Appendix 10-A

Brucejack Gold Mine Project: 2012 Surface Water Hydrology Baseline Report

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Pretium Resources Inc.

BRUCEJACK GOLD MINE PROJECT
2012 Surface Water Hydrology Baseline Report

PRETIVM

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BRUCEJACK GOLD MINE PROJECT

2012 SURFACE WATER HYDROLOGY BASELINE REPORT

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Prepared for:

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Pretium Resources Inc.

Prepared by:

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Executive Summary

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Executive Summary

The Brucejack Property is situated within the Sulphurets District of the Iskut River region, approximately 20 kilometres northwest of Bowser Lake or 65 kilometres north-northwest of the town of Stewart, British Columbia. The present report documents surface water hydrology baseline studies completed for the project area.

The objective of this study was to estimate key hydrologic parameters that characterize the hydrologic regime within the Project area for use in the environmental assessment as well as to assist in engineering design. In order to achieve this objective, Rescan established a hydrometric monitoring network and collected hydrometric data at streams, creeks, rivers, and lakes within the Project area during 2009 to 2012. This network evolved through the period of study as the scope of the Project changed. Hydrometric stations within the Project area that were used in this report include:

- the outflow of Brucejack Lake that characterizes the local hydrologic regime at Mine Site;
- three stations on Scott Creek, Todedada Creek, and Wildfire Creek watersheds that may be impacted by access roads;
- a water level station in the Brucejack Lake; and
- three hydrometric stations from a neighbouring project in Sulphurets-Unuk watersheds.

The data set is particularly valuable since there are few hydrologic records from similar catchments from the Water Survey of Canada or elsewhere. This is especially true for watersheds less than 100 km^2 in size. Monitored watersheds size, elevation, and glacierized coverage varied; as a result, different hydrologic regimes were seen in these watersheds. These include nival (Wildfire Creek), mixed (Brucejack Creek, Unuk River, Scott Creek, and Todedada Creek) and glacial (Sulphurets lake and Sulphurets Creek) regimes. Annual observed runoff values ranged from 1,188 mm at Wildfire-Hydro to 2,588 mm at Todedada-Hydro.

Observed data within the Project area were supplemented by regional hydrologic analyses based on Water Survey of Canada Stations to estimate key hydrologic indices in the Project area. These indices include mean annual runoff, monthly distribution of runoff, and peak and low flows. Based on the regional analyses, mean annual runoff values in watersheds within the Project area were estimated as a function of the median elevation of the watershed. Peak and low flows were proved to be dependent on the drainage area of watersheds.

Acknowledgements

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Acknowledgements

This report was produced for Pretium Resources Inc. by Rescan Environmental Services Ltd. It was written by Ali Naghibi (Ph.D., P.Eng.) and Emerson Belland (B.Sc.), and reviewed by David Luzi (M.Sc.). Ted Lewis (Ph.D.), Eli Hayman (B.Sc.) and Michael Soloducha (B.Sc.) contributed to analysis, QA/QC, presentation, budgeting, and field planning. Greg Norton (M.Sc.) was the project manager and Nicole Bishop (B.Sc.) the project coordinator. Field work was conducted by Emerson Belland, Michael Soloducha, Xavier Pinto, and Rob Larson with assistance from Brian Tait, Brendan Simpson and Ken Johnson of the Skii km Lax Ha, Trevor Englesmeier (Pretium), and Mark Jenkins and Stephanie Boha.

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Glossary and Abbreviations

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Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

7-day low flow	The minimum average 7-day flow that occurs over a specified period, such as a month, season or year.
Annual runoff	Annual runoff is a measure of the hydrological response of a drainage basin. It is often presented as a depth, in mm, over an entire basin allowing direct comparison with precipitation totals.
Bankfull Stage/Discharge	The stage or discharge of a watercourse in which the stream completely fills its channel and the elevation of the water surface coincides with the bank margins.
Discharge	The volume of flow moving through a cross section of a stream in a given unit of time; commonly expressed in cubic meters per second.
Freshet	In channels, the relatively high annual peak water discharge period resulting from spring/summer meltwater runoff of the snowpack accumulated over the winter.
Glacierized	A land area that is presently occupied or affected by glacial ice processes.
Hydrograph	A graphic presentation of the variation in discharge with elapsed time, based on data of stream gauging at a given hydrometric station on a stream.
masl	Metres Above Sea Level
Median Elevation	The elevation within a watershed which half the basin area lies above and half lies below.
NAD 83	North American Datum of 1983. The horizontal control datum for the U.S., Canada, Mexico, and Central America, based on a geocentric origin and the Geodetic Reference System 1980.
Pretivm	Pretium Resources Inc.
Rescan	Rescan Environmental Services Ltd.
Stage	The height of the water surface in a stream above its bed or a fixed level near the bed.
Stage-Discharge Curve	A curve derived from concurrently measured stage and discharge data that is used to estimate the discharge for any given observed stage. Often referred to as a rating curve for a hydrometric station.
The Project	Brucejack Gold Mine Project
Unit Yield	An index of discharge normalized by drainage area. This index allows for direct comparison of the potential rate of water volumes that can be expected from various sized drainage basins.
USGS	United States Geological Survey

UTM	Universal Transverse Mercator. A mathematical transformation (map projection) of the earth's surface to create a flat map sheet.
WSC	Water Survey of Canada

1. Introduction

1. Introduction

This report presents the results of the surface water hydrology baseline study completed by Rescan Environmental Services (Rescan) for the Brucejack Gold Mine Project (the Project). The report summarizes the hydrologic monitoring that was initiated and has continued since the fall of 2009. The purpose of the hydrology baseline study was to collect hydrologic information within the Project area in order to characterize its hydrologic regime.

Surface water flows affect water quantity and quality, and act as the habitat and transport medium for fish, along with aquatic and terrestrial life and their food sources. A surface water hydrology baseline study can be used to assess the potential impacts of the mine infrastructure on hydrologic characteristics and flow discharges in the drainage basins within the Project area, as well as downstream water bodies.

The Project study area lies within the Coast Mountains of northwestern British Columbia. With its proximity to the coast, the region is characterized by steep, rugged, high elevation topography with substantial glacier coverage that receives relatively high amounts of precipitation. The humid climate and physical characteristics of the region result in dynamic streams and rivers with high annual runoff rates and high average stream flows, making water resource management an important issue for mine plan development as well as operation and closure planning.

The report provides results from the field monitoring program, as well as a review of regional long-term datasets from hydrometric monitoring stations near the Project area. The data were used to prepare estimates of key hydrologic parameters that characterize the hydrologic regime within the Project area for use in the environmental assessment as well as to assist in engineering design. The main body of the report is divided into three sections:

- description of the hydrological setting of the Project area;
- summary results of the hydrometric monitoring program to date; and
- regional hydrologic analysis and derivation of hydrologic indices.

This report also includes Appendices that describe additional studies undertaken in support of the main hydrologic assessment. Appendices 1 to 6 contain data collected during the field monitoring program, and data used to describe the environmental setting of the region. This data includes:

- physiographic maps of the watersheds;
- manual discharge measurements;
- stage-discharge rating curves and channel geometry surveys;
- notes related to water level records at the hydrometric stations;
- discharge hydrographs; and
- daily discharge tables.

2. Project Description

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2. Project Description

Pretium Resources Inc. (Pretivm) proposes to develop the Brucejack Gold Mine Project (the Project) as a 2,700 tonne per day (tpd) underground gold and silver mine. The Brucejack property is located at 56°28′20″ N latitude by 130°11′31″ W longitude, which is approximately 950 km northwest of Vancouver, 65 km north-northwest of Stewart, and 21 km south-southeast of the closed Eskay Creek Mine (Figure 2-1). The Project is located within the Kitimat-Stikine Regional District. Several First Nation and Treaty Nations have traditional territory within the general region of the Project including the Skii km Lax Ha, the Nisga'a Nation, the Tahltan Nation, the Gitxan First Nation, and the Gitanyow First Nation.

The mine site area will be located near Brucejack Lake. Vehicle access to the mine site will be via an existing exploration access road from Highway 37 that may require upgrades to facilitate traffic during mine operations. A transmission line will connect the mine site to the provincial power grid near Stewart or along Highway 37; two options are currently under consideration.

The Project is located within the boundary range of the Coast Mountain Physiographic Belt, along the western margin of the Intermontane Tectonic Belt. The local terrain ranges from generally steep in the western portion of the Project area in the high alpine with substantial glacier cover to relatively subdued topography in the eastern portion of the Project area towards the Bell-Irving River. The Brucejack mine site will be located above the tree line in a mountainous area at an elevation of approximately 1,400 masl; surrounding peaks measure 2,200 m in elevation. The access and transmission corridors will span a range of elevations and ecosystems reaching a minimum elevation near the Bell Irving River of 500 masl. Sparse fir, spruce, and alder grow along the valley bottoms, with only scrub alpine spruce, juniper, alpine grass, moss, and heather covering the steep valley walls.

The general area of the Brucejack Property has been the target of mineral exploration since the 1960s. In the 1980s Newhawk Gold Mines Ltd. conducted advanced exploration activities at the current site of the proposed Brucejack mine site that included 5 km of underground development, construction of an access road along the Bowser River and Knipple Glacier, and resulted in the deposition of 60,000 m^3 of waste rock within Brucejack Lake.

Environmental baseline data was collected from Brucejack Lake and the surround vicinity in the 1980s to support a Stage I Impact Assessment for the Sulphurets Project proposed by Newhawk Gold Mines Ltd. Silver Standard Resources Inc. commenced recent environmental baseline studies specific to the currently proposed Project in 2009 which have been continued by Pretivm, following its acquisition of the Project in 2010. The scope and scale of the recent environmental baseline programs have varied over the period from 2009 to the present as the development plan for the Project has evolved.

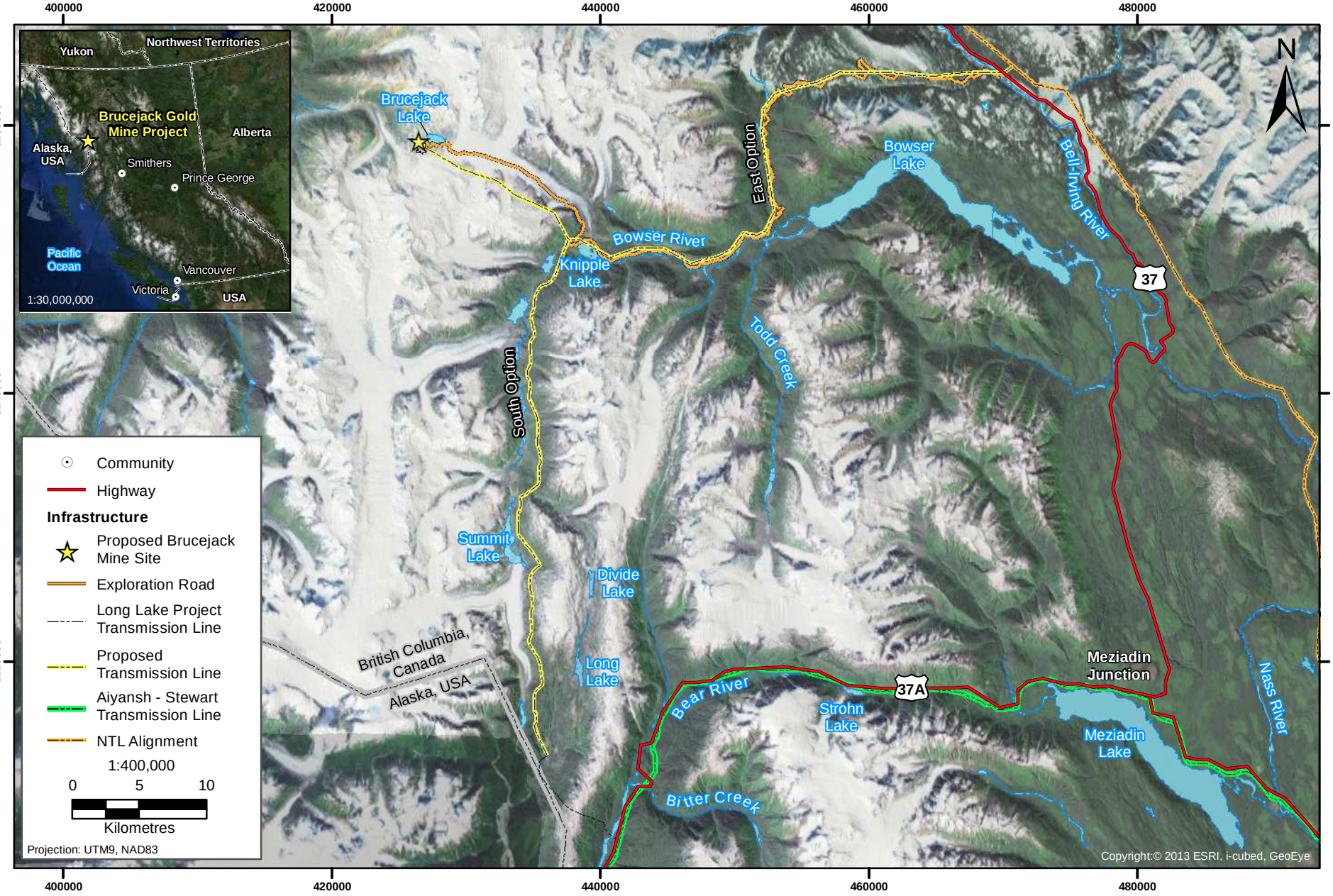

Figure 2-1

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Brucejack Gold Mine Project Overview

Figure 2-1

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3. Background Information

3. Background Information

3.1 APPLICABLE LEGISLATION (FEDERAL AND PROVINCIAL)

The statutory framework applicable to surface water quantity for mine developments in British Columbia is listed below.

- *Water Act* (RSBC 1996): The allocation and management of surface waters in British Columbia is currently administered under the BC *Water Act*. The *Act*, established in 1909 is the primary legislation for regulating the diversion, use, and storage of water, and managing water quality. The *Water Act* has been amended several times since its inception and has been integrated with other Provincial and Federal legislation.
- *Fisheries Act* (RSC 1985): The federal *Fisheries Act* provides the Department of Fisheries and Oceans with the responsibility to ensure sufficient flows for fish by preventing the harmful alteration, disruption or destruction (HADD) of fish habitat.
- *Canada Water Act* (RSC 1985): This legislation provides the framework for joint federal-provincial management of Canada's water resources. Approvals and licenses under the provincial *Water Act* are required to authorize the construction of works for the purposes of diverting, storing, or using water, or causing changes in and about a stream for any purpose.
- *Water Protection Act* (RSBC 1996): The *Act* authorizes a registrant to divert, extract, and store water or groundwater for removal from British Columbia.
- *International Rivers Improvement Ac*t (RSC 1985): It was enacted to ensure Canada can meet its obligations under the *1909 Boundary Waters Treaty*. The intent of the *Boundary Waters Treaty* is to ensure that Canada's water resources in international waters and in international rivers are developed and used in the best national interest. Under this Act, a permit is required because the construction of the Project may decrease the natural flow of an international river (e.g., Unuk River in the case of this project).

3.2 LITERATURE REVIEW

Newhawk Gold Mines conducted surface water hydrology studies in the Project area as part of environmental and socio-economic impact assessment for the Sulphurets Project (Newhawk, 1989). Such studies included non-continuous hydrometric monitoring of the Brucejack Lake area during two years of hydrometric monitoring (1987 and 1988).

In order to support the KSM project, development by Seabridge Gold Inc., Rescan installed a hydrometric monitoring network in the Sulphurets Creek and Unuk River watersheds, including Brucejack Lake watershed. Initial monitoring of surface water flows began in August 2007 at the outlet of Brucejack Lake. In 2008, Rescan assumed responsibility for maintaining the hydrometric station at Brucejack Lake (station BJL-H1). In 2010, a data sharing agreement between Pretivm and Seabridge Gold Inc. enabled information acquired from hydrometric stations BJL-H1, SL-H1, SC-H1, and UR-H1 to be used to support the Project.

In October 2009, Rescan initiated a surface water monitoring program for the Project with the installation of an automated hydrometric station (Scott-Hydro) along Scott Creek near its confluence with the Bowser River. The hydrometric monitoring program continued and expanded in 2010 at seven hydrometric stations within the Project area. Results of the 2010 baseline hydrology program were presented in Rescan (2011).

Historical flow discharge information from 12 hydrometric monitoring stations operated by the Water Survey of Canada (WSC) and US Geological Survey (USGS) within the region were used to conduct a regional hydrologic analysis in this study. These data and the regional analysis are outlined in Section 8 of this report.

4. Objectives

4. Objectives

The purpose of the surface water hydrology study was to characterize the hydrologic regime within the Project area. This was accomplished by establishing hydrometric monitoring stations at streams, creeks, rivers, and lakes within the Project area identified as important to planned Project infrastructure.

Specific objectives of the surface water hydrology study were:

- Operate and maintain hydrometric stations that contribute to characterization of the hydrologic regime. Retire those stations that were no longer needed due to changes in Project development plans;
- Develop and improve the stage-discharge curves at hydrometric monitoring stations;
- Calculate flow discharge estimates and generate annual hydrographs for each hydrometric station within the monitored drainage areas; and
- Integrate the site specific data with regional analyses to estimate hydrologic indices related to annual runoff, monthly runoff distribution, as well as peak and low flows.

5. Study Area

5. Study Area

The proposed Project is situated within the Brucejack Lake watershed, a small headwater sub-basin within the Sulphurets Creek watershed. Sulphurets Creek is a tributary of the Unuk River that flows southwest, eventually discharging in to the Pacific Ocean northeast of Ketchikan, Alaska (drainage area 2,577 km^2 at mouth). Within the Unuk River watershed, hydrologic data were collected from Brucejack Lake (drainage area 14 km^2), Sulphurets Lake (drainage area 84 km^2), Sulphurets Creek (drainage area 299 km^2) and the Unuk River above Sulphurets Creek (drainage area 400 km^2).

During the ongoing engineering design phase of the Project, sites in Scott Creek and Wildfire Creek watersheds have been considered for possible location of Project components (e.g., tailings management facility and processing plants). Therefore, hydrometric studies were conducted within the Scott Creek watershed and some neighbouring watersheds (i.e., Todedada Creek and Wildfire Creek). Although the Project has evolved and these Project components are no longer being considered here, hydrometric studies in Scott Creek (drainage area 75 km^2), Todedada Creek (drainage area 61 km^2), and Wildfire Creek (drainage area 67 km^2) watersheds continued. Such studies may support design and assessment of other components of the Project (e.g., access roads). Scott Creek and Todedada Creek are tributaries of the Bowser River and Treaty Creek, respectively. Wildfire Creek, Bowser River, and Treaty Creek drain into the Bell-Irving River (drainage area 5,330 km^2) which eventually flows into the Nass River (21,483 km^2 at mouth) which drains into the Pacific Ocean near the southern tip of the Alaskan panhandle.

Within Scott Creek, several small sub-catchments containing first-order glacierized and non-glacierized streams were monitored in 2010. Monitoring of these streams was discontinued in 2011 due to changes in the proposed Project description.

5.1 CHARACTERISTICS OF MAIN STUDY WATERSHEDS AND RIVER SYSTEMS

The Project is located within the Boundary Ranges of Coast Mountains physiographic region in northwestern British Columbia (Holland, 1976). The Boundary Ranges are comprised of dominantly granitic mountains along the Alaska-British Columbia border, extending northwest from the Nass River. The location of key watersheds and the main river systems potentially impacted by the Project are shown in Figure 5.1-1. The proposed mine site is situated within the Sulphurets Creek watershed, a tributary of the Unuk River.

Physiographic maps of all monitored watersheds are provided in Appendix 1 with stream channels divided into segments defined by channel gradient. Six channel gradient ranges have been identified that correspond to channel morphologic types (Table 5.1-1). These six gradient ranges are generally associated with changes in channel morphology, sediment transport capability, and response potential (WADNR 2011). Gradient is essentially a surrogate for stream energy, which in turn is a driver for morphologic change via sediment transport capacity.

Table 5.1-1. Valley Gradient and Channel Bed Morphology Classification (from WADNR, 2011)

	Pool-Riffle	Pool-Riffle, Plane-Bed	Plane-Bed, Forced Pool-Riffle	Step-Pool	Cascade	Colluvial
Gradient	< 1.0%	1.0 - 2.0%	2.0 - 4.0%	4.0 - 8.0%	8.0 - 20.0%	> 20.0%

Key physiographic characteristics of the main watersheds that are considered as key morphometric measures of drainage basins (Cheong and Hourston, 1998) are provided in Table 5.1-2 and described below. This information is estimated by geo-spatial analysis (with ArcGIS 10.1) based on British Columbia Freshwater Atlas Database (GeoBC, 2008) and 2 m contours based on a 2010 LiDAR.

Table 5.1-2. Physiographic Characteristics of Watersheds within the Project Area

Watershed		Hydrometric Station	Area (km^2)	Minimum Elevation (m)	Maximum Elevation (m)	Mean Elevation (m)	Median Elevation (m)	Elevation Relief Ratio[a]	Glacier Coverage (%)	Lake Coverage (%)	Wetland Coverage (%)	Steep Land Area[d] (%)	Valley Flat Extent[e] (%)	Tributary to
Unuk Drainages	Unuk River at Mouth	n/a	2,577	0	2,559	1,041	1,061	0.41	16.0	0.5	0.1	32.0	1.6	Pacific Ocean
	Unuk River	UR-H1	400	221	2,265	1,145	1,130	0.45	14.5	1.5	0.2	16.9	0.4	Unuk River
	Sulphurets Creek	SC-H1	299	217	2,559	1,438	1,479	0.52	37.7	0.4	0.0	31.1	0.1	Unuk River
	Sulphurets Lake	SL-H1	84	572	2,559	1,599	1,610	0.52	48.7	1.3	0.1	21.6	0.1	
	Brucejack Lake[b]	BJL-H1/BJL-H1a	14[b], 12[c]	1,345	2,383	1,644	1,596	0.29	41.5	6.2	0.7	14.7	6.1	Sulphurets Creek
Bell-Irving Drainages	Bell-Irving River	n/a	5,330	276	2,726	1,226	1,269	0.39	15.1	1.0	0.7	24.7	0.7	Nass River
	Scott Creek	Scott-Hydro	75	401	2,361	1,229	1,180	0.42	21.3	0.1	0.6	22.0	1.2	Bowser River
	Todedada Creek	Todedada-Hydro	61	574	2,235	1,187	1,179	0.37	24.8	0.5	6.0	22.9	9.0	Treaty Creek
	Wildfire Creek	Wildfire-Hydro	67	464	1,865	939	950	0.34	1.9	0.9	2.4	5.7	1.0	Bell-Irving River

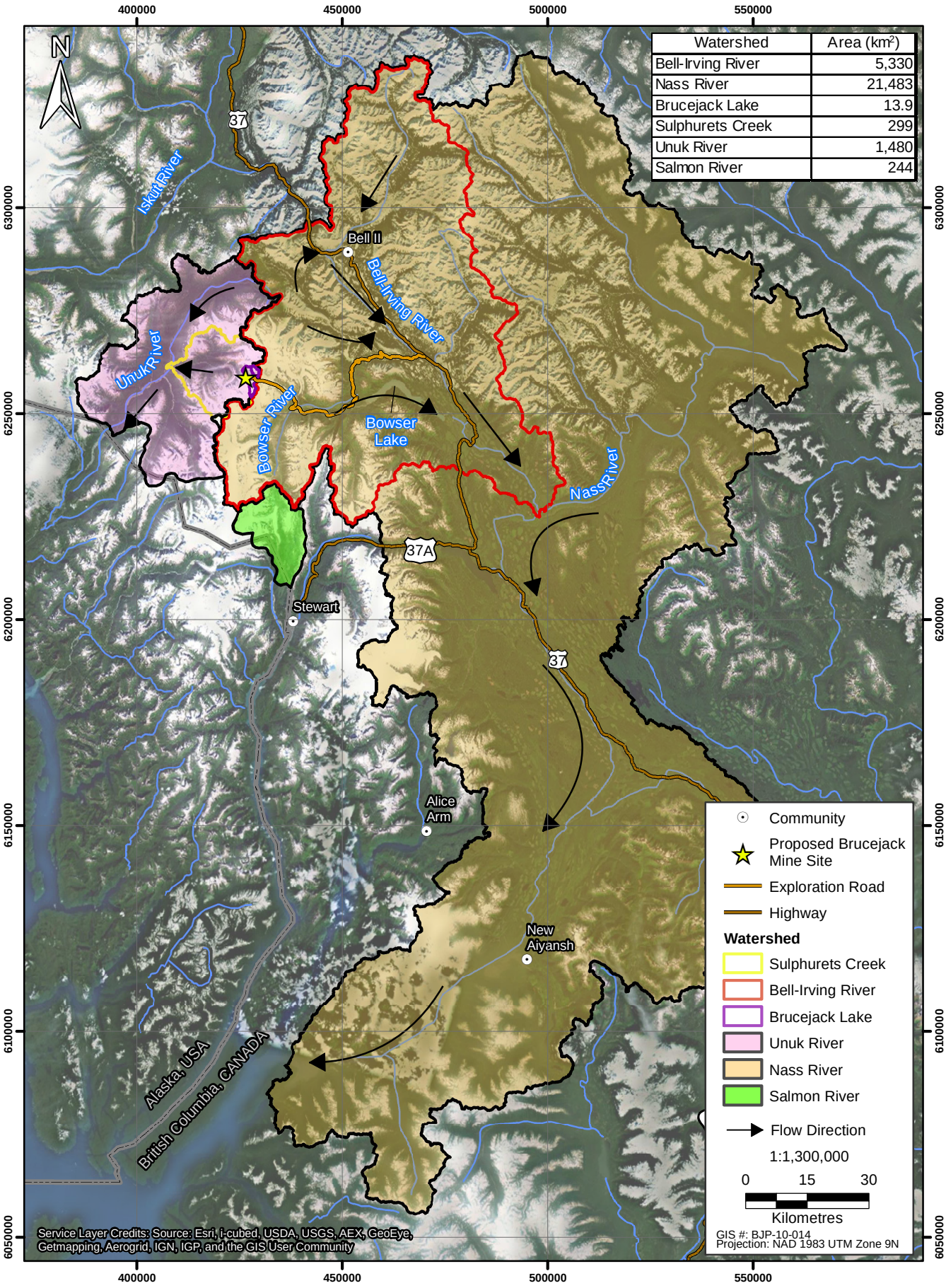
[a] *$(mean_{elevation} - min_{elevation})/(max_{elevation} - min_{elevation})$*

[b] *Based on BC Freshwater Atlas (GeoBC, 2008), excluding the East Lake contribution*

[c] *Based on KPL (2011), excluding the East Lake contribution*

[d] *Area with gradient greater than 60%*

[e] *Area with gradient less than 7%*



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Regional Hydrological Setting of the Project Area

Figure 5.1-1

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5.1.1 Unuk River Watershed and Sub-watersheds

The Unuk River originates in the mountains north of the Project area and flows southwest, eventually draining into the Pacific Ocean at Burroughs Bay in Alaska. The Unuk River watershed (2,577 km^2) contains the Sulphurets Creek watershed (299 km^2), which in turn includes the Brucejack Lake watershed (14 km^2), the location of the proposed Mining Site.

Elevations in the Unuk watershed range from 0 to 2,559 masl, with a median elevation of 1,061 masl. The Unuk River has an average channel gradient of 1%. Approximately 32% of the watershed can be described as being steepland (areas with greater than 60% gradient), and over 1% can be described as flatland (areas less than 7% gradient and connected to the channel network). The elevation ratio relief in the watershed (Equation 5.1-1) is 0.41. Glacier coverage within the Unuk watershed is 16%, and lakes and wetland areas cover less than 1% of the watershed. Based on these physiographic features, the Unuk River watershed is a steep basin where not much storage exists to attenuate floods. Therefore, a fast response time and high flood magnitudes are expected after precipitation events.

$$Elevation\ Relief\ Ratio = (mean_{elevation} - min_{elevation}) \ / \ (max_{elevation} - min_{elevation}) \qquad (5.1\text{-}1)$$

Physiographic characteristics of sub-drainages of Unuk River are shown in Table 5.1-2. These include Unuk River above confluence with Sulphurets Creek (UR-H1), Sulphurets Creek (SC-H1), Sulphurets Lake (SL-H1), and Brucejack lake (BJL-H1). By comparing the physiographic characteristics of these sub-drainages with each other, some major differences are notable. These include:

- Glacier coverage in the Unuk River watershed (15%) is much lower than those of Sulphurets Creek (38%), Sulphurets Lake (49%), Brucejack Lake (42%); and
- The elevation relief ratio in the Brucejack Lake watershed (0.29) is lower than those of Unuk River (0.45), Sulphurets Creek (0.52), and Sulphurets Lake (0.52). That is, areas with higher than average elevation are less abundant than those with lower than mean elevation in the Brucejack watershed. However, mean and median elevations in the Brucejack Lake watershed are higher than other watersheds. Therefore, the low elevation relief ratio in Brucejack Lake watershed may not be the reason for lower than regional runoff values in this watershed.

It should be noted that the drainage area of Brucejack Lake cannot be evaluated with certainty. East Lake, located upstream and approximately 500 m east of Brucejack Lake generally fills during late fall, winter, and spring after ice blocks the glacial tunnel that drains the lake eastward under Knipple Glacier. When the East Lake elevation exceeds the crest elevation of the outflow channel toward Brucejack Lake, flows begin to enter Brucejack Lake. During the late summer melt season, warmer water creates a new glacial tunnel into Knipple Glacier and East Lake drains rapidly (jokulhlaup or glacial outburst flood). From the high water mark created by fine sediment deposits and well-formed beach, it was implied that East Lake remained full and therefore contributed to Brucejack Lake for significantly longer periods in the past (Newhawk 1989). With the retreat of Knipple Glacier, it is expected that the glacial tunnel remains open throughout the year and the likelihood of East Lake drainage into Brucejack Lake will decrease. Therefore, in this report, East Lake watershed is excluded from Brucejack Lake watershed in default analysis scenarios. Given this assumption, BC Freshwater Atlas (GeoBC 2008) delineation shows a drainage area of 13.9 km^2 for Brucejak Lake watershed at the hydrometric station site (Table 5.1-3). This delineation is in agreement with available 2 m contour maps based on 2010 LiDAR. Excluding the East Lake watershed from the Brucejack Lake watershed represents a conservative scenario for most hydrologic indices, and is supported by the glacier retreat hypothesis. However, in the case of estimating peak flows based on regional analysis, a conservative scenario would include contribution of East Lake to the Brucejack Lake watershed. In such a scenario, the drainage area of Brucejack Lake watershed is 17.2 km^2 (Table 5.1-3).

Table 5.1-3. Drainage Area Scenarios for Brucejack Lake Watershed at Hydrometric Station BJL-H1

Delineation Source	Drainage Area (km^2)	
	Without East Lake	With East Lake
BC Freshwater Atlas (GeoBC 2008)	13.9	17.2
KPL (2011)	11.7	17.0

In a preliminary assessment of a hydroelectric facility at the outlet of Brucejack Lake, KPL (2011) suggested a watershed delineation for Brucejack Lake that was different from the one based on BC Freshwater Atlas (GeoBC, 2008). This includes drainage areas of 11.7 and 17.0 km^2 for Brucejack Lake without and with East Lake watershed, respectively (Table 5.1-3). Although these drainage areas may not be confirmed with data available through BC Freshwater Atlas (GeoBC, 2008), they will be considered as alternative scenarios in this study wherever applicable.

5.1.2 Bell-Irving River Sub-watersheds

From its origins northeast of the Project area, the Bell-Irving River flows southwest within the Klappan Range of the Skeena Mountains. The Bell-Irving itself flows within the Nass Basin physiographic region and continues until its confluence with the Nass River. The Nass flows 380 km from the Coast Mountains southwest to Nass Bay, an inlet of the Pacific Ocean. The Nass watershed (21,483 km^2) encompasses the Bell-Irving watershed (5,330 km^2), which in turn contains the watersheds of Wildfire Creek (67 km^2), Scott Creek (75 km^2), and Todedada Creek (61 km^2).

The Bell-Irving watershed has an average gradient of 1%. Elevations in the Bell-Irving watershed range from 276 masl to 2,726 masl, with a median elevation of 1,269 masl. Approximately 25% of the watershed can be described as being steepland (areas with greater than 60% gradient), whereas less than 1% can be described as flatland (areas less than 7% gradient and connected to the channel network). The elevation relief ratio in the watershed (Equation 5.1-1) is 0.39, which is close to that of the Unuk River watershed. Glaciers cover approximately 15% of the Bell-Irving watershed area. Lakes account for 1% of the area, and wetlands cover less than 1%.

Physiographic characteristics of Scott Creek, Todedada Creek, and Wildfire Creek watersheds are provided in Table 5.1-2. Most notable dissimilarities among these watersheds, include:

- Glacier coverage in the Wildfire Creek watershed (2%) is much lower than those of Scott Creek (21%) and Todedada Creek (25%) watersheds;
- Steepland areas cover less proportion of total watershed in the Wildfire Creek watershed (6%) than Scott Creek (22%) and Todedada Creek (23%) watersheds; and
- Flat lands adjacent to the streams are more abundant in the Todedada Creek watershed (9%) than Scott Creek (1%) and Wildfire Creek (1%) watersheds.

5.1.3 Salmon River Watershed

The Salmon River headwater is fed by the Salmon Glacier, and flows 23 km south to tidewater at the head of Portland Canal, Alaska (Mathews and Clague 1993). Drainage area of the watershed is 244 km^2, 35% of which is covered with glaciers. The watershed has a mean elevation of 1170 masl, and the estimated mean annual precipitation is 2790 mm (Wiley and Curran 2003). Summit Lake is an ice-dammed lake, dammed on the southern end by the Salmon Glacier. Prior to 1961, the lake drained northward over a bedrock sill into the Bowser River (Jones et al. 1985). In December 1961, probably after a long period of thinning and retreat of Salmon Glacier, a subglacial tunnel developed in the ice dam and the lake drained into the Salmon River quickly (Mathews and Clague 1993). The sudden drainage of the ice-dammed lake, referred to as jokulhlaup, occurred frequently after this event. In the early years (1960s), the lake emptied roughly every other year during the fall or early winter

(October through December). But recently, the releases have been occurring almost annually and considerably earlier in the year (late July through August). The water draining from Summit Lake during a jokulhlaup flows 3 km from the terminus of Salmon Galcier in a confined valley and 5 km in a canyon before emerging into the lower Salmon River. Here it flows over a braided stream that passes through Hyder, Alaska, and drains into Portland Canal. It has been noticed that the flood magnitude and damages have generally decreased since 1960s (Devaris 2013). The annual jokulhlaup cycle is likely to continue until the glacier retreats to the point that it no longer forms an effective seal (Mathews and Clague 1993). The US Geological Survey operates a hydrometric station on Salmon River near Hyder (15008000) that collected data during 1963 to 1973, and after 2010. The estimated mean annual precipitation in the watershed is 2794 mm (Wiley and Curran 2003).

A portion of the proposed Brucejack Transmission Line – South Option will pass through the Salmon River watershed; however, the transmission line is expected to have negligible effects on the surface water hydrology. Therefore, the project-specific hydrometric monitoring program did not include hydrometric stations within this watershed.

5.2 MORPHOLOGY AND PROCESSES IN MOUNTAIN CHANNELS

Historic glaciation has a persistent influence on topography and sediment flux in the Project area. During the Pleistocene, large glaciers carved valleys in the Coast Mountains into U-shaped cross-sectional profiles (Plate 5.2-1), with steep walls and broad valley floors. Longitudinally, the Pleistocene glaciation imposed a stepped valley topography – steep, glacially carved bedrock steps alternate with lower-gradient valleys, termed 'hanging valleys' because they are suspended and separated by the bedrock steps. In addition to its topographic imprint, glaciation is a tremendous force for the mobilization and transport of sediment. Ongoing glacial retreat exposes large amounts of unstable, easily mobilised sediment, which moves downstream in a prolonged sediment pulse that may take on the order of 10^4 years to move through an entire stream system (Church and Slaymaker 1989).

Plate 5.2-1. Bowser River flowing through a glacially carved U-shaped valley. View is downstream.

Channel form, or morphology, is a reflection of the relative magnitude of transport capacity to sediment supply (Montgomery and Buffington 1997). In a typical stream-formed valley, transport capacity decreases with increasing drainage basin size, while sediment supply increases. Channel form follows a general downstream progression from unstable morphologies generated by high gradient, high energy environments to relatively stable morphologies with established banks and floodplains. However, glaciation introduces a complex setting for morphological development not accounted for in the Montgomery and Buffington (1997) model. Channels, in these settings, may achieve a stable or semi-stable state in lower-gradient hanging valleys, but transport capacity and sediment supply are reset at each bedrock step, often leading to repeating downstream sequences of channel types (Brardinoni and Hassan 2007).

Small tributaries and low-order drainages in the Sulphurets watershed flow through high-elevation valleys that are narrow relative to the streams, allowing for direct delivery of sediment into the channels from landslides and mass movement. Channel form is highly unstable, with unconsolidated streambanks and continually shifting avenues of flow. These channels generally exhibit chaotic or cascade morphologies – unstructured or minimally structured channel forms characterized by continuous, tumbling flow around large clasts. Despite relatively large sediment inputs, the high energy of these channels makes them transport zones, rapidly delivering sediment to lower-gradient channels farther downstream (Montgomery and Buffington 1997).

Larger rivers and streams in the Project area flow through glacially carved U-shaped valleys that are many times wider than their channels. Lateral sediment delivery to the stream channel is generally indirect; landslides are frequent on the steep valley walls but they often do not reach the channels. However, channels receive a steady longitudinal supply of sediment from upstream transport zones. As a result of this high degree of sediment loading, the large rivers in the Project area display either braided or wandering gravel bed morphology, common among channels that drain glaciated mountain ranges. Braided rivers have multiple-channels, with channels splitting around bars or islands (braiding). Braiding processes are highly dynamic and are associated with high-energy environments, unstable banks, and high sediment loads (Bridge 2003). Wandering gravel bed rivers are laterally active anabranching channels described as a transition between braided and meandering rivers that develop in locations where sediment deposition is favoured, but bed-load transport rates are less than those associated with braided rivers (Knighton 1998). In both river types, complex sequences of erosion and deposition take place with variations in stage (water level).

5.3 HYDROLOGICAL REGIME

Watersheds in northwest British Columbia may represent a glacial, nival, or mixed regime based on their elevation and glacier coverage. A typical hydrological year can be divided into four main streamflow periods:

- **Winter** – Characterized by low to negligible streamflow in ice covered streams. Flow generally depends on the elevation of the stream and watershed area.
- **Spring/freshet** – Characterized by high flows due to snowmelt and rain-on-snow events. This is often the period in which annual peak flow occurs in watersheds with nival regimes.
- **Summer** – Characterized by steady or gradually declining moderate to high flows for lower elevation and non-glacierized watersheds. For these watersheds, peak flow events are supplied primarily by rainfall. For higher elevations catchments, substantial contributions from snowmelt can occur late into the season. Flows from heavily glacierized catchments will be supplemented by glacial melt. In these watersheds, a combination of glacial melt and rainfall may drive peak flows.

- **Fall** – Characterized by generally moderate to low flows, but interrupted by rain fed storm events, which can have peak flows in excess of freshet flows. In some watersheds, the most extreme flood events typically occur during this period. Between rainstorms, baseflow levels decline towards low winter flows as more precipitation falls in the form of snow and is stored within the snowpack.

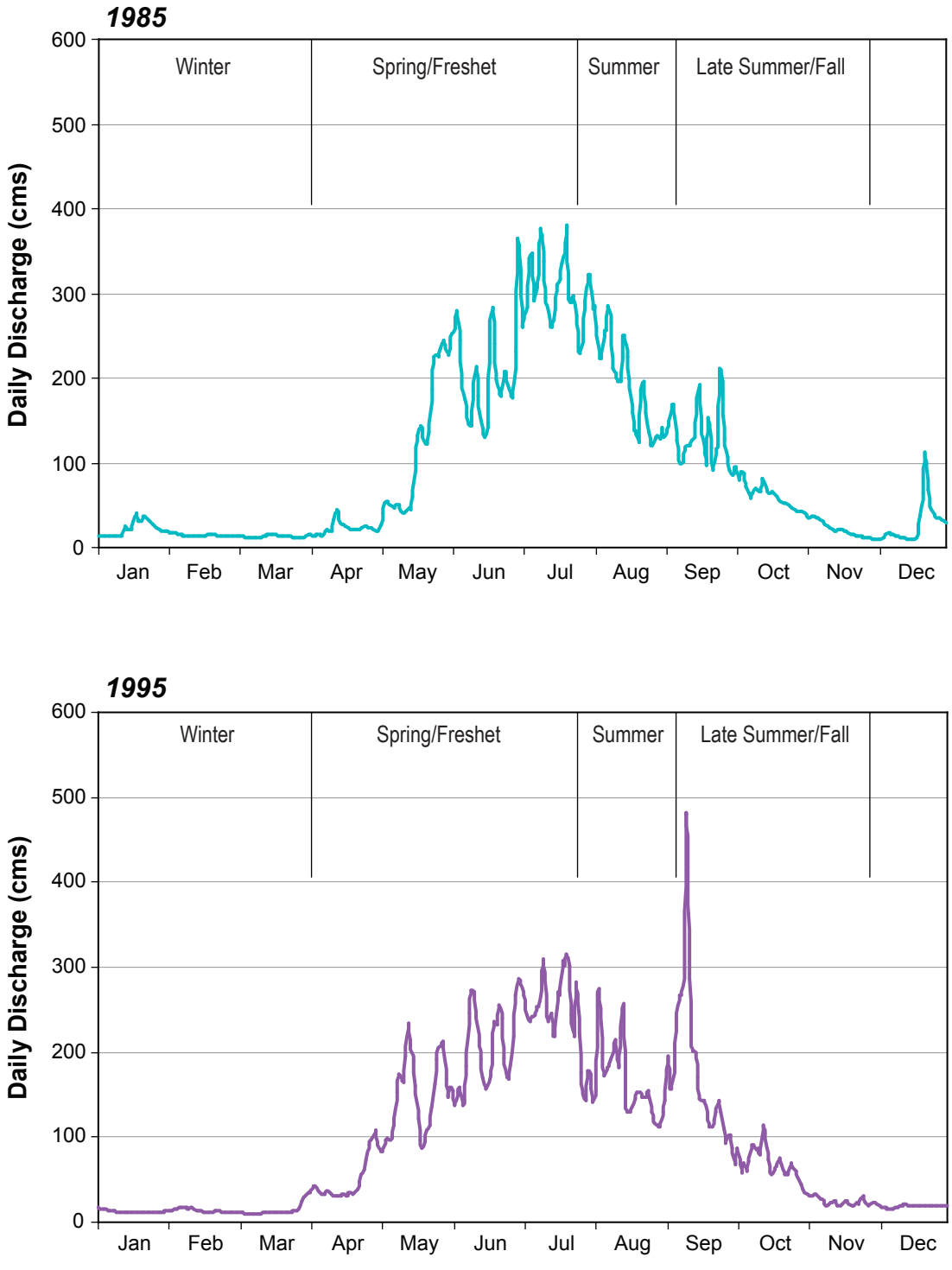
Two examples of typical annual flow hydrographs for northwest British Columbia are illustrated in Figure 5.3-1, from historical time series data for the Water Survey of Canada (WSC) hydrometric station on the Unuk River near Stewart (08DD001). During the winter, precipitation is stored as snowpack. Baseflow accounts for the majority of water discharge during the colder winter season (the two discharge spikes in winter 1985 are likely the result of measurement error due to ice encroachment in the channel). When air temperatures begin to rise in the spring, the greater solar radiation levels cause ice and snow to melt and precipitation to fall as rain. As a result, both the 1985 and 1995 hydrographs show a rapid increase in discharge from April to July. The period of high, snowmelt-driven spring flows is termed freshet. Peak annual flows often occur during freshet.

In many northwestern BC watersheds, flows steadily decline throughout the summer (visible for the Unuk River in both 1985 and 1995). However, in watersheds with large glacier coverage, flows are sustained and modulated by glacial melt. In these glacierized watersheds, flows often remain fairly consistent throughout the summer.

Large precipitation events are common in the fall for northwestern BC. These major events may result in dramatic short term increases in discharge, and sometimes trigger peak annual flows, such as the September 1995 peak. However, aside from short-term increases, flows generally continue to decrease throughout the fall, returning to baseflow levels in the winter.

The Project area lies in a transition zone between the very wet coastal region and the drier interior region of British Columbia. The regional hydroclimate of northwestern British Columbia is dominated by weather systems generated from the Pacific Ocean, and is also strongly influenced by orographic effects caused by the local mountainous topography that produce a high degree of spatial variability in snowfall and precipitation. Local topography also has an influence in controlling temperatures and the rate and timing of snowmelt. In addition, the presence of large glacierized areas can impact snowmelt rates and produce high runoff volume during summer months.

Due to the number of competing runoff generation processes and their varying spatial and temporal influences on streamflow hydrographs, the hydrological regime of the region is very dynamic, with a high degree of temporal and spatial variation. More specifically, as explained in Section 5.1-1, the contribution of East Lake to the Brucejack Lake watershed is not known with certainty.



Examples of Annual Discharge Hydrographs (1985 and 1995) for WSC Station 08DD001 (Unuk River near Stewart)

Figure 5.3-1

PRETIVM

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6. Hydrometric Monitoring Program

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6. Hydrometric Monitoring Program

6.1 HYDROMETRIC MONITORING NETWORK

The 2009 to 2012 hydrometric program was initiated to collect baseline hydrologic data for specific streams, rivers, and lakes within the study area. Automated hydrometric stations recorded water level during open water periods to monitor surface water flows in order to characterize the hydrological variation in these water bodies. The monitoring program began in 2009 with two hydrometric stations, one of which had been in operation since 2007 for a neighbouring project. From 2009 to 2012, new automated hydrometric stations were established, and some stations were retired as the Project evolved. A total of nine stations were established in the Bell-Irving drainage basins, and a total of six stations were used in the Sulphurets and Unuk drainages (Figure 6.1-1 and Table 6.1-1).

Initial monitoring of surface water flows at the outlet of Brucejack Lake (BJL-H1) began in August 2007 to support a neighbouring mining development by Seabridge Gold Inc. In 2008, Rescan assumed responsibility for maintaining the hydrometric station BJL-H1. In 2010, a data sharing agreement between Pretium Resources and Seabridge Gold Inc. enabled information acquired from the BJL-H1 hydrometric station to be used to support the Project.

In 2009, an automated hydrometric station (Scott-Hydro) was installed along Scott Creek near the confluence with Bowser River to monitor water levels within the study area. The Scott-Hydro station, as well as the hydrometric station located at the outlet of Brucejack Lake (BJL-H1) remained active throughout the winter of 2009 - 2010.

In 2010, the hydrometric network was expanded in the Scott Creek basin to record water levels at four of its drainage sub-basins (H2-Hydro, H3-Hydro, H4-Hydro, and H5-Hydro). These stations were decommissioned in 2011 due to changes in the scope of the Project. Additionally, an automated hydrometric station (Bowser-Hydro) was installed along the upper Bowser River to monitor water levels upstream of Scott Creek (Figure 6.1-1). Demobilization of the hydrometric stations occurred near the end of the open-water season. This was necessary to protect the pressure transducers from freezing-related damage during cold winter periods. At hydrometric stations where the pressure transducer was submerged in more than 0.3 m of water (as of the fall site visit each year); the monitoring instrument was assessed to be free of the risks associated with ice-related damages over the winter period. In these cases, the pressure transducers were left in place and the stations were not demobilized. Using this criterion, in 2010, pressure transducers were removed from monitoring stations Bowser-Hydro, H3-Hydro, H4-Hydro, and H5-Hydro. The monitoring instruments at stations BJL-H1, Scott-Hydro, and H2-Hydro were left in place so that they could continue to record water levels throughout the 2010/2011 winter season.

In 2011, in the Bell-Irving drainage basin, the Bowser-Hydro station was re-installed in May and two new hydrometric stations were installed at Todedada Creek (Todedada-Hydro) and Wildfire Creek (Wildfire-Hydro) to characterize hydrologic conditions at a regional scale. In the Scott Creek drainage basin, only Scott-Hydro station was kept active, while the other stations located within this drainage basin were not reinstalled (H2-Hydro, H3-Hydro, H4-Hydro, and H5-Hydro). In the Unuk River watershed, additional hydrometric stations were installed in and near Brucejack Lake to address specific project related needs. A lake monitoring station (BJL-H2) was installed to monitor variations in water level throughout the open water season at Brucejack Lake. These new hydrometric stations in the Brucejack Lake area were installed in June 2011, after lake ice broke up. In November 2011, the Bowser-Hydro station was demobilized for winter. The stations on Scott Creek (Scott-Hydro), Todedada Creek (Todedada-Hydro) and Wildfire Creek (Wildfire-Hydro) remained active through the 2011/2012 winter season, along with stations BJL-H1 and BJL-H2 located at Brucejack Lake.

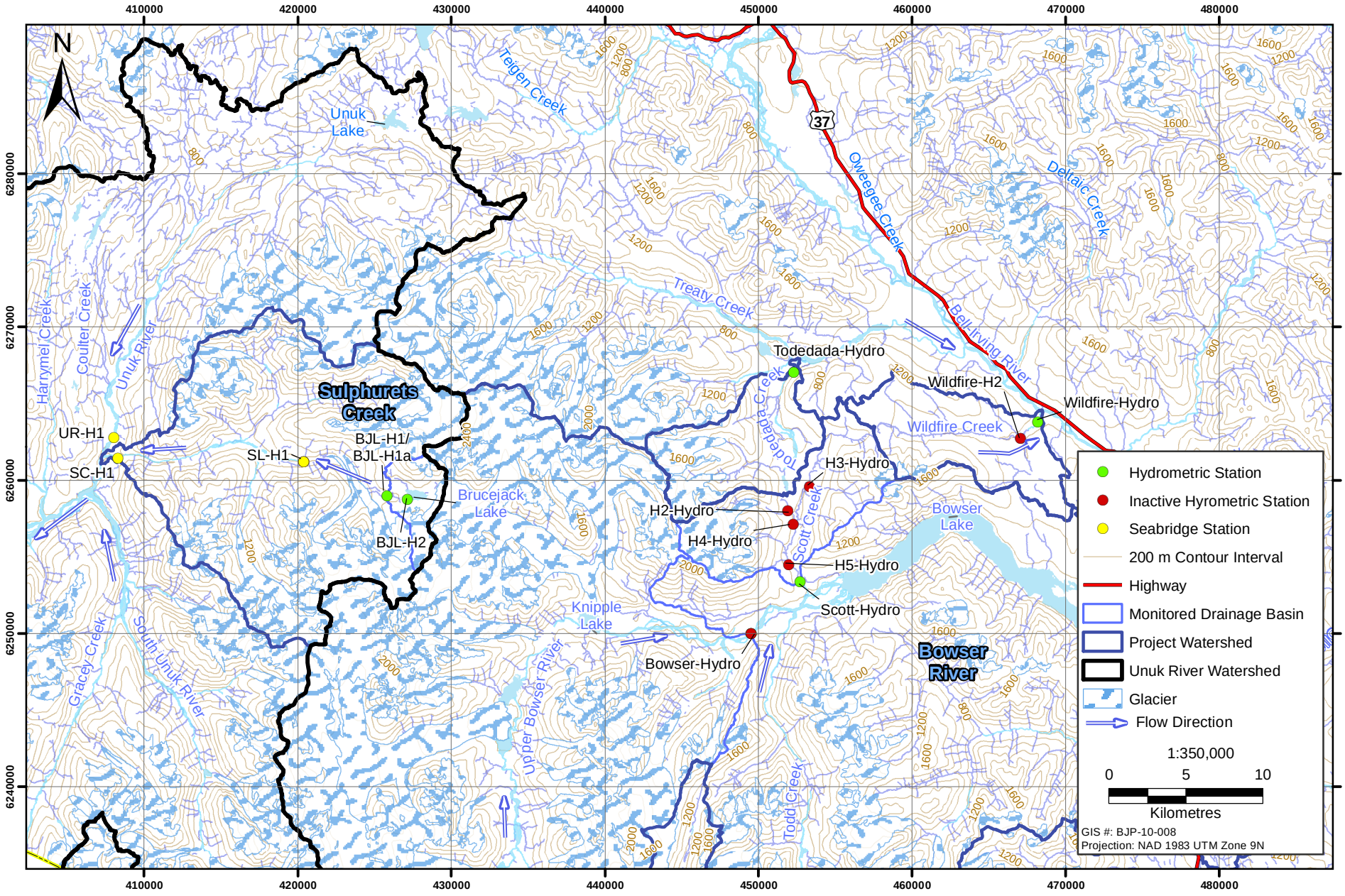

Figure 6.1-1

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Hydrometric Monitoring Stations within the Study Area

Figure 6.1-1

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Table 6.1-1. Hydrometric Monitoring Stations in the Brucejack Study Area

Hydrometric Monitoring Station	Location	Geographic Location[a]		Drainage Area (km^2)	Period of Operation	Continuous Monitoring Type
		Easting (m)	Northing (m)			
Unuk-Sulphurets Drainages						
BJL-H1	Outflow of Brucejack Lake	425,773	6,259,026	11.7[b], 13.9[c]	August 24, 2007 to July 24, 2012	Stream water level
BJL-H1a	50 m downstream of BJL-H1	425,739	6,259,085	11.7[b], 13.9[c]	July 24, 2012 to present	Stream water level
BJL-H2	Southern shore of Brucejack Lake	427,107	6,258,788	n/a	July 21, 2011 to present	Lake water level
SL-H1[d]	Sulphurets Lake at outlet	420,398	6,261,229	84.2	September 2007 to present	Stream water level
SC-H1[d]	Sulphurets Creek near mouth	408,256	6,261,490	298.6	January 1, 2010 to November 30, 2011	Stream water level
UR-H1[d]	Unuk River upstream of the confluence with Sulphurets Creek	408,007	6,262,837	400.1	April 28, 2010 to present	Stream water level
Bell-Irving Drainages						
Bowser-Hydro	Upstream of Scott Creek	449,486	6,250,000	757.0	July 7, 2010 to October 25, 2010 May 12, 2011 to November 25, 2011	Stream water level
Todedada-Hydro	1 km above the confluence with Treaty Creek	452,290	6,267,089	61.1	June 21, 2011 to present	Stream water level
Wildfire-Hydro	1 km above the confluence with Bell-Irving River	468,149	6,263,853	66.9	May 14, 2011 to present	Stream water level
Wildfire-H2	Southern tributary of Wildfire Creek	467,039	6,262,797	19.4	May 1, 2012 to November 22, 2012	Stream water level
Scott-Hydro	Near confluence with Bowser River	452,681	6,253,384	74.7	November 11, 2009 to present	Stream water level
H2-Hydro	Scott Creek north of H4-Hydro	452,260	6,257,144	36.5	July 5, 2010 to May 8, 2011	Stream water level
H3-Hydro	Eastern tributary of Scott Creek	453,299	6,259,644	7.6	July 8, 2010 to October 21, 2010	Stream water level
H4-Hydro	Western tributary of Scott Creek	451,891	6,258,033	16.5	July 4, 2010 to October 24, 2010	Stream water level
H5-Hydro	Western tributary of Scott Creek	451,945	6,254,500	6.8	July 6, 2010 to October 23, 2010	Stream water level

[a] *UTM Zone 9U, NAD 83*
[b] *Based on KPL (2011), excluding the East Lake watershed*
[c] *Based on BC Freshwater Atlas (GeoBC, 2008), excluding the East Lake watershed*
[d] *Stations operated by Seabridge Gold*
n/a No drainage area associated with hydrometric station.

In 2012, in the Bell-Irving drainage, the Bowser-Hydro station was not re-installed in spring, and a new station was installed on a tributary of Wildfire Creek (Wildfire-H2) in May to characterize a sub-basin for planned Project infrastructure. Due to changing Project design requirements, the station was removed in November. The pressure transducer and datalogger at Todedada-Hydro were repaired in June from animal inflicted damage that occurred between the May and June site visits. In the Unuk River watershed, when it was possible to access BJL-H1 in July, the station was removed and replaced with a new installation (BJL-H1a) at a location 50 meters downstream. The Brucejack Lake level station

(BJL-H2) was reset due to low voltage power outage in July but did not begin logging data again until October. Stations BJL-H1a, BJL-H2, Scott-Hydro, Todedada-Hydro, and Wildfire-Hydro were left installed and active over the 2012/2013 winter season.

Three additional stations operated by Seabridge Gold on an adjacent property were included in the Brucejack hydrometric monitoring network for analysis and reporting. The three hydrometric stations are SL-H1, at the outflow of Sulphurets Lake, SC-H1, located near the mouth of Sulphurets Creek, and UR-H1, on the Unuk River upstream of the confluence with Sulphurets Creek.

The aforementioned hydrometric data are temporally and spatially extensive, and were collected over a wide range of physiographic and geomorphic environments and watershed sizes (Table 6.1-1). This includes data collected in highly glacierized catchments (Table 5.1-2), in small catchments, in areas that receive extremely high rainfall and snowfall amounts, and in dynamic channels whose geometry can change throughout and within the open water season. The data set is particularly valuable since there are few hydrologic records from similar catchments available from the Water Survey of Canada (WSC) or the United States Geological Survey (USGS).

6.2 HYDROMETRIC STATION SETUPS

The majority of the hydrometric station setups consisted of a vented PS98i or PS9800 pressure transducer (Instrumentation Northwest Inc.) paired with an ELF-2 data logger (Terrascience Systems Ltd.) or an AquiStar multi-channel GDL data logger (Instrumentation Northwest Inc.). In addition, standard 1.0 m long WSC vertical staff gauge plates were installed at two hydrometric stations where installations would not be damaged by winter ice buildup (Scott-Hydro and Todedada-Hydro). The staff gauge plates are graduated at an interval of 0.01 m, and were installed as visual measurement checks of the water elevation (stage).

The pressure transducers were installed as deep in the channel as possible to allow for continuous monitoring of high, moderate, and low flow water levels. The pressure transducers continuously sampled and recorded water levels at ten minute intervals. When pressure transducers were removed prior to winter freeze-up, an attempt was made to reinstall them in the exact same location the following spring. In order to maintain continuous time series records over multiple years, the elevation of the pressure transducers was surveyed relative to a local arbitrary datum. Local benchmarks were used to maintain elevational control at each station during stage-discharge measurements.

Typically, the transducers and cabling were inserted into a flexible aluminum conduit with one end of the conduit attached to a 1.5 m long piece of angle iron. The angle iron was then placed into the water and bolted onto 19 mm (0.75 inch) diameter threaded anchor rods. The rods were drilled into bedrock or a large boulder (to a depth of at least 150 mm (~6 inches) and anchored in place with quick-setting rock epoxy. In cases where rock was not available for establishing anchor rods, the angle iron was both driven into the streambed and secured to a tree using a wooden support frame, or weighted down and then placed level on the bed of the stream channel, parallel to the direction of flow. The data loggers were housed in steel waterproof enclosures that were positioned on the adjacent channel bank above the high water mark.

At Brucejack Lake, station BJL-H1 historically employed Levelogger and Barologger™ (Solinst Canada Ltd.) pressure transducers. For monitoring purposes, the Levelogger continuously measured and recorded absolute pressure (water and atmospheric) at fifteen minute intervals. In conjunction with the Levelogger, the Barologger simultaneously measured and recorded atmospheric pressure to correct for the influence of variable atmospheric pressure. Both recording devices were housed inside a 38 mm (1.5 inch) diameter PVC pipe. The pipe was placed in the water and protected from rocks and debris in the stream by a larger 76 mm (3 inch) diameter galvanized steel pipe that was anchored to local rock outcroppings along the channel reach. In July 2012, station BJL-H1 was replaced by BJL-H1a, which utilizes an internally-vented PS9800 transducer paired with a multi-channel GDL datalogger (Instrumentation Northwest, Inc.).

Examples of hydrometric station setups are shown in Plates 6.2-1 and 6.2-2. Photos from all active stations are provided in Appendix 3.

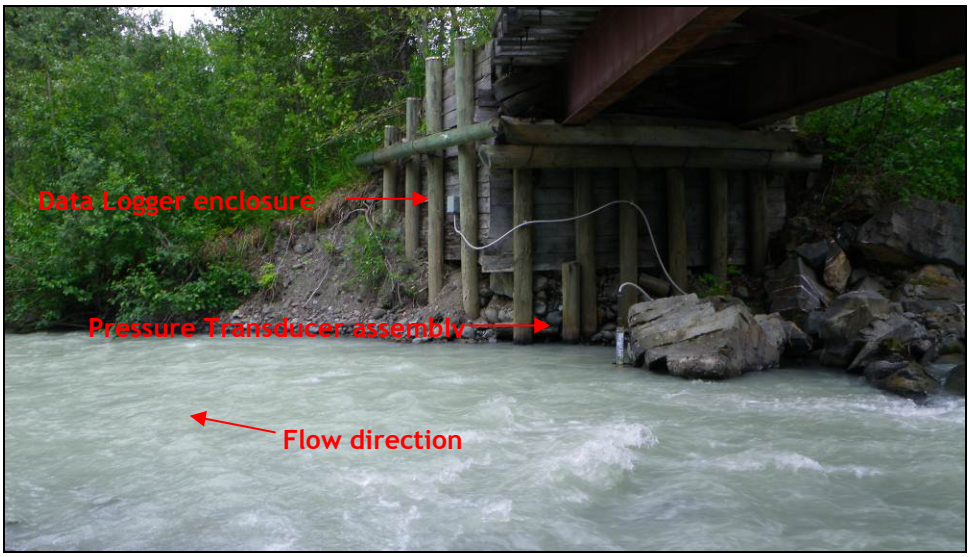
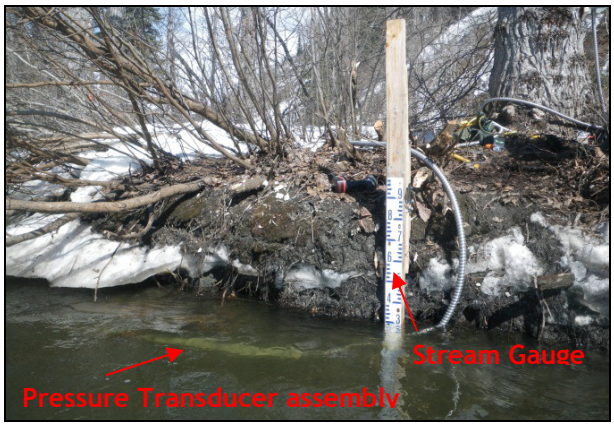
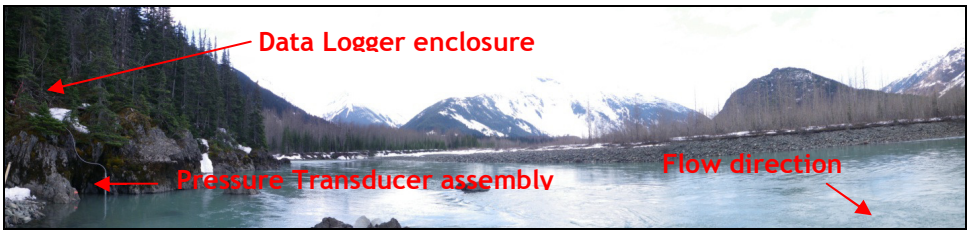


Plate 6.2-1. Low angle oblique view looking across Scott Creek towards the location of the installed hydrometric station (Scott-Hydro). July 3, 2010.



a)

b)



c)

Plate 6.2-2. Low angle views of typical hydrometric station setups used in the Study area: a) Todedada-Hydro; b) H2-Hydro; and c) Bowser-Hydro. Note the setup shown in the top left photo showing a pressure transducer laid horizontally on the channel bed, parallel to the flow. Where possible, a vertical setup anchored to bedrock or a large boulder was used.

6.3 HYDROMETRIC STATION SURVEYS

To establish and maintain elevation control at each of the hydrometric monitoring stations, at least three local benchmarks were installed. One primary benchmark at each station was assigned an assumed local elevation of 100.000 m relative to a local (non-geodetic) datum. All recorded water levels were then referenced to this primary benchmark. Throughout the monitoring period, hydrometric levelling surveys were completed, and the water level measured by the pressure transducer was checked and compared to surveyed water levels and the established benchmarks at the site. The survey was completed using an engineer's rod and level to check whether any change in the position or drift of the transducer signal had occurred. At sites where high snowfall accumulation can occur, a winter benchmark is installed significantly higher than the primary benchmark, allowing access during mid-winter site visits. Results of hydrometric levelling surveys are included in the discharge measurement forms in Appendix 2.

6.4 DISCHARGE MEASUREMENTS

At each hydrometric station, current velocity measurements were obtained so that water discharges could be determined. Measurements were taken throughout the year in order to obtain a range of discharges under varying flow conditions. At most stations, field personnel waded across a section of the stream in order to measure water velocities by means of a hand held current velocity meter. When water depth or flow velocity conditions at any of the hydrometric monitoring stations were too high to allow field personnel to safely wade across the streams, alternative methods of measuring discharge were used. The methods used were either salt-dilution gauging or acoustic Doppler current profiler (ADCP). Discharge measurement calculation forms for each site visit are located in Appendix 2.

6.4.1 Current Velocity Measurements

Manual water current velocity measurements were completed throughout the open water season, and at least once during winter low flow period each year. When air temperatures were above freezing and stream channels were safe to wade across, current velocity measurements were obtained manually by using either a rotating current meter (Swoffer 2100™ rotating current velocity meter on a horizontal axis by Swoffer Instruments Inc.) or a portable velocity meter (Marsh-McBirney Flo-mate™ by Hach Company). The Marsh-McBirney Flo-mate™ was preferred during cold weather and winter use because the Swoffer 2100™ current meter is prone to freeze up during cold weather conditions.

Water discharges were calculated from the stream velocity measurements using the velocity-area method which determines discharge across the channel between observation verticals. In this method it is assumed that the velocity sampled at each vertical represents the mean velocity in a segment. The segment area extends laterally from half the distance from the preceding vertical to half the distance to the next, and vertically from the water surface to the sounded depth. The partial discharges across the channel are then summed to obtain the estimated total discharge measurement. Typically a minimum of 20 current velocity measurements are taken across the width of a channel so each sounding or measurement interval accounts for less than 10% of the total discharge.

At each sounding point across the channel, if the observed water depth was less than 0.75 m, the current water velocities were measured at 60% of the flow depth from water surface. The measurement was assumed to be the mean velocity for the vertical water section. When water depths were greater than 0.75 m, current velocities were measured at 20% and 80% of the flow depth of water and the average of the two readings was taken as the mean velocity for the vertical. At each vertical, an average measurement time of 30 – 60 seconds ensured that velocity was representative of actual flow conditions. In all cases, the flow measurements satisfied the *British Columbia Manual of Standard Operating Procedures for Hydrometric Surveys* (RISC 2009).

6.4.2 Salt-dilution Measurements

Salt-dilution is a simple and reliable method of calculating current velocity rates in channels that are sufficiently steep and turbulent (Hudson and Fraser 2002; Moore 2004). This method can yield results that are comparable to the conventional velocity-area procedure when used in the appropriate situations. In settings where high gradient and turbulent flow conditions exist along mountain streams, it has been reported that the salt dilution procedure produces better results than the velocity-area method (Elder and Kattelmann 1990; Spence and McPhie 1997).

The salt-dilution method was used at least once during the 2012 open water season to estimate discharge at BJL-H1, Scott-Hydro, Todedada-Hydro, Wildfire-Hydro, and Wildfire-H2 (details are provided in Appendix 2). A known mass, M (mg), of common salt (sodium chloride, NaCl) is instantaneously discharged into the water at an upstream cross-section along a stream channel. The salt is then diluted with water from the natural dispersion process and forms a well-mixed plume that travels downstream. At a second cross-section downstream from the mixing reach, electrical conductivity is monitored as a proxy for mass concentration, C_M (mg/L) of salt at this location. If the measurement duration, T (sec), is long enough that the entire salt plume passes the downstream cross-section, the discharge, Q (L/s), is calculated from Equation 6.4-1 (Herschy 2009).

$$Q = \frac{M}{\int_0^T C_M dt} \qquad (6.4\text{-}1)$$

For each measurement two conductivity probes were used, installed off either bank, and the average of the measurements obtained from each probe was taken to be the estimated average discharge.

6.4.3 ADCP Measurements

At station Bowser-Hydro, water depth or water velocity conditions were often too high during the open water season to allow field personnel to safely wade and measure discharge with a handheld current velocity meter. Additionally, the channel was not steep, and under normal conditions, the flow was not sufficiently turbulent to reliably measure discharge by means of the salt dilution method. When these conditions occurred, water discharges were determined using an ADCP (Plate 6.4-1). An ADCP determines flow discharges in real-time, based on the measured water current velocities across a channel section. The ADCP-based gauging work was completed using StreamPro™ (Teledyne RD Instruments) following standard operating procedures (Rehmel et al. 2003, WSC 2004).

6.5 STAGE – DISCHARGE RELATIONSHIPS

Water discharge measurements, as explained in Section 6.4, were used to develop stage-discharge relationships for each hydrometric station. The individual discharge and concurrent stage values were plotted to produce stage-discharge rating curves (rating curve) for each hydrometric station. The relationships were used to convert water level data (stage) recorded by the automated hydrometric stations into a continuous discharge time-series.

The quality of a rating curve is a function of the number and accuracy of the individual data points that are used to generate the curve. Although a rating curve can be developed with as few as three points, each additional point increases the range and robustness of the rating curve. Flow measurements at the higher end of the flow range are especially important as they help to define flow and runoff during hydrologically significant, but short-lived flood events. The stage-discharge relationship can also change from low flow periods to high flow periods, depending on alterations in the channel's hydraulic geometry. When this is the case, a two-stage rating relationship may be developed. One relationship satisfies low water stage conditions, while the other relationship represents high stage conditions. This is important as high flows often require extrapolation beyond the range of the observed data used to generate the rating.

Plate 6.4-1. An ADCP measuring discharge on the Bowser River under swift water conditions. A cableway pulley system was used to guide the unit across the channel. October 26, 2011.

In the absence of a stage-discharge measurement corresponding to high flow conditions, the rating curve is often extrapolated to a high flow value that is beyond the range of the observed data used to generate the curve. Due to the high flow events observed during the 2011 study period, stage-discharge relationships in this study were extrapolated beyond 1.5 times the greatest measured discharge. However, any discharge extrapolation beyond that limit will have a high uncertainty associated with it (ISO 2010).

The rating curves were constructed using the Rating Development Toolbox within the Aquarius Workstation™ software, (Aquatic Informatics 2011). Methods specified by RISC (2009), ISO (2010), and Rantz et al. (1982) were followed to develop the rating curves. The concurrently measured water level (stage) and water discharge data were plotted on a logarithmic scale, and the Root Mean Square (RMS) error was assessed to produce a best-fit line for the rating curve. The best-fit line was represented by a power function (Equation 6.5-1) for the stage-discharge relationship.

$$Q = C\,(h - a)^{b} \qquad (6.5\text{-}1)$$

Where Q is the discharge (m^3/s), C and b are regression coefficients; h is the stage (water level; m). Variable a represents a datum correction for stage at zero flow (m), assuming that the gauge is positioned at a level below the point of zero flow. By convention, the rating curve is defined by a two dimensional graph whereby the dependent variable (Q) is plotted as the x-coordinate along the abscissa and the independent variable (h) is plotted as the y-coordinate along the ordinate (Herschy 2009).

Stream channels within the study area are high-gradient and highly energetic, resulting in a potential for rapid changes in stream channel geometry on the scale of months. Changes in channel geometry result in changes to the stage-discharge relation. When this occurred, a new rating relation was established for the channel.

6.6 DAILY DISCHARGE HYDROGRAPHS

Throughout the monitoring periods, water discharge estimates were calculated by applying the developed stage-discharge relationship to the recorded stage data. This allowed daily discharge hydrographs to be developed for each hydrometric station. During the winter season when individual flow measurements were carried out (but no pressure transducer was recording water levels in the channel), daily discharge values were estimated by assuming that the hydrograph followed a logarithmic decay function. A linear logarithmic decay equation was applied to the hydrograph for the interval from the last recorded water level completed to the winter low flow measurement conducted prior to the onset of the freshet each year.

Discharges extrapolated beyond 1.5 times the highest manual discharge measurement are indicated as estimated within daily flow summary tables (Appendix 6). Discharges are also marked as estimated when ice loading affected pressure transducer measurements and when runoff occurred on top of snow-lined channels, which temporarily and variably increased the water level elevation. Open water season discharge estimations were occasionally required as stations experienced short-term outages due to technical malfunction, natural damage, or vandalism. In these cases, discharge estimates were based on linear or logarithmic interpolation between reliable data points.

6.7 HYDROLOGIC INDICES

The calculated hydrologic indices presented in this report can be used to inform hydrologic assessment for engineering design of the Project infrastructure and for water resources management once the Project enters construction and operation. The indices presented are described below.

Annual runoff is the total quantity of water that is discharged (runs off) from a drainage basin in a year and is determined by dividing the volume of annual streamflow observed at a station by the drainage area upstream of that station. Runoff represents the difference between total inputs (annual rain and snow, and glacial melt) and losses (e.g., evaporation and losses to deep groundwater). It is commonly presented as a depth of water over a drainage basin. Runoff is valuable for obtaining gross estimates of the water available in a basin. Because it is standardized by drainage area, it is also a useful index for comparing the hydrologic response of basins of different sizes. Total annual runoff for each hydrometric station consists of measured and estimated runoff values during the period of record.

Monthly runoff distribution was determined by summing the daily runoff by month for each basin. It is presented as a depth (in mm) and as a percent of the total annual runoff to illustrate the spatial and temporal distribution of runoff in the study area.

Peak flow is an instantaneous local maximum value in the continuous time series of streamflows, preceded by a period of increasing values and followed by a period of decreasing values. Several peak values ordinarily occur in a year. The maximum peak value in a year is called the annual peak; peaks lower than the annual peak are called secondary peaks. Peak flows are used with flood frequency analysis techniques to estimate design flows used are then used for sizing hydraulic structures.

Low flows provide an estimate of the normal base flow conditions during the winter period and open water season, which is important for the sustained health of a stream’s aquatic community. The 7-day low flow for a stream is the average flow measured during the 7 consecutive days of lowest flow during a year or season.

6.8 QUALITY ASSURANCE AND QUALITY CONTROL

Data collection for this study was conducted in compliance with the BC guidelines for Water and Air Baseline Monitoring (BC Ministry of Environment 2012). The hydrotechnical standards and methods used in the monitoring program are based on standards published by the British Columbia Ministry of Environment (RISC 2009). These standards complement the national standards developed by the Water Survey of Canada (Environment Canada 1999). Methods used in rating curve development follow those outlined by both the RISC manual (RISC 2009) and the International Standards Organization (ISO 2010). The RISC manual outlines four criteria for both water level data and discharge data that are used to assess and grade (i.e. A, B, C, E estimated and U unknown) the overall quality of hydrometric data. The criteria are: instrumentation, stream channel condition, field procedures and data calculation and assessment. The list provided below details the methods that were used in the study, with the aim to achieve high quality data based on the standards in each of the four criteria.

- **Instrumentation.** All instrumentation used and calibration/verification procedures comply with the highest quality data collection outlined by in the RISC manual (i.e., Grade A). Data loggers and pressure transducers used for the recording and determining of continuous water level at the hydrometric station are checked, and if necessary calibrated by the manufacturer, prior to each field season. Current meters are sent for annual calibration to Environment Canada's laboratory at the National Water Research Institute in Burlington Ontario or to the manufacturer's vendor, as appropriate.
- **Stream Channel Condition.** Channel conditions affecting control of water level and discharge measurements meet the middle range of quality standards (i.e., Grade B/C). Gauging locations are sited to best meet the desirable criteria defined by RISC, however the highly unstable nature of the gauged streams due to erosion and aggradation make the higher levels of data quality in this criterion unfeasible.
- **Field Procedures.** The field procedures follow the highest standards for three out of four requirements outlined by RISC. These include the use of a minimum of three benchmarks at each station, more than two level checks per year, and twenty or more verticals in manual flow measurements. However, due to the unstable nature of the gauged streams in the study area, meeting the highest RISC standards of obtaining more than five measurements with a stable curve is not achieved at all sites and therefore the data collected varies in terms of grade (i.e., A, B, and C). Some of the stations were deactivated during winter. Wherever possible, an attempt was made to leave hydrometric stations active during the winter; however, the measurements were affected by ice. Therefore, the annual data is graded as E (estimated); this grade is similar to that assigned to seasonal WSC stations.
- **Data Calculation and Assessment.** Results of field monitoring and data collection at each station are compared to other stations and years and reviewed for anomalies. The methods used to develop rating curves are based on those outlined in both the RISC manual and by the International Standards Organization (ISO 2010; section 2.5). Generally, ten (RISC 2009) to fifteen (ISO 2010) measurements are required to develop quality rating relations and in several cases these minimums are not met due to the unstable channels causing ongoing shifts to the developed rating relations at each station. The standards apply to streams that are more stable than those observed in the study area, and include measurements made over multi-year programs. The aim of the monitoring program is to collect at least 5 to 6 measurements per year to increase confidence that data are robust and that rating relations are of good quality. For this criterion the overall data quality varies between sites (i.e., A – U).

For quality assurance purposes, data checks are conducted in the field at a minimum of ten percent of the time during the hydrometric monitoring process. In the office, the following procedure is performed:

- data reduction and analysis are carried out by the technologist or project hydrologist. Data are then imported into Aquarius™ software;
- within the Aquarius™ software format the data is examined for data integrity and consistency with provincial and federal standards; and
- if needed a final assessment and rationalization of any data anomalies or shortcomings are discussed and documented with the Discipline Manager for Hydrology.

7. Results of the Monitoring Program

7. Results of the Monitoring Program

This section provides the results of the hydrometric monitoring program for the active hydrometric stations within the study area. These include:

- Unuk-Sulphurets drainages including Stations BJL-H1, BJL-H1a, BJL-H2, SL-H1, SC-H1, and UR-H1. Stations BJL-H1 and BJL-H1a are 50 m apart on the Brucejack Creek, with no significant incremental flow between the two stations. Therefore, one set of results are provided for these stations, referred to as BJL-H1/BJL-H1a. Data regarding Stations SL-H1, SC-H1, and UR-H1 are taken from hydrologic studies on a neighbouring project (Rescan, 2013), and reported wherever applicable throughout this section; and
- Bell-Irving drainages including stations Scott-Hydro, Todedada-Hydro, and Wildfire-Hydro.

This report focuses on active stations in the study area. Information regarding the discontinued hydrometric stations (Wildfire-H2, Bowser-Hydro, H2-Hydro, H3-Hydro, H4-Hydro, H5-Hydro, and BJA-H1) were not sufficient to perform analysis and are not provided here.

7.1 WATER LEVEL DATA

Water level (i.e., stage) data were successfully recorded and retrieved from the stations within the hydrometric network. However, isolated gaps in the data records occurred in instances when the pressure transducers malfunctioned because of varying channel and flow conditions, or were damaged during an extreme rainfall event within the monitoring period.

During winter, water level data were affected by ice conditions in the channels at the hydrometric stations. The flow patterns and channel hydraulics were altered by seasonal ice build-up along the edges or within the stream reaches. The ice conditions had an influence on the development of stage-discharge relationships.

During the 2011 monitoring period, an extreme high flow event occurred in the region in early-September driven by sustained heavy rainfall. The event resulted in damage to some the hydrometric stations within the monitoring network (Todedada-Hydro, Scott-Hydro, and Wildfire-Hydro) and caused substantial changes to the channel geometry at these locations. Changes to the channel geometry subsequently altered the stage-discharge relationships at these locations. Due to these changes, rating points obtained later than mid-September at the stations mentioned were used to develop new stage-discharge relationships at these stations. It should be noted that the 2011 storm event may have residual morphologic effects in the following years. That is, the established rating curves may change in the next years.

Specific notes related to water levels recorded at the hydrometric stations are provided in Appendix 4.

7.2 DISCHARGE MEASUREMENTS

Discharge measurements for the active stations during the monitoring program are presented in Table 7.2-1. Details of these measurements, and the discharge measurements at stations that were discontinued during the monitoring program, are provided in Appendix 2.

7.3 STAGE – DISCHARGE RATING CURVES

Stage discharge curves were established for each stream monitoring station. Rating equations are summarized in Table 7.3-1, and rating curves are provided in Appendix 2.

Table 7.2-1. Summary of Flow Discharge Measurements at Active Stations in the Study Area

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007 Measurements												
BJL-H1							3.40[a]		0.39[a]			
2008 Measurements												
BJL-H1							1.25	0.71	0.38			
2009 Measurements												
BJL-H1							1.78	0.79	1.10	0.27		
Scott-Hydro										1.41		0.48
2010 Measurements												
BJL-H1					0.14, 0.68	1.22	0.86		2.86			
Bowser-Hydro												
Scott-Hydro							3.1	10.67, 4.65		2.07		
H2-Hydro							0.75	0.26, 0.30	2.39	0.98		
H3-Hydro							0.93	0.11, 0.08	1.28	0.21		
H4-Hydro							1.78	3.61	1.55	0.47		
H5-Hydro							0.76	2.40	0.82	0.20		
2011 Measurements												
BJL-H1							1.45		1.51			
BJL-H2							[b]		[b]			
Bowser-Hydro						[c]	206			18.9	3.45	
Scott-Hydro			0.25		3.59, 3.59		7.47		4.55	2.97	0.69	
H2-Hydro			0.06									
H3-Hydro			0.02									
H5-Hydro			0.06									
Todedada-Hydro					3.98	9.40	7.23					
Wildfire-Hydro					4.48	6.59	1.37		9.20			
2012 Measurements												
BJL-H1						1.70						
BJL-H1b							2.30		0.49	0.50		
BJL-H2							[b]			[b]		
Scott-Hydro			0.24		2.83, 3.76, 3.00, 2.92	8.01, 9.43	10.08		2.79	3.06	0.90	
Todedada-Hydro			0.65		3.51	10.60, 10.00	11.34		3.23	3.62	0.84	
Wildfire-Hydro			0.2		3.6	9.5, 12.4	3.8		0.7	1.8	0.3	
Wildfire-H2					1.68, 1.36	1.90, 1.74	[b]		0.06		0.15	

Notes:
[a] Discharge measurements completed by SRK Consulting Ltd.
[b] Site visited, no measurement taken
[c] Site visited, measurement did not pas QA/QC

Table 7.3-1. Stage – Discharge Rating Equations for Active Hydrometric Stations in the Study Area

Site	Rating Period	Number of Rating Points	RMS	Rating Curve Equation*
BJL-H1	July 15, 2007 – July 24, 2012	13	13.7	$Q = 6.762\ (h\text{-}98.650)^{2.339}$
BJL-H1a	July 24, 2012 - December 31, 2012	3	1.5	$Q = 7.643\ (h\text{-}98.820)^{2.317}$
Scott-Hydro	September 24, 2011 - December 31, 2012	11	8.5	$Q = 49.737\ (h\text{-}99.200)^{2.834}$
Todedada-Hydro	September 6, 2011 - December 31, 2012	6	7.2	$Q_{Low\ Flow} = 10.857\ (h\text{-}97.985)^{1.520}$ $Q_{High\ Flow} = 7.116\ (h\text{-}97.865)^{1.414}$
Wildfire-Hydro	September 9, 2011 - December 31, 2012	9	10.7	$Q = 31.670\ (h\text{-}98.170)^{2.171}$

** Rating curves generated in Aquarius™ Time Series Software*

Also included in Table 7.3-1 is the Root Mean Square error (RMS). The RMS is a statistical parameter that describes how well the values predicted by the stage-discharge relation fit or represent the observed data. The departure from true values computed by this statistic combines both bias and lack of precision. For a given sample size, the lower the RMS, the better the estimated values provided by the rating relationship.

7.4 DISCHARGE HYDROGRAPHS

Daily discharge hydrographs during the monitoring period are presented in Appendix 5. Hydrographs for SL-H1, SC-H1, and UR-H1 are taken from Rescan (2013). Low flows were observed during end-of-winter baseflow conditions. Annual low flows were followed by steep rising limbs of the hydrographs during the spring freshet. In glacierized watersheds, flows fluctuated throughout summer, but remained high due to glacial melt (depending on watershed elevation and extent of watershed glacierization). Streamflows in unglacierized basins gradually declined through the summer. Episodic autumn rainfall resulted in short-lived runoff events in both glacierized and non-glacierized basins. A particularly large rainfall event occurred in early September, 2011. Over an eight day period, 265 mm of rain fell at Brucejack Lake. In late fall and early winter, discharge receded back to baseflow levels.

Full-year hydrographs for the active stations in the study area include BJL-H1/BJL-H1a (2008, 2010-2012), SL-H1 (2008-2011), SC-H1 (2008-2011), UR-H1 (2008-2011), Scott-Hydro (2010-2012), Todedada-Hydro (2012), and Wildfire-Hydro (2012).

7.4.1 Unuk-Sulphurets Drainages

The Brucejack Lake outflow (BJL-H1/BJL-H1a) is characterized by a flashy hydrograph (Appendix 5), with multiple peaks. The outflow is located in a narrow canyon immediately below Brucejack Lake. Cycles of snow-and-ice dam buildup (normally in October) and breach (in May and June) in the canyon can generate large fluctuations in discharge (Appendix 4, Plate A4-1). Snow and ice obstructions in the canyon can cause backwater effects upstream. This results in a hydrograph with sudden stage increases followed by relatively sudden drops as water drains past the melting ice obstruction.

For SL-H12 and SC-H1, spring freshet typically began in late-April. In general, over the period of record, summer discharge remained relatively consistent or steadily increased, representing a glacial regime.

The Unuk River displayed spring freshet peaks, steadily declining flows throughout summer, and autumn flow peaks in response to precipitation. The Unuk River watershed is 15% glacierized area, substantially less glacier cover than the monitored watersheds in the Sulphurets drainages which range from 38 - 49% (Table 5.1-2). Due to the relatively low percentage of glacial cover in the Unuk River watershed, pluvial (rainfall) and nival (snowmelt) processes drive the hydrologic regime. However, glacial contribution can be observed, and the hydrological regime may be categorized as a mixed regime.

Discharge peaks associated with fall rainstorms are common in Unuk-Sulphurets drainages. An extreme precipitation event in early September 2011 is clearly visible on hydrographs for all stations.

7.4.2 Bell-Irving Drainages

Hydrographs for Scott-Hydro and Todedada-Hydro show an initial response to snowmelt in mid-to-late April (Appendix 5). Following the freshet, these stations follow a mixed (nival-glacial) regime.

The Wildfire-Hydro station experienced a May-June freshet peak, following by declining flows throughout summer, and a flow rise in autumn in response to precipitation. The Wildfire watershed is minimally glacierized (1.9%) and represents a nival regime.

Similar to Unuk-Sulphurets drainages, the extreme storm event in September 2011, caused a peak flow that equaled or exceeded the freshet discharge peaks.

7.5 HYDROLOGIC INDICIES

7.5.1 Annual Runoff and Volumetric Outflow

Average annual runoff ranged from a minimum of 1188 mm in Wildfire-Hydro watershed to a maximum of 2588 mm in Todedada-Hydro watershed, (Table 7.5-1). It should be noted that results from these two stations are based on one full year of data. In other watersheds with longer period of data, a distinctive difference is evident between Scott-Hydro on the east, and SL-H1, SC-H1, and UR-H1 on the west. Annual runoff in the Brucejack Lake watershed (BJL-H1/BJL-H1a) is between these low (east) and high (west) values. To estimate the mean annual runoff for BJL-H1/BJL-H1a, two drainage area scenarios were used: the scenario based on BC Freshwater Atlas (GeoBC 2008) and the alternative scenario based on KPL (2011) delineation. Discontinued stations (H2-H5 Hydro, Bowser-Hydro, Wildfire-H2, and BJA-H1) were excluded from this analysis due to insufficient data collected over the period of record.

Table 7.5-1. Estimated Annual Runoff (mm) and Mean Annual Discharge (m^3/s) in the Study Area

Watershed	Drainage Area (km^2)	Annual Runoff (mm)						Mean Annual Discharge (m^3/s)
		2008	2009	2010	2011	2012	Average	
BJL-H1 / BJL-H1a	13.9[a]	1690		1452	1432	1331	1477	0.65
	11.7[b]	2008		1725	1702	1582	1754	0.65
SL-H1	84.2	1886	2508	2297	2977		2417	6.45
SC-H1	298.6	2272	2450	2302	2480		2376	22.50
UR-H1	400.0	2011	2216	1870	2316		2103	26.68
Scott-Hydro	74.5			1568	1321	1501	1463	3.46
Todedada-Hydro	61.1					2588	2588	5.01
Wildfire-Hydro	66.9					1188	1188	2.52

[a] *Based on BC Feshwater Atlas (GeoBC 2008) delineation*
[b] *Based on KPL (2011) delineation*

Within the study area, the percent glacial coverage in a watershed affects the magnitude of annual runoff. In order to visualize this effect, estimated cumulative daily runoff in 2012 is shown for the active stations within the Project (Figure 7.5-1). More runoff is supplied in watersheds that can contribute glacial melt throughout the summer, while in snowmelt-fed watersheds, the water supply is largely exhausted after snowmelt. For example, in the minimally glacierized Wildfire-Hydro watershed, cumulative runoff had largely plateaued by mid-July, with the exception of renewed flow as a result of early-September rainfall. That is, a nival regime was evident in this watershed. By contrast, in Stations BJL-H1/BJL-H1a (42% glacierized), Scott-Hydro (21% glacierized), and Todedada-Hydro (25% glacierized), cumulative runoff continued to rise until September, presumably when falling air temperatures caused a cessation of glacial melt. That is, a glacial or mixed regime was observed in these watersheds.

