CSP) more than 0.3 m deep that could potentially pose a risk to either humans or wildlife (see Photos 25, 32, and 57).

As noted above, much of the subsidence area was backfilled and regraded with frozen rockfill that may have contained ice and snow. Some of the photographs illustrate typical surficial settlement in the subsidence area likely caused by thaw of frozen backfilled material. Again, the observed settlement is not considered to be a result of underground mine related subsidence. The thaw settlement areas have gentle slopes that do not present a risk to either humans or wildlife. Some of these thaw settlement areas have associated tension cracks around the perimeter. There are some longer tension cracks in the subsidence area (see Photos 70 and 71) that have been observed during previous post-reclamation inspections (i.e., are not new) and were previously noted as being related to historic larger-scale subsidence in the area. These previously observed longer tension

cracks are well weathered with internal erosion that has self-armoured confirming that they are not new. There are also similar previously observed tension cracks that run along the road at the east side of the subsidence area. However, these tension cracks are considered to be related to thaw creep of the gentle slope that extends from the road embankment down to towards the adjacent New Quarry. The road embankment and regraded slope is constructed of rockfill and is considered to be stable.

During the current and previous post-reclamation inspections there has been an area with ponded water in the centre of subsidence area (Photos 74 through 76) indicating that permafrost is preventing drainage of surface water from the depression. The shallow ponded water freezes solid each winter and does not interfere with maintaining permafrost conditions in the subsidence area. Because of the climate and depth of permafrost at Polaris, a very large and deep body of water is required to create a talik (i.e., thawed zone) through the permafrost.

4.2 Little Red Dog Quarry Landfill

No protruding waste, tension cracks or settlement depressions were observed on the Little Red Dog Quarry Landfill cover during the September 2014 inspection. Photographs 81 through 88 document the condition of the Little Red Dog Quarry Landfill cover during the September 2014 inspection.

4.3 Garrow Lake Dam and Creek Channel

Photographs 89 through 94 illustrate the condition of the breached Garrow Lake Dam and creek channel. Minor thaw settlement on the dam breach slopes appear to be unchanged during post-reclamation geotechnical inspections. Rip-rap at the base of the breach slopes appears to be in good condition and is effectively protecting the breach slopes from channel erosion.

4.4 Operational Landfill

Photographs 95 through 108 illustrate conditions observed at the Operational Landfill during the September 2014 inspection. No indications of slope instability or exposed waste were observed. No tension cracks or settlement depressions were observed on the landfill crest. No indications of erosion or slope instability were observed on the landfill slopes.

4.5 Marine Foreshore

The slopes adjacent to the former dock structure were observed to be stable. No active erosion features discharging sediment were observed in the foreshore area during the September 2014 inspection. Photographs 109 and 110 document a wooden pile observed in the water at the South end of the marine foreshore area. Photograph 114 documents the typical condition at the North end of marine foreshore area during the September 2014 inspection. Thaw settlement and the formation of gravel bars in response to ocean wave and ice action has been observed along the shoreline during previous post-reclamation inspections.

4.6 Mine Portals

The Polaris Mine was an underground mining operation. There were four portals used to access the mine and/or to convey ore out of the mine. During mine decommissioning, the portals were sealed and covered with rockfill to prevent access to the underground mine workings. During the September 2014 inspection only the

Main Portal and Conveyor Portal were visited. During previous post-reclamation inspections the North and Exploration portals were observed to have backfilled slopes that were stable.

The Conveyor Portal slope was observed to be in good condition during the September 2014 inspection (see Photograph 111). Most of the backfilled slope in front of the Main Portal was snow covered during the September 2014 inspection (see Photograph 112). The slope in front of the Main Portal had been regraded and flattened in 2009 to repair a slope failure. Photograph 113 is a close-up of some new minor slumping above the Main Portal slope.

5.0 DISCUSSION AND QUALITATIVE RISK ASSESSMENT

The following sections discuss the post-reclamation condition of each area inspected in September 2014 and if there are any potential safety risks to either humans or wildlife.

5.1 Operational Landfill and Little Red Dog Quarry Landfill

No protruding waste, erosion, slope instability or significant settlement was observed at either the Operational Landfill or the Little Red Dog Quarry Landfill during the September 2014 inspection. The batteries in the landfill thermistor dataloggers had not been changed since 2011 and therefore were not downloaded during the September 2014 inspection. Ground temperature data measured from 2006 through 2011 at the Little Red Dog Quarry Landfill and Operational Landfill previously indicated that permafrost had extended up through the waste into the overlying rockfill cover effectively encapsulating waste materials as designed. Observed conditions at the two landfills do not present a safety risk to either humans or wildlife.

5.2 Garrow Lake Dam and Creek Channel

The breached Garrow Lake Dam and creek channel were unchanged from previous post-reclamation geotechnical inspections. Rip-rap at the base of the breach slopes appears to be in good condition and is effectively protecting the breach slopes from channel erosion. Observed conditions at the breached dam and creek channel do not present a safety risk to either humans or wildlife.

5.3 Marine Foreshore Area

The slopes adjacent to the former dock structure were observed to be stable and no active erosion features discharging sediment were observed in the foreshore area during the September 2014 inspection. Minor thaw settlement and the formation of gravel bars in response to ocean wave and ice action have been observed during previous post-reclamation inspections. Observed conditions at the reclaimed shoreline area do not present a safety risk to either humans or wildlife.

5.4 Mine Portals

The Conveyor Portal and Main Portal were inspected during the September 2014 inspection. Although the North Portal and Exploration Portal were not inspected in September 2014, they both have relatively flat backfilled slopes that were observed to be stable throughout the 7 year post-reclamation monitoring period. The slope in front of the Conveyor Portal was observed to be stable during the September 2014 inspection. There was a small slump above the Main Portal slope that was repaired in 2009 but the overall slope appeared to be stable. The slope that is slumping above the Main Portal is steeper than the lower section where additional material was pushed to flatten the slope in 2009. This upper section of slope is supported by the lower, flatter slope which

would prevent a large scale slope failure exposing the sealed Main Portal. Minor thaw related slumping of the steeper upper slope above the Main Portal should be expected to continue until a stable slope is achieved. Observed conditions at the portals inspected in September 2014 are not considered to present a safety risk to either humans or wildlife.

5.5 Subsidence Area

There were no significant visual changes in the subsidence area from previous post-reclamation inspections. During site reclamation, much of the subsidence area was backfilled and regraded with frozen rockfill that may have contained ice and snow. Post-reclamation settlement that has been observed in the subsidence area is considered to be thaw related and not a result of underground mine related subsidence. Thaw settlement in the subsidence area has gentle slopes that do not present a risk to either humans or wildlife. Some of these thaw settlement areas have associated tension cracks around the perimeter. There are some longer tension cracks in the subsidence area that have been observed during previous post-reclamation inspections and may be related to historic larger-scale subsidence in the area. During the current and previous post-reclamation inspections there has been an area with ponded water in the centre of subsidence area indicating that permafrost is preventing drainage of surface water from the depression. The shallow ponded water freezes solid each winter and therefore does not interfere with maintaining permafrost conditions in the area.