Other factors control the amount of runoff within the study area, too; for example, the type and amount of precipitation. In higher elevation watersheds, more precipitation would be stored as snow. In addition, soil moisture, the thickness and particle size of unconsolidated sediment, vegetation type, and evapotranspiration all affect the amount of runoff and the shape of cumulative runoff curves (Linsley et al. 1986).

Unlike runoff, mean annual discharge (MAD) is not normalized to watershed size, and is controlled more by drainage area. During the record period, the lowest MAD were recorded at Station BJL-H1/BJL-H1a (drainage area 13.9 km^2), and highest MAD was recorded at UR-H1 (drainage area 400 km^2; Table 7.5-1).

7.5.2 Monthly Distribution of Runoff

Most runoff occurred during May to September (Tables 7.5-2 and 7.5-3; Figure 7.5-2). Among the stations, Wildfire-Hydro represents a nival regime with substantial decline in flow during summer, while SC-H1 and SL-H1 show a glacial regime with steadily increasing flow in summer, and other stations are between these two regimes.

7.5.3 Annual Peak Flows

Annual peak flow magnitudes were developed from the respective rating curves for each hydrometric monitoring station. Inevitable uncertainty is associated with peak flow assessment because: a) these flows are estimated based on extrapolated segments of rating curves; and b) some of these events are affected by downstream ice effects (e.g., BJL-H1/BJL-H1a peak flows during the initial freshet). Peak instantaneous and daily discharge typically varied in proportion to the size of the watershed. To allow comparison between watersheds, instantaneous and daily peak unit yield values are also calculated. Peak unit yield is the peak discharge normalized by watershed area, and is expressed in units of $L/s/km^2$. Table 7.5-4 provides the instantaneous and daily peak flow, instantaneous and daily peak unit yield, and, the observed timing of instantaneous peak flow for the monitored watersheds in the study area.

Peak flows in the study area drainage basins occurred at varying times of the year (Table 7.5-4). Peak flow magnitude was largely dependent on watershed area. Over the period of record, the average instantaneous peak flows ranged from 7.9 m^3/s at Station BJL-H1/BJL-H1a to 265.7 m^3/s at Station UR-H1 (Table 7.5-4). Peak flow within a given stream occurred in response to hydrometeorologic events. For example, in 2010 and 2011, peak flows occurred during the initial freshet (at BJL-H1/BJL-H1a) or fall rainfall events (at all other stations). In 2012, an avalanche upstream of Todedada-Hydro affected the channel and caused increased water levels in April.

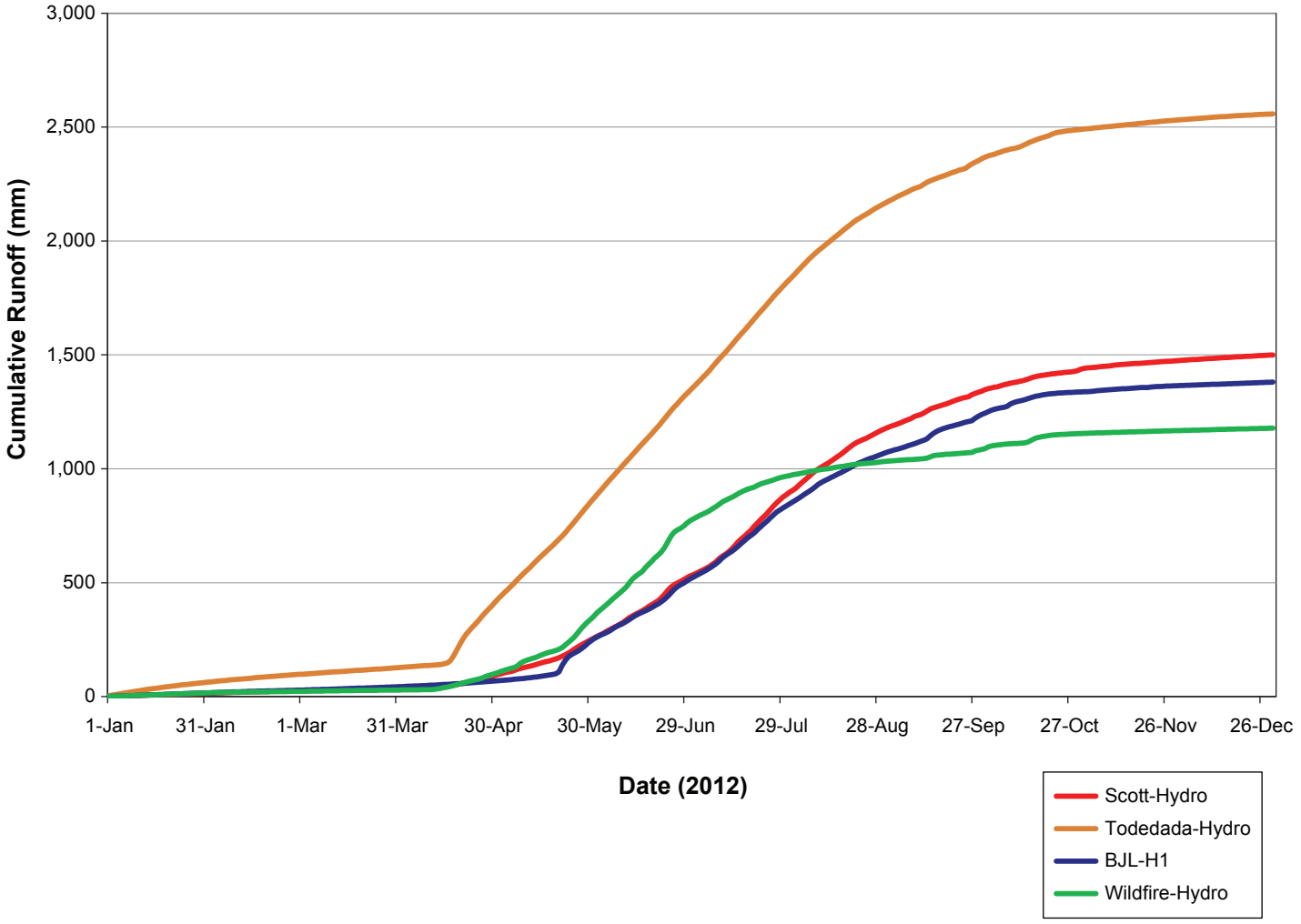


Figure 7.5-1

PRETIVM

Estimated 2012 Cumulative Runoff for Active Stations within the Project Area

Figure 7.5-1

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Table 7.5-2. Monthly Runoff Amounts (mm) for Period of Record in the Project Area

Station Name	Year	January	February	March	April	May	June	July	August	September	October	November	December	Annual Runoff
BJL-H1[a]	2008	*8*	*5*	*8*	*14*	*375*	*445*	*361*	*194*	*82*	*71*	*65*	*63*	*1690*
	2010	*26*	*18*	*25*	*46*	*303*	*267*	*248*	*192*	*153*	*120*	*34*	*20*	*1452*
	2011	*11*	*12*	*17*	*23*	*158*	*308*	*239*	*200*	*259*	*131*	*52*	*22*	*1432*
	2012	*16*	*12*	*14*	*23*	*171*	*253*	*317*	*225*	*161*	*96*	*26*	*15*	*1331*
	Mean	**15**	**12**	**16**	**27**	**252**	**318**	**291**	**203**	**164**	**105**	**44**	**30**	**1477**
	Minimum	**8**	**5**	**8**	**14**	**158**	**253**	**239**	**192**	**82**	**71**	**26**	**15**	**1331**
	Maximum	**26**	**18**	**25**	**46**	**375**	**445**	**361**	**225**	**259**	**131**	**65**	**63**	**1690**
SL-H1	2008	30	24	26	24	133	246	399	514	253	168	41	27	*1886*
	2009	17	11	10	14	96	388	763	636	454	87	22	9	*2508*
	2010	13	13	15	29	162	334	517	651	351	158	39	15	*2297*
	2011	10	11	14	16	143	463	600	683	849	150	30	9	*2977*
	Mean	**18**	**15**	**16**	**21**	**133**	**357**	**570**	**621**	**477**	**141**	**33**	**15**	**2417**
	Minimum	**10**	**11**	**10**	**14**	**96**	**246**	**399**	**514**	**253**	**87**	**22**	**9**	**1886**
	Maximum	**30**	**24**	**26**	**29**	**162**	**463**	**763**	**683**	**849**	**168**	**41**	**27**	**2977**
SC-H1	2008	*39*	*36*	*39*	*37*	*209*	*279*	*470*	*585*	*288*	*186*	*59*	*45*	*2272*
	2009	*52*	*33*	*23*	*50*	*134*	*409*	*668*	*547*	*406*	*73*	*31*	*23*	*2450*
	2010	*29*	*21*	*25*	*43*	*135*	*306*	*461*	*588*	*333*	*203*	*103*	*56*	*2302*
	2011	*30*	*24*	*23*	*27*	*167*	*410*	*472*	*482*	*512*	*228*	*70*	*35*	*2480*
	Mean	**37**	**29**	**27**	**39**	**161**	**351**	**518**	**550**	**385**	**172**	**66**	**40**	**2376**
	Minimum	**29**	**21**	**23**	**27**	**134**	**279**	**461**	**482**	**288**	**73**	**31**	**23**	**2272**
	Maximum	**52**	**36**	**39**	**50**	**209**	**410**	**668**	**588**	**512**	**228**	**103**	**56**	**2480**
UR-H1	2008	*39*	*49*	*71*	*93*	*277*	*346*	*384*	*325*	*155*	*154*	*74*	*46*	*2011*
	2009	*30*	*19*	*15*	*45*	*251*	*613*	*453*	*275*	*312*	*104*	*62*	*36*	*2216*
	2010	*35*	*36*	*46*	*59*	*196*	*318*	*296*	*264*	*278*	*209*	*90*	*41*	*1870*
	2011	*29*	*22*	*27*	*30*	*96*	*589*	*389*	*270*	*559*	*146*	*110*	*50*	*2316*
	Mean	**33**	**32**	**40**	**57**	**205**	**466**	**380**	**284**	**326**	**153**	**84**	**43**	**2103**
	Minimum	**29**	**19**	**15**	**30**	**96**	**318**	**296**	**264**	**155**	**104**	**62**	**36**	**1870**
	Maximum	**39**	**49**	**71**	**93**	**277**	**613**	**453**	**325**	**559**	**209**	**110**	**50**	**2316**
Scott-Hydro	2010	12	10	17	92	239	249	291	289	166	140	52	10	*1568*
	2011	4	2	2	12	242	281	234	183	231	90	24	15	*1321*
	2012	15	11	9	54	162	272	363	291	163	97	38	26	*1501*
	Mean	**10**	**8**	**9**	**53**	**214**	**267**	**296**	**255**	**187**	**109**	**38**	**17**	**1463**
	Minimum	**4**	**2**	**2**	**12**	**162**	**249**	**234**	**183**	**163**	**90**	**24**	**10**	**1321**
	Maximum	**15**	**11**	**17**	**92**	**242**	**281**	**363**	**291**	**231**	**140**	**52**	**26**	**1568**
Todedada-Hydro	2012	*63*	*35*	*30*	*275*	*463*	*480*	*490*	*355*	*196*	*131*	*42*	*28*	*2588*
	Mean	**63**	**35**	**30**	**275**	**463**	**480**	**490**	**355**	**196**	**131**	**42**	**28**	**2588**
	Minimum	**63**	**35**	**30**	**275**	**463**	**480**	**490**	**355**	**196**	**131**	**42**	**28**	**2588**
	Maximum	**63**	**35**	**30**	**275**	**463**	**480**	**490**	**355**	**196**	**131**	**42**	**28**	**2588**
Wildfire-Hydro	2012	*16*	*7*	*6*	*69*	*246*	*424*	*206*	*66*	*52*	*71*	*13*	*11*	*1188*
	Mean	**16**	**7**	**6**	**69**	**246**	**424**	**206**	**66**	**52**	**71**	**13**	**11**	**1188**
	Minimum	**16**	**7**	**6**	**69**	**246**	**424**	**206**	**66**	**52**	**71**	**13**	**11**	**1188**
	Maximum	**16**	**7**	**6**	**69**	**246**	**424**	**206**	**66**	**52**	**71**	**13**	**11**	**1188**

[a] *Based on BC Feshwater Atlas (GeoBC 2008) delineation*

Table 7.5-3. Monthly Runoff Distribution (%) for Period of Record in the Project Area

Station Name	Year	January	February	March	April	May	June	July	August	September	October	November	December
BJL-H1	2008	*0.5*	*0.3*	*0.5*	*0.8*	*22.2*	*26.3*	*21.3*	*11.5*	*4.9*	*4.2*	*3.8*	*3.8*
	2010	*1.8*	*1.2*	*1.7*	*3.2*	*20.9*	*18.4*	*17.1*	*13.2*	*10.5*	*8.3*	*2.3*	*1.3*
	2011	*0.8*	*0.8*	*1.2*	*1.6*	*11.0*	*21.5*	*16.7*	*13.9*	*18.1*	*9.2*	*3.6*	*1.6*
	2012	*1.2*	*0.9*	*1.1*	*1.8*	*12.9*	*19.0*	*23.8*	*16.9*	*12.1*	*7.2*	*2.0*	*1.2*
	Mean	**1.0**	**0.8**	**1.1**	**1.8**	**16.8**	**21.3**	**19.7**	**13.9**	**11.4**	**7.2**	**2.9**	**2.0**
	Minimum	**0.5**	**0.3**	**0.5**	**0.8**	**11.0**	**18.4**	**16.7**	**11.5**	**4.9**	**4.2**	**2.0**	**1.2**
	Maximum	**1.8**	**1.2**	**1.7**	**3.2**	**22.2**	**26.3**	**23.8**	**16.9**	**18.1**	**9.2**	**3.8**	**3.8**
SL-H1	2008	*1.6*	*1.3*	*1.4*	*1.3*	*7.0*	*13.0*	*21.2*	*27.2*	*13.4*	*8.9*	*2.2*	*1.4*
	2009	*0.7*	*0.5*	*0.4*	*0.6*	*3.8*	*15.5*	*30.4*	*25.4*	*18.1*	*3.5*	*0.9*	*0.4*
	2010	*0.6*	*0.6*	*0.6*	*1.2*	*7.0*	*14.5*	*22.5*	*28.3*	*15.3*	*6.9*	*1.7*	*0.6*
	2011	*0.3*	*0.4*	*0.5*	*0.5*	*4.8*	*15.5*	*20.2*	*22.9*	*28.5*	*5.0*	*1.0*	*0.3*
	Mean	**0.8**	**0.7**	**0.7**	**0.9**	**5.7**	**14.6**	**23.6**	**26.0**	**18.8**	**6.1**	**1.4**	**0.7**
	Minimum	**0.3**	**0.4**	**0.4**	**0.5**	**3.8**	**13.0**	**20.2**	**22.9**	**13.4**	**3.5**	**0.9**	**0.3**
	Maximum	**1.6**	**1.3**	**1.4**	**1.3**	**7.0**	**15.5**	**30.4**	**28.3**	**28.5**	**8.9**	**2.2**	**1.4**
SC-H1	2008	*1.7*	*1.6*	*1.7*	*1.6*	*9.2*	*12.3*	*20.7*	*25.8*	*12.7*	*8.2*	*2.6*	*2.0*
	2009	*2.1*	*1.3*	*0.9*	*2.0*	*5.5*	*16.7*	*27.3*	*22.3*	*16.6*	*3.0*	*1.3*	*1.0*
	2010	*1.3*	*0.9*	*1.1*	*1.9*	*5.9*	*13.3*	*20.0*	*25.5*	*14.5*	*8.8*	*4.5*	*2.4*
	2011	*1.2*	*1.0*	*0.9*	*1.1*	*6.7*	*16.5*	*19.1*	*19.4*	*20.6*	*9.2*	*2.8*	*1.4*
	Mean	**1.6**	**1.2**	**1.2**	**1.7**	**6.8**	**14.7**	**21.8**	**23.3**	**16.1**	**7.3**	**2.8**	**1.7**
	Minimum	**1.2**	**0.9**	**0.9**	**1.1**	**5.5**	**12.3**	**19.1**	**19.4**	**12.7**	**3.0**	**1.3**	**1.0**
	Maximum	**2.1**	**1.6**	**1.7**	**2.0**	**9.2**	**16.7**	**27.3**	**25.8**	**20.6**	**9.2**	**4.5**	**2.4**
UR-H1	2008	*1.9*	*2.4*	*3.5*	*4.6*	*13.8*	*17.2*	*19.1*	*16.2*	*7.7*	*7.7*	*3.7*	*2.3*
	2009	*1.4*	*0.9*	*0.7*	*2.0*	*11.3*	*27.6*	*20.4*	*12.4*	*14.1*	*4.7*	*2.8*	*1.6*
	2010	*1.9*	*1.9*	*2.4*	*3.2*	*10.5*	*17.0*	*15.8*	*14.1*	*14.9*	*11.2*	*4.8*	*2.2*
	2011	*1.3*	*1.0*	*1.2*	*1.3*	*4.1*	*25.4*	*16.8*	*11.6*	*24.2*	*6.3*	*4.8*	*2.1*
	Mean	**1.6**	**1.5**	**2.0**	**2.8**	**9.9**	**21.8**	**18.0**	**13.6**	**15.2**	**7.5**	**4.0**	**2.1**
	Minimum	**1.3**	**0.9**	**0.7**	**1.3**	**4.1**	**17.0**	**15.8**	**11.6**	**7.7**	**4.7**	**2.8**	**1.6**
	Maximum	**1.9**	**2.4**	**3.5**	**4.6**	**13.8**	**27.6**	**20.4**	**16.2**	**24.2**	**11.2**	**4.8**	**2.3**
Scott-Hydro	2010	*0.8*	*0.7*	*1.1*	*5.9*	*15.2*	*15.9*	*18.6*	*18.5*	*10.6*	*8.9*	*3.3*	*0.7*
	2011	*0.3*	*0.2*	*0.1*	*0.9*	*18.3*	*21.3*	*17.7*	*13.9*	*17.5*	*6.8*	*1.8*	*1.1*
	2012	*1.0*	*0.7*	*0.6*	*3.6*	*10.8*	*18.1*	*24.2*	*19.4*	*10.9*	*6.5*	*2.5*	*1.7*
	Mean	**0.7**	**0.5**	**0.6**	**3.5**	**14.8**	**18.4**	**20.2**	**17.2**	**13.0**	**7.4**	**2.5**	**1.2**
	Minimum	**0.3**	**0.2**	**0.1**	**0.9**	**10.8**	**15.9**	**17.7**	**13.9**	**10.6**	**6.5**	**1.8**	**0.7**
	Maximum	**1.0**	**0.7**	**1.1**	**5.9**	**18.3**	**21.3**	**24.2**	**19.4**	**17.5**	**8.9**	**3.3**	**1.7**
Todedada-Hydro	2012	*2.4*	*1.4*	*1.2*	*10.6*	*17.9*	*18.6*	*18.9*	*13.7*	*7.6*	*5.0*	*1.6*	*1.1*
	Mean	**2.4**	**1.4**	**1.2**	**10.6**	**17.9**	**18.6**	**18.9**	**13.7**	**7.6**	**5.0**	**1.6**	**1.1**
	Minimum	**2.4**	**1.4**	**1.2**	**10.6**	**17.9**	**18.6**	**18.9**	**13.7**	**7.6**	**5.0**	**1.6**	**1.1**
	Maximum	**2.4**	**1.4**	**1.2**	**10.6**	**17.9**	**18.6**	**18.9**	**13.7**	**7.6**	**5.0**	**1.6**	**1.1**
Wildfire-Hydro	2012	*1.4*	*0.6*	*0.5*	*5.8*	*20.7*	*35.7*	*17.4*	*5.6*	*4.4*	*5.9*	*1.1*	*1.0*
	Mean	**1.4**	**0.6**	**0.5**	**5.8**	**20.7**	**35.7**	**17.4**	**5.6**	**4.4**	**5.9**	**1.1**	**1.0**
	Minimum	**1.4**	**0.6**	**0.5**	**5.8**	**20.7**	**35.7**	**17.4**	**5.6**	**4.4**	**5.9**	**1.1**	**1.0**
	Maximum	**1.4**	**0.6**	**0.5**	**5.8**	**20.7**	**35.7**	**17.4**	**5.6**	**4.4**	**5.9**	**1.1**	**1.0**

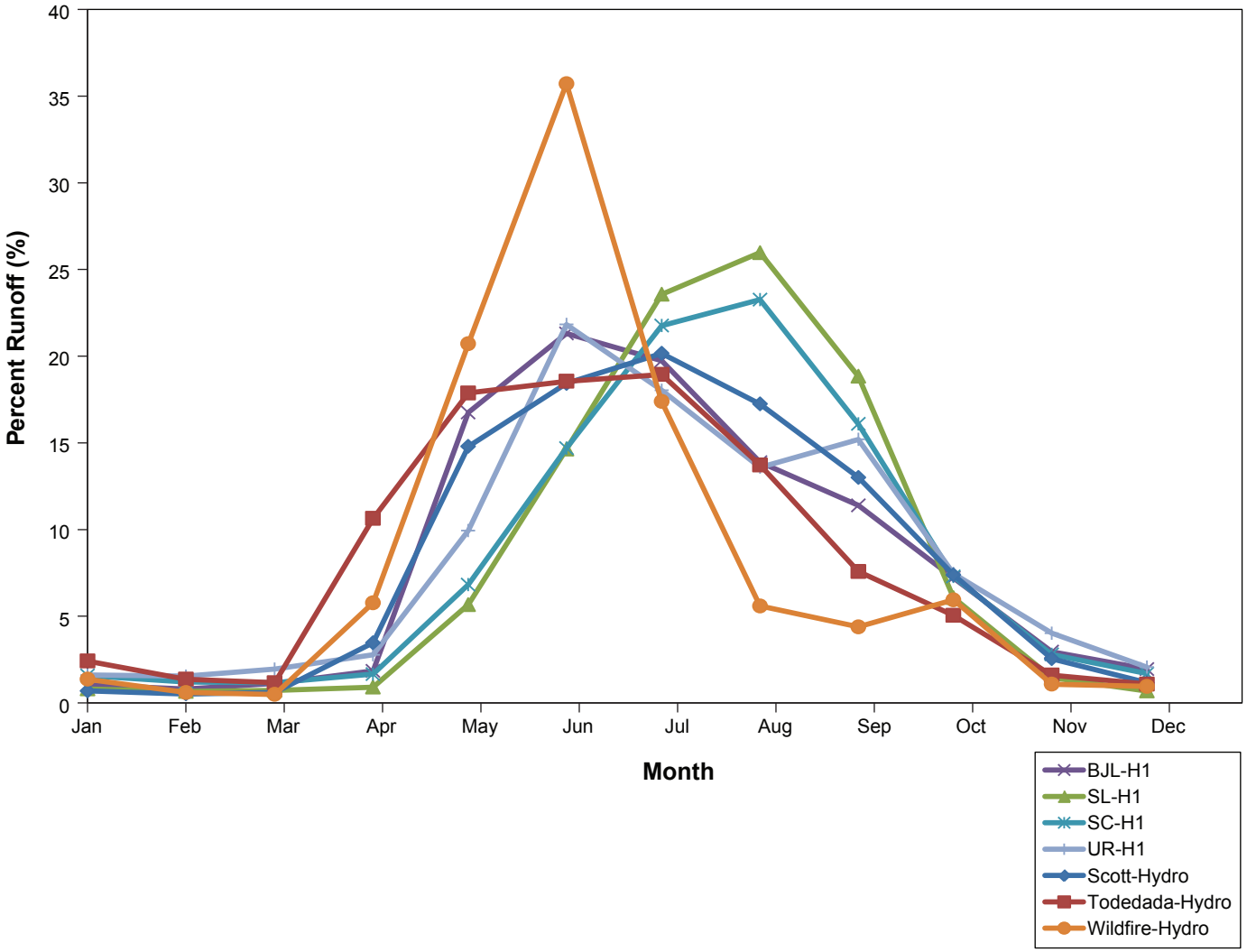

Figure 7.5-2

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Average Monthly Distribution of Runoff for Period of Record at Active Hydrometric Stations

Figure 7.5-2

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Table 7.5-4. Peak Discharge, Peak Unit Yield, and Time of Occurrence for Period of Record in Active Hydrometric Stations within the Study Area

Station Name	Year	Peak Discharge (m^3/s)		Instantaneous Peak	Peak Unit Yield ($L/s/km^2$)#		Mean Annual Discharge (m^3/s)
		Instantaneous	Daily		Instantaneous	Daily	
BJL-H1 / BJL-H1a	2008	*12.6*	*7.2*	23-May*	*904*	*520*	*0.75*
	2010	*4.3*	*3.7*	28-May	*308*	*268*	*0.64*
	2011	*7.7*	*3.5*	24-May*	*556*	*250*	*0.63*
	2012	*7.0*	*4.5*	22-May	*505*	*324*	*0.59*
	Mean	**7.9**	**4.7**		**568**	**340**	**0.65**
	Minimum	**4.3**	**3.5**		**308**	**250**	**0.59**
	Maximum	**12.6**	**7.2**		**904**	**520**	**0.75**
SL-H1	2008	29.1	27.7	24-Aug	346	329	5.04
	2009	55.1	52.2	30-Jul	654	620	6.70
	2010	72.7	54.0	3-Sep	863	641	6.13
	2011	n/a	63.9	8-Sep	n/a	759	7.95
	Mean	**52.3**	**49.4**		**621**	**587**	**6.45**
	Minimum	**29.1**	**27.7**		**346**	**329**	**5.04**
	Maximum	**72.7**	**63.9**		**863**	**759**	**7.95**
SC-H1	2008	132.0	56.8	18-Aug	*442*	*190*	*21.51*
	2009	159.6	128.2	30-Jul	*535*	*429*	*23.20*
	2010	171.4	132.1	4-Sep	*574*	*442*	*21.79*
	2011	140.6	127.0	22-Sep	*471*	*425*	*23.48*
	Mean	**150.9**	**111.0**		**505**	**372**	**22.50**
	Minimum	**132.0**	**56.8**		**442**	**190**	**21.51**
	Maximum	**171.4**	**132.1**		**574**	**442**	**23.48**
UR-H1	2008	122.3	95.7	29-Sep	*306*	*239*	*25.51*
	2009	314.8	200.1	22-Sep	*787*	*500*	*28.11*
	2010	359.9	180.4	3-Sep	*900*	*451*	*23.72*
	2011	*n/a*	291.0	21-Sep	*n/a*	*728*	*29.38*
	Mean	**265.7**	**191.8**		**664**	**479**	**26.68**
	Minimum	**122.3**	**95.7**		**306**	**239**	**23.72**
	Maximum	**359.9**	**291.0**		**900**	**728**	**29.38**
Scott-Hydro	2010	19.2	14.4	27-Sep*	257	193	3.70
	2011	27.7	24.3	9-Sep	371	326	3.12
	2012	17.7	15.2	21-Jul*	238	203	3.54
	Mean	**21.5**	**17.9**		**289**	**241**	**3.46**
	Minimum	**17.7**	**14.4**		**238**	**193**	**3.12**
	Maximum	**27.7**	**24.3**		**371**	**326**	**3.70**
Todedada-Hydro	2011	57.5	31.8	6-Sep*	*941*	*520*	*n/a*
	2012	19.4	18.5	19-Apr	*318*	*302*	*5.01*
	Mean	**38.5**	**25.1**		**630**	**411**	**5.01**
	Minimum	**19.4**	**18.5**		**318**	**302**	**5.01**
	Maximum	**57.5**	**31.8**		**941**	**520**	**5.01**
Wildfire-Hydro	2011	20.9	13.5	23-Sep*	*312*	*202*	*n/a*
	2012	35.2	20.2	24-Jun	*526*	*302*	*2.52*
	Mean	**28.0**	**16.9**		**419**	**252**	**2.52**
	Minimum	**20.9**	**13.5**		**312**	**202**	**2.52**
	Maximum	**35.2**	**20.2**		**526**	**302**	**2.52**

** Peak instantaneous and daily flows occurred on different dates*

 # Based on BC Freshwater Atlas (GeoBC 2008) delineation

7.5.4 Annual Low Flows

Annual low flows typically occur during the winter in the Project region, because a large percentage of the water is being stored as either snow or ice. At the majority of hydrometric stations, the pressure transducer is either not active during the winter (to protect the pressure membrane from freezing), or the quality of the data collected is unreliable (ice encroachment and accumulation changes the stage-discharge relation in the channel). Discharge during winter low-flow periods was estimated by interpolating between manual discharge measurements, and is marked as 'estimated'. Therefore, annual 7-day winter low flows in Table 7.5-5 include discharge estimates used to fill in gaps in yearly hydrographs. During the summer season (June to September), the average 7-day low flow was calculated yearly at each station.

Annual 7-day low flows that were calculated based on estimated winter flows generally varied with the size of watersheds ranging from 0.05 m^3/s at BJL-H1/BJL-H1a (13.9 km^2) to 3.92 m^3/s at UR-H1 (400.0 km^2). The 7-day low flows during the June to September open water period are of interest due to the increased biological activity during this period compared to the winter. Open water low flows in the study area usually occurred in late August to September when glacial melt declined and snowpack was exhausted. June to September 7-day low flows were dependent on the watershed size and glacier coverage. For example, although the drainage are of UR-H1 (400.0 km^2) is greater than that of SC-H1 (298.6 km^2), June to September 7-day low flows are higher at SC-H1. This is mainly to higher glacier coverage at SC-H1 (38%) compared with UR-H1 (15%).

Table 7.5-5. Low Flow Magnitudes for Period of Record in Active Stations within the Study Area

Station Name	Year	Average 7-Day Low Flows (m^3/s)		Winter Manual Flow Measurement (m^3/s)	Mean Annual Discharge (m^3/s)
		Jun-Sep[a]	Annual[b]		
BJL-H1 / BJL-H1a	2008	0.38	0.02	n/a	*0.75*
	2010	0.32	0.08	n/a	*0.64*
	2011	0.75	0.05	n/a	*0.63*
	2012	0.58	0.06	n/a	*0.59*
	Mean	0.51	0.05		0.65
	Minimum	0.32	0.02		0.59
	Maximum	0.75	0.08		0.75
SL-H1	2008	5.25	0.69	n/a	5.04
	2009	4.83	0.15	0.28	6.70
	2010	4.52	0.31	0.67	6.13
	2011	11.56	0.15	0.18	7.95
	Mean	6.54	0.33	0.38	6.45
	Minimum	4.52	0.15	0.18	5.04
	Maximum	11.56	0.69	0.67	7.95
SC-H1	2008	17.99	4.32	n/a	*21.51*
	2009	20.96	2.09	2.02	*23.20*
	2010	18.11	2.46	3.58	*21.79*
	2011	36.99	2.23	2.31	*23.48*
	Mean	23.51	2.77	2.64	22.50
	Minimum	17.99	2.09	2.02	21.51
	Maximum	36.99	4.32	3.58	23.48
UR-H1	2008	11.10	5.15	n/a	*25.51*
	2009	28.53	2.02	1.96	*28.11*
	2010	15.58	4.95	5.11	*23.72*
	2011	25.82	3.55	2.33	*29.38*
	Mean	20.26	3.92	3.13	26.68
	Minimum	11.10	2.02	1.96	23.72
	Maximum	28.53	5.15	5.11	29.38
Scott-Hydro	2010	2.08	0.19	0.48	3.70
	2011	3.26	0.04	0.25	3.12
	2012	3.89	0.22	0.24	3.54
	Mean	3.08	0.15	0.32	3.46
	Minimum	2.08	0.04	0.24	3.12
	Maximum	3.89	0.22	0.48	3.70
Todedada-Hydro	2011	3.55	n/a	n/a	*n/a*
	2012	3.48	0.52	0.65	*5.01*
	Mean	3.51	0.52	0.65	5.01
	Minimum	3.48	0.52	0.65	5.01
	Maximum	3.55	0.52	0.65	5.01
Wildfire-Hydro	2011	0.40	n/a	n/a	*n/a*
	2012	0.70	0.12	0.20	*2.52*
	Mean	0.55	0.12	0.20	2.52
	Minimum	0.40	0.12	0.20	2.52
	Maximum	0.70	0.12	0.20	2.52

[a] *based on average daily flow*
[b] *based on partial season data or estimated flows*
n/a winter manual flow measurement not available

8. Regional Analysis and Hydrologic Indices

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8. Regional Analysis and Hydrologic Indices

While the data collected within the Project area allowed for a detailed assessment of hydrological conditions during the monitoring period, they only provide an indication of the possible range of flows within the Project area over a limited time period. In order to undertake a hydrological assessment for mine site development, engineering design and for the environmental assessment process, an estimate of expected normal and return period values for a number of key hydrological indices that consider a wider range of hydrologic conditions over a longer time period is required. In order to make robust estimates of these indices, long-term flow records of at least 10 years in duration are preferred (Dingman 2002). When there are not sufficient data from local hydrometric stations for this purpose, estimates are generally derived through analysis of regional long-term hydrometric datasets. Using regional flow data and scaling relationships, estimates for the established hydrometric gauging stations can be derived and applied to any drainage area of interest within the Project area.

The available regional hydrologic data sets are analyzed and used to estimate average and extreme hydrological conditions within the Project area. These predictions are then compared to the observed data. Methodologies are described that can be used to calculate hydrological parameters for the key watershed and sub-watersheds in the Project area. The key parameters considered here include:

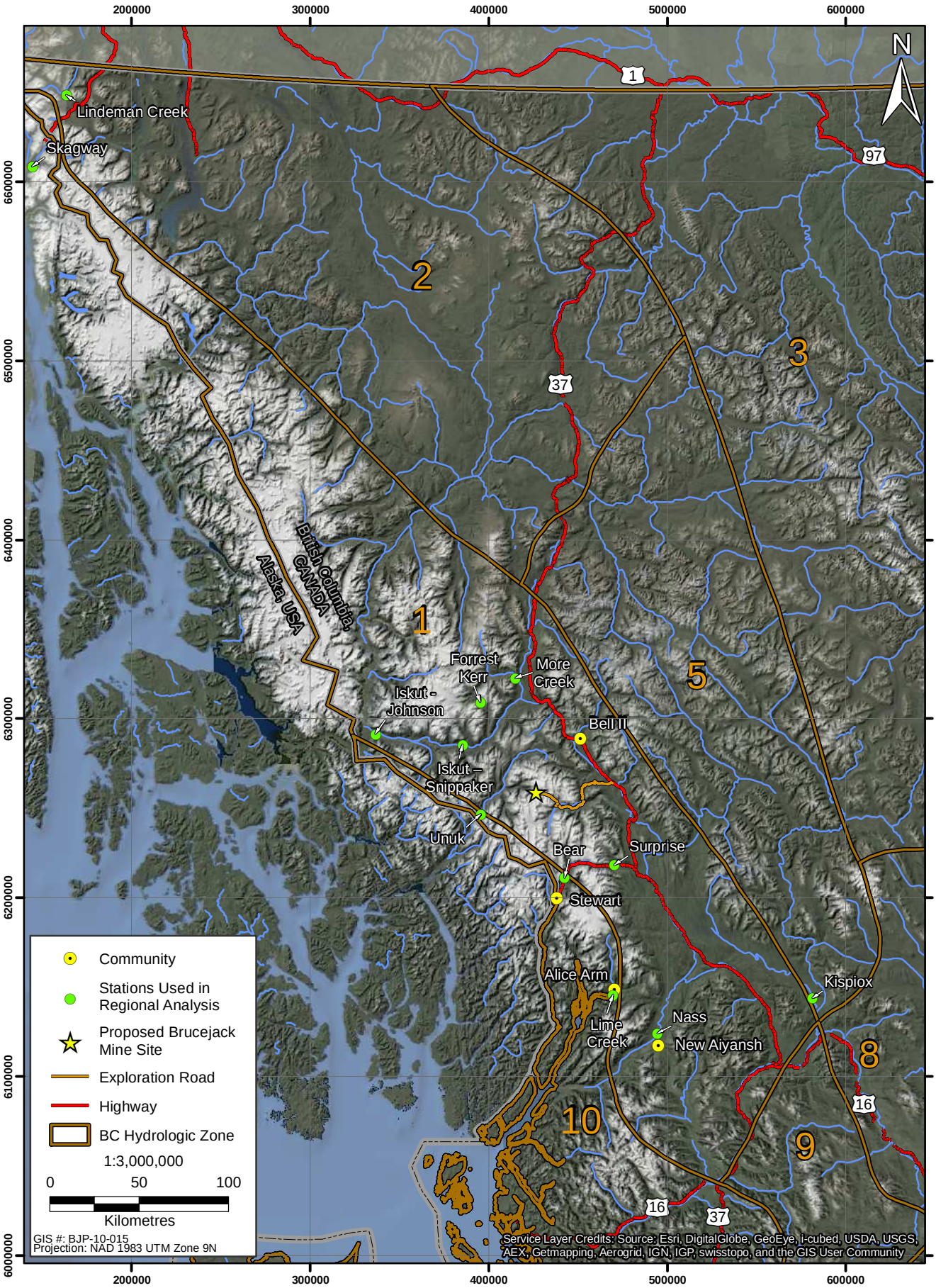
- annual runoff;
- monthly distribution of annual runoff;
- peak flows; and
- low flows.

All variables were estimated for a range of return periods. Values are calculated for selected hydrometric stations within the Project area, however, the methodologies employed are applicable to any other location within the Project area.

The reader is reminded that there are a limited number of hydrometric gauging stations in northwestern British Columbia. This lack of data increases the uncertainty associated with the results of any regional hydrologic assessment.

8.1 SELECTION OF REGIONAL STATIONS

The regional analysis was based on a selection of long-term hydrometric stations that are located within drainage basins which exhibit similar hydrologic characteristics as those within the Project area. The selection process was based on an evaluation of where the Project is located within British Columbia, relative to the 17 hydrologic zones that were defined across the province by the BC Ministry of Environment (Obedkoff 2003). Figure 8.1-1 illustrates selected zones in the general vicinity of the Project area as defined by Obedkoff (2003). The figure also shows the location of the WSC hydrometric gauging stations used in Obedkoff's hydrometric assessment. The Project area is located within Hydrologic Zone 1, Northern Coast Mountains. Summary details of regional hydrometric stations used in the regional hydrologic analysis are provided in Table 8.1-1.



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BC Hydrologic Zones: Regional Hydrometric Stations

Figure 8.1-1

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Table 8.1-1. Summary of Regional Hydrometric Stations

Station Name	Station ID	Monitoring Organization	Watershed Area (km^2)	Median Elevation (m)	Years of Available Data
Hydrometric Stations					
Bear River above Bitter Creek	08DC006	WSC	350	1,290	1967 - 1999
Forrest Kerr Creek above 460m Contour	08CG006	WSC	311	1,360	1972 - 1994
Iskut River below Johnson River	08CG001	WSC	9,500	1,260	1959 - 2010
Iskut above Snippaker Creek	08CG004	WSC	7,230	1,310	1966 - 1995
Kispiox River Near Hazelton	08EB004	WSC	1,880	749	1963 - 2010
Lime Creek Near the Mouth	08DB010	WSC	40	821	1976 - 1996
Lindeman Creek Near Bennett	09AA010	WSC	240	1,100	1950 - 1993
More Creek Near the Mouth	08CG005	WSC	844	1,360	1972 - 1995
Nass River above Shumal Creek	08DB001	WSC	18,400	1,050	1929 - 2010
Skagway River at Skagway	15056100	USGS	376	1,180	1963 - 1986
Surprise Creek Near the Mouth	08DA005	WSC	218	1,280	1967 - 2010
Unuk River Near Stewart	08DD001	WSC	1,480	1,180	1960 - 1996

8.2 ESTIMATION OF ANNUAL RUNOFF

Annual runoff is a measure of the hydrological response of a watershed. It is presented as runoff depth, in mm, over an entire watershed, allowing the direct comparison with precipitation totals. Runoff is calculated by dividing the total flow volume (m^3) observed at a monitoring station with the drainage area (km^2) upstream of the site. The variation in runoff across northwestern British Columbia is strongly controlled by spatial patterns of precipitation and glacial presence. As discussed previously, a strong gradient in precipitation exists from south to north in the Project area reflecting a change from a wet coastal to a dry interior climate. In addition, precipitation increases with elevation in the mountainous watersheds.

The Project hydrometric data presented in Section 7.5 illustrated how runoff varied within and between the watersheds in the Project area. No key factor emerged which influenced annual runoff totals. In general, runoff is influenced by the elevation of the watershed, watershed area, presence of glaciers, land cover and surficial and bedrock geology.

8.2.1 Average Annual Runoff

Estimates of average annual runoff and runoff values for different return periods for watersheds in the Project area were made using the results of an analysis of annual runoff data from regional hydrometric stations. Obedkoff (2001) related average annual runoff totals for WSC stations in northern British Columbia to the median elevation of the watershed lying upstream of the hydrometric station.

The median elevation is the elevation within a watershed which half of the basin area lies above and half lies below. The results of the analysis are shown in Figure 8.2-1. The graph illustrates the relationship between median elevation on annual runoff totals within the Northern Coast Mountain hydrologic zone (Table 8.2-1). There is a clear pattern of increasing runoff with median basin elevation, reflecting the expected increase in precipitation with elevation. The regression equation of the best-fit line is shown on the graph. Although the quality of the fit is poor, the line does reveal the underlying trend of increasing runoff with median elevation. Estimates of average annual runoff can be made using the relationship between annual runoff and median elevation.

Table 8.2-1. Summary of Data Plotted in Figure 8.2-2

Station	Years of Available Data	Median Elevation (m)	Watershed Area (km^2)	Average Annual Runoff (mm)
Regional Stations				
Bear River above Bitter Creek	1967-1999	1,290	350	2,270
Forrest Kerr Creek	1972-1994	1,360	311	2,880
Iskut above Snippaker Creek	1966 - 1995	1,310	7,230	1,260
Iskut River below Johnson River	1959 - 2010	1,260	9,500	1,511
Kispiox River Near Hazelton	1963 - 2010	749	1,880	756
Lime Creek Near the Mouth	1976 - 1996	821	40	1,400
Lindeman Creek Near Bennett	1954- 1993	1,100	240	1,300
More Creek Near the Mouth	1971 - 1994	1,360	844	1,820
Nass River above Shumal Creek	1949 - 2010	1,050	18,500	1,286
Skagway River at Skagway	1963 - 1986	1,180	376	1,520
Surprise Creek Near the Mouth	1967 - 2010	1,280	218	2,148
Unuk River Near Stewart	1957 - 1995	1,180	1,480	2,230
Project Stations				
BJL-H1*	2008 - 2012	1,596	14	1,477
		1,537	12	1,754
SL-H1	2008 - 2011	1,610	84	2,417
SC-H1	2008 - 2011	1,479	299	2,376
UR-H1	2008 - 2011	1,130	400	2,103
Scott-Hydro	2010 - 2012	1,180	75	1,463
Todedada-Hydro	2011 - 2012	1,179	61	2,588
Wildfire-Hydro	2012 - 2012	950	67	1,188

* *Two estimates are provided. The top row is based on Freshwater Atlas, and the second row is based in KPL (2011).*

In Figure 8.2-2 the observed data plot both above and below the regional regression line (a summary of the data used in the figure is provided in Table 8.2-1. The data were grouped into three classes, based on the location relative to the best-fit line (refer to Table 8.2-2). The first, or upper, class consisted of the Todedada-Hydro and UR-H1 stations. Five of the stations in the regional analysis were selected for this class: Forrest-Kerr, Lime, Surprise, Unuk and Bear. A line parallel to the regional regression line was created by minimizing the differences between the observed and the predicted average runoff for all five regional stations. This new regression equation was then used to estimate average annual runoff for Todedada-Hydro and UR-H1.

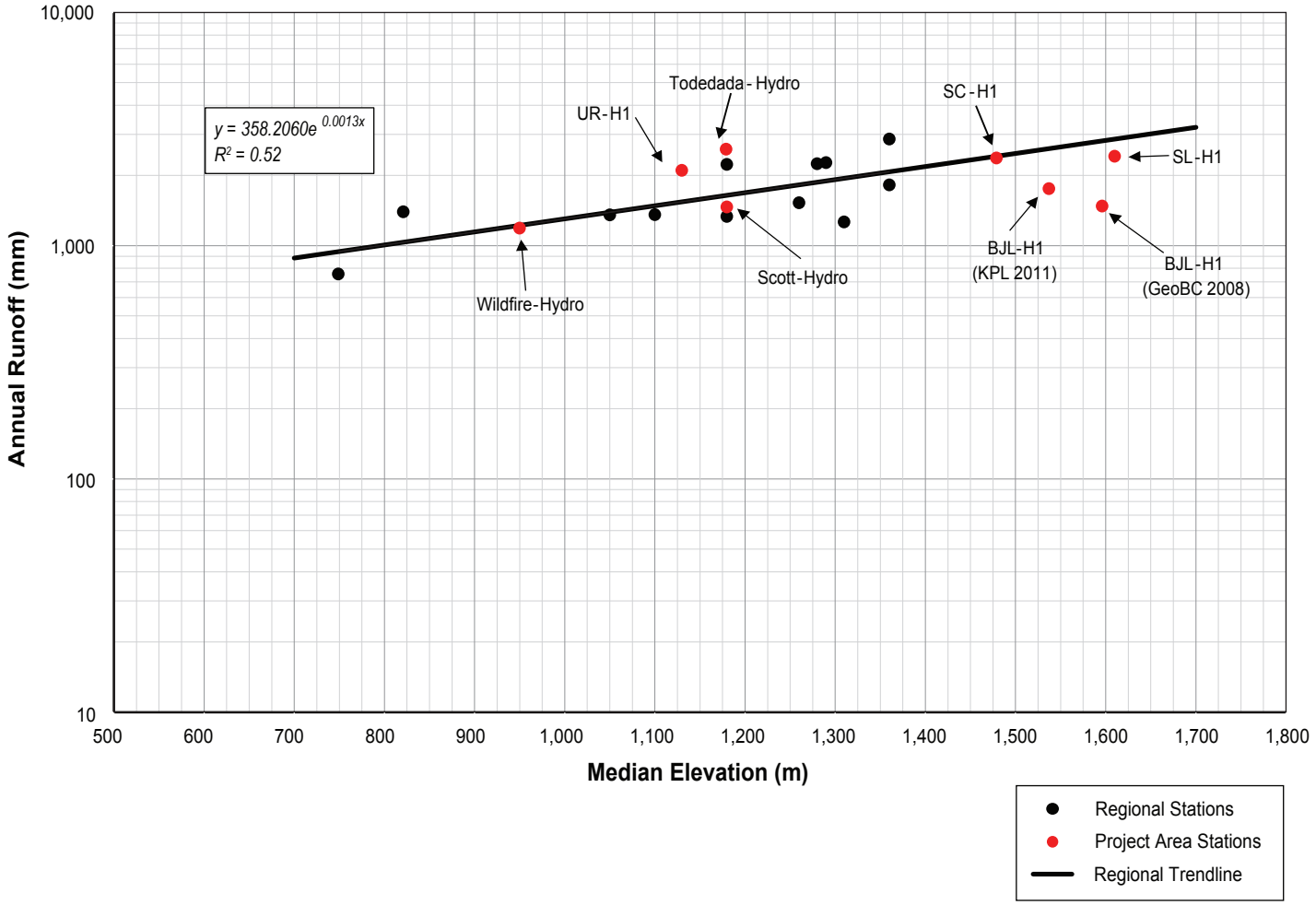

Figure 8.2-1

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Regional Analysis of Hydrologic Zone 1: Median Elevation vs Average Annual Runoff

Figure 8.2-1

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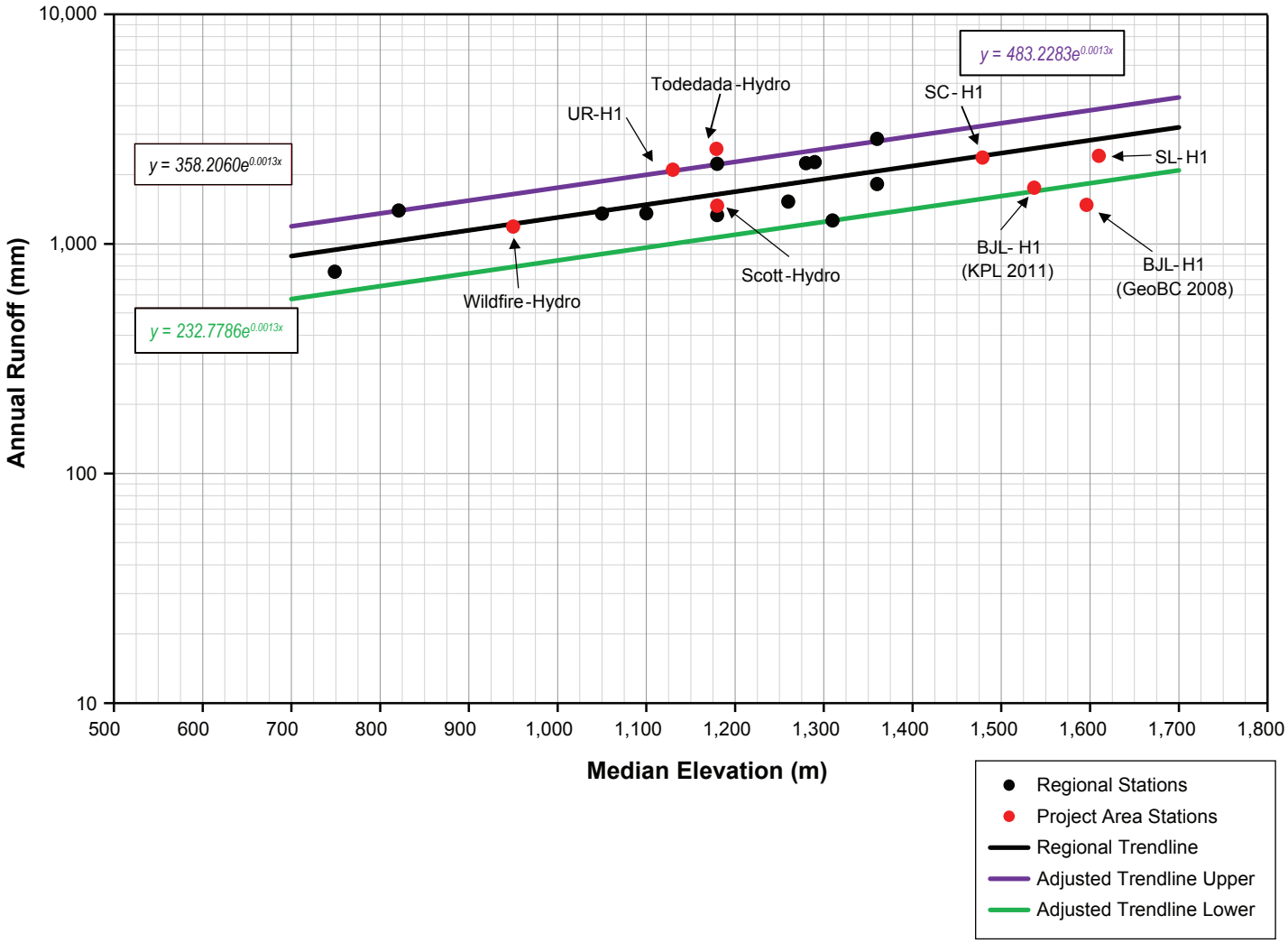

Figure 8.2-2

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Regional Relationships Used to Estimate Average Annual Runoff for Project Area Stations

Figure 8.2-2

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Table 8.2-2. Estimated Mean Annual Runoff for Gauged Drainages in the Project Area

Station Name	Drainage Area (km^2)	Median Elevation (m)	Annual Runoff (mm)						
			2008	2009	2010	2011	2012	Average (based on 2008-2012 observed data)	Estimated (based on regional analysis)
BJL-H1	13.9[a]	1596	1690		1452	1432	1331	1477	1829 [c]
	11.7[b]	1537	2008		1725	1702	1582	1754	1695 [c]
SL-H1	84.2	1610	1886	2508	2297	2977		2417	2866 [d]
SC-H1	298.6	1479	2272	2450	2302	2480		2376	2420 [d]
UR-H1	400.0	1130	2011	2216	1870	2316		2103	2080 [e]
Scott-Hydro	74.5	1180			1568	1321	1501	1463	1645 [d]
Todedada-Hydro	61.1	1179					2588	2588	2216 [e]
Wildfire-Hydro	66.9	950					1188	1188	1222 [d]

[a] *Based on Freshwater Atlas (GeoBC 2008)*

[b] *Based on KPL (2011)*

[c] *Estimated using lower regional regression relation:* $y = 232.7786e^{0.0013x}$

[d] *Estimated using regional regression relation:* $y = 358.2060e^{0.0013x}$

[e] *Estimated using upper reginoal regression relation:* $y = 483.2283e^{0.0013x}$

For the second class (SL-H1, SC-H1, Scott-Hydro, and Wildfire-Hydro) the regression line based on all regional stations is used. Only one regional station was used for the third class (BJL-H1/BJL-H1a) and that was Iskut–Snippaker. Two assessment results are provided for BJL-H1, based on watershed delineations from the BC Freshwater Atlas (GeoBC 2008) and KPL (2011).

8.2.2 Return Periods for Mean Annual Runoff

Estimates of the return periods for mean annual runoff across the Project area were determined using dimensionless scaling factors. The calculation of the empirical scaling factors was based on the statistical frequency analysis of historical discharge data from the regional hydrometric gauging stations that were considered in the analysis. This was carried out as a means of normalizing the variance of mean annual runoff levels that occur across the regional hydrologic zones that are present within northwest British Columbia.

The frequency analysis was conducted on the historical mean annual runoff for each regional hydrometric station. Flow magnitudes for annual runoff associated with 2-year, 5-year, 10-year, 25-year, 50-year, 100-year, and 200-year recurrence intervals were determined. Then the estimated mean annual runoff magnitudes for each recurrence interval were divided by that hydrometric station's average annual runoff event (associated with a 2-year return period) to obtain a scaling factor for each return period. The scaling factor allows return period estimates for mean annual runoff to be considered independent of the watershed areas for the hydrometric stations. It should be noted that the procedure is based on the assumption that the yearly annual runoff totals tend to cluster about a mean value that approximately follows a statistical normal probability distribution (Linsley et al. 1982; Rao and Hamed 2000).

For watersheds within the Project area, scaling factors were divided into three different groupings based on similarity of basin characteristics and hydrologic response. The three scaling factor groupings are presented in Table 8.2-3. For the majority of the stations, regional stations having watersheds with greater than 10% glaciated areas were selected. For Wildfire-Hydro, the average regional scaling factors were selected. For UR-H1, scaling factors from the Unuk River station were used because of their similarities. However, these scaling are not significantly different from those based on watersheds with greater than 10% that were used for majority of stations in the Project area.

Estimates of return periods are provided in Table 8.2-4. Results for BJL-H1 are based on the BC Freshwater Atlas watershed delineation. For sub-watersheds the mean annual runoff can be calculated by determining its geographical location relative to the Bell-Irving drainages or the Unuk-Sulphurets drainages, and the use of scaling factors relevant for that watershed's location.

8.3 MONTHLY DISTRIBUTION OF ANNUAL RUNOFF

An evaluation of the monthly flow distribution of annual runoff for the watershed areas was undertaken as an index of the seasonal variation in flows across the region. These values can be combined with annual runoff totals to estimate monthly runoff totals and average monthly flows associated with different annual runoff totals. Table 8.3-1 shows the average percentage of the annual runoff occurring in each month of record for the regional hydrologic stations and the hydrometric stations within the Project area. It should be noted that the length of record in the Project area does not represent long-term trends.

Table 8.2-3. Scaling Factors Used Return Period Annual Runoff - Wet and Dry Years

Return Period	Group 1[a] (Wildfire-Hydro)	Group 2[b] (BJL-H1, SL-H1, SC-H1, Scott-Hydro, and Todedada-Hydro)	Group 3[c] (UR-H1)
1 in 200 dry	0.60	0.63	0.66
1 in 100 dry	0.65	0.67	0.69
1 in 50 dry	0.69	0.71	0.73
1 in 25 dry	0.74	0.75	0.77
1 in 10 dry	0.81	0.82	0.83
2-year (average)	1.00	1.00	1.00
1 in 10 wet	1.19	1.18	1.17
1 in 25 wet	1.26	1.25	1.23
1 in 50 wet	1.31	1.29	1.27
1 in 100 wet	1.35	1.33	1.31
1 in 200 wet	1.39	1.37	1.34

[a] *Based on Average of all Regional Stations*

[b] *Based on Average of Regional Stations with more than 10% Glacier Coverage*

[c] *Based on WSC Station Unuk River*

Table 8.2-4. Estimated Annual Runoff Return Periods For Project Area

Station	Group 1[a] Wildfire-Hydro		Group 2[b]						Group 3[c] UR-H1	
Return Period	Scaling Factor	Estimated Annual Runoff (mm)	Scaling Factor	BJL-H1	SL-H1	SC-H1	Scott-Hydro	Todedada-Hydro	Scaling Factor	Estimated Annual Runoff (mm)
				Estimated Annual Runoff (mm)						
1 in 200 dry	0.60	738	0.63	1161	1820	1536	1044	1407	0.66	1374
1 in 100 dry	0.65	796	0.67	1226	1921	1622	1102	1485	0.69	1442
1 in 50 dry	0.69	846	0.71	1297	2032	1715	1166	1571	0.73	1517
1 in 25 dry	0.74	901	0.75	1375	2155	1819	1236	1666	0.77	1600
1 in 10 dry	0.81	987	0.82	1497	2345	1980	1346	1813	0.83	1729
Average	1.00	1222	1.00	1829	2866	2420	1645	2216	1.00	2080
1 in 10 wet	1.19	1456	1.18	2161	3387	2859	1943	2618	1.17	2431
1 in 25 wet	1.26	1542	1.25	2283	3577	3020	2053	2766	1.23	2560
1 in 50 wet	1.31	1598	1.29	2362	3700	3124	2123	2861	1.27	2643
1 in 100 wet	1.35	1648	1.33	2432	3811	3218	2187	2946	1.31	2718
1 in 200 wet	1.39	1693	1.37	2497	3912	3303	2245	3025	1.34	2786

[a] *Based on Average of all Regional Stations*

[b] *Based on Average of Regional Stations with more than 10% Glacier Coverage*

[c] *Based on WSC Station Unuk River*

Table 8-3-1. Monthly Runoff Distribution for Selected Regional Hydrometric Stations and Hydrometric Stations within the Project Area

Station Name	Watershed Area (km^2)	Percentage of Annual Runoff Occurring in Each Month (%)											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Regional Stations													
Lime Creek Near the Mouth	39	2.9	2.8	3.3	8.4	21.4	17.9	8.6	4.1	8.3	12.4	6.6	3.3
Bear River above Bitter Creek	350	1.1	0.9	1.1	2.2	7.4	15.1	21.1	21.2	14.2	10.0	3.9	1.8
Unuk River Near Stewart	1,480	1.8	1.4	1.4	2.7	9.0	16.7	20.0	18.1	12.7	9.5	4.3	2.4
Kispiox River Near Hazelton	1,880	1.5	1.3	1.8	7.3	19.4	22.8	13.7	7.1	7.4	9.7	5.5	2.4
Lindeman Creek Near Bennett	240	1.0	0.7	0.7	0.7	9.3	25.0	24.0	16.6	10.9	7.1	2.5	1.4
Iskut River below Johnson River	9,350	1.5	1.2	1.3	2.5	9.0	18.5	21.7	17.5	11.9	8.9	3.9	2.1
Iskut above Snippaker Creek	7,230	1.2	0.9	1.1	2.0	9.3	20.8	23.0	17.4	11.1	8.2	3.5	1.7
More Creek Near the Mouth	844	1.1	0.9	1.0	1.8	8.4	18.9	24.2	19.3	11.5	8.4	3.0	1.5
Forrest Kerr Creek	311	0.5	0.3	0.4	0.7	4.8	14.7	26.7	26.2	14.9	8.1	2.0	0.7
Surprise Creek Near the Mouth	218	0.7	0.6	0.7	2.4	12.6	23.8	22.6	15.7	10.1	7.2	2.6	1.1
Nass River above Shumal Creek	18,400	1.7	1.4	1.5	3.7	14.0	21.8	18.2	12.8	9.1	8.9	4.6	2.3
Skagway River at Skagway	974	0.7	0.5	0.5	1.1	7.4	21.8	26.6	19.6	11.8	7.0	2.1	0.9
Regional Average		1.3	1.1	1.2	3.0	11.0	19.8	20.9	16.3	11.2	8.8	3.7	1.8
Project Stations													
BJL-H1	14	1.0	0.8	1.1	1.8	16.8	21.3	19.7	13.9	11.4	7.2	2.9	2.0
SL-H1	84	0.8	0.7	0.7	0.9	5.7	14.6	23.6	26.0	18.8	6.1	1.4	0.7
SC-H1	299	1.6	1.2	1.2	1.7	6.8	14.7	21.8	23.3	16.1	7.3	2.8	1.7
UR-H1	400	1.6	1.5	2.0	2.8	9.9	21.8	18.0	13.6	15.2	7.5	4.0	2.1
Scott-Hydro	75	0.7	0.5	0.6	3.5	14.8	18.4	20.2	17.2	13.0	7.4	2.5	1.2
Todedada-Hydro	61	2.4	1.4	1.2	10.6	17.9	18.6	18.9	13.7	7.6	5.0	1.6	1.1
Wildfire-Hydro	67	1.4	0.6	0.5	5.8	20.7	35.7	17.4	5.6	4.4	5.9	1.1	1.0

The regional data show that flow is concentrated in the open water season (May to October) with less than 20% of the annual flow occurring from November to April at all stations except Lime. During the open water season the distribution of flow depends on the timing of freshet and also the balance between the volumes of water released during the freshet with water resulting from fall rains or glacier melt. Smaller watersheds with glaciers (for example, Forrest Kerr Creek and Bear Creek) show a higher proportion of flow occurring during July and August compared to the larger watersheds with lower glacier percentage. Such a pattern was also seen in the Project area, especially for stations within the Sulphurets Creek watershed, and reflects the dominant contribution of glacial meltwater in late summer. That is, local differences are visible in the pattern of monthly runoff distributions within the hydrological region.

In Figure 8.3-1 data from Stations BJL-H1/BJL-H1a, UR-H1, Scott-Hydro, and Todedada-Hydro are compared to the regional average data. It appears that monthly runoff distributions of these stations are similar to the regional average data. Data within the Sulphurets watershed (SL-H1 and SC-H1) are demonstrated in Figure 8.3-2. Data from these stations are similar and follow a pattern which is similar to Forrest Kerr Creek and Bear River. Finally, Figure 8.3-3 shows that data from Wildfire-Hydro which is different from all other stations.

Table 8.3-2 summarizes the values that are recommended to be used as monthly runoff distribution in hydrological assessment of the Project area. The values for BJL-H1/BJL-H1a, UR-H1, Scott-Hydro, and Todedada-Hydro are based on regional average data. Estimates for SL-H1 and SC-H1 are based on the average of data from Forrest Kerr Creek and Bear River. Values for Wildfire-Hydro are based on average from the stations in neighbouring North Treaty Creek and Teigen Creek (Rescan, 2013). For each watershed, the percent value of the annual flow that occurs in each month can be multiplied by the mean annual runoff totals to provide estimates of monthly runoff totals and average monthly flows.

8.4 REGIONAL PEAK FLOW ANALYSIS

The purpose of a flood frequency analysis is to predict river flood flows for different return periods. The return period refers to the probability of occurrence of the flood event. A 1-in-100 year return period (Q_{100}) event is the magnitude of flow that has a 1% chance of being equalled or exceeded in a given year. Similarly, a Q_{50} event has a 2% chance of being exceeded in any given year. The mean annual flood is generally defined as the Q_2 (i.e. it has a 50% probability of being equalled or exceeded in a given year). The probability of exceeding a flood of return period T within n years is $1-(1-(1/T)^n$ (Chow 1981).

There are no standard methodologies for flood frequency analysis in British Columbia, although guidance is offered in Coulson (1991). A number of methods for estimating the magnitude and frequency of peak flows have been applied to rivers in British Columbia. These include:

- single site flood frequency analysis;
- regional analysis;
- hydrological modelling, including the rational method; and
- channel geometry approaches.

Single site flood frequency analysis is appropriate for gauged rivers with long-term flow records. Hydrological models are sensitive to meteorological data, which are uncertain at this stage of the Project, and to watershed surface conditions. Channel geometry approaches, e.g., the California method, are rough estimates that are useful in absence of recorded flows. Considering these limitations, this study employs the regional analysis approach to estimate the peak flow indicators. Two different regional analysis techniques are used. These include the Quantile Regression Technique (QRT) and the Parameter Regression Technique (PRT). Please note that the terminology for these methods is not standard in the literature.

Table 8.3-2. Estimates of Monthly Runoff Distribution for Watersheds within the Project Area

Station Name	Percentage of Annual Runoff Occurring in Each Month (%)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BJL-H1, UR-H1, Scott-Hydro, and Todedada-Hydro[a]	1.3	1.1	1.2	3.0	11.0	19.8	20.9	16.3	11.2	8.8	3.7	1.8
SL-H1 and SC-H1[b]	0.8	0.6	0.7	1.5	6.1	14.9	23.9	23.7	14.6	9.0	2.9	1.2
Wildfire-Hydro[c]	1.5	1.4	1.6	3.7	19.0	25.3	15.0	8.3	10.7	8.1	3.4	2.0

[a] *Based on long-term average from regional stations*

[b] *Based on average of WSC Stations Forrest Kerr Creek and Bear River*

[c] *Based on average from the stations within the Teigen-Treaty Watersheds (Rescan, 2013)*

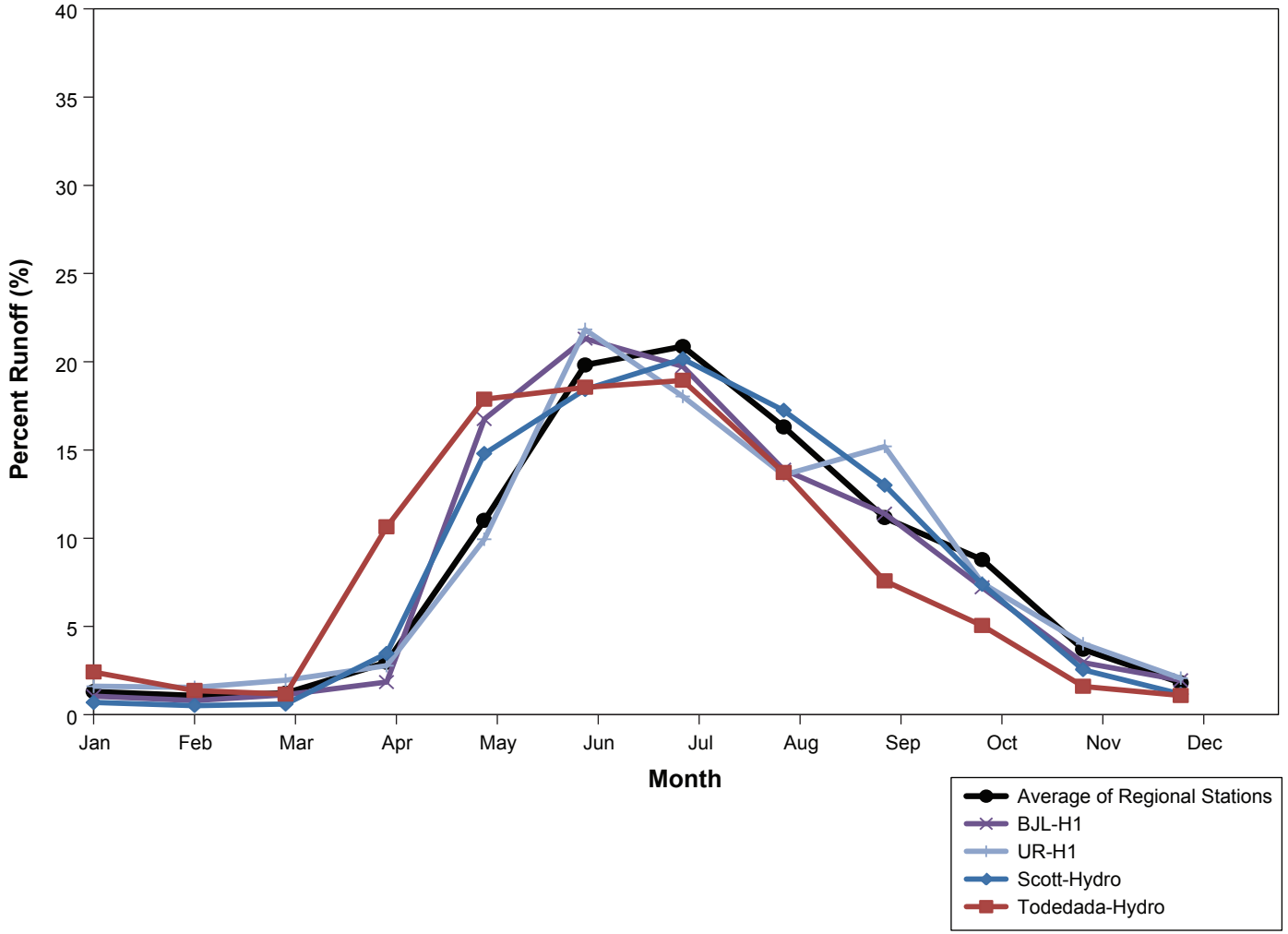

Figure 8.3-1

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Observed Monthly Runoff Distribution at Stations BJL-H1, UR-H1, Scott-Hydro, and Todedada-Hydro and the Average Regional Data

Figure 8.3-1

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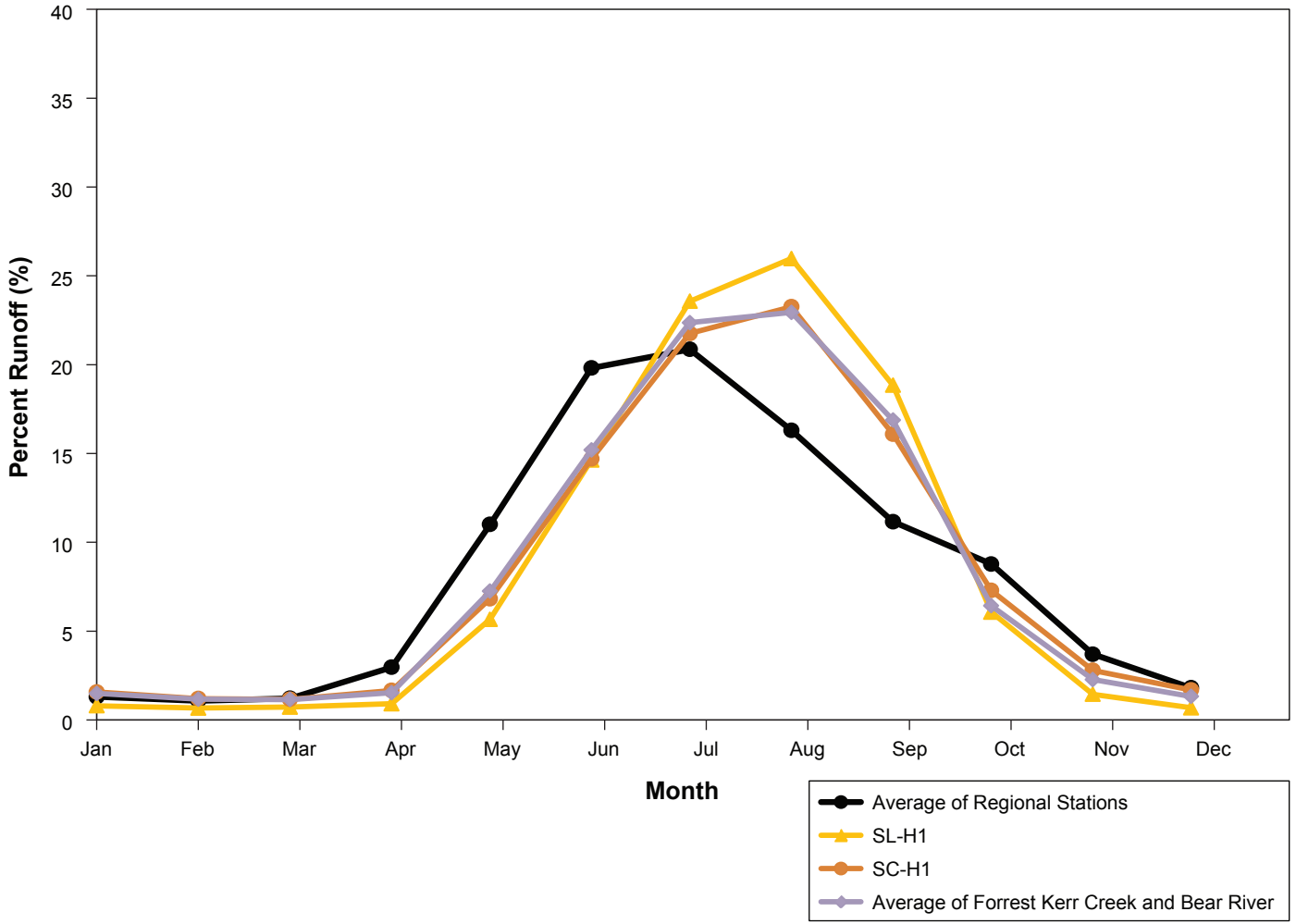

Figure 8.3-2

PRETIVM

Observed Monthly Runoff Distribution at Stations SL-H1 and SC-H1, Average of Sulphurets Watersheds (Rescan, 2013), and the Average Regional Data

Figure 8.3-2

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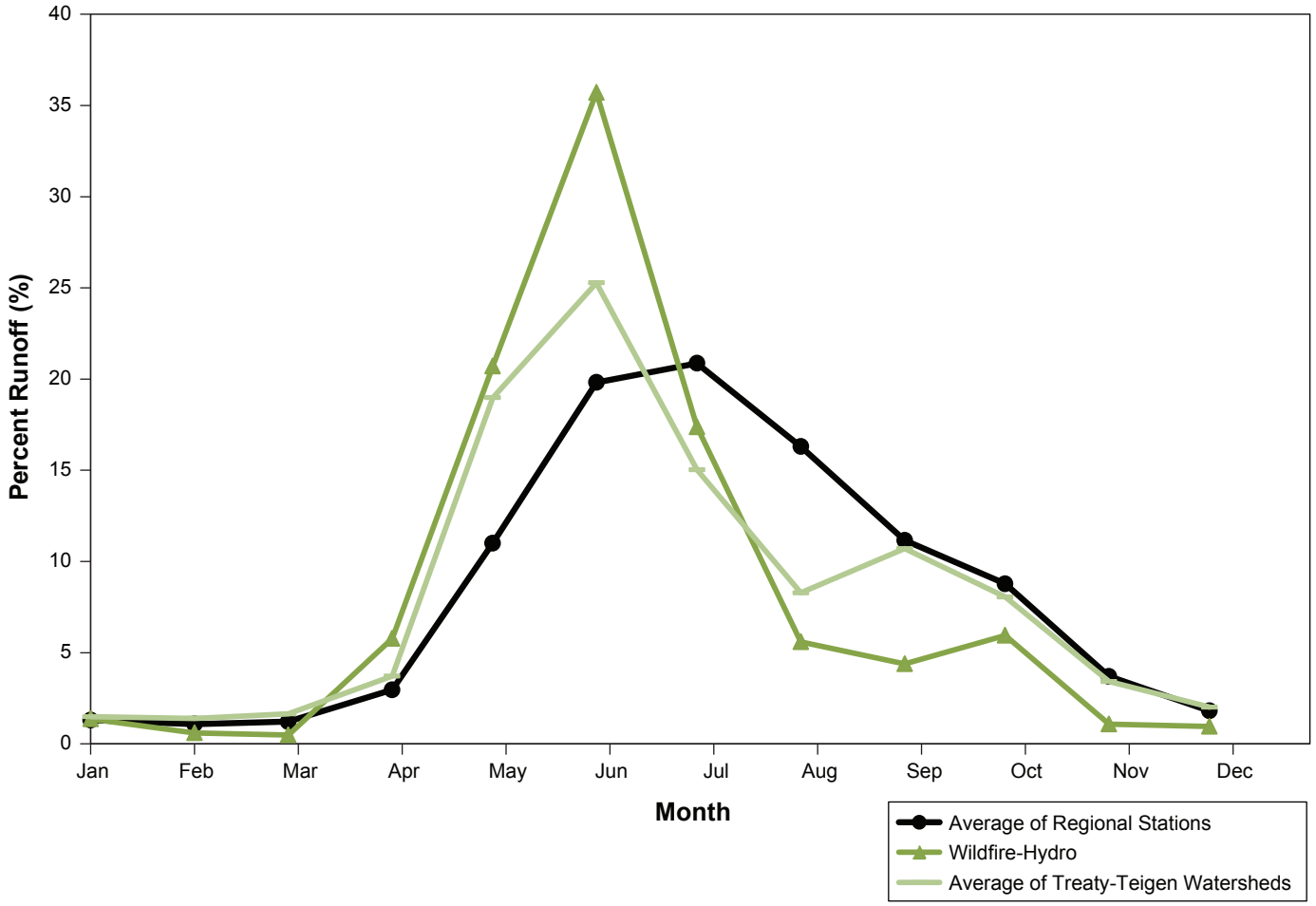

Figure 8.3-3

PRETIVM

Observed Monthly Runoff Distribution at Wildfire-Hydro Station, Average of Treaty-Teigen Watersheds (Rescan, 2013), and the Average Regional Data

Figure 8.3-3

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8.4.1 Quantile Regression Technique (QRT)

In British Columbia, a number of studies have developed simple regression equations relating peak flows to watershed area (for example, British Columbia Government 1996; Coulson and Obedkoff 1998; Church 1997; Obedkoff 2001; Eaton et al. 2002). The equation (8.4-1) generally takes the form:

$$Q_t = k_t A^x \qquad (8.4\text{-}1)$$

where Q_t is the flow (m^3/s) with return period t, k_t is an empirical coefficient for an event with return period t, A is the watershed area (km^2), and x is a scaling coefficient usually assumed to be between 0.6 and 1.0.

Peak flows at regional stations within Hydrologic Zone 1 (Obedkoff 2003) were estimated by examining flood frequencies for different return periods (Table 8.4-1). The flood frequency analyses were based on recorded instantaneous discharge data from regional hydrometric stations. The peak flow data were analyzed using HYFRAN-PLUS statistical software for the available period of record. The software contains a Decision Support System (DSS) which is designed to help with the selection of the most appropriate class of distributions with respect to extreme values. There are eighteen statistical distributions available in HYFRAN-PLUS. Specifically for flood frequency analysis the distributions can be grouped into three categories that contain the ten distributions that are widely used in hydrology to represent annual flow series. These results are summarized in Table 8.4-1.

Figure 8.4-1 shows the regional regression analysis of Q_t and watershed area, and demonstrates high correlation values for all return periods between 2 to 200 years. The Brucejack Lake watershed (BJL-H1/BJL-H1a) is smaller than the range of watersheds used to generate the regional curve. However, the observed data from the baseline program appear to be consistent with the regional curve providing some confidence in the use of the curve for smaller watersheds. Results of these regression analyses, including the fitted values of k_t and x (Equation 8.4-1) are summarized in Table 8.4-2. Given the regional values of k_t and x, peak flows with different return periods at the Project stations are assessed and summarized in Table 8.4-3. As previously mentioned, the hydrologic regime of the Brucejack Lake (BJL-H1/BJL-H1a) in complex in that the contribution of the East Lake watershed is uncertain. Since estimating the peak flows based on the regional analysis is sensitive to the watershed area, two scenarios are considered for drainage are of BJL-H1/BJL-H1a (i.e., with and without the East Lake watershed).

8.4.2 Parameter Regression Technique (PRT)

This method is commonly used in the United States where it is assumed that peak flows follow the Log-Pearson III distribution (LP3). That is, if $Y = \text{Log}(Q)$, Y is best described with the Pearson III distribution:

$$Log\ (Q_t) = M + K_t S \qquad (8.4\text{-}2)$$

where:
M = average of Y
K_t = the standardized LP3 frequency factor, which is a function of skewness (g)
S = standard deviation of Y
t = return period (yr)

Table 8.4-1. Estimates of Peak Flows at Regional Stations within Hydrologic Zone 1

	Surprise Creek	Iskut River below Johnson	Lime Creek	Forrest Kerr Creek	Bear River	More Creek	Unuk River	Iskut River above Snippaker	Nass River
Drainage Area (km^2)	218	9500	40	311	350	844	1,480	7,230	18,500
Years of Data	35	46	12	22	30	21	29	25	37
Average Peak Flow (m^3/s)	119	2710	41.3	164	172	406	756	1,760	3,870
	LP3	LP3	EXP	Gumble	LP3	LP3	EXP	LP3	LP3
Return Period (yrs)	**Peak Flows (m^3/s)**								
2	109	2,400	29.4	159	165	347	639	1,570	3,600
5	151	3,480	65	188	217	508	988	2,140	4,520
10	181	4,290	91.9	207	248	633	1,250	2,550	5,210
20	211	5,140	119	225	276	767	1,520	2,970	5,930
50	253	6,360	154	248	311	963	1,870	3,550	6,950
100	286	7,370	181	266	336	1,130	2,130	4,020	7,790
200	321	8,470	208	284	359	1,310	2,390	4,510	8,700

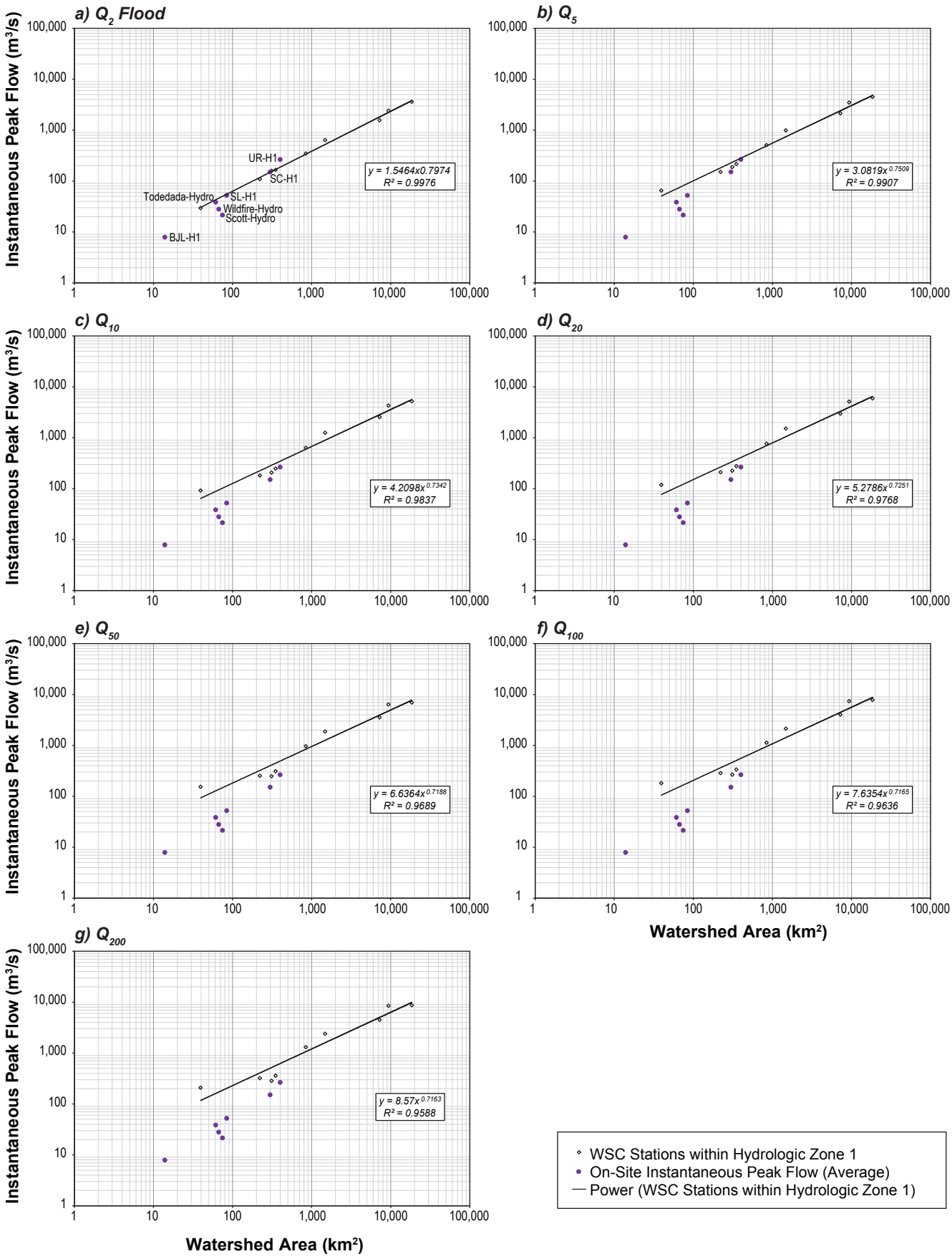
Table 8.4-2. Fitted Values of k_t and x (Equation 8.4-1) Based on Regional Regression Analysis

Return Period (yrs)	2	5	10	20	50	100	200
k_t	1.55	3.08	4.21	5.28	6.64	7.64	8.57
x	0.80	0.75	0.73	0.73	0.72	0.72	0.72

Table 8.4-3. Estimates of Peak Flows (m^3/s) at the Project Stations Based on Regional Quantile Regression Technique (QRT)

Watershed	Drainage Area (km^2)	Estimated Peak Flow based on Regional QRT (m^3/s)						
		Q_2	Q_5	Q_{10}	Q_{20}	Q_{50}	Q_{100}	Q_{200}
BJL-H1	14[a]	13	22	29	36	44	50	56
	17[b]	15	26	34	42	51	59	66
SL-H1	84	53	86	109	131	161	183	205
SC-H1	299	146	223	276	329	399	453	508
UR-H1	400	184	277	343	407	492	559	626
Scott-Hydro	75	48	78	100	120	147	168	188
Todedada-Hydro	61	41	68	86	104	128	145	163
Wildfire-Hydro	67	44	72	92	111	136	155	174

[a] *Drainage area without East Lake Watershed,* [b] *Drainage area with East Lake Watershed*



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Regional Regression Analysis between Peak Flow and Watershed Area

Figure 8.4-1

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The first three moments of the LP3 distribution (i.e., *M*, *S*, and *g*) for historical peak flows at the regional stations are demonstrated in Table 8.4-4. Regression analysis is conducted between the first three moments of the LP3 distribution (i.e., *M*, *S*, and *g*) and watershed area to find regional equations for these moments. Results are summarized in Table 8.4-5 and show a very high correlation between the first moment (*M*) and watershed area. Correlation between the other two moments (*S* and *g*) and watershed area is low; however, results of the null hypothesis test show *p*-values of less than 0.05 for both *M* and *g*. That, there is a statistically significant relationship between theses parameters (i.e., the null hypothesis at significance level of 0.05 is rejected). Therefore, the regression equations in Table 8.4-5 and Equation 8.4-2 are used to estimate peak flow with different return periods at the Project stations (Table 8.4-6). Estimates of peak flows at the Project stations based on QRT and PRT are different; however, the difference is limited to ±15% (Table 8.4-7).

Table 8.4-4. First Three Moments of Peak Flow Data at Regional Stations Based on LP3 Distribution

Regional Station	Area (km^2)	Years of Peak Flow Data	LP3 Moments of Log(Q) data		
			Mean	Standard Deviation	Skewness
Surprise Creek	221	40	2.045	0.159	0.593
Iskut River below Johnston	9,350	50	3.397	0.164	1.260
Lime Creek	39.4	12	1.526	0.333	-1.200
Forrest Kerr Creek	311	22	2.208	0.083	0.318
Bear River	350	30	2.213	0.141	0.248
More Creek	844	21	2.554	0.206	1.267
Unuk River	1,480	29	2.848	0.166	0.007
Iskut River above Snippaker	7,230	25	3.205	0.170	1.829
Nass River	18,500	44	3.569	0.105	1.151

Table 8.4-5. Regional Regression Equations for the First Three Moments of LP3 Distribution

	Mean (M)	Standard Deviation (S)	Skewness (g)
Regression equation	*M = 0.792Log(A) + 0.223*	*SD = -0.047Log(A) + 0.312*	*g = 0.547Log(A) - 0.963*
R^2	0.996	0.443	0.498
p-value*	4.9E-11	0.036	0.023

** for null hypothesis test*

Table 8.4-6. Estimates of Peak Flows (m^3/s) at the Project Stations Based on Regional Parameter Regression Technique (PRT)

Watershed	Drainage Area (km^2)	Estimated Peak Flow based on Regional PRT (m^3/s)						
		Q_2	Q_5	Q_{10}	Q_{20}	Q_{50}	Q_{100}	Q_{200}
BJL-H1	14[a]	14	22	28	35	40	45	50
	17[b]	16	26	33	42	48	55	62
SL-H1	84	52	86	108	139	164	190	218
SC-H1	299	148	221	277	357	424	497	577
UR-H1	400	186	275	343	442	526	618	719
Scott-Hydro	75	48	78	99	127	150	173	198
Todedada-Hydro	61	43	68	85	109	129	149	170
Wildfire-Hydro	67	45	72	91	117	138	159	182

[a] *Lower estimate of the drainage area without East Lake Watershed*
[b] *Higher estimate of the drainage area with East Lake Watershed*

Table 8.4-7. Difference between PRT and QRT Estimates of Peak Flows at the Project Stations

Watershed	Drainage Area (km^2)	Difference Between the Two Methods (%)						
		Q_2	Q_5	Q_{10}	Q_{20}	Q_{50}	Q_{100}	Q_{200}
BJL-H1	14[a]	27%	14%	9%	12%	4%	2%	1%
	17[b]	7%	-1%	-4%	-1%	-7%	-8%	-8%
SL-H1	84	-2%	0%	-1%	6%	2%	4%	6%
SC-H1	299	2%	-1%	0%	8%	6%	10%	14%
UR-H1	400	1%	-1%	0%	9%	7%	11%	15%
Scott-Hydro	75	0%	0%	-1%	5%	1%	3%	5%
Todedada-Hydro	61	4%	0%	-1%	5%	1%	2%	4%
Wildfire-Hydro	67	2%	0%	-1%	5%	1%	3%	5%

[a] *Lower estimate of the drainage area without East Lake Watershed*
[b] *Higher estimate of the drainage area with East Lake Watershed*

8.5 REGIONAL LOW FLOW ANALYSIS

Low flow magnitudes provide an estimate of the normal baseflow conditions of a stream and are important to the sustained health of a stream's aquatic community. This study determines the most commonly used indicator of low flows, the 7-day low flow. The 7-day low flow is the minimum average seven day flow that occurs consecutively over a specified period, such as a month, season, or year. A more severe low flow event associated with a 10 year return period (7-day Q_{10}) is also estimated here. The 7-day Q_{10} flow is defined as the minimum average seven day flow that has a recurrence interval of 10 years on average between occurrences. The 7-day Q_2, Q_5, Q_{10}, and Q_{20} are provided based on the BC guidelines for Water and Air Baseline Monitoring (BC Ministry of Environment 2012).

For streams at higher elevations or latitudes, the annual low flow will consistently occur during the winter, when most water is stored as either ice or snow. However, important aspects of a stream's health, such as presence of certain aquatic species, or activities that could impact the quantity or quality of water in a stream may be restricted to the open water season. Therefore, it is also useful to identify the low flow that occurs during this period. For this study, estimates are made of the average annual 7-day low flow and the annual 7-day Q_2, Q_5, Q_{10}, and Q_{20} as well as the average 7-day low flow and 7-day Q_2, Q_5, Q_{10}, and Q_{20} that occurs from June 1 to September 30. These measures are estimated at regional stations within Hydrologic Zone 1 (Table 8.5-1). In order to estimate 7-day low flows with return period of 2- to 200-years at regional stations, the 7-day low flow data were analyzed using HYFRAN-PLUS statistical software for the available period of record.

The annual 7-day low flows and the average 7-day low flows from June to September for the stations within the Project area are based on daily observed data during the operation period of each hydrometric station. These estimates are summarized in Table 7.5-5.

To characterize the average low flow or 7-day low flows with return period of 2- to 200-years requires an adequately long record of observed data. To be able to estimate the 7-day Q_{10}, for example, it is preferable to have an observed data record that is at least 10 years in length. This data set is not available for streams in the Project area. Therefore estimates were made using regional curves that relate low flows and watershed area.

Table 8.5-1. Estimates of 7-Day Low Flow and 7-Day Q_2, Q_5, Q_{10}, and Q_{20} at the Regional Stations within Hydrologic Zone 1

	Name	Bear River	Forrest Kerr Creek	Iskut River below Johnson	Iskut River above Snippaker	Lime Creek	More Creek	Nass River	Surprise Creek	Unuk River
Station	**Number**	**08DC006**	**08CG006**	**08CG001**	**08CG004**	**08DB010**	**08CG005**	**08DB001**	**08DA005**	**08DD001**
Median Elevation	(m)	1,290	1,360	1,260	1,310	821	1,360	1,050	1,280	1,180
Drainage Area	(km^2)	350	311	9,500	7,230	40.0	844	18,500	218	1,480
Normal Annual Runoff	(mm)	2766	2876	1531	1261	1381	1836	1292	2244	2231
Annual 7-Day Low Flows	20-year	1.15	0.59	31.50	17.00	0.04	3.27	46.00	0.42	6.55
(m^3/s)	10-year	1.31	0.63	34.30	17.50	0.05	3.53	51.70	0.49	7.24
	5-year	1.52	0.69	38.00	18.70	0.07	3.86	59.40	0.58	8.17
	2-year	2.01	0.83	46.60	23.40	0.13	4.60	77.60	0.80	10.40
	Mean	**2.07**	**0.87**	**48.30**	**26.40**	**0.17**	**4.70**	**82.10**	**0.83**	**10.90**
Jun-Sep 7-Day Low Flows	20-year	8.89	3.41	152.00	81.10	0.13	14.00	271.00	3.06	33.30
(m^3/s)	10-year	9.51	3.79	164.00	88.20	0.16	15.60	298.00	3.24	37.50
	5-year	10.40	4.63	182.00	98.50	0.20	17.80	334.00	3.63	43.30
	2-year	12.30	7.95	224.00	125.00	0.33	23.00	413.00	5.19	56.30
	Mean	**12.80**	**10.10**	**237.00**	**136.00**	**0.37**	**24.00**	**425.00**	**6.20**	**58.50**

Figures 8.5-1 and 8.5-2 present the regional curves relating annual and June through September 7-day low flows and watershed area. One note of caution is that the Brucejack Lake watershed (BJL-H1/BJL-H1a) is smaller than the range of watersheds used to generate the regional curve. However, the observed data from the baseline program appear to be consistent with the regional curve providing some confidence in the use of the curve for smaller watersheds. Figure 8.5-2 shows that average June through September observed low flows at all watersheds except Wildfire-Hydro are above the regional trend line. This is mainly due to the high glacier coverage in these watersheds and results in summer flows that are higher than the regional average. In order to account for this effect a second trend line is created by shifting the regional trend line so that it passes through the WSC station at Unuk River which has high glacier coverage and is close to these watersheds. Regional trend line for the average annual 7-day low flows (Figure 8.5-1) was not shifted to match the observed data because: a) annual low flows generally occur during the winter where the effect of glacier coverage is not applicable; and b) due to the freeze up limitations, observed data during the winter are not measured as accurately as those during the open water season, and hence, modifying the regional trend lines based on these observations is not justified.

Regional curves that relate the 7-day Q_2, Q_5, Q_{10}, and Q_{20} and watershed area are shown in Figures 8.5-3 and 8.5-4 for annual and June to September low flows, respectively. These estimated relationships demonstrate a high correlation. The trend line for June to September 7-day low flows is shifted to pass through the WSC station at Unuk River for the same reason as described in the previous paragraph.

The relationships between watershed area and low flow indices in Figures 8.5-1 to 8.5-4 are summarized in Tables 8.5-2 and 8.5-3 for annual and June to September indices, respectively. Using these relationships, the low flow indices are calculated for the hydrometric stations within the Project area. These results are presented in Tables 8.5-4 and 8.5-5.

8.6 SUMMARY OF REGIONAL ANALYSES

The regional hydrologic analysis was carried out to undertake a hydrological assessment for the Project area. The assessment included an estimate of expected normal and return period values for a number of key hydrological indices that consider a wide range of hydrologic conditions over a long time period. The estimates were adjusted, wherever applicable, based on site-specific observations.

The analyses were based on hydrologic data at thirteen regional hydrometric stations within the same hydrologic zone as the Project. All selected regional stations had more than 10 years of recorded flow data. The available regional hydrologic data sets were analyzed and used to estimate average and extreme hydrological conditions within the Project area. The key hydrological indices of interest include:

- annual runoff;
- monthly distribution of annual runoff;
- peak flows; and
- low flows.

For annual flow runoff values, the watersheds within the Project area were categorized into three groups. For each group of watersheds, a separate regional relationship, which best fitted to observed data from stations within that group, was used to estimate the annual flow volumes.

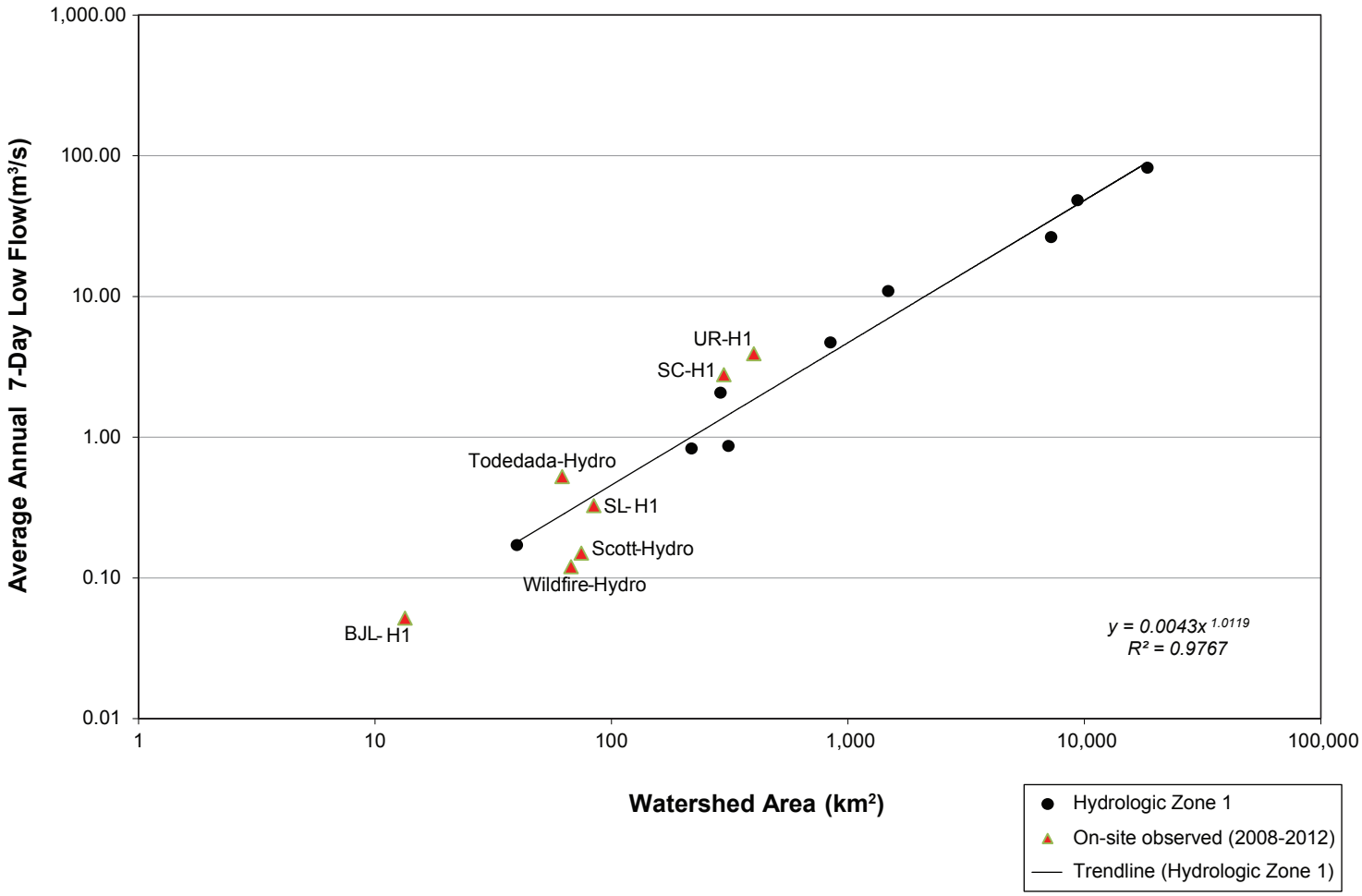

Figure 8.5-1

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Regional Analysis of Hydrologic Zone 1: Watershed Area vs Average Annual 7-Day Low Flow

Figure 8.5-1

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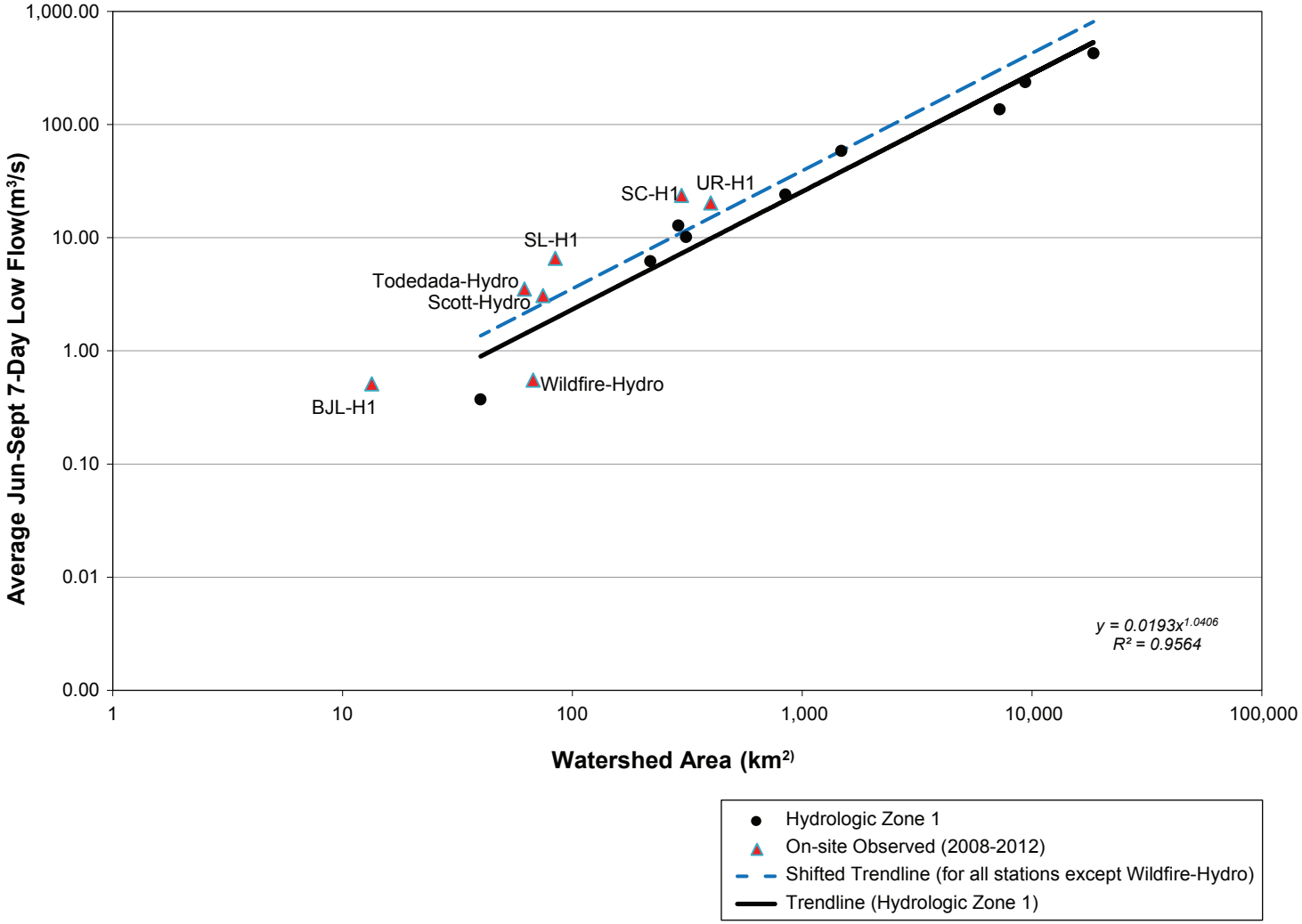

Figure 8.5-2

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Regional Analysis of Hydrologic Zone 1: Watershed Area vs Average June to September 7-Day Low Flow

Figure 8.5-2

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Table 8.5-2. Relationship between Watershed Area and Annual Low Flow Indices

Watershed	Mean Annual 7-Day Low Flow	2 Year 7-Day Low Flow (Annual)	5 Year 7-Day Low Flow (Annual)	10 Year 7-Day Low Flow (Annual)	20 Year 7-Day Low Flow (Annual)
BJL-H1, Sl-H1, SC-H1, UR-H1, Scott-Hydro, Todedada-Hydro, and Wildfire-Hydro	$Q = 0.0043A^{1.0119}$ (Regional equation)	$Q = 0.0036A^{1.0284}$ (Regional equation)	$Q = 0.002A^{1.074}$ (Regional equation)	$Q = 0.0015A^{1.094}$ (Regional equation)	$Q = 0.0012A^{1.1055}$ (Regional equation)

Table 8.5-3. Relationship between Watershed Area and June to September Low Flow Indices

Watershed	Mean Jun-Sep 7-Day Low Flow	2 Year 7-Day Low Flow (Jun-Sep)	5 Year 7-Day Low Flow (Jun-Sep)	10 Year 7-Day Low Flow (Jun-Sep)	20 Year 7-Day Low Flow (Jun-Sep)
BJL-H1, Sl-H1, SC-H1, UR-H1, Scott-Hydro, and Todedada-Hydro	$Q = 0.0294A^{1.0406}$ (Shifted Regional equation)	$Q = 0.0245A^{1.0605}$ (Shifted Regional equation)	$Q = 0.0140A^{1.101}$ (Shifted Regional equation)	$Q = 0.0108A^{1.1171}$ (Shifted Regional equation)	$Q = 0.0089A^{1.1277}$ (Shifted Regional equation)
Wildfire-Hydro	$Q = 0.0193A^{1.0406}$ (Regional equation)	$Q = 0.0153A^{1.0605}$ (Regional equation)	$Q = 0.0086A^{1.101}$ (Regional equation)	$Q = 0.0067A^{1.1171}$ (Regional equation)	$Q = 0.0056A^{1.1277}$ (Regional equation)

Table 8.5-4. Estimated Annual Low Flow Indices for the Watersheds in the Project Area

Watershed	Drainage Area (A) (km^2)	Mean Annual 7-Day Low Flow (m^3/s)	2 Year 7-Day Low Flow (Annual) ($m^3/3$)	5 Year 7-Day Low Flow (Annual) ($m^3/3$)	10 Year 7-Day Low Flow (Annual) ($m^3/3$)	20 Year 7-Day Low Flow (Annual) ($m^3/3$)
BJL-H1	14	0.06	0.05	0.03	0.03	0.02
SL-H1	84	0.38	0.34	0.23	0.19	0.16
SC-H1	299	1.37	1.26	0.91	0.77	0.65
UR-H1	400	1.85	1.71	1.25	1.05	0.90
Scott-Hydro	75	0.34	0.30	0.20	0.17	0.14
Todedada-Hydro	61	0.28	0.25	0.17	0.13	0.11
Wildfire-Hydro	67	0.30	0.27	0.18	0.15	0.13

Table 8.5-5. Estimated June to September Low Flow Indices for the Watersheds in the Project Area

Watershed	Drainage Area (A) (km^2)	Mean Jun-Sep 7-Day Low Flow (m^3/s)	2 Year 7-Day Low Flow (Jun-Sep) ($m^3/3$)	5 Year 7-Day Low Flow (Jun-Sep) ($m^3/3$)	10 Year 7-Day Low Flow (Jun-Sep) ($m^3/3$)	20 Year 7-Day Low Flow (Jun-Sep) ($m^3/3$)
BJL-H1	14	0.45	0.40	0.25	0.20	0.17
SL-H1	84	2.96	2.69	1.84	1.53	1.31
SC-H1	299	11.06	10.31	7.43	6.27	5.48
UR-H1	400	14.99	14.06	10.25	8.70	7.62
Scott-Hydro	75	2.61	2.37	1.61	1.33	1.14
Todedada-Hydro	61	2.12	1.92	1.30	1.07	0.92
Wildfire-Hydro	67	1.53	1.32	0.88	0.73	0.64

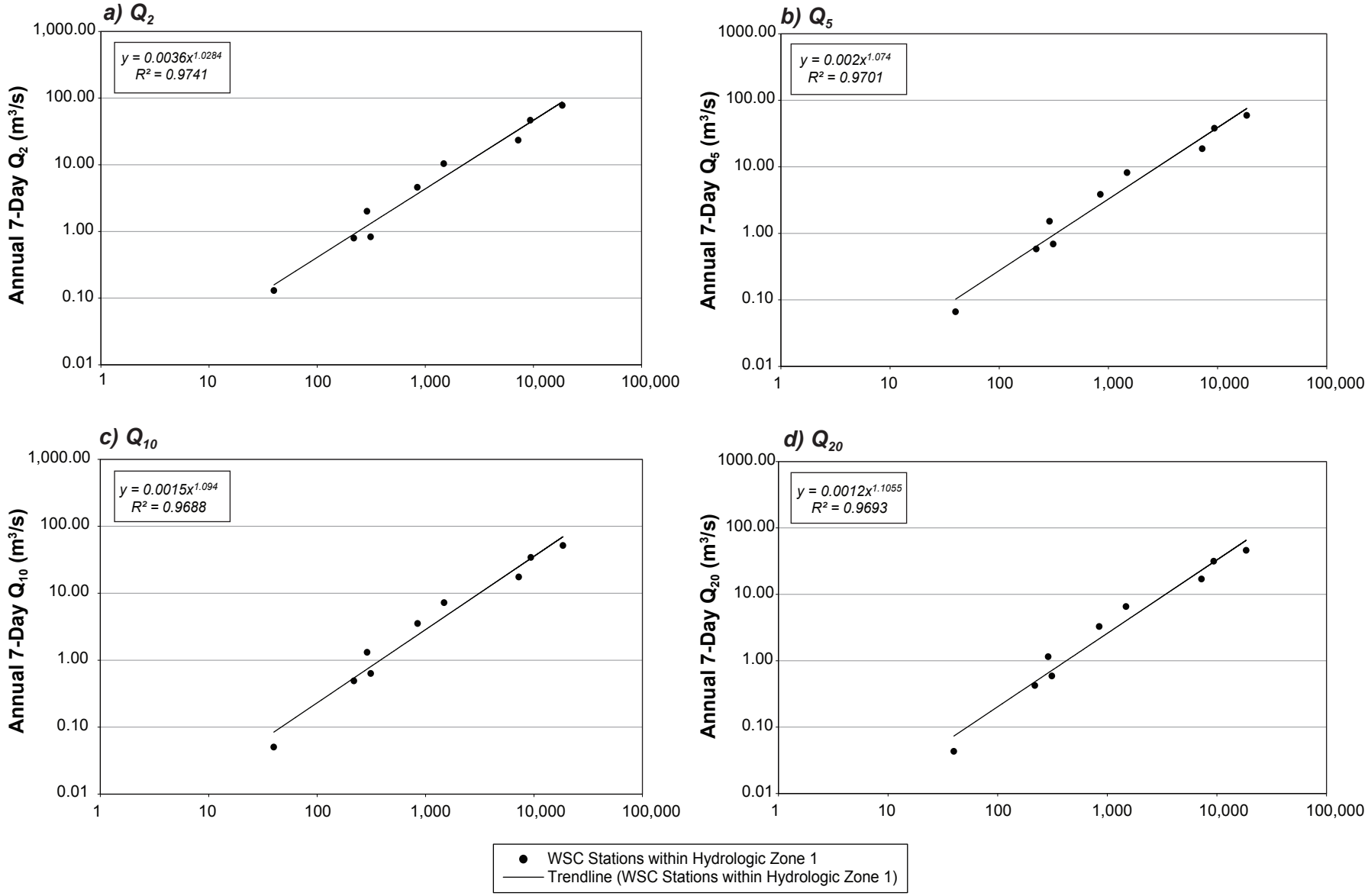

Figure 8.5-3

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Regional Regression Analysis between Annual 7-Day Low Flow and Watershed Area

Figure 8.5-3

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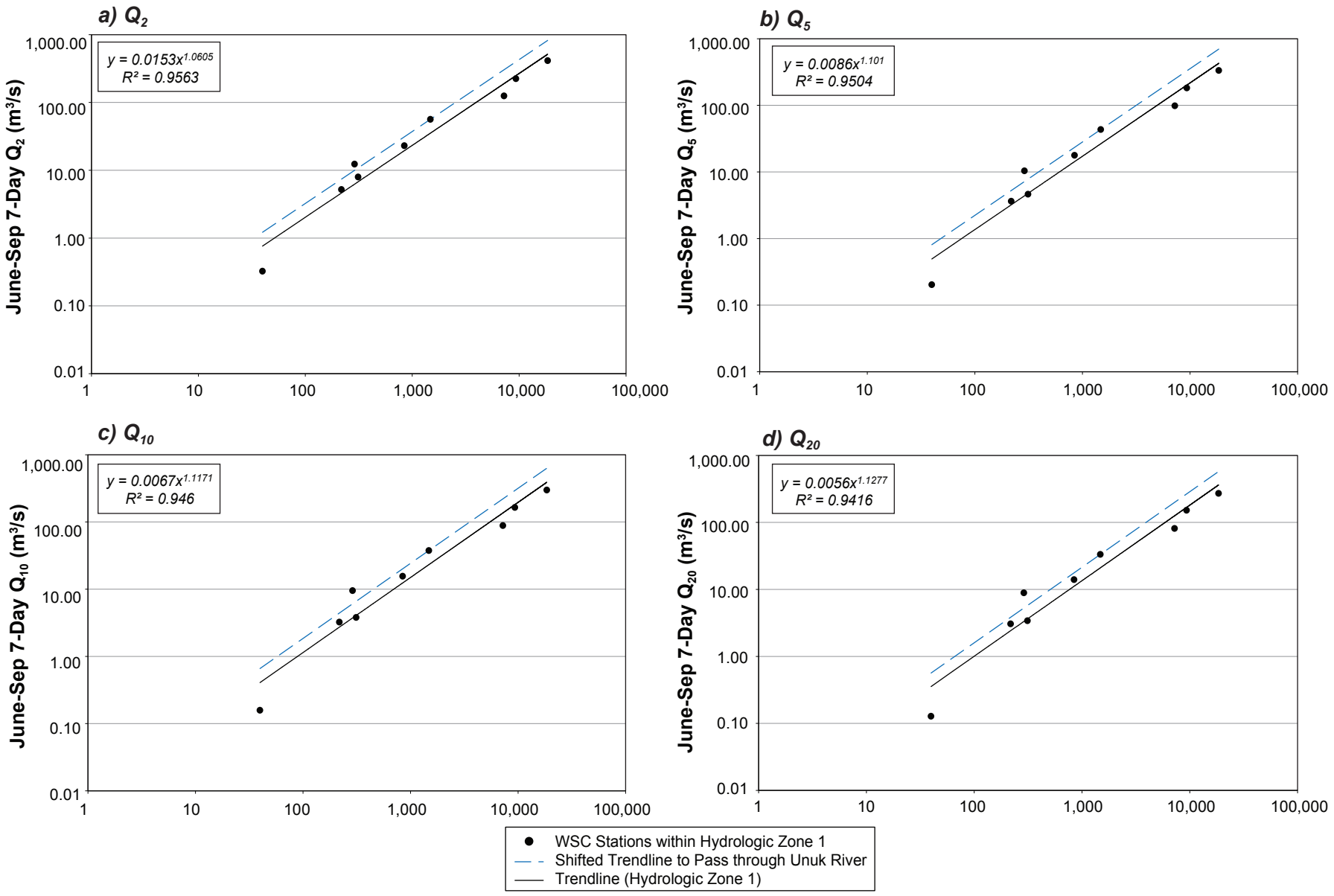

Figure 8.5-4

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Regional Regression Analysis between June to September 7-Day Low Flow and Watershed Area

Figure 8.5-4

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In analyzing the monthly distribution of annual flows, comparison of regional and site-specific data could be best supported by categorizing the watersheds within the Project area into three groups. The monthly distributions of annual data were different among these groups; most notable was a delayed peak flow in Sulphurets watersheds which are highly glacierized.

For estimating peak flows with return periods of 2 to 200 years, two approached were used. These include the Quantile Regression Technique (QRT) and Parameter Regression Technique (PRT). Results of the two approaches were reasonably close to each other (i.e., less than 15% difference) for all watersheds and return periods.

Two low flow indices were used in this study; the annual 7-day low flow and June through September 7-day low flow. Both average and extreme values (with return periods of 2 to 20 years) of these indices were calculated. For all site-specific stations (except Wildfire Hydro) the June to September low flow values were higher than those of the average regional stations. This was attributed to higher glacier coverage at the watersheds within the study area.

9. Summary and Conclusions

9. Summary and Conclusions

The Brucejack Gold Mine Project surface water hydrology baseline program collected hydrometric data from 2009 to 2012 to support a hydrologic assessment of streams, rivers and lakes within the Project area. These data were collected over a wide range of physiographic and geomorphic environments and watershed sizes. This includes data collected in highly glacierized catchments, in small catchments, in areas that receive extremely high rainfall and snowfall amounts, and in dynamic channels whose geometry can change throughout open water years, or within melt seasons.

The baseline program collected site-specific hydrologic data at a total of 15 hydrometric stations which measured watersheds that ranged in size from 14 km^2 to 400 km^2. Stage-discharge rating curves were developed for each station in the network with stage-discharge measurements added to the rating curves each year to increase the robustness of each curve. At hydrometric stations where stage-discharge relationships shifted due to changes in channel geometry caused by aggradation, scouring or channel migration, new rating curves were generated. Using the developed rating curves, the continuously recorded water levels were converted into continuous flow discharge hydrographs. Hydrologic indicators were then calculated from discharge hydrographs. All the information was obtained using standard operating methods, with the hydrotechnical analyses following documented procedures.

Generally, the open water season extended from approximately mid-April until late-October each year. Mean annual runoff ranged from 1,188 mm in Wildfire Creek to 2,588 mm in Todedada Creek. Annual runoff is generally higher for watersheds with higher median elevations. One notable exception is at station BJL-H1/BJL-H1a on Brucejack Creek. This may be attributed to the uncertainty in calculated drainage area, and the complexity of the hydrologic regime at this location (i.e., contribution of East Lake to Brucejack Lake inflows).

In 2011, an extreme precipitation event occurred in late August and early September which resulted in high runoff at all hydrometric stations within the Project area. Intense rainfall led to elevated discharge levels that caused extensive damage to the hydrometric network. The residual morphologic effects of this event, may affect the channel stability in the following years. That is, the established rating curves may change in the next years.

A regional hydrologic analysis was carried out for watersheds within the Project area. Such an assessment included an estimate of expected normal and return period values for a number of key hydrological indices that consider a wide range of hydrologic conditions over a long time period. The analysis was based on hydrologic data at thirteen regional hydrometric stations within the same hydrologic zone as the Project. The available regional hydrologic data sets were analyzed and used to estimate annual runoff, monthly distribution of annual runoff, peak flows and low flows. All hydrologic indices were assessed for a range of return periods, and the estimates were adjusted, wherever applicable, based on site-specific observations.

For annual flow runoff values, the watersheds within the Project area were categorized into three groups. For each group of watersheds, a separate regional relationship, which best fitted to observed data from stations within that group, was used to estimate the annual flow volumes. The first, or upper, class consisted of the Todedada-Hydro and UR-H1 stations; the second, or mid, class encompassed SL-H1, SC-H1, Scott-Hydro, and Wildfire-Hydro; and the third, or lower, class included BJL-H1/BJL-H1a.

In analyzing the monthly distribution of annual flows, comparison of regional and site-specific data could be best supported by categorizing the watersheds within the Project area into three groups. Stations SL-H1 and SC-H1 represented glacial regimes with delayed peak flows compared with other watersheds within the study area. Monthly flows for BJL-H1/BJL-H1a, UR-H1, Scott-Hydro, and Todedada-Hydro showed mixed regimes. Values for Wildfire-Hydro could best be described as a nival regime.

For estimating peak flows with return periods of 2 to 200 years, two approached were used. These include the Quantile Regression Technique (QRT) and Parameter Regression Technique (PRT). Results of the two approaches were reasonably close to each other (i.e., less than 15% difference) for all watersheds and return periods.

Two low flow indices were used in this study. These include annual 7-day low flow and June through September 7-day low flow. Both average and extreme values (with return periods of 2 to 20 years) of these indices were investigated. For all site-specific stations (except Wildfire Hydro) the June to September low flow values were higher than those of the average regional stations. This was attributed to higher glacier coverage at the watersheds within the study area.

It should be noted that as the surface water hydrology baseline program continues collecting hydrometric data at the site-specific stations, local data will be available over a longer period of time. Therefore, the local collected data can reliably be used to verify and adjust the estimated regional relationships.

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Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

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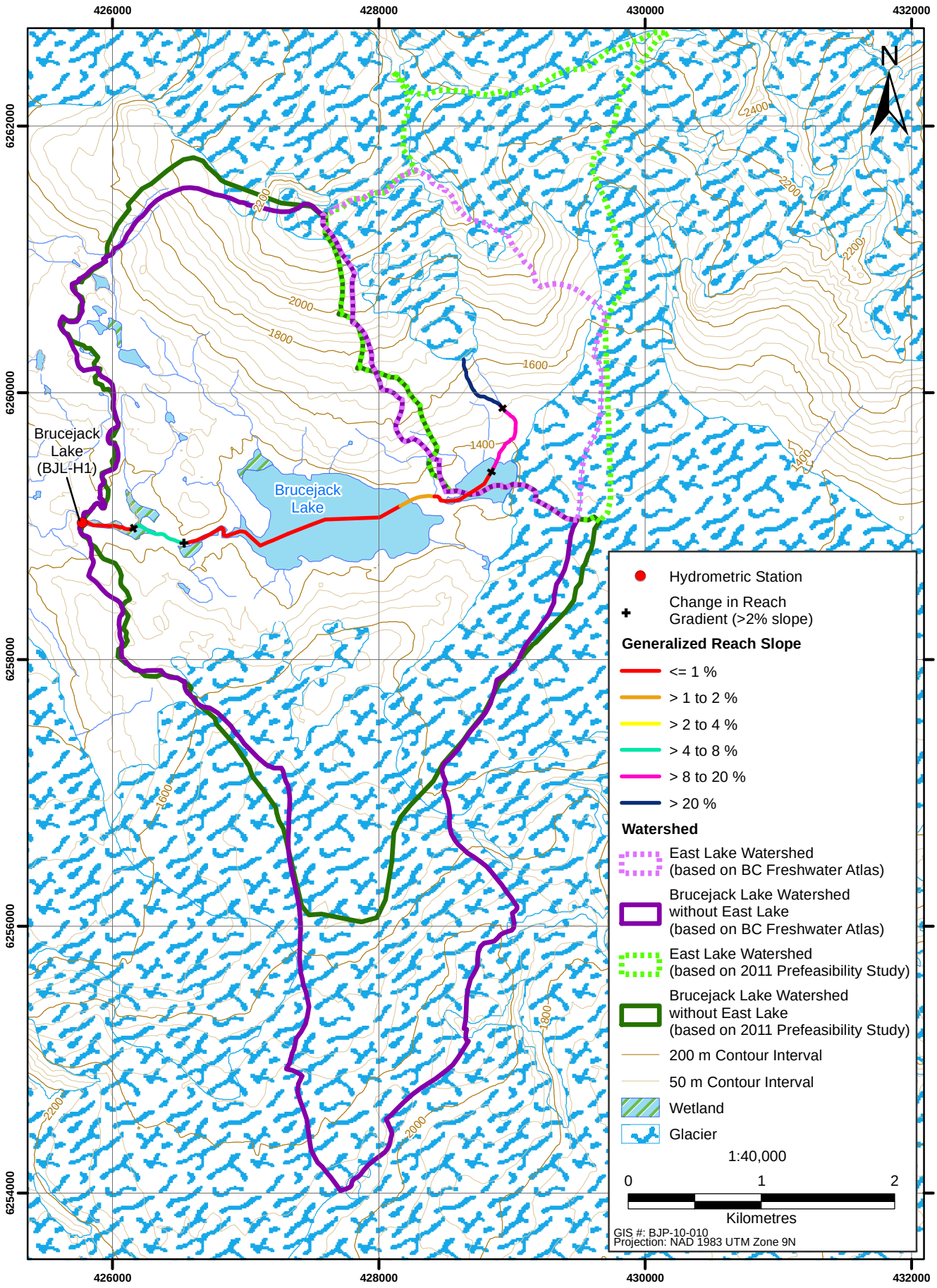
Appendix 1

Physiographic Maps of Watersheds in the Project Area

Rescan™
Engineers and Scientists

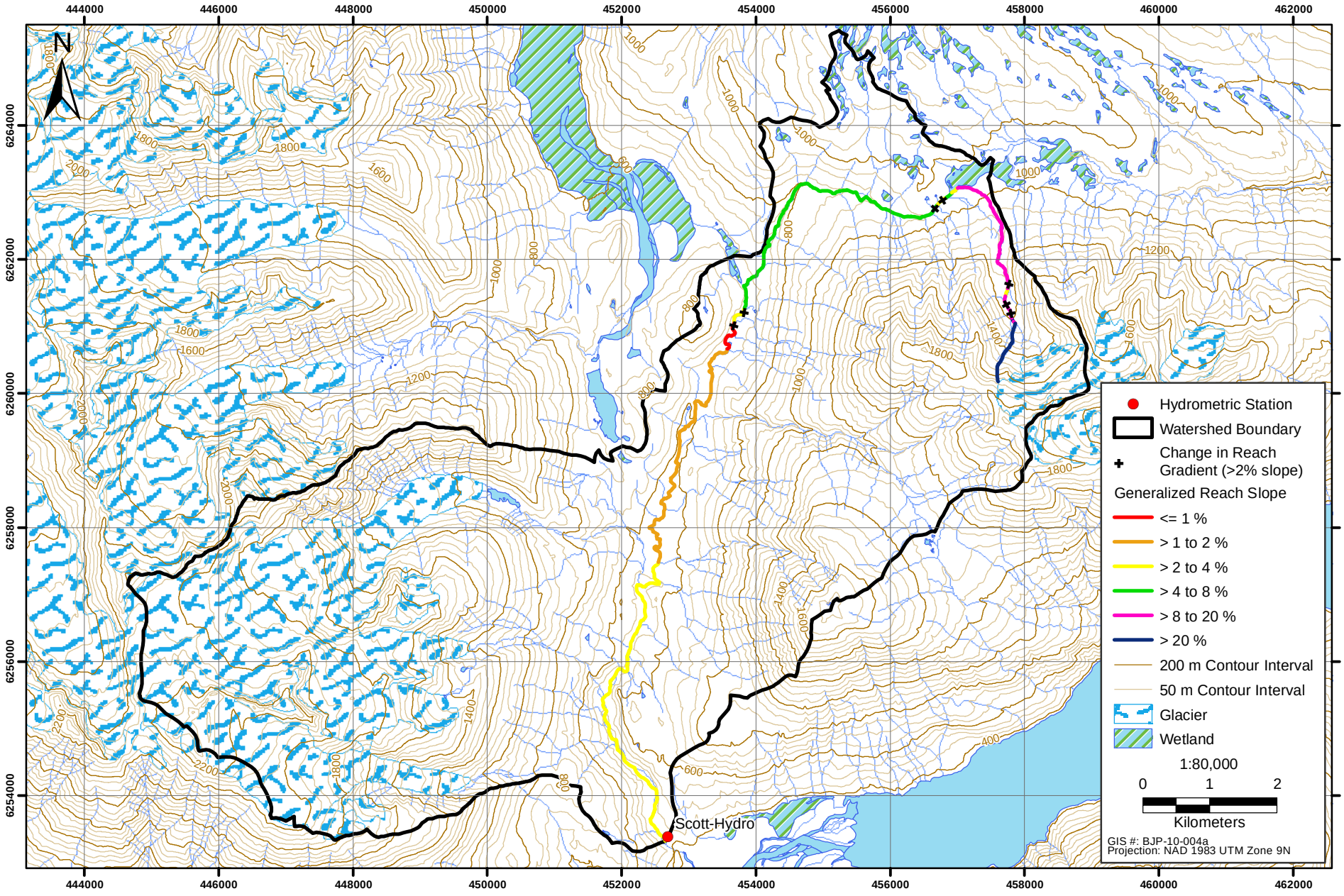


PRETIVM

Brucejack Lake Watershed

Appendix 1a

Rescan™ Engineers & Scientists



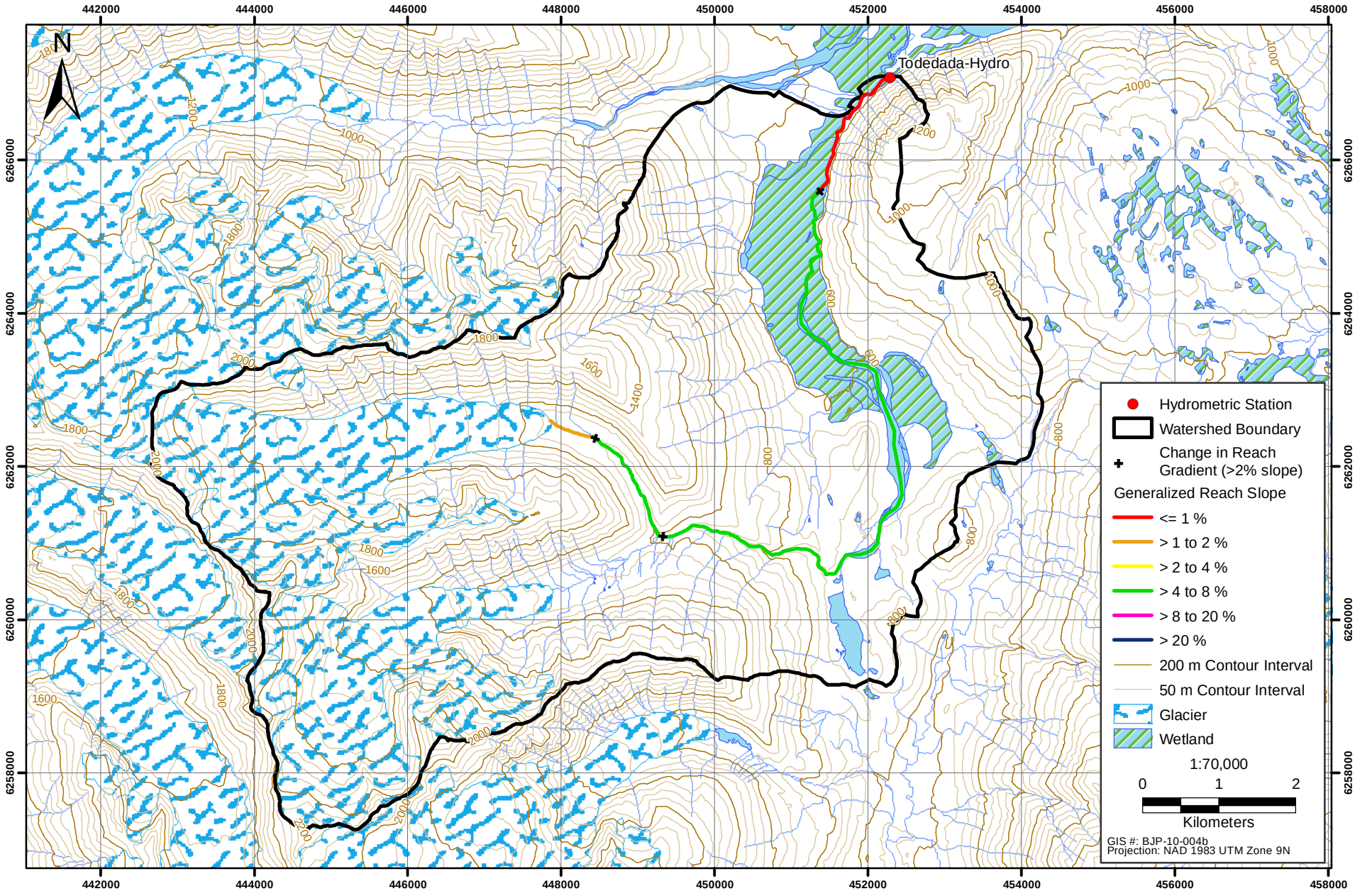
Appendix 1b

PRETIVM

Scott Creek Watershed

Appendix 1b

Rescan™ Engineers & Scientists



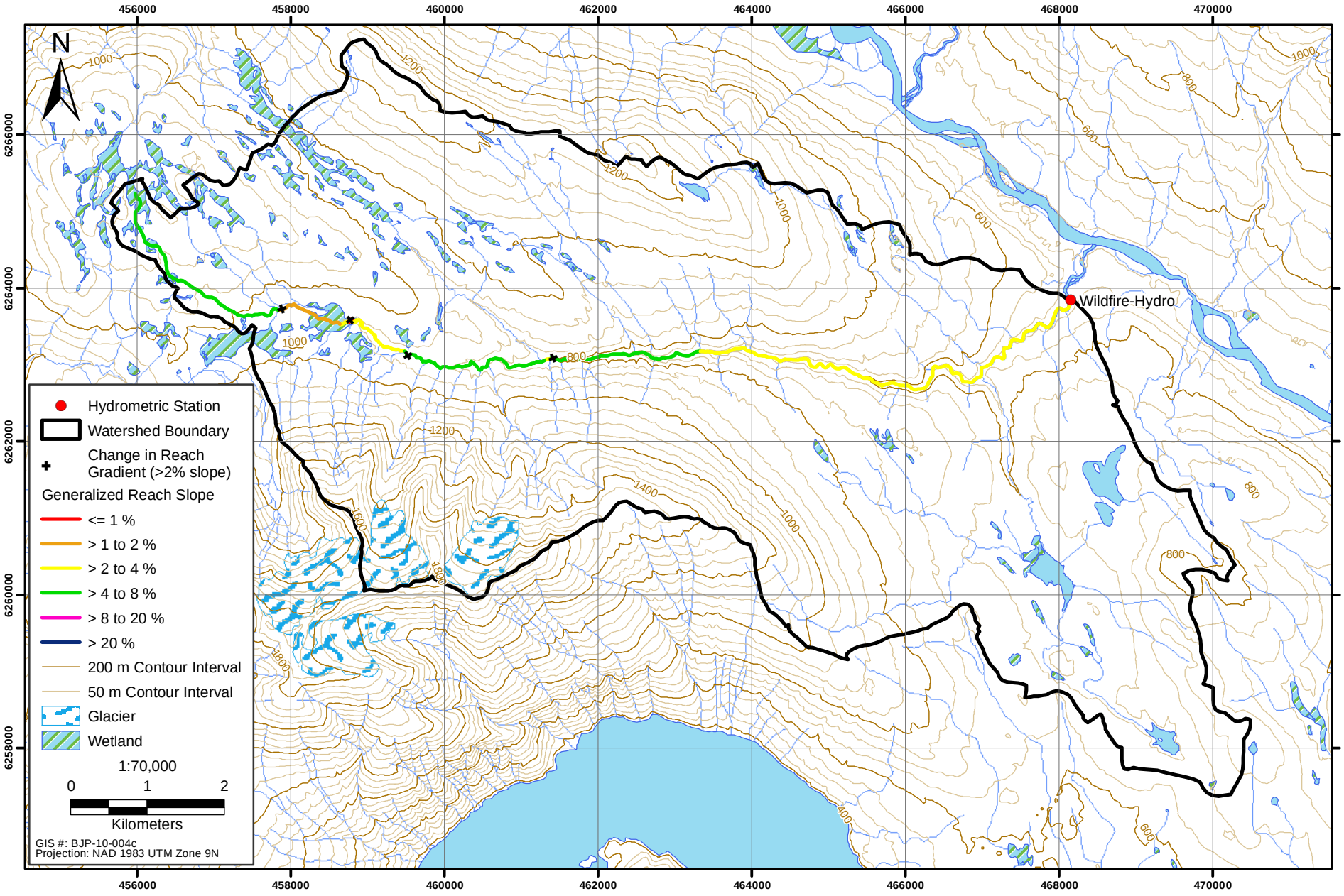
Appendix 1c

PRETIVM

Todedada Creek Watershed

Appendix 1c

Rescan™ Engineers & Scientists



Appendix 1d

PRETIVM

Wildfire Creek Watershed

Appendix 1d

Rescan™ Engineers & Scientists

Appendix 2
Manual Discharge Measurements

Rescan™
Engineers and Scientists

Appendix 2a-1. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2007

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	23-Jul-07			
Time at Site (24 hr)	Start Time:	2:00:00 PM	End Time:	3:00:00 PM
Personnel	SRK			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	N/A

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
WL				1.881	
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes

Summary	
Stage (m)	
Discharge (m^3/s)	3.400
Pressure Transducer Reading (m)	1.040
Pressure Transducer Elevation (m)	

Note: 2007 Measurements carried out by SRK

Discharge Measurement - Mid-Section Method						
Time (24 hr)	Start	14:00	End	14:30	Location	
Method	Velocity-area (Mid-section)			Propeller Size		
Flow Meter Type				Calibration Constant		
Stage (m)	Start	Reading	1.040	Time	14:00	
	End	Reading		Time		

	Station	Distance	Depth	Area	Revolution	Time	Velocity	Q	% of Total Q
Notes	(cm)	(cm)	(m)	(m^2)		(s)	(m/s)	(m3/s)	%
RB	14.30	0.65	0.00	0.00	0	0	0.00	0.000	0.0
	13.00	0.90	0.14	0.13	30	42	0.48	0.061	1.8
	12.50	0.50	0.26	0.13	60	45	0.89	0.116	3.4
	12.00	0.50	0.34	0.17	60	40	1.00	0.170	5.0
	11.50	0.50	0.40	0.20	80	50	1.07	0.213	6.3
	11.00	0.50	0.40	0.20	80	46	1.16	0.232	6.8
	10.50	0.50	0.40	0.20	80	49	1.09	0.218	6.4
	10.00	0.50	0.40	0.20	80	49	1.09	0.218	6.4
	9.50	0.50	0.38	0.19	80	47	1.13	0.216	6.3
	9.00	0.50	0.37	0.19	60	40	1.00	0.185	5.4
	8.50	0.50	0.34	0.17	60	40	1.00	0.170	5.0
	8.00	0.50	0.38	0.19	60	46	0.87	0.166	4.9
	7.50	0.50	0.38	0.19	60	42	0.95	0.181	5.3
	7.00	0.50	0.42	0.21	60	43	0.93	0.196	5.8
	6.50	0.50	0.37	0.19	80	51	1.05	0.194	5.7
	6.00	0.50	0.34	0.17	60	42	0.95	0.162	4.8
	5.50	0.50	0.36	0.18	60	47	0.85	0.154	4.5
	5.00	0.50	0.36	0.18	40	40	0.67	0.121	3.5
	4.50	0.50	0.36	0.18	40	42	0.64	0.115	3.4
	4.00	0.50	0.36	0.18	40	47	0.57	0.103	3.0
	3.50	0.50	0.39	0.20	30	44	0.46	0.090	2.6
	3.00	0.50	0.34	0.17	30	49	0.41	0.070	2.1
	2.50	0.50	0.27	0.14	20	42	0.32	0.044	1.3
	2.00	0.35	0.14	0.05	15	67	0.15	0.008	0.2
LB	1.80	0.10	0.00	0.00	0	0	0.00	0.000	0.0
Total Q								3.400	100.0

General Notes
WL 0.692m from upstream rock bolt, 0.115m from downstream rockbolt

Appendix 2a-1. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2007

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	30-Sep-07			
Time at Site (24 hr)	Start Time:	10:30:00 AM	End Time:	12:00:00 PM
Personnel	SRK			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	N/A

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes

Summary	
Stage (m)	
Discharge (m^3/s)	0.394
Pressure Transducer Reading (m)	0.760
Pressure Transducer Elevation (m)	

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	10:40	End	11:10	Location				
Method	Velocity-area (Mid-section)			Propeller Size					
Flow Meter Type				Calibration Constant					
Stage (m)	Start	Reading	0.760	Time	10:30				
	End	Reading		Time					

	Station	Distance	Depth	Area	Revolution	Time	Velocity	Q	% of Total Q
Notes	(cm)	(cm)	(m)	(m^2)		(s)	(m/s)	(m3/s)	%
RB	12.80	0.25	0.00	0.00	0	0	0.00	0.000	0.0
	12.30	0.50	0.12	0.06	trace	42	0.03	0.002	0.5
	11.80	0.45	0.17	0.08	5	52	0.07	0.006	1.4
	11.40	0.35	0.22	0.08	10	53	0.13	0.010	2.6
	11.10	0.30	0.30	0.09	15	43	0.24	0.022	5.5
	10.80	0.30	0.32	0.10	20	43	0.32	0.030	7.7
	10.50	0.30	0.32	0.10	30	53	0.38	0.037	9.3
	10.20	0.30	0.32	0.10	30	51	0.40	0.038	9.7
	9.90	0.30	0.30	0.09	15	54	0.19	0.017	4.4
	9.60	0.30	0.28	0.08	10	42	0.17	0.014	3.5
	9.30	0.30	0.24	0.07	15	54	0.19	0.014	3.5
	9.00	0.30	0.20	0.06	15	60	0.17	0.010	2.7
	8.70	0.30	0.18	0.05	7	42	0.12	0.006	1.6
	8.40	0.30	0.18	0.05	15	51	0.20	0.011	2.8
	8.10	0.30	0.18	0.05	20	52	0.26	0.014	3.6
	7.80	0.30	0.22	0.07	20	51	0.27	0.018	4.5
	7.50	0.30	0.20	0.06	20	51	0.27	0.016	4.1
	7.20	0.30	0.20	0.06	30	55	0.37	0.022	5.6
	6.90	0.30	0.20	0.06	30	49	0.41	0.025	6.3
	6.60	0.30	0.20	0.06	30	47	0.43	0.026	6.6
	6.30	0.40	0.20	0.08	20	40	0.34	0.027	6.9
	5.80	0.65	0.14	0.09	20	55	0.25	0.023	5.8
	5.00	0.65	0.08	0.05	7	46	0.11	0.006	1.4
	4.50	0.25	0.00	0.00	0	0	0.00	0.000	0.0
Total Q								0.394	100.0

General Notes
WL 1.00m from rockbolt to water surface

**Note: 2007 Measurements carried out by SRK*

Appendix 2a-2. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2008

Site Information					
Project Name	Brucejack Gold Mine Project				
Station Identification	BJL-H1				
Stream Name	Brucejack Lake outflow				
Date Monitored	25-Jul-08				
Time at Site (24 hr)	Start Time:	4:50:00 PM	End Time:	6:30:00 PM	
Personnel					
Station Coordinates	Easting	Northing	Elevation		
Weather Conditions					
Transducer Information					
PT Model	PS9800	Serial #			
Gain		Offset			
Status	Active	Battery			
# of Records		Memory Free			
Date Serviced		Crest Gauges			

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes

Summary	
Stage (m)	
Discharge (m^3/s)	1.245
Pressure Transducer Reading (m)	0.896
Pressure Transducer Elevation (m)	

Discharge Measurement - Mid-Section Method

Time (24 hr)	Start	16:50	End	17:30	Location	
Method	Velocity-area (Mid-section)		Propeller Size			
Flow Meter Type	Swoffer		Calibration Constant			
Stage (m)	Start	Reading	0.896	Time	16:50	
	End	Reading		Time		

Notes	Station (cm)	Distance (cm)	Depth (m)	Area (m^2)	Velocity (m/s)	Correct. Factor	Cal. Vel (m/s)	Q (m3/s)	% of Total Q %
LB	5.95	0.00	0.21	0.02	0.02			0.006	0.5
	5.75	0.20	0.18	0.05	0.33			0.015	1.2
	5.45	0.30	0.21	0.06	0.46			0.027	2.1
	5.20	0.25	0.41	0.10	0.14			0.014	1.1
	4.95	0.25	0.38	0.10	0.65			0.062	5.0
	4.70	0.25	0.36	0.09	0.9			0.080	6.4
	4.45	0.25	0.34	0.09	0.47			0.040	3.2
	4.20	0.25	0.40	0.10	0.75			0.075	6.0
	3.95	0.25	0.41	0.10	1.05			0.108	8.6
	3.70	0.25	0.59	0.15	0.65			0.096	7.7
	3.45	0.25	0.59	0.15	0.8			0.118	9.5
	3.20	0.25	0.56	0.14	0.84			0.118	9.4
	2.95	0.25	0.56	0.14	0.64			0.090	7.2
	2.70	0.25	0.57	0.14	0.58			0.083	6.6
	2.45	0.25	0.60	0.15	0.68			0.102	8.2
	2.20	0.25	0.59	0.15	0.76			0.112	9.0
	1.95	0.25	0.47	0.12	0.7			0.081	6.5
	1.70	0.25	0.29	0.07	0.25			0.018	1.5
	1.45	0.25	0.16	0.03	0.05			0.002	0.1
RB	1.30	0.15	0.00	0.00	0			0.000	0.0
Total Q								1.245	100.0

General Notes

Appendix 2a-2. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2008

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	31-Aug-08			
Time at Site (24 hr)	Start Time:		End Time:	
Personnel	X. Pinto, B. Simpson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes

Summary	
Stage (m)	
Discharge (m^3/s)	0.705
Pressure Transducer Reading (m)	0.736
Pressure Transducer Elevation (m)	

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	16:50	End	17:30	Location				
Method	Velocity-area (Mid-section)			Propeller Size					
Flow Meter Type	Swoffer			Calibration Constant					
Stage (m)	Start	Reading	0.736	Time	0:00				
	End	Reading		Time					

	Station	Distance	Depth	Area	Velocity	Correct.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	Factor	(m/s)	(m3/s)	%
	0.00	0.00	0.00	0.00	0	0.5		0.001	0.2
	0.20	0.20	0.26	0.05	0.19			0.010	1.4
	0.40	0.20	0.38	0.08	0.11			0.008	1.2
	0.60	0.20	0.43	0.09	0.39			0.034	4.8
	0.80	0.20	0.46	0.09	0.57			0.052	7.4
	1.00	0.20	0.51	0.10	0.72			0.073	10.4
	1.20	0.20	0.40	0.08	0.6			0.048	6.8
	1.40	0.20	0.52	0.10	0.39			0.041	5.8
	1.60	0.20	0.53	0.11	0.33			0.035	5.0
	1.80	0.20	0.53	0.11	0.58			0.061	8.7
	2.00	0.20	0.55	0.11	0.54			0.059	8.4
	2.20	0.20	0.62	0.12	0.42			0.052	7.4
	2.40	0.20	0.48	0.10	0.45			0.043	6.1
	2.60	0.20	0.44	0.09	0.54			0.048	6.7
	2.80	0.20	0.43	0.09	0.18			0.015	2.2
	3.00	0.20	0.38	0.08	0.33			0.025	3.6
	3.20	0.20	0.36	0.07	0.32			0.023	3.3
	3.40	0.20	0.29	0.06	0.47			0.027	3.9
	3.60	0.20	0.29	0.06	0.5			0.029	4.1
	3.80	0.20	0.27	0.05	0.15			0.008	1.1
	4.00	0.20	0.22	0.04	0.13			0.006	0.8
	4.20	0.20	0.16	0.03	0.12			0.004	0.5
	4.40	0.20	0.1	0.01	0.08			0.001	0.1
	4.60	0.20	0.0	0.00	0	0.50		0.000	0.1
Total Q								0.705	100.0

General Notes

Appendix 2a-2. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2008

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	24-Sep-08			
Time at Site (24 hr)	Start Time:	10:40:00 AM	End Time:	12:00:00 PM
Personnel	R. Larson, T. Larson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes

Summary	
Stage (m)	
Discharge (m^3/s)	0.382
Pressure Transducer Reading (m)	
Pressure Transducer Elevation (m)	

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	16:50	End	17:30	Location				
Method	Velocity-area (Mid-section)			Propeller Size					
Flow Meter Type	Swoffer			Calibration Constant					
Stage (m)	Start	Reading	0.000	Time	10:40				
	End	Reading		Time					

	Station	Distance	Depth	Area	Velocity	Correct.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	Factor	(m/s)	(m3/s)	%
	4.90	0.00	0.00	0.00	0	0.5		0.000	0.0
	4.70	0.20	0.00	0.00	0			0.000	0.0
	4.50	0.20	0.09	0.02	0			0.000	0.0
	4.30	0.20	0.08	0.02	0.43			0.006	1.7
	4.10	0.20	0.10	0.02	0.34			0.007	1.8
	3.90	0.20	0.18	0.03	0.13			0.005	1.2
	3.70	0.20	0.19	0.04	0.28			0.011	2.8
	3.50	0.20	0.13	0.03	0.03			0.001	0.2
	3.30	0.20	0.36	0.07	0.31			0.022	5.8
	3.10	0.20	0.34	0.07	0.51			0.035	9.1
	2.90	0.20	0.30	0.06	0.43			0.025	6.6
	2.70	0.20	0.44	0.09	0.51			0.045	11.7
	2.50	0.20	0.28	0.06	0.55			0.031	8.1
	2.30	0.20	0.41	0.08	0.33			0.027	7.1
	2.10	0.20	0.40	0.08	0.31			0.025	6.5
	1.90	0.20	0.40	0.08	0.56			0.045	11.7
	1.70	0.20	0.25	0.05	0.56			0.028	7.3
	1.50	0.20	0.30	0.06	0.31			0.018	4.8
	1.30	0.20	0.15	0.03	0.35			0.039	10.2
	1.15	0.15	0.00	0.00	0	0.75		0.013	3.3
Total Q								0.382	100.0

General Notes

Appendix 2a-3. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2009

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	16-Jul-09			
Time at Site (24 hr)	Start Time:	12:00:00 PM	End Time:	1:30:00 PM
Personnel	R. Larson, G. Johnson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes

Summary

Stage (m)		Used PT Stage in 2009
Discharge (m^3/s)	1.838	
Pressure Transducer Reading (m)	0.848	
Pressure Transducer Elevation (m)		

Discharge Measurement #1 - Mid-Section Method

Time (24 hr)	Start	12:00	End	12:20	Location	
Method	Velocity-area (Mid-section)				Propeller Size	
Flow Meter Type	Swoffer				Calibration Constant	
Stage (m)	Start	Reading	0.848	Time	12:00	
	End	Reading		Time		

Notes	Station (m)	Distance (m)	Depth (m)	Area (m^2)	Velocity (m/s)	Correct. Factor	Cal. Vel (m/s)	Q (m3/s)	% of Total Q (%)
LB	8.20	0.00	0.00	0.00	0			0.001	0.0
	7.90	0.30	0.16	0.07	0.09			0.005	0.2
	7.55	0.35	0.22	0.12	0.4			0.031	1.7
	7.20	0.35	0.27	0.14	0.64			0.060	3.3
	6.85	0.35	0.27	0.14	0.6			0.056	3.0
	6.50	0.35	0.07	0.03	1.22			0.028	1.5
	6.15	0.35	0.24	0.13	1.21			0.102	5.5
	5.80	0.35	0.22	0.12	1.33			0.102	5.6
	5.45	0.35	0.25	0.13	1.53			0.134	7.3
	5.10	0.35	0.19	0.10	1.21			0.080	4.4
	4.75	0.35	0.28	0.14	0.8			0.077	4.2
	4.40	0.35	0.25	0.13	0.85			0.074	4.0
	4.05	0.35	0.19	0.16	1.07			0.132	7.2
	3.07	0.98	0.28	0.31	1.01			0.182	9.9
	3.40	0.33	0.35	0.19	0.94			0.120	6.5
	3.00	0.40	0.34	0.20	1.04			0.133	7.2
	2.65	0.35	0.35	0.18	0.99			0.121	6.6
	2.30	0.35	0.47	0.25	1.39			0.229	12.4
	1.95	0.35	0.44	0.23	0.64			0.099	5.4
	1.60	0.35	0.28	0.14	0.71			0.068	3.7
RB	1.25	0.35	0.00	0.00	0			0.005	0.3
Total Q								**1.838**	**100.0**

General Notes

Use average of 2 measurements

Appendix 2a-3. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2009

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	16-Jul-09			
Time at Site (24 hr)	Start Time:	12:00:00 PM	End Time:	1:30:00 PM
Personnel	R. Larson, G. Johnson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				
Transducer Information				
PT Model	PS9800	Serial #		
Gain		Offset		
Status	Active	Battery		
# of Records		Memory Free		
Date Serviced		Crest Gauges		

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes
Summary					
Stage (m)			Used PT Stage in 2009		
Discharge (m^3/s)		1.718			
Pressure Transducer Reading (m)		0.848			
Pressure Transducer Elevation (m)					

Discharge Measurement #2 - Mid-Section Method									
Time (24 hr)	Start	12:00	End	12:20	Location				
Method	Velocity-area (Mid-section)			Propeller Size					
Flow Meter Type	Swoffer			Calibration Constant					
Stage (m)	Start	Reading	0.848	Time	12:00				
	End	Reading		Time					
	Station	Distance	Depth	Area	Velocity	Correct.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	Factor	(m/s)	(m3/s)	%
RB	1.25	0.00	0.00	0.00	0			0.000	0.0
	1.40	0.15	0.21	0.07	0.21			0.012	0.7
	1.80	0.40	1.23	0.71	1.23			0.157	9.1
	2.15	0.35	1.01	0.53	1.01			0.179	10.4
	2.50	0.35	1.11	0.58	1.11			0.138	8.0
	2.85	0.35	0.98	0.49	0.98			0.129	7.5
	3.15	0.30	1.34	0.60	1.34			0.149	8.7
	3.45	0.30	0.98	0.47	0.98			0.108	6.3
	3.80	0.35	1.07	0.56	1.07			0.101	5.9
	4.15	0.35	0.86	0.45	0.86			0.054	3.2
	4.50	0.35	1.19	0.62	1.19			0.081	4.7
	4.85	0.35	0.76	0.40	0.76			0.073	4.3
	5.20	0.35	1.39	0.73	1.39			0.100	5.8
	5.55	0.35	1.38	0.72	1.38			0.114	6.6
	5.90	0.35	1.22	0.64	1.22			0.111	6.5
	6.25	0.35	1.43	0.75	1.43			0.038	2.2
	6.60	0.35	1.14	0.60	1.14			0.064	3.7
	6.95	0.35	0.24	0.13	0.24			0.018	1.1
	7.30	0.35	0.71	0.37	0.71			0.056	3.3
	7.65	0.35	0.35	0.18	0.35			0.025	1.5
	8.00	0.35	0.29	0.02	0.29			0.011	0.7
LB	8.25	0.25	0.00	0.00	0			0.000	0.0
Total Q								1.718	100.0

General Notes

Use average of 2 measurements

Appendix 2a-3. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2009

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	15-Aug-09			
Time at Site (24 hr)	Start Time:	17:45	End Time:	12:00
Personnel	M. Soloducha, M. Jenkins			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes

Summary		
Stage (m)		Used PT Stage in 2009
Discharge (m^3/s)	0.790	
Pressure Transducer Reading (m)	0.686	
Pressure Transducer Elevation (m)		

Discharge Measurement Salt Dilution						
Date Monitored:	15-Aug-09				Pressure Transducer (m):	0.686
Time (24 hr):	Start	17:45	End	12:00	Amount of Salt injected:	4.0
Method	Salt Dilution				Mean Discharge Q (m^3/s):	0.790
Probe LB	600589		Ac LB	0	K (Cal. Constant) LB:	0.002
Probe RB	600743		Ac RB	0	K (Cal. Constant) RB:	0.002
Type of Salt:	Windsor				Error (Std Dev in m^3/s)	0.7

Probe RB: S/N	600743		
M =	1.988	kg	Mass of salt injected
M =	1988000	mg	
Δτ =		s	Time interval
Ac =		mS.s/cm	Area under curve
K1 =	0.00193	(mS L)/(cm mg)	Calibration constant
Q =	790.0	L/s	Discharge
Q =	**0.79**	m3/s	
RD =	2.5	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N	600589		
M =	1.988	kg	Mass of salt injected
M =	1988000	mg	
Δτ =		s	Time interval
Ac =		mS.s/cm	Area under curve
K1 =	0.00199	(mS L)/(cm mg)	Calibration constant
Q =	790.0	L/s	Discharge
Q =	**0.79**	m3/s	
RD =	2.5	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2a-3. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2009

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	17-Sep-09			
Time at Site (24 hr)	Start Time:	6:00:00 PM	End Time:	7:30:00 PM
Personnel	R. Larson, J. Robinson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes

Summary		
Stage (m)		Used PT Stage in 2009
Discharge (m^3/s)	1.098	
Pressure Transducer Reading (m)	0.754	
Pressure Transducer Elevation (m)		

Discharge Measurement #2 - Mid-Section Method						
Time (24 hr)	Start	12:00	End	12:20	Location	
Method	Velocity-area (Mid-section)				Propeller Size	
Flow Meter Type	Swoffer				Calibration Constant	
Stage (m)	Start	Reading	0.754	Time	18:00	
	End	Reading		Time		

Notes	Station (m)	Distance (m)	Depth (m)	Area (m^2)	Velocity (m/s)	Correct. Factor	Cal. Vel (m/s)	Q (m3/s)	% of Total Q %
LB	0.21	0.00	0.00	0.00	0			0.003	0.2
	0.33	0.12	0.21	0.03	0.21			0.040	3.6
	0.39	0.06	0.31	0.02	1.23			0.105	9.6
	0.43	0.04	0.37	0.02	1.01			0.107	9.7
	0.48	0.05	0.56	0.03	1.11			0.144	13.1
	0.50	0.02	0.51	0.02	0.98			0.088	8.0
	0.53	0.03	0.47	0.02	1.34			0.111	10.1
	0.56	0.03	0.50	0.02	0.98			0.096	8.8
	0.58	0.02	0.56	0.02	1.07			0.075	6.8
	0.61	0.03	0.56	0.03	0.86			0.108	9.8
	0.64	0.03	0.57	0.03	1.19			0.125	11.4
	0.67	0.03	0.47	0.02	0.76			0.089	8.1
	0.70	0.03	0.12	0.01	1.39			0.007	0.6
RB	0.75	0.05	0.00	0.00	1.38			0.001	0.1
Total Q								1.098	100.0

General Notes

Only one measurement on this date.

Appendix 2a-3. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2009

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	23-Oct-09			
Time at Site (24 hr)	Start Time:	4:30:00 PM	End Time:	6:15:00 PM
Personnel	R. Larson, J. Williams			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes

Summary		
Stage (m)		
Discharge (m^3/s)	0.273	
Pressure Transducer Reading (m)		No PT installed
Pressure Transducer Elevation (m)		

Discharge Measurement #2 - Mid-Section Method						
Time (24 hr)	Start	16:30	End	17:10	Location	
Method	Velocity-area (Mid-section)		Propeller Size			
Flow Meter Type	Swoffer		Calibration Constant			
Stage (m)	Start	Reading	0.000	Time	16:30	
	End	Reading		Time		

Notes	Station (m)	Distance (m)	Depth (m)	Area (m^2)	Velocity (m/s)	Correct. Factor	Cal. Vel (m/s)	Q (m3/s)	% of Total Q %
RB	0.12	0.00	0.00	0.00	0			0.000	0.0
	0.15	0.04	0.12	0.01	0.02			0.001	0.3
	0.18	0.03	0.42	0.01	0.59			0.050	18.2
	0.19	0.01	0.41	0.01	0.65			0.027	9.8
	0.20	0.01	0.39	0.01	0.55			0.021	7.9
	0.21	0.01	0.36	0.01	0.54			0.019	7.1
	0.22	0.01	0.38	0.01	0.51			0.019	7.1
	0.23	0.01	0.38	0.01	0.55			0.021	7.7
	0.24	0.01	0.35	0.01	0.47			0.016	6.0
	0.25	0.01	0.44	0.01	0.47			0.021	7.6
	0.26	0.01	0.44	0.01	0.42			0.018	6.8
	0.27	0.01	0.30	0.00	0.35			0.011	3.9
	0.28	0.01	0.36	0.01	0.36			0.013	4.8
	0.29	0.01	0.41	0.00	0.32			0.013	4.8
	0.30	0.01	0.42	0.00	0.19			0.012	4.4
	0.32	0.02	0.34	0.00	0.15			0.010	3.7
	0.34	0.02	0.31	0.00	0			0.000	0.0
	0.37	0.03	0.21	0.00	0			0.000	0.0
LB	0.41	0.04	0.00	0.00	0			0.000	0.0
Total Q								0.273	100.0

General Notes
Only one measurement on this date.

Appendix 2a-4. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	2-May-10			
Time at Site (24 hr)	Start Time:	3:15:00 PM	End Time:	5:30:00 PM
Personnel	R. Larson, X. Pinto			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes

Summary	
Stage (m)	98.909
Discharge (m^3/s)	0.141
Pressure Transducer Reading (m)	
Pressure Transducer Elevation (m)	

Discharge Measurement #1 - Mid-Section Method									
Time (24 hr)	Start	15:15	End	15:35	Location	Approx. 100m downstream of station			
Method	Velocity-area (Mid-section)			Propeller Size		2"			
Flow Meter Type	Swoffer			Calibration Constant		612			
Stage (m)	Start	Reading		Time					
	End	Reading		Time					

	Station	Distance	Depth	Area	Velocity	Correct.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	Factor	(m/s)	(m3/s)	%
Left Bank	5.00	0.00	0.00	0.01	0	0.3		0.000	0.0
	4.75	0.25	0.06	0.01	0			0.000	0.0
	4.65	0.10	0.10	0.01	0.07			0.001	0.6
	4.50	0.15	0.12	0.02	0.29			0.005	3.7
	4.35	0.15	0.13	0.02	0.37			0.007	5.1
	4.20	0.15	0.13	0.02	0.47			0.009	6.3
	4.05	0.15	0.16	0.02	0.46			0.011	7.9
	3.90	0.15	0.20	0.03	0.41			0.012	8.8
	3.75	0.15	0.22	0.03	0.44			0.014	10.1
	3.60	0.15	0.26	0.04	0.39			0.015	10.8
	3.45	0.15	0.28	0.04	0.21			0.009	6.2
	3.30	0.15	0.30	0.04	0.22			0.010	6.9
	3.15	0.15	0.34	0.05	0.25			0.013	9.1
	3.00	0.15	0.35	0.05	0.18			0.009	6.6
	2.85	0.15	0.17	0.03	0.09			0.002	1.6
	2.70	0.15	0.18	0.03	0.06			0.002	1.2
	2.55	0.15	0.18	0.03	0.08			0.002	1.5
	2.40	0.15	0.16	0.02	0.53			0.012	8.8
	2.25	0.15	0.17	0.02	0.16			0.004	2.8
	2.10	0.15	0.21	0.03	0.01			0.000	0.2
	1.95	0.15	0.16	0.02	0.08			0.002	1.4
Right Bank	1.80	0.15	0.00	0.01	0	0.70		0.001	0.5
Total Q								0.141	100.0

General Notes
Use average of 2 measurements

Appendix 2a-4. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	2-May-10			
Time at Site (24 hr)	Start Time:	3:15:00 PM	End Time:	5:30:00 PM
Personnel	R. Larson, X. Pinto			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes

Summary

Stage (m)	98.909
Discharge (m^3/s)	0.137
Pressure Transducer Reading (m)	
Pressure Transducer Elevation (m)	

Discharge Measurement #2 - Mid-Section Method

Time (24 hr)	Start	15:15	End	15:35	Location	Approx. 100m downstream of station
Method	Velocity-area (Mid-section)				Propeller Size	2"
Flow Meter Type	Swoffer				Calibration Constant	612
Stage (m)	Start	Reading		Time		
	End	Reading		Time		

Notes	Station (m)	Distance (m)	Depth (m)	Area (m^2)	Velocity (m/s)	Correct. Factor	Cal. Vel (m/s)	Q (m3/s)	% of Total Q %
Right Bank	1.80	0.00	0.00	0.01	0	0.7		0.002	1.1
	1.90	0.10	0.15	0.02	0.29			0.005	4.0
	2.05	0.15	0.14	0.02	0.07			0.001	1.0
	2.20	0.15	0.16	0.02	0.12			0.003	2.1
	2.35	0.15	0.18	0.03	0.43			0.011	8.2
	2.50	0.15	0.16	0.02	0.08			0.002	1.4
	2.65	0.15	0.20	0.03	0.04			0.001	0.9
	2.80	0.15	0.18	0.03	0.04			0.001	0.8
	2.95	0.15	0.35	0.05	0.13			0.007	5.0
	3.10	0.15	0.33	0.05	0.26			0.013	9.4
	3.25	0.15	0.31	0.05	0.19			0.009	6.4
	3.40	0.15	0.27	0.04	0.19			0.008	5.6
	3.55	0.15	0.27	0.04	0.31			0.012	9.0
	3.70	0.15	0.23	0.03	0.44			0.015	10.8
	3.85	0.15	0.20	0.03	0.46			0.014	10.1
	4.00	0.15	0.17	0.02	0.43			0.011	7.8
	4.15	0.15	0.13	0.02	0.45			0.009	6.4
	4.30	0.15	0.11	0.02	0.44			0.007	5.3
	4.45	0.15	0.10	0.02	0.32			0.005	3.5
	4.60	0.15	0.08	0.02	0.07			0.002	1.1
Left Bank	5.00	0.40	0.00	0.02	0	0.30		0.000	0.2
Total Q								**0.137**	**100.0**

General Notes

Use average of 2 measurements

Appendix 2a-4. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2010

Site Information

Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	22-May-10			
Time at Site (24 hr)	Start Time:	2:45:00 PM	End Time:	4:30:00 PM
Personnel	R. Larson, J. Morgan			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information

PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes

Summary

Stage (m)	99.261
Discharge (m^3/s)	0.687
Pressure Transducer Reading (m)	
Pressure Transducer Elevation (m)	

Discharge Measurement #1 - Mid-Section Method

Time (24 hr)	Start 14:45	End 15:10	Location	Approx. 100m downstream of station
Method	Velocity-area (Mid-section)		Propeller Size	2"
Flow Meter Type	Swoffer		Calibration Constant	608
Stage (m)	Start	Reading	Time	
	End	Reading	Time	

Notes	Station (m)	Distance (m)	Depth (m)	Area (m^2)	Velocity (m/s)	Correct. Factor	Cal. Vel (m/s)	Q (m3/s)	% of Total Q %
Right Bank	8.00	0.00	0.00	0.02	0	0.9		0.003	0.4
	7.80	0.20	0.23	0.05	0.14			0.006	0.9
	7.60	0.20	0.24	0.05	0.17			0.008	1.2
	7.40	0.20	0.26	0.05	0.37			0.019	2.8
	7.20	0.20	0.28	0.06	0.52			0.029	4.2
	7.00	0.20	0.28	0.06	0.57			0.032	4.6
	6.80	0.20	0.28	0.06	0.71			0.040	5.8
	6.60	0.20	0.28	0.06	0.78			0.044	6.4
	6.40	0.20	0.29	0.06	0.75			0.043	6.3
	6.20	0.20	0.31	0.06	0.61			0.038	5.5
	6.00	0.20	0.31	0.06	0.61			0.037	5.4
	5.80	0.20	0.28	0.06	0.47			0.026	3.8
	5.60	0.20	0.28	0.05	0.48			0.026	3.8
	5.40	0.20	0.38	0.07	0.3			0.023	3.3
	5.20	0.20	0.51	0.10	0.46			0.047	6.8
	5.00	0.20	0.51	0.10	0.48			0.049	7.1
	4.80	0.20	0.47	0.09	0.45			0.042	6.1
	4.60	0.20	0.42	0.08	0.52			0.044	6.4
	4.40	0.20	0.34	0.07	0.61			0.041	6.0
	4.20	0.20	0.31	0.06	0.61			0.038	5.5
	4.00	0.20	0.25	0.05	0.63			0.031	4.5
	3.80	0.20	0.18	0.04	0.46			0.016	2.3
	3.60	0.20	0.10	0.02	0.22			0.004	0.6
Left Bank	3.45	0.15	0.00	0.01	0	0.80		0.001	0.2
Total Q								**0.687**	**100.0**

General Notes

Use average of 2 measurements

Appendix 2a-4. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	22-May-10			
Time at Site (24 hr)	Start Time:	2:45:00 PM	End Time:	4:30:00 PM
Personnel	R. Larson, J. Morgan			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes

Summary	
Stage (m)	99.261
Discharge (m^3/s)	0.669
Pressure Transducer Reading (m)	
Pressure Transducer Elevation (m)	

Discharge Measurement #1 - Mid-Section Method									
Time (24 hr)	Start	15:10	End	15:30	Location	Approx. 100m downstream of station			
Method	Velocity-area (Mid-section)			Propeller Size		2"			
Flow Meter Type	Swoffer			Calibration Constant		608			
Stage (m)	Start	Reading		Time					
	End	Reading		Time					
	Station	Distance	Depth	Area	Velocity	Correct.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	Factor	(m/s)	(m3/s)	%
Left Bank	3.45	0.00	0.00	0.00	0	0.8		0.000	0.1
	3.50	0.05	0.06	0.01	0.31			0.002	0.3
	3.70	0.20	0.12	0.02	0.44			0.011	1.6
	3.90	0.20	0.22	0.04	0.54			0.024	3.6
	4.10	0.20	0.29	0.06	0.62			0.035	5.3
	4.30	0.20	0.32	0.06	0.57			0.036	5.5
	4.50	0.20	0.40	0.08	0.57			0.046	6.8
	4.70	0.20	0.46	0.09	0.46			0.042	6.3
	4.90	0.20	0.50	0.10	0.45			0.045	6.7
	5.10	0.20	0.52	0.10	0.51			0.053	7.9
	5.30	0.20	0.36	0.07	0.48			0.035	5.2
	5.50	0.20	0.24	0.05	0.44			0.021	3.2
	5.70	0.20	0.28	0.06	0.39			0.021	3.2
	5.90	0.20	0.31	0.06	0.57			0.035	5.3
	6.10	0.20	0.29	0.06	0.66			0.038	5.7
	6.30	0.20	0.30	0.06	0.73			0.044	6.5
	6.50	0.20	0.28	0.06	0.72			0.040	5.9
	6.70	0.20	0.29	0.06	0.69			0.039	5.9
	6.90	0.20	0.29	0.06	0.6			0.034	5.1
	7.10	0.20	0.28	0.06	0.43			0.024	3.6
	7.30	0.20	0.28	0.06	0.38			0.021	3.2
	7.50	0.20	0.24	0.05	0.26			0.012	1.9
	7.70	0.20	0.24	0.05	0.12			0.006	0.9
	7.90	0.20	0.27	0.04	0.05			0.002	0.3
Right Bank	8.00	0.10	0.00	0.01	0	0.90		0.001	0.1
Total Q								**0.669**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2a-4. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	27-Jun-10			
Time at Site (24 hr)	**Start Time:**	11:00:00 AM	**End Time:**	1:30:00 PM
Personnel	R. Larson, R. Robinson			
Station Coordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
CP1	1.809	101.809		100.000	Top bolt in boulder
WL			2.655	99.154	
CP2			1.959	99.850	Bottom bolt in boulder
CP2	2.066	101.916			
WL			2.764	99.152	
CP1			1.916	100.000	

BM#	**Established Elevation (m)**	**Mean Elevation (this date)**	**Difference (m)**	**Notes**
CP1		100.000		
CP2		99.850		

Summary	
Stage (m)	99.154
Discharge (m^3/s)	1.430
Pressure Transducer Reading (m)	0.877
Pressure Transducer Elevation (m)	98.277

Discharge Measurement #1 - Mid-Section Method									
Time (24 hr)	**Start**	11:00	**End**	11:20	**Location**	Approx. 350m downstream of station			
Method	Velocity-area (Mid-section)			**Propeller Size**		2"			
Flow Meter Type	Swoffer			**Calibration Constant**		426			
Stage (m)	**Start**	**Reading**	0.877	**Time**	11:00				
	End	**Reading**		**Time**					

	Station	**Distance**	**Depth**	**Area**	**Velocity**	**Correct.**	**Cal. Vel**	**Q**	**% of Total Q**
Notes	**(m)**	**(m)**	**(m)**	**(m^2)**	**(m/s)**	**Factor**	**(m/s)**	**(m3/s)**	**%**
Left Bank	8.70	0.00	0.00	0.01	0	0.4	0.00	0.001	0.0
	8.20	0.50	0.04	0.02	0.2		0.14	0.003	0.2
	7.70	0.50	0.16	0.08	0.86		0.60	0.048	3.4
	7.20	0.50	0.24	0.12	0.51		0.36	0.043	3.0
rock upstream	6.70	0.50	0.22	0.13	0.01		0.01	0.001	0.1
rock upstream	6.00	0.70	0.24	0.14	0.03		0.02	0.003	0.2
	5.50	0.50	0.27	0.11	0.82		0.57	0.062	4.3
	5.20	0.30	0.26	0.08	0.94		0.66	0.055	3.9
	4.85	0.35	0.35	0.11	1.17		0.82	0.086	6.0
	4.60	0.25	0.35	0.09	1.4		0.98	0.086	6.0
	4.35	0.25	0.33	0.08	1.67		1.17	0.096	6.7
	4.10	0.25	0.34	0.08	1.9		1.33	0.113	7.9
	3.85	0.25	0.36	0.11	1.93		1.35	0.146	10.2
	3.50	0.35	0.39	0.10	1.52		1.06	0.103	7.2
	3.35	0.15	0.35	0.07	1.69		1.18	0.083	5.8
	3.10	0.25	0.29	0.07	1.67		1.17	0.085	5.9
	2.85	0.25	0.27	0.07	1.37		0.96	0.065	4.5
	2.60	0.25	0.35	0.09	1.86		1.30	0.114	8.0
	2.35	0.25	0.31	0.08	1.96		1.37	0.106	7.4
	2.10	0.25	0.36	0.09	1.23		0.86	0.077	5.4
	1.85	0.25	0.26	0.08	0.7		0.49	0.038	2.7
Right Bank	1.50	0.35	0.0	0.05	0	0.80	0.00	0.018	1.2
Total Q								**1.430**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2a-4. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	27-Jun-10			
Time at Site (24 hr)	Start Time:	11:00:00 AM	End Time:	1:30:00 PM
Personnel	R. Larson, R. Robinson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
CP1	1.809	101.809		100.000	Top bolt in boulder
WL			2.655	99.154	
CP2			1.959	99.850	Bottom bolt in boulder
CP2	2.066	101.916			
WL			2.764	99.152	
CP1			1.916	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
CP1		100.000		
CP2		99.850		

Summary	
Stage (m)	99.154
Discharge (m^3/s)	1.198
Pressure Transducer Reading (m)	0.877
Pressure Transducer Elevation (m)	98.277

Discharge Measurement #2 - Mid-Section Method

Time (24 hr)	Start	11:20	End	11:40	Location	Approx. 350m downstream of station
Method	Velocity-area (Mid-section)			Propeller Size	2"	
Flow Meter Type	Swoffer			Calibration Constant	426	
Stage (m)	Start	Reading	0.877	Time	11:20	
	End	Reading		Time		

Notes	Station (m)	Distance (m)	Depth (m)	Area (m^2)	Velocity (m/s)	Correct. Factor	Cal. Vel (m/s)	Q (m3/s)	% of Total Q %
Right Bank	1.50	0.00	0.00	0.09	0	0.7	0.00	0.054	4.5
	2.00	0.50	0.36	0.14	1.22		0.85	0.115	9.6
	2.25	0.25	0.31	0.08	1.9		1.33	0.103	8.6
	2.50	0.25	0.36	0.09	1.76		1.23	0.111	9.2
	2.75	0.25	0.33	0.08	2.01		1.40	0.116	9.7
	3.00	0.25	0.30	0.08	1.49		1.04	0.078	6.5
	3.25	0.25	0.31	0.08	1.36		0.95	0.074	6.1
	3.50	0.25	0.38	0.10	1.5		1.05	0.100	8.3
	3.75	0.25	0.33	0.08	0.93		0.65	0.054	4.5
	4.00	0.25	0.31	0.08	0.79		0.55	0.043	3.6
	4.25	0.25	0.32	0.08	1.4		0.98	0.078	6.5
	4.50	0.25	0.32	0.08	0.58		0.41	0.032	2.7
	4.75	0.25	0.31	0.08	0.65		0.45	0.035	2.9
	5.00	0.25	0.31	0.08	0.77		0.54	0.042	3.5
	5.25	0.25	0.26	0.07	0.56		0.39	0.025	2.1
	5.50	0.25	0.27	0.07	0.42		0.29	0.020	1.7
	5.75	0.25	0.27	0.18	0.11		0.08	0.013	1.1
	6.80	1.05	0.22	0.17	0.38		0.27	0.045	3.8
	7.30	0.50	0.21	0.11	0.45		0.31	0.033	2.8
	7.80	0.50	0.16	0.11	0.3		0.21	0.023	2.0
Left Bank	8.70	0.90	0.00	0.07	0	0.30	0.00	0.005	0.4
Total Q								1.198	100.0

General Notes

Use average of 2 measurements

Appendix 2a-4. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	27-Jul-10			
Time at Site (24 hr)	Start Time:	12:00:00 PM	End Time:	2:00:00 PM
Personnel	R. Larson, R. Burns			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
CP1	1.583	101.583		100.000	
WL			2.481	99.102	
CP2			1.735	99.848	
CP2	1.690	101.538			
WL			2.436	99.102	
CP1			1.542	99.996	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
CP1		99.998		
CP2		99.848		