The 2014 inspection attempted to photograph and GPS locate all of the vent/backfill raises in the vicinity of the subsidence area for future reference. Most of the vent/raise locations have corrugated steel pipe (CSP) extending slightly above ground surface that could be a result of one of the following or a combination thereof:

- CSP that originally extended above ground surface following installation during mine operations;
- Seasonal thaw settlement of backfill placed around and inside the CSP (backfill that was likely frozen and may have contained ice and snow); and/or
- frost jacking that is slowly pushing the CSP out of the ground.

At most of the vent/raise locations the amount of settlement is less than 0.3 m deep which is not considered to present a safety risk to humans or wildlife. There are four vent/backfill raise locations with substantial settlement immediately beside the raise resulting in up to 1 m of exposed CSP that could potentially present a safety risk to humans or wildlife. There are three vent/backfill raise locations with internal settlement (i.e., inside the CSP) that is more than 0.3 m deep and could potentially pose a safety risk to either humans or wildlife. Previous post-reclamation inspections had observed thaw settlement around the vent/backfill raises that was assumed to be unchanged since the mine site was decommissioned. However, it appears that the depth of settlement around and inside the CSP at some raise locations may be increasing over time. Even if there has been some post-reclamation settlement at the vent/backfill raises, it is important to note that any settlement is considered to be a result of seasonal thaw and consolidation of backfill and not related to underground mine subsidence.

5.5.1 Qualitative Risk Assessment

The assessment of potential risk to humans and wildlife and risk mitigation options at the former Polaris mine site needs to consider the following:

- the remoteness of the site;

- frequency of human and animal traffic across the site;
- corresponding very low likelihood of the risk occuring;
- potential consequence of the risk/hazard; and
- the presence of similar natural risks/hazards in the high Arctic.

It should be noted that natural erosion gullies on the tundra can often be 0.5 m deep requiring ATVs to slow down and/or be careful. There are also large boulders, bedrock outcrops, cliffs and other natural hazards that present more significant risk to humans or wildlife than residual risks at the decommissioned Polaris mine site.

A qualitative risk assessment has been carried out for potential hazards identified in the Subsidence Area using a risk matrix approach. A risk matrix is comprised of one index representing the relative likelihood of occurrence and the other index representing the potential consequence severity of the hazard. The assessed risk is the product of the likelihood and consequence which can be visualized with a risk matrix. Table 2 presents a 5 x 5 risk matrix that was used to assess the safety risk to either humans or wildlife of subsidence area hazards. The *Likelihood Index* ranges from a “Rare” event to a “Certain” event along the vertical axis and can be defined by probability values (as percentages) or expected frequency of occurrence. The *Consequence Severity Index* ranges from “Negligible” to “Disastrous” with descriptions of each of the five consequence categories related to safety along the horizontal axis. A risk matrix is a valuable tool for communicating risk assessment results, prioritizing risks and implementing effective risk mitigation options. By qualitatively assessing the likelihood and consequence of potential hazards, a 5 x 5 risk matrix can be used to assign a risk rating from 1 through 25. The risk rating determined by the matrix is color coded to help identify if risk management actions or mitigation is required. For the risk matrix shown in Table 2, a risk rating between 1 and 6 (green) would be considered minor and can be managed by ongoing monitoring. A risk rating between 7 and 15 (yellow) would be considered moderate and require evaluation of mitigation measures to reduce the risk. A risk rating 16 or higher (red) would be considered significant and require immediate action to reduce the risk rating to an acceptable level.

Qualitative risk assessment of the safety hazards listed in Table 3 all result in risk ratings less than 6 that would be considered minor and can be managed by ongoing monitoring. Therefore biannual geotechnical inspections of the site (e.g., every 2 years) are recommended to confirm that any additional settlement does not increase safety risk to an unacceptable level. Potential risk mitigation options that could be considered in the future to reduce risk if further settlement is observed include:

- Placing additional backfill inside the CSP at raise locations with significant internal settlement (e.g., more than 0.3 m); and/or
- Placement of high visibility signage or boulders around vent/backfill raises with exposed CSP extending 1 m or more above ground.

However, it should be noted that placing boulders to warn or prevent access to an area will not remove the risk. For example, the risk of crashing an ATV into a raise CSP that extends above ground surface is no different than crashing into a boulder that naturally exists on the tundra.

Table 2: Risk Matrix

Likelihood	Risk Rating				
Certain • 99% probability, or • could occur within months	**11**	**16**	**20**	**23**	**25**
Likely • 50-99% probability, or • could occur annually	**7**	**12**	**17**	**21**	**24**
Possible • 20-50% probability, or • could occur in 2-5 years	**4**	**8**	**13**	**18**	**22**
Unlikely • 1-20% probability, or • could occur in 5-20 years	**2**	**5**	**9**	**14**	**19**
Rare • <1% probability, or • Occurs less than once every 20 years	**1**	**3**	**6**	**10**	**15**
	Negligible	**Minor**	**Moderate**	**Serious**	**Disastrous**
Consequence Category	Reversible injury requiring first aid	Reversible injury resulting in 5 or less disabling days	Reversible injury resulting in more than 5 disabling days	Single fatality or permanent injury to 1 person	Multiple fatalities or permanent injury to more than 10 persons

Table 3: Subsidence Area Qualitative Risk Assessment Results

Hazard	Likelihood	Consequence Category	Risk Rating	Recommendation
Tripping hazard from settlement inside CSP less than 0.3 m deep	Rare	Negligible	1 (green)	Ongoing monitoring for increased settlement
Tripping hazard from settlement inside CSP more than 0.3 m deep	Rare	Minor	3 (green)	Ongoing monitoring for increased settlement
ATV flat tire from driving over raised CSP edge	Rare	Negligible	1 (green)	Ongoing monitoring for increased settlement
ATV rollover in thaw settlement depression more than 1 m deep	Rare	Moderate	6 (green)	Ongoing monitoring for increased settlement
ATV crash into exposed CSP that extends more than 1 m above ground surface	Rare	Moderate	6 (green)	Ongoing monitoring for increased settlement

6.0 CLOSURE AND RECOMMENDATIONS

Based on the geotechnical inspection completed on September 2, 2014 the decommissioned former Polaris mine site generally appeared to be in a stable condition. A qualitative risk assessment was carried out for safety hazards identified in the subsidence area. Biannual geotechnical inspections of the site (e.g., every 2 years) are recommended to confirm that any additional settlement at the vent/backfill raises in the subsidence does not increase safety risk to an unacceptable level. No potential safety risks to either humans or wildlife were identified for the other areas inspected in September 2014.

We trust this report meets your present requirements. Please feel free to contact the undersigned should you have any questions.

Report Signature Page

GOLDER ASSOCIATES LTD.

Darrin Johnson, P.Eng.
Associate, Senior Geotechnical Engineer

Peter Merry, P.Eng.
Associate, Senior Geotechnical Engineer

DCJ/PM

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APPENDIX A

2014 Polaris Geotechnical Inspection Photographs

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

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Golder Associates

Azimuth Consulting Group Partnership
218-2902 West Broadway
Vancouver, BC
Canada V6K 2G8

Phone: 604-730-1220
Fax: 604-739-8511
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Our File #: TC-11-02

October 17, 2014

Mr. Bruce Donald
Teck Metals
Bag 2000
Kimberley, BC V1A 3E1

Dear Mr. Donald:

RE: Water Quality Summary Report – Garrow Creek 2014

This letter describes the chemistry of Garrow Creek during two Garrow Creek water quality testing periods during the open water period of 2014 and compares these results to historic data collected since mine closure in 2002. Garrow Creek drains Garrow Lake, historically used as a tailings deposition facility and as such, the creek has represented the 'effluent' source from this facility, which has been the subject of considerable study over the last decade.

Background

Garrow Lake is a small (4.2 km^2), permanently chemically and thermally stratified meromictic lake with a maximum depth of 40 m and unique limnological characteristics (Ouellet and Dickman 1983, Fallis et al, 1987, Azimuth 2005). The lake is ultra-oligotrophic with very low nutrient concentration and a depauperate biological community that inhabits the upper oxygenated layer, including a marine relict population of fourhorn sculpin, *Myoxocephalus quadricornis* (Fallis et al. 1987).

The drainage area of Garrow Lake is very small. This, combined with low annual precipitation means that total annual discharge from the lake via Garrow Creek is also small. Discharge to Garrow Bay, 1.4 km south of the lake outlet occurs during the brief open water period when the creek channel thaws in late June or early July, through early September when the system freezes again. Discharge is relatively high for about two weeks in early July, before diminishing to a base flow for the remainder of the discharge period.

2014 Garrow Creek Chemistry

Methods – Two sets of water samples were collected in 2014; the first on July 10 by the Aboriginal Affairs and Northern Development Canada (AANDC) and the second on September 2, coordinated by SRK Consultants for Teck. Laboratory reports by Taiga

Environmental Whitehorse and Exova Ottawa Ontario for the July and September collections respectively, are provided in **Appendix A**.

Water from Garrow Creek was collected by hand by wading into the stream and directing a laboratory supplied collecting vessel into the stream and allowed to fill. In each event, water was collected for analysis of conventional parameters (pH, turbidity, TSS, hardness, alkalinity, conductivity), nutrients (nitrogen, phosphorus) and total metals concentrations. In the July collection, water was also analysed for hydrocarbons. We presume that appropriate preservatives were added in the field; we don't know if samples were filtered in the field or in the lab for dissolved parameters.

Quality Control – There were no quality control/quality assurance (QA/QC) samples collected in July. In the September sampling event, three QA/QC samples were collected including a field duplicate sample (an independent sample collected at a slightly different time), a trip blank (laboratory distilled water carried from the lab to site and back, unopened) and a field blank (laboratory distilled water used to clean and rinse sampling vessels). Results of all QA/QC samples were within acceptable ranges. Field duplicate results were very similar to original sample results; metals in trip and field blank samples were all at non-detectable concentrations.

Results – While this technical memorandum focuses on zinc concentrations, which has been the main contaminant of concern in Garrow Lake, as a result of an accidental spill of tailings material into Garrow Lake surface waters during mine operations, select conventional parameters and metals are also addressed.

Conventional Parameters – Key indicator parameters in Garrow Creek water are pH, salinity and/or conductivity and total suspended solids. Results of these parameters are a direct indicator of surface water conditions within Garrow Lake. In 2014, pH (7.4, 7.8), conductivity (1240 µS/cm, 5980 µS/cm) and TSS (12, <2 mg/L) in Garrow Creek were within expected ranges during the July and September sampling events respectively (Azimuth 2011). These results confirm that surface water limnological conditions of Garrow Lake are normal. The TSS concentration in the spring sample was somewhat higher than 'normal' and was likely due to freshet flow.

Zinc – Historically, zinc concentrations in Garrow Lake, like other metals, typically increase over the course of the open water season, as runoff from the lake is less influenced by the diluting effect of ice melt and rainwater. In the few years since cessation of tailings deposition to the bottom of Garrow Lake there has been a general decline in zinc concentrations in Garrow Lake surface waters and thus Garrow Creek. Lake/creek concentrations have been stable since 2004. **Figure 1** depicts the temporal trend in Garrow Creek zinc concentration between 2001 and 2011, with the 2014 concentrations overlain. In July, the zinc concentration was 28 µg/L and 55 µg/L (averaged over two samples) in September. Since 2004, zinc has ranged from 10 – 25 µg/L in early July to 30 – 70 µg/L by September. These concentrations are within the expected concentration range for zinc for these dates and well below the license limit of 500 µg/L (0.5 mg/L).

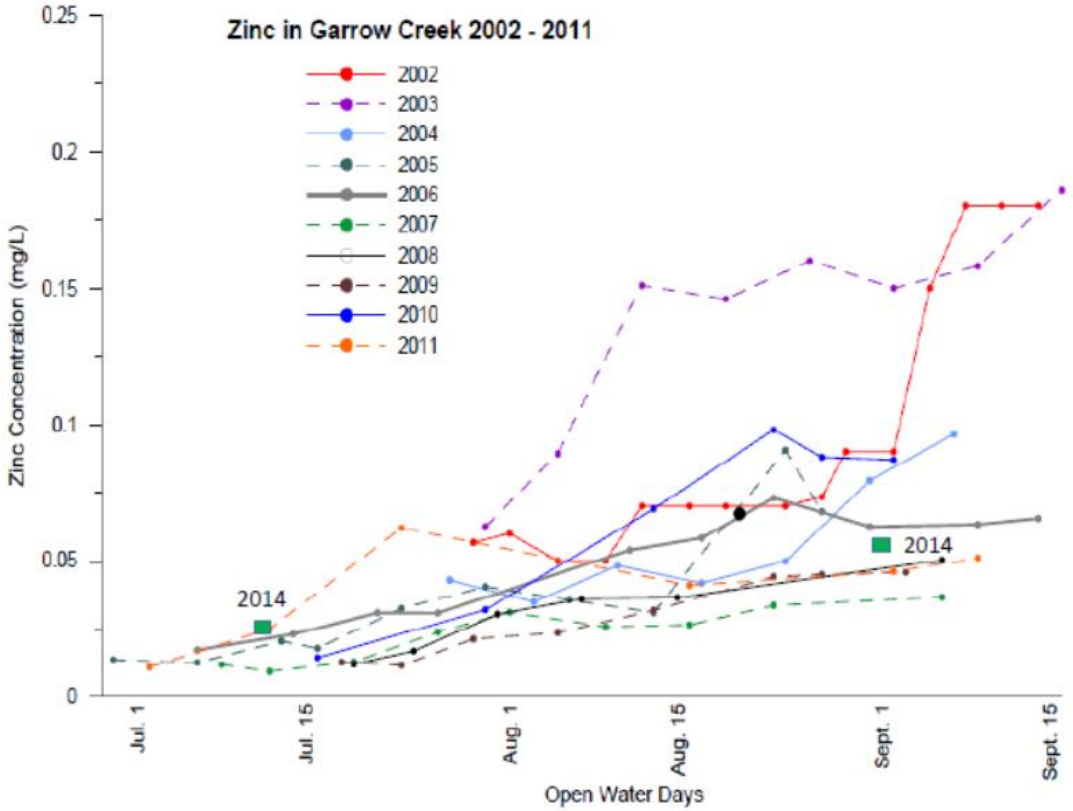


Figure 1. Zinc concentration (mg/L) 2002 – 2011 with 2014 data.