Summary	
Stage (m)	99.102
Discharge (m^3/s)	0.855
Pressure Transducer Reading (m)	0.823
Pressure Transducer Elevation (m)	98.279

Discharge Measurement #1 - Mid-Section Method

Time (24 hr)	Start	12:00	End	12:20	Location	Approx. 100m downstream of station	
Method	Velocity-area (Mid-section)			Propeller Size		2"	
Flow Meter Type	Swoffer			Calibration Constant		610	
Stage (m)	Start	Reading	0.823	Time	12:00		
	End	Reading		Time			

	Station	Distance	Depth	Area	Velocity	Correct.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	Factor	(m/s)	(m3/s)	%
Left Bank	6.00	0.00	0.00	0.03	0	0.2		0.002	0.2
	5.50	0.50	0.11	0.04	0.34			0.015	1.7
	5.20	0.30	0.22	0.07	0.26			0.017	2.0
	4.90	0.30	0.25	0.06	0.57			0.036	4.2
	4.70	0.20	0.22	0.04	0.66			0.029	3.4
	4.50	0.20	0.24	0.05	0.86			0.041	4.8
	4.30	0.20	0.41	0.08	0.57			0.047	5.5
	4.10	0.20	0.30	0.06	0.7			0.042	4.9
	3.90	0.20	0.46	0.09	0.59			0.054	6.3
	3.70	0.20	0.34	0.07	0.58			0.039	4.6
	3.50	0.20	0.46	0.09	0.69			0.063	7.4
	3.30	0.20	0.47	0.09	0.76			0.071	8.4
	3.10	0.20	0.51	0.10	0.71			0.072	8.5
	2.90	0.20	0.51	0.10	0.56			0.057	6.7
	2.70	0.20	0.53	0.11	0.42			0.045	5.2
	2.50	0.20	0.51	0.10	0.7			0.071	8.3
	2.30	0.20	0.49	0.10	0.73			0.072	8.4
	2.10	0.20	0.46	0.09	0.66			0.061	7.1
Rock upstream	1.90	0.20	0.47	0.12	0.03			0.004	0.4
	1.60	0.30	0.32	0.13	0.11			0.014	1.6
Right Bank	1.10	0.50	0.00	0.08	0	0.30		0.003	0.3
Total Q								0.855	100.0

General Notes
Use average of 2 measurements

Appendix 2a-4. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	27-Jul-10			
Time at Site (24 hr)	Start Time:	12:00:00 PM	End Time:	2:00:00 PM
Personnel	R. Larson, R. Burns			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
CP1	1.583	101.583		100.000	
WL			2.481	99.102	
CP2			1.735	99.848	
CP2	1.690	101.538			
WL			2.436	99.102	
CP1			1.542	99.996	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
CP1		99.998		
CP2		99.848		

Summary	
Stage (m)	99.102
Discharge (m^3/s)	0.871
Pressure Transducer Reading (m)	0.823
Pressure Transducer Elevation (m)	98.279

Discharge Measurement #2 - Mid-Section Method									
Time (24 hr)	Start	12:00	End	12:20	Location	Approx. 100m downstream of station			
Method	Velocity-area (Mid-section)			Propeller Size		2"			
Flow Meter Type	Swoffer			Calibration Constant		610			
Stage (m)	Start	Reading	0.823	Time	12:00				
	End	Reading		Time					

	Station	Distance	Depth	Area	Velocity	Correct.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	Factor	(m/s)	(m3/s)	%
Right Bank	1.10	0.00	0.00	0.03	0	0.3		0.000	0.0
	1.45	0.35	0.15	0.05	0.04			0.002	0.2
	1.75	0.30	0.31	0.09	0.07			0.006	0.7
	2.00	0.25	0.42	0.09	0.47			0.044	5.1
	2.20	0.20	0.49	0.10	0.74			0.073	8.3
	2.40	0.20	0.49	0.10	0.76			0.074	8.5
	2.60	0.20	0.51	0.10	0.58			0.059	6.8
	2.80	0.20	0.50	0.10	0.54			0.054	6.2
	3.00	0.20	0.49	0.10	0.68			0.067	7.6
	3.20	0.20	0.50	0.10	0.79			0.079	9.1
	3.40	0.20	0.44	0.09	0.79			0.070	8.0
	3.60	0.20	0.37	0.07	0.65			0.048	5.5
	3.80	0.20	0.46	0.09	0.54			0.050	5.7
	4.00	0.20	0.30	0.06	0.82			0.049	5.6
	4.20	0.20	0.30	0.06	0.62			0.037	4.3
	4.40	0.20	0.34	0.07	0.69			0.047	5.4
	4.60	0.20	0.22	0.06	0.81			0.045	5.1
	4.90	0.30	0.18	0.05	0.6			0.032	3.7
	5.20	0.30	0.21	0.06	0.22			0.014	1.6
	5.50	0.30	0.19	0.08	0.25			0.019	2.2
Left Bank	6.00	0.50	0.00	0.05	0	0.20		0.002	0.3
Total Q								0.871	100.0

General Notes
Use average of 2 measurements

Appendix 2a-4. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	28-Sep-10			
Time at Site (24 hr)	Start Time:	9:30:00 AM	End Time:	11:30:00 AM
Personnel	R. Larson, T. Marsden			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
CP1 (T83)	0.569	100.569		100.000	
WL			1.300	99.269	
a			2.004	98.565	
T84			0.718	99.851	
T84	1.010	100.861			
WL			1.590	99.271	
T83			0.861	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
CP1 (T83)		100.000		
T84		99.851		

Summary	
Stage (m)	99.270
Discharge (m^3/s)	2.820
Pressure Transducer Reading (m)	1.007
Pressure Transducer Elevation (m)	98.263

Discharge Measurement #1 - Mid-Section Method									
Time (24 hr)	Start	9:30	End	9:50	Location	Approx. 100m downstream of station			
Method	Velocity-area (Mid-section)			Propeller Size		2"			
Flow Meter Type	Swoffer			Calibration Constant		610			
Stage (m)	Start	Reading	1.007	Time	9:30				
	End	Reading		Time					

	Station	Distance	Depth	Area	Velocity	Correct.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	Factor	(m/s)	(m3/s)	%
Left Bank	8.70	0.00	0.00	0.14	0	0.3		0.005	0.2
	7.60	1.10	0.25	0.18	0.12			0.021	0.7
	7.30	0.30	0.30	0.09	0.42			0.038	1.3
	7.00	0.30	0.17	0.05	1.37			0.070	2.5
	6.70	0.30	0.52	0.16	0.96			0.150	5.3
	6.40	0.30	0.57	0.20	1.16			0.231	8.2
	6.00	0.40	0.65	0.26	1.12			0.291	10.3
	5.60	0.40	0.75	0.26	1.4			0.368	13.0
	5.30	0.30	0.61	0.21	1.23			0.263	9.3
20% depth	4.90	0.40	0.84	0.15	0.47			0.069	2.4
80% depth		4.90	0.84	0.15	1.24			0.182	6.5
20% depth	4.60	4.60	0.82	0.10	0.6			0.062	2.2
80% depth		4.60	0.82	0.10	1.11			0.114	4.0
20% depth	4.40	4.40	0.82	0.10	0.67			0.069	2.4
80% depth		4.40	0.82	0.10	1.11			0.114	4.0
	4.10	4.10	0.74	0.22	1.03			0.229	8.1
20% depth	3.80	0.30	0.77	0.12	1.08			0.125	4.4
80% depth		3.80	0.77	0.12	1.02			0.118	4.2
20% depth	3.50	3.50	0.80	0.12	0.31			0.037	1.3
80% depth		3.50	0.80	0.12	0.97			0.116	4.1
20% depth	3.20	3.20	0.79	0.16	0.76			0.120	4.3
80% depth		3.20	0.8	0.16	0.1			0.016	0.6
20% depth	2.70	2.70	0.8	0.22	0.1			0.022	0.8
80% depth		2.70	0.8	0.22	-0.06			-0.013	-0.5
	2.10	2.10	0.7	0.55	0.01			0.005	0.2
Right Bank	1.20	0.90	0.0	0.33	0	0.00		0.000	0.0
Total Q								**2.820**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2a-4. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	28-Sep-10			
Time at Site (24 hr)	Start Time:	9:30:00 AM	End Time:	11:30:00 AM
Personnel	R. Larson, T. Marsden			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
CP1 (T83)	0.569	100.569		100.000	
WL			1.300	99.269	
a			2.004	98.565	
T84			0.718	99.851	
T84	1.010	100.861			
WL			1.590	99.271	
T83			0.861	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
CP1 (T83)		100.000		
T84		99.851		

Summary	
Stage (m)	99.270
Discharge (m^3/s)	2.897
Pressure Transducer Reading (m)	1.007
Pressure Transducer Elevation (m)	98.263

Discharge Measurement #2 - Mid-Section Method									
Time (24 hr)	Start	9:50	End	10:10	Location	Approx. 100m downstream of station			
Method	Velocity-area (Mid-section)			Propeller Size		2"			
Flow Meter Type	Swoffer			Calibration Constant		610			
Stage (m)	Start	Reading	1.007	Time	9:50				
	End	Reading		Time					

	Station	Distance	Depth	Area	Velocity	Correct.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	Factor	(m/s)	(m3/s)	%
Right Bank	1.20	0.00	0.00	0.35	0	0		0.000	0.0
	2.30	1.10	0.64	0.45	-0.05			-0.022	-0.8
20% depth	2.60	0.30	0.77	0.13	0.11			0.015	0.5
80% depth		2.60	0.77	0.13	-0.06			-0.008	-0.3
20% depth	3.00	3.00	0.77	0.13	0.61			0.082	2.8
80% depth		3.00	0.77	0.13	0.06			0.008	0.3
	3.30	3.30	0.68	0.24	0.73			0.174	6.0
20% depth	3.70	0.40	0.78	0.14	1.08			0.147	5.1
80% depth		3.70	0.78	0.14	1.09			0.149	5.1
	4.00	4.00	0.71	0.25	1.07			0.266	9.2
20% depth	4.40	0.40	0.82	0.16	0.78			0.128	4.4
80% depth		4.40	0.82	0.16	1.17			0.192	6.6
20% depth	4.80	4.80	0.81	0.14	0.59			0.084	2.9
80% depth		4.80	0.81	0.14	1.09			0.155	5.3
	5.10	5.10	0.58	0.17	1.23			0.214	7.4
	5.40	0.30	0.70	0.21	1.2			0.252	8.7
	5.70	0.30	0.74	0.22	1.37			0.304	10.5
	6.00	0.30	0.55	0.17	1.18			0.195	6.7
	6.30	0.30	0.62	0.19	1.24			0.231	8.0
	6.60	0.30	0.53	0.16	1.26			0.200	6.9
	6.90	0.30	0.28	0.08	1.33			0.112	3.9
	7.20	0.30	0.3	0.13	0.32			0.041	1.4
	7.70	0.50	0.2	0.15	-0.11			-0.017	-0.6
Left Bank	8.70	1.00	0.0	0.10	0	0.30		-0.003	-0.1
Total Q								2.897	100.0

General Notes
Use average of 2 measurements

Appendix 2a-5. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	19-Jul-11			
Time at Site (24 hr)	Start Time:	3:30:00 PM	End Time:	4:25:00 PM
Personnel	M Soloducha, J Cristobal			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 83	0.722	100.722		100.000	
BM 84			0.871	99.851	
WL			1.575	99.147	
TBM	1.494	101.437	0.779	99.943	
WL			2.290	**99.147**	
BM 84			1.586	99.851	
BM 83			1.434	**100.003**	

BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes
BM 83	100.000	100.002		-0.001	
BM 84	99.851	99.851		0.000	

Summary	
Stage (m)	99.147
Discharge (m^3/s)	1.45
Pressure Transducer Reading (m)	1.635
Pressure Transducer Elevation (m)	97.512

Discharge Measurement - Mid-Section Method										
Time (24 hr)	Start	15:30	End	15:45	Location					
Method	Velocity-area (Mid-section)			Instrument Model	Flo-Mate					
Flow Meter Type	Electromagnetic sensor			Instrument Serial #						
Stage (m)	Start	Reading	1.635	Time	15:30					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	0.85	0.00	0.00	0.01	0			0.000	0.0
	1.00	0.11	0.15	0.02	-0.02			0.000	0.0
	1.20	0.08	0.20	0.02	0.09			0.001	0.1
	1.40	0.40	0.20	0.08	0.76			0.061	4.2
	1.60	0.57	0.20	0.11	0.85			0.097	6.7
	1.80	0.70	0.20	0.14	0.87			0.122	8.4
	2.00	0.72	0.20	0.14	0.73			0.105	7.2
	2.20	0.72	0.20	0.14	0.5			0.072	5.0
	2.40	0.78	0.20	0.16	0.35			0.055	3.8
	2.60	0.74	0.20	0.15	0.66			0.098	6.7
	2.80	0.73	0.20	0.15	0.77			0.112	7.8
	3.00	0.68	0.20	0.14	0.85			0.116	8.0
	3.20	0.64	0.20	0.13	0.58			0.074	5.1
	3.40	0.66	0.20	0.13	0.66			0.087	6.0
	3.60	0.56	0.20	0.11	0.82			0.092	6.3
	3.80	0.45	0.20	0.09	0.78			0.070	4.8
	4.00	0.36	0.20	0.07	0.99			0.071	4.9
	4.20	0.38	0.20	0.08	0.95			0.072	5.0
Behind Rock	4.40	0.43	0.20	0.09	0.17			0.015	1.0
	4.60	0.44	0.20	0.09	0.76			0.067	4.6
	4.80	0.40	0.20	0.14	0.28			0.022	1.5
	5.00	0.24	0.20	0.58	0.5			0.024	1.7
	5.20	0.22	0.20	0.55	0.53			0.017	1.2
Right Bank	5.30	0.00	0.50	0.10	0			0.000	0.0
Total Q								**1.450**	**100.0**

General Notes

Appendix 2a-5. Manual Discharge Measurements and Levelling Surveys at BJL-H1 in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	23-Sep-11			
Time at Site (24 hr)	Start Time:	2:20:00 PM	End Time:	4:00:00 PM
Personnel	R Larson, Alex			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 083	1.460	101.460		100.000	
WL			2.295	99.165	
BM 084	1.429	101.279	1.610	99.850	
WL			2.123	99.156	
BM 083			1.280	**99.999**	
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes
BM 083	100.000	100.000		0.000	
WL	99.851	99.850		0.001	

Summary	
Stage (m)	99.161
Discharge (m^3/s)	1.51
Pressure Transducer Reading (m)	1.526
Pressure Transducer Elevation (m)	97.635

Discharge Measurement - Mid-Section Method										
Time (24 hr)	Start	15:30	End	15:45	Location					
Method	Velocity-area (Mid-section)			Instrument Model	Flo-Mate					
Flow Meter Type	Electromagnetic sensor			Instrument Serial #						
Stage (m)	Start	Reading	1.635	Time	15:30					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	6.60	0.00	0.0	0.04	0			0.000	0.0
	6.30	0.27	0.3	0.12	-0.05			-0.006	-0.4
	5.70	0.39	0.6	0.20	0.39			0.076	5.0
	5.30	0.35	0.4	0.12	0.83			0.102	6.7
	5.00	0.29	0.3	0.09	1.04			0.090	6.0
	4.70	0.44	0.3	0.13	0.87			0.115	7.6
	4.40	0.43	0.3	0.13	0.96			0.124	8.2
	4.10	0.36	0.3	0.09	0.96			0.086	5.7
	3.90	0.41	0.2	0.08	0.85			0.070	4.6
	3.70	0.50	0.2	0.00	0.9			0.090	6.0
	3.90	0.54	0.2	0.11	0.84			0.181	12.0
	3.30	0.56	0.6	0.22	0.81			0.181	12.0
	3.10	0.61	0.2	0.12	0.77			0.094	6.2
	2.90	0.68	0.2	0.15	0.81			0.124	8.2
	2.65	0.54	0.3	0.12	0.81			0.098	6.5
	2.45	0.51	0.2	0.13	0.57			0.073	4.8
	2.15	0.60	0.3	0.20	-0.02			-0.004	-0.3
	1.80	0.30	0.4	0.10	0.12			0.012	0.8
Right Bank	1.50	0.00	0.3	0.05	0			0.000	0.0
Total Q								1.507	100.0

General Notes

Appendix 2a-6. Manual Discharge Measurements and Levelling Surveys at BJL-H1 and BJL-H1a in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1			
Stream Name	Brucejack Lake outflow			
Date Monitored	21-Jun-12			
Time at Site (24 hr)	Start Time:	8:40	End Time:	10:00
Personnel	E. Belland, T. Englesmeier			
Station Coordinates	Easting	Northing	Elevation	
	425840	6258899	1350	
Weather Conditions	Sunny, clear			

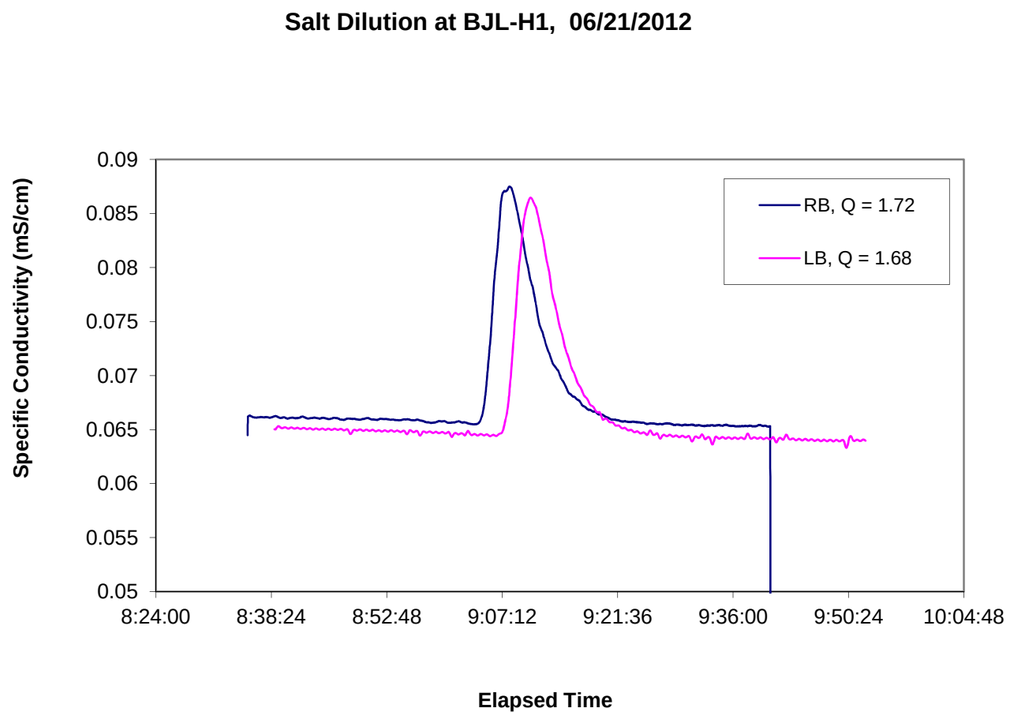
Transducer Information			
PT Model	Solinst Levellogger	Serial #	1024558
Gain	n/a	Offset	98.65
Status	active	Battery	99%
# of Records		Memory Free	25%
Date Serviced		Crest Gauges	n/a

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes

BM#	Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes

Summary	
Stage (m) from PT Reading	99.526
Discharge (m^3/s)	1.700
Pressure Transducer Reading (m)	0.876
Pressure Transducer Elevation (m)	n/a

Discharge Measurement Salt Dilution						
Date Monitored:	21-Jun-12				Pressure Transducer (m):	0.876
Time (24 hr):	Start	8:30	End	9:50	Amount of Salt injected:	7.324 kg
Method	Salt Dilution				Mean Discharge Q (m^3/s):	1.7
Probe LB		YSI # 13620	Ac LB	7.8639	K (Cal. Constant) LB:	0.0018
Probe RB		YSI # 12397	Ac RB	8.0989	K (Cal. Constant) RB:	0.0019
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.03



General Notes
Both probes on RB of outflow channel for safety reasons. Probes ~200 m DS of salt injection. Too much snowpack for site survey.

Appendix 2a-6. Manual Discharge Measurements and Levelling Surveys at BJL-H1 and BJL-H1a in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1a			
Stream Name	Brucejack Lake outflow			
Date Monitored	24-Jul-12			
Time at Site (24 hr)	Start Time:	15:00	End Time:	18:30
Personnel	E. Belland, T. Englesmeier			
Station Cordinates	Easting	Northing	Elevation	
	425840	6258899	1350	
Weather Conditions	fair, sunny			

Transducer Information			
PT Model	PS9800	Serial #	21121001
Gain		Offset	98.65
Status	Active	Battery	100%
# of Records	0	Memory Free	100%
Date Serviced	24-Jul-12	Crest Gauges	n/a

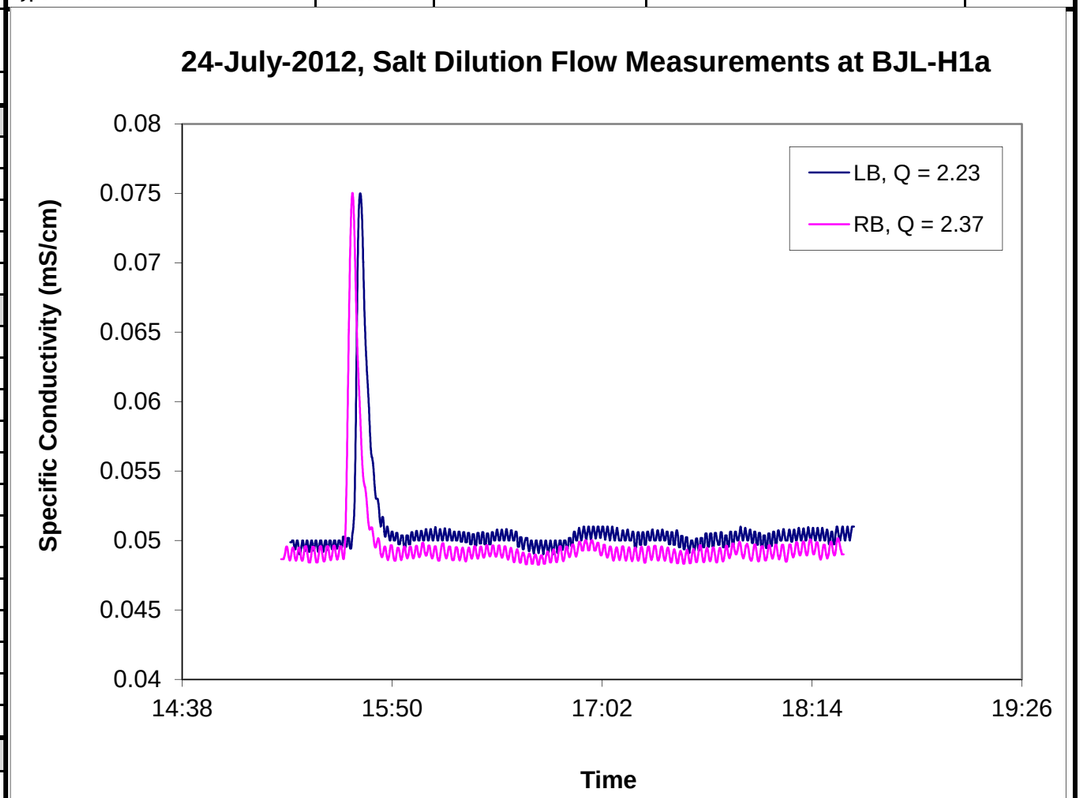
Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 100	1.351	101.351		100.000	P
BM 101			1.047	100.304	
BM 102			1.515	99.836	
PT			1.292	100.059	(top of angle iron)
WL			1.932	**99.419**	
TBM	1.152	101.176	1.327	100.024	
WL			1.757	**99.419**	
PT			1.117	100.059	
BM 102			1.338	99.838	
BM 101			0.871	100.305	
BM 100			1.174	100.002	

BM#	Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes
BM 100	100.000	100.001	n/a	Installed this day
BM 101	100.305	100.305	n/a	Installed this day
BM 102	99.837	99.837	n/a	Installed this day

Summary	
Stage (m)	99.419
Discharge (m^3/s)	2.300
Pressure Transducer Reading (m)	0.674
Pressure Transducer Elevation (m)	98.745

Discharge Measurement Salt Dilution						
Date Monitored:	24-Jul-12				Pressure Transducer (m):	0.674
Time (24 hr):	Start	15:00	End	18:30	Amount of Salt injected:	7.943
Method	Salt Dilution				Mean Discharge Q (m^3/s):	2.30
Probe LB	YSI #15457		Ac LB	6.39813364	K (Cal. Constant) LB:	0.0018
Probe RB	YSI # 18061		Ac RB	6.36385616	K (Cal. Constant) RB:	0.0019
Type of Salt:	Windsor				Error (Std Dev in m^3/s)	0.10



General Notes

New PT location in canyon on RB wall. Installed this day. New site reference "BJL-H1a"

Appendix 2a-6. Manual Discharge Measurements and Levelling Surveys at BJL-H1 and BJL-H1a in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1a			
Stream Name	Brucejack Lake outflow			
Date Monitored	26-Sep-12			
Time at Site (24 hr)	Start Time:	9:00:00 AM	End Time:	11:00:00 AM
Personnel	E. Belland, B. Tait			
Station Coordinates	Easting	Northing	Elevation	
	425840	6258899	1350	
Weather Conditions	clear, cold, sunny			

Transducer Information			
PT Model	PS9800	Serial #	21121001
Gain		Offset	98.65
Status	Active	Battery	95%
# of Records	9179	Memory Free	252,560
Date Serviced	24-Jul-12	Crest Gauges	n/a

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 100	1.106	101.106		100.000	P
BM 102			1.270	99.836	
PT			1.050	100.056	top of angle iron
WL			1.978	**99.128**	
TBM	1.115	101.198	1.023	100.083	
WL			2.077	**99.121**	
PT			1.143	100.055	
BM 102			1.364	99.834	
BM 100			1.201	99.997	
BM#	Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes
BM 100	100.000	99.999		0.001	
BM 102	99.837	99.835		0.002	
					Unable to locate 101

Summary	
Stage (m)	99.125
Discharge (m^3/s)	0.49
Pressure Transducer Reading (m)	0.384
Pressure Transducer Elevation (m)	98.741

Discharge Measurement - Mid-Section Method										
Time (24 hr)	Start	930	End	1000	Location	15m US of falls at old (SRK) PT				
Method	Velocity-area (Mid-section)				Instrument Model	Flo-Mate				
Flow Meter Type	Electromagnetic sensor				Instrument Serial #	2007528				
Stage (m)	Start	Reading	0.384		Time	9:30				
	End	Reading			Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
RB	23.50	0.00	0.00	0.07	0			0.000	0.0
	23.00	0.27	0.50	0.21	-0.02			-0.004	-0.8
	22.00	0.43	1.00	0.43	0.03			0.013	2.6
	21.00	0.55	1.00	0.55	0.02			0.011	2.2
	20.00	0.49	1.00	0.49	0.01			0.005	1.0
	19.00	0.58	1.00	0.58	0.01			0.006	1.2
	18.00	0.55	1.00	0.55	0.01			0.005	1.1
	17.00	0.49	1.00	0.49	0.01			0.005	1.0
	16.00	0.61	1.00	0.61	0			0.000	0.0
	15.00	0.58	1.00	0.58	0.02			0.012	2.3
	14.00	0.67	1.00	0.67	0.06			0.040	8.1
	13.00	0.55	1.00	0.41	0.1			0.041	8.3
	12.50	0.58	0.50	0.29	0.07			0.020	4.1
	12.00	0.61	0.50	0.46	0.05			0.023	4.6
	11.00	0.61	1.00	0.46	0.07			0.032	6.5
	10.50	0.55	0.50	0.27	0.12			0.033	6.7
	10.00	0.49	0.50	0.37	0.16			0.059	11.8
	9.00	0.40	1.00	0.40	0.11			0.044	8.8
	8.00	0.40	1.00	0.40	0.11			0.044	8.8
	7.00	0.43	1.00	0.43	0.09			0.038	7.8
	6.00	0.52	1.00	0.52	0.09			0.047	9.4
	5.00	0.37	1.00	0.37	0.06			0.022	4.4
LB	4.00	0.00	1.00	0.18	0			0.000	0.0
Total Q								**0.494**	**100.0**

General Notes

Appendix 2a-6. Manual Discharge Measurements and Levelling Surveys at BJL-H1 and BJL-H1a in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H1a			
Stream Name	Brucejack Lake outflow			
Date Monitored	18-Oct-12			
Time at Site (24 hr)	**Start Time:**	9:40:00 AM	**End Time:**	11:00:00 AM
Personnel	E. Belland, B. Tait			
Station Coordinates	**Easting**	**Northing**	**Elevation**	
	425840	6258899	1350	
Weather Conditions	foggy			

Transducer Information			
PT Model	PS 9800	**Serial #**	21121001
Gain		**Offset**	98.65
Status	Active	**Battery**	99%
# of Records	15,000	**Memory Free**	249,394
Date Serviced	24-Jul-12	**Crest Gauges**	n/a

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM 100	0.834	100.834		100.000	
BM 102			0.998	99.836	
				100.834	
PT			2.066	98.768	hose clamp at bottom of PT
WL			1.703	**99.131**	
TBM	1.802	100.923	1.713	99.121	
WL			1.792	**99.131**	
PT			2.157	98.766	
BM 102			1.085	99.838	
BM 100			0.923	100.000	

BM#	**Elevation (m)**	**Mean Elevation (this date)**	**Difference (m)**	**Notes**
BM 100	100.000	100.000	0.000	
BM 102	99.837	99.837	0.000	
				Unable to locate 101

Summary	
Stage (m)	99.131
Discharge (m^3/s)	0.50
Pressure Transducer Reading (m)	0.365
Pressure Transducer Elevation (m)	98.766

Discharge Measurement - Mid-Section Method										
Time (24 hr)	**Start**	940	**End**	1000	**Location**	at PT in BJ canyon				
Method	Velocity-area (Mid-section)				**Instrument Model**	Flo-Mate				
Flow Meter Type	Electromagnetic sensor				**Instrument Serial #**	2007528				
Stage (m)	**Start**	**Reading**	0.365	**Time**	10:15					
	End	**Reading**		**Time**						

	Station	**Depth**	**Distance**	**Area**	**Velocity (m/s)**			**Q**	**% of Total Q**
Notes	**(m)**	**(m)**	**(m)**	**(m^2)**	**60%**	**20%**	**80%**	**(m3/s)**	**%**
LB	21.70	0.00	0.00	0.04	0			0.000	0.0
	22.20	0.16	0.50	0.06	0.01			0.001	0.1
	22.50	0.26	0.30	0.10	0.01			0.001	0.2
	23.00	0.32	0.50	0.13	0.06			0.008	1.5
	23.30	0.34	0.30	0.10	0.24			0.024	4.9
	23.60	0.34	0.30	0.10	0.37			0.038	7.5
	23.90	0.34	0.30	0.10	0.26			0.027	5.3
	24.20	0.34	0.30	0.10	0.33			0.034	6.7
	24.50	0.40	0.30	0.12	0.49			0.059	11.7
	24.80	0.40	0.30	0.12	0.4			0.048	9.6
	25.10	0.36	0.30	0.11	0.49			0.053	10.6
	25.40	0.32	0.30	0.10	0.44			0.042	8.4
	25.70	0.34	0.30	0.10	0.5			0.051	10.2
	26.00	0.32	0.30	0.10	0.52			0.050	10.0
	26.30	0.30	0.30	0.09	0.34			0.031	6.1
	26.60	0.30	0.30	0.09	0.24			0.022	4.3
	26.90	0.28	0.30	0.10	0.12			0.012	2.3
	27.30	0.30	0.40	0.09	0.02			0.002	0.4
	27.50	0.32	0.20	0.08	0.01			0.001	0.2
RB	27.80	0.00	0.30	0.05	0			0.000	0.0
Total Q								**0.501**	**100.0**

General Notes
Note accumulation of snow on RB of Brucejack Canyon.

Appendix 2b-1. Levelling Surveys at BJL-H2 in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H2			
Stream Name	Brucejack Lake			
Date Monitored	21-Jul-11			
Time at Site (24 hr)	**Start Time:**	2:40:00 PM	**End Time:**	4:00:00 PM
Personnel	M Soloducha, J Cristobal			
Station Coordinates	**Easting**	**Northing**	**Elevation**	
	427107	6258788		
Weather Conditions				

Transducer Information			
PT Model		**Serial #**	
Gain		**Offset**	
Status		**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
TBM 1	1.775	101.775		100.000	No BM tags onhand
TBM 2			0.391	101.384	TBM refers to tag not location
TBM 3			2.427	99.348	
WL			2.662	**99.113**	
TP	2.625	101.773	2.627	99.148	
WL			2.659	**99.114**	
TBM 3			2.424	99.349	
TBM 2			0.389	101.384	
TBM 1			1.772	100.001	

BM#	**Established Elevation (m)**	**Mean Elevation (this date) (m)**	**Difference (m)**	**Notes**
TBM 1		100.001		
TBM 2		101.384		
TBM 3		99.349		

Summary	
Stage (m)	99.114
Discharge (m^3/s)	n/a
Pressure Transducer Reading (m)	0.602
Pressure Transducer Elevation (m)	98.512

Appendix 2b-1. Levelling Surveys at BJL-H2 in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H2			
Stream Name	Brucejack Lake			
Date Monitored	23-Sep-11			
Time at Site (24 hr)	**Start Time:**	9:30:00 AM	**End Time:**	10:30:00 AM
Personnel	R Larson, Alex			
Station Coordinates	**Easting**	**Northing**	**Elevation**	
	427107	6258788		
Weather Conditions				

Transducer Information			
PT Model		**Serial #**	
Gain		**Offset**	
Status		**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM22 (TBM1)	1.171	101.171		100.000	
WL			2.337	**98.834**	
BM21 (TBM3)	1.911	101.255	1.827	99.344	
WL			2.426	**98.829**	
BM 022			1.258	99.997	

BM#	**Established Elevation (m)**	**Mean Elevation (this date) (m)**	**Difference (m)**	**Notes**
BM 22		99.999		
BM 21		99.344		

Summary	
Stage (m)	98.832
Discharge (m^3/s)	n/a
Pressure Transducer Reading (m)	0.320
Pressure Transducer Elevation (m)	98.512

Appendix 2b-2. Levelling Surveys at BJL-H2 in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H2			
Stream Name	Brucejack Lake			
Date Monitored	24-Jul-12			
Time at Site (24 hr)	**Start Time:**	1:05:00 PM	**End Time:**	
Personnel	E. Belland, T. Englesmeier			
Station Coordinates	**Easting**	**Northing**	**Elevation**	
	427107	6258788		
Weather Conditions	foggy			

Transducer Information			
PT Model		**Serial #**	
Gain		**Offset**	
Status		**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM 021	1.848	101.848		100.000	On top of boulder
Cond. Ring			1.099	100.749	Ring bolt attached to conduit
PT			1.974	99.874	Marked on PT stilling well; 2nd ring lower U bolt
WL			2.291	**99.557**	
TBM	2.206	101.900	2.154	99.694	
WL			2.341	**99.559**	
PT			2.023	99.877	
Cond. Ring			1.147	100.753	
BM 021			1.897	100.003	

BM#	**Established Elevation (m)**	**Mean Elevation (this date) (m)**	**Difference (m)**	**Notes**
BM 021		100.002		
Cond. Ring		100.751		

Summary	
Stage (m)	99.558
Discharge (m^3/s)	n/a
Pressure Transducer Reading (m)	0.394
Pressure Transducer Elevation (m)	99.164

Appendix 2b-2. Levelling Surveys at BJL-H2 in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	BJL-H2			
Stream Name	Brucejack Lake Level			
Date Monitored	18-Oct-12			
Time at Site (24 hr)	**Start Time:**	12:20:00 PM	**End Time:**	
Personnel	E. Belland, B. Tait			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
	427107	6258788		
Weather Conditions	Fair, dry, cold			

Transducer Information			
PT Model		**Serial #**	
Gain		**Offset**	
Status		**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM 021	0.775	100.775		100.000	
PT			0.899	99.876	PT BM on stilling well
WL			1.448	**99.327**	
TBM	1.608	100.783	1.600	99.175	
WL			1.456	**99.327**	
PT			0.905	99.878	
BM 021			0.783	100.000	

BM#	**Established Elevation (m)**	**Mean Elevation (this date) (m)**	**Difference (m)**	**Notes**
BM 021		100.000		

Summary	
Stage (m)	99.327
Discharge (m^3/s)	n/a
Pressure Transducer Reading (m)	0.187
Pressure Transducer Elevation (m)	99.140

Appendix 2c-1. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2009

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	11-Oct-09			
Time at Site (24 hr)	Start Time:	3:50:00 PM	End Time:	5:00:00 PM
Personnel	X. Pinto, Dan Jarrat			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM100	0.626	100.626		100.000	
BM99			0.748	99.878	
BM98			0.495	100.131	
1m Staff gauge			1.000	99.626	
WL			1.574	99.052	
BM99	0.665	100.543		99.878	
BM100			0.543	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM100		100.000		
BM99		99.878		
BM98		100.131		

Summary	
Stage (m)	99.052
Discharge (m^3/s)	1.420
Pressure Transducer Reading (m)	0.350
Pressure Transducer Elevation (m)	98.702

Discharge Measurement #1 - Mid-Section Method										
Time (24 hr)	Start	15:50	End	16:30	Location	10m downstream of station				
Method	Velocity-area (Mid-section)			Propeller Size		3"				
Flow Meter Type	Swoffer			Calibration Constant		426, 609				
Stage (m)	Start	Reading	0.350	Time	15:50					
	End	Reading		Time						

	Station	Distance	Depth	Area	Velocity	Correct.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	Factor	(m/s)	(m3/s)	%
LB	3.30	0.00	0.00	0.00	0	0.5	0.00	0.001	0.1
	3.70	0.40	0.09	0.04	0.21		0.30	0.011	0.8
	4.10	0.40	0.20	0.08	0.47		0.67	0.054	3.8
	4.50	0.40	0.33	0.12	0.46		0.66	0.076	5.3
	4.80	0.30	0.39	0.10	0.58		0.83	0.081	5.7
	5.00	0.20	0.36	0.07	0.57		0.81	0.059	4.1
	5.20	0.20	0.38	0.08	0.55		0.79	0.060	4.2
	5.40	0.20	0.39	0.08	0.62		0.89	0.069	4.9
	5.60	0.20	0.38	0.08	0.6		0.86	0.065	4.6
	5.80	0.20	0.39	0.08	0.61		0.87	0.068	4.8
rock upstream	6.00	0.20	0.23	0.05	0.67		0.96	0.044	3.1
	6.20	0.20	0.35	0.07	0.64		0.91	0.064	4.5
	6.40	0.20	0.28	0.06	0.6		0.86	0.048	3.4
	6.60	0.20	0.36	0.07	0.55		0.79	0.057	4.0
	6.80	0.20	0.37	0.07	0.59		0.84	0.062	4.4
	7.00	0.20	0.36	0.07	0.49		0.70	0.050	3.6
	7.20	0.20	0.38	0.08	0.51		0.73	0.055	3.9
	7.40	0.20	0.38	0.08	0.44		0.63	0.048	3.4
	7.60	0.20	0.33	0.07	0.39		0.56	0.037	2.6
	7.80	0.20	0.31	0.12	0.42		0.60	0.074	5.2
RB	8.40	0.60	0.25	0.13	0.42		0.60	0.075	5.3
	8.80	0.40	0.19	0.08	0.5		0.71	0.054	3.8
	9.20	0.40	0.3	0.10	0.36		0.51	0.054	3.8
	9.60	0.40	0.2	0.07	0.51		0.73	0.052	3.7
	10.00	0.40	0.1	0.06	0.39		0.56	0.031	2.2
	10.40	0.40	0.2	0.07	0.42		0.60	0.043	3.0
	10.80	0.40	0.2	0.06	0.29		0.41	0.027	1.9
	11.20	0.40	0.2	0.06	0.07		0.10	0.006	0.5
	11.60	0.40	0.1	0.06	0.25		0.36	0.020	1.4
	12.00	0.40	0.1	0.03	0	0.10	0.00	0.001	0.1
Total Q								1.420	100.0

General Notes
Use average of 2 measurements. Top nut in prop missing

Appendix 2c-1. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2009

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	11-Oct-09			
Time at Site (24 hr)	Start Time:	3:50:00 PM	End Time:	5:00:00 PM
Personnel	X. Pinto, Dan Jarrat			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM100	0.626	100.626		100.000	
BM99			0.748	99.878	
BM98			0.495	100.131	
1m Staff gauge			1.000	99.626	
WL			1.574	99.052	
BM99	0.665	100.543		99.878	
BM100			0.543	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM100		100.000		
BM99		99.878		
BM98		100.131		

Summary	
Stage (m)	99.052
Discharge (m^3/s)	1.390
Pressure Transducer Reading (m)	0.350
Pressure Transducer Elevation (m)	98.702

Discharge Measurement #2 - Mid-Section Method										
Time (24 hr)	Start	15:50	End	16:30	Location	10m downstream of station				
Method	Velocity-area (Mid-section)			Propeller Size		3"				
Flow Meter Type	Swoffer			Calibration Constant		426, 609				
Stage (m)	Start	Reading	0.350	Time	15:50					
	End	Reading		Time						

	Station	Distance	Depth	Area	Velocity	Correct.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	Factor	(m/s)	(m3/s)	%
LB	12.00	0.00	0.00	0.00	0	0.1	0.00	0.000	0.0
	11.40	0.60	0.00	0.00	0		0.00	0.000	0.0
	11.00	0.40	0.12	0.05	0.31		0.44	0.021	1.5
	10.60	0.40	0.14	0.06	0.04		0.06	0.003	0.2
	10.20	0.40	0.15	0.06	0.43		0.61	0.037	2.7
	9.80	0.40	0.18	0.07	0.33		0.47	0.034	2.4
	9.40	0.40	0.25	0.10	0.23		0.33	0.033	2.4
	9.00	0.40	0.20	0.08	0.37		0.53	0.042	3.0
	8.60	0.40	0.26	0.10	0.32		0.46	0.048	3.4
	8.20	0.40	0.23	0.09	0.47		0.67	0.062	4.4
rock upstream	7.80	0.40	0.22	0.09	0.43		0.61	0.054	3.9
	7.40	0.40	0.31	0.12	0.45		0.64	0.080	5.7
	7.00	0.40	0.38	0.15	0.58		0.83	0.126	9.1
	6.60	0.40	0.36	0.14	0.57		0.81	0.117	8.4
	6.20	0.40	0.36	0.14	0.54		0.77	0.111	8.0
	5.80	0.40	0.38	0.15	0.61		0.87	0.133	9.5
	5.40	0.40	0.36	0.14	0.61		0.87	0.126	9.0
	5.00	0.40	0.37	0.15	0.56		0.80	0.118	8.5
	4.60	0.40	0.34	0.14	0.57		0.81	0.111	8.0
	4.20	0.40	0.28	0.11	0.52		0.74	0.083	6.0
RB	3.80	0.40	0.19	0.09	0.33		0.47	0.040	2.9
	3.30	0.50	0.16	0.04	0	0.50	0.00	0.010	0.7
Total Q								1.390	100.0

General Notes
Use average of 2 measurements. Top nut in prop missing

Appendix 2c-1. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2009

Date: 12/14/2009

Time: **11:36**

Location: **right at the station**

Instrument: **Flowtracker**

Calibration 3" prop **n/a** **Calibration on indicator** **n/a**

Personnel: **Xavier Pinto-Flowtracker; Shane Spencer-Notes**

Total Q (m^3/s) 0.4814

Error (flowtracke +/- 6.9% → 0.0332166 m^3/s

0.4814 6.9

Note: survey was not satisfactory. Closing error ~ 7 cm, also WS was not surveyed. Refer to survey when station was installed for PT offset

Appendix 2c-2. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott-Hydro			
Stream Name	Scott Creek			
Date Monitored	3-Jul-10			
Time at Site (24 hr)	Start Time:	10:30:00 AM	End Time:	12:00:00 PM
Personnel	X. Pinto, M. Soloducha			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 99	0.702	100.702		100.000	
BM 100			0.575	100.127	
WL			1.356	99.346	
BM 98			0.447	100.255	
BM 98	0.518	100.773			
BM 99			0.773	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 99		100.000		
BM 100		100.127		
BM 98		100.128		

Summary	
Stage (m)	99.346
Discharge (m^3/s)	3.213
Pressure Transducer Reading (m)	0.136
Pressure Transducer Elevation (m)	99.210

Discharge Measurement #1 - Mid-Section Method										
Time (24 hr)	Start	10:30	End	10:50	Location					
Method	Velocity-area (Mid-section)			Propeler Size	2"					
Flow Meter Type	Swoffer			Calibration Constant	613					
Stage (m)	Start	Reading	0.136	Time	10:10					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Right Bank	3.45	0.00	0.00	0.00	0			0.000	0.0
CF	3.80	0.04	0.35	0.03	0.09			0.002	0.1
0.2	4.50	0.09	0.70	0.09	0.07			0.004	0.1
	5.20	0.20	0.70	0.21	0.05			0.007	0.2
	5.90	0.19	0.70	0.20	0.62			0.082	2.6
	6.60	0.28	0.70	0.29	0.97			0.190	5.9
	7.30	0.34	0.70	0.36	1.26			0.300	9.3
	8.00	0.42	0.70	0.44	0.98			0.288	9.0
	8.70	0.40	0.70	0.42	1			0.280	8.7
	9.40	0.45	0.70	0.47	0.73			0.230	7.2
	10.10	0.37	0.70	0.39	1.14			0.295	9.2
	10.80	0.32	0.70	0.34	0.7			0.157	4.9
	11.50	0.43	0.70	0.45	0.76			0.229	7.1
	12.20	0.22	0.70	0.23	0.79			0.122	3.8
	12.90	0.17	0.70	0.18	0.42			0.050	1.6
	13.60	0.17	0.70	0.18	0.5			0.060	1.9
	14.30	0.16	0.70	0.17	0.78			0.087	2.7
	15.00	0.16	0.70	0.17	0.8			0.090	2.8
	15.70	0.25	0.70	0.26	0.67			0.117	3.6
	16.40	0.33	0.70	0.35	0.75			0.173	5.4
	17.10	0.20	0.70	0.21	1.34			0.188	5.8
CF	17.80	0.37	0.70	0.36	1			0.231	7.2
0.15	18.35	0.07	0.55	0.05	0.3			0.031	0.9
Left Bank	18.70	0.00	0.35	0.00	0			0.001	0.0
Total Q								3.213	100.0

General Notes
Use average of 2 measurements

Appendix 2c-2. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott-Hydro			
Stream Name	Scott Creek			
Date Monitored	3-Jul-10			
Time at Site (24 hr)	Start Time:	10:30:00 AM	End Time:	12:00:00 PM
Personnel	X. Pinto, M. Soloducha			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 99	0.702	100.702		100.000	
BM 100			0.575	100.127	
WL			1.356	99.346	
BM 98			0.447	100.255	
BM 98	0.518	100.773			
BM 99			0.773	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 99		100.000		
BM 100		100.127		
BM 98		100.128		

Summary	
Stage (m)	99.346
Discharge (m^3/s)	2.989
Pressure Transducer Reading (m)	0.136
Pressure Transducer Elevation (m)	99.210

Discharge Measurement #2 - Mid-Section Method									
Time (24 hr)	Start	10:50	End	11:10	Location				
Method	Velocity-area (Mid-section)			Propeler Size		2"			
Flow Meter Type	Swoffer			Calibration Constant		613			
Stage (m)	Start	Reading	0.136	Time	10:10				
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	18.70	0.00	0.00	0.00	0			0.001	0.0
CF	18.20	0.05	0.50	0.04	0.32			0.010	0.3
0.15	17.50	0.36	0.70	0.38	1.03			0.260	8.7
	16.80	0.33	0.70	0.35	1.1			0.254	8.5
	16.10	0.28	0.70	0.29	0.32			0.063	2.1
	15.40	0.18	0.70	0.19	0.69			0.087	2.9
	14.70	0.17	0.70	0.18	0.53			0.063	2.1
	14.00	0.22	0.70	0.23	0.71			0.109	3.7
	13.30	0.25	0.70	0.26	0.7			0.123	4.1
	12.60	0.19	0.70	0.20	0.79			0.105	3.5
	11.90	0.14	0.70	0.15	0.85			0.083	2.8
	11.20	0.31	0.70	0.33	0.77			0.167	5.6
	10.50	0.43	0.70	0.45	0.87			0.262	8.8
	9.80	0.40	0.70	0.42	0.94			0.263	8.8
	9.10	0.47	0.70	0.49	0.75			0.247	8.3
	8.40	0.36	0.70	0.38	0.5			0.126	4.2
	7.70	0.47	0.70	0.49	1			0.329	11.0
	7.00	0.40	0.70	0.42	0.75			0.210	7.0
	6.30	0.28	0.70	0.29	0.62			0.122	4.1
	5.60	0.20	0.70	0.21	0.6			0.084	2.8
	4.90	0.12	0.70	0.13	0.16			0.013	0.4
CF	4.20	0.08	0.70	0.07	0.2			0.009	0.3
0.2	3.75	0.02	0.45	0.01	0.005			0.000	0.0
Right Bank	3.45	0.00	0.30	0.00	0			0.000	0.0
Total Q								2.989	100.0

General Notes
Use average of 2 measurements

Appendix 2c-2. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	3-Jul-10			
Time at Site (24 hr)	Start Time:	14:31	End Time:	16:00
Personnel	X. Pinto, Stephanie Boha			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 99	0.702	100.702		100.000	
BM 100			0.575	100.127	
WL			1.356	99.346	
BM 98			0.447	100.255	
BM 98	0.518	100.773			
BM 99			0.773	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes
BM 99		100.000		
BM 98		100.255		
BM 100		100.127		

Summary	
Stage (m)	100.127
Discharge (m^3/s)	3.132
Pressure Transducer Reading (m)	0.518
Pressure Transducer Elevation (m)	99.609

Discharge Measurement Salt Dilution						
Date Monitored:	3-Jul-10				Pressure Transducer (m):	0.518
Time (24 hr):	Start	11:15	End	12:00	Amount of Salt injected:	20
Method	Salt Dilution				Mean Discharge Q (m^3/s):	3.13
Probe LB		600336	Ac LB		K (Cal. Constant) LB:	0.002
Probe RB		115562	Ac RB		K (Cal. Constant) RB:	0.002
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	

Probe RB: S/N ...			
M =	10	kg	Mass of salt injected
M =	10000000	mg	
Δτ =	2	s	Time interval
Ac =	6.466295765	mS.s/cm	Area under curve
K1 =	0.00193	(mS L)/(cm mg)	Calibration constant
Q =	2984.7	L/s	Discharge
Q =	**2.98**	m3/s	
RD =	3.4	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N ...	600336		
M =	10	kg	Mass of salt injected
M =	10000000	mg	
Δτ =	2	s	Time interval
Ac =	6.097277128	mS.s/cm	Area under curve
K1 =	0.002	(mS L)/(cm mg)	Calibration constant
Q =	3280.2	L/s	Discharge
Q =	**3.28**	m3/s	
RD =	3.0	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2c-2. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	13-Aug-10			
Time at Site (24 hr)	**Start Time:**	14:31	**End Time:**	16:00
Personnel	X. Pinto, Stephanie Boha			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM 99	0.930	100.930		100.000	
WL			1.363	99.567	
BM 98			0.678	100.252	
BM 100			0.804	100.126	
	0.742	100.868			
BM 99			0.867	100.001	

BM#	**Established Elevation (m)**	**Mean Elevation (this date) (m)**	**Difference (m)**	**Notes**
BM 99		100.001		
BM 100		100.126		
BM 98		100.252		

Summary	
Stage (m)	99.567
Discharge (m^3/s)	10.668
Pressure Transducer Reading (m)	0.740
Pressure Transducer Elevation (m)	98.827

Discharge Measurement Salt Dilution						
Date Monitored:	13-Aug-10				**Pressure Transducer (m):**	0.740
Time (24 hr):	**Start**	11:15	**End**	**12:00**	**Amount of Salt injected:**	22.406
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	10.67
Probe LB			**Ac LB**		**K (Cal. Constant) LB:**	0.002
Probe RB			**Ac RB**		**K (Cal. Constant) RB:**	0.002
Type of Salt:	Windsor				**Error (Std Dev in m^3/s)**	

Probe RB: S/N ...

M =	11.203	kg	Mass of salt injected
M =	11203000	mg	
Δτ =	2	s	Time interval
Ac =	2.161946387	mS.s/cm	Area under curve
K1 =	0.00211749	(mS L)/(cm mg)	Calibration constant
Q =	10972.6	L/s	Discharge
Q =	**10.97**	m3/s	
RD =	1.0	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N ... 600336

M =	11.203	kg	Mass of salt injected
M =	11203000	mg	
Δτ =	2	s	Time interval
Ac =	2.256174536	mS.s/cm	Area under curve
K1 =	0.002087202	(mS L)/(cm mg)	Calibration constant
Q =	10364.0	L/s	Discharge
Q =	**10.36**	m3/s	
RD =	1.1	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2c-2. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	31-Aug-10			
Time at Site (24 hr)	Start Time:	14:31	End Time:	16:00
Personnel	X. Pinto, Stephanie Boha			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 99	0.930	100.930		100.000	
WL			1.363	99.567	
BM 98			0.678	100.252	
BM 100			0.804	100.126	
	0.742	100.868			
BM 99			0.867	100.001	

BM#	Established Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes
BM 99		100.001		
BM 100		100.126		
BM 98		100.252		

Summary	
Stage (m)	99.567
Discharge (m^3/s)	4.645
Pressure Transducer Reading (m)	0.740
Pressure Transducer Elevation (m)	98.827

Discharge Measurement Salt Dilution						
Date Monitored:	31-Aug-10				Pressure Transducer (m):	0.740
Time (24 hr):	Start	11:15	End	12:00	Amount of Salt injected:	40.348
Method	Salt Dilution				Mean Discharge Q (m^3/s):	4.65
Probe LB			Ac LB		K (Cal. Constant) LB:	0.002
Probe RB			Ac RB		K (Cal. Constant) RB:	0.002
Type of Salt:	Windsor				Error (Std Dev in m^3/s)	

Probe RB: S/N ...

M =	20.174	kg	Mass of salt injected
M =	20174000	mg	
Δτ =	2	s	Time interval
Ac =	2.161946387	mS.s/cm	Area under curve
K1 =	0.00211749	(mS L)/(cm mg)	Calibration constant
Q =	4230.0	L/s	Discharge
Q =	**4.23**	m3/s	
RD =	4.8	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N ...

M =	20.174	kg	Mass of salt injected
M =	20174000	mg	
Δτ =	2	s	Time interval
Ac =		mS.s/cm	Area under curve
K1 =		(mS L)/(cm mg)	Calibration constant
Q =	5060.0	L/s	Discharge
Q =	**5.06**	m3/s	
RD =	4.0	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2c-2. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott-Hydro			
Stream Name	Scott Creek			
Date Monitored	25-Sep-10			
Time at Site (24 hr)	Start Time:	9:50:00 AM	End Time:	11:30:00 AM
Personnel	M. Soloducha, M. Jenkins			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 99	0.994	100.994		100.000	
BM 100			0.871	100.123	
BM 98			0.741	100.253	
CG RB			1.234	99.760	
WL			2.168	98.826	**(+0.358)**
WL	2.120	100.946			
CG RB			1.187	99.759	
BM 99			0.948	99.998	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 99		99.999		
BM 100		100.123		
BM 98		100.253		

Summary	
Stage (m)	99.184
Discharge (m^3/s)	2.100
Pressure Transducer Reading (m)	0.521
Pressure Transducer Elevation (m)	98.663

Discharge Measurement #1 - Mid-Section Method									
Time (24 hr)	Start	10:10	End	10:30	Location				
Method	Velocity-area (Mid-section)			Instrument Model	FM 2000				
Flow Meter Type	Flo-Mate			Instrument Serial #					
Stage (m)	Start	Reading	0.136	Time	10:10				
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	1.35	0.00	0.00	0.00	0			0.000	0.0
CF	1.40	0.03	0.05	0.01	0.02			0.000	0.0
0	1.80	0.02	0.40	0.01	0.06			0.000	0.0
	2.20	0.16	0.40	0.10	0.3			0.019	0.9
	2.60	0.24	0.40	0.14	0.45			0.043	2.1
	3.00	0.33	0.40	0.20	0.66			0.087	4.1
	3.40	0.37	0.40	0.22	0.67			0.099	4.7
	3.80	0.39	0.40	0.23	0.77			0.120	5.7
	4.20	0.37	0.40	0.22	0.77			0.114	5.4
	4.60	0.39	0.40	0.23	0.96			0.150	7.1
	5.00	0.43	0.40	0.26	0.81			0.139	6.6
	5.40	0.49	0.40	0.29	0.97			0.190	9.1
	5.80	0.50	0.40	0.30	0.93			0.186	8.9
	6.20	0.46	0.40	0.28	1.06			0.195	9.3
	6.60	0.41	0.40	0.25	0.93			0.153	7.3
	7.00	0.38	0.40	0.23	0.88			0.134	6.4
	7.40	0.40	0.40	0.24	0.8			0.128	6.1
	7.80	0.40	0.40	0.24	0.65			0.104	5.0
	8.20	0.38	0.40	0.23	0.7			0.106	5.1
CF	8.60	0.34	0.40	0.20	0.64			0.087	4.1
0.5	9.00	0.18	0.40	0.11	0.62			0.045	2.1
Right Bank	9.40	0.00	0.40	0.00	0			0.000	0.0
Total Q								**2.100**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2c-2. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott-Hydro			
Stream Name	Scott Creek			
Date Monitored	25-Sep-10			
Time at Site (24 hr)	**Start Time:**	9:50:00 AM	**End Time:**	11:30:00 AM
Personnel	M. Soloducha, M. Jenkins			
Station Coordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM 99	0.994	100.994		100.000	
BM 100			0.871	100.123	
BM 98			0.741	100.253	
CG RB			1.234	99.760	
WL			2.168	98.826	**(+0.358)**
WL	2.120	100.946			
CG RB			1.187	99.759	
BM 99			0.948	99.998	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 99		99.999		
BM 100		100.123		
BM 98		100.253		

Summary	
Stage (m)	99.184
Discharge (m^3/s)	2.049
Pressure Transducer Reading (m)	0.521
Pressure Transducer Elevation (m)	98.663

Discharge Measurement #2 - Mid-Section Method									
Time (24 hr)	**Start**	10:30	**End**	10:50	**Location**				
Method	Velocity-area (Mid-section)			**Instrument Model**	FM 2000				
Flow Meter Type	Flo-Mate			**Instrument Serial #**					
Stage (m)	**Start**	**Reading**	0.136	**Time**	10:10				
	End	**Reading**		**Time**					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Right Bank	9.40	0.00	0.00	0.00	0			0.000	0.0
CF	9.20	0.08	0.20	0.03	0.1			0.002	0.1
0.5	8.80	0.22	0.40	0.13	0.6			0.053	2.6
	8.40	0.39	0.40	0.23	0.69			0.108	5.3
	8.00	0.39	0.40	0.23	0.74			0.115	5.6
	7.60	0.43	0.40	0.26	0.63			0.108	5.3
	7.20	0.38	0.40	0.23	0.73			0.111	5.4
	6.80	0.42	0.40	0.25	0.97			0.163	8.0
	6.40	0.45	0.40	0.27	1.12			0.202	9.8
	6.00	0.52	0.40	0.31	0.84			0.175	8.5
	5.60	0.45	0.40	0.27	1.1			0.198	9.7
	5.20	0.45	0.40	0.27	0.75			0.135	6.6
	4.80	0.37	0.40	0.22	0.94			0.139	6.8
	4.40	0.39	0.40	0.23	0.78			0.122	5.9
	4.00	0.39	0.40	0.23	0.79			0.123	6.0
	3.60	0.39	0.40	0.23	0.8			0.125	6.1
	3.20	0.28	0.40	0.17	0.73			0.082	4.0
	2.80	0.25	0.40	0.15	0.51			0.051	2.5
	2.40	0.20	0.40	0.12	0.37			0.030	1.4
CF	2.00	0.14	0.40	0.08	0.11			0.006	0.3
0	1.60	0.06	0.40	0.03	0.07			0.001	0.1
Left Bank	1.35	0.00	0.25	0.00	0			0.000	0.0
Total Q								**2.049**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2c-3. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott-Hydro			
Stream Name	Scott Creek			
Date Monitored	19-Mar-11			
Time at Site (24 hr)	Start Time:	10:10:00 AM	End Time:	10:30:00 AM
Personnel	M Soloducha, K Johnson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 99	0.282	100.282		100.000	
BM 100			0.139	100.143	
BM 98			0.004	100.278	
WL			1.404	98.878	
TP 1	0.868	100.398	0.752	**99.530**	
WL			1.519	98.879	
BM 98			0.122	**100.276**	
BM 100			0.254	100.144	
BM 99			0.398	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 99	100	100.000		
BM 100	100.144	100.144		
BM 98	100.277	100.277		

Summary	
Stage (m)	98.879
Discharge (m^3/s)	0.246
Pressure Transducer Reading (m)	0.136
Pressure Transducer Elevation (m)	98.743

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	10:10	End	10:45	Location				
Method	Velocity-area (Mid-section)			Instrument Model		FM 2000			
Flow Meter Type	Marsh Mcbirney Flo-mate			Instrument Serial #					
Stage (m)	Start	Reading	0.136	Time	10:10				
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Right Bank	0.80	0.00	0.00	0.03	0			0.001	0.5
	1.20	0.14	0.40	0.06	0.19			0.011	4.3
	1.60	0.17	0.40	0.07	0.29			0.020	8.0
	2.00	0.15	0.40	0.06	0.29			0.017	7.1
	2.40	0.17	0.40	0.07	0.13			0.009	3.6
	2.80	0.21	0.40	0.08	0.29			0.024	9.9
	3.20	0.22	0.40	0.09	0.39			0.034	14.0
	3.60	0.22	0.40	0.09	0.37			0.033	13.2
	4.00	0.22	0.40	0.09	0.34			0.030	12.2
	4.40	0.23	0.40	0.09	0.39			0.036	14.6
	4.80	0.13	0.40	0.05	0.27			0.014	5.7
	5.20	0.10	0.40	0.04	0.23			0.009	3.7
	5.60	0.15	0.40	0.05	0.03			0.001	0.5
	5.80	0.12	0.20	0.02	0.15			0.004	1.5
	6.00	0.11	0.20	0.03	0.09			0.003	1.2
	6.40	0.08	0.40	0.03	-0.01			0.000	-0.1
Left Bank	6.80	0.00	0.40	0.02	0			0.000	0.0
Total Q								**0.246**	**100.0**

General Notes

Appendix 2c-3. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott-Hydro			
Stream Name	Scott Creek			
Date Monitored	8-May-11			
Time at Site (24 hr)	Start Time:	9:45:00 AM	End Time:	10:15:00 AM
Personnel	M Soloducha, B Simpson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 99	0.879	100.879		100.000	
BM 100			0.753	100.126	
BM 98			0.616	100.263	
WL			1.593	99.286	
TP 1	1.455	100.782	1.552	**99.327**	
WL			1.497	99.285	
BM 98			0.519	**100.263**	
BM 100			0.656	100.126	
BM 99			0.783	99.999	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 99	100	100.000	-0.001	
BM 100	100.144	100.126	-0.018	
BM 98	100.277	100.263	-0.014	

Summary	
Stage (m)	99.286
Discharge (m^3/s)	3.591
Pressure Transducer Reading (m)	0.468
Pressure Transducer Elevation (m)	98.818

Discharge Measurement - Mid-Section Method							
Time (24 hr)	Start	9:45	End	10:15	Location		
Method	Velocity-area (Mid-section)			Instrument Model		FM 2000	
Flow Meter Type	Marsh Mcbirney Flo-mate			Instrument Serial #			
Stage (m)	Start	Reading	0.468	Time	9:45		
	End	Reading		Time			

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Right Bank	12.10	0.00	0.00	0.04	0	0	0.00	0.000	0.0
	11.70	0.22	0.40	0.09	1.42	1.41	0.99	0.087	2.4
	11.30	0.40	0.40	0.16	1.35	1.34	0.94	0.151	4.2
	10.90	0.53	0.40	0.21	1.2	1.19	0.84	0.178	4.9
	10.50	0.48	0.40	0.19	1.74	1.73	1.22	0.233	6.5
	10.10	0.47	0.40	0.19	1.62	1.61	1.13	0.213	5.9
	9.70	0.48	0.40	0.19	1.96	1.95	1.37	0.263	7.3
	9.30	0.47	0.40	0.19	2.01	2.00	1.40	0.264	7.3
	8.90	0.49	0.40	0.20	2.03	2.02	1.42	0.278	7.7
	8.50	0.52	0.40	0.21	2.01	2.00	1.40	0.292	8.1
	8.10	0.48	0.40	0.19	1.83	1.82	1.28	0.245	6.8
	7.70	0.44	0.40	0.18	1.93	1.92	1.35	0.237	6.6
	7.30	0.38	0.40	0.15	1.76	1.75	1.23	0.187	5.2
	6.90	0.40	0.40	0.16	1.64	1.63	1.15	0.183	5.1
	6.50	0.40	0.40	0.16	1.65	1.64	1.15	0.184	5.1
	6.10	0.37	0.40	0.15	1.59	1.58	1.11	0.164	4.6
	5.70	0.37	0.40	0.15	1.39	1.38	0.97	0.144	4.0
	5.30	0.35	0.40	0.14	0.97	0.96	0.68	0.095	2.6
	4.90	0.26	0.40	0.10	0.83	0.82	0.58	0.060	1.7
	4.50	0.31	0.40	0.12	0.73	0.72	0.51	0.063	1.8
	4.10	0.20	0.40	0.08	0.58	0.58	0.41	0.032	0.9
	3.70	0.17	0.40	0.07	0.52	0.52	0.36	0.025	0.7
	3.30	0.10	0.40	0.04	0.43	0.43	0.30	0.012	0.3
Left Bank	2.90	0.00	0.40	0.00	0	0.00	0.00	0.000	0.0
Total Q								**3.591**	**100.0**

General Notes
QA/QC: Velocity was corrected to adjust for a 2" prop. with a 3" cal. Constant

Appendix 2c-3. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott-Hydro			
Stream Name	Scott Creek			
Date Monitored	14-May-11			
Time at Site (24 hr)	Start Time:	11:45:00 AM	End Time:	12:10:00 PM
Personnel	M Soloducha, I Blackburn			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 99	0.894	100.894		100.000	
BM 100			0.769	100.125	
BM 98			0.633	100.261	
WL			1.602	99.292	
TP 1	1.566	100.911	1.549	**99.345**	
WL			1.618	99.293	
BM 98			0.651	**100.260**	
BM 100			0.787	100.124	
BM 99			0.911	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 99	100	100.000	0.000	
BM 100	100.144	100.125	-0.020	
BM 98	100.277	100.261	-0.016	

Summary	
Stage (m)	99.293
Discharge (m^3/s)	3.586
Pressure Transducer Reading (m)	0.475
Pressure Transducer Elevation (m)	98.818

Discharge Measurement - Mid-Section Method							
Time (24 hr)	Start	11:45	End	12:10	Location		
Method	Velocity-area (Mid-section)			Instrument Model		FM 2000	
Flow Meter Type	Marsh Mcbirney Flo-mate			Instrument Serial #			
Stage (m)	Start	Reading	0.475	Time	11:45		
	End	Reading		Time			

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	6.00	0.00	0.00	0.01	0	0	0.00	0.000	0.0
	6.40	0.06	0.40	0.02	0.12	0.12	0.08	0.002	0.1
	6.80	0.15	0.40	0.06	0.17	0.17	0.12	0.007	0.2
	7.20	0.16	0.40	0.06	0.9	0.89	0.63	0.040	1.1
	7.60	0.25	0.40	0.10	1.11	1.10	0.78	0.078	2.2
	8.00	0.28	0.40	0.11	0.97	0.96	0.68	0.076	2.1
	8.40	0.27	0.40	0.11	1.41	1.39	0.98	0.106	3.0
	8.80	0.30	0.40	0.12	1.41	1.39	0.98	0.118	3.3
	9.20	0.29	0.40	0.12	1.88	1.86	1.31	0.152	4.2
	9.60	0.41	0.40	0.16	1.45	1.43	1.01	0.166	4.6
	10.00	0.42	0.40	0.17	1.86	1.84	1.30	0.218	6.1
	10.40	0.34	0.40	0.14	1.6	1.58	1.12	0.152	4.2
	10.80	0.37	0.40	0.15	1.71	1.69	1.19	0.177	4.9
	11.20	0.41	0.40	0.16	1.85	1.83	1.29	0.212	5.9
	11.60	0.46	0.40	0.18	2.11	2.09	1.47	0.271	7.6
	12.00	0.52	0.40	0.21	2.03	2.01	1.42	0.295	8.2
	12.40	0.48	0.40	0.19	2.08	2.06	1.45	0.279	7.8
	12.80	0.52	0.40	0.21	1.96	1.94	1.37	0.285	7.9
	13.20	0.54	0.40	0.22	1.28	1.26	0.89	0.193	5.4
	13.60	0.52	0.40	0.21	1.77	1.75	1.24	0.257	7.2
	14.00	0.50	0.40	0.20	1.54	1.52	1.08	0.215	6.0
	14.40	0.40	0.40	0.16	1.68	1.66	1.17	0.188	5.2
	14.80	0.24	0.40	0.10	1.08	1.07	0.75	0.081	2.3
	15.20	0.15	0.40	0.04	0.68	0.67	0.47	0.018	0.5
Right Bank	15.30	0.00	0.50	0.00	0	0.00	0.00	0.000	0.0
Total Q								**3.586**	**100.0**

General Notes
QA/QC: Velocity was corrected to adjust for a 2" prop. with a 3" cal. Constant

Appendix 2c-3. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	20-Jul-11			
Time at Site (24 hr)	Start Time:	11:15	End Time:	12:10
Personnel	M. Soloducha, J. Cristobal			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 099	0.935	100.935		100.000	
BM 0100			0.814	100.121	
Bm 098			0.674	100.261	
WL			1.499	99.436	
TBM	0.879	100.928	0.886	**100.049**	
WL			1.494	99.434	
BM 098			0.668	**100.260**	
BM 100			0.807	100.121	
BM 099			0.928	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes
BM 099	100	100.000	0.000	
BM 0100	100.144	100.121	0.023	
Bm 098	100.277	100.261	0.016	

Summary	
Stage (m)	99.435
Discharge (m^3/s)	7.473
Pressure Transducer Reading (m)	0.629
Pressure Transducer Elevation (m)	98.806

Discharge Measurement Salt Dilution						
Date Monitored:	20-Jul-11				Pressure Transducer (m):	0.629
Time (24 hr):	Start	11:15	End	12:00	Amount of Salt injected:	20.162
Method	Salt Dilution				Mean Discharge Q (m^3/s):	7.473272019
Probe LB		600336	Ac LB		K (Cal. Constant) LB:	0.002
Probe RB		115562	Ac RB		K (Cal. Constant) RB:	0.002
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	6.7

Probe RB: S/N ...	115562		
M =	20.162	kg	Mass of salt injected
M =	20162000	mg	
Δτ =	2	s	Time interval
Ac =	5.353145455	mS.s/cm	Area under curve
K1 =	0.001917983	(mS L)/(cm mg)	Calibration constant
Q =	7223.9	L/s	Discharge
Q =	**7.22**	m3/s	
RD =	2.8	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N ...	600336		
M =	20.162	kg	Mass of salt injected
M =	20162000	mg	
Δτ =	2	s	Time interval
Ac =	5.133682867	mS.s/cm	Area under curve
K1 =	0.001966363	(mS L)/(cm mg)	Calibration constant
Q =	7722.7	L/s	Discharge
Q =	**7.72**	m3/s	
RD =	2.6	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2c-3. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott-Hydro			
Stream Name	Scott Creek			
Date Monitored	23-Sep-11			
Time at Site (24 hr)	Start Time:	2:20:00 PM	End Time:	4:00:00 PM
Personnel	R. Larson, Alex			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 083	1.460	101.460		100.000	
WL			2.295	**99.165**	
BM 084	1.429	101.279	1.610	99.850	
WL			2.123	**99.156**	
BM 083			1.280	99.999	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 083	100	100.000	-0.001	

Summary	
Stage (m)	99.161
Discharge (m^3/s)	1.507
Pressure Transducer Reading (m)	1.526
Pressure Transducer Elevation (m)	97.635

Discharge Measurement - Mid-Section Method

Time (24 hr)	Start	11:45	End	12:10	Location		
Method	Velocity-area (Mid-section)			Instrument Model		FM 2000	
Flow Meter Type	Marsh Mcbirney Flo-mate			Instrument Serial #			
Stage (m)	Start	Reading	1.526	Time	11:45		
	End	Reading		Time			

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	6.60	0.00	0.00	0.04			0.00	0.000	0.0
	6.30	0.27	0.30	0.12			-0.05	-0.006	-0.4
	5.70	0.39	0.60	0.20			0.39	0.076	5.0
	5.30	0.35	0.40	0.12			0.83	0.102	6.7
	5.00	0.29	0.30	0.09			1.04	0.090	6.0
	4.70	0.44	0.30	0.13			0.87	0.115	7.6
	4.40	0.43	0.30	0.13			0.96	0.124	8.2
	4.10	0.36	0.30	0.09			0.96	0.086	5.7
	3.90	0.41	0.20	0.08			0.85	0.070	4.6
	3.70	0.50	0.20	0.00			0.90	0.090	6.0
	3.90	0.54	0.20	0.11			0.84	0.181	12.0
	3.30	0.56	0.60	0.22			0.81	0.181	12.0
	3.10	0.61	0.20	0.12			0.77	0.094	6.2
	2.90	0.68	0.20	0.15			0.81	0.124	8.2
	2.65	0.54	0.25	0.12			0.81	0.098	6.5
	2.45	0.51	0.20	0.13			0.57	0.073	4.8
	2.15	0.60	0.30	0.20			-0.02	-0.004	-0.3
	1.80	0.30	0.35	0.10			0.12	0.012	0.8
Right Bank	1.50	0.00	0.30	0.05			0.00	0.000	0.0
Total Q								1.507	100.0

General Notes

QA/QC: Velocity was corrected to adjust for a 2" prop. with a 3" cal. Constant

Appendix 2c-3. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	30-Oct-11			
Time at Site (24 hr)	Start Time:	10:30	End Time:	12:00
Personnel	Rob Larson, K Johnson			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 099	0.995	100.995		100.000	
WL			1.401	**99.594**	
BM 100	0.950	101.060	0.885	100.110	
WL			1.467	**99.593**	
BM 099			1.060	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes
BM 099	100	100.000	0.000	

Summary	
Stage (m)	99.594
Discharge (m^3/s)	2.969
Pressure Transducer Reading (m)	0.769
Pressure Transducer Elevation (m)	98.825

Discharge Measurement Salt Dilution						
Date Monitored:	30-Oct-11				Pressure Transducer (m):	0.769
Time (24 hr):	Start	10:30	End	12:00	Amount of Salt injected:	20.162
Method	Salt Dilution				Mean Discharge Q (m^3/s):	2.969
Probe LB	"Flagged"		Ac LB		K (Cal. Constant) LB:	0.002
Probe RB	"Non-Flagged"		Ac RB		K (Cal. Constant) RB:	0.002
Type of Salt:	Windsor				Error (Std Dev in m^3/s)	7.8

Probe RB: S/N ...	"Non-Flagged"		
M =	9.127	kg	Mass of salt injected
M =	9127000	mg	
Δτ =	2	s	Time interval
Ac =	7.098938104	mS.s/cm	Area under curve
K1 =	0.002219942	(mS L)/(cm mg)	Calibration constant
Q =	2854.1	L/s	Discharge
Q =	**2.85**	m3/s	
RD =	3.2	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N ...	"Flagged"		
M =	9.127	kg	Mass of salt injected
M =	9127000	mg	
Δτ =	2	s	Time interval
Ac =	5.842737093	mS.s/cm	Area under curve
K1 =	0.001974531	(mS L)/(cm mg)	Calibration constant
Q =	3084.4	L/s	Discharge
Q =	**3.08**	m3/s	
RD =	3.0	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2c-3. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott-Hydro			
Stream Name	Scott Creek			
Date Monitored	11-Nov-11			
Time at Site (24 hr)	Start Time:	9:30:00 AM	End Time:	11:00:00 AM
Personnel	M. Soloducha			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 099	1.296	101.296		100.000	
BM 100			1.183	**100.113**	
WL			1.799	99.497	
TBM	1.491	101.249	1.538	**99.758**	
WL			1.757	99.492	
BM 100			1.137	100.112	
BM 099			1.249	**100.000**	
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes
BM 099	100	100.000		0.000	
BM 100	100.144	100.113		-0.031	

Summary	
Stage (m)	99.495
Discharge (m^3/s)	0.693
Pressure Transducer Reading (m)	0.702
Pressure Transducer Elevation (m)	98.793

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	9:30	End	9:55	Location				
Method	Velocity-area (Mid-section)			Instrument Model	FM 2000				
Flow Meter Type	Marsh Mcbirney Flo-mate			Instrument Serial #					
Stage (m)	Start	Reading	0.702	Time	9:30				
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Right Bank	1.20	0.00	0.00	0.00	0			0.000	0.0
	1.50	0.24	0.30	0.10	-0.03			-0.003	-0.4
	2.00	0.34	0.50	0.17	-0.02			-0.003	-0.5
	2.50	0.47	0.50	0.24	0.02			0.005	0.7
	3.00	0.62	0.50	0.31	0.1			0.031	4.5
	3.50	0.72	0.50	0.36	0.2			0.072	10.4
	4.00	0.70	0.50	0.35	0.12			0.042	6.1
	4.50	0.60	0.50	0.30	0.25			0.075	10.8
	5.00	0.54	0.50	0.27	0.29			0.078	11.3
	5.50	0.53	0.50	0.27	0.33			0.087	12.6
	6.00	0.50	0.50	0.25	0.36			0.090	13.0
	6.50	0.44	0.50	0.22	0.31			0.068	9.8
	7.00	0.34	0.50	0.17	0.27			0.046	6.6
	7.50	0.29	0.50	0.15	0.24			0.035	5.0
	8.00	0.24	0.50	0.12	0.25			0.030	4.3
	8.50	0.23	0.50	0.12	0.18			0.021	3.0
	9.00	0.25	0.50	0.13	0.1			0.013	1.8
	9.50	0.23	0.50	0.12	0.01			0.001	0.2
	10.00	0.17	0.50	0.09	0.02			0.002	0.2
	10.50	0.15	0.50	0.08	0.03			0.002	0.3
	11.00	0.14	0.50	0.07	0.03			0.002	0.3
	11.50	0.12	0.50	0.06	0			0.000	0.0
	12.00	0.06	0.50	0.03	-0.01			0.000	0.0
Left Bank	12.40	0.00	0.40	0.00	0			0.000	0.0
Total Q								**0.693**	**100.0**

General Notes

Appendix 2c-4. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	20-Mar-12			
Time at Site (24 hr)	**Start Time:**	5:05:00 PM	**End Time:**	6:00:00 PM
Personnel	M. Soloducha, E. Belland			
Station Coordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model		**Serial #**	
Gain		**Offset**	
Status		**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM 100	0.725	100.725		100.000	Not Primary!
WL			1.546	**99.354**	**D = 0.175'**
TBM	1.467	100.729	1.463	99.262	
WL			1.551	**99.353**	**D = 0.175'**
BM 100			0.729	100.000	

BM#	**Established Elevation (m)**	**Mean Elevation (this date) (m)**	**Difference (m)**	**Notes**
BM 100		100.000		
0				
0				

Summary	
Stage (m)	99.354
Discharge (m3/s)	0.2
Pressure Transducer Reading (m)	0.643
Pressure Transducer Elevation (m)	98.711

Discharge Measurement - Mid-Section Method									
Time (24 hr)	**Start**	17:05	**End**	18:00	**Location**	at bridge			
Method	Velocity-area (Mid-section)			**Instrument Model**		Flo-Mate			
Flow Meter Type	Marsh McBirney			**Instrument Serial #**					
Stage (m)	**Start**	**Reading**		**Time**	17:00				
	End	**Reading**	0.708	**Time**	17:35				

	Station	**Depth**	**Distance**	**Area**	**Velocity (m/s)**			**Q**	**% of Total Q**
Notes	**(m)**	**(m)**	**(m)**	**(m^2)**	**60%**	**20%**	**80%**	**(m3/s)**	**%**
Left Bank	3.70	0.00	0.00	0.00	0			0.000	0.0
	3.80	0.06	0.10	0.02	-0.02			0.000	-0.1
	4.20	0.12	0.40	0.05	-0.01			0.000	-0.2
	4.60	0.15	0.40	0.06	0			0.000	0.0
	5.00	0.15	0.40	0.06	0			0.000	0.0
	5.40	0.17	0.40	0.07	-0.01			-0.001	-0.3
	5.80	0.20	0.40	0.08	0			0.000	0.0
	6.20	0.21	0.40	0.09	0			0.000	0.0
	6.60	0.21	0.40	0.09	0.03			0.003	1.1
	7.00	0.21	0.40	0.09	0.07			0.006	2.5
	7.40	0.24	0.40	0.10	0.07			0.007	2.8
	7.80	0.27	0.40	0.11	0.09			0.010	4.1
	8.20	0.30	0.40	0.12	0.13			0.016	6.6
	8.60	0.34	0.40	0.13	0.13			0.017	7.2
	9.00	0.44	0.40	0.18	0.19			0.034	14.0
	9.40	0.46	0.40	0.18	0.17			0.031	12.9
	9.80	0.43	0.40	0.17	0.11			0.019	7.8
	10.20	0.40	0.40	0.16	0.12			0.019	7.9
	10.60	0.43	0.40	0.17	0.14			0.024	9.9
	11.00	0.44	0.40	0.15	0.12			0.019	7.7
log	11.30	0.49	0.30	0.17	0.08			0.014	5.7
behind log	11.70	0.46	0.40	0.18	0.09			0.016	6.8
	12.10	0.49	0.40	0.17	0.05			0.009	3.5
	12.40	0.52	0.30	0.10	0			0.000	0.0
Right Bank	12.50	0.00	0.10	0.00	0			0.000	0.0
Total Q								**0.241**	**100.0**

General Notes
Depth originally measured in 1/10s of feet; converted to meters for this calculation.

Appendix 2c-4. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	2-May-12			
Time at Site (24 hr)	Start Time:	8:30	End Time:	12:00
Personnel	E. Belland, T. Englesmeier			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions	clear, 10 deg C			

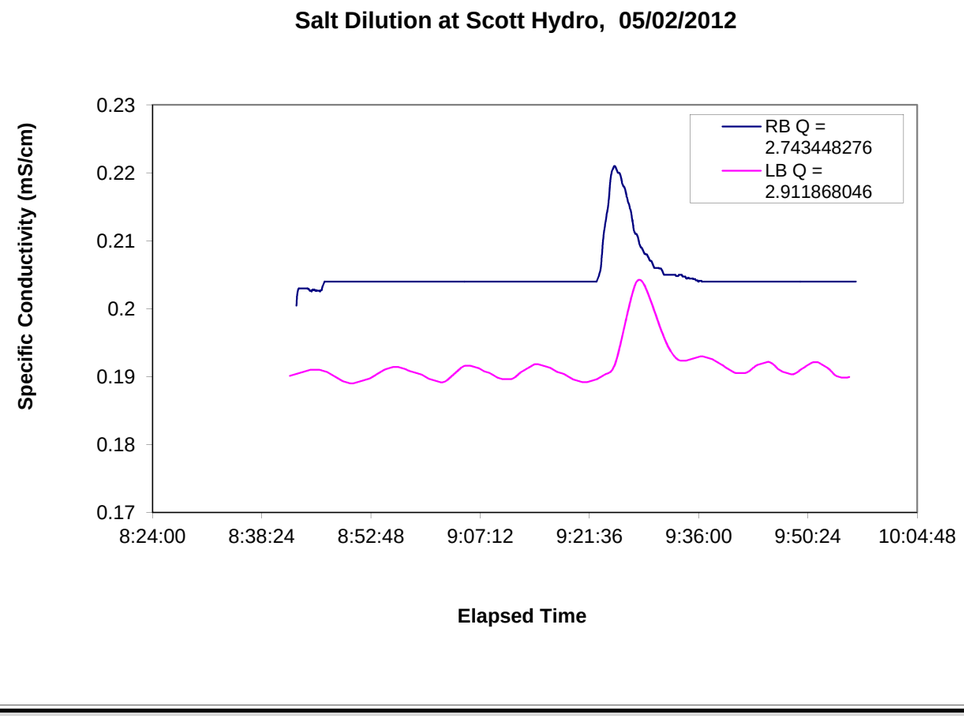
Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 100	1.956	101.956		100.000	
BM 099			2.065	99.891	
PT			2.399	99.557	top rebar
WL			2.370	**99.586**	(notes+.010)
TBM	2.555	101.735	2.776	99.180	
WL			2.148	**99.587**	
PT			2.177	99.558	
BM 099			1.841	99.894	
BM 100			1.734	100.001	

BM#	Established Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes
BM 100		100.001	-100.001	
BM 099		99.893	-99.893	

Summary	
Stage (m)	99.587
Discharge (m^3/s)	2.8
Pressure Transducer Reading (m)	0.901
Pressure Transducer Elevation (m)	98.686

Discharge Measurement Salt Dilution						
Date Monitored:	2-May-12				Pressure Transducer (m):	0.901
Time (24 hr):	Start	8:30	End	10:00	Amount of Salt injected:	5.967
Method	Salt Dilution				Mean Discharge Q (m^3/s):	2.827658161
Probe LB		17106	Ac LB	4.0984	K (Cal. Constant) LB:	0.002
Probe RB		11172	Ac RB	4.35	K (Cal. Constant) RB:	0.002
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.1



General Notes

Appendix 2c-4. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	2-May-12			
Time at Site (24 hr)	Start Time:	10:40:00 AM	End Time:	
Personnel	E. Belland, T. Englesmeier			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 100	1.956	101.956		100.000	
BM 099			2.065	99.891	
PT			2.399	99.557	top rebar
WL			2.370	99.586	(notes+.010)
TBM	2.555	101.735	2.776	99.180	
WL			2.148	99.587	
PT			2.177	99.558	
BM 099			1.841	99.894	
BM 100			1.734	100.001	

BM#	Established Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes
BM 100		100.001		
BM 099		99.893		

Summary	
Stage (m)	99.587
Discharge (m^3/s)	3.8
Pressure Transducer Reading (m)	0.901
Pressure Transducer Elevation (m)	98.686

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	10:40	End		Location	at bridge			
Method	Velocity-area (Mid-section)			Instrument Model		Flo-Mate			
Flow Meter Type	Marsh McBirney			Instrument Serial #		2007528			
Stage (m)	Start	Reading	0.901	Time	10:37				
	End	Reading	0.899	Time	11:28				

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
RB	18.50	0.00	0.00	0.02	0			0.000	0.0
behind PT	18.40	0.38	0.10	0.15	-0.08			-0.012	-0.3
behind PT	17.70	0.54	0.70	0.38	0			0.000	0.0
	17.00	0.68	0.70	0.48	0.19			0.090	2.4
	16.30	0.80	0.70	0.56	0.44			0.246	6.6
	15.60	0.64	0.70	0.45	0.62			0.278	7.4
	14.90	0.66	0.70	0.46	0.76			0.351	9.3
	14.20	0.65	0.70	0.46	0.78			0.355	9.4
	13.50	0.62	0.70	0.43	0.95			0.412	11.0
	12.80	0.54	0.70	0.38	0.77			0.291	7.7
	12.10	0.50	0.70	0.35	0.95			0.333	8.9
	11.40	0.46	0.70	0.32	0.79			0.254	6.8
	10.70	0.42	0.70	0.29	0.82			0.241	6.4
	10.00	0.40	0.70	0.28	0.93			0.260	6.9
	9.30	0.40	0.70	0.28	0.84			0.235	6.3
	8.60	0.44	0.70	0.31	0.67			0.206	5.5
	7.90	0.40	0.70	0.28	0.46			0.129	3.4
	7.20	0.28	0.70	0.20	0.28			0.055	1.5
	6.50	0.22	0.70	0.15	0.12			0.018	0.5
	5.80	0.18	0.70	0.13	0.08			0.010	0.3
	5.10	0.16	0.70	0.11	0.01			0.001	0.0
	4.40	0.14	0.70	0.08	0.01			0.001	0.0
LB	4.00	0.00	0.40	0.00	0			0.000	0.0
Total Q								3.756	100.0

General Notes

Appendix 2c-4. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	5-May-12			
Time at Site (24 hr)	Start Time:	9:00	End Time:	
Personnel	E. Belland, T. Englesmeier			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions	foggy, overcast			

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

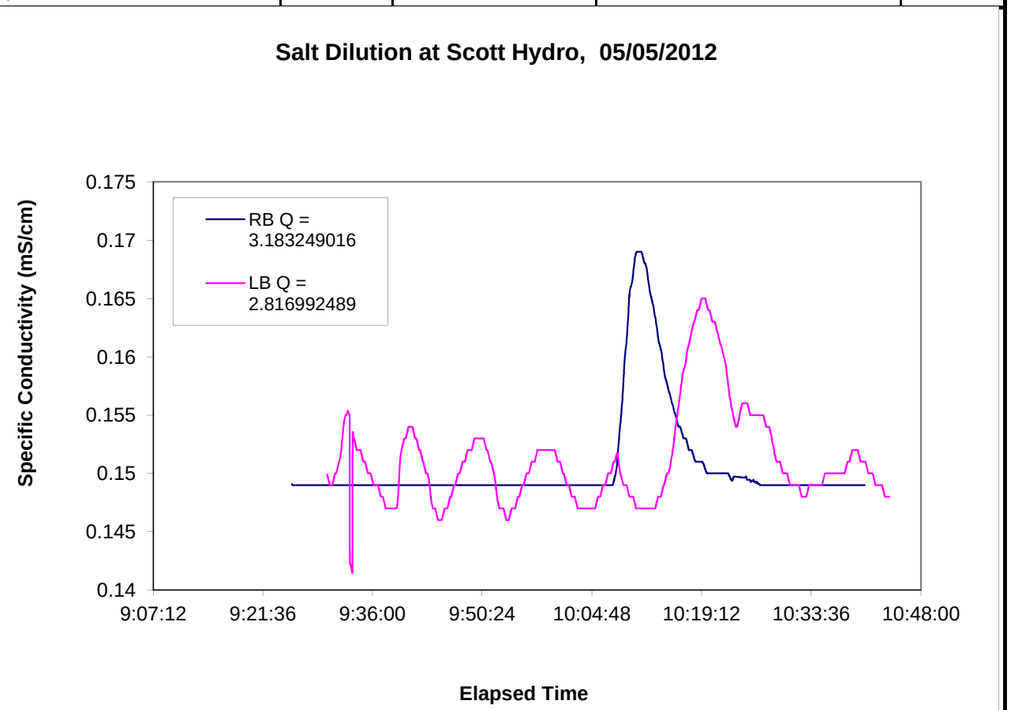
Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 100	2.219	102.219		100.000	P
BM 099			2.317	99.902	
BM 006			2.360	99.859	LB rebar
PT			2.649	99.570	top rebar
WL			2.658	**99.561**	
TBM	2.760	101.989	2.990	99.229	
WL			2.425	**99.564**	
PT			2.398	99.591	
BM 006			2.118	99.871	
BM 099			2.059	99.930	
BM 100			1.970	100.019	

BM#	Established Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes
BM 100		100.000	-100.000	
BM 099		99.902	-99.902	

Summary	
Stage (m)	99.563
Discharge (m^3/s)	3.0
Pressure Transducer Reading (m)	0.859
Pressure Transducer Elevation (m)	98.704

Discharge Measurement Salt Dilution						
Date Monitored:	5-May-12				Pressure Transducer (m):	0.859
Time (24 hr):	Start	9:20	End	10:50	Amount of Salt injected:	11.326
Method	Salt Dilution				Mean Discharge Q (m^3/s):	3
Probe LB		17106	Ac LB	**8.0412**	K (Cal. Constant) LB:	0.002
Probe RB		11172	Ac RB	**7.116**	K (Cal. Constant) RB:	0.002
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.255



General Notes

Snow banks melted significantly since May 2 visit, water noticably warmer.