Other Metals – Data on other metals collected in 2014 are contained in **Appendix A**. Although a detailed comparison of 2014 data with historic data has not been made, a few select heavy metals are highlighted here for illustration. Metal concentrations for arsenic, cadmium, copper and lead from 2014 are compared to the range of 2011 data (Azimuth 2011), the most recent year that total metals data were collected over the open water season from Garrow Creek. Note that detection limits (DLs) achieved by Exova are higher than in previous years. This may have been due to interference by the highly brackish water of the creek. We recommend that Exova use lower DLs or another lab be chosen that can achieve lower DLs.

Note that like zinc, concentrations of other metals also tend to be higher in fall than in spring. Results (July and September respectively) are as follows:

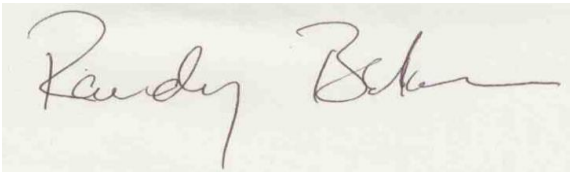
- Arsenic in 2014 was <0.5 and 0.5 µg/L, within the range (<0.5 – 0.5 µg/L) of 2011 data.
- Cadmium in 2014 was <0.1 and <0.5 µg/L, higher than the range of 0.05 – 0.40 µg/L because of higher detection limits in 2014.
- Copper in 2014 was 1.7 and <5 µg/L, within the range of 0.5 – 1.5 µg/L in 2011.

- Lead in 2014 was 0.5 µg/L in July, within the range of 0.1 – 0.5 µg/L in 2011. The DL was too high in September.

- Nickel in 2014 was 2.5 in July, within the range of 0.2 – 9 µg/L in 2011. The DL was too high in September.

Summary – Conventional parameter and zinc concentrations in Garrow Creek in July and September of 2014 were typical and well within the range of concentrations observed in historic sampling dating back to 2001. These data suggest that limnological conditions in Garrow Lake are stable and have not changed.

Sincerely,
Azimuth Consulting Group



Randy Baker, M.Sc., R.P.Bio. Principal

References

Azimuth Consulting Group. 2005. Limnology and ecology of Garrow Lake, Little Cornwallis Island, Nunavut – August 2003. A report prepared for Teck Cominco Metals, Kimberley BC by Azimuth Consulting Group, Vancouver BC. May, 2005. 48 p. + App.

Azimuth Consulting Group. 2011. Technical Memo prepared for Teck on October 17, 2011. Evaluation of limnological and chemical conditions of Garrow Lake and chemistry of Garrow Creek, Nunavut 2002 – 2011.

Fallis, B.W., S. M. Harbicht and B.J. Mackenzie. 1987. A preliminary study of the limnology and biology of Garrow Lake, Northwest Territories; an Arctic meromictic lake. Department of Fisheries and Oceans, Winnipeg, MB. Unpublished data. ii + 55 p.

Ouellet, M. and M. Dickman. 1983. The meromictic Garrow Lake, Canadian Arctic Archipelago. INRS-Eau, Rep. 77. 85 p.

Appendix A

Taiga Environmental – July 2014 Results

Exova Lab – September 2014 Conventional parameters (ignore metals due to DL issues)

Exova Lab – September 2014 Metals analysis

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 140489

- FINAL REPORT -

Prepared For: Nunavut District Office

Address: Box 100
Iqaluit,NU
X0A 0H0

Attn: **Andrew Keim** **Facsimile: (867) 979-6445**

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) to ISO/IEC 17025 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: Thursday, July 31, 2014
Print Date: ***Thursday, July 31, 2014***

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 140489

- CERTIFICATE OF ANALYSIS -

Client Sample ID: Frustration **Taiga Sample ID:** 001

Client Project: Polaris
Sample Type: Raw Water
Received Date: 14-Jul-14
Sampling Date: 10-Jul-14
Sampling Time: 13:00
Location: Polaris
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Nutrients						
Ammonia as Nitrogen	0.007	0.005	mg/L	16-Jul-14	SM4500-NH3:	
Chemical Oxygen Demand	6	5	mg/L	14-Jul-14	SM5220:D	
Nitrogen, Total	0.24	0.06	mg/L	14-Jul-14	ISO/TR 11905	
Inorganics - Physicals						
Alkalinity, Total (as CaCO3)	48.0	0.4	mg/L	14-Jul-14	SM2320:B	
Colour, Apparent	15	5	CU	14-Jul-14	SM2120:B	
Conductivity, Specific (@25C)	187	0.4	µS/cm	14-Jul-14	SM2510:B	
pH	7.83		pH units	14-Jul-14	SM4500-H:B	
Solids, Total Suspended	6	3	mg/L	17-Jul-14	SM2540:D	
Turbidity	2.05	0.05	NTU	17-Jul-14	SM2130:B	
Major Ions						
Calcium	20.4	0.1	mg/L	14-Jul-14	SM4110:B	
Chloride	11.7	0.7	mg/L	14-Jul-14	SM4110:B	
Hardness	70.8	0.7	mg/L	14-Jul-14	SM4110:B	

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Taiga Batch No.: 140489

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Client Sample ID: Frustration **Taiga Sample ID:** 001

Magnesium	4.8	0.1	mg/L	14-Jul-14	SM4110:B	
Nitrate+Nitrite as Nitrogen	0.09	0.01	mg/L	14-Jul-14	SM4110:B	
Potassium	0.6	0.1	mg/L	14-Jul-14	SM4110:B	
Sodium	7.8	0.1	mg/L	14-Jul-14	SM4110:B	
Sulphate	25	1	mg/L	14-Jul-14	SM4110:B	
Organics						
Hexane Extractable Material		2.0	mg/L		EPA1664A	104
Oil and Grease, visible	Non-visible			16-Jul-14	Visual Exam	
Subcontracted Organics						
Benzene	< 0.0050	0.005	mg/L	17-Jul-14	EPA 5021	
Ethylbenzene	< 0.0050	0.005	mg/L	17-Jul-14	EPA 5021	
Toluene	< 0.0050	0.005	mg/L	17-Jul-14	EPA 5021	
Xylenes	< 0.0071	0.0071	mg/L	17-Jul-14	EPA 5021	
Trace Metals						
Aluminum	36.7	5	µg/L	25-Jul-14	EPA200.8	
Antimony	0.1	0.1	µg/L	25-Jul-14	EPA200.8	
Arsenic	0.3	0.2	µg/L	25-Jul-14	EPA200.8	
Barium	114	0.1	µg/L	25-Jul-14	EPA200.8	
Beryllium	< 0.1	0.1	µg/L	25-Jul-14	EPA200.8	
Cadmium	< 0.10	0.1	µg/L	25-Jul-14	EPA200.8	
Cesium	< 0.1	0.1	µg/L	25-Jul-14	EPA200.8	
Chromium	0.2	0.1	µg/L	25-Jul-14	EPA200.8	
Cobalt	< 0.1	0.1	µg/L	25-Jul-14	EPA200.8	
Copper	0.9	0.2	µg/L	25-Jul-14	EPA200.8	
Iron	39	5	µg/L	25-Jul-14	EPA200.8	