Appendix 2c-4. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	5-May-12			
Time at Site (24 hr)	Start Time:	10:37:00 AM	End Time:	11:05:00 AM
Personnel	E. Belland, T. Englesmeier			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions	foggy, overcast			

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 100	2.219	102.219		100.000	P
BM 099			2.317	99.902	
BM 006			2.360	99.859	LB rebar
PT			2.649	99.570	top rebar
WL			2.658	**99.561**	
TBM	2.760	101.989	2.990	99.229	
WL			2.425	**99.564**	
PT			2.398	99.591	
BM 006			2.118	99.871	
BM 099			2.059	99.930	
BM 100			1.970	100.019	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 100		100.000		
BM 099		99.902		

Summary	
Stage (m)	99.563
Discharge (m^3/s)	2.9
Pressure Transducer Reading (m)	0.859
Pressure Transducer Elevation (m)	98.704

Discharge Measurement - Mid-Section Method										
Time (24 hr)	Start		End		Location	at bridge				
Method	Velocity-area (Mid-section)			Instrument Model		Flo-Mate				
Flow Meter Type	Marsh McBirney			Instrument Serial #		2007528				
Stage (m)	Start	Reading	0.859	Time	10:37					
	End	Reading		Time	11:05					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
LB	17.20	0.00	0.00	0.08	0			0.000	0.0
	15.70	0.10	1.50	0.11	-0.02			-0.002	-0.1
	15.00	0.12	0.70	0.08	0			0.000	0.0
	14.30	0.18	0.70	0.13	0.06			0.008	0.3
	13.60	0.22	0.70	0.15	0.15			0.023	0.8
	12.90	0.30	0.70	0.21	0.23			0.048	1.7
	12.20	0.34	0.70	0.24	0.4			0.095	3.3
	11.50	0.34	0.70	0.24	0.62			0.148	5.1
	10.80	0.34	0.70	0.24	0.72			0.171	5.9
	10.10	0.42	0.70	0.29	0.76			0.223	7.7
	9.40	0.46	0.70	0.32	0.59			0.190	6.5
	8.70	0.42	0.70	0.29	0.61			0.179	6.1
	8.00	0.48	0.70	0.34	0.72			0.242	8.3
	7.30	0.58	0.70	0.41	0.72			0.292	10.0
	6.60	0.62	0.70	0.43	0.8			0.347	11.9
	5.90	0.64	0.70	0.45	0.69			0.309	10.6
	5.20	0.60	0.70	0.42	0.63			0.265	9.1
	4.50	0.74	0.70	0.52	0.47			0.243	8.3
	3.80	0.70	0.70	0.49	0.24			0.118	4.0
behind PT	3.10	0.56	0.70	0.39	0.12			0.047	1.6
behind PT	2.40	0.50	0.70	0.25	-0.07			-0.018	-0.6
	2.10	0.44	0.30	0.10	-0.12			-0.012	-0.4
RB	1.95	0.00	0.15	0.00	0			0.000	0.0
Total Q								**2.918**	**100.0**

General Notes
Snow banks melted significantly since May 2 visit, water noticably warmer.

Appendix 2c-4. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	19-Jun-12			
Time at Site (24 hr)	Start Time:	13:00	End Time:	15:00
Personnel	E. Belland, T. Englesmeier			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions				

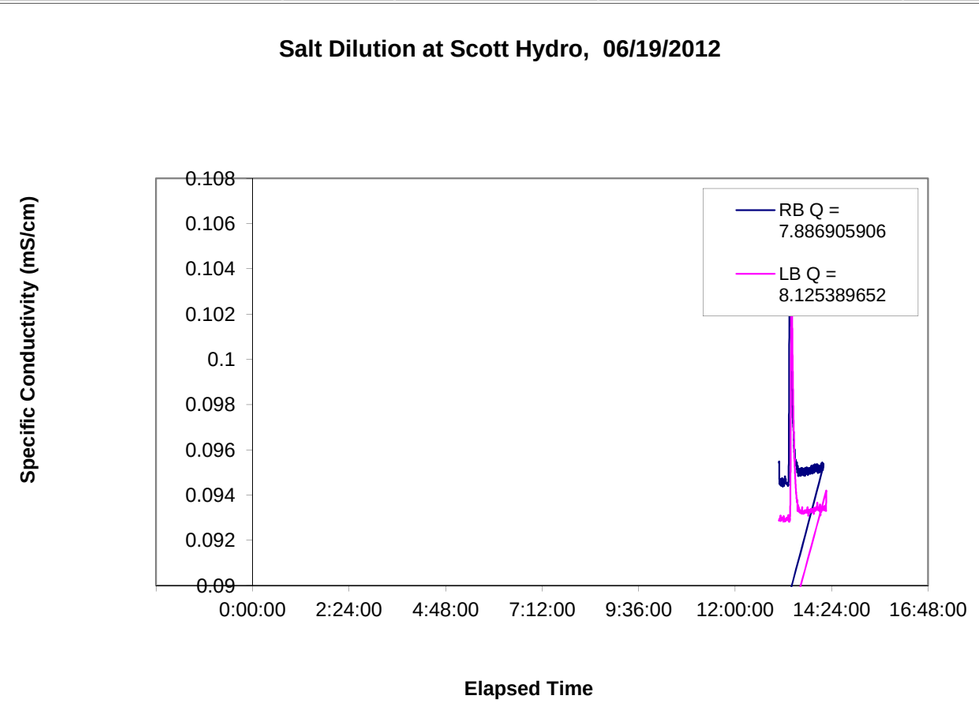
Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 100	2.020	2.020			P
BM 099			2.132	2.132	
PT			2.469	2.469	top horiz. Rebar
WL			2.308	**2.308**	
TBM	2.340	4.800	2.460	2.460	
WL			2.188	**2.188**	
PT			2.348	2.348	
BM 099			2.012	2.012	
BM 100			1.900	1.900	

BM#	Established Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes
BM 100		100.000		
BM 099		99.888		

Summary	
Stage (m)	2.248
Discharge (m^3/s)	8.0
Pressure Transducer Reading (m)	0.963
Pressure Transducer Elevation (m)	1.285

Discharge Measurement Salt Dilution						
Date Monitored:	19-Jun-12				Pressure Transducer (m):	0.963
Time (24 hr):	Start	13:00	End	15:00	Amount of Salt injected:	12.219
Method	Salt Dilution				Mean Discharge Q (m^3/s):	8.01
Probe LB		13620	Ac LB	2.7068486	K (Cal. Constant) LB:	0.0018
Probe RB		12397	Ac RB	2.7068486	K (Cal. Constant) RB:	0.0019
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.2



General Notes

Appendix 2c-4. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	22-Jun-12			
Time at Site (24 hr)	Start Time:	8:00	End Time:	10:00
Personnel	E. Belland, T. Englesmeier			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

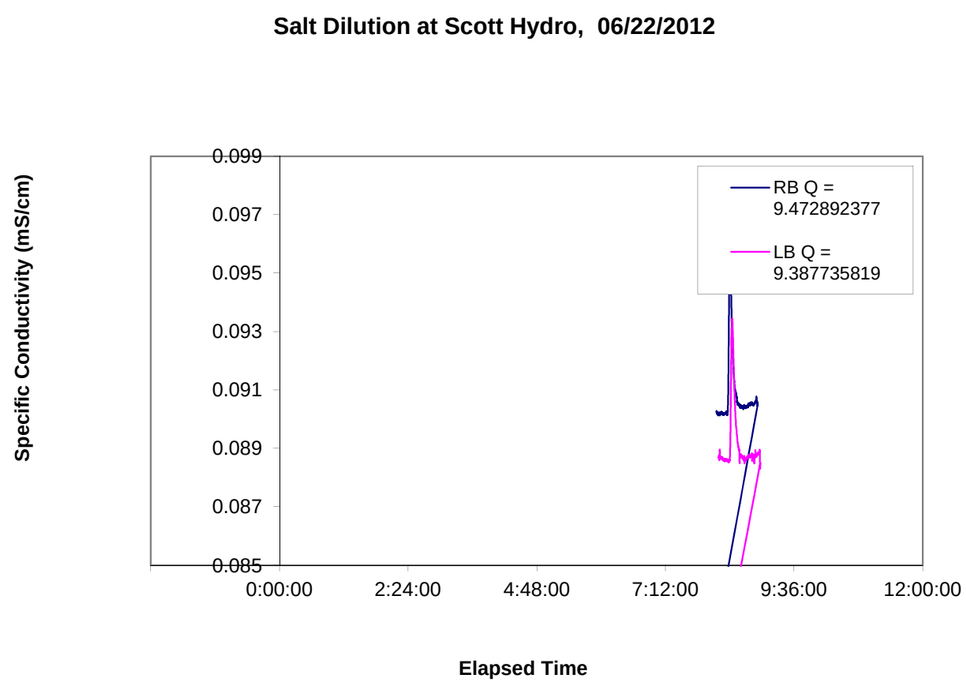
Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 100	1.962	101.962		100.000	P
BM 099			2.074	99.888	
PT			2.408	99.554	top rebar
WL			2.209	**99.753**	
TBM	2.155	101.839	2.278	99.684	
WL			2.086	**99.753**	
PT			2.286	99.553	
BM 099			1.951	99.888	
BM 100			1.840	99.999	

BM#	Established Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes
BM 100		100.000	-100.000	
BM 099		99.888	-99.888	

Summary	
Stage (m)	99.753
Discharge (m^3/s)	9.4
Pressure Transducer Reading (m)	1.001
Pressure Transducer Elevation (m)	98.752

Discharge Measurement Salt Dilution						
Date Monitored:	22-Jun-12				Pressure Transducer (m):	1.001
Time (24 hr):	Start	8:00	End	9:00	Amount of Salt injected:	7.27
Method	Salt Dilution				Mean Discharge Q (m^3/s):	9.43
Probe LB		0	Ac LB	1.3939463	K (Cal. Constant) LB:	0.0018
Probe RB		0	Ac RB	1.4581608	K (Cal. Constant) RB:	0.0019
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.1



General Notes
Flew further upstream than 19-Jun-12 measurement to inject salt.

Appendix 2c-4. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott Hydro			
Stream Name	Scott Creek			
Date Monitored	25-Jul-12			
Time at Site (24 hr)	Start Time:	10:30	End Time:	12:00
Personnel	E. Belland, T. Englesmeier			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions	clear, 20 deg C			

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

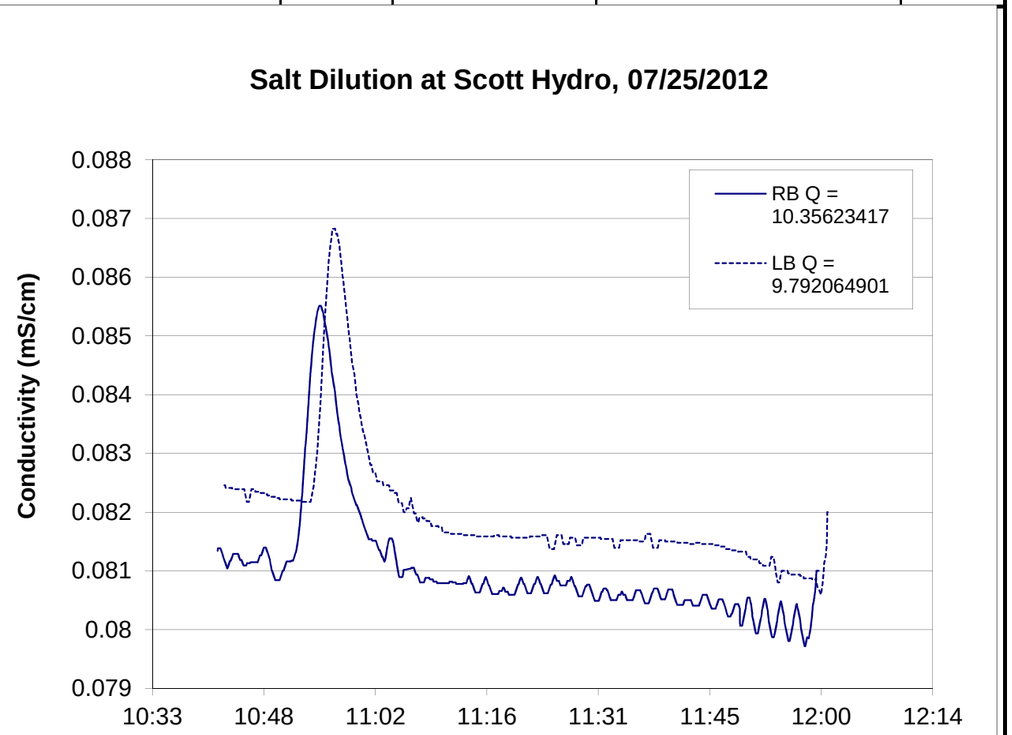
Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 100	1.935	101.935		100.000	P
BM 099			2.048	99.887	
CG			2.275	99.660	Crest Gauge: +0.274
PT			2.385	99.550	top rebar
WL			2.154	**99.781**	
TBM	2.124	101.794	2.265	99.670	
WL			2.014	**99.780**	
PT			2.244	99.550	
CG			2.135	99.659	
BM 099			1.908	99.886	
BM 100			1.795	99.999	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 100		100.000		
BM 099		99.887		

Summary	
Stage (m)	99.781
Discharge (m^3/s)	10.1
Pressure Transducer Reading (m)	1.033
Pressure Transducer Elevation (m)	98.748

Discharge Measurement Salt Dilution						
Date Monitored:	25-Jul-12				Pressure Transducer (m):	1.033
Time (24 hr):	Start	10:00	End	12:00	Amount of Salt injected:	7.434
Method	Salt Dilution				Mean Discharge Q (m^3/s):	10.075
Probe LB		15457	Ac LB	1.3665351	K (Cal. Constant) LB:	0.0018
Probe RB		18061	Ac RB	1.3638741	K (Cal. Constant) RB:	0.0019
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.4



General Notes

Appendix 2c-4. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	SCOTT-HYDRO			
Stream Name	Scott Creek			
Date Monitored	25-Sep-12			
Time at Site (24 hr)	Start Time:	9:00:00 AM	End Time:	
Personnel	EB, Brian Tait			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions	foggy			

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 100	1.133	101.133		100.000	P
BM 099			1.245	99.888	
PT			1.580	99.553	top rebar
WL			1.582	**99.551**	
TBM	1.499	101.114	1.518	99.615	
WL			1.562	**99.552**	
PT			1.559	99.555	
BM 099			1.222	99.892	
BM 100			1.109	100.005	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 100		100.003		
BM 099		99.890		
0				

Summary	
Stage (m)	99.552
Discharge (m^3/s)	2.8
Pressure Transducer Reading (m)	0.821
Pressure Transducer Elevation (m)	98.731

Discharge Measurement - Mid-Section Method										
Time (24 hr)	Start		End		Location	2 m DS of bridge				
Method	Velocity-area (Mid-section)			Instrument Model		Flo-Mate				
Flow Meter Type	Electromagnetic			Instrument Serial #						
Stage (m)	Start	Reading	9:00	Time						
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
RB	1.40	0.00	0.00	0.01	0			0.000	0.0
	1.70	0.09	0.30	0.05	0.12			0.006	0.2
	2.50	0.09	0.80	0.07	0.3			0.022	0.8
	3.30	0.21	0.80	0.16	0.31			0.050	1.8
	4.00	0.34	0.70	0.25	0.28			0.070	2.5
	4.80	0.61	0.80	0.49	0.2			0.098	3.5
	5.60	0.76	0.80	0.50	0.2			0.099	3.5
	6.10	0.73	0.50	0.48	0.23			0.109	3.9
	6.90	0.70	0.80	0.49	0.45			0.221	7.9
	7.50	0.52	0.60	0.28	0.58			0.165	5.9
	8.00	0.43	0.50	0.28	0.65			0.180	6.5
	8.80	0.27	0.80	0.22	0.97			0.213	7.6
	9.60	0.24	0.80	0.20	0.89			0.174	6.2
	10.40	0.24	0.80	0.20	1.23			0.240	8.6
	11.20	0.21	0.80	0.17	1.18			0.201	7.2
	12.00	0.21	0.80	0.17	1.32			0.225	8.1
	12.80	0.24	0.80	0.17	0.92			0.157	5.6
	13.40	0.21	0.60	0.17	1.08			0.184	6.6
	14.40	0.18	1.00	0.16	1.04			0.171	6.1
	15.20	0.21	0.80	0.17	0.79			0.135	4.8
	16.00	0.12	0.80	0.10	0.54			0.053	1.9
	16.80	0.09	0.80	0.07	0.31			0.021	0.8
LB	17.50	0.00	0.70	0.03	0			0.000	0.0
Total Q								**2.795**	**100.0**

General Notes
2 m DS of bridge

Appendix 2c-4. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott-Hydro			
Stream Name	Scott Creek			
Date Monitored	17-Oct-12			
Time at Site (24 hr)	Start Time:	2:00:00 PM	End Time:	
Personnel	EB, Brian Tait			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions	foggy			

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 100	1.112	101.112		100.000	P
BM 099			1.226	99.886	
PT			1.561	99.551	top rebar
WL			1.555	**99.557**	
TBM	1.085	101.073	1.124	99.988	
WL			1.510	**99.563**	
PT			1.522	99.551	
BM 099			1.186	99.887	
BM 100			1.073	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 100		100.000		
BM 099		99.887		

Summary	
Stage (m)	99.560
Discharge (m^3/s)	3.1
Pressure Transducer Reading (m)	0.843
Pressure Transducer Elevation (m)	98.717

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	1400	End		Location	at PT, 2 m DS of bridge			
Method	Velocity-area (Mid-section)			Instrument Model		Flo-Mate			
Flow Meter Type	Electromagnetic			Instrument Serial #		2007528			
Gauge Stage (m)	Start	Reading	0.93	Time	14:30				
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
RB	20.30	0.00	0.00	0.03	0			0.000	0.0
	20.70	0.16	0.40	0.11	0.24			0.027	0.9
	21.70	0.16	1.00	0.14	0.41			0.059	1.9
	22.50	0.34	0.80	0.26	0.43			0.110	3.6
	23.20	0.52	0.70	0.39	0.39			0.152	5.0
	24.00	0.64	0.80	0.48	0.39			0.187	6.1
	24.70	0.66	0.70	0.50	0.32			0.158	5.2
	25.50	0.52	0.80	0.39	0.62			0.242	7.9
	26.20	0.50	0.70	0.38	0.69			0.259	8.5
	27.00	0.40	0.80	0.30	0.84			0.252	8.2
	27.70	0.22	0.70	0.17	1.14			0.188	6.2
	28.50	0.24	0.80	0.19	1.14			0.219	7.2
	29.30	0.24	0.80	0.18	1.19			0.214	7.0
	30.00	0.24	0.70	0.20	1.13			0.231	7.5
	31.00	0.20	1.00	0.17	0.7			0.119	3.9
	31.70	0.26	0.70	0.20	1.16			0.226	7.4
	32.50	0.26	0.80	0.20	0.98			0.191	6.2
	33.20	0.20	0.70	0.15	0.82			0.123	4.0
	34.00	0.16	0.80	0.11	0.64			0.072	2.3
	34.60	0.10	0.60	0.08	0.4			0.030	1.0
LB	35.50	0.00	0.90	0.04	0			0.000	0.0
Total Q								3.059	100.0

General Notes

Appendix 2c-4. Manual Discharge Measurements and Levelling Surveys at Scott Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Scott-Hydro			
Stream Name	Scott Creek			
Date Monitored	21-Nov-12			
Time at Site (24 hr)	Start Time:	9:45:00 AM	End Time:	
Personnel	EB, Ali Naghibi			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions	-3, light snow			

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 100	1.323	101.323		100.000	P
BM 99			1.435	99.888	
PT			1.772	99.551	op horiz. threaded rod
WL			1.874	**99.449**	
TBM	1.648	101.259	1.712	99.611	
WL			1.808	**99.451**	
PT			1.707	99.552	
BM 99			1.371	99.888	
BM 100			1.258	100.001	
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes
BM 100		100.001			
BM 99		99.888			

Summary	
Stage (m)	99.450
Discharge (m^3/s)	0.9
Pressure Transducer Reading (m)	0.729
Pressure Transducer Elevation (m)	98.721

Discharge Measurement - Mid-Section Method										
Time (24 hr)	Start	945	End		Location	at PT, 2 m DS of bridge				
Method	Velocity-area (Mid-section)			Instrument Model						
Flow Meter Type	Marsh Mcbirney Flo-mate			Instrument Serial #		14614				
Stage (m)	Start	Reading	0.805	Time	9:45					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
LB	13.60	0.00	0.00	0.02	0			0.000	0.0
	14.00	0.08	0.40	0.04	-0.01			0.000	0.0
	14.60	0.10	0.60	0.06	0.03			0.002	0.2
	15.10	0.12	0.50	0.07	0.54			0.036	4.0
	15.70	0.13	0.60	0.07	0.57			0.041	4.5
	16.20	0.14	0.50	0.07	0.42			0.029	3.3
	16.70	0.15	0.50	0.08	0.6			0.045	5.0
	17.20	0.16	0.50	0.08	0.6			0.048	5.3
	17.70	0.16	0.50	0.08	0.72			0.058	6.4
	18.20	0.16	0.50	0.08	0.92			0.074	8.2
	18.70	0.16	0.50	0.09	0.93			0.082	9.1
	19.30	0.18	0.60	0.12	0.7			0.082	9.1
	20.00	0.18	0.70	0.11	0.84			0.091	10.1
	20.50	0.20	0.50	0.10	0.8			0.080	8.9
	21.00	0.28	0.50	0.14	0.58			0.081	9.0
	21.50	0.35	0.50	0.14	0.44			0.062	6.8
	21.80	0.38	0.30	0.13	0.39			0.052	5.8
	22.20	0.48	0.40	0.19	0.27			0.052	5.8
	22.60	0.53	0.40	0.21	0.06			0.013	1.4
	23.00	0.59	0.40	0.27	0.06			0.016	1.8
eddy	23.50	0.60	0.50	0.45	0.04			0.018	2.0
eddy	24.50	0.51	1.00	0.54	-0.08			-0.043	-4.8
eddy	25.60	0.20	1.10	0.19	-0.08			-0.015	-1.7
RB	26.40	0.00	0.80	0.08	0			0.000	0.0
Total Q								**0.901**	**100.0**

General Notes

Appendix 2d-1. Manual Discharge Measurements and Levelling Surveys at H2-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H2-Hydro			
Stream Name				
Date Monitored	4-Jul-10			
Time at Site (24 hr)	Start Time:	1:00:00 PM	End Time:	3:00:00 PM
Personnel	M. Soloducha, X. Pinto			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 34	0.729	100.729		100.000	
BM 33			1.752	98.977	
WL			3.228	97.501	
BM 35			1.802	98.927	
	1.765	100.692			
BM 34			0.692	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 34		100.000		
BM 33		98.977		
BM 35		98.927		

Summary	
Stage (m)	97.501
Discharge (m^3/s)	0.8
Pressure Transducer Reading (m)	0.541
Pressure Transducer Elevation (m)	96.960

Discharge Measurement #1- Mid-Section Method										
Time (24 hr)	Start	13:00	End	13:20	Location	At Station				
Method	Velocity-area (Mid-section)			Calibration constant		607				
Flow Meter Type	Swoffer			Propellor Size		2"				
Stage (m)	Start	Reading	0.541	Time	13:00					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
right bank	1.80	0.00	0.0	0.00	0			0.000	0.0
CF	2.10	0.17	0.3	0.08	0			0.000	0.0
0	2.40	0.16	0.3	0.07	0.01			0.000	0.1
	2.70	0.16	0.3	0.07	0.03			0.001	0.2
	3.00	0.15	0.3	0.07	0.09			0.004	0.5
	3.30	0.21	0.3	0.09	0.21			0.013	1.7
	3.60	0.21	0.3	0.09	0.08			0.005	0.6
	3.90	0.09	0.3	0.04	0.43			0.012	1.5
	4.20	0.16	0.3	0.07	0.63			0.030	3.8
	4.50	0.26	0.3	0.12	0.37			0.029	3.6
	4.80	0.42	0.3	0.19	0.62			0.078	9.9
	5.10	0.26	0.3	0.12	0.85			0.066	8.4
	5.40	0.40	0.3	0.18	1.11			0.133	16.8
	5.70	0.20	0.3	0.09	0.76			0.046	5.7
	6.00	0.32	0.3	0.14	0.77			0.074	9.3
	6.30	0.30	0.3	0.14	0.91			0.082	10.3
	6.60	0.28	0.3	0.13	0.93			0.078	9.9
	6.90	0.23	0.3	0.10	0.57			0.039	5.0
	7.20	0.19	0.3	0.09	0.67			0.038	4.8
	7.50	0.16	0.3	0.07	0.43			0.021	2.6
	7.80	0.16	0.3	0.07	0.32			0.015	1.9
CF	8.10	0.10	0.3	0.07	0.5			0.028	3.5
0	8.90	0.04	0.8	0.04	0			0.000	0.0
left bank	9.35	0.00	0.4	0.00	0			0.000	0.0
Total Q								**0.793**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2d-1. Manual Discharge Measurements and Levelling Surveys at H2-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H2-Hydro			
Stream Name				
Date Monitored	4-Jul-10			
Time at Site (24 hr)	Start Time:	1:00:00 PM	End Time:	3:00:00 PM
Personnel	M. Soloducha, X. Pinto			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 34	0.729	100.729		100.000	
BM 33			1.752	98.977	
WL			3.228	97.501	
BM 35			1.802	98.927	
	1.765	100.692			
BM 34			0.692	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 34		100.000		
BM 33		98.977		
BM 35		98.927		

Summary	
Stage (m)	97.501
Discharge (m^3/s)	0.7
Pressure Transducer Reading (m)	0.541
Pressure Transducer Elevation (m)	96.960

Discharge Measurement #2- Mid-Section Method									
Time (24 hr)	Start	13:20	End	13:40	Location	At Station			
Method	Velocity-area (Mid-section)			Calibration constant		607			
Flow Meter Type	Swoffer			Propellor Size		2"			
Stage (m)	Start	Reading	0.541	Time	13:00				
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
left bank	9.35	0.00	0.0	0.00	0			0.000	0.0
CF	9.00	0.05	0.4	0.04	0			0.000	0.0
0	8.20	0.10	0.8	0.10	0.36			0.020	2.8
	7.90	0.14	0.3	0.06	0.14			0.006	0.8
	7.60	0.16	0.3	0.07	0.39			0.019	2.6
	7.30	0.20	0.3	0.09	0.41			0.025	3.5
	7.00	0.22	0.3	0.10	0.86			0.057	8.0
	6.70	0.20	0.3	0.09	0.79			0.047	6.7
	6.40	0.30	0.3	0.14	0.94			0.085	11.9
	6.10	0.33	0.3	0.15	0.45			0.045	6.3
	5.80	0.20	0.3	0.09	0.64			0.038	5.4
	5.50	0.28	0.3	0.13	0.89			0.075	10.6
	5.20	0.46	0.3	0.21	0.88			0.121	17.2
	4.90	0.43	0.3	0.19	0.59			0.076	10.7
	4.60	0.41	0.3	0.18	0.11			0.014	1.9
	4.30	0.18	0.3	0.08	0.64			0.035	4.9
	4.00	0.18	0.3	0.08	0.44			0.023	3.3
	3.70	0.20	0.3	0.09	0.05			0.003	0.4
	3.40	0.20	0.3	0.09	0.16			0.010	1.4
	3.10	0.20	0.3	0.09	0.15			0.009	1.3
	2.80	0.15	0.3	0.07	0.05			0.002	0.3
	2.50	0.18	0.3	0.08	0			0.000	0.0
CF	2.20	0.15	0.3	0.07	0			0.000	0.0
0	1.90	0.13	0.3	0.02	0			0.000	0.0
right bank	1.80	0.00	0.1	0.00	0			0.000	0.0
Total Q								**0.708**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2d-1. Manual Discharge Measurements and Levelling Surveys at H2-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H2-Hydro			
Stream Name				
Date Monitored	13-Aug-10			
Time at Site (24 hr)	Start Time:	11:30:00 AM	End Time:	1:00:00 PM
Personnel	X. Pinto, S. Boha			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 34	0.647	100.647		100.000	
BM 33			1.671	98.976	
WL			3.283	97.364	
BM 35			1.721	98.926	
	1.689	100.615		**97.364**	
BM 34			0.618	99.997	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 34		99.999		
BM 33		98.976		
BM 35		98.926		

Summary	
Stage (m)	97.364
Discharge (m^3/s)	0.265
Pressure Transducer Reading (m)	0.402
Pressure Transducer Elevation (m)	96.962

Discharge Measurement #1- Mid-Section Method									
Time (24 hr)	Start	13:20	End	13:40	Location	At Station			
Method	Velocity-area (Mid-section)			Calibration constant		612			
Flow Meter Type	Swoffer			Indicator constant		426			
Stage (m)	Start	Reading	0.405	Time	11:30	August 13th, 2010			
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity	Conv. Vel.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	3"	(m/s)	(m3/s)	%
right bank	2.00	0.00	0.0	0.00	0	0	0.00	0.000	0.1
CF	2.20	0.15	0.2	0.04	0.01	0.01	0.01	0.000	0.1
0	2.35	0.17	0.2	0.04	0.1	0.14	0.14	0.004	1.4
	2.50	0.12	0.2	0.03	0.11	0.16	0.16	0.003	1.1
	2.65	0.22	0.2	0.05	0.22	0.32	0.32	0.010	3.9
	2.80	0.26	0.2	0.06	0.1	0.14	0.14	0.006	2.1
	2.95	0.22	0.2	0.05	0.26	0.37	0.37	0.012	4.7
	3.10	0.26	0.2	0.06	0.36	0.52	0.52	0.020	7.6
	3.25	0.33	0.2	0.07	0.45	0.65	0.65	0.032	12.1
	3.40	0.30	0.2	0.07	0.51	0.73	0.73	0.033	12.5
	3.55	0.23	0.2	0.05	0.48	0.69	0.69	0.024	9.0
	3.70	0.26	0.2	0.06	0.14	0.20	0.20	0.008	3.0
rock US	3.85	0.21	0.2	0.05	0.06	0.09	0.09	0.003	1.0
rock US	4.00	0.23	0.2	0.05	0.05	0.07	0.07	0.002	0.9
	4.15	0.17	0.2	0.04	0.53	0.76	0.76	0.019	7.3
	4.30	0.19	0.1	0.04	0.57	0.82	0.82	0.023	8.8
	4.45	0.18	0.2	0.04	0.46	0.66	0.66	0.018	6.7
	4.60	0.17	0.1	0.04	0.62	0.89	0.89	0.023	8.6
	4.75	0.16	0.2	0.04	0.4	0.57	0.57	0.014	5.2
	4.90	0.13	0.2	0.03	0.15	0.22	0.22	0.004	1.6
	5.05	0.04	0.1	0.01	0.17	0.24	0.24	0.001	0.6
	5.20	0.05	0.2	0.01	0.27	0.39	0.39	0.003	1.1
	5.35	0.04	0.1	0.01	0.04	0.06	0.06	0.000	0.1
CF	5.50	0.04	0.2	0.01	0	0.00	0.00	0.000	0.0
0	5.75	0.03	0.3	0.01	0.17	0.24	0.24	0.001	0.4
left bank	5.80	0.00	0.0	0.00	0	0.00	0.00	0.000	0.1
Total Q								**0.265**	**100.0**

General Notes
Survey done on August 11th, 2010 but no flow measurment as Swoffer was broken. Returned August 13th to complete flow measurement. Use average of 2 measurements.

Appendix 2d-1. Manual Discharge Measurements and Levelling Surveys at H2-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H2-Hydro			
Stream Name				
Date Monitored	13-Aug-10			
Time at Site (24 hr)	Start Time:	11:30:00 AM	End Time:	1:00:00 PM
Personnel	X. Pinto, S. Boha			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 34	0.647	100.647		100.000	
BM 33			1.671	98.976	
WL			3.283	97.364	
BM 35			1.721	98.926	
	1.689	100.615		**97.364**	
BM 34			0.618	99.997	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 34		99.999		
BM 33		98.976		
BM 35		98.926		

Summary	
Stage (m)	97.364
Discharge (m^3/s)	0.255
Pressure Transducer Reading (m)	0.402
Pressure Transducer Elevation (m)	96.962

Discharge Measurement #2- Mid-Section Method									
Time (24 hr)	Start	13:20	End	13:40	Location	At Station			
Method	Velocity-area (Mid-section)			Calibration constant		612			
Flow Meter Type	Swoffer			Indicator constant		426			
Stage (m)	Start	Reading	0.405	Time	11:30	August 13th, 2010			
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity	Conv. Vel.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	3"	(m/s)	(m3/s)	%
left bank	5.80	0.00	0.0	0.00	0	0	0.00	0.000	0.0
CF	5.70	0.02	0.1	0.00	0	0.00	0.00	0.000	0.0
0	5.58	0.04	0.1	0.01	0.1	0.14	0.14	0.001	0.4
	5.33	0.05	0.3	0.02	0.08	0.11	0.11	0.001	0.5
	5.18	0.07	0.2	0.02	0.13	0.19	0.19	0.002	0.8
	5.03	0.04	0.1	0.01	0.13	0.19	0.19	0.001	0.4
	4.88	0.15	0.2	0.03	0.25	0.36	0.36	0.008	3.2
	4.73	0.19	0.2	0.04	0.48	0.69	0.69	0.020	7.7
	4.58	0.12	0.1	0.03	0.46	0.66	0.66	0.012	4.7
	4.43	0.20	0.2	0.05	0.45	0.65	0.65	0.019	7.6
	4.28	0.21	0.1	0.05	0.53	0.76	0.76	0.024	9.4
	4.13	0.18	0.2	0.04	0.42	0.60	0.60	0.016	6.4
rock US	3.98	0.23	0.2	0.05	0.04	0.06	0.06	0.002	0.8
rock US	3.83	0.24	0.2	0.05	0.03	0.04	0.04	0.002	0.6
	3.68	0.26	0.2	0.06	0.17	0.24	0.24	0.010	3.7
	3.53	0.24	0.2	0.05	0.46	0.66	0.66	0.024	9.3
	3.38	0.30	0.2	0.07	0.46	0.66	0.66	0.030	11.7
	3.23	0.30	0.2	0.07	0.41	0.59	0.59	0.027	10.4
	3.08	0.35	0.2	0.09	0.26	0.37	0.37	0.023	9.0
	2.88	0.38	0.2	0.10	0.16	0.23	0.23	0.015	6.0
	2.73	0.26	0.2	0.06	0.11	0.16	0.16	0.006	2.4
	2.58	0.20	0.2	0.05	0.19	0.27	0.27	0.008	3.2
	2.43	0.15	0.2	0.03	0.13	0.19	0.19	0.004	1.5
CF	2.30	0.11	0.1	0.02	0.06	0.09	0.09	0.001	0.4
0	2.20	0.12	0.1	0.02	0	0.00	0.00	0.000	0.0
right bank	2.00	0.00	0.2	0.00	0	0.00	0.00	0.000	0.0
Total Q								**0.255**	**100.0**

General Notes
Survey done on August 11th, 2010 but no flow measurment as Swoffer was broken. Returned August 13th to complete flow measurement. Use average of 2 measurements.

Appendix 2d-1. Manual Discharge Measurements and Levelling Surveys at H2-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H2-Hydro			
Stream Name				
Date Monitored	31-Aug-10			
Time at Site (24 hr)	Start Time:	11:30:00 AM	End Time:	1:00:00 PM
Personnel	M. Soloducha, B. Simpson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 34	0.765	100.765		100.000	
BM 33			1.790	98.975	
WL			3.402	97.363	
BM 35			1.843	98.922	
BM 35	1.755	100.677		**98.922**	
BM 34			0.679	99.998	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 34		99.999		
BM 33		98.975		
BM 35		98.922		

Summary	
Stage (m)	97.363
Discharge (m^3/s)	0.224
Pressure Transducer Reading (m)	0.404
Pressure Transducer Elevation (m)	96.959

Discharge Measurement #1- Mid-Section Method									
Time (24 hr)	Start	11:30	End	11:50	Location	At Station			
Method	Velocity-area (Mid-section)			Calibration constant		610			
Flow Meter Type	Swoffer			Propeller		2"			
Stage (m)	Start	Reading	0.405	Time	11:30				
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	1.65	0.00	0.0	0.00	0			0.000	0.0
	1.70	0.08	0.1	0.01	0.03			0.000	0.1
	1.90	0.08	0.2	0.02	0.18			0.003	1.3
	2.10	0.11	0.2	0.03	0.17			0.004	1.7
	2.30	0.10	0.2	0.03	0.16			0.003	1.4
	2.50	0.15	0.2	0.05	0.43			0.013	5.8
	2.70	0.13	0.2	0.04	0.2			0.005	2.3
	2.90	0.12	0.2	0.04	0.37			0.009	4.0
	3.10	0.19	0.2	0.06	0.27			0.010	4.6
	3.30	0.06	0.2	0.02	0.22			0.003	1.2
rock	3.50	0.03	0.2	0.01	0.06			0.000	0.2
rock	3.70	0.23	0.2	0.07	0.37			0.017	7.6
	3.90	0.20	0.2	0.06	0.43			0.017	7.7
	4.10	0.28	0.2	0.08	0.29			0.016	7.2
	4.30	0.30	0.2	0.09	0.31			0.019	8.3
	4.50	0.35	0.2	0.11	0.38			0.027	11.9
	4.70	0.38	0.2	0.11	0.26			0.020	8.8
	4.90	0.37	0.2	0.11	0.21			0.016	6.9
	5.10	0.38	0.2	0.11	0.28			0.021	9.5
	5.30	0.43	0.2	0.13	0.17			0.015	6.5
	5.50	0.43	0.2	0.13	0.08			0.007	3.1
	5.70	0.45	0.2	0.12	0			0.000	0.0
Right Bank	5.85	0.00	0.2	0.00	0			0.000	0.0
Total Q								**0.224**	**100.0**

General Notes
Use average of 2 measurements.

Appendix 2d-1. Manual Discharge Measurements and Levelling Surveys at H2-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H2-Hydro			
Stream Name				
Date Monitored	31-Aug-10			
Time at Site (24 hr)	Start Time:	11:30:00 AM	End Time:	1:00:00 PM
Personnel	M. Soloducha, B. Simpson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 34	0.765	100.765		100.000	
BM 33			1.790	98.975	
WL			3.402	97.363	
BM 35			1.843	98.922	
BM 35	1.755	100.677		**98.922**	
BM 34			0.679	99.998	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 34		99.999		
BM 33		98.975		
BM 35		98.922		

Summary	
Stage (m)	97.363
Discharge (m^3/s)	0.380
Pressure Transducer Reading (m)	0.404
Pressure Transducer Elevation (m)	96.959

Discharge Measurement #2- Mid-Section Method									
Time (24 hr)	Start	11:50	End	12:10	Location	At Station			
Method	Velocity-area (Mid-section)			Calibration constant		610			
Flow Meter Type	Swoffer			Propeller		2"			
Stage (m)	Start	Reading	0.405	Time	11:30				
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Right Bank	5.85	0.00	0.0	0.00	0			0.000	0.1
	5.60	0.45	0.3	0.16	0.01			0.001	0.4
	5.40	0.44	0.2	0.13	0.04			0.005	1.4
	5.20	0.42	0.2	0.13	0.26			0.033	8.6
	5.00	0.40	0.2	0.12	0.24			0.029	7.6
	4.80	0.38	0.2	0.11	0.23			0.026	6.9
	4.60	0.36	0.2	0.11	0.39			0.042	11.1
	4.40	0.35	0.2	0.11	0.22			0.023	6.1
	4.20	0.31	0.2	0.09	0.31			0.029	7.6
	4.00	0.25	0.2	0.08	0.52			0.039	10.3
	3.80	0.25	0.2	0.08	0.47			0.035	9.3
	3.60	0.24	0.2	0.07	0.38			0.027	7.2
	3.40	0.04	0.2	0.01	0			0.000	0.0
	3.20	0.06	0.2	0.02	0.34			0.006	1.6
	3.00	0.18	0.2	0.05	0.34			0.018	4.8
	2.80	0.14	0.2	0.04	0.42			0.018	4.6
	2.60	0.13	0.2	0.04	0.19			0.007	1.9
	2.40	0.11	0.2	0.03	0.52			0.017	4.5
	2.20	0.08	0.2	0.02	0.23			0.006	1.5
	2.00	0.10	0.2	0.03	0.14			0.004	1.0
	1.80	0.06	0.2	0.02	0.22			0.013	3.5
Left Bank	1.65	0.00	0.2	0.00	0			0.000	0.1
Total Q								**0.380**	**100.0**

General Notes
Use average of 2 measurements.

Appendix 2d-1. Manual Discharge Measurements and Levelling Surveys at H2-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H2-Hydro			
Stream Name				
Date Monitored	3-Sep-10			
Time at Site (24 hr)	Start Time:	2:30:00 PM	End Time:	4:00:00 PM
Personnel	M. Soloducha, B. Simpson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 34	0.571	100.571		100.000	
BM 33			1.596	98.975	
WL			2.907	**97.664**	
CG RB TOP			1.996	98.575	
CG RB BOT			2.475	98.096	
BM 35			1.648	98.923	
BM 35	1.782	100.705		98.923	
BM 34			0.705	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 34		100.000		
BM 33		98.975		
BM 35		98.923		

Summary	
Stage (m)	97.664
Discharge (m^3/s)	2.351
Pressure Transducer Reading (m)	0.609
Pressure Transducer Elevation (m)	97.055

Discharge Measurement #1- Mid-Section Method										
Time (24 hr)	Start	14:00	End	14:20	Location	At Station				
Method	Velocity-area (Mid-section)			Calibration constant						
Flow Meter Type	Swoffer			Propeller						
Stage (m)	Start	Reading	0.405	Time	14:30					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	8.60	0.00	0.0	0.00	0			0.005	0.2
	8.20	0.41	0.4	0.25	0.11			0.018	0.8
	7.80	0.45	0.4	0.27	0.07			0.013	0.5
	7.40	0.44	0.4	0.26	0.69			0.121	5.2
	7.00	0.36	0.4	0.22	1.02			0.147	6.2
	6.60	0.44	0.4	0.26	0.55			0.097	4.1
	6.20	0.60	0.4	0.36	0.71			0.170	7.2
	5.80	0.61	0.4	0.36	0.89			0.215	9.2
	5.40	0.64	0.4	0.38	1.35			0.346	14.7
	5.00	0.55	0.4	0.33	1.28			0.282	12.0
	4.60	0.45	0.4	0.27	0.84			0.151	6.4
	4.20	0.42	0.4	0.25	1.1			0.185	7.9
	3.80	0.44	0.4	0.26	1.25			0.220	9.4
	3.40	0.34	0.4	0.20	1.11			0.151	6.4
	3.00	0.31	0.4	0.18	0.83			0.101	4.3
	2.60	0.27	0.4	0.16	0.61			0.066	2.8
	2.20	0.19	0.4	0.11	0.42			0.032	1.4
	1.80	0.13	0.4	0.08	0.57			0.030	1.3
	1.40	0.05	0.4	0.03	0.09			0.002	0.1
	1.00	0.00	0.4	0.00	0			0.000	0.0
Right Bank	0.60	0.00	0.4	0.00	0			0.000	0.0
Total Q								2.351	100.0

General Notes
Use average of 2 measurements.

Appendix 2d-1. Manual Discharge Measurements and Levelling Surveys at H2-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H2-Hydro			
Stream Name				
Date Monitored	3-Sep-10			
Time at Site (24 hr)	Start Time:	11:30:00 AM	End Time:	1:00:00 PM
Personnel	M. Soloducha, B. Simpson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 34	0.571	100.571		100.000	
BM 33			1.596	98.975	
WL			2.907	**97.664**	
CG RB TOP			1.996	98.575	
CG RB BOT			2.475	98.096	
BM 35			1.648	98.923	
BM 35	1.782	100.705		98.923	
BM 34			0.705	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 34		100.000		
BM 33		98.975		
BM 35		98.923		

Summary	
Stage (m)	97.664
Discharge (m^3/s)	2.425
Pressure Transducer Reading (m)	0.609
Pressure Transducer Elevation (m)	97.055

Discharge Measurement #2- Mid-Section Method										
Time (24 hr)	Start	11:50	End	12:10	Location	At Station				
Method	Velocity-area (Mid-section)			Calibration constant						
Flow Meter Type	Swoffer			Propeller						
Stage (m)	Start	Reading	0.405	Time	14:30					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	0.60	0.00	0.0	0.00	0			0.000	0.0
	0.80	0.02	0.2	0.01	0			0.000	0.0
	1.20	0.04	0.4	0.02	0			0.000	0.0
	1.60	0.05	0.4	0.03	0.07			0.001	0.1
	2.00	0.12	0.4	0.07	0.45			0.022	0.9
	2.40	0.25	0.4	0.15	0.73			0.073	3.0
	2.80	0.29	0.4	0.17	0.98			0.114	4.7
	3.20	0.34	0.4	0.20	1.12			0.152	6.3
	3.60	0.37	0.4	0.22	1.22			0.181	7.4
	4.00	0.43	0.4	0.26	1.18			0.203	8.4
	4.40	0.45	0.4	0.27	0.95			0.171	7.1
	4.80	0.52	0.4	0.31	1.31			0.272	11.2
	5.20	0.60	0.4	0.36	1.47			0.353	14.5
	5.60	0.61	0.4	0.37	1.34			0.327	13.5
	6.00	0.47	0.4	0.28	0.79			0.149	6.1
	6.40	0.45	0.4	0.27	0.48			0.086	3.6
	6.80	0.41	0.4	0.25	0.81			0.133	5.5
	7.20	0.40	0.4	0.24	0.79			0.126	5.2
	7.60	0.18	0.4	0.11	0.47			0.033	1.4
	8.00	0.42	0.4	0.25	0.15			0.025	1.0
	8.40	0.36	0.4	0.18	0.03			0.003	0.1
Right Bank	8.60	0.00	0.2	0.00	0			0.001	0.0
Total Q								**2.425**	**100.0**

General Notes
Use average of 2 measurements.

Appendix 2d-1. Manual Discharge Measurements and Levelling Surveys at H2-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H2-Hydro			
Stream Name				
Date Monitored	23-Oct-10			
Time at Site (24 hr)	Start Time:	3:00:00 PM	End Time:	5:00:00 PM
Personnel	M. Soloducha, M. Jenkins			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 34	0.749	100.749		100.000	
BM 33			1.773	98.976	
BM 35			1.823	98.926	
WL			3.402	**97.347**	**(+0.173)**
WL	3.304	100.651			
BM 34			0.650	100.001	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 34		100.001		
BM 33		98.976		
BM 35		98.926		

Summary	
Stage (m)	97.520
Discharge (m^3/s)	0.921
Pressure Transducer Reading (m)	0.551
Pressure Transducer Elevation (m)	96.969

Discharge Measurement #1- Mid-Section Method									
Time (24 hr)	Start	15:00	End	15:20	Location	At Station			
Method	Velocity-area (Mid-section)			Instrument Model		FM 2000			
Flow Meter Type	Flo-Mate			Serial #					
Stage (m)	Start	Reading	0.551	Time	15:00				
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Right Bank	7.60	0.00	0.0	0.00	0			0.003	0.4
	7.30	0.55	0.3	0.25	0.16			0.026	2.9
	7.00	0.54	0.3	0.24	0.19			0.031	3.3
	6.70	0.52	0.3	0.23	0.47			0.073	8.0
	6.40	0.54	0.3	0.24	0.57			0.092	10.0
	6.10	0.47	0.3	0.21	0.42			0.059	6.4
	5.80	0.40	0.3	0.18	0.56			0.067	7.3
	5.50	0.38	0.3	0.17	0.93			0.106	11.5
	5.20	0.30	0.3	0.14	0.57			0.051	5.6
	4.90	0.36	0.3	0.16	0.81			0.087	9.5
	4.60	0.34	0.3	0.15	0.89			0.091	9.9
	4.30	0.30	0.3	0.14	0.79			0.071	7.7
	4.00	0.28	0.3	0.13	0.65			0.055	5.9
	3.70	0.20	0.3	0.09	0.5			0.030	3.3
	3.40	0.26	0.3	0.12	0.7			0.055	5.9
	3.10	0.18	0.3	0.08	0.36			0.019	2.1
	2.80	0.12	0.3	0.05	0.06			0.002	0.2
	2.50	0.02	0.3	0.01	0.18			0.001	0.1
	2.20	0.02	0.3	0.01	0			0.000	0.0
	1.90	0.02	0.3	0.01	0.06			0.000	0.0
	1.60	0.01	0.3	0.00	0			0.000	0.0
Left Bank	1.40	0.00	0.2	0.00	0			0.000	0.0
Total Q								**0.921**	**100.0**

General Notes
Use average of 2 measurements.

Appendix 2d-1. Manual Discharge Measurements and Levelling Surveys at H2-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H2-Hydro			
Stream Name				
Date Monitored	23-Oct-10			
Time at Site (24 hr)	Start Time:	3:00:00 PM	End Time:	5:00:00 PM
Personnel	M. Soloducha, M. Jenkins			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 34	0.749	100.749		100.000	
BM 33			1.773	98.976	
BM 35			1.823	98.926	
WL			3.402	**97.347**	**(+0.173)**
WL	3.304	100.651			
BM 34			0.650	100.001	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 34		100.001		
BM 33		98.976		
BM 35		98.926		

Summary	
Stage (m)	97.520
Discharge (m^3/s)	1.038
Pressure Transducer Reading (m)	0.551
Pressure Transducer Elevation (m)	96.969

Discharge Measurement #1- Mid-Section Method										
Time (24 hr)	Start	15:20	End	15:40	Location	At Station				
Method	Velocity-area (Mid-section)			Instrument Model		FM 2000				
Flow Meter Type	Flo-Mate			Serial #						
Stage (m)	Start	Reading	0.551	Time	15:00					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	1.40	0.00	0.0	0.00	0			0.000	0.0
	1.70	0.02	0.3	0.01	0			0.000	0.0
	2.00	0.02	0.3	0.01	0.13			0.001	0.1
	2.30	0.02	0.3	0.01	0.13			0.001	0.1
	2.70	0.10	0.4	0.06	-0.04			-0.001	-0.1
	3.00	0.13	0.3	0.06	0.34			0.013	1.3
	3.30	0.23	0.3	0.10	0.56			0.039	3.7
	3.60	0.22	0.3	0.10	0.52			0.034	3.3
	3.90	0.28	0.3	0.13	0.64			0.054	5.2
	4.20	0.27	0.3	0.12	0.76			0.062	5.9
	4.50	0.36	0.3	0.16	0.85			0.092	8.8
	4.80	0.36	0.3	0.16	0.8			0.086	8.3
	5.10	0.30	0.3	0.14	0.8			0.072	6.9
	5.40	0.38	0.3	0.17	0.96			0.109	10.5
	5.70	0.42	0.3	0.19	1.03			0.130	12.5
	6.00	0.43	0.3	0.19	0.62			0.080	7.7
	6.30	0.50	0.3	0.23	0.72			0.108	10.4
	6.60	0.52	0.3	0.23	0.67			0.105	10.1
	6.90	0.52	0.3	0.23	0.18			0.028	2.7
	7.20	0.56	0.3	0.25	0.1			0.017	1.6
	7.50	0.50	0.3	0.18	0.08			0.008	0.8
Right Bank	7.60	0.00	0.1	0.00	0			0.001	0.1
Total Q								**1.038**	**100.0**

General Notes
Use average of 2 measurements.

Appendix 2d-2. Manual Discharge Measurements and Levelling Surveys at H2-Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H2-Hydro			
Stream Name				
Date Monitored	19-Mar-11			
Time at Site (24 hr)	Start Time:	1:10:00 PM	End Time:	4:00:00 PM
Personnel	M. Soloducha, K. Johnson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 34	1.176	101.176		100.000	
BM 33			2.198	98.978	
WL			3.932	97.244	
TP	3.805	101.193	3.788	97.388	
WL			3.947	**97.246**	
BM 33			2.214	98.979	
BM 34			1.193	**100.000**	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 34		100.000		
BM 33		98.979		

Summary	
Stage (m)	97.245
Discharge (m^3/s)	0.1
Pressure Transducer Reading (m)	0.290
Pressure Transducer Elevation (m)	96.955

Discharge Measurement #1- Mid-Section Method									
Time (24 hr)	Start	13:10	End	13:30	Location	At Station			
Method	Velocity-area (Mid-section)			Instrument Model		FM 2000			
Flow Meter Type	Flo-Mate			Serial #					
Stage (m)	Start	Reading	0.290	Time	13:10				
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
right bank	0.40	0.00	0.0	0.00	0			0.000	0.1
CF	0.55	0.08	0.2	0.02	0.01			0.000	0.2
0	0.70	0.10	0.2	0.02	0.05			0.001	1.3
	0.85	0.16	0.2	0.04	0.15			0.004	6.1
	1.00	0.15	0.2	0.03	0.17			0.004	6.4
	1.15	0.14	0.2	0.03	0.26			0.005	9.2
	1.30	0.15	0.2	0.03	0.32			0.007	12.1
	1.45	0.17	0.2	0.04	0.35			0.009	15.0
	1.60	0.16	0.2	0.04	0.23			0.006	9.3
	1.75	0.17	0.2	0.04	0.23			0.006	9.9
	1.90	0.11	0.2	0.02	0.28			0.005	7.8
	2.05	0.11	0.2	0.02	0.2			0.003	5.6
	2.20	0.11	0.2	0.02	0.11			0.002	3.1
	2.35	0.00	0.2	0.00	0			0.000	0.0
	2.60	0.10	0.3	0.03	0.29			0.006	9.8
	2.75	0.10	0.2	0.02	0.13			0.002	3.3
	2.90	0.08	0.2	0.02	0.05			0.001	1.0
	3.05	0.07	0.2	0.02	0.01			0.000	0.2
CF	3.20	0.02	0.2	0.00	-0.03			0.000	-0.1
0	3.30	0.02	0.1	0.00	-0.01			0.000	0.0
left bank	3.40	0.00	0.1	0.00	0			0.000	0.0
Total Q								0.059	100.0

General Notes

Appendix 2e-1. Manual Discharge Measurements and Levelling Surveys at H3-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H3-Hydro			
Stream Name				
Date Monitored	7-Jul-10			
Time at Site (24 hr)	Start Time:	2:00:00 PM	End Time:	4:00:00 PM
Personnel	M. Soloducha, X. Pinto			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 028	0.909	100.909		100.000	
BM 029			0.635	100.274	
WL			2.550	**98.359**	
BM 008			1.217	99.692	
	1.186	100.878			
BM 028			0.877	100.001	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 028		100.001		
BM 029		100.274		
BM 008		99.692		

Summary	
Stage (m)	98.359
Discharge (m^3/s)	0.9
Pressure Transducer Reading (m)	0.414
Pressure Transducer Elevation (m)	97.945

Discharge Measurement #1- Mid-Section Method										
Time (24 hr)	Start	14:00	End	14:20	Location	At Station				
Method	Velocity-area (Mid-section)			Indicator Constant		615				
Flow Meter Type	Swoffer			Propellor Size		2"				
Stage (m)	Start	Reading	0.414	Time	14:00					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
right bank	3.40	0.00	0.0	0.00	0			0.000	0.0
CF	3.45	0.15	0.1	0.02	0.04			0.001	0.1
0.5	3.60	0.12	0.2	0.03	0.03			0.001	0.1
	3.75	0.17	0.2	0.04	0.34			0.009	1.0
	3.90	0.17	0.2	0.04	0.37			0.009	1.0
	4.05	0.21	0.2	0.05	0.81			0.026	2.8
	4.20	0.21	0.2	0.05	0.56			0.018	1.9
	4.35	0.22	0.1	0.05	0.45			0.015	1.6
	4.50	0.20	0.2	0.05	0.74			0.022	2.4
	4.65	0.48	0.2	0.11	0.99			0.071	7.8
grass upstream	4.80	0.38	0.1	0.09	0.72			0.041	4.5
	4.95	0.40	0.2	0.09	0.34			0.020	2.2
	5.10	0.40	0.1	0.09	1.15			0.069	7.6
	5.25	0.40	0.2	0.09	1.2			0.072	7.9
	5.40	0.44	0.2	0.10	1.24			0.082	9.0
	5.55	0.41	0.1	0.09	1.26			0.077	8.5
	5.70	0.36	0.2	0.08	0.94			0.051	5.6
	5.85	0.38	0.1	0.08	1.06			0.060	6.5
	6.00	0.29	0.2	0.07	1.01			0.044	4.8
	6.15	0.42	0.2	0.09	0.94			0.059	6.5
	6.30	0.42	0.1	0.09	0.73			0.045	5.0
	6.45	0.45	0.2	0.10	0.71			0.048	5.3
CF	6.60	0.46	0.1	0.10	0.73			0.050	5.5
0.75	6.75	0.25	0.2	0.05	0.55			0.017	1.9
left bank	6.85	0.00	0.1	0.00	0			0.005	0.6
Total Q								**0.912**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2e-1. Manual Discharge Measurements and Levelling Surveys at H3-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H3-Hydro			
Stream Name				
Date Monitored	7-Jul-10			
Time at Site (24 hr)	Start Time:	2:00:00 PM	End Time:	4:00:00 PM
Personnel	M. Soloducha, X. Pinto			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 028	0.909	100.909		100.000	
BM 029			0.635	100.274	
WL			2.550	**98.359**	
BM 008			1.217	99.692	
	1.186	100.878			
BM 028			0.877	100.001	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 028		100.001		
BM 029		100.274		
BM 008		99.692		

Summary	
Stage (m)	98.359
Discharge (m^3/s)	1.0
Pressure Transducer Reading (m)	0.414
Pressure Transducer Elevation (m)	97.945

Discharge Measurement #2- Mid-Section Method										
Time (24 hr)	Start	14:20	End	14:40	Location	At Station				
Method	Velocity-area (Mid-section)			Indicator Constant		615				
Flow Meter Type	Swoffer			Propellor Size		2"				
Stage (m)	Start	Reading	0.414	Time	14:00					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
left bank	6.85	0.00	0.0	0.00	0			0.003	0.3
CF	6.80	0.13	0.0	0.02	0.21			0.034	3.5
0.75	6.65	0.33	0.1	0.07	0.68			0.043	4.5
	6.50	0.42	0.2	0.09	0.68			0.052	5.5
	6.35	0.45	0.2	0.10	0.77			0.053	5.6
	6.20	0.42	0.1	0.09	0.85			0.065	6.8
	6.05	0.43	0.2	0.10	1.01			0.059	6.2
	5.90	0.36	0.1	0.08	1.1			0.064	6.7
	5.75	0.41	0.2	0.09	1.04			0.063	6.7
	5.60	0.45	0.2	0.10	0.94			0.087	9.2
	5.45	0.44	0.1	0.10	1.32			0.088	9.3
	5.30	0.45	0.1	0.10	1.31			0.083	8.7
	5.15	0.40	0.1	0.09	1.38			0.039	4.1
	5.00	0.41	0.2	0.09	0.63			0.035	3.7
	4.85	0.40	0.1	0.09	0.59			0.045	4.7
	4.70	0.40	0.2	0.08	0.89			0.032	3.3
	4.60	0.31	0.1	0.05	0.82			0.022	2.3
	4.45	0.21	0.1	0.05	0.72			0.018	1.9
	4.30	0.23	0.2	0.05	0.54			0.022	2.4
	4.15	0.21	0.1	0.05	0.71			0.027	2.9
	4.00	0.22	0.2	0.05	0.83			0.010	1.0
	3.85	0.17	0.2	0.04	0.38			0.007	0.7
	3.70	0.15	0.2	0.03	0.29			0.001	0.1
CF	3.55	0.14	0.2	0.03	0.03			0.000	0.0
0.5	3.45	0.16	0.1	0.02	0.02			0.000	0.0
right bank	3.40	0.00	0.1	0.00	0				
Total Q								**0.951**	**99.9**

General Notes
Use average of 2 measurements

Appendix 2e-1. Manual Discharge Measurements and Levelling Surveys at H3-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H3-Hydro			
Stream Name				
Date Monitored	13-Aug-10			
Time at Site (24 hr)	Start Time:	9:45:00 AM	End Time:	11:30:00 AM
Personnel	X. Pinto, S. Boha			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 028	0.950	100.950		100.000	
BM 029			0.676	100.274	
WL			2.866	**98.084**	
BM 008			1.259	99.691	
	1.230	100.921		**98.084**	
BM 028			0.919	100.002	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 028		100.001		
BM 029		100.274		
BM 008		99.691		

Summary	
Stage (m)	98.084
Discharge (m^3/s)	0.120
Pressure Transducer Reading (m)	0.170
Pressure Transducer Elevation (m)	97.914

Discharge Measurement #1- Mid-Section Method										
Time (24 hr)	Start	9:45	End	10:05	Location	0.5m DS of station				
Method	Velocity-area (Mid-section)			Indicator Constant		608				
Flow Meter Type	Swoffer			Calibration constant		426				
Stage (m)	Start	Reading	0.170	Time	9:45					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity	Conv. Vel.	Cal. Vel	Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	(m/s)	3"	(m/s)	(m3/s)	%
right bank	2.70	0.00	0.0	0.00	0		0.00	0.000	0.0
	2.60	0.09	0.1	0.01	0		0.00	0.000	0.0
	2.50	0.08	0.1	0.01	0.08		0.11	0.001	0.8
	2.40	0.08	0.1	0.01	0.13		0.19	0.001	1.2
	2.30	0.07	0.1	0.01	0.1		0.14	0.001	0.8
	2.20	0.16	0.1	0.02	0.11		0.16	0.003	2.1
	2.10	0.16	0.1	0.02	0.21		0.30	0.005	4.0
	2.00	0.18	0.1	0.03	0.34		0.49	0.009	7.3
	1.90	0.19	0.1	0.03	0.45		0.64	0.012	10.2
	1.80	0.20	0.1	0.03	0.46		0.66	0.013	11.0
grass upstream	1.70	0.15	0.1	0.02	0.42		0.60	0.009	7.5
	1.60	0.11	0.1	0.02	0.4		0.57	0.006	5.3
	1.50	0.11	0.1	0.02	0.3		0.43	0.005	3.9
	1.40	0.15	0.1	0.02	0.21		0.30	0.004	3.8
	1.30	0.15	0.1	0.02	0.24		0.34	0.005	4.3
	1.20	0.15	0.1	0.02	0.34		0.49	0.007	6.1
	1.10	0.16	0.1	0.02	0.32		0.46	0.007	6.1
	1.00	0.14	0.1	0.02	0.31		0.44	0.006	5.2
	0.90	0.15	0.1	0.02	0.24		0.34	0.005	4.3
	0.80	0.21	0.1	0.03	0.27		0.39	0.008	6.8
	0.70	0.20	0.1	0.03	0.31		0.44	0.009	7.4
	0.60	0.09	0.1	0.01	0.12		0.17	0.002	1.3
left bank	0.50	0.00	0.1	0.00	0		0.00	0.001	0.6
Total Q								**0.120**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2e-1. Manual Discharge Measurements and Levelling Surveys at H3-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H3-Hydro			
Stream Name				
Date Monitored	13-Aug-10			
Time at Site (24 hr)	Start Time:	9:45:00 AM	End Time:	11:30:00 AM
Personnel	X. Pinto, S. Boha			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 028	0.950	100.950		100.000	
BM 029			0.676	100.274	
WL			2.866	**98.084**	
BM 008			1.259	99.691	
	1.230	100.921		**98.084**	
BM 028			0.919	100.002	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 028		100.001		
BM 029		100.274		
BM 008		99.691		

Summary	
Stage (m)	98.084
Discharge (m^3/s)	0.103
Pressure Transducer Reading (m)	0.170
Pressure Transducer Elevation (m)	97.914

Discharge Measurement #2- Mid-Section Method										
Time (24 hr)	Start	10:05	End	10:25	Location	0.5m DS of station				
Method	Velocity-area (Mid-section)			Indicator Constant		608				
Flow Meter Type	Swoffer			Calibration constant		426				
Stage (m)	Start	Reading	0.170	Time	9:45					
	End	Reading		Time						

Notes	Station (m)	Depth (m)	Distance (m)	Area (m^2)	Velocity (m/s)	Conv. Vel. 3"	Cal. Vel (m/s)	Q (m3/s)	% of Total Q %
left bank	0.50	0.00	0.0	0.00	0		0.00	0.000	0.3
	0.55	0.04	0.1	0.00	0.19		0.27	0.001	0.8
	0.65	0.20	0.1	0.03	0.27		0.39	0.008	7.5
	0.75	0.20	0.1	0.03	0.27		0.39	0.008	7.5
	0.85	0.20	0.1	0.03	0.26		0.37	0.007	7.2
	0.95	0.16	0.1	0.02	0.29		0.41	0.007	6.4
	1.05	0.15	0.1	0.02	0.3		0.43	0.006	6.2
	1.15	0.16	0.1	0.02	0.36		0.51	0.008	8.0
	1.25	0.14	0.1	0.02	0.31		0.44	0.006	6.0
	1.35	0.13	0.1	0.02	0.26		0.37	0.005	4.7
	1.45	0.12	0.1	0.02	0.3		0.43	0.005	5.0
	1.55	0.10	0.1	0.02	0.37		0.53	0.005	5.1
	1.65	0.12	0.1	0.02	0.49		0.70	0.008	8.1
	1.75	0.16	0.1	0.02	0.39		0.56	0.009	8.6
	1.85	0.14	0.1	0.02	0.38		0.54	0.008	7.3
	1.95	0.11	0.1	0.02	0.29		0.41	0.005	4.4
	2.05	0.08	0.1	0.01	0.22		0.31	0.003	2.4
	2.15	0.11	0.1	0.02	0.07		0.10	0.001	1.1
	2.25	0.16	0.1	0.02	0.12		0.17	0.003	2.7
	2.35	0.07	0.1	0.01	0.09		0.13	0.001	0.9
	2.45	0.05	0.1	0.01	0.01		0.01	0.000	0.1
	2.55	0.05	0.1	0.01	0		0.00	0.000	0.0
right bank	2.70	0.00	0.2	0.00	0		0.00	0.000	0.0
Total Q								**0.103**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2e-1. Manual Discharge Measurements and Levelling Surveys at H3-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H3-Hydro			
Stream Name				
Date Monitored	31-Aug-10			
Time at Site (24 hr)	Start Time:	4:00:00 PM	End Time:	6:00:00 PM
Personnel	M. Soloducha, B. Simpson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM028	0.863	100.863		100.000	
BM029			0.586	100.277	
WL			3.117	**97.746**	
BM008			1.169	99.694	
BM008	1.038	100.732		**99.694**	
BM028			0.731	100.001	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM028		100.001		
BM029		100.277		
BM008		99.694		

Summary	
Stage (m)	97.746
Discharge (m^3/s)	0.091
Pressure Transducer Reading (m)	0.172
Pressure Transducer Elevation (m)	97.574

Discharge Measurement #1- Mid-Section Method										
Time (24 hr)	Start	16:00	End	16:20	Location	At Station				
Method	Velocity-area (Mid-section)			Calibration constant		608				
Flow Meter Type	Swoffer			Propeller Size		2"				
Stage (m)	Start	Reading	0.172	Time	16:00	Correction Factor 0.5				
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	4.40	0.00	0.0	0.00	0			0.001	0.7
	4.30	0.15	0.1	0.02	0.16			0.002	2.6
	4.20	0.13	0.1	0.02	0.12			0.002	1.7
	4.10	0.15	0.1	0.02	0.09			0.001	1.5
	4.00	0.15	0.1	0.02	0.09			0.001	1.5
	3.90	0.20	0.1	0.03	0.01			0.000	0.2
	3.80	0.22	0.1	0.03	0.02			0.000	0.5
	3.70	0.25	0.1	0.04	0.02			0.000	0.6
	3.60	0.30	0.1	0.05	0.04			0.001	1.3
	3.50	0.33	0.1	0.05	0.04			0.001	1.5
	3.40	0.29	0.1	0.04	0.05			0.001	1.6
	3.30	0.30	0.1	0.05	0.06			0.002	2.0
	3.20	0.33	0.1	0.05	0.15			0.005	5.5
	3.10	0.32	0.1	0.05	0.13			0.004	4.6
	3.00	0.35	0.1	0.05	0.34			0.012	13.1
	2.90	0.26	0.1	0.04	0.26			0.007	7.5
	2.80	0.27	0.1	0.04	0.31			0.008	9.2
	2.70	0.18	0.1	0.03	0.41			0.007	8.1
	2.60	0.20	0.1	0.03	0.56			0.011	12.3
	2.50	0.25	0.1	0.04	0.21			0.005	5.8
	2.40	0.16	0.1	0.02	0.33			0.005	5.8
	2.30	0.20	0.1	0.03	0.15			0.003	3.3
	2.20	0.15	0.1	0.02	0.13			0.002	2.1
	2.10	0.15	0.1	0.02	0.08			0.001	1.3
	2.00	0.10	0.1	0.02	0.35			0.004	3.9
	1.90	0.11	0.1	0.01	0.17			0.001	1.5
Right Bank	1.85	0.00	0.0	0.00	0			0.000	0.3
Total Q								**0.091**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2e-1. Manual Discharge Measurements and Levelling Surveys at H3-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H3-Hydro			
Stream Name				
Date Monitored	31-Aug-10			
Time at Site (24 hr)	Start Time:	4:00:00 PM	End Time:	6:00:00 PM
Personnel	M. Soloducha, B. Simpson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM028	0.863	100.863		100.000	
BM029			0.586	100.277	
WL			3.117	**97.746**	
BM008			1.169	99.694	
BM008	1.038	100.732		**99.694**	
BM028			0.731	100.001	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM028		100.001		
BM029		100.277		
BM008		99.694		

Summary	
Stage (m)	97.746
Discharge (m^3/s)	0.075
Pressure Transducer Reading (m)	0.172
Pressure Transducer Elevation (m)	97.574

Discharge Measurement #2- Mid-Section Method										
Time (24 hr)	Start	16:20	End	16:40	Location	At Station				
Method	Velocity-area (Mid-section)			Calibration constant		608				
Flow Meter Type	Swoffer			Propeller size		2"				
Stage (m)	Start	Reading	0.172	Time	16:00	Correction Factor 0.5				
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Right Bank	1.85	0.00	0.0	0.00	0			0.000	0.3
	1.95	0.15	0.1	0.02	0.06			0.001	1.2
	2.05	0.10	0.1	0.02	0.28			0.003	3.7
	2.15	0.18	0.1	0.03	0.15			0.003	3.6
	2.25	0.15	0.1	0.02	0.24			0.004	4.8
	2.35	0.17	0.1	0.03	0.21			0.004	4.8
	2.45	0.25	0.1	0.04	0.15			0.004	5.0
	2.55	0.20	0.1	0.03	0.52			0.010	13.9
	2.65	0.21	0.1	0.03	0.39			0.008	10.9
	2.75	0.30	0.1	0.05	0.4			0.012	16.0
	2.85	0.24	0.1	0.04	0.13			0.003	4.2
	2.95	0.22	0.1	0.03	0.13			0.003	3.8
	3.05	0.31	0.1	0.05	0.23			0.007	9.5
	3.15	0.34	0.1	0.05	0.06			0.002	2.7
	3.25	0.35	0.1	0.05	0.07			0.002	3.3
	3.35	0.31	0.1	0.05	0.06			0.002	2.5
	3.45	0.32	0.1	0.05	0.03			0.001	1.3
	3.55	0.29	0.1	0.04	0.01			0.000	0.4
	3.65	0.28	0.1	0.04	0.02			0.001	0.7
	3.75	0.24	0.1	0.04	0.01			0.000	0.3
	3.85	0.21	0.1	0.03	0.03			0.001	0.8
	3.95	0.17	0.1	0.03	0			0.000	0.0
	4.05	0.16	0.1	0.02	0.08			0.001	1.7
	4.15	0.14	0.1	0.02	0.03			0.000	0.6
	4.25	0.13	0.1	0.02	0.09			0.001	1.6
	4.35	0.15	0.1	0.02	0.14			0.002	2.1
Left Bank	4.40	0.00	0.1	0.00	0			0.000	0.4
Total Q								**0.075**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2e-1. Manual Discharge Measurements and Levelling Surveys at H3-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H3-Hydro			
Stream Name				
Date Monitored	3-Sep-10			
Time at Site (24 hr)	Start Time:	10:20:00 AM	End Time:	12:00:00 PM
Personnel	M. Soloducha, B. Simpson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM028	0.992	100.992		100.000	
BM029			0.718	100.274	
WL			3.008	**97.984**	
CG LB			1.408	99.584	
BM008			1.304	99.688	
BM008	1.242	100.930			
BM028			0.931	99.999	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM028		100.000		
BM029		100.274		
CG LB		99.584		

Summary	
Stage (m)	97.984
Discharge (m^3/s)	1.238
Pressure Transducer Reading (m)	0.494
Pressure Transducer Elevation (m)	97.490

Discharge Measurement #1- Mid-Section Method										
Time (24 hr)	Start	10:20	End	10:40	Location	At Station				
Method	Velocity-area (Mid-section)			Calibration constant						
Flow Meter Type	Swoffer			Propeller size		2"				
Stage (m)	Start	Reading	0.494	Time	10:20	Correction Factor 0.5				
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	5.25	0.00	0.0	0.00	0			0.003	0.3
	5.20	0.34	0.0	0.03	0.82			0.021	1.7
	5.10	0.31	0.1	0.05	1.07			0.033	2.7
	5.00	0.34	0.1	0.05	1.05			0.036	2.9
	4.90	0.46	0.1	0.07	1.05			0.048	3.9
	4.80	0.44	0.1	0.07	1.07			0.047	3.8
	4.70	0.48	0.1	0.07	1.47			0.071	5.7
	4.60	0.46	0.1	0.07	1.33			0.061	4.9
	4.50	0.52	0.1	0.08	1.33			0.069	5.6
	4.40	0.51	0.1	0.08	0.93			0.047	3.8
	4.30	0.54	0.1	0.08	0.79			0.043	3.4
	4.20	0.55	0.1	0.08	0.74			0.041	3.3
	4.10	0.59	0.1	0.09	0.81			0.048	3.9
	4.00	0.58	0.1	0.09	1.31			0.076	6.1
	3.90	0.60	0.1	0.09	1.41			0.084	6.8
	3.80	0.54	0.1	0.08	1.63			0.088	7.1
	3.70	0.53	0.1	0.08	1.43			0.076	6.1
	3.60	0.52	0.1	0.08	0.51			0.027	2.1
	3.50	0.48	0.1	0.07	0.44			0.021	1.7
	3.40	0.43	0.1	0.06	0.74			0.032	2.6
	3.30	0.36	0.1	0.05	1.03			0.037	3.0
	3.20	0.33	0.1	0.05	1.11			0.037	3.0
	3.10	0.32	0.1	0.05	0.84			0.026	2.1
	3.00	0.30	0.1	0.05	0.67			0.020	1.6
	2.90	0.28	0.1	0.04	0.87			0.024	2.0
	2.80	0.31	0.1	0.05	0.61			0.019	1.5
	2.70	0.27	0.1	0.04	0.82			0.022	1.8
	2.60	0.36	0.1	0.05	0.8			0.029	2.3
	2.50	0.18	0.1	0.03	0.89			0.016	1.3
	2.40	0.20	0.1	0.03	0.88			0.018	1.4
	2.30	0.17	0.1	0.03	0.9			0.015	1.2
	2.20	0.16	0.1	0.02	0.06			0.001	0.1
	2.10	0.13	0.1	0.02	0.16			0.002	0.2
Right Bank	2.00	0.00	0.1	0.00	0			0.000	0.0
Total Q								**1.238**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2e-1. Manual Discharge Measurements and Levelling Surveys at H3-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H3-Hydro			
Stream Name				
Date Monitored	3-Sep-10			
Time at Site (24 hr)	Start Time:	10:20:00 AM	End Time:	12:00:00 PM
Personnel	M. Soloducha, B. Simpson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM028	0.992	100.992		100.000	
BM029			0.718	100.274	
WL			3.008	**97.984**	
CG LB			1.408	99.584	
BM008			1.304	99.688	
BM008	1.242	100.930			
BM028			0.931	99.999	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM028		100.000		
BM029		100.274		
CG LB		99.584		

Summary	
Stage (m)	97.984
Discharge (m^3/s)	1.311
Pressure Transducer Reading (m)	0.494
Pressure Transducer Elevation (m)	97.490

Discharge Measurement #2- Mid-Section Method										
Time (24 hr)	Start	10:40	End	11:00	Location	At Station				
Method	Velocity-area (Mid-section)			Calibration constant						
Flow Meter Type	Swoffer			Propeller size		2"				
Stage (m)	Start	Reading	0.494	Time	10:20	Correction Factor 0.5				
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Right Bank	2.00	0.00	0.0	0.00	0			0.000	0.0
	2.05	0.09	0.0	0.01	0.15			0.001	0.1
	2.15	0.12	0.1	0.02	0.05			0.001	0.0
	2.25	0.21	0.1	0.03	0.66			0.014	1.0
	2.35	0.34	0.1	0.05	0.84			0.029	2.2
	2.45	0.25	0.1	0.04	0.8			0.020	1.5
	2.55	0.24	0.1	0.04	0.87			0.021	1.6
	2.65	0.26	0.1	0.04	0.69			0.018	1.4
	2.75	0.26	0.1	0.04	0.74			0.019	1.5
	2.85	0.29	0.1	0.04	0.72			0.021	1.6
	2.95	0.29	0.1	0.04	1			0.029	2.2
	3.05	0.30	0.1	0.04	0.87			0.026	2.0
	3.15	0.33	0.1	0.05	0.58			0.019	1.5
	3.25	0.36	0.1	0.05	1.12			0.040	3.1
	3.35	0.36	0.1	0.05	0.87			0.031	2.4
	3.45	0.46	0.1	0.07	0.51			0.023	1.8
	3.55	0.52	0.1	0.08	1.02			0.053	4.0
	3.65	0.53	0.1	0.08	1.41			0.075	5.7
	3.75	0.60	0.1	0.09	1.48			0.089	6.8
	3.85	0.61	0.1	0.09	1.36			0.083	6.3
	3.95	0.58	0.1	0.09	1.35			0.078	6.0
	4.05	0.54	0.1	0.08	0.9			0.049	3.7
	4.15	0.54	0.1	0.08	0.96			0.052	4.0
	4.25	0.53	0.1	0.08	1.03			0.054	4.1
	4.35	0.53	0.1	0.08	1.25			0.066	5.1
	4.45	0.51	0.1	0.08	1.38			0.070	5.4
	4.55	0.55	0.1	0.08	1.17			0.064	4.9
	4.65	0.48	0.1	0.07	1.17			0.056	4.3
	4.75	0.54	0.1	0.08	1.42			0.077	5.8
	4.85	0.43	0.1	0.06	0.95			0.041	3.1
	4.95	0.39	0.1	0.06	0.69			0.027	2.1
	5.05	0.51	0.1	0.08	0.62			0.031	2.4
	5.15	0.46	0.1	0.07	0.76			0.035	2.7
Left Bank	5.25	0.00	0.1	0.00	0			0.000	0.0
Total Q								**1.311**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2e-1. Manual Discharge Measurements and Levelling Surveys at H3-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H3-Hydro			
Stream Name				
Date Monitored	22-Oct-10			
Time at Site (24 hr)	Start Time:	10:37:00 AM	End Time:	12:10:00 PM
Personnel	M. Soloducha,M. Jenkins			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM028	1.031	101.031		100.000	
BM029			0.756	100.275	
BM008			1.341	**99.690**	
CG RB			1.683	99.348	
CG LB			2.655	**98.376**	
WL			3.232	97.799	**(+0.257)**
WL	3.245	101.044			
CG RB			1.698	99.346	
CG LB			2.678	98.366	
BM008			1.355	99.689	
BM029			0.769	100.275	
BM028			**1.0**	**100.0**	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM028		100.000		
BM029		100.275		
BM008		99.690		

Summary	
Stage (m)	98.056
Discharge (m^3/s)	0.211
Pressure Transducer Reading (m)	0.165
Pressure Transducer Elevation (m)	97.891

Discharge Measurement #1- Mid-Section Method										
Time (24 hr)	Start	10:40	End	11:02	Location	At Station				
Method	Velocity-area (Mid-section)			Instrument Model		FM 2000				
Flow Meter Type	Flo-Mate			Serial #						
Stage (m)	Start	Reading	0.165	Time	10:37					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	0.85	0.00	0.0	0.00	0			0.000	0.0
	1.00	0.37	0.2	0.08	0.04			0.002	1.1
	1.15	0.36	0.2	0.08	0.16			0.009	4.1
	1.30	0.36	0.2	0.08	0.24			0.013	6.1
	1.45	0.28	0.2	0.06	0.27			0.011	5.4
	1.60	0.22	0.2	0.05	0.28			0.009	4.4
	1.75	0.27	0.2	0.06	0.19			0.008	3.6
	1.90	0.27	0.2	0.06	0.35			0.014	6.7
	2.05	0.30	0.2	0.07	0.4			0.018	8.5
	2.20	0.31	0.2	0.07	0.49			0.023	10.8
	2.35	0.26	0.2	0.06	0.37			0.014	6.8
	2.50	0.24	0.2	0.05	0.37			0.013	6.3
	2.65	0.22	0.2	0.05	0.44			0.015	6.9
	2.80	0.22	0.2	0.05	0.52			0.017	8.1
	2.95	0.22	0.2	0.05	0.33			0.011	5.2
	3.10	0.16	0.2	0.04	0.63			0.015	7.2
	3.25	0.11	0.2	0.02	0.58			0.010	4.5
	3.40	0.10	0.2	0.02	0.36			0.005	2.6
	3.55	0.08	0.2	0.02	0.21			0.003	1.2
	3.70	0.08	0.2	0.02	0.11			0.001	0.6
Right Bank	3.85	0.00	0.2	0.00	0			0.000	0.0
Total Q								**0.211**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2e-1. Manual Discharge Measurements and Levelling Surveys at H3-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H3-Hydro			
Stream Name				
Date Monitored	22-Oct-10			
Time at Site (24 hr)	Start Time:	10:37:00 AM	End Time:	12:10:00 PM
Personnel	M. Soloducha,M. Jenkins			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM028	1.031	101.031		100.000	
BM029			0.756	100.275	
BM008			1.341	**99.690**	
CG RB			1.683	99.348	
CG LB			2.655	**98.376**	
WL			3.232	97.799	**(+0.257)**
WL	3.245	101.044			
CG RB			1.698	99.346	
CG LB			2.678	98.366	
BM008			1.355	99.689	
BM029			0.769	100.275	
BM028			**1.0**	**100.0**	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM028		100.000		
BM029		100.275		
BM008		99.690		

Summary	
Stage (m)	98.056
Discharge (m^3/s)	0.212
Pressure Transducer Reading (m)	0.165
Pressure Transducer Elevation (m)	97.891

Discharge Measurement #1- Mid-Section Method										
Time (24 hr)	Start	11:02	End	11:25	Location	At Station				
Method	Velocity-area (Mid-section)			Instrument Model		FM 2000				
Flow Meter Type	Flo-Mate			Serial #						
Stage (m)	Start	Reading	0.165	Time	10:37					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Right Bank	3.85	0.00	0.0	0.00	0			0.000	0.0
	3.75	0.08	0.1	0.01	0.05			0.001	0.2
	3.60	0.11	0.2	0.02	0.16			0.003	1.2
	3.45	0.10	0.2	0.02	0.35			0.005	2.5
	3.30	0.12	0.2	0.03	0.46			0.008	3.9
	3.15	0.13	0.2	0.03	0.56			0.011	5.2
	3.00	0.22	0.2	0.05	0.41			0.014	6.4
	2.85	0.22	0.2	0.05	0.53			0.017	8.3
	2.70	0.23	0.2	0.05	0.46			0.016	7.5
	2.55	0.22	0.2	0.05	0.38			0.013	5.9
	2.40	0.26	0.2	0.06	0.33			0.013	6.1
	2.25	0.29	0.2	0.07	0.46			0.020	9.4
	2.10	0.28	0.2	0.06	0.36			0.015	7.1
	1.95	0.29	0.2	0.07	0.37			0.016	7.6
	1.80	0.29	0.2	0.07	0.27			0.012	5.5
	1.65	0.20	0.2	0.05	0.23			0.007	3.3
	1.50	0.19	0.2	0.04	0.35			0.010	4.7
	1.35	0.36	0.2	0.08	0.35			0.019	8.9
	1.20	0.35	0.2	0.08	0.24			0.013	5.9
	1.05	0.37	0.2	0.08	0.01			0.001	0.3
	0.90	0.35	0.2	0.06	0			0.000	0.0
Left Bank	0.85	0.00	0.1	0.00	0			0.000	0.0
Total Q								0.212	100.0

General Notes
Use average of 2 measurements

Appendix 2e-2. Manual Discharge Measurements and Levelling Surveys at H3-Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H3-Hydro			
Stream Name				
Date Monitored	20-Mar-11			
Time at Site (24 hr)	Start Time:	10:10:00 AM	End Time:	11:00:00 AM
Personnel	M. Soloducha, K. Johnson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 008	0.765	100.765		100.000	
Btm Thread Rod			1.731	99.034	
WL			2.542	98.223	
TP1	2.432	100.739	2.458	98.307	
WL			2.514	**98.225**	
Btm Thread Rod			1.705	99.034	
BM 008			0.735	**100.004**	
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes
BM 008		100.002			
Btm Thread Rod		99.034			

Summary	
Stage (m)	98.224
Discharge (m^3/s)	0.020
Pressure Transducer Reading (m)	
Pressure Transducer Elevation (m)	