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- CERTIFICATE OF ANALYSIS -

Client Sample ID: Frustration **Taiga Sample ID:** 001

Lead	0.1	0.1	µg/L	25-Jul-14	EPA200.8
Lithium	1.4	0.2	µg/L	25-Jul-14	EPA200.8
Manganese	1.5	0.1	µg/L	25-Jul-14	EPA200.8
Mercury	< 0.01	0.01	µg/L	25-Jul-14	EPA200.8
Molybdenum	0.6	0.1	µg/L	25-Jul-14	EPA200.8
Nickel	1.0	0.1	µg/L	25-Jul-14	EPA200.8
Rubidium	0.2	0.1	µg/L	25-Jul-14	EPA200.8
Selenium	< 0.5	0.5	µg/L	25-Jul-14	EPA200.8
Silver	0.2	0.1	µg/L	25-Jul-14	EPA200.8
Strontium	922	0.1	µg/L	25-Jul-14	EPA200.8
Thallium	< 0.1	0.1	µg/L	25-Jul-14	EPA200.8
Titanium	1.2	0.1	µg/L	25-Jul-14	EPA200.8
Uranium	0.4	0.1	µg/L	25-Jul-14	EPA200.8
Vanadium	0.5	0.1	µg/L	25-Jul-14	EPA200.8
Zinc	5.3	5	µg/L	25-Jul-14	EPA200.8

ReportDate: Thursday, July 31, 2014
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Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 140489

- CERTIFICATE OF ANALYSIS -

Client Sample ID: Garrow **Taiga Sample ID:** 002

Client Project: Polaris
Sample Type: Leachate/Dump
Received Date: 14-Jul-14
Sampling Date: 10-Jul-14
Sampling Time: 13:00
Location: Polaris
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Nutrients						
Ammonia as Nitrogen	0.048	0.005	mg/L	16-Jul-14	SM4500-NH3:	
Chemical Oxygen Demand	10	5	mg/L	14-Jul-14	SM5220:D	
Nitrogen, Total	0.62	0.06	mg/L	14-Jul-14	ISO/TR 11905	
Inorganics - Physicals						
Colour, Apparent	27	5	CU	14-Jul-14	SM2120:B	
Conductivity, Specific (@25C)	1240	0.4	µS/cm	14-Jul-14	SM2510:B	
pH	7.36		pH units	14-Jul-14	SM4500-H:B	
Solids, Total Suspended	12	3	mg/L	17-Jul-14	SM2540:D	
Turbidity	1.29	0.05	NTU	25-Jul-14	SM2130:B	
Major Ions						
Calcium	40.4	0.1	mg/L	14-Jul-14	SM4110:B	
Chloride	289	0.7	mg/L	14-Jul-14	SM4110:B	
Hardness	201	0.7	mg/L	14-Jul-14	SM4110:B	
Magnesium	24.3	0.1	mg/L	14-Jul-14	SM4110:B	
Nitrate+Nitrite as Nitrogen	0.39	0.01	mg/L	14-Jul-14	SM4110:B	
Potassium	7.1	0.1	mg/L	14-Jul-14	SM4110:B	

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Taiga Batch No.: 140489

- CERTIFICATE OF ANALYSIS -

Client Sample ID: Garrow **Taiga Sample ID:** 002

Sodium	168	0.1	mg/L	14-Jul-14	SM4110:B
Sulphate	121	1	mg/L	14-Jul-14	SM4110:B
Organics					
Hexane Extractable Material	< 2.0	2.0	mg/L	24-Jul-14	EPA1664A
Oil and Grease, visible	Non-visible			16-Jul-14	Visual Exam
Subcontracted Organics					
Benzene	< 0.0050	0.005	mg/L	17-Jul-14	EPA 5021
Ethylbenzene	< 0.0050	0.005	mg/L	17-Jul-14	EPA 5021
Toluene	< 0.0050	0.005	mg/L	17-Jul-14	EPA 5021
Xylenes	< 0.0071	0.0071	mg/L	17-Jul-14	EPA 5021
Trace Metals					
Aluminum	104	5	µg/L	25-Jul-14	EPA200.8
Antimony	0.2	0.1	µg/L	25-Jul-14	EPA200.8
Arsenic	0.5	0.2	µg/L	25-Jul-14	EPA200.8
Barium	51.0	0.1	µg/L	25-Jul-14	EPA200.8
Beryllium	< 0.1	0.1	µg/L	25-Jul-14	EPA200.8
Cadmium	< 0.10	0.1	µg/L	25-Jul-14	EPA200.8
Cesium	< 0.1	0.1	µg/L	25-Jul-14	EPA200.8
Chromium	0.3	0.1	µg/L	25-Jul-14	EPA200.8
Cobalt	0.1	0.1	µg/L	25-Jul-14	EPA200.8
Copper	1.7	0.2	µg/L	25-Jul-14	EPA200.8
Iron	154	5	µg/L	25-Jul-14	EPA200.8
Lead	0.5	0.1	µg/L	25-Jul-14	EPA200.8
Lithium	7.2	0.2	µg/L	25-Jul-14	EPA200.8
Manganese	17.4	0.1	µg/L	25-Jul-14	EPA200.8

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Taiga Batch No.: 140489

- CERTIFICATE OF ANALYSIS -

Client Sample ID: Garrow **Taiga Sample ID:** 002

Mercury	< 0.01	0.01	µg/L	25-Jul-14	EPA200.8
Molybdenum	2.2	0.1	µg/L	25-Jul-14	EPA200.8
Nickel	2.5	0.1	µg/L	25-Jul-14	EPA200.8
Rubidium	2.0	0.1	µg/L	25-Jul-14	EPA200.8
Selenium	0.7	0.5	µg/L	25-Jul-14	EPA200.8
Silver	0.1	0.1	µg/L	25-Jul-14	EPA200.8
Strontium	293	0.1	µg/L	25-Jul-14	EPA200.8
Thallium	< 0.1	0.1	µg/L	25-Jul-14	EPA200.8
Titanium	2.9	0.1	µg/L	25-Jul-14	EPA200.8
Uranium	0.7	0.1	µg/L	25-Jul-14	EPA200.8
Vanadium	0.8	0.1	µg/L	25-Jul-14	EPA200.8
Zinc	28.3	5	µg/L	25-Jul-14	EPA200.8

ReportDate: Thursday, July 31, 2014
Print Date: *Thursday, July 31, 2014*

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 140489

- CERTIFICATE OF ANALYSIS -

Client Sample ID: TB **Taiga Sample ID:** 003

Client Project: Polaris
Sample Type:
Received Date: 14-Jul-14
Sampling Date: 10-Jul-14
Sampling Time: 13:00
Location: Polaris
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Nutrients						
Ammonia as Nitrogen	< 0.005	0.005	mg/L	16-Jul-14	SM4500-NH3:	
Nitrogen, Total	0.09	0.06	mg/L	14-Jul-14	ISO/TR 11905	
Inorganics - Physicals						
Solids, Total Suspended	< 3	3	mg/L	17-Jul-14	SM2540:D	

ReportDate: Thursday, July 31, 2014
Print Date: ***Thursday, July 31, 2014***

Taiga Environmental Laboratory
4601-52nd Ave., Box 1500, Yellowknife, NT. X1A 2R3
Tel: (867)-669-2788 Fax: (867)-669-2718

Taiga Batch No.: 140489

- CERTIFICATE OF ANALYSIS -

Client Sample ID: TB **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: Thursday, July 31, 2014

Print Date: *Thursday, July 31, 2014*

EXOVA ENVIRONMENTAL ONTARIO

Certificate of Analysis

Client: Teck Metals
Bag 2000
Kimberley, BC
V1A 3E1
Attention: Mr. Mark Donald
PO#:
Invoice to: SRK Consulting

Report Number: 1419062
Date Submitted: 2014-09-05
Date Reported: 2014-09-11
Project: Polaris
COC #: 176345

Dear Mark Donald:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____

Lorna Wilson
Laboratory Supervisor, Inorganics

Client: Teck Metals
Bag 2000
Kimberley, BC
V1A 3E1
Attention: Mr. Mark Donald
PO#:
Invoice to: SRK Consulting

Report Number: 1419062
Date Submitted: 2014-09-05
Date Reported: 2014-09-11
Project: Polaris
COC #: 176345

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1131674 Water 2014-09-02 Garrow Creek	1131675 Water 2014-09-02 Garrow Creek 01	1131676 Water 2014-09-02 Field Blank	1131677 Water 2014-09-02 Trip Blank
Calculations	Hardness as CaCO3	1	mg/L			669	675	<1	<1
General Chemistry	Alkalinity as CaCO3	5	mg/L			64	53	<5	<5
	Conductivity	5	uS/cm			5980	5990	<5	<5
	pH	1.00				7.81	7.81	5.87	5.45
	Total Suspended Solids	2	mg/L			<2	<2	<2	<2
Mercury	Hg	0.0001	mg/L			<0.0001	<0.0001		<0.0001
Metals	Ag	0.0001	mg/L						<0.0001
		0.001	mg/L			<0.001	<0.001		
	Al	0.01	mg/L						<0.01
		0.1	mg/L			<0.1	<0.1		
	As	0.001	mg/L						<0.001
		0.01	mg/L			<0.01	<0.01		
	B	0.01	mg/L						<0.01
		0.1	mg/L			0.5	0.4		
	Ba	0.01	mg/L						<0.01
		0.1	mg/L			<0.1	<0.1		
	Be	0.0005	mg/L						<0.0005
		0.005	mg/L			<0.005	<0.005		
	Ca	1	mg/L			60	61	<1	<1
	Cd	0.0001	mg/L						<0.0001
		0.001	mg/L			<0.001	<0.001		
	Co	0.0002	mg/L						<0.0002
		0.002	mg/L			<0.002	<0.002		
	Cr	0.001	mg/L						<0.001
		0.01	mg/L			<0.01	<0.01		
	Cu	0.001	mg/L						<0.001

Guideline = *** = Guideline Exceedence**
** = Analysis completed at Mississauga, Ontario.
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

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Client: Teck Metals
Bag 2000
Kimberley, BC
V1A 3E1
Attention: Mr. Mark Donald
PO#:
Invoice to: SRK Consulting

Report Number: 1419062
Date Submitted: 2014-09-05
Date Reported: 2014-09-11
Project: Polaris
COC #: 176345

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1131674 Water 2014-09-02 Garrow Creek	1131675 Water 2014-09-02 Garrow Creek 01	1131676 Water 2014-09-02 Field Blank	1131677 Water 2014-09-02 Trip Blank
Metals	Cu	0.01	mg/L			<0.01	<0.01		
	Fe	0.03	mg/L						<0.03
		0.3	mg/L			<0.3	<0.3		
	K	1	mg/L			29	30		<1
	Li	0.001	mg/L						<0.001
		0.01	mg/L			0.03	0.03		
	Mg	1	mg/L			126	127	<1	<1
	Mn	0.01	mg/L						<0.01
		0.1	mg/L			<0.1	<0.1		
	Mo	0.005	mg/L						<0.005
		0.05	mg/L			<0.05	<0.05		
	Na	2	mg/L			1000	990		<2
	Ni	0.005	mg/L						<0.005
		0.05	mg/L			<0.05	<0.05		
	Pb	0.001	mg/L						<0.001
		0.01	mg/L			<0.01	<0.01		
	Sb	0.0005	mg/L						<0.0005
		0.005	mg/L			<0.005	<0.005		
	Se	0.001	mg/L						<0.001
		0.01	mg/L			<0.01	<0.01		
	Si	0.1	mg/L			0.2	0.2		<0.1
	Sr	0.001	mg/L						<0.001
		0.01	mg/L			1.20	1.12		
	Ti	0.01	mg/L						<0.01
		0.1	mg/L			<0.1	<0.1		
	Tl	0.0001	mg/L						<0.0001

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Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.			
					1131674 Water 2014-09-02 Garrow Creek	1131675 Water 2014-09-02 Garrow Creek 01	1131676 Water 2014-09-02 Field Blank	1131677 Water 2014-09-02 Trip Blank
Metals	Tl	0.001	mg/L		<0.001	<0.001		
	U	0.001	mg/L					<0.001
		0.01	mg/L		<0.01	<0.01		
	V	0.001	mg/L					<0.001
		0.01	mg/L		<0.01	<0.01		
	Zn	0.01	mg/L					<0.01
		0.1	mg/L		<0.1	<0.1		

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.
					1131678 Water 2014-09-02 DI Water
Calculations	Hardness as CaCO3	1	mg/L		<1
General Chemistry	Alkalinity as CaCO3	5	mg/L		<5
	Conductivity	5	uS/cm		<5
	pH	1.00			5.28
	Total Suspended Solids	2	mg/L		<2
Metals	Ca	1	mg/L		<1
	Mg	1	mg/L		<1

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QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 0 **Analysis Date** 2014-09-11 **Method** C SM2340B			
Hardness as CaCO3			
Run No 275719 **Analysis Date** 2014-09-06 **Method** M SM3112B-3500B			
Hg	<0.0001 mg/L	96	70-130
Run No 275850 **Analysis Date** 2014-09-09 **Method** C SM2540			
Total Suspended Solids	<2 mg/L	98	90-110
Run No 275885 **Analysis Date** 2014-09-09 **Method** SM 2320B			
Alkalinity as CaCO3	<5 mg/L	97	95-105
Conductivity	<5 uS/cm	101	95-105
pH	5.80	100	90-110
Run No 275941 **Analysis Date** 2014-09-10 **Method** EPA 200.8			
Ag	<0.0001 mg/L	101	94-106
Al	<0.01 mg/L	107	89-111
As	<0.001 mg/L	100	93-106
B	<0.01 mg/L	95	88-112