Discharge Measurement #1- Mid-Section Method									
Time (24 hr)	Start	10:10	End	10:40	Location				
Method	Velocity-area (Mid-section)			Instrument Model	FM 2000				
Flow Meter Type	Flo-Mate			Serial #					
Stage (m)	Start	Reading		Time					
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
right bank	3.00	0.00	0.0	0.00	0			0.000	0.0
Out of water	2.90	0.00	0.1	0.00	0			0.000	0.0
	2.80	0.04	0.1	0.01	0			0.000	0.0
	2.70	0.04	0.1	0.01	0			0.000	0.0
	2.60	0.04	0.1	0.01	0			0.000	0.0
	2.50	0.04	0.1	0.01	0.01			0.000	0.2
	2.40	0.04	0.1	0.01	0.16			0.001	3.3
	2.30	0.04	0.1	0.01	0.15			0.001	3.1
	2.20	0.05	0.1	0.01	0.16			0.001	4.1
	2.10	0.05	0.1	0.01	0.12			0.001	3.1
	2.00	0.06	0.1	0.01	0.18			0.001	5.5
	1.90	0.06	0.1	0.01	0.12			0.001	3.7
	1.80	0.09	0.1	0.01	0.1			0.001	4.6
	1.70	0.10	0.1	0.02	0.09			0.001	4.6
Behind rock	1.60	0.11	0.1	0.02	0.02			0.000	1.1
	1.50	0.10	0.1	0.02	0.19			0.002	9.7
	1.40	0.10	0.1	0.02	0.25			0.003	12.8
	1.30	0.11	0.1	0.02	0.18			0.002	10.2
	1.20	0.08	0.1	0.01	0.08			0.001	3.3
Behind rock	1.10	0.08	0.1	0.01	0.05			0.000	2.1
Behind rock	1.00	0.18	0.1	0.03	0.02			0.000	1.8
	0.90	0.17	0.1	0.03	0.06			0.001	5.2
	0.80	0.18	0.1	0.03	0.1			0.002	9.2
	0.70	0.18	0.1	0.03	0.03			0.001	2.8
CF	0.60	0.20	0.1	0.03	0.03			0.001	3.1
1	0.50	0.14	0.1	0.02	0.06			0.001	4.3
left bank	0.40	0.00	0.1	0.01	0			0.000	2.2
Total Q								**0.020**	**100.0**

General Notes

Appendix 2f-1. Manual Discharge Measurements and Levelling Surveys at H4-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H4-Hydro			
Stream Name				
Date Monitored	5-Jul-10			
Time at Site (24 hr)	**Start Time:**	9:19	**End Time:**	11:30
Personnel	M. Soloducha, X. Pinto			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM 007	1.286	101.286		100.000	
BM 006			0.415	**100.871**	
WL			2.833	98.453	
BM 005			1.762	99.524	
	1.711	101.235		**98.453**	
BM 007			1.237	99.998	

BM#	**Established Elevation (m)**	**Mean Elevation (this date)**	**Difference (m)**	**Notes**
BM 007		99.999		
BM 006		100.871		
BM 005		99.524		

Summary	
Stage (m)	98.453
Discharge (m^3/s)	1.781
Pressure Transducer Reading (m)	0.500
Pressure Transducer Elevation (m)	97.953

Discharge Measurement Salt Dilution						
Date Monitored:	5-Jul-10				**Pressure Transducer (m):**	0.500
Time (24 hr):	**Start**	9:19	**End**	11:30	**Amount of Salt injected:**	20.0
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	1.781
Probe LB	600589		**Ac LB**	**10.638**	**K (Cal. Constant) LB:**	0.002
Probe RB	600743		**Ac RB**	**11.4760649**	**K (Cal. Constant) RB:**	0.002
Type of Salt:	Windsor				**Error (Std Dev in m^3/s)**	0.7

Probe RB: S/N	600743		
M =	10	kg	Mass of salt injected
M =	10000000	mg	
$\Delta\tau$ =	2	s	Time interval
Ac =	11.47606494	mS.s/cm	Area under curve
K1 =	0.00193	(mS L)/(cm mg)	Calibration constant
Q =	1681.8	L/s	Discharge
Q =	**1.68**	m3/s	
RD =	5.9	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N	600589		
M =	10	kg	Mass of salt injected
M =	10000000	mg	
$\Delta\tau$ =	2	s	Time interval
Ac =	10.638	mS.s/cm	Area under curve
K1 =	0.002	(mS L)/(cm mg)	Calibration constant
Q =	1880.1	L/s	Discharge
Q =	**1.88**	m3/s	
RD =	4.6	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2f-1. Manual Discharge Measurements and Levelling Surveys at H4-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H4-Hydro			
Stream Name				
Date Monitored	12-Aug-10			
Time at Site (24 hr)	**Start Time:**	11:30	**End Time:**	14:00
Personnel	X. Pinto, Stephanie Boha			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 007	1.847	101.847		100.000	
BM 006			0.977	**100.870**	
WL			3.223	98.624	
BM 005			2.327	99.520	
	2.296	101.816		**98.624**	
BM 007			1.817	99.999	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 007		100.000		
BM 006		100.870		
BM 005		99.520		

Summary	
Stage (m)	98.624
Discharge (m^3/s)	3.607
Pressure Transducer Reading (m)	0.687
Pressure Transducer Elevation (m)	97.937

Discharge Measurement Salt Dilution						
Date Monitored:	12-Aug-10				**Pressure Transducer (m):**	0.687
Time (24 hr):	**Start**	11:30	**End**	14:00	**Amount of Salt injected:**	8.1
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	3.607
Probe LB		600589	**Ac LB**	**2.240664**	**K (Cal. Constant) LB:**	0.002
Probe RB		600743	**Ac RB**	**2.46958562**	**K (Cal. Constant) RB:**	0.002
Type of Salt:		Windsor			**Error (Std Dev in m^3/s)**	0.7

Probe RB: S/N	600743		
M =	4.03	kg	Mass of salt injected
M =	4030000	mg	
Δτ =	2	s	Time interval
Ac =	2.469585617	mS.s/cm	Area under curve
K1 =	0.002087202	(mS L)/(cm mg)	Calibration constant
Q =	3406.0	L/s	Discharge
Q =	**3.41**	m3/s	
RD =	1.2	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N	600589		
M =	4.03	kg	Mass of salt injected
M =	4030000	mg	
Δτ =	2	s	Time interval
Ac =	2.240664	mS.s/cm	Area under curve
K1 =	0.00211749	(mS L)/(cm mg)	Calibration constant
Q =	3808.5	L/s	Discharge
Q =	**3.81**	m3/s	
RD =	1.1	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2f-1. Manual Discharge Measurements and Levelling Surveys at H4-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H4-Hydro			
Stream Name				
Date Monitored	1-Sep-10			
Time at Site (24 hr)	**Start Time:**	10:00	**End Time:**	12:00
Personnel	M. Soloducha, B. Simpson			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM 007	1.862	101.862		100.000	
BM 006			0.986	100.876	
WL			3.489	**98.373**	
CG 1			1.753	100.109	
CG 2			1.672	100.190	
BM 005			2.337	99.525	
BM 005	2.277	101.802			
BM 007			1.800	100.002	

BM#	**Established Elevation (m)**	**Mean Elevation (this date)**	**Difference (m)**	**Notes**
BM 007		100.001		
BM 006		100.876		
BM 005		99.525		

Summary	
Stage (m)	98.373
Discharge (m^3/s)	1.550
Pressure Transducer Reading (m)	0.426
Pressure Transducer Elevation (m)	97.947

Discharge Measurement Salt Dilution						
Date Monitored:	1-Sep-10				**Pressure Transducer (m):**	0.426
Time (24 hr):	**Start**	10:00	**End**	12:00	**Amount of Salt injected:**	16.1
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	1.550
Probe LB		600589	**Ac LB**	**0**	**K (Cal. Constant) LB:**	0.002
Probe RB		600743	**Ac RB**	**0**	**K (Cal. Constant) RB:**	0.002
Type of Salt:		Windsor			**Error (Std Dev in m^3/s)**	0.7

Probe RB: S/N	600743		
M =	8.03	kg	Mass of salt injected
M =	8030000	mg	
Δτ =		s	Time interval
Ac =		mS.s/cm	Area under curve
K1 =		(mS L)/(cm mg)	Calibration constant
Q =	1370.0	L/s	Discharge
Q =	**1.37**	m3/s	
RD =	5.9	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N	600589		
M =	8.03	kg	Mass of salt injected
M =	8030000	mg	
Δτ =		s	Time interval
Ac =		mS.s/cm	Area under curve
K1 =		(mS L)/(cm mg)	Calibration constant
Q =	1730.0	L/s	Discharge
Q =	**1.73**	m3/s	
RD =	4.6	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2f-1. Manual Discharge Measurements and Levelling Surveys at H4-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H4-Hydro			
Stream Name				
Date Monitored	12-Oct-10			
Time at Site (24 hr)	**Start Time:**	9:30	**End Time:**	12:00
Personnel	M. Soloducha, M. Jenkins			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM007	1.526	101.526		100.000	
BM006			0.653	100.873	
BM005			2.003	99.523	
CG D/S			2.765	98.761	
CG U/S			0.241	101.285	
WL			3.619	**97.907**	**(+0.271)**
WL	3.588	101.495			
CG U/S			0.209	101.286	
CG D/S			2.734	98.761	
BM007			1.494	100.001	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM007		100.001		
BM006		100.873		
BM005		100.001		

Summary	
Stage (m)	98.178
Discharge (m^3/s)	0.741
Pressure Transducer Reading (m)	0.221
Pressure Transducer Elevation (m)	97.957

Discharge Measurement Salt Dilution						
Date Monitored:	12-Oct-10				**Pressure Transducer (m):**	0.221
Time (24 hr):	**Start**	9:30	**End**	12:00	**Amount of Salt injected:**	16.0
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	0.741
Probe LB	600589		**Ac LB**	**23.8976581**	**K (Cal. Constant) LB:**	0.002
Probe RB	600743		**Ac RB**	**23.6172494**	**K (Cal. Constant) RB:**	0.002
Type of Salt:	Windsor				**Error (Std Dev in m^3/s)**	0.7

Probe RB: S/N	600743		
M =	8.011	kg	Mass of salt injected
M =	8011000	mg	
Δτ =	2	s	Time interval
Ac =	23.61724935	mS.s/cm	Area under curve
K1 =	0.002214578	(mS L)/(cm mg)	Calibration constant
Q =	751.2	L/s	Discharge
Q =	**0.75**	m3/s	
RD =	10.7	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N	600589		
M =	8.011	kg	Mass of salt injected
M =	8011000	mg	
Δτ =	2	s	Time interval
Ac =	23.89765812	mS.s/cm	Area under curve
K1 =	0.002182309	(mS L)/(cm mg)	Calibration constant
Q =	731.6	L/s	Discharge
Q =	**0.73**	m3/s	
RD =	11.0	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2g-1. Manual Discharge Measurements and Levelling Surveys at H5-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H5-Hydro			
Stream Name				
Date Monitored	5-Jul-10			
Time at Site (24 hr)	**Start Time:**	14:30	**End Time:**	16:30
Personnel	M. Soloducha, X. Pinto			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM 32	0.922	100.922		100.000	
BM 31			2.678	98.244	
WL			3.263	**97.659**	
BM 30			2.951	97.971	
	2.976	100.947		97.659	
BM 32			0.948	99.999	

BM#	**Established Elevation (m)**	**Mean Elevation (this date)**	**Difference (m)**	**Notes**
BM 32		100.000		
BM 31		98.244		
BM 30		97.971		

Summary	
Stage (m)	97.659
Discharge (m^3/s)	0.756
Pressure Transducer Reading (m)	0.500
Pressure Transducer Elevation (m)	97.159

Discharge Measurement Salt Dilution						
Date Monitored:	5-Jul-10				**Pressure Transducer (m):**	0.500
Time (24 hr):	**Start**	14:30	**End**	16:30	**Amount of Salt injected:**	16.0
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	0.756
Probe LB	600589		**Ac LB**	**20.4258711**	**K (Cal. Constant) LB:**	0.002
Probe RB	600743		**Ac RB**	**20.4258711**	**K (Cal. Constant) RB:**	0.002
Type of Salt:	Windsor				**Error (Std Dev in m^3/s)**	0.7

Probe RB: S/N	600743		
M =	8.001	kg	Mass of salt injected
M =	8001000	mg	
$\Delta\tau$ =	2	s	Time interval
Ac =	20.42587107	mS.s/cm	Area under curve
K1 =	0.00193	(mS L)/(cm mg)	Calibration constant
Q =	756.0	L/s	Discharge
Q =	**0.76**	m3/s	
RD =	10.6	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N	600589		
M =	8.001	kg	Mass of salt injected
M =	8001000	mg	
$\Delta\tau$ =	2	s	Time interval
Ac =	20.42587107	mS.s/cm	Area under curve
K1 =	0.00193	(mS L)/(cm mg)	Calibration constant
Q =	756.0	L/s	Discharge
Q =	**0.76**	m3/s	
RD =	10.6	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2g-1. Manual Discharge Measurements and Levelling Surveys at H5-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H5-Hydro			
Stream Name				
Date Monitored	12-Aug-10			
Time at Site (24 hr)	**Start Time:**	14:26	**End Time:**	16:30
Personnel	X. Pinto, S. Boha			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 32	1.095	101.095		100.000	
WL			3.067	**98.028**	
BM 30			3.123	97.972	
	3.100	101.072			
BM 32			1.069	100.003	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 32		100.002		
BM 30		97.972		

Summary	
Stage (m)	97.972
Discharge (m^3/s)	2.398
Pressure Transducer Reading (m)	0.500
Pressure Transducer Elevation (m)	97.472

Discharge Measurement Salt Dilution						
Date Monitored:	12-Aug-10				**Pressure Transducer (m):**	0.500
Time (24 hr):	**Start**	14:26	**End**	15:03	**Amount of Salt injected:**	5.0
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	2.398
Probe LB	0	**Ac LB**	**2.06975944**		**K (Cal. Constant) LB:**	0.002
Probe RB	0	**Ac RB**	**2.37221116**		**K (Cal. Constant) RB:**	0.002
Type of Salt:	Windsor				**Error (Std Dev in m^3/s)**	0.7

Probe RB: S/N ...

M =	2.523	kg	Mass of salt injected
M =	2523000	mg	
Δτ =	2	s	Time interval
Ac =	2.372211164	mS.s/cm	Area under curve
K1 =	0.00211749	(mS L)/(cm mg)	Calibration constant
Q =	2252.1	L/s	Discharge
Q =	**2.25**	m3/s	
RD =	1.1	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N ...

M =	2.523	kg	Mass of salt injected
M =	2523000	mg	
Δτ =	2	s	Time interval
Ac =	2.069759441	mS.s/cm	Area under curve
K1 =	0.002087202	(mS L)/(cm mg)	Calibration constant
Q =	2544.3	L/s	Discharge
Q =	**2.54**	m3/s	
RD =	1.0	kg / (m3/s)	Ratio of salt to flow

General Notes

BM 31 not accessible on this date.

Appendix 2g-1. Manual Discharge Measurements and Levelling Surveys at H5-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H5-Hydro			
Stream Name				
Date Monitored	1-Sep-10			
Time at Site (24 hr)	**Start Time:**	12:47	**End Time:**	15:00
Personnel	M. Soloducha, J. Simpson			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM 032	0.976	100.976		100.000	
BM 030			3.005	**97.971**	
WL			3.143	97.833	
CG RB			1.506	99.470	
CG LB			2.760	98.216	
BM 031			2.735	98.241	
BM 031	2.683	100.924			
BM 032			0.925	99.999	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 032		100.000		
BM 030		97.971		
BM 031		98.241		

Summary	
Stage (m)	97.833
Discharge (m^3/s)	0.815
Pressure Transducer Reading (m)	0.231
Pressure Transducer Elevation (m)	97.602

Discharge Measurement Salt Dilution						
Date Monitored:	1-Sep-10				**Pressure Transducer (m):**	0.231
Time (24 hr):	**Start**	12:47	**End**	15:03	**Amount of Salt injected:**	11.3
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	0.815
Probe LB	0		**Ac LB**	**0**	**K (Cal. Constant) LB:**	0.002
Probe RB	0		**Ac RB**	**0**	**K (Cal. Constant) RB:**	0.002
Type of Salt:	Windsor				**Error (Std Dev in m^3/s)**	0.7

Probe RB: S/N ...

M =	5.66	kg	Mass of salt injected
M =	5661000	mg	
Δτ =		s	Time interval
Ac =		mS.s/cm	Area under curve
K1 =		(mS L)/(cm mg)	Calibration constant
Q =	810.0	L/s	Discharge
Q =	**0.81**	m3/s	
RD =	7.0	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N ...

M =	5.661	kg	Mass of salt injected
M =	5661000	mg	
Δτ =		s	Time interval
Ac =		mS.s/cm	Area under curve
K1 =		(mS L)/(cm mg)	Calibration constant
Q =	820.0	L/s	Discharge
Q =	**0.82**	m3/s	
RD =	6.9	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2g-1. Manual Discharge Measurements and Levelling Surveys at H5-Hydro in 2010

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H5-Hydro			
Stream Name				
Date Monitored	23-Oct-10			
Time at Site (24 hr)	**Start Time:**	10:45	**End Time:**	13:00
Personnel	M. Soloducha, M. Jenkins			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM032	1.162	101.162		100.000	
BM030			3.190	97.972	
BM031			2.913	98.249	
CGLB			2.966	98.196	
CGRB			2.865	98.297	
WL			3.542	97.620	(+0.990)
WL	3.566	101.186			
CGLB			3.991	97.195	
CGRB			2.888	98.298	
BM032			1.186	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM032		100.000		
BM031		98.249		
BM030		97.972		

Summary	
Stage (m)	98.610
Discharge (m^3/s)	0.696
Pressure Transducer Reading (m)	0.500
Pressure Transducer Elevation (m)	98.110

Discharge Measurement Salt Dilution						
Date Monitored:	23-Oct-10				**Pressure Transducer (m):**	0.500
Time (24 hr):	**Start**	10:45	**End**	11:23	**Amount of Salt injected:**	16.0
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	0.696
Probe LB		0	**Ac LB**	**25.4557782**	**K (Cal. Constant) LB:**	0.002
Probe RB		99B9	**Ac RB**	**25.17479**	**K (Cal. Constant) RB:**	0.002
Type of Salt:		Windsor			**Error (Std Dev in m^3/s)**	0.7

Probe RB: S/N 99B9			
M =	8.011	kg	Mass of salt injected
M =	8011000	mg	
Δτ =	2	s	Time interval
Ac =	25.17479001	mS.s/cm	Area under curve
K1 =	0.002214578	(mS L)/(cm mg)	Calibration constant
Q =	704.7	L/s	Discharge
Q =	**0.70**	m3/s	
RD =	11.4	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N ...			
M =	8.011	kg	Mass of salt injected
M =	8011000	mg	
Δτ =	2	s	Time interval
Ac =	25.45577815	mS.s/cm	Area under curve
K1 =	0.002182309	(mS L)/(cm mg)	Calibration constant
Q =	686.8	L/s	Discharge
Q =	**0.69**	m3/s	
RD =	11.7	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2g-2. Manual Discharge Measurements and Levelling Surveys at H5-Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	H5-Hydro			
Stream Name				
Date Monitored	19-Mar-10			
Time at Site (24 hr)	Start Time:	4:00:00 PM	End Time:	5:30:00 PM
Personnel	M. Soloducha, K. Johnson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 32	1.184	101.184		100.000	
BM 31			2.934	98.250	
WL			3.759	**97.425**	
TP 1	3.546	101.139	3.591	97.593	
WL			3.712	**97.427**	
BM 31			2.884	98.255	
BM 32			1.136	**100.003**	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 32		100.002		
BM 31		98.253		

Summary	
Stage (m)	97.426
Discharge (m^3/s)	0.063
Pressure Transducer Reading (m)	
Pressure Transducer Elevation (m)	

Discharge Measurement #1- Mid-Section Method									
Time (24 hr)	Start	16:00	End	16:30	Location	At Station			
Method	Velocity-area (Mid-section)			Intrument Model		FM2000			
Flow Meter Type	Flo-Mate			Serial #					
Stage (m)	Start	Reading	0.000	Time	16:00				
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
right bank	0.30	0.00	0.0	0.00	0			0.000	0.5
CF	0.40	0.08	0.1	0.01	0.15			0.001	1.9
0.5	0.50	0.08	0.1	0.01	0.25			0.002	3.2
	0.60	0.08	0.1	0.01	0.33			0.003	4.2
	0.70	0.07	0.1	0.01	0.09			0.001	1.0
	0.80	0.00	0.1	0.00	0			0.000	0.0
	0.90	0.00	0.1	0.00	0			0.000	0.0
	1.00	0.00	0.1	0.00	0			0.000	0.0
	1.10	0.13	0.1	0.02	0.69			0.009	14.3
	1.20	0.15	0.1	0.02	0.75			0.011	18.0
	1.30	0.14	0.1	0.02	0.61			0.009	13.6
	1.40	0.07	0.1	0.01	0.01			0.000	0.1
	1.50	0.06	0.1	0.01	0.8			0.005	7.7
	1.60	0.02	0.1	0.00	0.22			0.000	0.7
	1.70	0.09	0.1	0.01	0.55			0.005	7.9
	1.80	0.08	0.1	0.01	0.54			0.004	6.9
	1.90	0.08	0.1	0.01	0.48			0.004	6.1
	2.00	0.06	0.1	0.01	0.66			0.004	6.3
	2.10	0.05	0.1	0.01	0.37			0.002	3.0
	2.20	0.06	0.1	0.01	0.33			0.002	3.2
	2.30	0.04	0.1	0.01	0.19			0.001	1.2
CF	2.40	0.05	0.1	0.01	0.01			0.000	0.1
0	2.50	0.02	0.1	0.00	0.04			0.000	0.1
left bank	2.60	0.00	0.1	0.00	0			0.000	0.0
Total Q								**0.063**	**100.0**

General Notes
Use average of 2 measurements

Appendix 2h-1. Manual Discharge Measurements and Levelling Surveys at Todedada Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Todedada Hydro			
Stream Name	Todedada Creek			
Date Monitored	12-May-11			
Time at Site (24 hr)	**Start Time:**	17:20	**End Time:**	18:15
Personnel	M. Soloducha, I. Blackburn			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 047	0.920	100.920		100.000	
BM 046			1.665	**99.255**	
BM 045			1.653	99.267	
CG			1.486	**99.434**	
WL			2.744	98.176	
TBM	1.703	100.862	1.761	99.159	
WL			2.684	**98.178**	
CG			1.428	99.434	
BM 045			1.596	99.266	
BM 046			1.606	99.256	
BM 047			0.863	99.999	

BM#	Established Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes
BM 047	100	100.000	0.000	
BM 046	99.256	99.256	0.000	
BM 045	99.267	99.267	0.000	

Summary	
Stage (m)	99.345
Discharge (m^3/s)	3.981
Pressure Transducer Reading (m)	0.769
Pressure Transducer Elevation (m)	98.576

Discharge Measurement Salt Dilution						
Date Monitored:	12-May-11				**Pressure Transducer (m):**	0.622
Time (24 hr):	**Start**	17:20	**End**	18:15	**Amount of Salt injected:**	20.1
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	3.981
Probe LB	08J00777		**Ac LB**		**K (Cal. Constant) LB:**	0.002
Probe RB	Not Working		**Ac RB**		**K (Cal. Constant) RB:**	n/a
Type of Salt:	Windsor				**Error (Std Dev in m^3/s)**	0.0

Probe RB: S/N ... Probe not functioning properly

M =	20.122	kg	Mass of salt injected
M =	20122000	mg	
$\Delta\tau$ =	2	s	Time interval
Ac =	0	mS.s/cm	Area under curve
K1 =	n/a	(mS L)/(cm mg)	Calibration constant
Q =	n/a	L/s	Discharge
Q =	**n/a**	m3/s	
RD =	n/a	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N ... 08J100777

M =	20.122	kg	Mass of salt injected
M =	20122000	mg	
$\Delta\tau$ =	1	s	Time interval
Ac =	8.95887	mS.s/cm	Area under curve
K1 =	0.00177	(mS L)/(cm mg)	Calibration constant
Q =	3980.9	L/s	Discharge
Q =	**3.98**	m3/s	
RD =	5.1	kg / (m3/s)	Ratio of salt to flow

General Notes

Right bank probe not functioning on this visit. Discharge based on data collected at left banks probe.

Appendix 2h-1. Manual Discharge Measurements and Levelling Surveys at Todedada Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Todedada Hydro			
Stream Name	Todedada Creek			
Date Monitored	21-Jun-11			
Time at Site (24 hr)	Start Time:	13:50	End Time:	15:00
Personnel	M. Soloducha, I. Blackburn			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes

Summary		
Stage (m)		No Survey
Discharge (m^3/s)	9.404	
Pressure Transducer Reading (m)	0.734	
Pressure Transducer Elevation (m)		No Survey

Discharge Measurement Salt Dilution						
Date Monitored:	21-Jun-11				Pressure Transducer (m):	0.734
Time (24 hr):	Start	13:50	End	15:00	Amount of Salt injected:	19.460
Method	Salt Dilution				Mean Discharge Q (m^3/s):	9.404
Probe LB		11D100286	Ac LB		K (Cal. Constant) LB:	0.0020
Probe RB		11D100287	Ac RB		K (Cal. Constant) RB:	0.0020
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	2.6

Probe RB: S/N ...

M =	19.46 kg	Mass of salt injected
M =	19460000 mg	
Δτ =	2 s	Time interval
Ac =	4.104919716 mS.s/cm	Area under curve
K1 =	0.001957564 (mS L)/(cm mg)	Calibration constant
Q =	9280.1 L/s	Discharge
Q =	**9.28** m3/s	

RD =	2.0969528 kg / (m3/s)	Ratio salt to flow
M =	19.46 kg	Mass salt injected
M =	19460000 mg	
Δτ =	2 s	Time interval
Ac =	4.150212633 mS.s/cm	Area under curve
K1 =	0.00203191 (mS L)/(cm mg)	Calibration constant
Q =	9527.5 L/s	Discharge
Q =	**9.53** m3/s	

General Notes

Appendix 2h-1. Manual Discharge Measurements and Levelling Surveys at Todedada Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Todedada Hydro			
Stream Name	Todedada Creek			
Date Monitored	21-Jul-11			
Time at Site (24 hr)	**Start Time:**	8:35	**End Time:**	9:30
Personnel	M. Soloducha, J Cristobal			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 47	0.628	100.628		100.000	
Bm 046			1.363	**99.265**	
BM 045			1.366	99.262	
WL			2.145	**98.483**	
TBM	1.738	100.582	1.784	98.844	
WL			2.108	**98.474**	
BM 045			1.319	99.263	
BM 046			1.363	99.219	
BM 047			0.583	99.999	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 47	100	100.000	0.001	
Bm 046	99.256	99.242	0.014	
BM 045	99.267	99.263	0.005	

Summary	
Stage (m)	98.479
Discharge (m^3/s)	7.231
Pressure Transducer Reading (m)	0.673
Pressure Transducer Elevation (m)	97.806

Discharge Measurement Salt Dilution						
Date Monitored:	21-Jul-11				**Pressure Transducer (m):**	0.673
Time (24 hr):	**Start**	8:35	**End**	9:30	**Amount of Salt injected:**	19.8
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	7.231
Probe LB	600336	**Ac LB**			**K (Cal. Constant) LB:**	0.0020
Probe RB	115562	**Ac RB**			**K (Cal. Constant) RB:**	0.0019
Type of Salt:	Windsor				**Error (Std Dev in m^3/s)**	7.4

Probe RB: S/N ...

M =	19.821 kg	Mass of salt injected
M =	19821000 mg	
Δτ =	2 s	Time interval
Ac =	5.070653931 mS.s/cm	Area under curve
K1 =	0.001917983 (mS L)/(cm mg)	Calibration constant
Q =	7497.3 L/s	Discharge
Q =	**7.50** m3/s	
RD =	2.6 kg / (m3/s)	Ratio of salt to flow

Probe RB 2: S/N ...

M =	19.821 kg	Mass of salt injected
M =	19821000 mg	
Δτ =	2 s	Time interval
Ac =	5.596636783 mS.s/cm	Area under curve
K1 =	0.001966363 (mS L)/(cm mg)	Calibration constant
Q =	6964.1 L/s	Discharge
Q =	**6.96** m3/s	
RD =	2.8 kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2h-1. Manual Discharge Measurements and Levelling Surveys at Todedada Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Todedada Hydro			
Stream Name	Todedada Creek			
Date Monitored	25-Sep-11			
Time at Site (24 hr)	**Start Time:**	16:00	**End Time:**	17:00
Personnel	R. Larson, Alex			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 047	0.388	100.388		100.000	
BM 045			1.121	99.267	
WL			1.493	**98.895**	
BM 046	1.149	100.407	1.130	99.258	
WL			1.509	**98.898**	
BM 045			1.139	99.268	
BM 047			0.403	100.004	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 047	100	100.002	-0.002	
BM 045	99.256	99.268	-0.012	
WL	99.267	99.258	0.009	

Summary	
Stage (m)	98.897
Discharge (m^3/s)	6.037
Pressure Transducer Reading (m)	1.160
Pressure Transducer Elevation (m)	97.737

Discharge Measurement Salt Dilution						
Date Monitored:	25-Sep-11				**Pressure Transducer (m):**	1.160
Time (24 hr):	**Start**	16:00	**End**	17:00	**Amount of Salt injected:**	36.2
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	6.037
Probe LB	SN15468		**Ac LB**		**K (Cal. Constant) LB:**	0.0023
Probe RB	SN13234		**Ac RB**		**K (Cal. Constant) RB:**	0.0023
Type of Salt:	Windsor				**Error (Std Dev in m^3/s)**	0.5

Probe RB: S/N ... SN13234

M =	36.189	kg	Mass of salt injected
M =	36189000	mg	
$\Delta\tau$ =	2	s	Time interval
Ac =	13.71009064	mS.s/cm	Area under curve
K1 =	0.002293172	(mS L)/(cm mg)	Calibration constant
Q =	6053.0	L/s	Discharge
Q =	**6.05**	m3/s	
RD =	6.0	kg / (m3/s)	Ratio of salt to flow

ProbeRB 2: S/N .. SN15468

M =	36.189	kg	Mass of salt injected
M =	36189000	mg	
$\Delta\tau$ =	2	s	Time interval
Ac =	13.57651522	mS.s/cm	Area under curve
K1 =	0.00225854	(mS L)/(cm mg)	Calibration constant
Q =	6020.3	L/s	Discharge
Q =	**6.02**	m3/s	
RD =	6.0	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2h-1. Manual Discharge Measurements and Levelling Surveys at Todedada Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Todedada Hydro			
Stream Name	Todedada Creek			
Date Monitored	27-Oct-11			
Time at Site (24 hr)	Start Time:	3:30:00 PM	End Time:	4:15:00 PM
Personnel	R. Larson. K. Johnson			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS 9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 047	0.569	100.569		100.000	
WL			1.827	**98.742**	
BM 045			1.305	99.264	
BM 046	1.212	100.464	1.317	99.252	
BM 045			1.201	99.263	
WL			1.723	**98.741**	
BM 047			0.466	99.998	
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes
BM 047		99.999			
BM 045		99.264			
BM 046		99.252			

Summary	
Stage (m)	99.003
Discharge (m^3/s)	2.181
Pressure Transducer Reading (m)	0.814
Pressure Transducer Elevation (m)	98.189

Discharge Measurement - Mid-Section Method										
Time (24 hr)	Start	15:30	End	16:15	Location					
Method	Velocity-area (Mid-section)			Instrument Model	Flo-Mate					
Flow Meter Type	Electromagnetic			Instrument Serial #						
Stage (m)	Start	Reading	0.814	Time	15:30					
	End	Reading		Time						
	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q	
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%	
Right Bank	0.80	0.00	0.00	0.00	0			0.000	0.0	
	1.10	0.60	0.30	0.17	-0.01			-0.002	-0.1	
	1.35	0.64	0.25	0.16	0.18			0.029	1.3	
	1.60	0.67	0.25	0.18		0.58	0.64	0.112	5.2	
	1.90	0.68	0.30	0.20		0.62	0.59	0.123	5.7	
	2.20	0.71	0.30	0.21		0.69	0.61	0.138	6.3	
	2.50	0.75	0.30	0.23		0.80	0.76	0.176	8.0	
	2.80	0.74	0.30	0.22		0.68	0.87	0.172	7.9	
	3.10	1.06	0.30	0.32		0.74	1.06	0.286	13.1	
	3.40	0.68	0.30	0.24		0.72	1.08	0.214	9.8	
	3.80	0.58	0.40	0.23	0.98			0.227	10.4	
	4.20	0.58	0.40	0.23	0.88			0.204	9.4	
	4.60	0.52	0.40	0.21	0.45			0.094	4.3	
	5.00	0.44	0.40	0.22	0.7			0.154	7.1	
	5.60	0.26	0.60	0.18	0.53			0.096	4.4	
	6.40	0.24	0.80	0.22	0.38			0.082	3.8	
	7.40	0.12	1.00	0.10	0.41			0.042	1.9	
	8.10	0.14	0.70	0.15	0.01			0.001	0.1	
	9.50	0.15	1.40	0.19	0.16			0.030	1.4	
	10.60	0.08	1.10	0.11	0.01			0.001	0.1	
Left Bank	12.3	0.00	1.70	0.00	0			0.000	0.0	
Total Q								**2.181**	**100.0**	

General Notes

Appendix 2h-1. Manual Discharge Measurements and Levelling Surveys at Todedada Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Todedada Hydro			
Stream Name	Todedada Creek			
Date Monitored	11-Nov-11			
Time at Site (24 hr)	Start Time:	12:10:00 PM	End Time:	12:45:00 PM
Personnel	M. Soloducha, K. Johnson			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS 9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 047	0.756	100.756		100.000	
BM 009			0.919	99.837	
WL			1.727	**99.029**	
LB BM			1.791	98.965	
TBM	1.759	100.828	1.687	99.069	
LB BM			1.863	98.965	
BM 047			0.830	99.998	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 047		99.999		
BM 009		99.837		

Summary	
Stage (m)	99.029
Discharge (m^3/s)	0.786
Pressure Transducer Reading (m)	0.592
Pressure Transducer Elevation (m)	98.437

Discharge Measurement - Mid-Section Method										
Time (24 hr)	Start	12:10	End	12:30	Location					
Method	Velocity-area (Mid-section)			Instrument Model	Flo-Mate					
Flow Meter Type	Electromagnetic			Instrument Serial #						
Stage (m)	Start	Reading	0.592	Time	12:10					
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Right Bank	18.00	0.00	0.00	0.00	0			0.000	0.0
	17.80	0.86	0.20	0.43	-0.01			-0.004	-0.5
	17.00	0.83	0.80	0.66	0.06			0.040	5.1
	16.20	0.86	0.80	0.69	0.01			0.007	0.9
	15.40	0.71	0.80	0.57		0.06	0.20	0.000	0.0
	14.60	0.79	0.80	0.63		0.65	0.35	0.000	0.0
	13.80	0.85	0.80	0.68		0.13	0.07	0.000	0.0
	13.00	0.69	0.80	0.55	0.09			0.050	6.3
	12.20	0.49	0.80	0.39	0.07			0.027	3.5
	11.40	0.53	0.80	0.42	0.13			0.055	7.0
	10.60	0.36	0.80	0.29	0.34			0.098	12.5
	9.80	0.37	0.80	0.30	0.33			0.098	12.4
	9.00	0.43	0.80	0.34	0.29			0.100	12.7
	8.20	0.30	0.80	0.24	0.26			0.062	7.9
	7.40	0.33	0.80	0.26	0.23			0.061	7.7
	6.60	0.38	0.80	0.30	0.32			0.097	12.4
	5.80	0.24	0.80	0.19	0.1			0.019	2.4
	5.00	0.22	0.80	0.18	0.32			0.056	7.2
	4.20	0.19	0.80	0.15	0.14			0.021	2.7
	3.40	0.19	0.80	0.15	-0.01			-0.002	-0.2
	2.6	0.13	0.80	0.10	0			0.000	0.0
	1.8	0.06	0.80	0.04	0			0.000	0.0
	1.2	0.00	0.60	0.00	0			0.000	0.0
Total Q								**0.786**	**100.0**

General Notes

Appendix 2h-2. Manual Discharge Measurements and Levelling Surveys at Todedada Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Todedada Hydro			
Stream Name	Todedada Creek			
Date Monitored	20-Mar-12			
Time at Site (24 hr)	**Start Time:**	9:30:00 AM	**End Time:**	4:00:00 PM
Personnel	E. Belland, M. Soloducha			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions	cool, clear, -5 deg C			

Transducer Information			
PT Model		**Serial #**	
Gain		**Offset**	
Status		**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
Crest Gauge	1.033	1.033		0.000	Crest Gauge- tie in to BMs
WL			3.166	**-2.133**	**D=0.225**
TBM	0.955	1.057	0.931	0.102	
WL			3.191	**-2.134**	**D=0.225**
Crest Gauge			1.055	0.002	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes

Summary	
Stage (m)	-2.134
Discharge (m^3/s)	0.7
Pressure Transducer Reading (m)	0.440
Pressure Transducer Elevation (m)	-2.573

Discharge Measurement - Mid-Section Method

Time (24 hr)	**Start**	13:20	**End**	14:10	**Location**	at PT	
Method	Velocity-area (Mid-section)			**Instrument Model**		Flo-Mate	
Flow Meter Type	Electromagnetic			**Instrument Serial #**		13124	
Stage (m)	**Start**	**Reading**		**Time**	13:20		
	End	**Reading**		**Time**	14:10		

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	10.40	0.00	0.00	0.03	0			0.000	0.0
	10.10	0.18	0.30	0.05	-0.02			-0.001	-0.2
	9.80	0.24	0.30	0.07	-0.01			-0.001	-0.1
	9.50	0.27	0.30	0.08	0.1			0.008	1.3
	9.20	0.27	0.30	0.08	0.09			0.007	1.1
	8.90	0.30	0.30	0.09	0.3			0.027	4.2
	8.60	0.30	0.30	0.09	0.1			0.009	1.4
	8.30	0.37	0.30	0.11	0.03			0.003	0.5
	8.00	0.43	0.30	0.13	0.17			0.022	3.3
	7.70	0.44	0.30	0.13	0.08			0.011	1.6
	7.40	0.46	0.30	0.14	0.05			0.007	1.0
	7.10	0.47	0.30	0.14	0.36			0.051	7.8
	6.80	0.49	0.30	0.15	0.4			0.059	9.0
	6.50	0.55	0.30	0.16	0.36			0.059	9.1
	6.20	0.56	0.30	0.17	0.24			0.041	6.2
	5.90	0.58	0.30	0.14	0.22			0.032	4.9
	5.70	0.61	0.20	0.15	-0.02			-0.003	-0.5
	5.40	0.61	0.30	0.18	0.13			0.024	3.6
	5.10	0.67	0.30	0.20	0.28			0.056	8.6
	4.80	0.70	0.30	0.21	0.23			0.048	7.4
	4.5	0.70	0.30	0.21	0.39			0.082	12.6
	4.2	0.70	0.30	0.21	0.25			0.053	8.0
	3.9	0.64	0.30	0.19	0.12			0.023	3.5
	3.6	0.67	0.30	0.20	0.17			0.034	5.2
	3.3	0.64	0.30	0.19	0.01			0.002	0.3
Right Bank	3.00	0.00	0.30	0.00	0			0.000	0.0
Total Q								**0.653**	**100.0**

General Notes

Channel completely infilled with snow, depth from 1 to 2 meters. Datalogger buried in snow.

Appendix 2h-2. Manual Discharge Measurements and Levelling Surveys at Todedada Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Todedada Hydro			
Stream Name	Todedada Creek			
Date Monitored	2-May-12			
Time at Site (24 hr)	Start Time:	13:00	End Time:	15:00
Personnel	E. Belland, T. Englesmeier			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions	Cloudy, +10 deg C, melt conditions			

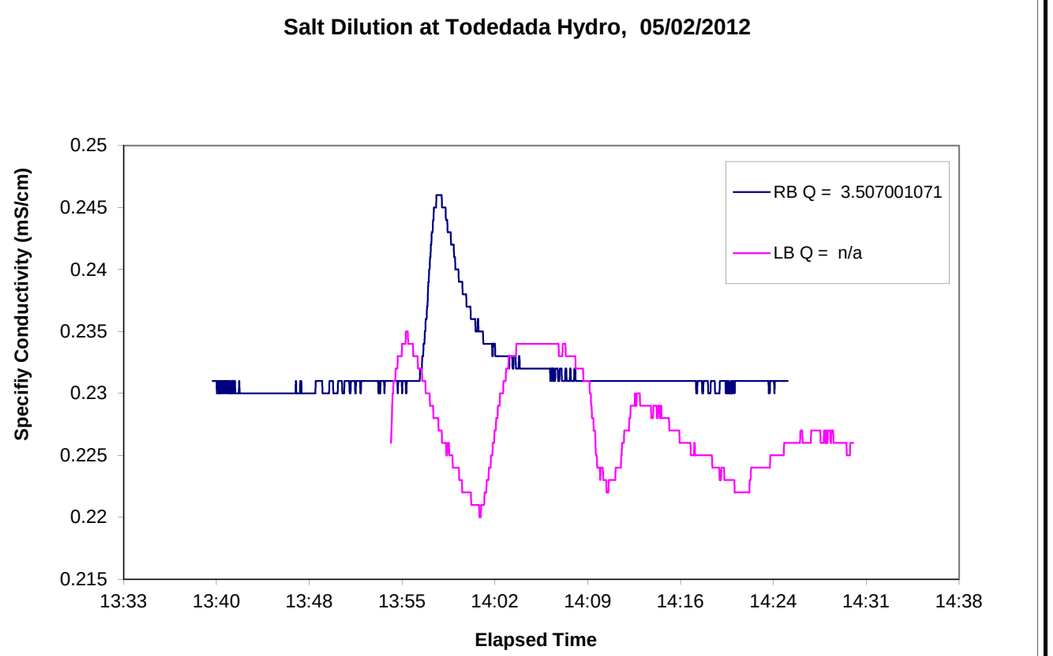
Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 009	1.477	101.477		100.000	P
BM 046			2.061	99.416	
BM 045			2.060	99.417	
WL			2.380	**99.097**	
TBM	0.785	101.603	0.659	100.818	
WL			2.546	**99.057**	
BM 045			2.186	99.417	
BM 046			2.187	99.416	
BM 009			1.603	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 009		100.000		
BM 046		99.416		
BM 045		99.417		

Summary	
Stage (m)	99.077
Discharge (m^3/s)	3.5
Pressure Transducer Reading (m)	1.050
Pressure Transducer Elevation (m)	98.027

Discharge Measurement Salt Dilution						
Date Monitored:	2-May-12				Pressure Transducer (m):	1.050
Time (24 hr):	Start	13:30	End	14:30	Amount of Salt injected:	5.021
Method	Salt Dilution				Mean Discharge Q (m^3/s):	3.507
Probe LB		17106	Ac LB	n/a	K (Cal. Constant) LB:	0.002
Probe RB		11172	Ac RB	3.1706281	K (Cal. Constant) RB:	0.002
Type of Salt:	Windsor				Error (Std Dev in m^3/s)	n/a



General Notes
LB probe failed to read conductivity spike, data from this probe disregarded.

Appendix 2h-2. Manual Discharge Measurements and Levelling Surveys at Todedada Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Todedada Hydro			
Stream Name	Todedada Creek			
Date Monitored	19-Jun-12			
Time at Site (24 hr)	Start Time:	9:00	End Time:	
Personnel	E. Belland, T. Englesmeier			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions				

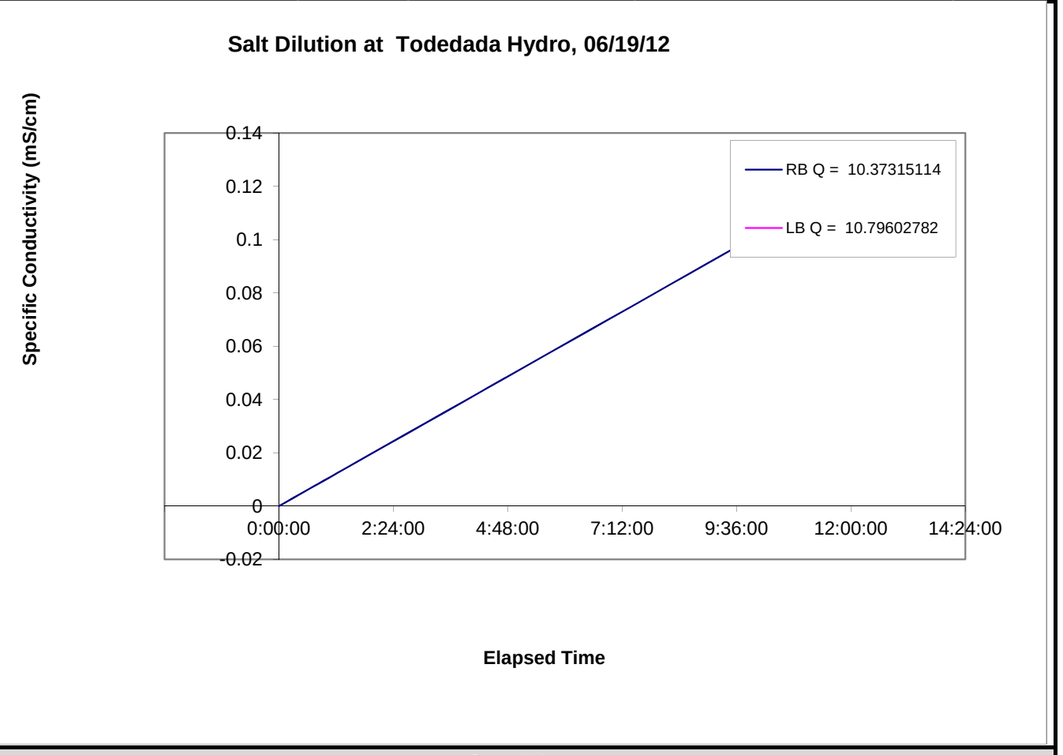
Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 009	0.727	100.727		100.000	P
BM 047			0.570	100.157	
Crest gauge bolt			1.143	99.584	#
WL			1.461	**99.266**	
TBM	1.304	100.776	1.255	99.472	
WL			1.510	**99.266**	
Crest gauge bolt			1.192	99.584	
BM 047			0.619	100.157	
BM 009			0.776	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 009		100.000		
BM 047		100.157		
Crest gauge bolt		99.584		

Summary	
Stage (m)	99.266
Discharge (m^3/s)	10.6
Pressure Transducer Reading (m)	n/a
Pressure Transducer Elevation (m)	#VALUE!

Discharge Measurement Salt Dilution						
Date Monitored:	19-Jun-12				Pressure Transducer (m):	n/a
Time (24 hr):	Start	10:00	End	11:20	Amount of Salt injected:	7.9
Method	Salt Dilution				Mean Discharge Q (m^3/s):	10.6
Probe LB		13620	Ac LB	1.46350123	K (Cal. Constant) LB:	0.002
Probe RB		12397	Ac RB	1.523163	K (Cal. Constant) RB:	0.002
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.3



General Notes
#: WL noted at CG bolt + 0.335m. PT wire was ripped out of datalogger when personnel arrived at site. PT re-installed on next visit.

Appendix 2h-2. Manual Discharge Measurements and Levelling Surveys at Todedada Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Todedada Hydro			
Stream Name	Todedada Creek			
Date Monitored	21-Jun-12			
Time at Site (24 hr)	Start Time:	13:00	End Time:	16:00
Personnel	E. Belland, T. Englesmeier			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions				

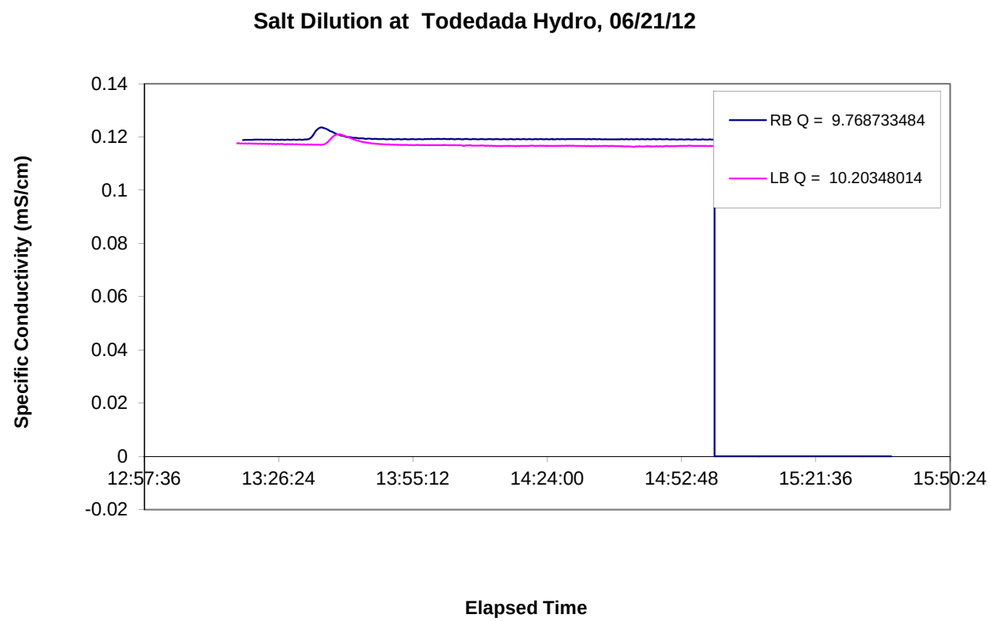
Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records	0	Memory Free	
Date Serviced	21-Jun-12	Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 009	0.773	100.773		100.000	P
BM 047			0.615	100.158	
Crest gauge			1.190	99.583	
PT			2.475	98.298	middle of angle iron
WL			1.520	**99.253**	
TBM	1.308	100.690	1.391	99.382	
WL			1.435	**99.255**	
PT			2.392	98.298	
Crest gauge			1.103	99.587	
BM 047			0.532	100.158	
BM 009			0.690	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 009		100.000		
BM 047		100.158		
Crest gauge		99.585		

Summary	
Stage (m)	99.254
Discharge (m^3/s)	10.0
Pressure Transducer Reading (m)	1.013
Pressure Transducer Elevation (m)	98.241

Discharge Measurement Salt Dilution						
Date Monitored:	21-Jun-12				Pressure Transducer (m):	1.013
Time (24 hr):	Start	13:20	End	15:40	Amount of Salt injected:	7.27
Method	Salt Dilution				Mean Discharge Q (m^3/s):	10
Probe LB		13620	Ac LB	1.425004	K (Cal. Constant) LB:	0.002
Probe RB		12397	Ac RB	1.48842222	K (Cal. Constant) RB:	0.002
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.3



General Notes
Re-installed PT at this location this visit. Horizontal laydown installation.

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Todedada Hydro			
Stream Name	Todedada Creek			
Date Monitored	25-Jul-12			
Time at Site (24 hr)	Start Time:	8:00	End Time:	10:00
Personnel	E. Belland, T. Englesmeier			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions	Fair			

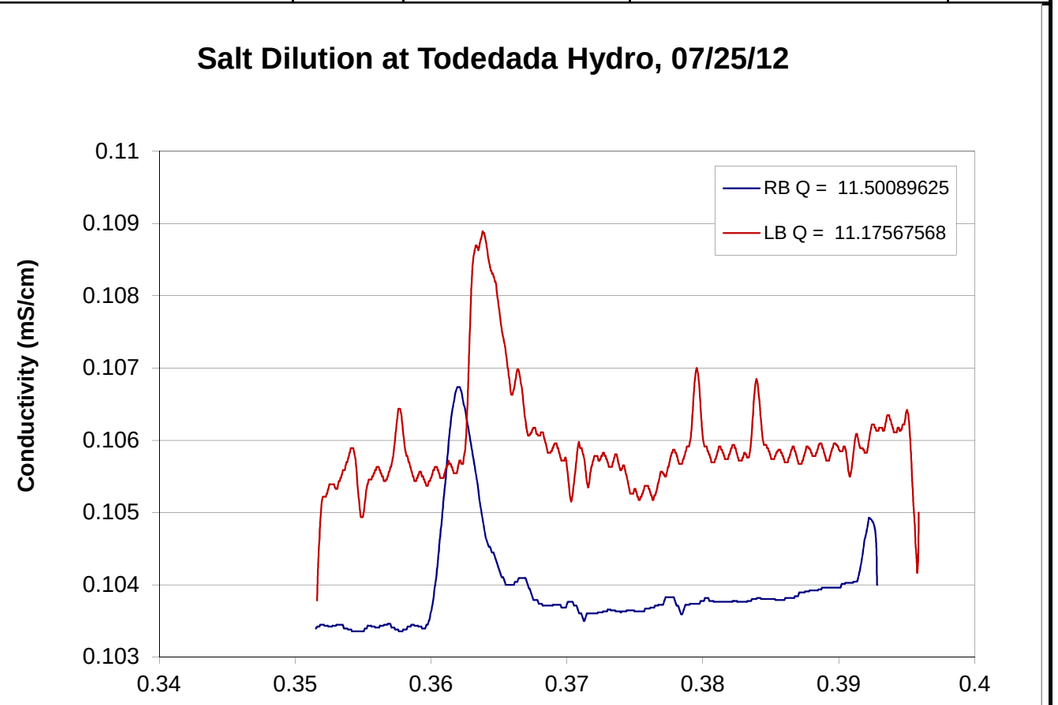
Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	No marks

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 009	0.652	100.652		100.000	P
BM 047			0.495	100.157	
Crest Gauge			1.069	99.583	bolt @ base
PT			2.407	98.245	
WL			1.365	**99.287**	
TBM	1.237	100.505	1.384	99.268	
WL			1.220	**99.285**	
PT			2.257	98.248	
Crest Gauge			0.922	99.583	
BM 047			0.348	100.157	
BM 009			0.505	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 009		100.000		
BM 047		100.157		
Crest Gauge		99.583		

Summary	
Stage (m)	99.286
Discharge (m^3/s)	11.3
Pressure Transducer Reading (m)	1.088
Pressure Transducer Elevation (m)	98.198

Discharge Measurement Salt Dilution						
Date Monitored:	25-Jul-12				Pressure Transducer (m):	1.088
Time (24 hr):	Start	8:20	End	9:30	Amount of Salt injected:	5.789
Method	Salt Dilution				Mean Discharge Q (m^3/s):	11.34
Probe LB		15457	Ac LB	**0.9324**	K (Cal. Constant) LB:	0.0018
Probe RB		18061	Ac RB	**0.95636894**	K (Cal. Constant) RB:	0.0019
Type of Salt:	Windsor				Error (Std Dev in m^3/s)	0.2



General Notes
New cottonwood fallen from right bank on this visit. Flows noted flooding RB, downstream of PT.

Appendix 2h-2. Manual Discharge Measurements and Levelling Surveys at Todedada Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	TODEDADA-HYDRO			
Stream Name	Todedada Creek			
Date Monitored	25-Sep-12			
Time at Site (24 hr)	Start Time:	1:30:00 PM	End Time:	
Personnel	EB, Brian Tait			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions	foggy			

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 009	0.412	100.412		100.000	P
BM 047			0.241	100.171	
PT				100.412	
WL			1.547	**98.865**	
TBM		100.412		100.412	
WL				100.412	
TBM		100.412		100.412	
WL				100.412	
PT				100.412	
BM 3				100.412	
BM 2				100.412	
BM 1				100.412	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 009		100.206		
BM 047		100.292		
0		100.412		

Summary	
Stage (m)	98.865
Discharge (m^3/s)	3.2
Pressure Transducer Reading (m)	0.297
Pressure Transducer Elevation (m)	98.568

Discharge Measurement - Mid-Section Method

Time (24 hr)	Start	1330	End		Location	10 m DS of cottonwood across stream		
Method	Velocity-area (Mid-section)			Instrument Model		Flo-Mate		
Flow Meter Type	Electromagnetic			Instrument Serial #				
Stage (m)	Start	Reading		Time	13:50			
	End	Reading		Time				

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
RB	3.00	0.00	0.00	0.01	0			0.000	0.0
	3.10	0.21	0.10	0.05	0.08			0.004	0.1
	3.50	0.40	0.40	0.16	0.73			0.116	3.6
	3.90	0.49	0.40	0.20	1.23			0.240	7.4
	4.30	0.58	0.40	0.29	1.3			0.376	11.6
	4.90	0.58	0.60	0.29	1.38			0.400	12.4
	5.30	0.61	0.40	0.27	1.35			0.370	11.5
	5.80	0.55	0.50	0.27	1.33			0.365	11.3
	6.30	0.43	0.50	0.23	1.33			0.312	9.7
	6.90	0.43	0.60	0.23	0.98			0.230	7.1
	7.40	0.37	0.50	0.20	1.15			0.231	7.2
	8.00	0.30	0.60	0.18	0.98			0.179	5.5
	8.60	0.21	0.60	0.13	0.73			0.093	2.9
	9.20	0.24	0.60	0.17	0.38			0.065	2.0
	10.00	0.15	0.80	0.12	0.43			0.052	1.6
	10.80	0.15	0.80	0.12	0.34			0.041	1.3
	11.60	0.18	0.80	0.16	0.26			0.040	1.3
	12.50	0.15	0.90	0.14	0.39			0.056	1.7
	13.50	0.18	1.00	0.18	0.27			0.049	1.5
	14.50	0.09	1.00	0.07	0.14			0.010	0.3
LB	15.10	0.00	0.60	0.03	0			0.000	0.0
Total Q								**3.233**	**100.0**

General Notes

Appendix 2h-2. Manual Discharge Measurements and Levelling Surveys at Todedada Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	TODEDADA-HYDRO			
Stream Name	Todedada Creek			
Date Monitored	17-Oct-12			
Time at Site (24 hr)	Start Time:	9:30:00 AM	End Time:	
Personnel	E. Belland, B. Tait			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions	light snow			

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 009	0.348	100.348		100.000	P
BM 047			0.187	100.161	
PT			2.126	98.222	PT possibly buried in seds
WL			1.415	**98.933**	
TBM	1.060	100.431	0.977	99.371	
WL			1.497	**98.934**	
PT			2.204	98.227	D=0.705
BM 047			0.273	100.158	
BM 009			0.431	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 009		100.000		
BM 047		100.160		
0		#DIV/0!		

Summary	
Stage (m)	98.934
Discharge (m^3/s)	3.6
Pressure Transducer Reading (m)	0.406
Pressure Transducer Elevation (m)	98.527

Discharge Measurement - Mid-Section Method										
Time (24 hr)	Start	930	End		Location	~20 m DS of PT at rebar (same as Sept location)				
Method	Velocity-area (Mid-section)			Instrument Model		Flo-Mate				
Flow Meter Type	Electromagnetic			Instrument Serial #		2007528				
Stage (m)	Start	Reading		Time						
	End	Reading		Time						

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
RB	20.50	0.00	0.00	0.03	0			0.000	0.0
	20.80	0.20	0.30	0.08	0.24			0.019	0.5
	21.30	0.32	0.50	0.13	0.83			0.106	2.9
	21.60	0.34	0.30	0.12	1.23			0.146	4.0
	22.00	0.54	0.40	0.24	1.19			0.289	8.0
	22.50	0.64	0.50	0.32	1.06			0.339	9.4
	23.00	0.66	0.50	0.33	1.18			0.389	10.7
	23.50	0.64	0.50	0.32	1.09			0.349	9.6
	24.00	0.48	0.50	0.24	1.12			0.269	7.4
	24.50	0.50	0.50	0.25	1.15			0.288	7.9
	25.00	0.48	0.50	0.24	0.93			0.223	6.2
	25.50	0.56	0.50	0.28	0.82			0.230	6.3
	26.00	0.48	0.50	0.24	0.97			0.233	6.4
	26.50	0.40	0.50	0.20	0.63			0.126	3.5
	27.00	0.44	0.50	0.22	0.81			0.178	4.9
	27.50	0.40	0.50	0.20	0.74			0.148	4.1
	28.00	0.40	0.50	0.20	0.49			0.098	2.7
	28.50	0.36	0.50	0.18	0.34			0.061	1.7
	29.00	0.30	0.50	0.15	0.51			0.077	2.1
	29.50	0.24	0.50	0.11	0.37			0.040	1.1
	29.90	0.14	0.40	0.06	0.29			0.016	0.4
LB	30.30	0.00	0.40	0.03	0			0.000	0.0
Total Q								**3.624**	**100.0**

General Notes
20 m DS of PT at rebar (same as September location)

Appendix 2h-2. Manual Discharge Measurements and Levelling Surveys at Todedada Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	TODEDADA-HYDRO			
Stream Name	Todedada Creek			
Date Monitored	21-Nov-12			
Time at Site (24 hr)	**Start Time:**	3:00:00 PM	**End Time:**	
Personnel	E. Belland, A. Naghibi			
Station Coordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions	light snow			

Transducer Information			
PT Model		**Serial #**	
Gain		**Offset**	
Status		**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM 009	0.737	100.737		100.000	P
BM 047			0.570	100.167	
PT					not accessible
WL			2.491	**98.246**	**D=0.575**
TBM	1.753	100.703	1.787	98.950	
WL			2.425	**98.278**	**D=0.545**
PT					not accessible
BM 047			0.540	100.163	
BM 009			0.705	99.998	

BM#	**Established Elevation (m)**	**Mean Elevation (this date)**	**Difference (m)**	**Notes**
BM 009		99.999		
BM 047		100.165		

Summary	
Stage (m)	98.822
Discharge (m^3/s)	0.8
Pressure Transducer Reading (m)	0.266
Pressure Transducer Elevation (m)	98.556

Discharge Measurement - Mid-Section Method									
Time (24 hr)	**Start**	1500	**End**		**Location**	~10m DS of Oct location, 20m DS of cottonwood			
Method	Velocity-area (Mid-section)			**Instrument Model**		Flomate			
Flow Meter Type	Flomate			**Instrument Serial #**		14614			
Stage (m)	**Start**	**Reading**	0.266	**Time**	0:00				
	End	**Reading**		**Time**					

	Station	**Depth**	**Distance**	**Area**	**Velocity (m/s)**			**Q**	**% of Total Q**
Notes	**(m)**	**(m)**	**(m)**	**(m^2)**	**60%**	**20%**	**80%**	**(m3/s)**	**%**
LB	11.50	0.00	0.00	0.03	0			0.000	0.0
	11.70	0.31	0.20	0.08	-0.02			-0.002	-0.2
	12.00	0.34	0.30	0.10	0.01			0.001	0.1
	12.30	0.40	0.30	0.12	0.19			0.023	2.7
	12.60	0.48	0.30	0.14	0.71			0.102	12.1
	12.90	0.44	0.30	0.13	0.68			0.090	10.7
	13.20	0.54	0.30	0.16	0.72			0.117	13.9
	13.50	0.54	0.30	0.16	0.63			0.102	12.1
	13.80	0.57	0.30	0.17	0.59			0.101	12.0
	14.10	0.58	0.30	0.17	0.5			0.087	10.3
	14.40	0.58	0.30	0.17	0.57			0.099	11.8
	14.70	0.57	0.30	0.14	0.44			0.063	7.4
	14.90	0.54	0.20	0.14	0.22			0.030	3.5
	15.20	0.58	0.30	0.17	0.17			0.030	3.5
	15.50	0.38	0.30	0.11	0			0.000	0.0
RB	15.80	0.00	0.30	0.06	0			0.000	0.0
Total Q								**0.842**	**100.0**

General Notes
Discharge measured at constriction DS of previous gauging location. ~1m snow and ice lens buildup along banks, channel geometry is changed. Estimate 0.5m snow and ice over PT location.

Appendix 2i-1. Manual Discharge Measurements and Levelling Surveys at Wildfire Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	14-May-11			
Time at Site (24 hr)	**Start Time:**	9:00	**End Time:**	0.486111111
Personnel	M. Soloducha, I. Blackburn			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 042	1.367	101.367		100.000	
BM 043			0.609	**100.758**	
CG			1.075	100.292	
BM 044			1.961	99.406	
WL			2.172	**99.195**	
TBM	2.029	101.293	2.103	99.264	
WL			2.089	**99.204**	
BM 044			1.884	99.409	
CG			0.997	100.296	
CG			0.529	100.764	
CG			1.293	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 042	100	100.000	0.000	
BM 043	100.758	100.758	0.000	
BM 044	99.409	99.409	0.000	

Summary	
Stage (m)	99.200
Discharge (m^3/s)	4.438
Pressure Transducer Reading (m)	0.275
Pressure Transducer Elevation (m)	98.925

Discharge Measurement Salt Dilution						
Date Monitored:	14-May-11				**Pressure Transducer (m):**	0.275
Time (24 hr):	**Start**	9:00	**End**	10:10	**Amount of Salt injected:**	20.1
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	4.438
Probe LB	08J00777		**Ac LB**		**K (Cal. Constant) LB:**	0.002
Probe RB	Not Working		**Ac RB**		**K (Cal. Constant) RB:**	0.002
Type of Salt:	Windsor				**Error (Std Dev in m^3/s)**	0.7

Probe RB: S/N ...

M =	20.14	kg	Mass of salt injected
M =	20140000	mg	
Δτ =	1	s	Time interval
Ac =	8.014039	mS.s/cm	Area under curve
K1 =	0.001772409	(mS L)/(cm mg)	Calibration constant
Q =	4454.2	L/s	Discharge
Q =	**4.45**	m3/s	
RD =	4.5	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N 08J100777

M =	20.14	kg	Mass of salt injected
M =	20140000	mg	
Δτ =	1	s	Time interval
Ac =	8.146886	mS.s/cm	Area under curve
K1 =	0.001789	(mS L)/(cm mg)	Calibration constant
Q =	4422.0	L/s	Discharge
Q =	**4.42**	m3/s	
RD =	4.6	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2i-1. Manual Discharge Measurements and Levelling Surveys at Wildfire Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	21-Jun-11			
Time at Site (24 hr)	Start Time:	12:00	End Time:	13:30
Personnel	M. Soloducha, I. Blackburn			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes

Summary		
Stage (m)		No Survey
Discharge (m^3/s)	5.414	
Pressure Transducer Reading (m)	0.376	
Pressure Transducer Elevation (m)		No Survey

Discharge Measurement Salt Dilution						
Date Monitored:	21-Jun-11				Pressure Transducer (m):	0.376
Time (24 hr):	Start	12:00	End	13:30	Amount of Salt injected:	20.5
Method	Salt Dilution				Mean Discharge Q (m^3/s):	5.414
Probe LB	11D100286		Ac LB		K (Cal. Constant) LB:	0.002214578
Probe RB	11D100287		Ac RB		K (Cal. Constant) RB:	0.001957564
Type of Salt:	Windsor				Error (Std Dev in m^3/s)	13.3

Probe RB: S/N 11D100287

M =	20.464	kg	Mass of salt injected
M =	20464000	mg	
$\Delta\tau$ =	2	s	Time interval
Ac =	7.924363194	mS.s/cm	Area under curve
K1 =	0.001957564	(mS L)/(cm mg)	Calibration constant
Q =	5055.2	L/s	Discharge
Q =	**5.06**	m3/s	
RD =	4.0	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N 11D100286

M =	20.464	kg	Mass of salt injected
M =	20464000	mg	
$\Delta\tau$ =	2	s	Time interval
Ac =	7.84968951	mS.s/cm	Area under curve
K1 =	0.002214578	(mS L)/(cm mg)	Calibration constant
Q =	5773.4	L/s	Discharge
Q =	**5.77**	m3/s	
RD =	3.5	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2i-1. Manual Discharge Measurements and Levelling Surveys at Wildfire Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	20-Jul-11			
Time at Site (24 hr)	**Start Time:**	12:35	**End Time:**	14:22
Personnel	M. Soloducha, J. Cristobal			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM 043	0.133	100.133		100.000	
BM 042			0.356	**99.777**	
2			0.033	100.100	
WL			1.847	**98.286**	
PT			2.194	97.939	
TBM	1.768	100.110	1.791	98.342	
PT			2.177	**97.933**	
WL			1.856	98.254	
2			0.012	100.098	
BM 042			0.334	99.776	
BM 043			0.111	99.999	

BM#	**Established Elevation (m)**	**Mean Elevation (this date)**	**Difference (m)**	**Notes**
BM 043		100.000		
BM 042		99.777		

Summary	
Stage (m)	98.270
Discharge (m^3/s)	1.367
Pressure Transducer Reading (m)	0.294
Pressure Transducer Elevation (m)	97.976

Discharge Measurement Salt Dilution						
Date Monitored:	20-Jul-11				**Pressure Transducer (m):**	0.294
Time (24 hr):	**Start**	12:35	**End**	14:00	**Amount of Salt injected:**	20.5
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	1.367
Probe LB	600336		**Ac LB**		**K (Cal. Constant) LB:**	0.002
Probe RB	115562		**Ac RB**		**K (Cal. Constant) RB:**	0.002
Type of Salt:	Windsor				**Error (Std Dev in m^3/s)**	1.9

Probe RB: S/N	115562		
M =	20.489	kg	Mass of salt injected
M =	20489000	mg	
$\Delta\tau$ =	2	s	Time interval
Ac =	28.47975245	mS.s/cm	Area under curve
K1 =	0.001917983	(mS L)/(cm mg)	Calibration constant
Q =	1379.8	L/s	Discharge
Q =	**1.38**	m3/s	
RD =	14.8	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N	600336		
M =	20.489	kg	Mass of salt injected
M =	20489000	mg	
$\Delta\tau$ =	2	s	Time interval
Ac =	29.75806886	mS.s/cm	Area under curve
K1 =	0.001966363	(mS L)/(cm mg)	Calibration constant
Q =	1353.9	L/s	Discharge
Q =	**1.35**	m3/s	
RD =	15.1	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2i-1. Manual Discharge Measurements and Levelling Surveys at Wildfire Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	24-Sep-11			
Time at Site (24 hr)	**Start Time:**	13:30	**End Time:**	15:20
Personnel	R Larson, Alex			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 042	0.247	100.025		99.778	
WL			1.324	**98.701**	
BM 065			0.917	99.108	
BM 024	1.307	100.015	1.317	**98.708**	
BM 065			0.904	99.111	
WL			1.312	98.703	
BM 042			0.233	**99.782**	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 042		99.780		

Summary	
Stage (m)	98.702
Discharge (m^3/s)	9.204
Pressure Transducer Reading (m)	0.627
Pressure Transducer Elevation (m)	98.075

Discharge Measurement Salt Dilution						
Date Monitored:	24-Sep-11				**Pressure Transducer (m):**	0.294
Time (24 hr):	**Start**	13:30	**End**	15:00	**Amount of Salt injected:**	40.9
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	9.204
Probe LB	SN15468		**Ac LB**		**K (Cal. Constant) LB:**	0.002
Probe RB	SN13234		**Ac RB**		**K (Cal. Constant) RB:**	0.002
Type of Salt:	Windsor				**Error (Std Dev in m^3/s)**	2.2

Probe RB: S/N SN13234

M =	40.9	kg	Mass of salt injected
M =	40900000	mg	
$\Delta\tau$ =	2	s	Time interval
Ac =	10.07943108	mS.s/cm	Area under curve
K1 =	0.002293172	(mS L)/(cm mg)	Calibration constant
Q =	9305.2	L/s	Discharge
Q =	**9.31**	m3/s	
RD =	4.4	kg / (m3/s)	Ratio of salt to flow

Probe LB: S/N SN15468

M =	40.9	kg	Mass of salt injected
M =	40900000	mg	
$\Delta\tau$ =	2	s	Time interval
Ac =	10.14865332	mS.s/cm	Area under curve
K1 =	0.00225854	(mS L)/(cm mg)	Calibration constant
Q =	9102.1	L/s	Discharge
Q =	**9.10**	m3/s	
RD =	4.5	kg / (m3/s)	Ratio of salt to flow

General Notes

Appendix 2i-1. Manual Discharge Measurements and Levelling Surveys at Wildfire Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	28-Oct-11			
Time at Site (24 hr)	Start Time:	3:35:00 PM	End Time:	5:00:00 PM
Personnel	R Larson, K Johnson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS 9800	Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 020	0.821	100.821		100.000	
WL			2.373	98.448	
BM 018	1.284	100.717	1.388	99.433	
WL			2.270	98.447	
BM 020			0.719	**99.998**	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 020		99.999		
BM 018		99.433		

Summary	
Stage (m)	98.448
Discharge (m^3/s)	1.97
Pressure Transducer Reading (m)	0.404
Pressure Transducer Elevation (m)	98.044

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	3:35:00 PM	End	16:00	Location				
Method	Velocity-area (Mid-section)			Instrument Model		FM 2000			
Flow Meter Type	Flo-Mate			Instrument Serial #					
Stage (m)	Start	Reading	0.404	Time					
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	17.00	0.00	0.00	0.09	0			0.000	0.0
	16.50	0.35	0.50	0.16	-0.04			-0.006	-0.3
	16.10	0.44	0.40	0.18	-0.02			-0.004	-0.2
	15.70	0.46	0.40	0.16	0.14			0.023	1.1
	15.40	0.40	0.30	0.14	0.23			0.032	1.6
	15.00	0.61	0.40	0.21	0.38			0.081	4.1
	14.70	0.57	0.30	0.17	0.62			0.106	5.4
	14.40	0.60	0.30	0.18	0.98			0.176	9.0
	14.10	0.62	0.30	0.19	0.82			0.153	7.7
	13.80	0.64	0.30	0.19	0.7			0.134	6.8
	13.50	0.64	0.30	0.19	0.84			0.161	8.2
	13.20	0.60	0.30	0.18	0.54			0.097	4.9
	12.90	0.55	0.30	0.17	0.58			0.096	4.9
	12.60	0.54	0.30	0.16	0.75			0.122	6.2
	12.30	0.54	0.30	0.16	0.91			0.147	7.5
	12.00	0.56	0.30	0.17	0.78			0.131	6.7
	11.70	0.53	0.30	0.16	0.98			0.156	7.9
	11.40	0.50	0.30	0.15	0.61			0.091	4.6
	11.10	0.50	0.30	0.15	0.97			0.146	7.4
	10.80	0.46	0.30	0.18	0.26			0.048	2.4
	10.30	0.38	0.50	0.29	0.08			0.023	1.2
	9.30	0.29	1.00	0.25	0.2			0.049	2.5
	8.60	0.19	0.70	0.14	0.05			0.007	0.4
Right Bank	7.80	0.00	0.80	0.00	0			0.000	0.0
Total Q								1.969	100.0

General Notes
Winter benchmarks used; will have to be tied in to hub.

Appendix 2i-1. Manual Discharge Measurements and Levelling Surveys at Wildfire Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	11-Nov-11			
Time at Site (24 hr)	Start Time:	3:16:00 PM	End Time:	3:46:00 PM
Personnel	M. Soloducha, K. Johnson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS 9800	Serial #	
Gain		Offset	
Status		Battery	
# of Records	Active	Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 020	1.062	101.062		100.000	
BM 018			1.620	99.442	
BM 011			2.371	98.691	
WL			2.281	**98.781**	
TBM	2.146	101.008	2.200	98.862	
WL			2.232	**98.776**	
BM011			2.314	98.694	
BM 018			1.568	99.440	
BM 020			1.011	99.997	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 020		99.999		
BM 018		99.441		
BM 011		98.693		

Summary	
Stage (m)	98.779
Discharge (m^3/s)	0.25
Pressure Transducer Reading (m)	0.316
Pressure Transducer Elevation (m)	98.463

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	3:16:00 PM	End	15:45	Location				
Method	Velocity-area (Mid-section)			Instrument Model		FM 2000			
Flow Meter Type	Flo-Mate			Instrument Serial #					
Stage (m)	Start	Reading	0.316	Time	15:16				
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	0.80	0.00	0.00	0.03	0			0.000	0.0
	1.00	0.52	0.20	0.25	0			0.000	0.0
	1.75	0.67	0.75	0.50	-0.02			-0.010	-4.1
	2.50	0.84	0.75	0.63	-0.03			-0.019	-7.7
	3.25	0.90	0.75	0.68	-0.03			-0.020	-8.2
	4.00	0.93	0.75	0.70	-0.02			-0.014	-5.7
	4.75	0.90	0.75	0.68		0.03	0.02	0.017	6.9
	5.50	0.86	0.75	0.65		0.19	0.29	0.155	63.0
	6.25	0.85	0.75	0.64		0.14	0.32	0.147	59.7
	7.00	0.67	0.75	0.50	0.05			0.025	10.2
	7.75	0.68	0.75	0.51	-0.04			-0.020	-8.3
	8.50	0.62	0.75	0.47	-0.04			-0.019	-7.6
	9.25	0.48	0.75	0.36	0.03			0.011	4.4
	10.00	0.30	0.75	0.23	-0.01			-0.002	-0.9
	10.75	0.22	0.75	0.17	0			0.000	0.0
	11.50	0.19	0.75	0.14	-0.02			-0.003	-1.2
	12.25	0.10	0.75	0.08	0			0.000	0.0
	13.00	0.14	0.75	0.09	-0.01			-0.001	-0.4
	13.60	0.07	0.60	0.03	-0.01			0.000	-0.1
Right Bank	13.80	0.00	0.20	0.00	0			0.000	0.0
Total Q								**0.246**	**100.0**

General Notes
Winter benchmarks used; will have to be tied in to hub.

Appendix 2i-2. Manual Discharge Measurements and Levelling Surveys at Wildfire Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	21-Mar-12			
Time at Site (24 hr)	Start Time:	10:50:00 AM	End Time:	11:40:00 AM
Personnel	E. Belland, M. Soloducha			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 019	0.940	102.198		0.000	W
BM 059			1.993	100.205	HI from BM 059
WL			3.936	**98.262**	
TBM	3.823	102.141	3.880	98.318	
WL			3.879	**98.262**	
BM 059			1.935	100.206	
BM 019			0.882	101.259	
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes

Summary	
Stage (m)	98.262
Discharge (m^3/s)	0.17
Pressure Transducer Reading (m)	0.622
Pressure Transducer Elevation (m)	97.640

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	10:50:00 AM	End	11:40	Location				
Method	Velocity-area (Mid-section)			Instrument Model					
Flow Meter Type				Instrument Serial #					
Stage (m)	Start	Reading		Time					
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
LB	3.40	0.00	0.00	0.01	0			0.000	0.0
	3.60	0.11	0.20	0.03	-0.01			0.000	-0.2
	3.90	0.12	0.30	0.04	0			0.000	0.0
	4.20	0.09	0.30	0.03	0.04			0.001	0.7
	4.50	0.12	0.30	0.04	0			0.000	0.0
	4.80	0.17	0.30	0.05	-0.01			-0.001	-0.3
	5.10	0.18	0.30	0.05	0.03			0.002	1.0
	5.40	0.30	0.30	0.09	0.04			0.004	2.2
	5.70	0.30	0.30	0.09	0.04			0.004	2.2
	6.00	0.30	0.30	0.09	0.04			0.004	2.2
	6.30	0.30	0.30	0.09	0.09			0.008	5.0
	6.60	0.32	0.30	0.10	0.12			0.012	6.9
	6.90	0.35	0.30	0.11	0.08			0.008	5.1
	7.20	0.37	0.30	0.11	0.05			0.005	3.3
	7.50	0.37	0.30	0.11	0.07			0.008	4.6
	7.80	0.35	0.30	0.11	0.13			0.014	8.2
	8.10	0.32	0.30	0.10	0.11			0.011	6.4
	8.40	0.30	0.30	0.09	0.12			0.011	6.6
	8.70	0.35	0.30	0.11	0.06			0.006	3.8
	9.00	0.38	0.30	0.11	0.14			0.016	9.6
	9.30	0.38	0.30	0.11	0.11			0.013	7.6
	9.60	0.37	0.30	0.11	0.12			0.013	7.9
	9.90	0.38	0.30	0.11	0.12			0.014	8.3
	10.20	0.37	0.30	0.11	0.07			0.008	4.6
	10.50	0.34	0.30	0.10	0.05			0.005	3.0
	10.80	0.27	0.30	0.08	0.03			0.002	1.5
	11.10	0.12	0.30	0.03	-0.01			0.000	-0.2
	11.30	0.00	0.20	0.00	0			0.000	0.0
Total Q								**0.166**	**100.0**

General Notes
Winter benchmarks used; will have to be tied in to hub.

Appendix 2i-2. Manual Discharge Measurements and Levelling Surveys at Wildfire Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	3-May-12			
Time at Site (24 hr)	Start Time:	8:00	End Time:	12:00
Personnel				
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

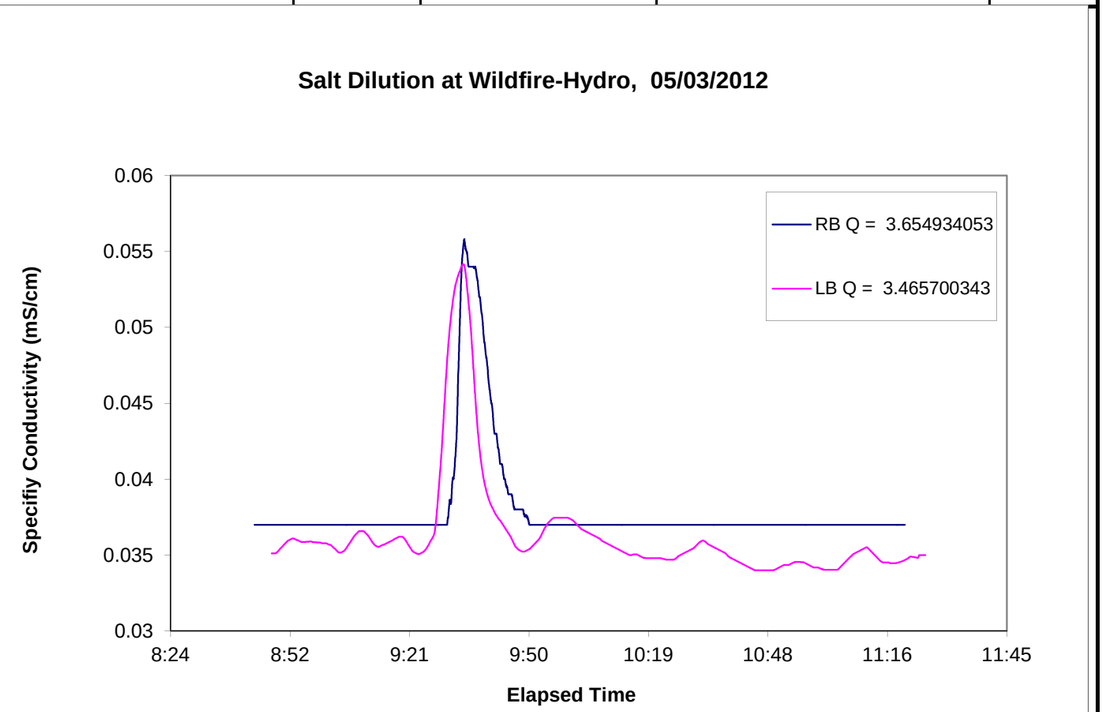
Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes

Summary	
Stage (m)	
Discharge (m^3/s)	3.6
Pressure Transducer Reading (m)	
Pressure Transducer Elevation (m)	

Discharge Measurement Salt Dilution						
Date Monitored:	3-May-12				Pressure Transducer (m):	
Time (24 hr):	Start	8:40	End	11:30	Amount of Salt injected:	14.946
Method	Salt Dilution				Mean Discharge Q (m^3/s):	3.56
Probe LB		17106	Ac LB	9.55047451	K (Cal. Constant) LB:	0.002
Probe RB		11172	Ac RB	9.056	K (Cal. Constant) RB:	0.002
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.1



General Notes
Salt dilution performed downstream of monitoring site at future bridge crossing location- stage estimated from PT timeseries data.