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QC Summary

Analyte	Blank	QC % Rec	QC Limits
Ba	<0.01 mg/L	106	91-109
Be	<0.0005 mg/L	102	93-107
Cd	<0.0001 mg/L	102	93-107
Co	<0.0002 mg/L	99	94-106
Cr	<0.001 mg/L	99	94-106
Cu	<0.001 mg/L	99	93-106
Fe	<0.03 mg/L	97	92-107
Li	<0.001 mg/L	100	94-106
Mn	<0.01 mg/L	102	94-106
Mo	<0.005 mg/L	98	94-106
Ni	<0.005 mg/L	96	94-106
Pb	<0.001 mg/L	103	70-130
Sb	<0.0005 mg/L	100	90-110
Se	<0.001 mg/L	102	91-108
Si	<0.1 mg/L	113	74-126
Sr	<0.001 mg/L	102	89-110
Ti	<0.01 mg/L	99	94-106

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QC Summary

Analyte	Blank	QC % Rec	QC Limits
Tl	<0.0001 mg/L	100	95-105
U	<0.001 mg/L	100	94-106
V	<0.001 mg/L	98	93-107
Zn	<0.01 mg/L	98	94-106
Run No 275972 **Analysis Date** 2014-09-10 **Method** M SM3120B-3500C			
Ca	<1 mg/L	98	80-120
K	<1 mg/L	106	80-120
Mg	<1 mg/L	98	80-120
Na	<2 mg/L	104	80-120
Run No 275999 **Analysis Date** 2014-09-10 **Method** M SM3120B-3500C			
Si	<0.1 mg/L	103	70-130
Run No 276024 **Analysis Date** 2014-09-11 **Method** EPA 200.8			
Ag	<0.001 mg/L	102	94-106
Al	<0.1 mg/L	103	89-111
As	<0.01 mg/L	100	93-106
B	<0.1 mg/L	106	88-112
Ba	<0.1 mg/L	99	91-109

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QC Summary

Analyte	Blank	QC % Rec	QC Limits
Be	<0.005 mg/L	106	93-107
Cd	<0.001 mg/L	100	93-107
Co	<0.002 mg/L	105	94-106
Cr	<0.01 mg/L	102	94-106
Cu	<0.01 mg/L	96	93-106
Fe	<0.3 mg/L	100	92-107
Li	<0.01 mg/L	100	94-106
Mn	<0.1 mg/L	100	94-106
Mo	<0.05 mg/L	99	94-106
Ni	<0.05 mg/L	99	94-106
Pb	<0.01 mg/L	107	70-130
Sb	<0.005 mg/L	97	90-110
Se	<0.01 mg/L	100	91-108
Sr	<0.01 mg/L	101	89-110
Ti	<0.1 mg/L	97	94-106
Tl	<0.001 mg/L	101	95-105
U	<0.01 mg/L	103	94-106

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QC Summary

Analyte	Blank	QC % Rec	QC Limits
V	<0.01 mg/L	99	93-107
Zn	<0.1 mg/L	101	94-106

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Project: Polaris
COC #: 176345

Sample Comment Summary

Sample ID: 1131674	Garrow Creek	Metals MRL elevated due to high conductivity (10x dilution was done).
Sample ID: 1131675	Garrow Creek 01	Metals MRL elevated due to high conductivity (10x dilution was done).

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EXOVA ENVIRONMENTAL ONTARIO

Certificate of Analysis

Client: Teck Metals
Bag 2000
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V1A 3E1
Attention: Mr. Mark Donald
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Invoice to: SRK Consulting

Report Number: 1419063
Date Submitted: 2014-09-05
Date Reported: 2014-10-03
Project: Polaris
COC #: 176345

Dear Mark Donald:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

Revision 1: This is an amendment and supercedes all previous copies of this report. Some samples MRL were too high and have been changed.

APPROVAL: _____

Nadine Pinsonneault
Team Leader, Inorganics

All analysis is completed in Ottawa, Ontario (unless otherwise indicated).

Exova (Ottawa) is certified and accredited for specific parameters by:
CALA, Canadian Association for Laboratory Accreditation (to ISO 17025), OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils), Licensed by Ontario MOE for specific tests in drinking water.

Exova (Mississauga) is accredited for specific parameters by:
SCC, Standards Council of Canada (to ISO 17025)

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only.

Guideline values listed on this report are provided for ease of use (informational purposes) only. Exova recommends consulting the official provincial or federal guideline as required.

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Report Number: 1419063
Date Submitted: 2014-09-05
Date Reported: 2014-10-03
Project: Polaris
COC #: 176345

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1131679 Water 2014-09-02 Garrow Creek - Total	1131680 Water 2014-09-02 Garrow Creek 01 - Total	1131681 Water 2014-09-02 Field Blank - Total	1131682 Water 2014-09-02 Trip Blank - Total
Mercury	Hg	0.0001	mg/L			<0.0001	<0.0001	<0.0001	<0.0001
Metals	Ag	0.0001	mg/L					<0.0001	<0.0001
		0.0005	mg/L			<0.0005	<0.0005		
	Al	0.01	mg/L					<0.01	<0.01
		0.05	mg/L			<0.05	<0.05		
	As	0.001	mg/L					<0.001	<0.001
		0.005	mg/L			<0.005	<0.005		
	B	0.01	mg/L					<0.01	<0.01
		0.05	mg/L			0.40	0.39		
	Ba	0.01	mg/L					<0.01	<0.01
		0.05	mg/L			<0.05	<0.05		
	Be	0.0005	mg/L					<0.0005	<0.0005
		0.002	mg/L			<0.002	<0.002		
	Ca	1	mg/L			60	60	<1	<1
	Cd	0.0001	mg/L					<0.0001	<0.0001
		0.0005	mg/L			<0.0005	<0.0005		
	Co	0.0002	mg/L					<0.0002	<0.0002
		0.001	mg/L			<0.001	<0.001		
	Cr	0.001	mg/L					<0.001	<0.001
		0.005	mg/L			<0.005	<0.005		
	Cu	0.001	mg/L					<0.001	<0.001
		0.005	mg/L			<0.005	<0.005		
	Fe	0.03	mg/L					<0.03	<0.03
		0.2	mg/L			<0.2	<0.2		
	K	1	mg/L			29	29	<1	<1
	Li	0.001	mg/L					<0.001	<0.001