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	20-Jun-12			
Time at Site (24 hr)	Start Time:	12:00	End Time:	14:00
Personnel	E. Belland, T. Englesmeier			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions	Fair, overcast			

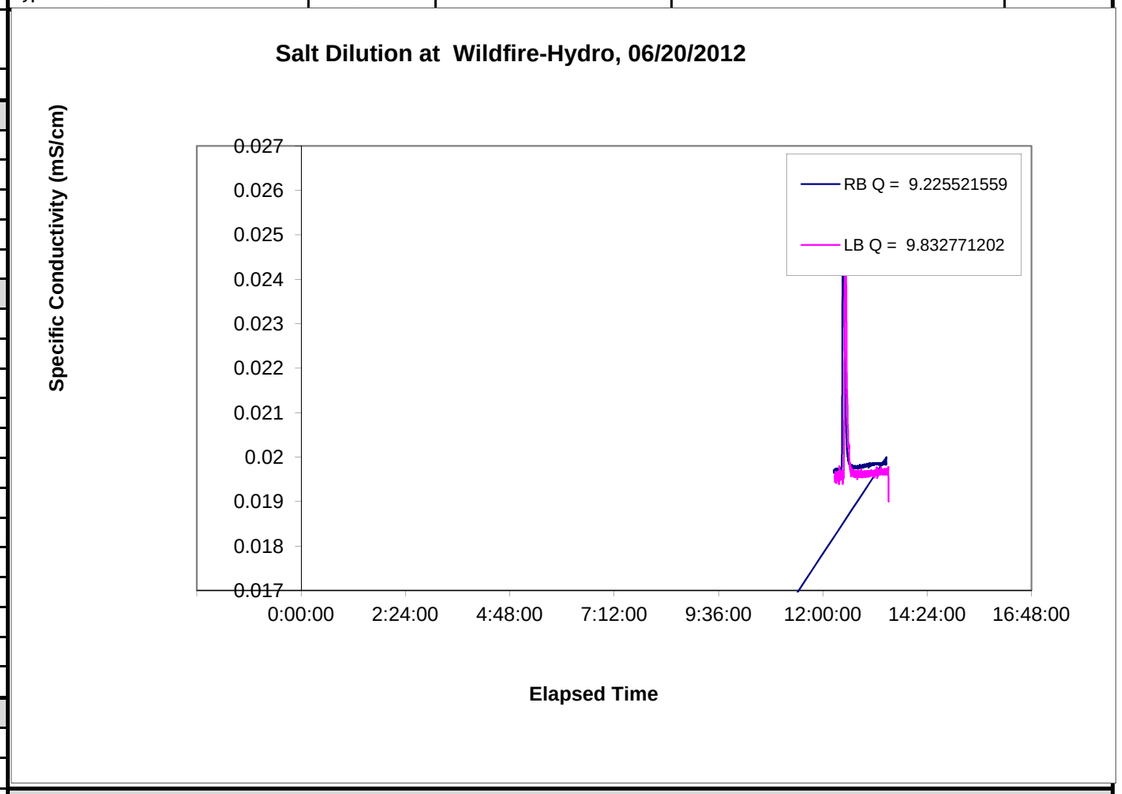
Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 020	0.955	100.955		100.000	P
BM 059			0.751	100.204	
BM 018			1.518	99.437	
PT			2.812	98.143	3rd hose clamp
WL			2.224	**98.731**	
TBM	2.373	100.906	2.422	98.533	
WL			2.176	**98.730**	
PT			2.765	98.141	
BM 018			1.472	99.434	
BM 059			0.703	100.203	
BM 020			0.907	99.999	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 020		100.000	-100.000	
BM 059		100.204	-100.204	
BM 018		99.436	-99.436	

Summary	
Stage (m)	98.731
Discharge (m^3/s)	9.5
Pressure Transducer Reading (m)	0.725
Pressure Transducer Elevation (m)	98.006

Discharge Measurement Salt Dilution						
Date Monitored:	20-Jun-12				Pressure Transducer (m):	0.725
Time (24 hr):	Start	12:15	End	13:30	Amount of Salt injected:	6.225
Method	Salt Dilution				Mean Discharge Q (m^3/s):	9.53
Probe LB		13620	Ac LB	1.26617408	K (Cal. Constant) LB:	0.002
Probe RB		12397	Ac RB	1.3495172	K (Cal. Constant) RB:	0.002
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.4



General Notes

Appendix 2i-2. Manual Discharge Measurements and Levelling Surveys at Wildfire Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	22-Jun-12			
Time at Site (24 hr)	Start Time:	10:00	End Time:	
Personnel	E. Belland, T. Englesmeier			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions	Fair			

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

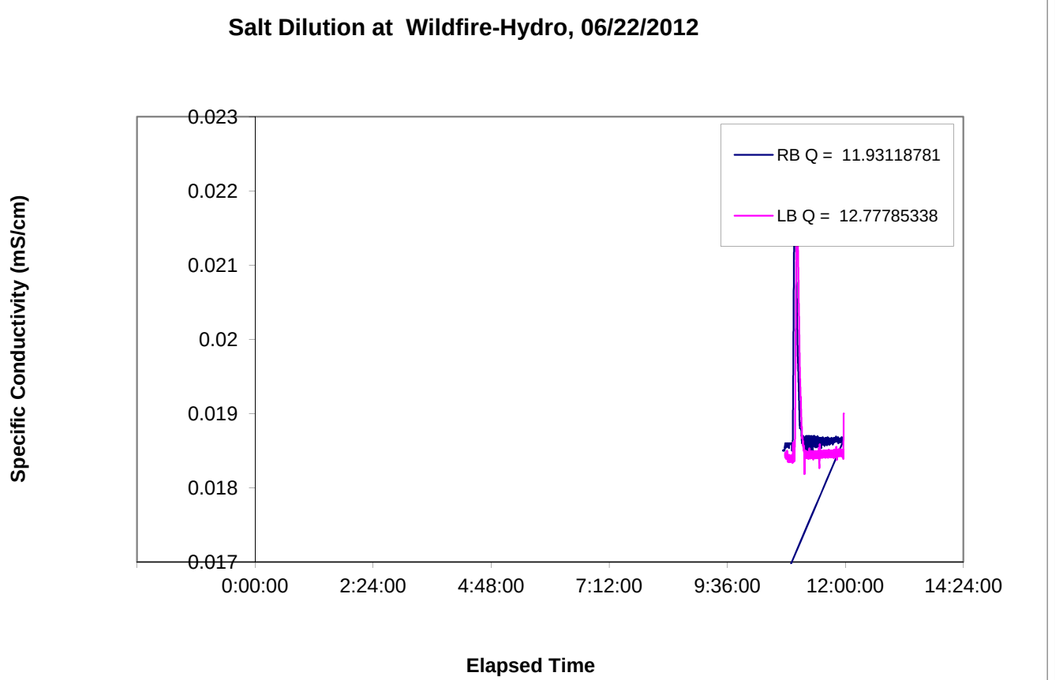
Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 020	0.987	100.987		100.000	BM 028 (?)
BM 059			0.782	100.205	
BM 018			1.551	99.436	
PT			2.867	98.120	
WL			2.178	**98.809**	
TBM	2.401	101.014	2.374	98.613	
WL			2.205	**98.809**	
PT			2.904	98.110	
BM 018			1.577	99.437	
BM 059			0.807	100.207	
BM 020			1.014	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 020		100.000	-100.000	
BM 059		100.206	-100.206	
BM 018		99.437	-99.437	

Summary	
Stage (m)	98.809
Discharge (m^3/s)	12.4
Pressure Transducer Reading (m)	0.793
Pressure Transducer Elevation (m)	98.016

Discharge Measurement Salt Dilution						
Date Monitored:	22-Jun-12				Pressure Transducer (m):	0.793
Time (24 hr):	Start	10:30	End	12:00	Amount of Salt injected:	5.93
Method	Salt Dilution				Mean Discharge Q (m^3/s):	12.35
Probe LB		13620	Ac LB	0.92816842	K (Cal. Constant) LB:	0.002
Probe RB		12397	Ac RB	0.99403347	K (Cal. Constant) RB:	0.002
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.6



General Notes
Both probes on LB for safety reasons

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	26-Jul-12			
Time at Site (24 hr)	Start Time:	7:40	End Time:	10:00
Personnel	E. Belland, T. Englesmeier			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

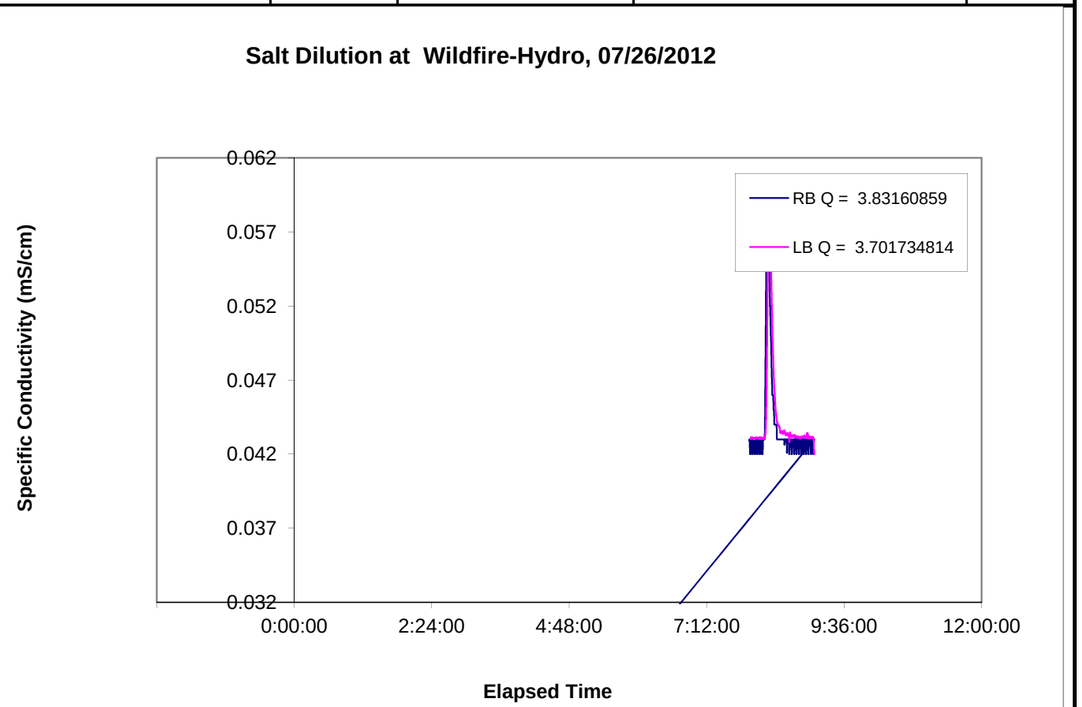
Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 020	0.942	100.942		100.000	P
BM 059			0.738	100.204	
BM 018			1.505	99.437	rebar
PT			2.800	98.142	
WL			2.423	**98.519**	
TBM	2.234	100.831	2.345	98.597	
WL			2.308	**98.523**	
PT			2.683	98.148	
BM 018			1.394	99.437	
BM 059			0.625	100.206	
BM 020			0.827	100.004	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 020		100.002	-100.002	
BM 059		100.205	-100.205	
BM 018		99.437	-99.437	

Summary	
Stage (m)	98.521
Discharge (m^3/s)	3.8
Pressure Transducer Reading (m)	0.466
Pressure Transducer Elevation (m)	98.055

Discharge Measurement Salt Dilution						
Date Monitored:	26-Jul-12				Pressure Transducer (m):	0.466
Time (24 hr):	Start	7:45	End	9:15	Amount of Salt injected:	9.032
Method	Salt Dilution				Mean Discharge Q (m^3/s):	3.77
Probe LB		15457	Ac LB	4.87987414	K (Cal. Constant) LB:	0.002
Probe RB		18061	Ac RB	4.71446902	K (Cal. Constant) RB:	0.002
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.1



General Notes

Appendix 2i-2. Manual Discharge Measurements and Levelling Surveys at Wildfire Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	26-Sep-12			
Time at Site (24 hr)	Start Time:	3:15:00 PM	End Time:	
Personnel	EB, Brian Tait			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions	rain			

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 011	1.426	100.119		98.693	BM 011 el. From 2011
WL			1.788	98.331	From x-section survey

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes

Summary	
Stage (m)	
Discharge (m^3/s)	0.7
Pressure Transducer Reading (m)	0.315
Pressure Transducer Elevation (m)	

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	1515	End		Location	at PT			
Method	Velocity-area (Mid-section)			Instrument Model					
Flow Meter Type				Instrument Serial #					
Stage (m)	Start	Reading		Time					
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
LB	1.30	0.00	0.00	0.02	0			0.000	0.0
	1.60	0.15	0.30	0.05	0.02			0.001	0.2
	2.00	0.21	0.40	0.10	0.02			0.002	0.3
	2.50	0.30	0.50	0.15	0.01			0.002	0.2
	3.00	0.40	0.50	0.20	0.09			0.018	2.6
	3.50	0.46	0.50	0.18	0.34			0.062	8.9
	3.80	0.46	0.30	0.14	0.49			0.067	9.7
	4.10	0.43	0.30	0.15	0.58			0.087	12.4
	4.50	0.49	0.40	0.17	0.52			0.089	12.7
	4.80	0.46	0.30	0.18	0.26			0.048	6.8
	5.30	0.40	0.50	0.20	0.13			0.026	3.7
	5.80	0.40	0.50	0.16	0.23			0.036	5.2
	6.10	0.46	0.30	0.14	0.43			0.059	8.5
	6.40	0.37	0.30	0.11	0.72			0.079	11.3
	6.70	0.34	0.30	0.10	0.49			0.049	7.1
	7.00	0.40	0.30	0.12	0.3			0.036	5.1
	7.30	0.24	0.30	0.09	0.35			0.030	4.3
	7.70	0.12	0.40	0.06	0			0.000	0.0
	8.30	0.12	0.60	0.08	0			0.000	0.0
	9.00	0.12	0.70	0.07	0.09			0.007	0.9
RB	9.50	0.00	0.50	0.03	0			0.000	0.0
Total Q								0.696	100.0

General Notes
Stage height obtained from PT timeseries- Stage in survey not taken at usual stage location.

Appendix 2i-2. Manual Discharge Measurements and Levelling Surveys at Wildfire Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	19-Oct-12			
Time at Site (24 hr)	Start Time:	9:00:00 AM	End Time:	
Personnel	EB, Brian Tait			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions	fair, clear			

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 020	0.885	100.885		100.000	P
BM 052			0.677	100.208	W
BM 018			1.450	99.435	rebar on LB
PT			2.790	98.095	
WL			2.443	**98.442**	
TBM	2.554	100.891	2.548	98.337	
WL			2.457	**98.434**	
PT			2.798	98.093	
BM 018			1.458	99.433	
BM 052			0.687	100.204	
BM 020			0.894	99.997	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 020		99.999		
BM 052		100.206		
BM 018		99.434		

Summary	
Stage (m)	98.438
Discharge (m^3/s)	1.8
Pressure Transducer Reading (m)	0.420
Pressure Transducer Elevation (m)	98.018

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	850	End		Location	at PT			
Method	Velocity-area (Mid-section)			Instrument Model					
Flow Meter Type				Instrument Serial #		2007528			
Stage (m)	Start	Reading		Time					
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
LB	20.20	0.00	0.00	0.03	0			0.000	0.0
	20.50	0.20	0.30	0.07	-0.02			-0.001	-0.1
	20.90	0.30	0.40	0.14	0.07			0.009	0.5
	21.40	0.40	0.50	0.20	0.1			0.020	1.1
	21.90	0.48	0.50	0.24	0.18			0.043	2.4
	22.40	0.56	0.50	0.25	0.61			0.154	8.5
	22.80	0.54	0.40	0.22	0.77			0.166	9.2
	23.20	0.58	0.40	0.23	0.57			0.132	7.3
	23.60	0.58	0.40	0.26	0.9			0.235	13.0
	24.10	0.62	0.50	0.31	0.53			0.164	9.1
	24.60	0.54	0.50	0.27	0.57			0.154	8.5
	25.10	0.64	0.50	0.29	0.69			0.199	11.0
	25.50	0.50	0.40	0.18	0.83			0.145	8.1
	25.80	0.48	0.30	0.14	0.93			0.134	7.4
	26.10	0.50	0.30	0.15	0.75			0.113	6.2
	26.40	0.48	0.30	0.19	0.26			0.050	2.8
	26.90	0.36	0.50	0.18	0.13			0.023	1.3
	27.40	0.28	0.50	0.14	0.04			0.006	0.3
	27.90	0.30	0.50	0.17	0.26			0.043	2.4
	28.50	0.16	0.60	0.07	0.14			0.010	0.6
	28.80	0.14	0.30	0.05	0.07			0.003	0.2
RB	29.20	0.00	0.40	0.03	0			0.000	0.0
Total Q								**1.802**	**100.0**

General Notes

Appendix 2i-2. Manual Discharge Measurements and Levelling Surveys at Wildfire Hydro in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire Hydro			
Stream Name	Wildfire Creek			
Date Monitored	22-Nov-12			
Time at Site (24 hr)	Start Time:	12:35:00 PM	End Time:	
Personnel	EB, Ali Naghibi			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions	(-5, snowing)			

Transducer Information			
PT Model		Serial #	
Gain		Offset	
Status		Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 020	0.908	100.908		100.000	P
BM 059			0.705	100.203	
PT			2.817	98.091	hose clamp at end of PT
WL			2.278	**98.630**	
TBM	2.337	100.935	2.310	98.598	
WL			2.305	**98.630**	
PT			2.841	98.094	
BM 059			0.729	100.206	
BM 020			0.933	100.002	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 020		100.001		
BM 059		100.205		

Summary	
Stage (m)	98.630
Discharge (m^3/s)	0.25
Pressure Transducer Reading (m)	0.622
Pressure Transducer Elevation (m)	98.008

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	1235	End	1305	Location	~ 20m US of PT			
Method	Velocity-area (Mid-section)			Instrument Model		Flo-mate			
Flow Meter Type	Electromagnetic			Instrument Serial #					
Stage (m)	Start	Reading	0.622	Time	12:35				
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
LB	11.00	0.00	0.00	0.05	0			0.000	0.0
	11.20	0.48	0.20	0.10	0.06			0.006	2.3
	11.40	0.52	0.20	0.10	0.08			0.008	3.3
	11.60	0.48	0.20	0.10	0.04			0.004	1.5
	11.80	0.48	0.20	0.10	0.1			0.010	3.8
	12.00	0.55	0.20	0.11	0.2			0.022	8.7
	12.20	0.55	0.20	0.11	0.2			0.022	8.7
	12.40	0.58	0.20	0.12	0.28			0.032	12.9
	12.60	0.50	0.20	0.10	0.25			0.025	9.9
	12.80	0.50	0.20	0.10	0.32			0.032	12.7
	13.00	0.52	0.20	0.10	0.35			0.036	14.4
	13.20	0.54	0.20	0.11	0.33			0.036	14.1
	13.40	0.48	0.20	0.10	0.16			0.015	6.1
	13.60	0.50	0.20	0.10	0.08			0.008	3.2
	13.80	0.50	0.20	0.10	-0.04			-0.004	-1.6
RB	14.00	0.00	0.20	0.00	0			0.000	0.0
Total Q								0.252	100.0

General Notes
Channel has accumulated ~.75m of snow/ice on RB and 0.10m on LB. Channel geometry at gauging section is artificial; from ice breaking

Appendix 2j-1. Manual Discharge Measurements and Levelling Surveys at Wildfire-H2 in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire H2			
Stream Name	Wildfire Creek			
Date Monitored	1-May-12			
Time at Site (24 hr)	Start Time:	9:00	End Time:	16:00
Personnel	E. Belland, M. Soloducha, T. Englesmeier			
Station Coordinates	Easting	Northing	Elevation	
	467039	6262797	521	
Weather Conditions	Overcast			

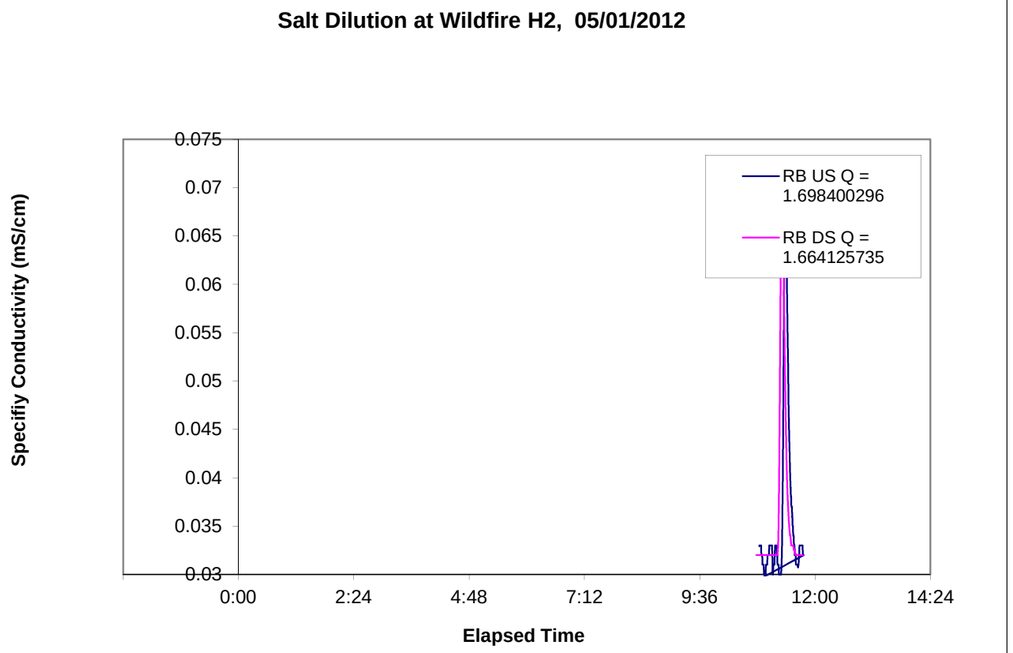
Transducer Information			
PT Model	PS9800	Serial #	9090152
Gain		Offset	
Status	Active	Battery	
# of Records	0	Memory Free	100%
Date Serviced	1-May-12	Crest Gauges	n/a

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 080	1.361	101.361		100.000	P
BM 082			1.799	99.562	
BM 081			0.878	100.483	W
PT			4.298	97.063	bot. hose clamp
WL			3.952	**97.409**	
TBM	3.857	101.810	3.408	97.953	
WL			4.395	**97.415**	
PT			4.748	97.062	
BM 081			1.321	100.489	
BM 082			2.240	99.570	
BM 080			1.808	100.002	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 080		100.001	-100.001	
BM 082		99.566	-99.566	
BM 081		100.486	-100.486	

Summary	
Stage (m)	97.412
Discharge (m^3/s)	1.7
Pressure Transducer Reading (m)	0.420
Pressure Transducer Elevation (m)	96.992

Discharge Measurement Salt Dilution						
Date Monitored:	1-May-12				Pressure Transducer (m):	0.420
Time (24 hr):	Start	10:45	End	12:00	Amount of Salt injected:	11.99
Method	Salt Dilution				Mean Discharge Q (m^3/s):	1.68126302
Probe RB DS		11172	Ac RB DS	**15.956**	K (Cal. Constant) LB:	0.002
Probe RB US		17106	Ac RB US	**15.634**	K (Cal. Constant) RB:	0.002
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.03



General Notes
Site installed this date. Both probes on right bank due to safety concerns crossing creek.

Appendix 2j-1. Manual Discharge Measurements and Levelling Surveys at Wildfire-H2 in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire H2			
Stream Name	Wildfire Creek			
Date Monitored	3-May-12			
Time at Site (24 hr)	Start Time:	13:00	End Time:	15:00
Personnel	E. Belland, T. Englesmeier			
Station Coordinates	Easting	Northing	Elevation	
	467039	6262797	521	
Weather Conditions	Clear, +10 deg C			

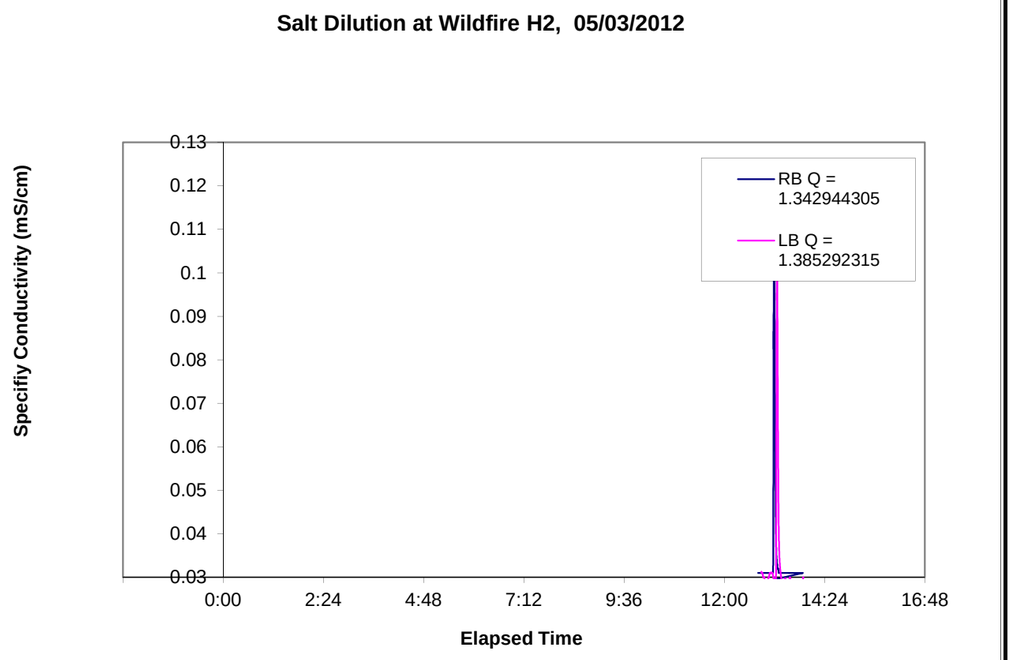
Transducer Information			
PT Model	PS9800	Serial #	9090152
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced	1-May-12	Crest Gauges	Installed

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 080	1.935	101.935		100.000	P
BM 082			2.357	99.578	
BM 081			1.439	100.496	
PT			4.850	97.085	
WL			4.575	**97.360**	
TBM	4.238	102.178	3.995	97.940	
WL			4.815	**97.363**	
PT					
BM 081			1.676	100.502	
BM 082			2.593	99.585	
BM 080			2.175	100.003	
Crest Gauge			2.968	99.210	Nail at base

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 080		100.002		
BM 082		99.582		
BM 081		100.499		

Summary	
Stage (m)	97.362
Discharge (m^3/s)	1.4
Pressure Transducer Reading (m)	0.396
Pressure Transducer Elevation (m)	96.965

Discharge Measurement Salt Dilution						
Date Monitored:	3-May-12				Pressure Transducer (m):	0.396
Time (24 hr):	Start		End	14:00	Amount of Salt injected:	6.924
Method	Salt Dilution				Mean Discharge Q (m^3/s):	1.36411831
Probe LB		17106	Ac LB	**11.068955**	K (Cal. Constant) LB:	0.002
Probe RB		11172	Ac RB	**11.418**	K (Cal. Constant) RB:	0.002
Type of Salt:	Windsor				Error (Std Dev in m^3/s)	0.1



General Notes

Appendix 2j-1. Manual Discharge Measurements and Levelling Surveys at Wildfire-H2 in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire H2			
Stream Name	Wildfire Creek			
Date Monitored	20-Jun-12			
Time at Site (24 hr)	Start Time:	9:00	End Time:	12:00
Personnel	E. Belland, T. Englesmeier			
Station Coordinates	Easting	Northing	Elevation	
	467039	6262797	521	
Weather Conditions				

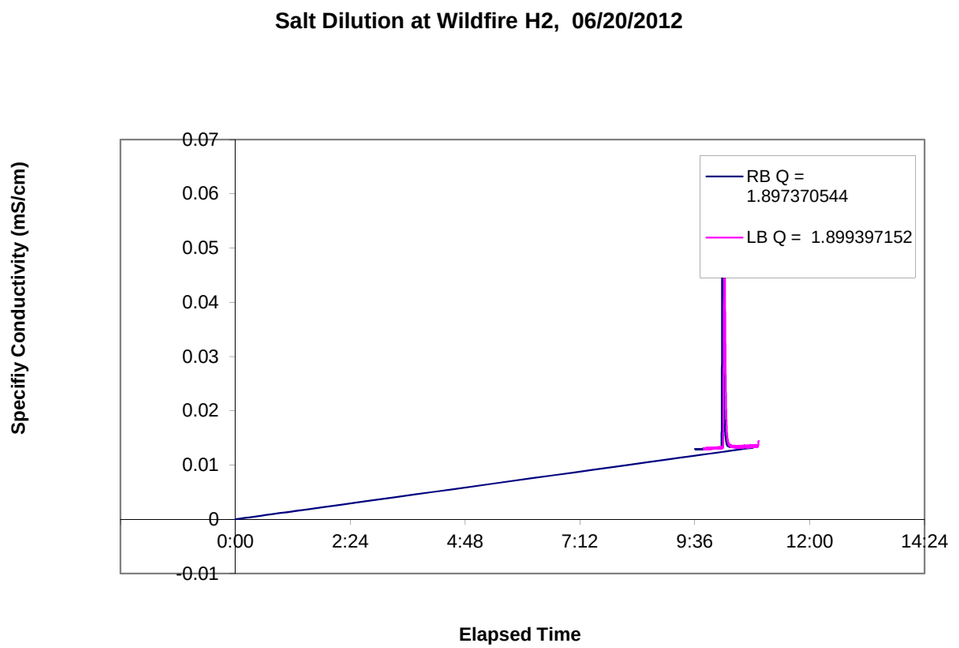
Transducer Information			
PT Model	PS9800	Serial #	9090152
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced	1-May-12	Crest Gauges	Checked

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 080	0.787	100.787		100.000	P
BM 082			1.226	99.561	
BM 081			0.307	100.480	W
PT			3.528	97.259	bot. hose clamp
WL			3.387	**97.400**	
TBM	3.558	100.615	3.730	97.057	
WL			3.224	**97.391**	
PT			3.356	97.259	
BM 081			0.136	100.479	
BM 082			1.055	99.560	
BM 080			0.616	99.999	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 080		100.000		
BM 082		99.561		
BM 081		100.480		

Summary	
Stage (m)	97.396
Discharge (m^3/s)	1.9
Pressure Transducer Reading (m)	0.411
Pressure Transducer Elevation (m)	96.984

Discharge Measurement Salt Dilution						
Date Monitored:	20-Jun-12				Pressure Transducer (m):	0.411
Time (24 hr):	Start	9:00	End	11:00	Amount of Salt injected:	4.955
Method	Salt Dilution				Mean Discharge Q (m^3/s):	1.89838385
Probe LB		13620	Ac LB	**5.7772194**	K (Cal. Constant) LB:	0.002
Probe RB		12397	Ac RB	**5.7833901**	K (Cal. Constant) RB:	0.002
Type of Salt:		Windsor			Error (Std Dev in m^3/s)	0.0



General Notes

Appendix 2j-1. Manual Discharge Measurements and Levelling Surveys at Wildfire-H2 in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire H2			
Stream Name	Wildfire Creek			
Date Monitored	22-Jun-12			
Time at Site (24 hr)	Start Time:	12:00	End Time:	15:00
Personnel	E. Belland, T. Englesmeier			
Station Coordinates	Easting	Northing	Elevation	
	467039	6262797	521	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	9090152
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced	1-May-12	Crest Gauges	Checked

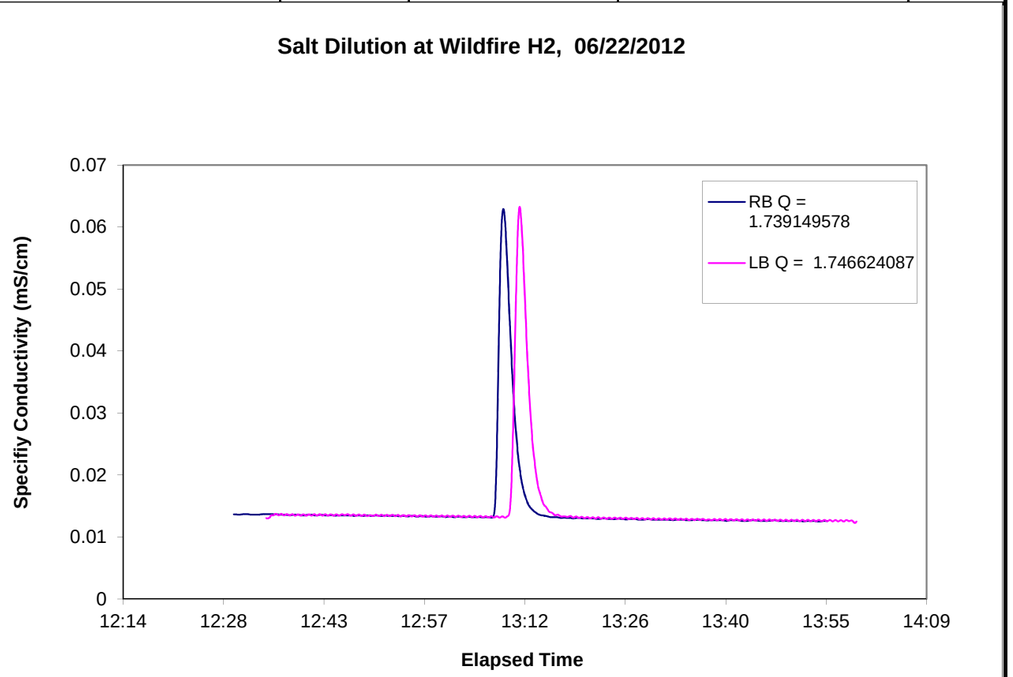
Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 080	0.877	100.877		100.000	P
BM 082			1.316	99.561	
BM 081			0.398	100.479	W
PT			3.619	97.258	bot. hose clamp
WL			3.489	**97.388**	
TBM	3.821	100.895	3.803	97.074	
WL			3.508	**97.387**	
PT			3.637	97.258	
BM 081			0.416	100.479	
BM 082			1.333	99.562	
BM 080			0.897	99.998	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 080		99.999		
BM 082		99.562		
BM 081		100.479		

Summary	
Stage (m)	97.388
Discharge (m^3/s)	1.7
Pressure Transducer Reading (m)	0.404
Pressure Transducer Elevation (m)	96.983

Discharge Measurement Salt Dilution						
Date Monitored:	22-Jun-12				Pressure Transducer (m):	0.404
Time (24 hr):	Start	12:00	End	14:00	Amount of Salt injected:	4.935
Method	Salt Dilution				Mean Discharge Q (m^3/s):	1.74288683
Probe LB		13620	Ac LB	**6.2571806**	K (Cal. Constant) LB:	0.002
Probe RB		12397	Ac RB	**6.2840727**	K (Cal. Constant) RB:	0.002
Type of Salt:	Windsor				Error (Std Dev in m^3/s)	0.01



General Notes

Appendix 2j-1. Manual Discharge Measurements and Levelling Surveys at Wildfire-H2 in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Wildfire H2			
Stream Name	Wildfire Creek			
Date Monitored	25-Jul-12			
Time at Site (24 hr)	**Start Time:**	12:00	**End Time:**	16:00
Personnel	E. Belland, T. Englesmeier			
Station Coordinates	**Easting**	**Northing**	**Elevation**	
	467039	6262797	521	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	9090152
Gain		**Offset**	
Status	Active	**Battery**	
# of Records	65534	**Memory Free**	49754
Date Serviced	1-May-12	**Crest Gauges**	Checked

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 080	0.697	100.697		100.000	P
BM 082			1.134	99.563	
BM 081			0.216	100.481	
PT			3.642	97.055	bot. hose clamp
WL			3.582	**97.115**	
TBM	3.451	100.423	3.725	96.972	
WL			3.324	**97.099**	
PT			3.362	97.061	
BM 081			-0.060	100.483	
BM 082			0.862	99.561	
BM 080			0.423	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 080		100.000		
BM 082		99.562		
BM 081		100.482		

Summary	
Stage (m)	97.107
Discharge (m^3/s)	n/a
Pressure Transducer Reading (m)	0.130
Pressure Transducer Elevation (m)	96.978

Discharge Measurement Salt Dilution						
Date Monitored:	25-Jul-12				**Pressure Transducer (m):**	0.130
Time (24 hr):	**Start**		**End**		**Amount of Salt injected:**	
Method	Salt Dilution				**Mean Discharge Q (m^3/s):**	
Probe LB			**Ac LB**		**K (Cal. Constant) LB:**	
Probe RB			**Ac RB**		**K (Cal. Constant) RB:**	
Type of Salt:					**Error (Std Dev in m^3/s)**	

n/a

General Notes

Salt dilution conductivity data unusable from this site visit.

Appendix 2j-1. Manual Discharge Measurements and Levelling Surveys at Wildfire-H2 in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	WILDFIRE-H2			
Stream Name	Upper Wildfire Creek			
Date Monitored	26-Sep-12			
Time at Site (24 hr)	Start Time:	12:10:00 PM	End Time:	1:50:00 PM
Personnel	E. Belland, Brian Tait			
Station Coordinates	Easting	Northing	Elevation	
	467039	6262797	521	
Weather Conditions	rain			

Transducer Information			
PT Model	PS9800	Serial #	9090152
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced	1-May-12	Crest Gauges	Checked

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 080	0.856	100.856		100.000	P
BM 082			1.295	99.561	
BM 081			0.374	100.482	W
PT			3.799	97.057	bot hose clamp
WL			3.799	**97.057**	
TBM	2.706	100.660	2.902	97.954	
WL			3.602	**97.058**	
PT			3.602	97.058	
BM 081			0.177	100.483	
BM 082			1.098	99.562	
BM 080			0.658	100.002	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 080		100.001		
BM 082		99.562		
BM 081		100.483		

Summary	
Stage (m)	97.058
Discharge (m^3/s)	0.1
Pressure Transducer Reading (m)	0.100
Pressure Transducer Elevation (m)	96.958

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	1210	End		Location	6m US of PT, before riffle section			
Method	Velocity-area (Mid-section)			Instrument Model		Flo-Mate			
Flow Meter Type	Electromagnetic			Instrument Serial #					
Stage (m)	Start	Reading		Time					
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
LB	6.50	0.00	0.00	0.00	0			0.000	0.0
	6.40	0.06	0.10	0.02	0.01			0.000	0.3
	6.00	0.06	0.40	0.02	0			0.000	0.0
	5.80	0.06	0.20	0.02	0.02			0.000	0.6
	5.40	0.09	0.40	0.03	0.02			0.001	1.0
	5.20	0.12	0.20	0.02	0.07			0.002	3.0
	5.00	0.15	0.20	0.03	0.04			0.001	2.1
	4.80	0.15	0.20	0.03	0.07			0.002	3.7
	4.60	0.18	0.20	0.04	0.08			0.003	5.1
	4.40	0.18	0.20	0.04	0.1			0.004	6.4
	4.20	0.12	0.20	0.02	0.12			0.003	5.1
	4.00	0.18	0.20	0.04	0.14			0.005	8.9
	3.80	0.18	0.20	0.05	0.14			0.006	11.2
	3.50	0.21	0.30	0.16	0.06			0.010	16.7
	2.30	0.24	1.20	0.17	0.08			0.014	23.8
	2.10	0.21	0.20	0.06	0.08			0.005	8.9
	2.90	0.12	0.80	0.04	0.05			0.002	3.2
RB	2.70	0.00	0.20	0.01	0			0.000	0.0
Total Q								**0.057**	**100.0**

General Notes

Appendix 2j-1. Manual Discharge Measurements and Levelling Surveys at Wildfire-H2 in 2012

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	WILDFIRE-H2			
Stream Name	Upper Wildfire Creek			
Date Monitored	22-Nov-12			
Time at Site (24 hr)	Start Time:	10:20:00 AM	End Time:	
Personnel	EB, Ali Naghibi			
Station Coordinates	Easting	Northing	Elevation	
	467039	6262797	521	
Weather Conditions	(-5, no snow)			

Transducer Information			
PT Model	PS9800	Serial #	9090152
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced	1-May-12	Crest Gauges	Checked

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 080	0.511	100.511		100.000	P
BM 082			0.949	99.562	
PT			3.455	97.056	bottom hose clamp
WL			3.298	**97.213**	
TBM	3.251	100.529	3.233	97.278	
WL			3.310	**97.219**	
PT			3.471	97.058	
BM 082			0.965	99.564	
BM 080			0.527	100.002	

BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes
BM 080		100.001		
BM 082		99.563		

Summary	
Stage (m)	97.216
Discharge (m^3/s)	0.15
Pressure Transducer Reading (m)	0.221
Pressure Transducer Elevation (m)	96.995

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	1050	End		Location	6m US of PT, before riffle section			
Method	Velocity-area (Mid-section)			Instrument Model					
Flow Meter Type				Instrument Serial #					
Stage (m)	Start	Reading		Time					
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
LB	15.50	0.00	0.00	0.01	0			0.000	0.0
	15.30	0.08	0.20	0.02	0.13			0.003	1.7
	15.00	0.09	0.30	0.02	0.13			0.003	1.9
	14.80	0.10	0.20	0.02	0.14			0.003	1.8
	14.60	0.08	0.20	0.02	0.22			0.004	2.3
	14.40	0.12	0.20	0.02	0.34			0.008	5.3
	14.20	0.12	0.20	0.02	0.4			0.010	6.2
	14.00	0.22	0.20	0.04	0.25			0.011	7.1
	13.80	0.17	0.20	0.03	0.24			0.008	5.3
	13.60	0.18	0.20	0.04	0.16			0.006	3.7
	13.40	0.16	0.20	0.03	0.27			0.009	5.6
	13.20	0.16	0.20	0.03	0.41			0.013	8.5
	13.00	0.21	0.20	0.04	0.4			0.017	10.9
	12.80	0.22	0.20	0.04	0.41			0.018	11.7
	12.60	0.26	0.20	0.05	0.39			0.020	13.1
	12.40	0.25	0.20	0.05	0.26			0.013	8.4
	12.20	0.24	0.20	0.05	0.18			0.009	5.6
	12.00	0.09	0.20	0.02	0.07			0.001	0.8
RB	11.80	0.00	0.20	0.01	0			0.000	0.0
Total Q								**0.154**	**100.0**

General Notes

Appendix 2k-1. Manual Discharge Measurements and Levelling Surveys at Bowser-Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Bowser-Hydro			
Stream Name	Bowser Creek			
Date Monitored	20-Mar-11			
Time at Site (24 hr)	Start Time:	1:10:00 PM	End Time:	2:00:00 PM
Personnel	M. Soloducha, K. Johnson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
CG Bolt	1.821	101.821		100.000	
Top CG Pole			0.351	101.470	
WL			3.949	97.872	
RB			3.934	97.887	
LB			3.951	**97.870**	
TBM	1.983	101.752	2.052	99.769	
WL			3.885	**97.867**	
Top CG Pole			0.284	101.468	
CG Bolt			1.752	100.000	
BM#	Established Elevation (m)	Mean Elevation (this date)		Difference (m)	Notes

Summary		
Stage (m)	97.870	
Discharge (m^3/s)	4.0	
Pressure Transducer Reading (m)		PT Not installed
Pressure Transducer Elevation (m)		PT Not installed

Discharge Measurement - Mid-Section Method							
Time (24 hr)	Start	13:10	End	13:40	Location		
Method	Velocity-area (Mid-section)			Instrument Model		Flo-Mate	
Flow Meter Type	Electromagnetic			Instrument Serial #			
Stage (m)	Start	Reading	n/a	Time			
	End	Reading		Time			

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Right Bank	38.00	0.00	0.0	0.00	0			0.000	0.0
	37.80	0.02	0.2	0.01	0.04			0.000	0.0
	37.50	0.08	0.3	0.07	-0.01			-0.001	0.0
	36.00	0.21	1.5	0.32	0.07			0.022	0.6
	34.50	0.25	1.5	0.38	0.2			0.075	1.9
	33.00	0.23	1.5	0.35	0.18			0.062	1.5
	31.50	0.29	1.5	0.44	0.25			0.109	2.7
	30.00	0.24	1.5	0.36	0.22			0.079	2.0
	28.50	0.22	1.5	0.33	0.22			0.073	1.8
	27.00	0.27	1.5	0.41	0.11			0.045	1.1
	25.50	0.25	1.5	0.38	0.21			0.079	2.0
	24.00	0.21	1.5	0.32	0.22			0.069	1.7
	22.50	0.44	1.5	0.66	0.6			0.396	9.9
	21.00	0.46	1.5	0.69	0.87			0.600	15.0
	19.50	0.33	1.5	0.50	0.47			0.233	5.8
	18.00	0.43	1.5	0.65	0.46			0.297	7.4
	16.50	0.47	1.5	0.71	0.97			0.684	17.1
	15.00	0.48	1.5	0.72	0.5			0.360	9.0
	13.50	0.41	1.5	0.62	0.48			0.295	7.4
	12.00	0.36	1.5	0.54	0.42			0.227	5.7
	10.50	0.26	1.5	1.43	0.34			0.133	3.3
	9.00	0.15	1.5	0.79	0.37			0.083	2.1
	7.50	0.12	1.5	0.54	0.25			0.045	1.1
	6.00	0.12	1.5	0.45	0.11			0.020	0.5
	4.50	0.10	1.5	0.30	0.11			0.017	0.4
	3.00	0.15	1.5	0.34	0.03			0.007	0.2
	1.50	0.06	1.5	0.09	0.03			0.002	0.0
Left Bank	1.00	0.00	0.5	0.02	0			0.000	0.0
Total Q								**4.009**	**100.0**

General Notes
Pressure Transducer not installed

Appendix 2k-1. Manual Discharge Measurements and Levelling Surveys at Bowser-Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Bowser-Hydro			
Stream Name	Bowser Creek			
Date Monitored	11-May-11			
Time at Site (24 hr)	**Start Time:**	10:00:00 AM	**End Time:**	2:20:00 PM
Personnel	M. Soloducha, B. Simpson			
Station Coordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
BM 049	0.354	100.354		100.000	
BM 050			0.174	100.180	
BM 048			0.109	100.245	
WL			2.210	**98.144**	
CG			0.668	99.686	
TBM	1.451	100.386	1.419	98.935	
WL			2.242	**98.144**	
CG			0.700	99.686	
BM 048			0.138	100.248	
BM 050			0.205	100.181	
BM 049			0.386	100.386	

BM#	**Established Elevation (m)**	**Mean Elevation (this date)**	**Difference (m)**	**Notes**
BM 049		100.193		
BM 050		100.181		
BM 048		100.247		

Summary	
Stage (m)	98.144
Discharge (m^3/s)	No Discharge Measurement
Pressure Transducer Reading (m)	0.393
Pressure Transducer Elevation (m)	97.751

Appendix 2k-1. Manual Discharge Measurements and Levelling Surveys at Bowser-Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Bowser-Hydro			
Stream Name	Bowser Creek			
Date Monitored	25-Jun-11			
Time at Site (24 hr)	**Start Time:**	9:15:00 AM	**End Time:**	2:20:00 PM
Personnel	M. Soloducha, B. Simpson			
Station Coordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status	Active	**Battery**	
# of Records		**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey					
Stn	**BS**	**HI**	**FS**	**Elevation**	**Notes**
49	0.795	100.795		100.000	
50			0.615	100.180	
48			0.549	100.246	
wl			1.553	**99.242**	
tbm	1.124	100.767	1.152	99.643	
wl			1.523	**99.244**	
48			0.522	100.245	
50			0.588	100.179	
49			0.767	100.000	
BM#	**Established Elevation (m)**	**Mean Elevation (this date)**		**Difference (m)**	**Notes**
49		100.000			
50		100.180			
48		100.246			

Summary	
Stage (m)	99.243
Discharge (m^3/s)	No Discharge Measurement
Pressure Transducer Reading (m)	1.565
Pressure Transducer Elevation (m)	97.678

Appendix 2k-1. Manual Discharge Measurements and Levelling Surveys at Bowser-Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Bowser-Hydro			
Stream Name	Bowser Creek			
Date Monitored	29-Oct-11			
Time at Site (24 hr)	Start Time:	11:00:00 AM	End Time:	12:44:00 PM
Personnel	R. Larson, K. Johnson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 49	0.588	100.588		100.000	
BM 50			0.407	100.181	
WL			2.798	97.790	
BM 48	0.278	100.525	0.341	100.247	
WL			2.732	**97.793**	
BM 50			0.342	100.183	
BM 49			0.522	**100.003**	
BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes	
BM 49		100.002			
BM 50		100.182			
BM 48		100.247			

Summary	
Stage (m)	97.792
Discharge (m^3/s)	18.9
Pressure Transducer Reading (m)	0.936
Pressure Transducer Elevation (m)	96.856

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	12:10	End	12:45	Location				
Method	Velocity-area (Mid-section)			Instrument Model		Flo-Mate			
Flow Meter Type	Electromagnetic			Instrument Serial #					
Stage (m)	Start	Reading	0.936	Time					
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Right Bank	3.40	0.00	0.0	0.00	0			0.000	0.0
	5.40	0.09	2.0	0.23	0.08			0.018	0.1
	8.40	0.29	3.0	0.87	0.13			0.113	0.6
	11.40	0.30	3.0	0.90	0.33			0.297	1.6
	14.40	0.42	3.0	1.05	0.24			0.252	1.3
	16.40	0.60	2.0	1.20	0.44			0.528	2.8
	18.40	0.62	2.0	1.24	0.32			0.397	2.1
	20.40	0.77	2.0	1.54	0.475			0.732	3.9
	22.40	0.77	2.0	1.54		0.33	0.62	0.816	4.3
	24.40	0.83	2.0	1.66		0.39	0.67	0.872	4.6
	26.40	0.82	2.0	1.64		0.35	0.70	1.017	5.4
	28.40	0.99	2.0	1.98		0.46	0.78	1.257	6.7
	30.40	0.96	2.0	1.92		0.53	0.74	1.142	6.0
	32.40	1.13	2.0	2.26		0.50	0.69	1.740	9.2
	34.40	1.05	2.0	2.10		0.71	0.83	1.344	7.1
	36.40	1.05	2.0	2.10		0.50	0.78	1.533	8.1
	38.40	1.08	2.0	2.16		0.59	0.87	1.663	8.8
	40.40	1.08	2.0	2.16		0.59	0.95	1.339	7.1
	42.40	1.13	2.0	2.26		0.39	0.85	1.480	7.8
	44.40	0.93	2.0	3.07		0.48	0.83	1.283	6.8
	46.40	0.90	2.0	1.80		0.58	0.80	1.008	5.3
	48.40	0.36	2.0	0.47	0.13	0.42	0.70	0.061	0.3
Left Bank	49.00	0.00	0.6	0.00	0			0.000	0.0
Total Q								**18.893**	**100.0**

General Notes

Appendix 2k-1. Manual Discharge Measurements and Levelling Surveys at Bowser-Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Bowser-Hydro			
Stream Name	Bowser Creek			
Date Monitored	24-Nov-11			
Time at Site (24 hr)	Start Time:	1:18:00 PM	End Time:	2:00:00 PM
Personnel	M. Soloducha, K. Johnson			
Station Coordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status	Active	Battery	
# of Records		Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
BM 49	1.202	101.202		100.000	
CG BLT			1.515	99.687	
WL			3.639	97.563	
TBM	3.493	101.141	3.554	97.648	
WL			3.577	**97.564**	
CG BLT			1.453	99.688	
BM 49			1.139	**100.002**	
BM#	Established Elevation (m)	Mean Elevation (this date)	Difference (m)	Notes	
BM 49		100.001			

Summary	
Stage (m)	97.564
Discharge (m^3/s)	3.6
Pressure Transducer Reading (m)	0.713
Pressure Transducer Elevation (m)	96.851

Discharge Measurement - Mid-Section Method									
Time (24 hr)	Start	13:18	End	14:00	Location				
Method	Velocity-area (Mid-section)			Instrument Model		Flo-Mate			
Flow Meter Type	Electromagnetic			Instrument Serial #					
Stage (m)	Start	Reading	0.713	Time					
	End	Reading		Time					

	Station	Depth	Distance	Area	Velocity (m/s)			Q	% of Total Q
Notes	(m)	(m)	(m)	(m^2)	60%	20%	80%	(m3/s)	%
Left Bank	3.00	0.00	0.0	0.00	0			0.000	0.0
	3.50	0.32	0.5	0.32	0.07			0.022	0.6
	5.00	0.76	1.5	1.14	0.28			0.319	9.2
	6.50	0.88	1.5	1.32		0.15	0.35	0.000	0.0
	8.00	0.92	1.5	1.38		0.22	0.35	0.000	0.0
	9.50	1.00	1.5	1.50		0.12	0.48	0.000	0.0
	11.00	1.05	1.5	1.58		0.27	0.39	0.000	0.0
	12.50	1.11	1.5	1.67		0.22	0.41	0.000	0.0
	14.00	1.03	1.5	1.55		0.25	0.48	0.000	0.0
	15.50	0.89	1.5	1.34		0.32	0.47	0.000	0.0
	17.00	0.78	1.5	1.17	0.51			0.597	17.3
	18.50	0.88	1.5	1.32		0.10	0.44	0.000	0.0
	20.00	0.84	1.5	1.26		0.13	0.39	0.000	0.0
	21.50	0.76	1.5	1.14	0.31			0.353	10.2
	23.00	0.82	1.5	1.23	0.47			0.578	16.7
	24.50	0.78	1.5	1.17	0.33			0.386	11.2
	26.00	0.88	1.5	1.32		0.13	0.21	0.000	0.0
	27.50	0.70	1.5	1.05	0.41			0.431	12.5
	29.00	0.68	1.5	1.02	0.3			0.306	8.9
	30.50	0.50	1.5	0.75	0.25			0.188	5.4
	32.00	0.58	1.5	0.87	0.16			0.139	4.0
	33.50	0.51	1.5	0.77	0.12			0.092	2.7
	35.00	0.40	1.5	0.70	0.06			0.042	1.2
	37.00	0.40	2.0	0.80	0.07			0.056	1.6
	39.00	0.39	2.0	0.68	0.06			0.041	1.2
	40.50	0.20	1.5	0.20	0.02			0.004	0.1
Right Bank	41.00	0.00	0.5	0.00	0			0.000	0.0
Total Q								**3.554**	**102.9**

General Notes

Appendix 2k-2. ADCP Discharge Measurements and Levelling Surveys at Bowser-Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Bowser-Hydro			
Stream Name	Bowser Creek			
Date Monitored	19-Jul-11			
Time at Site (24 hr)	**Start Time:**	10:00	**End Time:**	22:00
Personnel	M. Soloducham S. Jennings			
Station Cordinates	**Easting**	**Northing**	**Elevation**	
Weather Conditions				

Transducer Information			
PT Model	PS9800	**Serial #**	
Gain		**Offset**	
Status		**Battery**	
# of Records	Active	**Memory Free**	
Date Serviced		**Crest Gauges**	

Hydrometric Leveling Survey

Stn	BS	HI	FS	Elevation	Notes
BM 049	1.482	101.482		100.000	
BM 050			1.302	100.180	
WL			2.008	**99.474**	
TBM	1.537	101.418	1.601	99.881	
WL			1.944	**99.474**	
Bm 050			1.239	100.179	
Bm 049			1.418	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes
BM 049		100.000		
BM 050		100.180		

Discharge Measurement ADCP								
Time (24 hr)		**Start**	11:00	**End**	20:00	**Location**		
Method		Velocity-area (ADCP)				**Water Temp (ADCP)(°C)**	-	
Flow Meter Type		ADCP				**Water Temp (Therm) (°C)**	-	
Instrument Model		River Ray				**Mean Discharge Q (m^3/s)**	206.2	
Instrument Serial#		54988				**Error (Std Dev in m^3/s)**	3.13	
Stage (m)	**Start**	**Reading**		**Time**		**Mean % of Q Measured**	59.7	
	End	**Reading**		**Time**				
File Location		(Measurement File Location on the N: Drive)						

	Discharge Q (m^3/s)							% Bad	
Transect #	**Top**	**Mid**	**Bottom**	**Left**	**Right**	**Total Q**	**% Q Measured**	**Ensembles**	**Bins**
1	33.60	120.00	47.70	0.43	2.67	204.40	58.7	6	10
2	33.00	122.00	46.60	0.40	2.30	204.30	59.7	7	10
3	32.90	127.00	47.10	1.09	1.68	209.77	60.5	6	10
Mean	**33.17**	**123.00**	**47.13**	**0.64**	**2.22**	**206.16**	**59.7**	**6.3**	**10.0**

General Notes

Hydrometric survey completed following morning (7/20/11)

Summary			
Stage (m)	99.474		
Discharge (m^3/s)	206.2		
Pressure Transducer Reading (m)	1.788		
Pressure Transducer Elevation (m)	97.686		

Appendix 2k-2. ADCP Discharge Measurements and Levelling Surveys at Bowser-Hydro in 2011

Site Information				
Project Name	Brucejack Gold Mine Project			
Station Identification	Bowser-Hydro			
Stream Name	Bowser Creek			
Date Monitored	26-Oct-11			
Time at Site (24 hr)	Start Time:	11:00	End Time:	12:30
Personnel	M. Soloducha, R. Larson			
Station Cordinates	Easting	Northing	Elevation	
Weather Conditions				

Transducer Information			
PT Model	PS9800	Serial #	
Gain		Offset	
Status		Battery	
# of Records	Active	Memory Free	
Date Serviced		Crest Gauges	

Hydrometric Leveling Survey					
Stn	BS	HI	FS	Elevation	Notes
49	0.665	100.665		100.000	
50			0.485	100.180	
WL			2.867	**97.798**	
48	0.310	100.555	0.420	100.245	
WL			2.759	**97.796**	
50			0.375	100.180	
49			0.555	100.000	

BM#	Established Elevation (m)	Mean Elevation (this date) (m)	Difference (m)	Notes
49		100.000		
50		100.180		
48		100.245		

Discharge Measurement ADCP								
Time (24 hr)		Start	11:00	End	12:30	Location		
Method		Velocity-area (ADCP)				Water Temp (ADCP)(°C)	1.9	
Flow Meter Type		ADCP				Water Temp (Therm) (°C)	3.1	
Instrument Model		River Ray				Mean Discharge Q (m³/s)	17.9	
Instrument Serial#		64658				Error (Std Dev in m³/s)	0.62	
Stage (m)	Start	Reading		Time		Mean % of Q Measured	38.5	
	End	Reading		Time				
File Location		(Measurement File Location on the N: Drive)						

	Discharge Q (m³/s)							% Bad	
Transect #	Top	Mid	Bottom	Left	Right	Total Q	% Q Measured	Ensembles	Bins
1	4.11	6.73	4.35	0.45	3.17	18.81	35.8	1	21
2	4.01	6.72	4.02	0.43	2.29	17.47	38.5	4	17
3	4.01	7.29	4.33	0.35	1.56	17.54	41.6	7	19
4	3.70	6.82	3.74	0.40	3.19	17.85	38.2	0	19
Mean	**3.96**	**6.89**	**4.11**	**0.41**	**2.55**	**17.92**	**38.5**	**3.0**	**19.0**

General Notes

Hydrometric survey completed following morning (7/20/11)

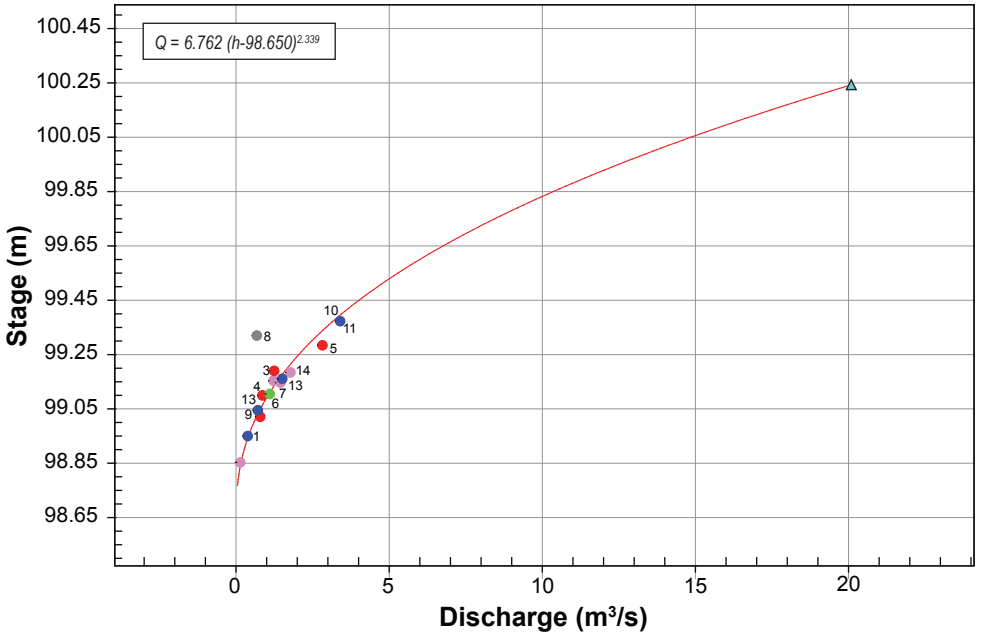
Summary			
Stage (m)	97.797		
Discharge (m³/s)	17.9		
Pressure Transducer Reading (m)	0.018		
Pressure Transducer Elevation (m)	97.779		

Appendix 3

Stage Discharge Rating Curves and Channel Geometry Surveys

Rescan™
Engineers and Scientists

BJL-H1 low angle view looking upstream from the gauging section. The hydrometric station is located approximately 100m upstream from the gauging section, anchored to a large boulder in a large pool. Blue arrow gives flow direction. Photograph taken on July 20, 2011.



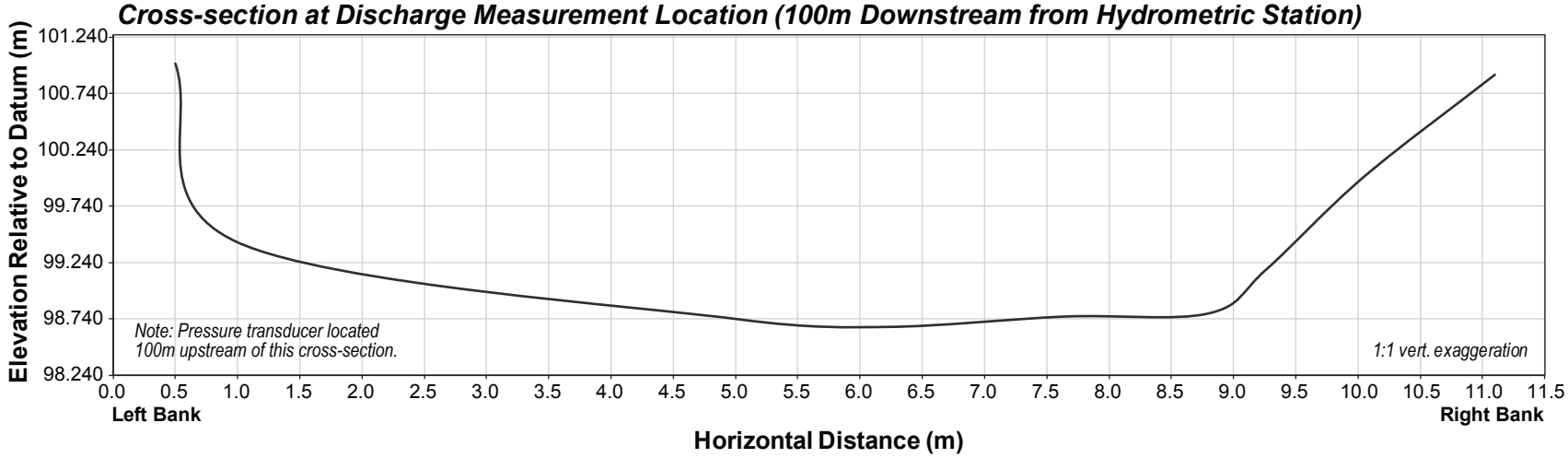


Figure A3-1

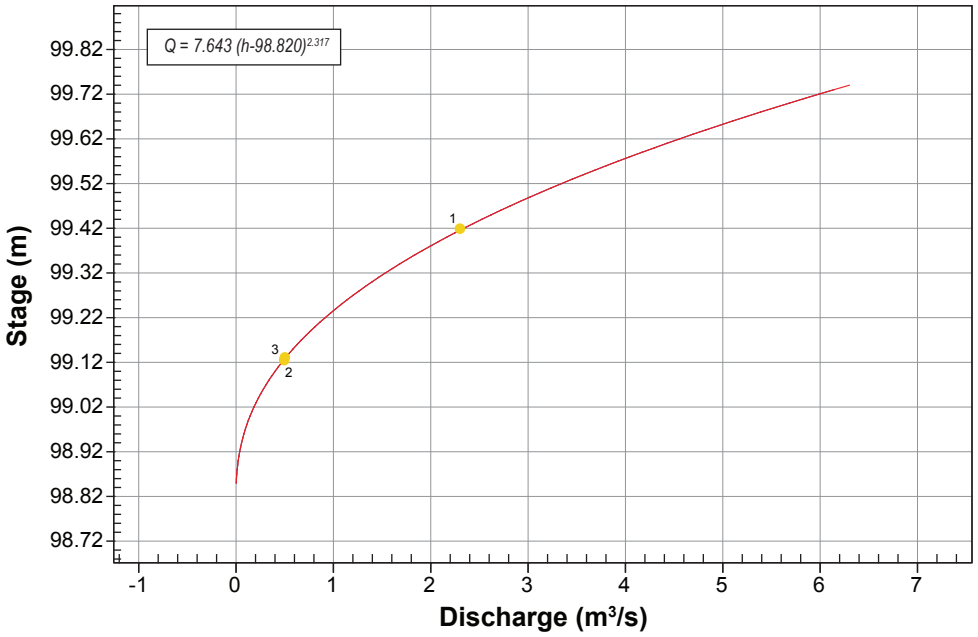
PRETIVM

Station BJL-H1 Stage-Discharge Curve and Channel Geometry
(Rating Period from July 15, 2007 to July 24, 2012)

Figure A3-1

Rescan™ Engineers & Scientists

BJL-H1a pressure transducer location. The channel is approximately 9 meters wide and is constrained by steep bedrock walls for this low gradient reach. Blue arrow gives flow direction and yellow arrow indicates pressure transducer installation. Photograph taken on July 24, 2012.



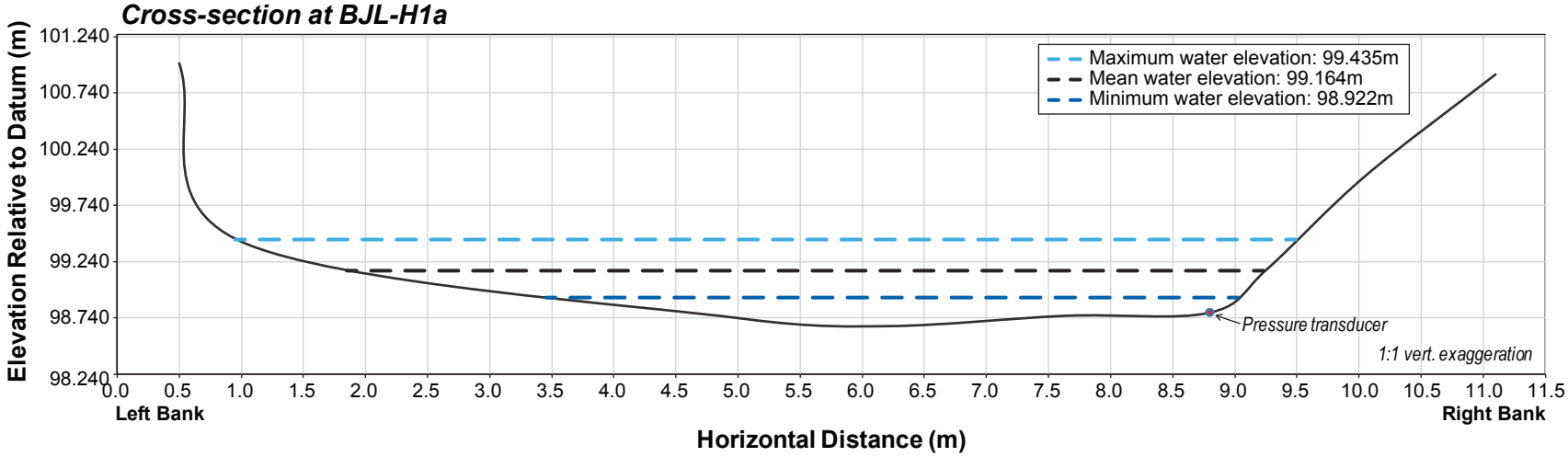


Figure A3-2

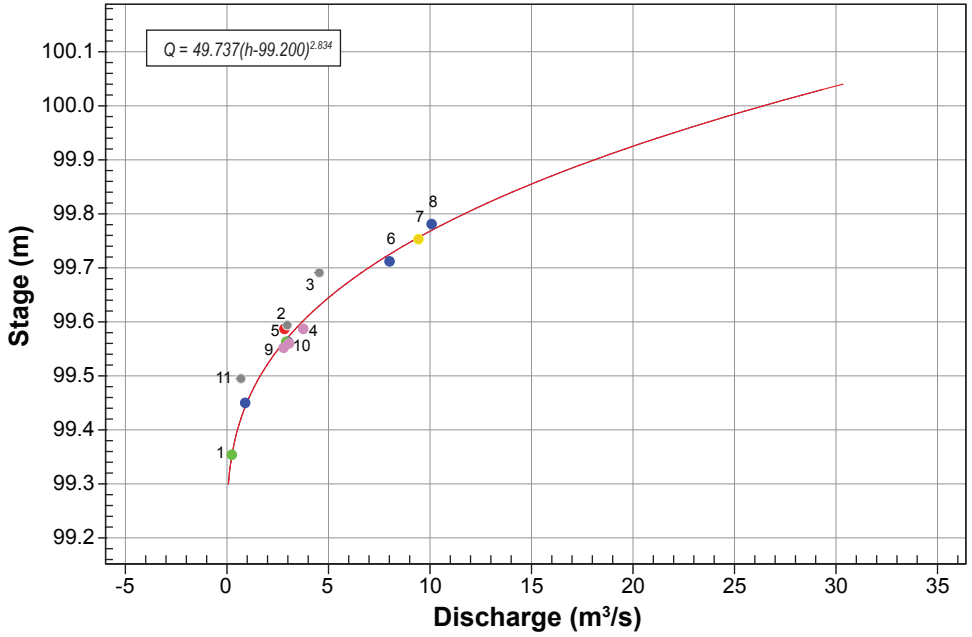
PRETIVM

Station BJL-H1a Stage-Discharge Curve and Channel Geometry
(Rating Period from July 24, 2012 to December 31, 2012)

Figure A3-2

Rescan™ Engineers & Scientists

Scott-Hydro, viewed across the channel. The stream alternates between plane-bed and pool-riffle morphology throughout the measured reach. Flow in this photo given by the blue arrow and the transducer is located under the bridge at the yellow arrow. Photo taken on September 25, 2012.



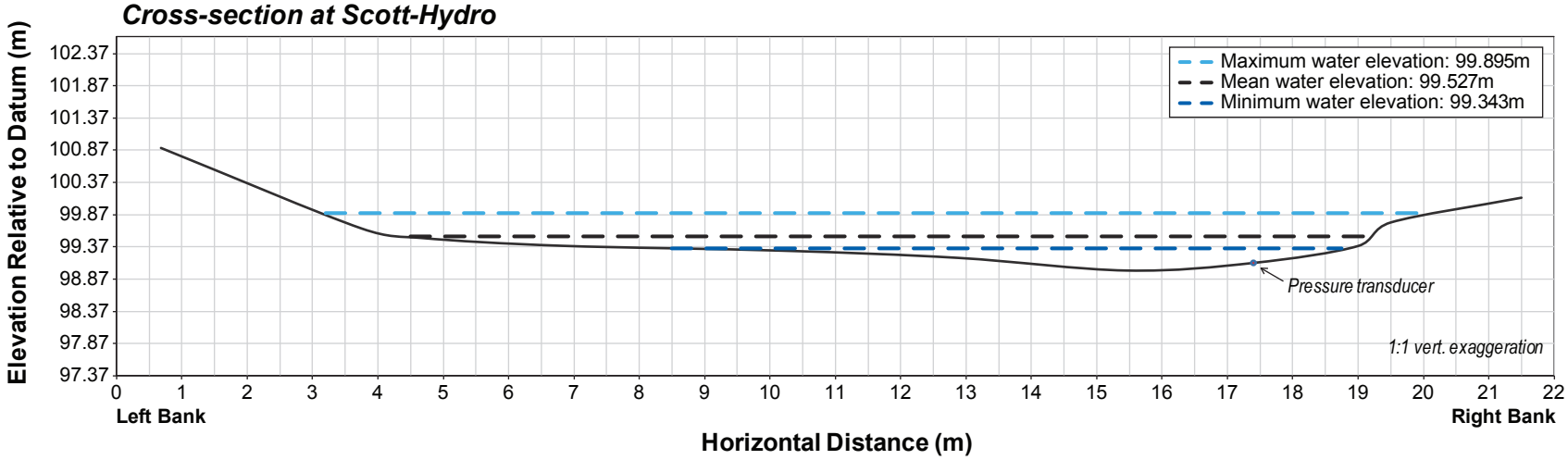


Figure A3-3

PRETIVM

Station Scott-Hydro Stage-Discharge Curve and Channel Geometry
(Rating Period from September 24, 2011 to December 31, 2012)

Figure A3-3

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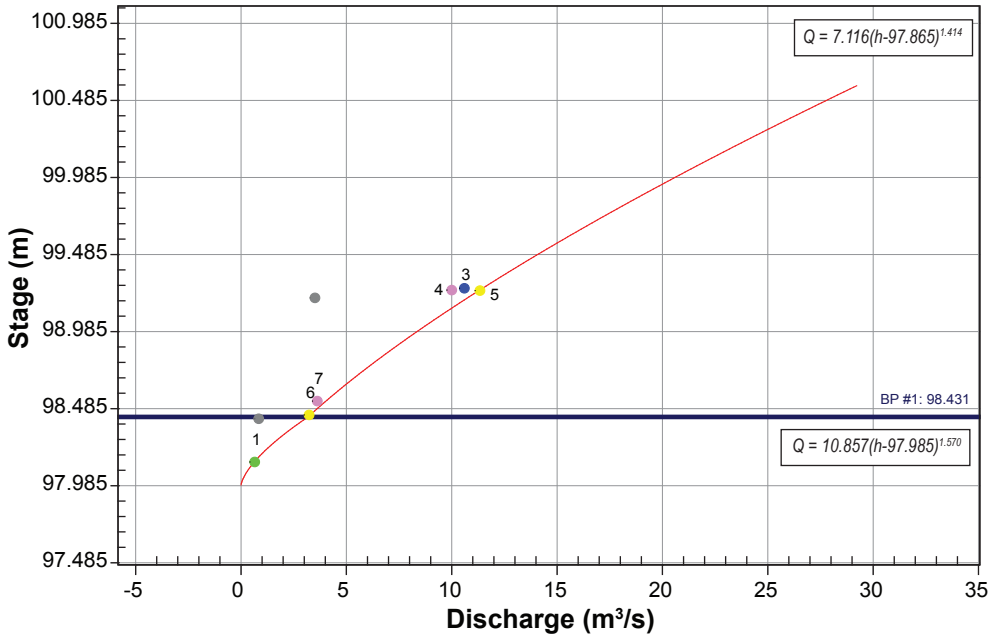
Aerial view of Todedada-Hydro station. The meandering channel has a gravel bed and is bounded by low vegetated banks. Flow direction given by the blue arrow and pressure transducer installation at the yellow arrow. Photograph taken on June 25, 2012.



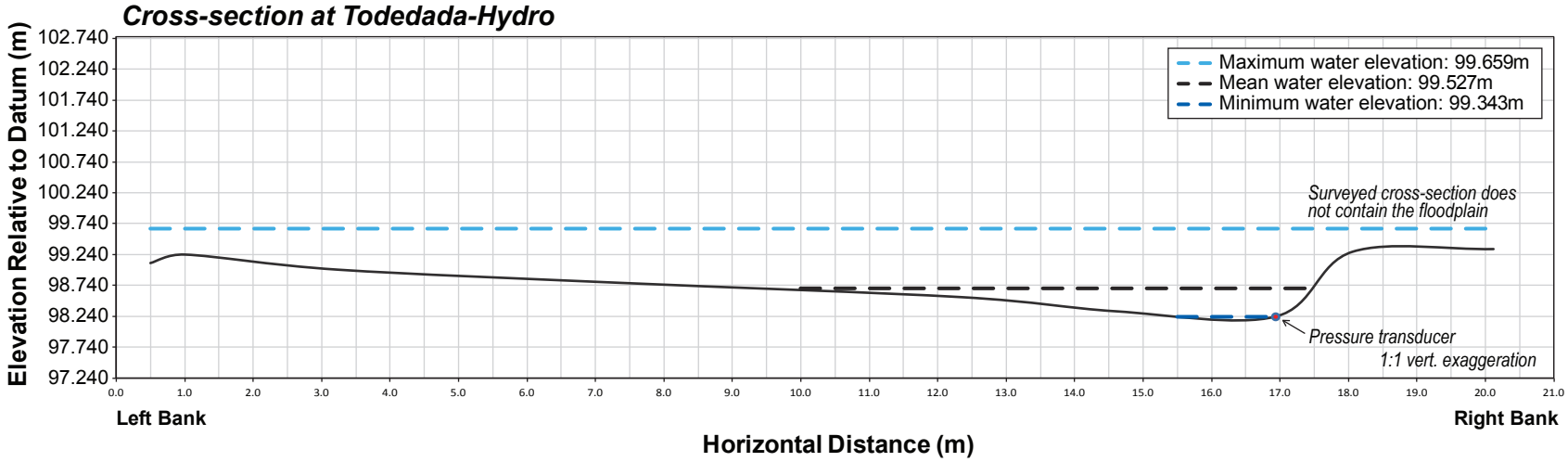


Figure A3-4

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Station Todedada-Hydro Stage-Discharge Curve and Channel Geometry
(Rating Period from September 6, 2011 to December 31, 2012)

Figure A3-4

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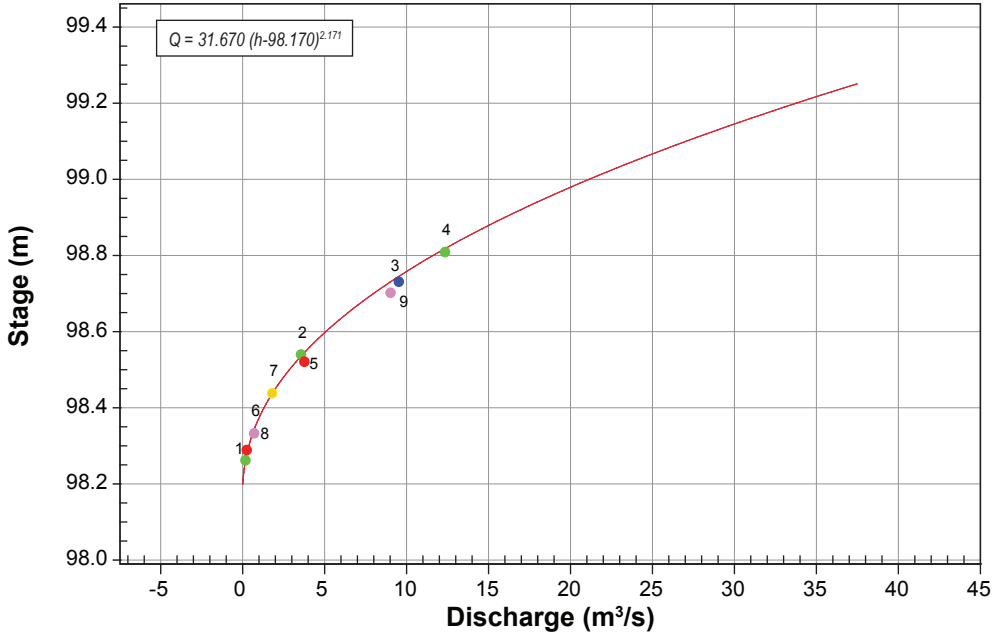
Wildfire-Hydro, looking upstream at monitored reach. Channel is bordered by low, cobbled banks and is approximately 15 meters wide during high flow events. Flow direction given by blue arrow, pressure transducer located at yellow arrow. Photograph taken on July 26, 2012.



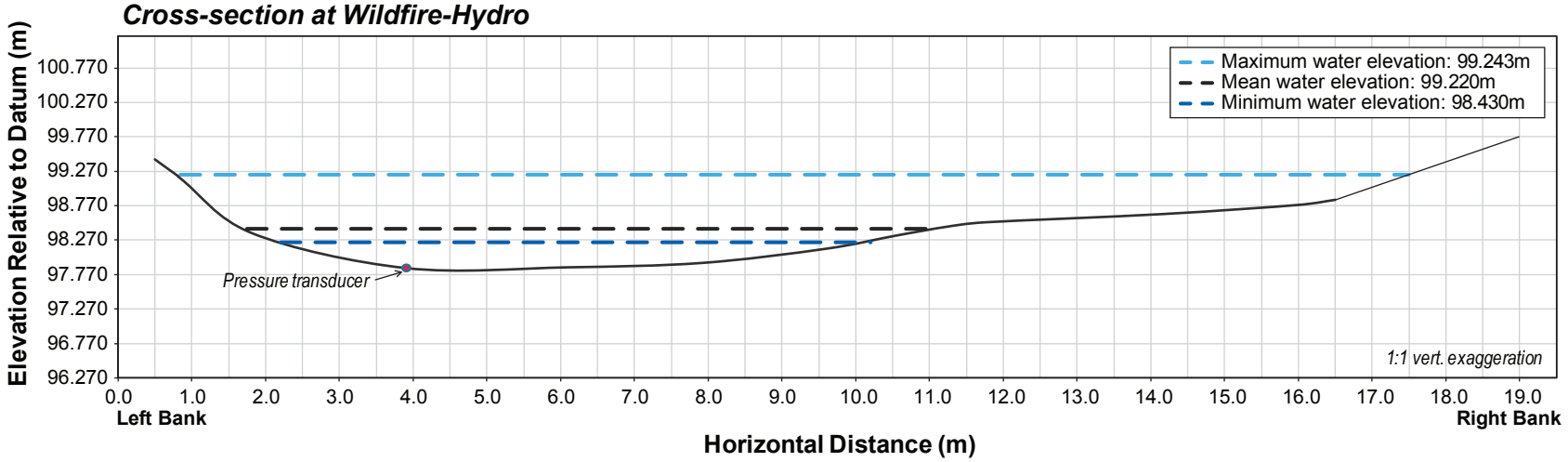


Figure A3-5

PRETIVM

Station Wildfire-Hydro Stage-Discharge Curve and Channel Geometry
(Rating Period from September 9, 2011 to December 31, 2012)

Figure A3-5

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Appendix 4

Notes Related to Water Level Records at the Hydrometric Stations

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Appendix 4 - Notes Related to Water Level Records at the Hydrometric Stations

STATION BJL-H1

Ice and snow build-up along and within the channel affected pressure transducer measurement of stage at this hydrometric station in late fall, winter and spring. Ice effects can be manifested as an increase in pressure and hence stage without an associated increase in discharge. To compensate and correct for this effect, the water level data were adjusted based on either manual on-site discharge measurements or estimated winter low flows. During the breakup period, ice also builds up at this station location, which is located at the outlet of Brucejack Lake (Plate A4-1). Flows during this period had to be estimated. This site was deactivated on July 24, 2012 and replaced by BJL-H1a.

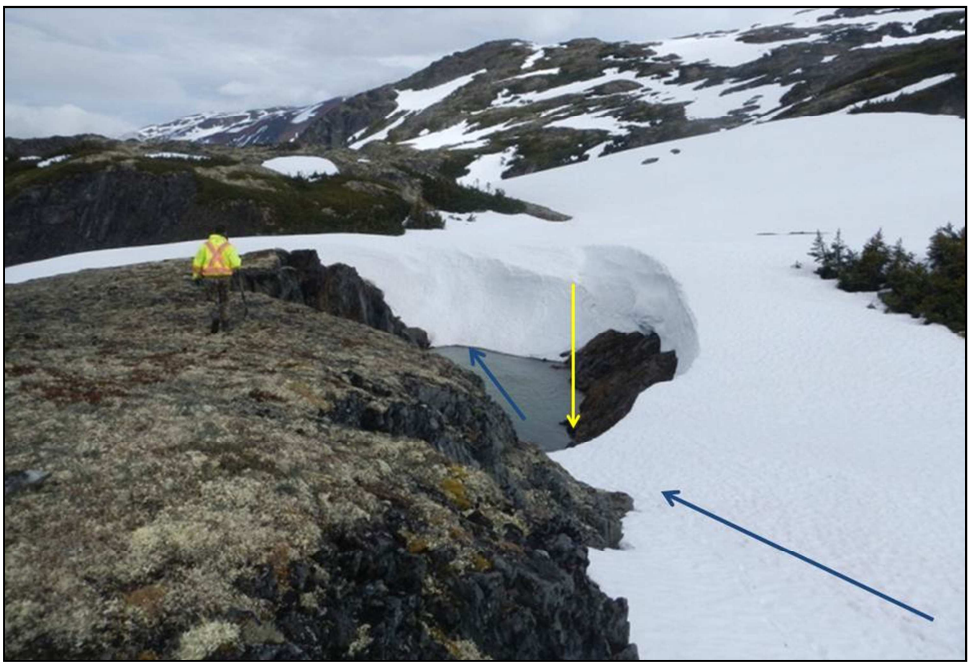

Plate A4-1. Outlet of Brucejack Lake showing the location of frequent snow and ice obstruction. Influxes of ice and snow frequently obstruct drainage from the lake throughout the freshet period, resulting in several increases in water stage that do not correspond to discharge from the lake. View is looking downstream (blue arrows indicate direction of flow). Yellow arrow indicates the approximate location of hydrometric station BJL-H1a. Photo taken June 21, 2012.

STATION BJL-H1A

Due to the seasonal inaccessibility of BJL-H1 by windblown snow and ice build-up, station BJL-H1a was installed in a section of bedrock channel 50 meters downstream of BJL-H1. As a result, all future stage-discharge relationships will be based on stages recorded at this site. There is no significant change between drainage areas of BJL-H1 and BJL-H1a; that is, hydrologic indices of these stations are identical.

STATION BJL-H2

The station was installed on July 22, 2011, and recorded lake level data until June 27, 2012, when the datalogger failed due to low voltage in the batteries. The period from October 31, 2011 to June 1, 2012 showed artificially high stage values due to snow and ice cover on the surface of Brucejack Lake. The datalogger batteries were replaced on July 25, 2012 and logging resumed until an unintentional shutdown occurred on July 30, 2012. Logging was resumed again on October 18, 2012. Stage data was estimated from June 28 until July 24, 2012 using a linear relationship between BJL-H1 stage and BJL-H2 stage (Equation A4-1). For the period of July 30 to November 24, 2012, the stage at BJL-H2 was estimated using a linear relationship with discharge at BJL-H1a (Equation A4-2). Results of these estimations and the integration of LIDAR surveyed lake level elevations are provided in Figure A4-1.

$$Stage_{BJL\text{-}H2} = 0.93 * Stage_{BJL\text{-}H1} - 0.4906 \;\; ; \;\; R^2 = 0.78 \qquad \text{Equation (A4-1)}$$

$$Stage_{BJL\text{-}H2} = 0.17 * Discharge_{BJL\text{-}H1a} + 0.0732 \;\; ; \;\; R^2 = 0.87 \qquad \text{Equation (A4-2)}$$

STATION TODEDADA-HYDRO

The station was installed prior to the spring freshet on May 12, 2011, and started recording data on June 21, 2012. Floods in early September 2011 caused channel geometry changes, and hence, a new rating curve was developed through the 2012 open water season. In 2012, a series of spring avalanches upstream of Todedada-Hydro affected the channel and therefore the stage-discharge relation in April (Plate A4-2). The station was damaged by a natural event, possibly wildlife, on June 2, 2012, and was repaired on June 21. Linear interpolation was used to estimate flows during this period.

Plate A4-2. Aerial view of Todedada-Hydro after avalanches buried sections of channel, causing an instantaneous peak in the stage record, and probably altering the channel by introducing sediment into the channel. Station location is given by yellow arrow and flow direction is generally as given by the blue arrow. Photo taken May 2, 2012.

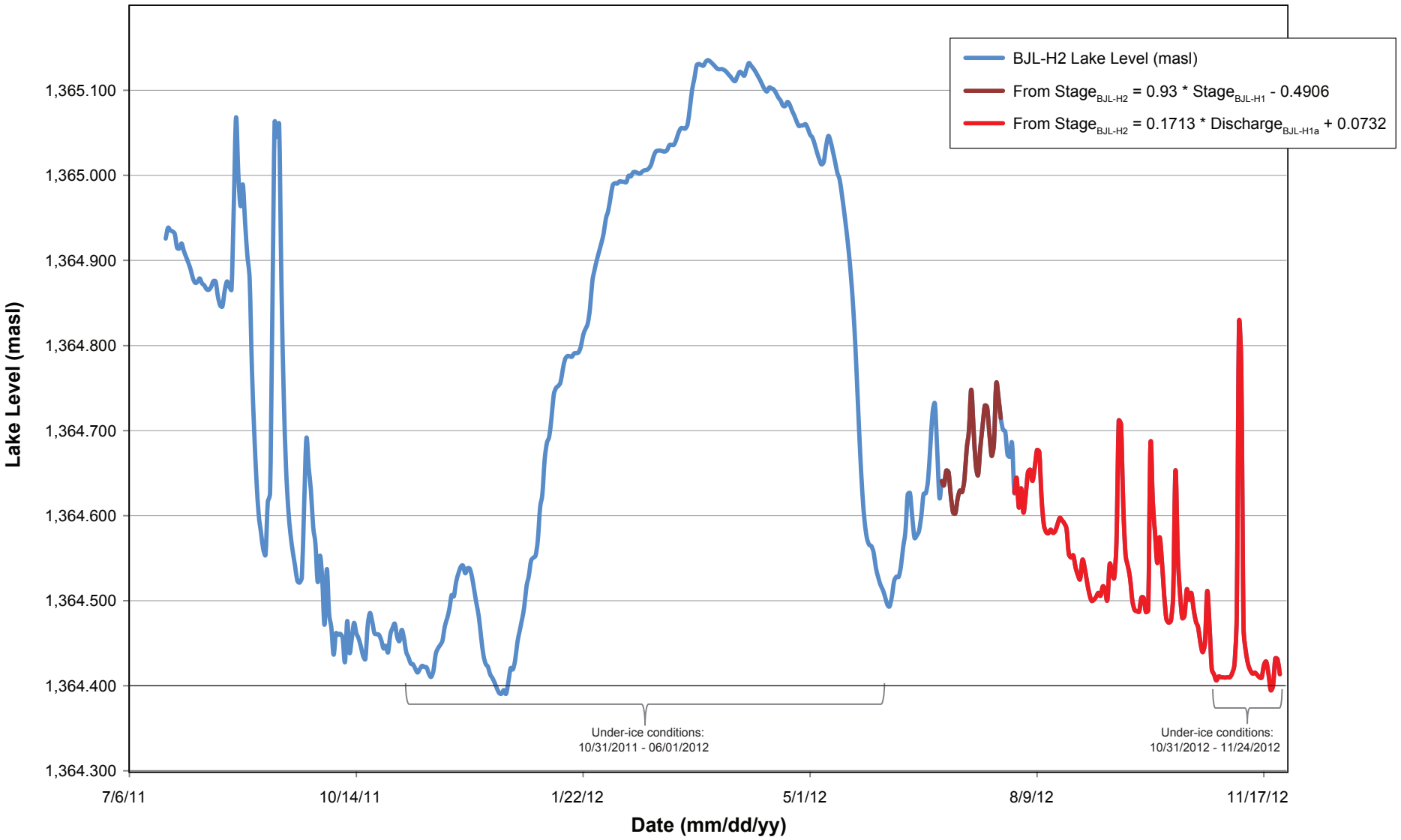

Figure A4-1

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Water Level Data at Brucejack Lake (BJL-H2)

Figure A4-1

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STATION WILDFIRE-HYDRO

The station was installed on May 12, 2011, but the channel was subsequently altered by logging activities in late May. The pressure transducer collected data during the freshet between May and June, but an offset of 0.070 m was required to fit the timeseries to the rating curve, so data collected during this time are considered estimates. The station was replaced on June 25, 2011. It was damaged by an early September 2011 flood and was replaced at a new location 350 meters upstream on October 28, 2011. A new stage-discharge relationship was generated for this location throughout the 2012 open water season.

STATION SCOTT-HYDRO

Ice and snow build-up along the channel impacted stage readings recorded by the pressure transducer over the 2010/2011 and 2011/2012 winter periods. Spikes in the water level data that occurred over a period of a few hours or days during low flow periods were assumed to be associated with ice effects along the channel. These anomalies were removed from the record set, and flow was interpolated using adjoining survey level data and discharge measurements collected from open water unaffected by ice buildup. Similar to Wildfire-Hydro, the Scott-Hydro station was affected by flooding events in September 2011 and the morphology of the channel was affected such that a new stage-discharge relationship was created from September 2011 onwards.