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Certificate of Analysis

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Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1131679 Water 2014-09-02 Garrow Creek - Total	1131680 Water 2014-09-02 Garrow Creek 01 - Total	1131681 Water 2014-09-02 Field Blank - Total	1131682 Water 2014-09-02 Trip Blank - Total
Metals	Li	0.005	mg/L			0.035	0.034		
	Mg	1	mg/L			125	125	<1	<1
	Mn	0.01	mg/L					<0.01	<0.01
		0.05	mg/L			<0.05	<0.05		
	Mo	0.005	mg/L					<0.005	<0.005
		0.02	mg/L			<0.02	<0.02		
	Na	2	mg/L			952	950	<2	<2
	Ni	0.005	mg/L					<0.005	<0.005
		0.02	mg/L			<0.02	<0.02		
	Pb	0.001	mg/L					<0.001	<0.001
		0.005	mg/L			<0.005	<0.005		
	Sb	0.0005	mg/L					<0.0005	<0.0005
		0.002	mg/L			<0.002	<0.002		
	Se	0.001	mg/L					<0.001	<0.001
		0.005	mg/L			<0.005	<0.005		
	Si	0.1	mg/L			0.2	0.2	<0.1	<0.1
	Sr	0.001	mg/L					<0.001	<0.001
		0.005	mg/L			1.22	1.15		
	Ti	0.01	mg/L					<0.01	<0.01
		0.05	mg/L			<0.05	<0.05		
	Tl	0.0001	mg/L					<0.0001	<0.0001
		0.0005	mg/L			<0.0005	<0.0005		
	U	0.001	mg/L					<0.001	<0.001
		0.005	mg/L			<0.005	<0.005		
	V	0.001	mg/L					<0.001	<0.001
		0.005	mg/L			<0.005	<0.005		

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Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1131679 Water 2014-09-02 Garrow Creek - Total	1131680 Water 2014-09-02 Garrow Creek 01 - Total	1131681 Water 2014-09-02 Field Blank - Total	1131682 Water 2014-09-02 Trip Blank - Total
Metals	Zn	0.01	mg/L					<0.01	<0.01
		0.05	mg/L			0.06	0.05		

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1131683 Water 2014-09-02 DI Water - Total
Mercury	Hg	0.0001	mg/L			<0.0001
Metals	Ag	0.0001	mg/L			<0.0001
	Al	0.01	mg/L			<0.01
	As	0.001	mg/L			<0.001
	B	0.01	mg/L			<0.01
	Ba	0.01	mg/L			<0.01
	Be	0.0005	mg/L			<0.0005
	Ca	1	mg/L			<1
	Cd	0.0001	mg/L			<0.0001
	Co	0.0002	mg/L			<0.0002
	Cr	0.001	mg/L			<0.001
	Cu	0.001	mg/L			<0.001
	Fe	0.03	mg/L			<0.03
	K	1	mg/L			<1
	Li	0.001	mg/L			<0.001
	Mg	1	mg/L			<1
	Mn	0.01	mg/L			<0.01

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Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D. 1131683 Water 2014-09-02 DI Water - Total
Metals	Mo	0.005	mg/L		<0.005
	Na	2	mg/L		<2
	Ni	0.005	mg/L		<0.005
	Pb	0.001	mg/L		<0.001
	Sb	0.0005	mg/L		0.0021
	Se	0.001	mg/L		<0.001
	Si	0.1	mg/L		<0.1
	Sr	0.001	mg/L		<0.001
	Ti	0.01	mg/L		<0.01
	Tl	0.0001	mg/L		<0.0001
	U	0.001	mg/L		<0.001
	V	0.001	mg/L		<0.001
	Zn	0.01	mg/L		<0.01

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QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 275719 **Analysis Date** 2014-09-06 **Method** M SM3112B-3500B			
Hg	<0.0001 mg/L	96	70-130
Run No 275941 **Analysis Date** 2014-09-10 **Method** EPA 200.8			
Ag	<0.0001 mg/L	101	94-106
Al	<0.01 mg/L	107	89-111
As	<0.001 mg/L	100	93-106
B	<0.01 mg/L	95	88-112
Ba	<0.01 mg/L	106	91-109
Be	<0.0005 mg/L	102	93-107
Cd	<0.0001 mg/L	102	93-107
Co	<0.0002 mg/L	99	94-106
Cr	<0.001 mg/L	99	94-106
Cu	<0.001 mg/L	99	93-106
Fe	<0.03 mg/L	97	92-107
Li	<0.001 mg/L	100	94-106

Guideline = *** = Guideline Exceedence**
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Client: Teck Metals
Bag 2000
Kimberley, BC
V1A 3E1
Attention: Mr. Mark Donald
PO#:
Invoice to: SRK Consulting

Report Number: 1419063
Date Submitted: 2014-09-05
Date Reported: 2014-10-03
Project: Polaris
COC #: 176345

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Mn	<0.01 mg/L	102	94-106
Mo	<0.005 mg/L	98	94-106
Ni	<0.005 mg/L	96	94-106
Pb	<0.001 mg/L	103	70-130
Sb	<0.0005 mg/L	100	90-110
Se	<0.001 mg/L	102	91-108
Si	<0.1 mg/L	113	74-126
Sr	<0.001 mg/L	102	89-110
Ti	<0.01 mg/L	99	94-106
Tl	<0.0001 mg/L	100	95-105
U	<0.001 mg/L	100	94-106
V	<0.001 mg/L	98	93-107
Zn	<0.01 mg/L	98	94-106
Run No 275972 **Analysis Date** 2014-09-10 **Method** M SM3120B-3500C			
Ca	<1 mg/L	98	80-120
K	<1 mg/L	106	80-120
Mg	<1 mg/L	98	80-120

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QC Summary

Analyte	Blank	QC % Rec	QC Limits
Na	<2 mg/L	104	80-120
Run No 275999 **Analysis Date** 2014-09-10 **Method** M SM3120B-3500C			
Si	<0.1 mg/L	103	70-130
Run No 277278 **Analysis Date** 2014-10-02 **Method** EPA 200.8			
Ag	<0.0005 mg/L	102	94-106
Al	<0.05 mg/L	98	89-111
As	<0.005 mg/L	102	93-106
B	<0.05 mg/L	97	88-112
Ba	<0.05 mg/L	100	91-109
Be	<0.002 mg/L	98	93-107
Cd	<0.0005 mg/L	101	93-107
Co	<0.001 mg/L	101	94-106
Cr	<0.005 mg/L	101	94-106
Cu	<0.005 mg/L	101	93-106
Fe	<0.2 mg/L	98	92-107
Li	<0.005 mg/L	99	94-106
Mn	<0.05 mg/L	101	94-106

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QC Summary

Analyte	Blank	QC % Rec	QC Limits
Mo	<0.02 mg/L	98	94-106
Ni	<0.02 mg/L	100	94-106
Pb	<0.005 mg/L	105	70-130
Sb	<0.002 mg/L	99	90-110
Se	<0.005 mg/L	101	91-108
Sr	<0.005 mg/L	101	89-110
Ti	<0.05 mg/L	101	94-106
Tl	<0.0005 mg/L	100	95-105
U	<0.005 mg/L	101	94-106
V	<0.005 mg/L	98	93-107
Zn	<0.05 mg/L	100	94-106

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Sample Comment Summary

Sample ID: 1131679	Garrow Creek - Total	Metals MRL elevated due to high conductivity (5x dilution was done). Metals results are total.
Sample ID: 1131680	Garrow Creek 01 - Total	Metals MRL elevated due to high conductivity (5x dilution was done). Metals results are total.
Sample ID: 1131681	Field Blank - Total	Metals results are total.
Sample ID: 1131682	Trip Blank - Total	Metals results are total.
Sample ID: 1131683	DI Water - Total	Metals results are total.

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