Appendix 5
Annual Hydrographs

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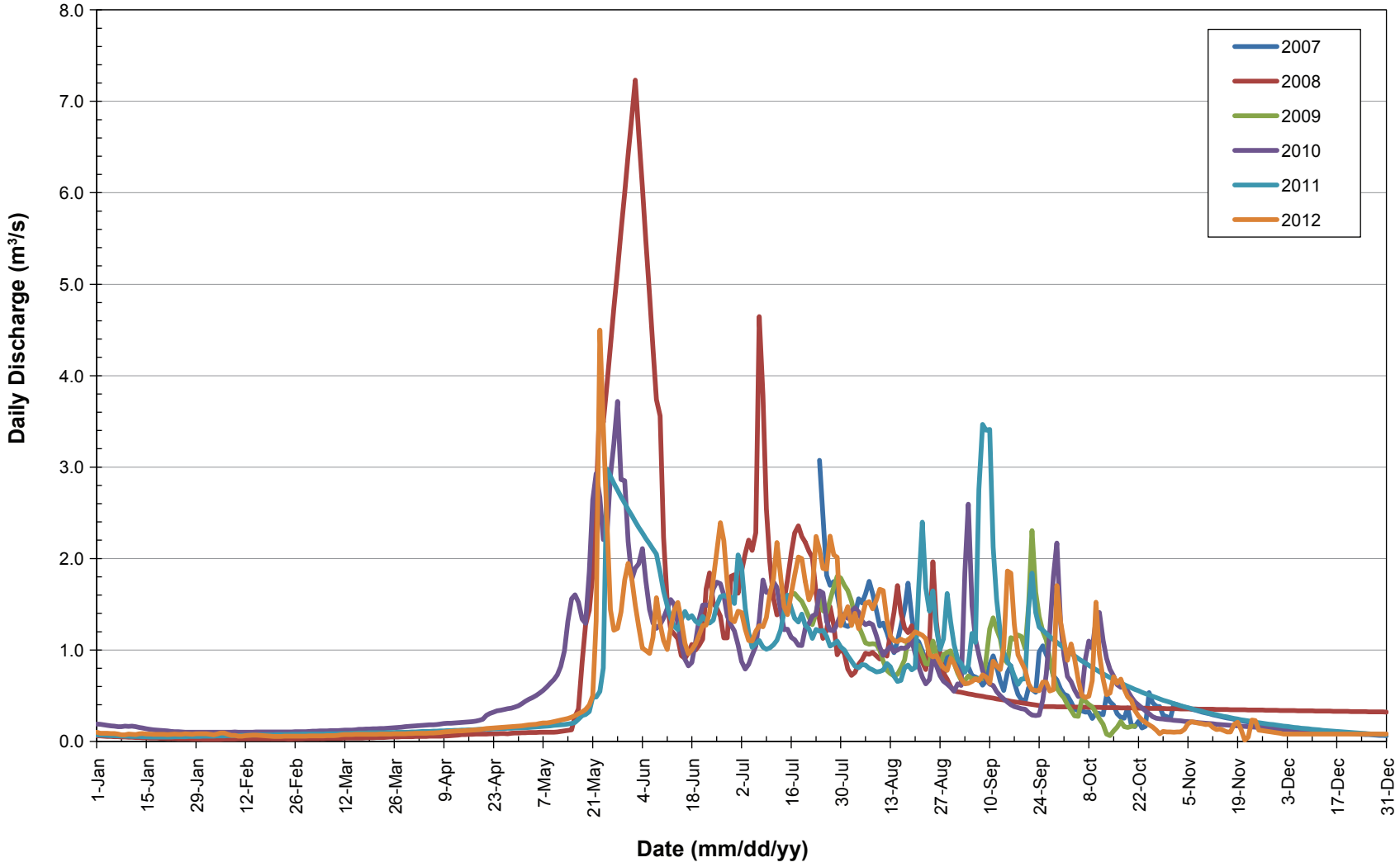

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Annual Hydrographs at Hydrometric Station BJL-H1

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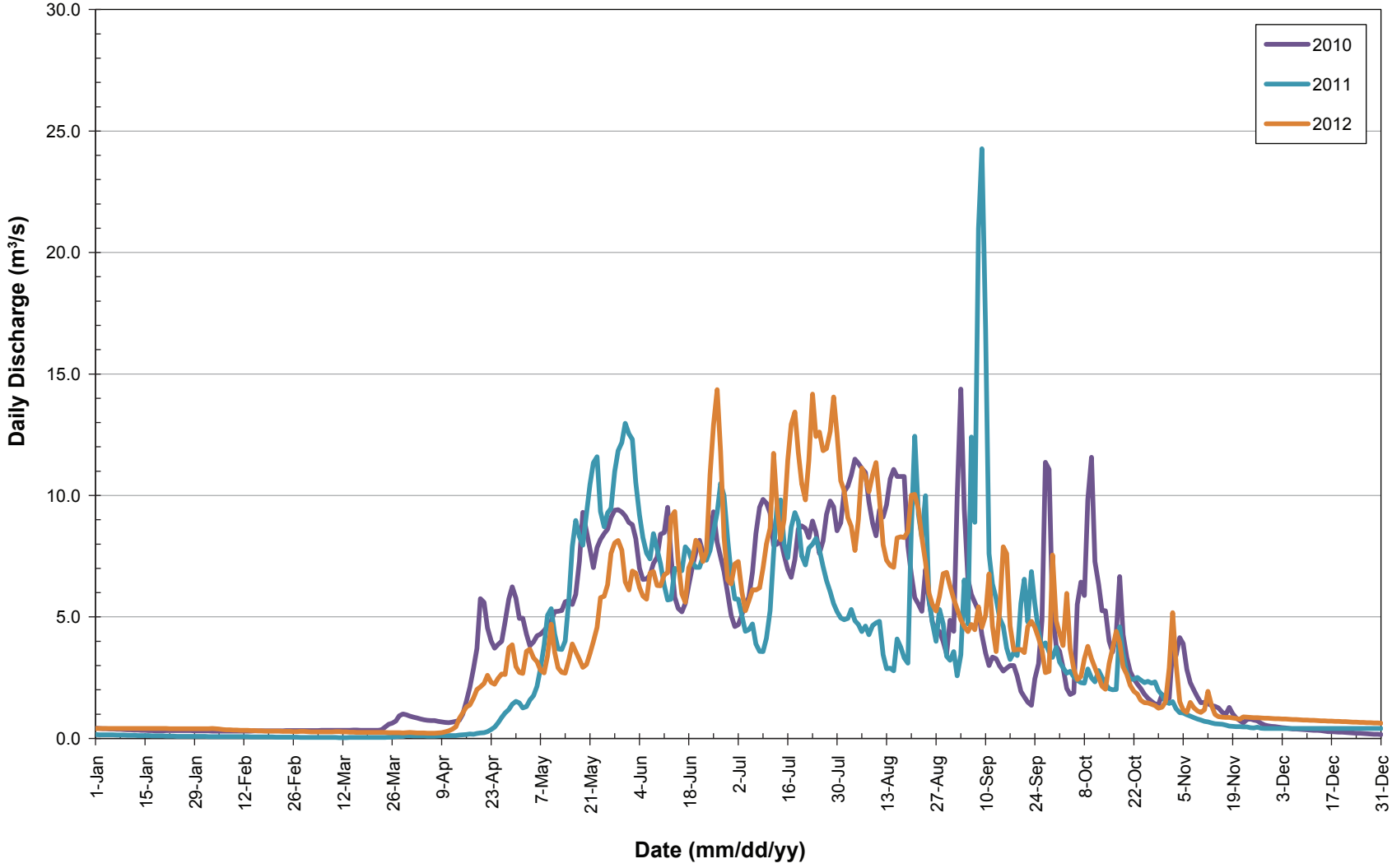

PRETIVM

Annual Hydrographs at Hydrometric Station Scott-Hydro

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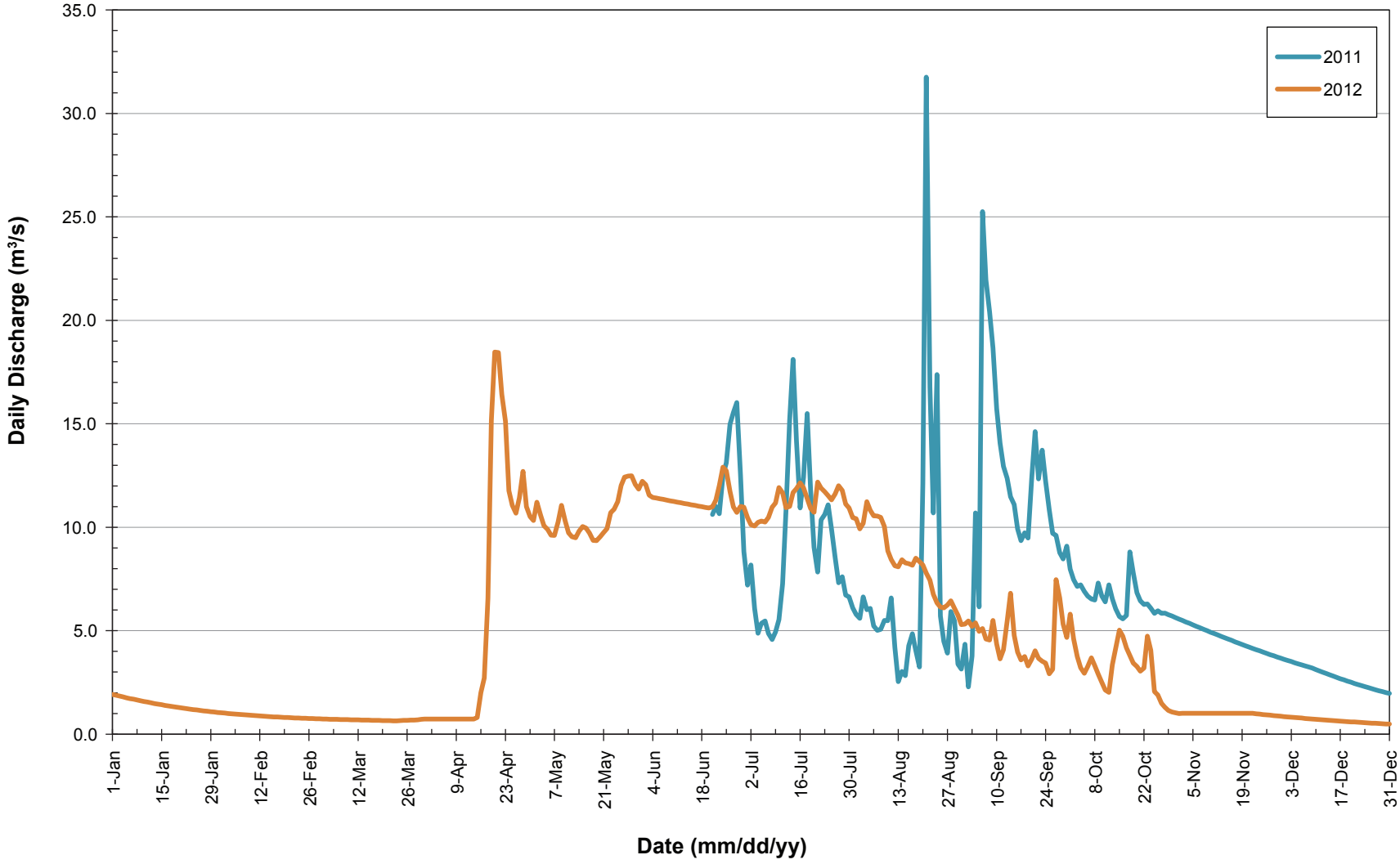
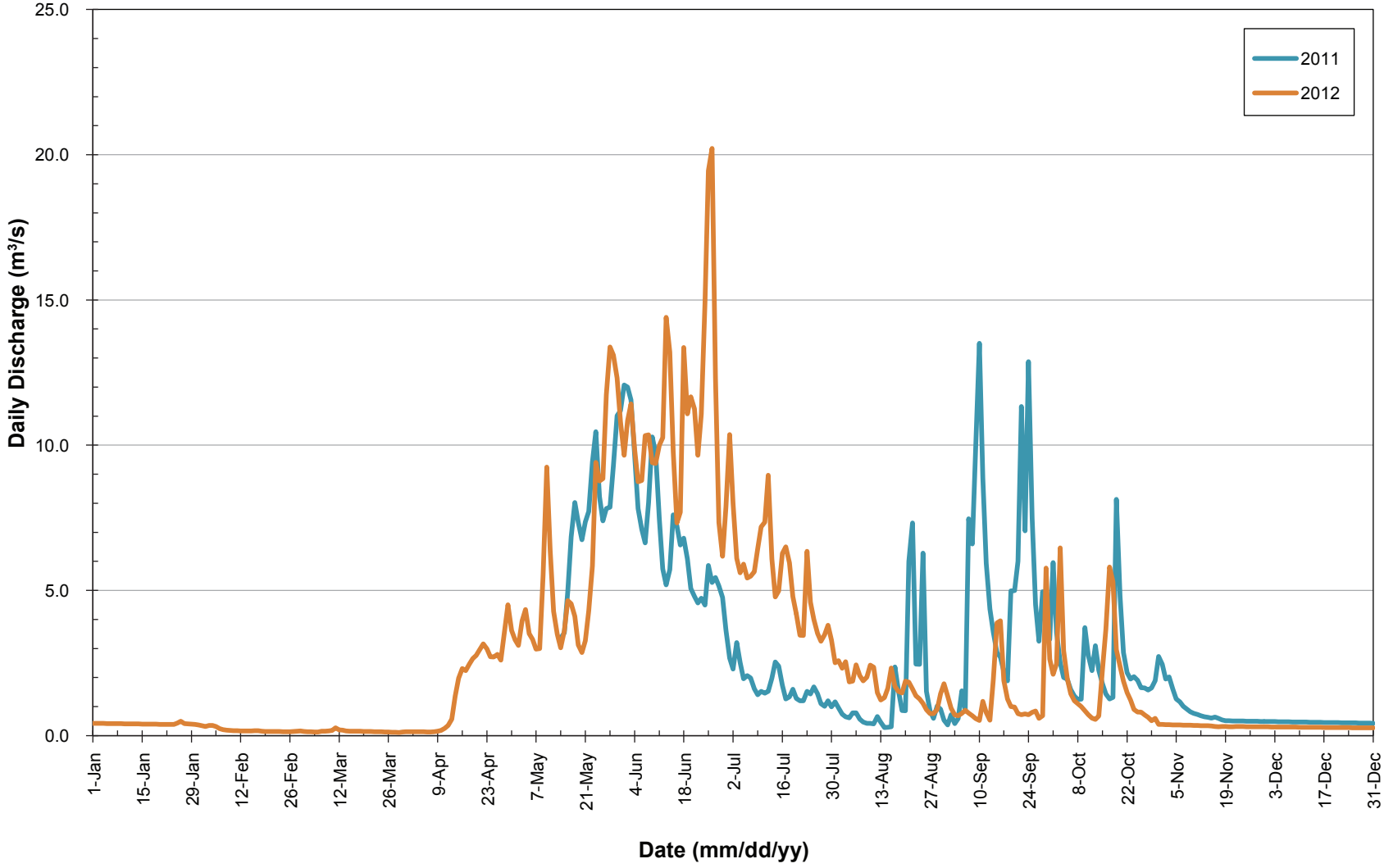


PRETIVM

Annual Hydrographs at Hydrometric Station Todedada-Hydro

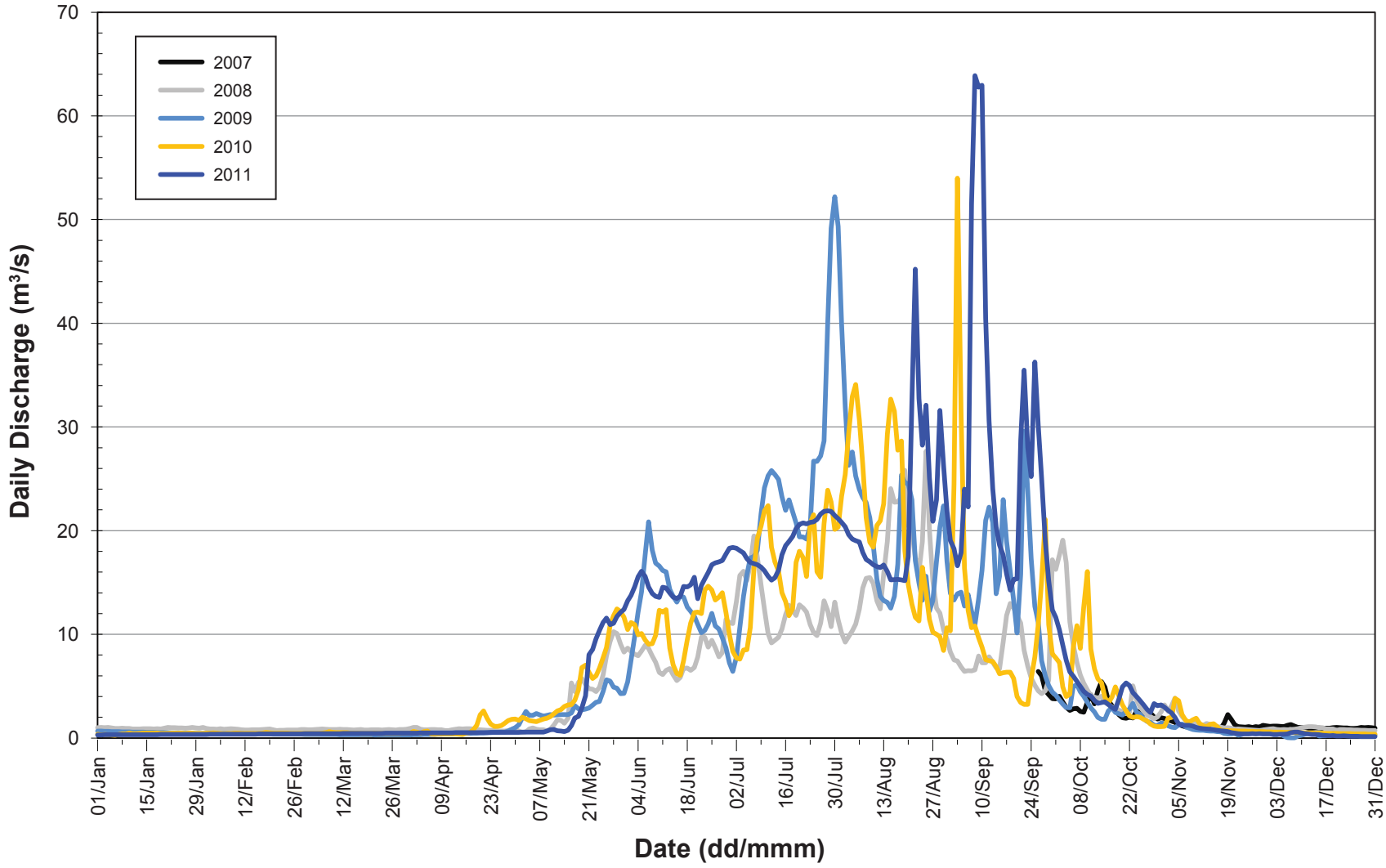
Rescan™ Engineers & Scientists



PRETIVM

Annual Hydrographs at Hydrometric Station Wildfire-Hydro

Rescan™ Engineers & Scientists



Appendix 5.5

PRETIVM

Annual Hydrographs at Hydrometric Station SL-H1

Appendix 5.5

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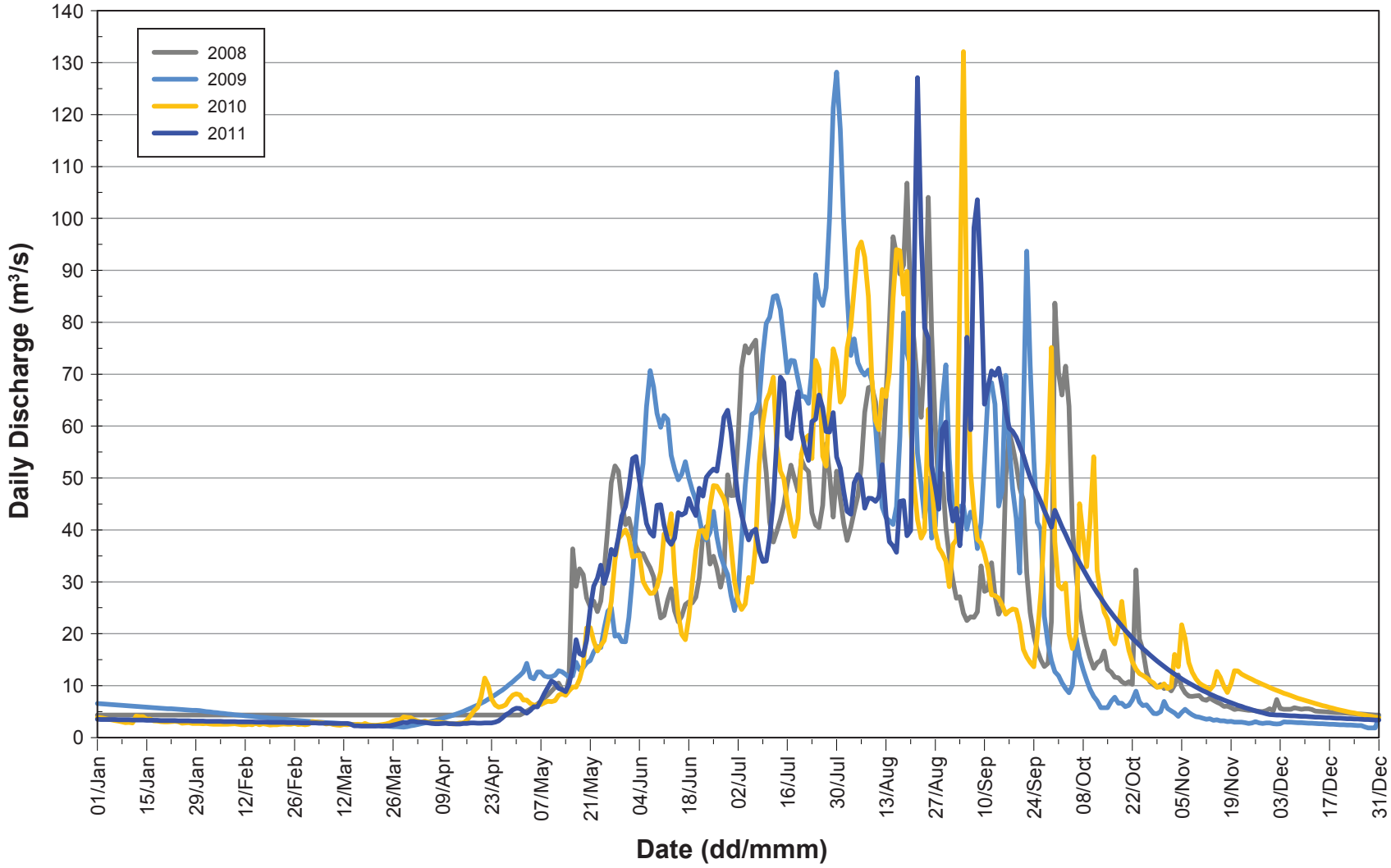
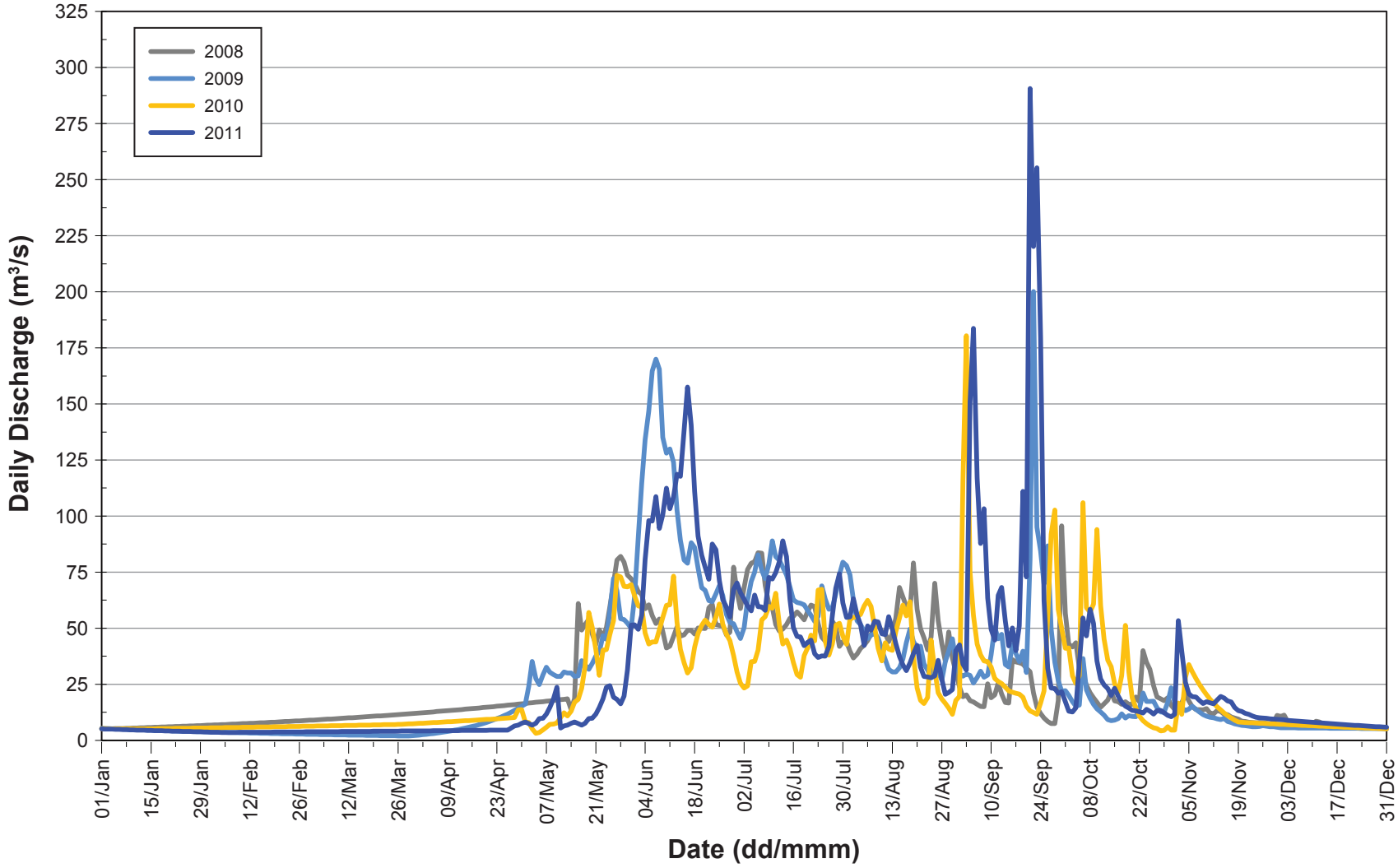


PRETIVM

Annual Hydrographs at Hydrometric Station SC-H1

Rescan™ Engineers & Scientists



PRETIVM

Annual Hydrographs at Hydrometric Station UR-H1

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Appendix 6
Daily Discharge Tables

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Appendix 6a. Station BJL-H1/BJL-H1a Daily Discharge Table

2007 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1								1.256	0.852	0.516	*0.413*	*0.161*
2								1.282	0.725	0.500	*0.400*	*0.156*
3								1.383	0.791	0.431	*0.388*	*0.151*
4								1.559	0.815	0.351	*0.376*	*0.147*
5								1.514	0.720	0.338	*0.364*	*0.142*
6								1.611	0.706	0.333	*0.353*	*0.138*
7								1.750	0.683	0.319	*0.342*	*0.133*
8								1.618	0.615	0.322	*0.331*	*0.129*
9								1.435	0.661	0.252	*0.321*	*0.125*
10								1.262	0.841	0.308	*0.311*	*0.121*
11								1.295	0.935	0.306	*0.302*	*0.118*
12								1.189	0.821	0.292	*0.292*	*0.114*
13								1.069	0.659	0.501	*0.283*	*0.110*
14								0.970	0.558	0.434	*0.274*	*0.107*
15								1.098	0.754	0.396	*0.266*	*0.104*
16								1.263	0.830	0.304	*0.258*	*0.101*
17								1.447	0.645	0.261	*0.250*	*0.097*
18								1.730	0.514	0.253	*0.242*	*0.094*
19								1.364	0.455	0.367	*0.235*	*0.092*
20								1.115	0.435	0.179	*0.227*	*0.089*
21								1.091	0.587	0.163	*0.220*	*0.086*
22								0.992	0.568	0.218	*0.214*	*0.083*
23								0.877	0.536	0.148	*0.207*	*0.081*
24							3.074	0.840	0.975	0.163	*0.201*	*0.078*
25							2.468	0.929	1.045	0.534	*0.194*	*0.076*
26							1.817	0.842	0.950	0.425	*0.188*	*0.073*
27							1.706	0.737	0.869	0.383	*0.183*	*0.071*
28							1.747	0.686	0.720	0.381	*0.177*	*0.069*
29							1.610	0.950	0.673	0.286	*0.171*	*0.067*
30							1.404	0.976	0.574	0.272	*0.166*	*0.065*
31							1.270	0.907		0.246		*0.063*
MEAN							1.887	1.195	0.717	0.328	*0.272*	*0.105*
MAX							3.074	1.750	1.045	0.534	*0.413*	*0.161*
MIN							1.270	0.686	0.435	0.148	*0.166*	*0.063*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6a. Station BJL-H1/BJL-H1a Daily Discharge Table

2008 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*0.061*	*0.023*	*0.031*	*0.054*	*0.094*	*7.233*	1.858	0.723	*0.536*	*0.377*	*0.357*	*0.338*
2	*0.059*	*0.022*	*0.031*	*0.055*	*0.096*	*6.646*	2.055	0.753	*0.528*	*0.377*	*0.356*	*0.338*
3	*0.057*	*0.022*	*0.032*	*0.055*	*0.097*	*6.059*	2.200	0.843	*0.521*	*0.376*	*0.356*	*0.337*
4	*0.055*	*0.022*	*0.032*	*0.056*	*0.098*	*5.471*	2.090	0.892	*0.514*	*0.375*	*0.355*	*0.336*
5	*0.054*	*0.024*	*0.033*	*0.057*	*0.100*	*4.884*	2.281	0.965	*0.506*	*0.375*	*0.354*	*0.336*
6	*0.052*	*0.024*	*0.033*	*0.057*	*0.100*	*4.297*	4.647	0.953	*0.499*	*0.374*	*0.354*	*0.335*
7	*0.050*	*0.025*	*0.033*	*0.058*	*0.100*	*3.740*	3.785	0.974	*0.492*	*0.373*	*0.353*	*0.335*
8	*0.049*	*0.025*	*0.034*	*0.059*	*0.100*	3.559	2.545	0.937	*0.485*	*0.373*	*0.352*	*0.334*
9	*0.047*	*0.026*	*0.034*	*0.060*	*0.101*	2.233	1.964	0.900	*0.479*	*0.372*	*0.352*	*0.333*
10	*0.046*	*0.027*	*0.035*	*0.063*	*0.104*	1.522	1.566	0.981	*0.472*	*0.371*	*0.351*	*0.333*
11	*0.044*	*0.027*	*0.036*	*0.065*	*0.110*	1.220	1.382	0.932	*0.465*	*0.371*	*0.351*	*0.332*
12	*0.043*	*0.029*	*0.036*	*0.070*	*0.115*	1.175	1.417	1.178	*0.459*	*0.370*	*0.350*	*0.332*
13	*0.042*	*0.029*	*0.037*	*0.074*	*0.121*	1.123	1.542	1.413	*0.452*	*0.369*	*0.349*	*0.331*
14	*0.040*	*0.028*	*0.037*	*0.075*	*0.126*	0.940	1.768	1.703	*0.446*	*0.369*	*0.349*	*0.330*
15	*0.039*	*0.029*	*0.038*	*0.076*	*0.273*	0.907	2.057	1.407	*0.440*	*0.368*	*0.348*	*0.330*
16	*0.038*	*0.028*	*0.038*	*0.077*	*0.354*	0.967	2.278	1.238	*0.434*	*0.367*	*0.347*	*0.329*
17	*0.037*	*0.028*	*0.039*	*0.079*	*0.870*	1.061	2.359	1.189	*0.428*	*0.367*	*0.347*	*0.329*
18	*0.036*	*0.028*	*0.040*	*0.080*	*1.277*	1.000	2.243	1.265	*0.422*	*0.366*	*0.346*	*0.328*
19	*0.035*	*0.027*	*0.041*	*0.081*	*1.432*	1.049	2.178	1.010	*0.416*	*0.365*	*0.346*	*0.328*
20	*0.034*	*0.027*	*0.042*	*0.081*	*1.828*	1.117	2.081	0.934	*0.410*	*0.365*	*0.345*	*0.327*
21	*0.032*	*0.027*	*0.042*	*0.082*	*2.636*	1.667	2.009	0.866	*0.404*	*0.364*	*0.344*	*0.326*
22	*0.031*	*0.027*	*0.044*	*0.083*	*3.753*	1.842	1.624	0.784	*0.398*	*0.363*	*0.344*	*0.326*
23	*0.031*	*0.027*	*0.047*	*0.085*	*3.487*	1.513	1.326	1.077	*0.393*	*0.363*	*0.343*	*0.325*
24	*0.030*	*0.027*	*0.048*	*0.085*	*3.905*	1.458	1.128	1.965	*0.382*	*0.362*	*0.343*	*0.325*
25	*0.029*	*0.027*	*0.049*	*0.085*	*4.324*	1.368	1.216	1.311	*0.381*	*0.361*	*0.342*	*0.324*
26	*0.028*	*0.027*	*0.050*	*0.085*	*4.742*	1.131	1.474	0.961	*0.381*	*0.361*	*0.341*	*0.323*
27	*0.027*	*0.029*	*0.051*	*0.088*	*5.161*	1.133	1.269	0.749	*0.380*	*0.360*	*0.341*	*0.323*
28	*0.026*	*0.029*	*0.051*	*0.091*	*5.579*	1.804	0.947	0.680	*0.379*	*0.359*	*0.340*	*0.322*
29	*0.025*	*0.030*	*0.052*	*0.092*	*5.998*	1.823	1.013	0.600	*0.379*	*0.359*	*0.339*	*0.322*
30	*0.024*		*0.053*	*0.094*	*6.416*	1.622	0.961	*0.551*	*0.378*	*0.358*	*0.339*	*0.321*
31	*0.024*		*0.054*		*6.835*		0.791	*0.543*		*0.358*		*0.320*
MEAN	*0.040*	*0.027*	*0.040*	*0.073*	*1.946*	*2.385*	1.873	*1.009*	*0.442*	*0.367*	*0.348*	*0.329*
MAX	*0.061*	*0.030*	*0.054*	*0.094*	*6.835*	*7.233*	4.647	*1.965*	*0.536*	*0.377*	*0.357*	*0.338*
MIN	*0.024*	*0.022*	*0.031*	*0.054*	*0.094*	*0.907*	0.791	*0.543*	*0.378*	*0.358*	*0.339*	*0.320*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6a. Station BJL-H1/BJL-H1a Daily Discharge Table

2009 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1								1.651	0.745	0.477		
2								1.534	0.669	0.402		
3								1.370	0.667	0.340		
4								1.262	0.717	0.279		
5								1.172	0.683	0.273		
6								1.077	0.687	0.457		
7								1.063	0.680	0.437		
8								1.070	0.688	0.403		
9								1.063	0.889	0.379		
10								0.997	1.229	0.316		
11								0.878	1.352	0.248		
12								0.776	1.228	0.188		
13								0.742	1.122	0.079		
14								0.716	0.908	0.062		
15								0.734	0.859	0.116		
16							1.606	0.804	1.135	0.156		
17							1.618	0.892	1.117	0.220		
18							1.567	1.114	1.165	*0.162*		
19							1.532	1.066	1.148	*0.152*		
20							1.452	1.008	1.013	*0.164*		
21							1.361	1.053	1.483	*0.167*		
22							1.276	0.953	2.306			
23							1.405	0.848	1.633			
24							1.606	0.845	1.365			
25							1.431	1.098	1.200			
26							1.407	0.948	1.108			
27							1.547	0.829	0.907			
28							1.686	0.950	0.707			
29							1.805	0.973	0.584			
30							1.787	0.991	0.519			
31							1.707	0.856				
MEAN							1.550	1.011	1.017	*0.261*		
MAX							1.805	1.651	2.306	*0.477*		
MIN							1.276	0.716	0.519	*0.062*		

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6a. Station BJL-H1/BJL-H1a Daily Discharge Table

2010 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*0.191*	*0.101*	*0.107*	*0.169*	*0.414*	1.772	1.053	1.347	0.629	0.940	*0.232*	*0.135*
2	*0.189*	*0.101*	*0.110*	*0.172*	*0.439*	1.895	0.875	1.421	0.612	0.710	*0.228*	*0.133*
3	*0.180*	*0.100*	*0.112*	*0.176*	*0.462*	1.943	0.793	1.462	1.845	0.654	*0.224*	*0.130*
4	*0.175*	*0.100*	*0.113*	*0.179*	*0.480*	2.109	0.844	1.415	2.594	0.562	*0.220*	*0.128*
5	*0.171*	*0.099*	*0.114*	*0.181*	*0.503*	1.755	0.941	1.318	1.485	0.491	*0.216*	*0.125*
6	*0.168*	*0.099*	*0.115*	*0.182*	*0.529*	1.442	1.043	1.277	1.117	0.515	*0.213*	*0.123*
7	*0.161*	*0.100*	*0.115*	*0.185*	*0.557*	1.295	1.323	1.297	0.948	0.902	*0.209*	*0.120*
8	*0.160*	*0.101*	*0.117*	*0.191*	*0.594*	1.237	1.764	1.276	0.774	1.098	*0.206*	*0.118*
9	*0.166*	*0.102*	*0.117*	*0.195*	*0.635*	1.276	1.629	1.158	0.682	1.019	*0.202*	*0.116*
10	*0.164*	*0.102*	*0.119*	*0.198*	*0.675*	1.349	1.629	1.032	0.625	1.325	*0.199*	*0.113*
11	*0.166*	*0.101*	*0.120*	*0.200*	*0.726*	1.454	1.746	0.941	0.611	1.410	*0.195*	*0.111*
12	*0.162*	*0.101*	*0.122*	*0.202*	*0.821*	1.550	1.685	0.997	0.546	1.105	*0.192*	*0.109*
13	*0.154*	*0.101*	*0.124*	*0.205*	*0.991*	1.500	1.431	1.037	0.499	0.908	*0.188*	*0.107*
14	*0.146*	*0.101*	*0.124*	*0.207*	*1.314*	1.289	1.222	0.981	0.463	0.787	*0.185*	*0.104*
15	*0.138*	*0.103*	*0.127*	*0.209*	*1.561*	1.061	1.229	0.999	0.431	0.713	*0.182*	*0.102*
16	*0.132*	*0.103*	*0.131*	*0.212*	*1.603*	0.899	1.138	1.022	0.401	0.621	*0.179*	*0.100*
17	*0.127*	*0.103*	*0.132*	*0.216*	*1.522*	0.827	1.113	1.016	0.380	0.591	*0.175*	*0.098*
18	*0.125*	*0.103*	*0.134*	*0.222*	*1.336*	0.865	1.052	1.036	0.370	0.604	*0.172*	*0.096*
19	*0.121*	*0.103*	*0.135*	*0.230*	*1.291*	1.085	1.047	1.113	0.358	0.552	*0.169*	*0.094*
20	*0.117*	*0.103*	*0.137*	*0.241*	*1.857*	1.330	1.234	0.960	0.353	0.484	*0.166*	*0.092*
21	*0.114*	*0.103*	*0.139*	*0.284*	*2.640*	1.489	1.289	0.819	0.315	0.433	*0.163*	*0.090*
22	*0.110*	*0.103*	*0.140*	*0.306*	*2.929*	1.494	1.373	0.705	0.288	0.399	*0.160*	*0.088*
23	*0.108*	*0.103*	*0.142*	*0.321*	*2.671*	1.482	1.393	0.628	0.282	0.367	*0.157*	*0.086*
24	*0.106*	*0.103*	*0.144*	*0.334*	*2.206*	1.668	1.646	0.676	0.288	0.334	*0.154*	*0.084*
25	*0.104*	*0.104*	*0.147*	*0.340*	*2.268*	1.741	1.625	0.903	0.457	*0.304*	*0.151*	*0.083*
26	*0.102*	*0.106*	*0.149*	*0.349*	*2.907*	1.725	1.310	0.832	0.736	*0.271*	*0.149*	*0.081*
27	*0.102*	*0.106*	*0.152*	*0.359*	*3.255*	1.602	1.217	0.718	1.198	*0.255*	*0.146*	*0.079*
28	*0.101*	*0.106*	*0.155*	*0.365*	*3.719*	1.371	1.211	0.657	1.806	*0.248*	*0.143*	*0.077*
29	*0.102*		*0.160*	*0.375*	*2.864*	1.273	1.289	0.626	2.169	*0.244*	*0.140*	*0.076*
30	*0.102*		*0.164*	*0.389*	*2.852*	1.208	1.386	0.591	1.304	*0.240*	*0.138*	*0.074*
31	*0.102*		*0.167*		*2.187*		1.385	0.550		*0.236*		*0.072*
MEAN	*0.138*	*0.102*	*0.132*	*0.246*	*1.574*	1.433	1.287	0.994	0.819	*0.623*	*0.182*	*0.101*
MAX	*0.191*	*0.106*	*0.167*	*0.389*	*3.719*	2.109	1.764	1.462	2.594	*1.410*	*0.232*	*0.135*
MIN	*0.101*	*0.099*	*0.107*	*0.169*	*0.414*	0.827	0.793	0.550	0.282	*0.236*	*0.138*	*0.072*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6a. Station BJL-H1/BJL-H1a Daily Discharge Table

2011 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*0.071*	*0.056*	*0.079*	*0.104*	*0.148*	*2.469*	2.038	0.934	0.896	*1.020*	*0.414*	*0.173*
2	*0.069*	*0.057*	*0.079*	*0.106*	*0.150*	*2.404*	1.917	0.879	0.851	*0.991*	*0.402*	*0.168*
3	*0.067*	*0.058*	*0.080*	*0.108*	*0.154*	*2.341*	1.458	0.824	0.758	*0.963*	*0.390*	*0.163*
4	*0.066*	*0.059*	*0.081*	*0.109*	*0.155*	*2.279*	1.187	0.804	0.830	*0.935*	*0.379*	*0.158*
5	*0.064*	*0.060*	*0.081*	*0.110*	*0.157*	*2.218*	1.027	0.840	1.182	*0.908*	*0.368*	*0.154*
6	*0.063*	*0.061*	*0.082*	*0.112*	*0.162*	*2.160*	1.070	0.834	1.082	*0.882*	*0.357*	*0.149*
7	*0.061*	*0.062*	*0.082*	*0.113*	*0.164*	*2.103*	1.102	0.799	2.756	*0.857*	*0.347*	*0.145*
8	*0.060*	*0.063*	*0.083*	*0.114*	*0.166*	2.047	1.032	0.781	3.468	*0.832*	*0.337*	*0.141*
9	*0.058*	*0.063*	*0.084*	*0.115*	*0.170*	1.848	1.007	0.758	3.403	*0.808*	*0.328*	*0.137*
10	*0.057*	*0.064*	*0.084*	*0.117*	*0.174*	1.644	1.023	0.765	3.413	*0.785*	*0.318*	*0.133*
11	*0.056*	*0.065*	*0.086*	*0.118*	*0.179*	1.481	1.058	0.780	2.127	*0.762*	*0.309*	*0.129*
12	*0.054*	*0.066*	*0.086*	*0.120*	*0.182*	1.345	1.107	0.852	1.558	*0.741*	*0.300*	*0.125*
13	*0.053*	*0.068*	*0.087*	*0.121*	*0.184*	1.259	1.219	0.818	1.186	*0.719*	*0.292*	*0.122*
14	*0.052*	*0.069*	*0.088*	*0.122*	*0.189*	1.222	1.414	0.714	0.973	*0.699*	*0.283*	*0.118*
15	*0.051*	*0.070*	*0.089*	*0.124*	*0.195*	1.326	1.601	0.656	0.871	*0.679*	*0.275*	*0.115*
16	*0.050*	*0.070*	*0.091*	*0.126*	*0.208*	1.421	1.459	0.667	0.816	*0.659*	*0.267*	*0.111*
17	*0.049*	*0.071*	*0.092*	*0.128*	*0.241*	1.346	1.346	0.805	0.713	*0.640*	*0.259*	*0.108*
18	*0.048*	*0.071*	*0.093*	*0.130*	*0.283*	1.376	1.306	0.836	0.623	*0.622*	*0.252*	*0.105*
19	*0.048*	*0.072*	*0.094*	*0.132*	*0.294*	1.314	1.392	0.783	0.683	*0.604*	*0.245*	*0.102*
20	*0.048*	*0.073*	*0.094*	*0.133*	*0.326*	1.285	1.269	0.808	0.685	*0.587*	*0.238*	*0.099*
21	*0.050*	*0.074*	*0.094*	*0.135*	*0.483*	1.365	1.231	1.667	1.451	*0.570*	*0.231*	*0.096*
22	*0.050*	*0.075*	*0.095*	*0.136*	*0.485*	1.321	1.128	2.397	1.839	*0.553*	*0.224*	*0.094*
23	*0.051*	*0.076*	*0.096*	*0.137*	*0.546*	1.295	1.225	1.681	1.411	*0.538*	*0.218*	*0.091*
24	*0.051*	*0.076*	*0.096*	*0.138*	*0.801*	1.326	1.205	1.424	1.251	*0.522*	*0.212*	*0.088*
25	*0.052*	*0.077*	*0.097*	*0.140*	*2.979*	1.485	1.213	1.646	*1.215*	*0.507*	*0.206*	*0.086*
26	*0.053*	*0.078*	*0.098*	*0.141*	*2.900*	1.584	1.148	1.243	*1.180*	*0.493*	*0.200*	*0.083*
27	*0.054*	*0.079*	*0.099*	*0.143*	*2.823*	1.599	1.043	1.004	*1.146*	*0.478*	*0.194*	*0.081*
28	*0.055*	*0.079*	*0.100*	*0.145*	*2.749*	1.577	1.066	1.122	*1.114*	*0.465*	*0.188*	*0.079*
29	*0.056*		*0.101*	*0.146*	*2.676*	1.578	1.097	1.617	*1.082*	*0.451*	*0.183*	*0.076*
30	*0.056*		*0.101*	*0.147*	*2.605*	1.507	1.035	1.312	*1.051*	*0.438*	*0.178*	*0.074*
31	*0.056*		*0.102*		*2.536*		0.999	1.061		*0.426*		*0.072*
MEAN	*0.056*	*0.068*	*0.090*	*0.126*	*0.821*	*1.651*	1.239	1.036	*1.387*	*0.682*	*0.280*	*0.115*
MAX	*0.071*	*0.079*	*0.102*	*0.147*	*2.979*	*2.469*	2.038	2.397	*3.468*	*1.020*	*0.414*	*0.173*
MIN	*0.048*	*0.056*	*0.079*	*0.104*	*0.148*	*1.222*	0.999	0.656	*0.623*	*0.426*	*0.178*	*0.072*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6a. Station BJL-H1/BJL-H1a Daily Discharge Table

2012 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*0.099*	*0.083*	*0.059*	*0.089*	*0.177*	1.492	1.409	1.268	0.680	0.888	0.104	*0.080*
2	*0.088*	*0.076*	*0.059*	*0.090*	*0.180*	1.253	1.228	1.400	0.629	1.065	0.104	*0.080*
3	*0.090*	*0.071*	*0.060*	*0.090*	*0.186*	1.018	1.104	1.233	0.635	0.907	0.132	*0.080*
4	*0.090*	*0.081*	*0.061*	*0.092*	*0.188*	0.994	1.098	1.355	0.655	0.672	0.192	*0.080*
5	*0.085*	*0.093*	*0.061*	*0.093*	*0.195*	0.963	1.204	1.510	0.683	0.505	0.215	*0.080*
6	*0.086*	*0.091*	*0.062*	*0.095*	*0.201*	1.137	1.265	1.527	0.664	0.479	0.207	*0.080*
7	*0.080*	*0.077*	*0.063*	*0.097*	*0.203*	1.572	1.255	1.451	0.728	0.492	0.199	*0.080*
8	*0.072*	*0.066*	*0.064*	*0.102*	*0.208*	1.284	1.354	1.546	0.704	0.665	0.192	*0.080*
9	*0.072*	*0.065*	*0.065*	*0.106*	*0.215*	1.102	1.609	1.664	0.635	1.521	0.185	*0.080*
10	*0.080*	*0.057*	*0.071*	*0.108*	*0.224*	1.005	1.779	1.649	0.879	0.956	0.187	*0.080*
11	*0.078*	*0.057*	*0.073*	*0.113*	*0.234*	1.237	2.177	1.332	0.825	0.680	0.151	*0.080*
12	*0.073*	*0.062*	*0.075*	*0.115*	*0.241*	1.431	1.802	1.151	0.786	0.511	0.129	*0.080*
13	*0.084*	*0.067*	*0.075*	*0.116*	*0.251*	1.520	1.473	1.100	1.027	0.527	0.136	*0.080*
14	*0.087*	*0.070*	*0.076*	*0.117*	*0.266*	1.325	1.386	1.092	1.864	0.707	0.121	*0.080*
15	*0.079*	*0.070*	*0.076*	*0.119*	*0.284*	1.072	1.617	1.117	1.839	0.635	0.104	*0.080*
16	*0.080*	*0.067*	*0.077*	*0.123*	*0.302*	0.959	1.816	1.095	1.279	0.682	0.102	*0.080*
17	*0.078*	*0.063*	*0.078*	*0.126*	*0.323*	1.003	2.015	1.107	0.946	0.571	0.188	*0.080*
18	*0.077*	*0.059*	*0.078*	*0.130*	*0.350*	1.067	1.998	1.153	0.868	0.487	0.211	*0.080*
19	*0.077*	*0.056*	*0.078*	*0.134*	*0.398*	1.157	1.749	1.197	0.783	0.446	0.128	*0.080*
20	*0.077*	*0.055*	*0.079*	*0.140*	*0.501*	1.269	1.547	1.181	0.630	0.341	0.015	*0.080*
21	*0.076*	*0.055*	*0.079*	*0.145*	*1.318*	1.271	1.653	1.160	0.566	0.276	0.045	*0.080*
22	*0.076*	*0.055*	*0.080*	*0.148*	*4.500*	1.411	2.242	1.123	0.558	0.236	0.232	*0.080*
23	*0.079*	*0.056*	*0.081*	*0.150*	*3.450*	1.770	2.097	0.950	0.555	0.208	0.227	*0.080*
24	*0.079*	*0.056*	*0.082*	*0.152*	2.397	2.068	1.893	0.925	0.651	0.182	0.125	*0.080*
25	*0.078*	*0.056*	*0.082*	*0.155*	1.440	2.392	1.882	0.940	0.647	0.158	*0.118*	*0.080*
26	*0.082*	*0.057*	*0.083*	*0.157*	1.216	2.195	2.245	0.856	0.551	0.124	*0.112*	*0.080*
27	*0.080*	*0.057*	*0.084*	*0.161*	1.236	1.734	2.038	0.805	0.565	0.082	*0.106*	*0.080*
28	*0.078*	*0.058*	*0.084*	*0.165*	1.414	1.339	2.013	0.778	1.704	0.109	*0.100*	*0.080*
29	*0.083*	*0.058*	*0.085*	*0.167*	1.766	1.307	1.266	0.910	1.309	0.104	*0.095*	*0.080*
30	*0.084*		*0.086*	*0.171*	1.947	1.424	1.371	0.854	1.096	0.103	*0.089*	*0.080*
31	*0.082*		*0.088*		1.774		1.472	0.761		0.102		*0.080*
MEAN	*0.081*	*0.065*	*0.074*	*0.126*	*0.890*	1.359	1.647	1.168	0.865	0.497	*0.142*	*0.080*
MAX	*0.099*	*0.093*	*0.088*	*0.171*	*4.500*	2.392	2.245	1.664	1.864	1.521	*0.232*	*0.080*
MIN	*0.072*	*0.055*	*0.059*	*0.089*	*0.177*	0.959	1.098	0.761	0.551	0.082	*0.015*	*0.080*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6b. Station Scott-Hydro Daily Discharge Table

2010 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*0.416*	*0.311*	*0.323*	0.879	4.944	8.884	4.602	10.150	4.407	3.584	*1.658*	*0.488*
2	*0.410*	*0.309*	*0.324*	0.838	4.946	8.793	4.680	10.379	9.879	2.925	*3.725*	*0.469*
3	*0.403*	*0.306*	*0.326*	0.802	4.290	8.221	5.096	10.831	14.378	2.062	*3.409*	*0.447*
4	*0.397*	*0.302*	*0.327*	0.765	3.814	7.006	5.558	11.490	9.448	1.803	*4.144*	*0.435*
5	*0.391*	*0.300*	*0.328*	0.747	3.975	6.548	5.794	11.319	6.559	1.885	*3.902*	*0.409*
6	*0.385*	*0.298*	*0.329*	0.737	4.221	6.560	6.851	11.117	5.922	5.509	*2.838*	*0.389*
7	*0.378*	*0.298*	*0.330*	0.737	4.288	6.725	8.431	10.948	5.599	6.440	*2.297*	*0.388*
8	*0.372*	*0.299*	*0.332*	0.701	4.442	7.208	9.508	9.745	5.255	5.884	*1.982*	*0.379*
9	*0.366*	*0.300*	*0.333*	0.682	4.618	7.456	9.832	8.862	4.259	9.823	*1.710*	*0.364*
10	*0.360*	*0.301*	*0.334*	0.664	4.842	8.409	9.685	8.340	3.511	11.573	*1.473*	*0.350*
11	*0.354*	*0.303*	*0.335*	0.649	5.225	8.472	9.268	9.405	2.996	7.275	*1.481*	*0.340*
12	*0.348*	*0.304*	*0.336*	0.671	5.233	9.507	7.954	9.113	3.341	6.344	*1.423*	*0.334*
13	*0.342*	*0.305*	*0.337*	0.701	5.262	7.466	7.993	9.619	3.286	5.251	*1.357*	*0.335*
14	*0.337*	*0.306*	*0.339*	0.746	5.624	5.812	8.215	10.679	2.990	5.255	*1.320*	*0.321*
15	*0.331*	*0.307*	*0.340*	0.989	5.679	5.346	7.551	11.068	2.775	4.010	*1.252*	*0.299*
16	*0.325*	*0.308*	*0.343*	1.536	5.509	5.207	6.956	10.776	2.886	3.557	*1.081*	*0.283*
17	*0.319*	*0.309*	*0.339*	2.103	5.927	5.552	6.634	10.785	2.995	4.322	*0.976*	*0.276*
18	*0.314*	*0.310*	*0.331*	2.884	7.290	6.309	7.362	10.783	3.001	6.663	*1.279*	*0.272*
19	*0.308*	*0.312*	*0.330*	3.699	9.303	7.061	8.623	7.933	2.568	4.269	*1.014*	*0.263*
20	*0.310*	*0.313*	*0.331*	5.749	8.514	7.652	8.748	6.744	1.941	3.339	*0.838*	*0.253*
21	*0.320*	*0.314*	*0.329*	5.604	7.803	8.159	8.643	5.792	1.706	2.747	*0.737*	*0.244*
22	*0.325*	*0.315*	*0.338*	4.549	7.031	7.650	8.267	5.523	1.489	2.450	*0.636*	*0.236*
23	*0.327*	*0.316*	*0.352*	4.011	7.851	7.563	8.949	5.235	1.364	2.238	*0.778*	*0.227*
24	*0.327*	*0.317*	*0.462*	3.719	8.188	8.430	8.483	6.960	2.461	2.055	*0.804*	*0.218*
25	*0.325*	*0.319*	0.582	3.869	8.427	9.327	7.612	5.685	3.076	1.813	*0.760*	*0.210*
26	*0.321*	*0.320*	0.631	3.994	8.609	8.072	8.137	4.772	4.855	1.651	*0.723*	*0.202*
27	*0.318*	*0.321*	0.717	4.807	9.092	7.459	9.217	4.459	11.370	1.525	*0.624*	*0.194*
28	*0.318*	*0.322*	0.933	5.739	9.397	6.864	9.777	4.406	11.072	1.415	*0.550*	*0.180*
29	*0.317*		1.002	6.239	9.418	5.957	9.529	3.990	5.157	1.392	*0.518*	*0.173*
30	*0.316*		0.970	5.779	9.318	5.072	8.544	3.473	3.811	1.809	*0.501*	*0.168*
31	*0.316*		0.915		9.153		8.869	4.868		*1.567*		*0.163*
MEAN	*0.345*	*0.309*	*0.448*	2.520	6.524	7.292	7.915	8.234	4.812	*3.949*	*1.526*	*0.300*
MAX	*0.416*	*0.322*	1.002	6.239	9.418	9.507	9.832	11.490	14.378	11.573	*4.144*	*0.488*
MIN	*0.308*	*0.298*	*0.323*	0.649	3.814	5.072	4.602	3.473	1.364	1.392	*0.501*	*0.163*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6b. Station Scott-Hydro Daily Discharge Table

2011 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*0.159*	*0.080*	*0.044*	*0.106*	1.463	12.536	5.736	4.880	3.579	3.142	*1.443*	*0.414*
2	*0.154*	*0.079*	*0.043*	*0.102*	1.252	12.306	5.726	4.944	2.581	2.915	*1.512*	*0.414*
3	*0.150*	*0.078*	*0.042*	*0.107*	1.310	10.534	5.035	5.311	3.447	2.685	*1.224*	*0.414*
4	*0.146*	*0.077*	*0.040*	*0.104*	1.580	9.198	4.405	4.841	6.524	2.762	*1.059*	*0.413*
5	*0.145*	*0.076*	*0.039*	*0.098*	1.759	8.267	4.468	4.693	4.712	2.530	*1.052*	*0.413*
6	*0.145*	*0.076*	*0.038*	*0.095*	2.149	7.625	4.706	4.397	12.406	2.398	*0.974*	*0.413*
7	*0.139*	*0.073*	*0.037*	*0.096*	2.871	7.389	3.883	4.627	8.893	2.291	*0.923*	*0.413*
8	*0.138*	*0.072*	*0.036*	*0.106*	3.836	8.433	3.589	4.270	20.992	2.278	*0.854*	*0.413*
9	*0.134*	*0.070*	*0.036*	*0.115*	5.073	7.784	3.572	4.650	24.269	2.860	*0.801*	*0.412*
10	*0.131*	*0.069*	*0.039*	*0.117*	5.342	7.184	4.122	4.753	16.862	2.491	*0.759*	*0.412*
11	*0.128*	*0.071*	*0.035*	*0.114*	4.295	6.308	5.266	4.818	7.608	2.330	*0.707*	*0.412*
12	*0.125*	*0.071*	*0.035*	*0.114*	3.685	5.701	7.596	3.449	6.362	2.796	*0.680*	*0.412*
13	*0.122*	*0.069*	*0.035*	*0.118*	3.664	5.728	9.726	2.869	5.756	2.514	*0.642*	*0.412*
14	*0.119*	*0.067*	*0.036*	*0.135*	4.005	6.998	9.814	2.891	4.957	2.246	*0.606*	*0.411*
15	*0.116*	*0.066*	*0.038*	*0.147*	5.723	6.954	7.998	2.785	4.611	2.051	*0.599*	*0.411*
16	*0.113*	*0.064*	*0.039*	0.162	7.899	6.899	7.432	4.095	3.718	1.998	*0.580*	*0.411*
17	*0.110*	*0.062*	*0.041*	0.176	8.968	7.884	8.685	3.751	3.251	2.008	*0.545*	*0.411*
18	*0.107*	*0.061*	*0.042*	0.175	8.312	7.717	9.291	3.317	3.538	4.597	*0.510*	*0.411*
19	*0.104*	*0.059*	*0.044*	0.199	7.947	7.238	8.936	3.092	3.414	3.494	*0.494*	*0.410*
20	*0.102*	*0.057*	*0.042*	0.222	9.261	7.039	7.521	8.597	5.570	2.719	*0.488*	*0.410*
21	*0.099*	*0.056*	*0.043*	0.231	10.443	7.045	7.137	12.434	6.553	2.439	*0.482*	*0.410*
22	*0.096*	*0.054*	*0.044*	0.277	11.342	7.476	7.827	9.222	4.789	2.436	*0.476*	*0.410*
23	*0.092*	*0.053*	*0.045*	0.365	11.588	7.337	7.994	8.267	6.869	2.509	*0.471*	*0.410*
24	*0.086*	*0.051*	*0.045*	0.462	9.341	7.735	8.235	9.985	5.536	2.402	*0.441*	*0.409*
25	*0.088*	*0.050*	*0.048*	0.633	8.706	8.501	7.765	5.739	4.406	2.300	*0.426*	*0.409*
26	*0.089*	*0.048*	*0.054*	0.863	9.281	9.295	7.070	4.758	3.746	2.354	*0.459*	*0.409*
27	*0.086*	*0.047*	*0.071*	1.050	9.468	10.503	6.501	3.998	3.928	2.270	*0.416*	*0.409*
28	*0.084*	*0.046*	*0.081*	1.193	10.990	9.992	6.034	5.303	3.553	2.328	*0.415*	*0.409*
29	*0.083*		*0.086*	1.405	11.843	8.177	5.541	4.709	3.336	*1.967*	*0.414*	*0.408*
30	*0.082*		*0.116*	1.528	12.174	6.754	5.221	3.384	3.752	*1.780*	*0.414*	*0.408*
31	*0.081*		*0.112*		12.973		4.959	3.212		*1.510*		*0.408*
MEAN	*0.115*	*0.064*	*0.049*	*0.354*	6.727	8.085	6.509	5.098	6.651	*2.497*	*0.696*	*0.411*
MAX	*0.159*	*0.080*	*0.116*	1.528	12.973	12.536	9.814	12.434	24.269	4.597	*1.512*	*0.414*
MIN	*0.081*	*0.046*	*0.035*	*0.095*	1.252	5.701	3.572	2.785	2.581	*1.510*	*0.414*	*0.408*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6b. Station Scott-Hydro Daily Discharge Table

2012 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*0.408*	*0.402*	*0.288*	*0.241*	2.718	6.114	7.183	10.192	5.740	4.307	*2.888*	*0.815*
2	*0.408*	*0.403*	*0.281*	*0.228*	2.679	6.892	7.279	9.086	5.325	3.827	*5.183*	*0.808*
3	*0.408*	*0.405*	*0.274*	*0.223*	3.587	6.805	6.018	8.726	4.888	5.970	*3.069*	*0.801*
4	*0.407*	*0.395*	*0.272*	*0.222*	3.676	6.214	5.256	7.738	4.601	3.687	*1.515*	*0.794*
5	*0.407*	*0.385*	*0.270*	*0.217*	3.311	5.857	5.652	9.008	4.399	2.849	*1.170*	*0.787*
6	*0.407*	*0.369*	*0.267*	*0.214*	3.163	5.725	6.122	11.132	4.688	2.422	*1.072*	*0.781*
7	*0.407*	*0.359*	*0.269*	*0.217*	2.812	6.808	6.113	10.766	4.474	2.544	*1.484*	*0.774*
8	*0.407*	*0.353*	*0.269*	*0.225*	2.697	6.872	6.197	10.147	5.421	3.277	*1.250*	*0.767*
9	*0.406*	*0.347*	*0.269*	*0.239*	3.398	6.297	7.009	10.855	4.568	3.790	*1.139*	*0.761*
10	*0.406*	*0.342*	*0.274*	*0.264*	4.696	6.287	8.006	11.355	5.066	3.280	*1.071*	*0.754*
11	*0.406*	*0.337*	*0.279*	0.316	3.556	6.731	8.659	9.856	6.766	2.913	*1.178*	*0.748*
12	*0.406*	*0.333*	*0.268*	0.382	2.899	6.823	11.734	7.968	4.611	2.511	*1.938*	*0.741*
13	*0.406*	*0.330*	*0.263*	0.478	2.718	9.104	9.446	7.339	3.576	2.148	*1.357*	*0.735*
14	*0.406*	*0.321*	*0.258*	0.818	2.683	9.336	8.181	7.114	5.229	2.026	*0.985*	*0.729*
15	*0.405*	*0.318*	*0.255*	1.051	3.248	7.274	9.008	7.039	7.891	3.088	*0.901*	*0.722*
16	*0.405*	*0.315*	*0.252*	1.294	3.885	5.942	11.451	8.259	7.603	3.700	*0.881*	*0.716*
17	*0.405*	*0.311*	*0.251*	1.375	3.575	5.599	12.928	8.298	4.622	4.410	*0.866*	*0.710*
18	*0.405*	*0.306*	*0.249*	1.671	3.247	7.024	13.432	8.262	3.639	3.938	*0.862*	*0.704*
19	*0.405*	*0.303*	*0.245*	2.018	2.927	7.379	11.763	8.520	3.660	2.943	*0.838*	*0.698*
20	*0.404*	*0.299*	*0.243*	2.122	3.048	8.158	10.483	10.008	3.660	2.630	*0.819*	*0.692*
21	*0.404*	*0.299*	*0.244*	2.257	3.482	7.944	9.820	10.038	3.526	2.189	*0.784*	*0.686*
22	*0.404*	*0.297*	*0.247*	2.597	3.986	7.282	11.442	9.432	4.607	1.940	*0.881*	*0.680*
23	*0.404*	*0.293*	*0.245*	2.304	4.576	7.659	14.172	8.266	4.825	1.832	*0.873*	*0.674*
24	*0.404*	*0.287*	*0.243*	2.226	5.792	10.872	12.422	7.247	4.570	1.564	*0.866*	*0.668*
25	*0.403*	*0.288*	*0.239*	2.469	5.849	12.894	12.611	5.985	4.123	1.476	*0.858*	*0.662*
26	*0.403*	*0.282*	*0.236*	2.658	6.326	14.353	11.844	5.517	3.645	1.463	*0.851*	*0.657*
27	*0.403*	*0.283*	*0.233*	2.628	7.618	11.795	11.933	5.242	2.706	1.406	*0.844*	*0.651*
28	*0.403*	*0.285*	*0.231*	3.724	8.045	8.284	12.634	5.864	2.762	1.350	*0.836*	*0.646*
29	*0.403*	*0.288*	*0.230*	3.856	8.147	6.519	14.057	6.781	7.556	1.247	*0.829*	*0.640*
30	*0.402*		*0.235*	2.959	7.750	6.360	12.539	6.840	4.846	1.292	*0.822*	*0.634*
31	*0.402*		*0.242*		6.450		10.607	6.267		1.505		*0.629*
MEAN	*0.405*	*0.329*	*0.256*	*1.383*	4.276	7.707	9.871	8.360	4.786	2.694	*1.297*	*0.718*
MAX	*0.408*	*0.405*	*0.288*	3.856	8.147	14.353	14.172	11.355	7.891	5.970	*5.183*	*0.815*
MIN	*0.402*	*0.282*	*0.230*	*0.214*	2.679	5.599	5.256	5.242	2.706	1.247	*0.784*	*0.629*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6c. Station Todedada-Hydro Daily Discharge Table

2011 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1							7.202	5.793	4.350	7.971	*5.565*	*3.616*
2							8.183	5.593	2.290	7.464	*5.494*	*3.561*
3							6.077	6.636	3.783	7.138	*5.423*	*3.506*
4							4.873	6.013	10.691	7.212	*5.352*	*3.451*
5							5.362	6.082	6.158	6.903	*5.281*	*3.398*
6							5.466	5.235	25.253	6.670	*5.211*	*3.345*
7							4.868	5.017	21.962	6.535	*5.141*	*3.293*
8							4.574	5.067	20.410	6.487	*5.071*	*3.241*
9							4.943	5.491	18.657	7.303	*5.002*	*3.190*
10							5.529	5.482	15.733	6.674	*4.933*	*3.126*
11							7.264	6.587	14.074	6.397	*4.865*	*3.059*
12							10.815	4.199	12.938	7.221	*4.797*	*2.993*
13							15.206	2.537	12.374	6.544	*4.730*	*2.929*
14							18.112	3.035	11.476	6.047	*4.663*	*2.865*
15							14.171	2.826	11.104	5.688	*4.597*	*2.803*
16							10.938	4.267	9.917	5.568	*4.531*	*2.742*
17							12.412	4.854	9.351	5.736	*4.466*	*2.683*
18							15.502	4.046	9.735	8.808	*4.401*	*2.624*
19							11.805	3.244	9.474	7.801	*4.337*	*2.567*
20							9.035	12.126	12.373	6.833	*4.274*	*2.510*
21						10.621	7.841	31.761	14.619	6.440	*4.211*	*2.455*
22						11.012	10.356	16.788	12.336	6.270	*4.148*	*2.401*
23						10.653	10.622	10.691	13.726	6.296	*4.087*	*2.348*
24						12.474	11.090	17.380	12.236	6.087	*4.026*	*2.297*
25						13.118	9.915	5.713	10.849	5.841	*3.965*	*2.246*
26						14.983	8.524	4.490	9.701	5.968	*3.905*	*2.197*
27						15.545	7.322	3.911	9.609	*5.838*	*3.846*	*2.148*
28						16.030	7.609	5.928	8.776	*5.854*	*3.788*	*2.101*
29						12.559	6.720	5.477	8.467	*5.781*	*3.730*	*2.055*
30						8.825	6.635	3.381	9.082	*5.709*	*3.673*	*2.010*
31							6.100	3.146		*5.637*		*1.965*
MEAN						12.582	8.873	6.864	11.717	*6.539*	*4.584*	*2.765*
MAX						16.030	18.112	31.761	25.253	8.808	*5.565*	*3.616*
MIN						8.825	4.574	2.537	2.290	5.568	*3.673*	*1.965*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6c. Station Todedada-Hydro Daily Discharge Table

2012 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*1.922*	*1.034*	*0.735*	*0.737*	11.217	12.055	10.126	9.916	5.468	4.607	*1.006*	*0.835*
2	*1.880*	*1.017*	*0.729*	*0.731*	10.593	*11.552*	10.055	10.182	5.206	3.746	*1.006*	*0.819*
3	*1.839*	*1.001*	*0.724*	*0.736*	10.078	*11.441*	10.234	11.232	5.383	3.203	*1.006*	*0.804*
4	*1.799*	*0.986*	*0.719*	*0.736*	9.893	*11.409*	10.296	10.825	4.962	2.940	*1.006*	*0.789*
5	*1.760*	*0.971*	*0.714*	*0.736*	9.620	*11.377*	10.248	10.554	5.111	3.276	*1.006*	*0.775*
6	*1.722*	*0.956*	*0.709*	*0.736*	9.612	*11.344*	10.481	10.536	4.605	3.690	*1.006*	*0.760*
7	*1.685*	*0.942*	*0.704*	*0.736*	10.247	*11.312*	10.976	10.483	4.553	3.311	*1.006*	*0.746*
8	*1.649*	*0.929*	*0.700*	*0.736*	11.065	*11.280*	11.169	10.034	5.501	2.901	*1.006*	*0.733*
9	*1.614*	*0.916*	*0.695*	*0.736*	10.315	*11.248*	11.920	8.861	4.363	2.501	*1.006*	*0.719*
10	*1.580*	*0.903*	*0.691*	*0.736*	9.737	*11.216*	11.669	8.445	3.644	2.140	*1.006*	*0.706*
11	*1.547*	*0.891*	*0.687*	*0.736*	9.540	*11.184*	10.950	8.144	4.086	2.016	*1.006*	*0.693*
12	*1.514*	*0.880*	*0.683*	*0.736*	9.493	*11.152*	11.005	8.086	5.450	3.350	*1.006*	*0.680*
13	*1.483*	*0.869*	*0.678*	*0.736*	9.805	*11.120*	11.680	8.430	6.808	4.155	*1.006*	*0.667*
14	*1.452*	*0.858*	*0.674*	*0.808*	10.031	*11.088*	11.865	8.282	4.780	5.032	*1.006*	*0.655*
15	*1.422*	*0.848*	*0.670*	*2.006*	9.958	*11.056*	12.147	8.246	3.970	4.741	*1.006*	*0.643*
16	*1.393*	*0.838*	*0.666*	2.711	9.721	*11.024*	11.911	8.167	3.582	4.170	*1.006*	*0.631*
17	*1.365*	*0.828*	*0.662*	6.567	9.364	*10.992*	11.394	8.503	3.754	3.807	*1.006*	*0.619*
18	*1.338*	*0.819*	*0.657*	15.153	9.352	*10.960*	10.913	8.336	3.300	3.438	*1.006*	*0.608*
19	*1.312*	*0.811*	*0.653*	18.474	9.538	*10.937*	10.729	8.175	3.623	3.278	*1.006*	*0.597*
20	*1.286*	*0.802*	*0.649*	18.441	9.747	*10.986*	12.184	7.788	4.031	3.050	*1.006*	*0.586*
21	*1.261*	*0.794*	*0.642*	16.420	9.938	*11.309*	11.888	7.441	3.666	3.197	*1.006*	*0.575*
22	*1.237*	*0.786*	*0.648*	15.124	10.704	12.006	11.723	6.758	3.524	4.737	*0.987*	*0.564*
23	*1.214*	*0.779*	*0.655*	11.766	10.868	12.908	11.521	6.342	3.440	4.059	*0.969*	*0.554*
24	*1.191*	*0.772*	*0.662*	11.061	11.239	12.728	11.325	6.142	2.917	2.058	*0.951*	*0.544*
25	*1.169*	*0.765*	*0.670*	10.681	12.015	11.734	11.620	6.102	3.138	1.889	*0.934*	*0.533*
26	*1.148*	*0.758*	*0.677*	11.411	12.423	10.985	12.005	6.246	7.465	1.493	*0.916*	*0.524*
27	*1.127*	*0.752*	*0.684*	12.709	12.474	10.714	11.774	6.442	6.578	*1.298*	*0.899*	*0.514*
28	*1.107*	*0.746*	*0.691*	10.992	12.485	11.012	11.126	6.076	5.316	*1.153*	*0.883*	*0.504*
29	*1.088*	*0.740*	*0.718*	10.514	12.070	10.971	10.930	5.755	4.674	*1.068*	*0.867*	*0.495*
30	*1.069*		*0.736*	10.324	11.849	10.461	10.471	5.296	5.802	*1.038*	*0.851*	*0.486*
31	*1.051*		*0.736*		12.223		10.413	5.315		*0.998*		*0.477*
MEAN	*1.427*	*0.862*	*0.688*	*6.491*	10.555	*11.319*	11.185	8.101	4.623	*2.979*	*0.980*	*0.640*
MAX	*1.922*	*1.034*	*0.736*	18.474	12.485	12.908	12.184	11.232	7.465	5.032	*1.006*	*0.835*
MIN	*1.051*	*0.740*	*0.642*	*0.731*	9.352	10.461	10.055	5.296	2.917	*0.998*	*0.851*	*0.477*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6d. Station Wildfire-Hydro Daily Discharge Table

2011 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1						12.068	2.668	0.956	0.365	5.957	2.456	*0.486*
2						11.996	2.294	0.741	0.724	3.544	1.952	*0.484*
3						11.554	3.200	0.646	0.416	2.508	2.022	*0.482*
4						9.644	2.519	0.615	0.581	2.005	1.606	*0.480*
5						7.823	1.960	0.787	1.546	1.943	1.266	*0.478*
6						7.103	2.066	0.780	0.844	1.591	1.163	*0.476*
7						6.633	1.984	0.564	7.463	1.357	1.008	*0.474*
8						8.014	1.610	0.465	6.596	1.245	0.911	*0.472*
9						10.280	1.402	0.427	9.970	1.251	0.818	*0.470*
10						9.729	1.528	0.421	13.512	3.716	0.768	*0.468*
11						7.462	1.464	0.405	8.872	2.763	0.733	*0.466*
12						5.741	1.526	0.654	5.931	2.234	0.688	*0.464*
13						5.194	1.978	0.456	4.358	3.093	0.647	*0.462*
14					3.355	5.711	2.534	0.276	3.554	2.250	0.633	*0.460*
15					3.540	7.604	2.393	0.289	2.853	1.788	0.605	*0.458*
16					4.953	7.223	1.731	0.302	2.708	1.430	0.639	*0.456*
17					6.839	6.560	1.258	2.364	2.204	1.261	0.597	*0.454*
18					8.030	6.794	1.335	1.572	1.887	1.316	*0.540*	*0.452*
19					7.352	6.082	1.598	0.867	4.980	8.133	*0.510*	*0.450*
20					6.744	5.062	1.284	0.860	4.995	4.815	*0.508*	*0.448*
21					7.359	4.797	1.199	5.997	6.001	2.857	*0.506*	*0.446*
22					7.716	4.568	1.201	7.324	11.334	2.166	*0.504*	*0.444*
23					9.422	4.729	1.528	2.460	7.053	1.953	*0.502*	*0.442*
24					10.466	4.499	1.431	2.457	12.872	2.026	*0.500*	*0.440*
25					8.228	5.857	1.676	6.287	7.489	1.903	*0.498*	*0.438*
26					7.398	5.272	1.445	1.528	4.506	1.655	*0.496*	*0.436*
27					7.819	5.445	1.103	0.850	3.251	1.645	*0.494*	*0.434*
28					7.865	5.155	1.011	0.595	4.956	1.573	*0.492*	*0.433*
29					9.302	4.758	1.198	1.016	3.692	1.641	*0.490*	*0.431*
30					11.018	3.625	0.993	0.909	3.308	1.896	*0.488*	*0.429*
31					11.182		1.163	0.534		2.722		*0.427*
MEAN					7.699	6.899	1.686	1.432	4.961	2.459	0.835	0.456
MAX					11.182	12.068	3.200	7.324	13.512	8.133	2.456	0.486
MIN					3.355	3.625	0.993	0.276	0.365	1.245	0.488	0.427

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6d. Station Wildfire-Hydro Daily Discharge Table

2012 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*0.425*	*0.341*	*0.143*	*0.130*	3.101	10.846	7.998	2.322	0.948	2.475	*0.380*	*0.300*
2	*0.423*	*0.318*	*0.133*	*0.129*	3.953	11.418	6.100	2.548	0.715	6.462	*0.376*	*0.299*
3	*0.421*	*0.353*	*0.131*	*0.132*	4.338	9.847	5.603	1.846	0.680	2.922	*0.373*	*0.298*
4	*0.419*	*0.348*	*0.127*	*0.133*	3.512	8.743	5.905	1.873	0.769	1.957	*0.369*	*0.296*
5	*0.417*	*0.314*	*0.125*	*0.126*	3.309	8.787	5.427	2.439	0.873	1.440	*0.366*	*0.295*
6	*0.416*	*0.240*	*0.153*	*0.122*	2.981	10.328	5.485	2.070	0.778	1.198	*0.362*	*0.294*
7	*0.414*	*0.201*	*0.148*	*0.132*	2.999	10.353	5.638	1.885	0.688	1.096	*0.359*	*0.293*
8	*0.412*	*0.186*	*0.163*	0.151	5.512	9.398	6.432	2.012	0.587	0.996	*0.355*	*0.292*
9	*0.410*	*0.181*	*0.178*	0.179	9.241	9.376	7.186	2.428	0.524	0.860	*0.352*	*0.290*
10	*0.408*	*0.172*	*0.269*	0.248	6.381	9.995	7.348	2.353	1.182	0.716	*0.348*	*0.289*
11	*0.406*	*0.166*	*0.193*	0.355	4.276	10.253	8.964	1.476	0.789	0.604	*0.345*	*0.288*
12	*0.404*	*0.161*	*0.184*	0.568	3.490	14.405	6.082	1.222	0.533	0.554	*0.341*	*0.287*
13	*0.403*	*0.158*	*0.162*	1.364	3.025	13.198	4.772	1.306	1.932	0.675	*0.338*	*0.286*
14	*0.401*	*0.157*	*0.153*	1.972	3.613	9.783	4.984	1.629	3.884	2.272	*0.333*	*0.284*
15	*0.399*	*0.161*	*0.148*	2.310	4.645	7.320	6.272	2.331	3.949	3.665	*0.316*	*0.283*
16	*0.397*	*0.170*	*0.150*	2.240	4.541	7.695	6.504	1.695	1.898	5.803	*0.308*	*0.282*
17	*0.395*	*0.166*	*0.149*	2.462	4.109	13.367	5.945	1.527	1.259	5.302	*0.314*	*0.281*
18	*0.394*	*0.149*	*0.147*	2.655	3.125	11.081	4.784	1.470	1.001	2.964	*0.311*	*0.280*
19	*0.392*	*0.143*	*0.145*	2.758	2.860	11.662	4.193	1.873	0.986	2.387	*0.309*	*0.279*
20	*0.390*	*0.139*	*0.140*	2.972	3.272	11.248	3.453	1.839	0.760	1.874	*0.309*	*0.277*
21	*0.388*	*0.139*	*0.136*	3.156	4.300	9.653	3.451	1.609	0.718	1.481	*0.310*	*0.276*
22	*0.386*	*0.141*	*0.133*	2.987	5.837	11.074	6.349	1.373	0.747	1.227	*0.310*	*0.275*
23	*0.385*	*0.140*	*0.130*	2.719	9.410	14.888	4.591	1.261	0.724	0.904	*0.311*	*0.274*
24	*0.383*	*0.135*	*0.127*	2.706	8.764	19.451	3.995	1.110	0.802	0.811	*0.309*	*0.273*
25	*0.435*	*0.137*	*0.123*	2.796	8.849	20.221	3.518	0.893	0.851	0.808	*0.308*	*0.272*
26	*0.491*	*0.133*	*0.119*	2.596	11.742	12.327	3.247	0.761	0.590	0.716	*0.306*	*0.271*
27	*0.418*	*0.143*	*0.115*	3.593	13.378	7.340	3.471	0.757	0.684	0.629	*0.305*	*0.269*
28	*0.408*	*0.151*	*0.110*	4.501	13.103	6.172	3.801	0.900	5.768	0.514	*0.304*	*0.268*
29	*0.397*	*0.163*	*0.121*	3.616	12.318	7.878	3.290	1.446	2.635	*0.591*	*0.303*	*0.267*
30	*0.391*		*0.130*	3.302	10.811	10.361	2.513	1.787	2.107	*0.387*	*0.301*	*0.266*
31	*0.367*		*0.129*		9.652		2.583	1.361		*0.383*		*0.265*
MEAN	*0.406*	*0.190*	*0.146*	*1.770*	6.143	10.949	5.158	1.658	1.345	*1.764*	*0.331*	*0.282*
MAX	*0.491*	*0.353*	*0.269*	4.501	13.378	20.221	8.964	2.548	5.768	6.462	*0.380*	*0.300*
MIN	*0.367*	*0.133*	*0.110*	*0.122*	2.860	6.172	2.513	0.757	0.524	*0.383*	*0.301*	*0.265*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6e. Station SL-H1 Daily Discharge Table

2007 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1										3.774	1.872	1.131
2										4.025	1.741	1.144
3										3.460	1.627	1.156
4										2.962	1.502	1.124
5										2.671	1.324	1.086
6										2.808	1.163	1.230
7										2.870	1.081	1.290
8										2.571	1.069	1.159
9										2.488	0.955	1.033
10										3.434	1.010	1.021
11										4.166	1.008	1.026
12										3.292	0.978	0.948
13										4.590	1.050	0.948
14										5.438	1.041	0.966
15										4.906	0.954	0.971
16										3.592	0.819	0.949
17										3.116	0.916	0.942
18										2.692	1.426	0.951
19										2.222	2.246	0.985
20										1.953	1.813	1.013
21										1.912	1.245	0.985
22										1.993	1.100	0.983
23										1.923	1.070	0.963
24										2.611	1.059	0.911
25										2.442	1.094	0.932
26									6.410	2.310	1.027	0.938
27									5.980	2.433	1.087	1.023
28									4.576	2.410	1.053	1.008
29									4.164	2.030	1.215	1.022
30									3.792	1.825	1.165	0.990
31										1.962		0.941
MEAN									4.984	2.932	*1.224*	*1.025*
MAX									6.410	5.438	*2.246*	*1.290*
MIN									3.792	1.825	*0.819*	*0.911*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6e. Station SL-H1 Daily Discharge Table

2008 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.989	0.921	0.793	1.024	0.532	8.325	13.179	9.252	7.539	17.634	2.559	0.887
2	1.010	0.875	0.803	0.840	0.594	8.073	15.672	9.765	7.429	19.092	3.122	0.830
3	1.005	0.879	0.810	0.793	0.878	7.939	16.083	10.329	6.838	16.907	3.841	0.798
4	1.021	0.856	0.833	0.792	0.967	8.394	15.197	10.983	6.420	11.176	2.583	0.830
5	0.977	0.899	0.860	0.814	0.841	8.932	16.778	12.432	6.498	8.976	2.079	0.784
6	0.911	0.850	0.845	0.816	0.806	8.650	19.480	14.466	6.463	7.272	1.683	0.813
7	0.921	0.860	0.831	0.803	0.784	7.912	17.445	15.406	6.570	6.068	1.447	0.845
8	0.948	0.903	0.827	0.786	0.701	7.306	14.780	15.465	7.907	5.274	1.388	0.894
9	0.915	0.883	0.830	0.724	0.857	6.317	12.431	14.911	7.260	4.622	1.418	0.985
10	0.918	0.853	0.842	0.730	1.240	6.118	10.082	13.236	7.251	4.091	1.301	1.044
11	0.880	0.802	0.827	0.786	1.733	6.518	9.163	12.451	7.825	3.953	1.231	1.098
12	0.875	0.781	0.819	0.845	1.698	6.703	9.415	15.812	7.304	3.844	1.398	1.100
13	0.868	0.760	0.798	0.896	1.431	6.101	9.713	18.956	6.762	4.014	1.288	1.083
14	0.890	0.790	0.778	0.877	1.913	5.529	10.502	24.055	6.669	3.411	1.175	1.007
15	0.898	0.796	0.785	0.901	5.305	5.847	11.895	22.748	9.233	3.214	1.090	0.990
16	0.888	0.796	0.807	0.896	4.480	6.711	12.803	22.755	11.824	3.000	1.052	0.878
17	0.871	0.818	0.782	0.875	5.354	6.740	12.288	23.244	12.970	2.878	0.977	0.860
18	0.895	0.857	0.781	0.812	5.735	6.532	11.808	25.824	12.551	2.688	0.985	0.876
19	0.873	0.859	0.790	0.786	5.155	6.801	12.818	20.489	11.829	2.527	0.955	0.737
20	0.957	0.795	0.802	0.766	4.744	7.815	12.547	19.895	11.087	2.525	0.841	0.820
21	1.025	0.720	0.782	0.743	4.694	9.734	12.141	17.413	8.469	2.499	0.862	*0.808*
22	0.994	0.749	0.781	0.732	4.467	9.689	10.931	16.058	6.935	5.025	0.842	*0.797*
23	1.000	0.735	0.782	0.725	4.882	8.760	10.188	18.928	5.802	3.682	0.813	*0.785*
24	0.963	0.763	0.808	0.694	6.062	9.427	9.875	27.666	5.076	3.025	0.788	*0.774*
25	0.968	0.757	0.785	0.673	7.898	8.719	11.096	20.103	4.552	2.556	0.771	*0.763*
26	0.954	0.773	0.780	0.680	9.318	7.831	13.223	15.163	4.280	2.210	0.752	*0.752*
27	0.979	0.779	0.813	0.716	10.249	8.238	12.273	12.536	4.551	2.066	0.724	*0.741*
28	1.018	0.812	0.829	0.815	10.084	11.448	10.725	12.040	5.576	1.861	0.767	*0.730*
29	0.975	0.830	0.857	0.834	9.052	11.124	13.094	10.425	17.193	2.021	0.812	*0.720*
30	0.958		0.917	0.659	8.293	11.028	11.379	9.518	16.245	2.500	0.879	*0.709*
31	1.010		1.017		8.654		10.136	8.285		3.199		*0.699*
MEAN	*0.947*	*0.819*	*0.819*	*0.794*	*4.174*	*7.975*	12.553	*16.149*	*8.230*	*5.284*	*1.347*	*0.853*
MAX	*1.025*	*0.921*	*1.017*	*1.024*	*10.249*	*11.448*	19.480	*27.666*	*17.193*	*19.092*	*3.841*	*1.100*
MIN	*0.868*	*0.720*	*0.778*	*0.659*	*0.532*	*5.529*	9.163	*8.285*	*4.280*	*1.861*	*0.724*	*0.699*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6e. Station SL-H1 Daily Discharge Table

2009 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*0.665*	*0.436*	*0.352*	*0.306*	1.277	5.402	6.417	40.031	13.974	4.133	*1.393*	*0.506*
2	*0.656*	*0.433*	*0.350*	*0.313*	1.941	7.504	7.795	31.960	13.311	3.678	*1.166*	*0.340*
3	*0.647*	*0.430*	*0.347*	*0.321*	2.553	9.835	10.662	26.289	13.905	3.273	*1.042*	*0.342*
4	*0.638*	*0.426*	*0.344*	*0.328*	2.172	12.160	13.672	27.580	14.054	2.934	*1.004*	*0.437*
5	*0.629*	*0.423*	*0.342*	*0.336*	2.185	14.084	15.760	25.260	12.725	2.914	*1.237*	*0.186*
6	*0.621*	*0.420*	*0.339*	*0.345*	2.354	17.679	17.374	23.985	13.848	4.980	*1.343*	*0.033*
7	*0.612*	*0.417*	*0.336*	*0.353*	2.243	20.848	17.482	23.190	12.237	5.128	*1.080*	*0.003*
8	*0.604*	*0.414*	*0.334*	*0.362*	2.097	18.130	18.101	22.720	10.940	4.442	*0.935*	*0.002*
9	*0.596*	*0.410*	*0.331*	*0.370*	2.178	16.871	21.614	21.218	13.409	4.029	*0.830*	*0.197*
10	*0.587*	*0.407*	*0.329*	*0.379*	2.258	16.596	24.135	18.651	16.168	3.435	*0.777*	*0.257*
11	*0.579*	*0.404*	*0.326*	*0.389*	2.196	16.159	25.295	15.337	20.984	2.919	*0.743*	*0.376*
12	*0.571*	*0.401*	*0.324*	*0.398*	2.233	16.025	25.782	13.671	22.257	2.512	*0.738*	*0.458*
13	*0.564*	*0.398*	*0.321*	*0.408*	2.266	14.339	25.404	13.256	20.801	1.976	*0.685*	*0.464*
14	*0.556*	*0.395*	*0.319*	*0.418*	2.260	13.653	24.939	13.073	13.920	1.806	*0.679*	*0.419*
15	*0.548*	*0.392*	*0.317*	*0.428*	2.257	13.103	23.282	12.529	15.567	1.813	*0.673*	*0.179*
16	*0.541*	*0.389*	*0.314*	*0.438*	2.409	13.719	21.956	13.672	22.999	2.610	*0.608*	*0.210*
17	*0.533*	*0.386*	*0.312*	*0.449*	3.111	13.595	22.965	16.773	18.958	2.936	*0.585*	*0.206*
18	*0.526*	*0.383*	*0.309*	*0.460*	2.808	12.635	21.797	25.368	16.051	*2.466*	*0.438*	*0.356*
19	*0.519*	*0.380*	*0.307*	*0.471*	2.706	12.227	20.746	24.600	13.265	*2.336*	*0.381*	*0.415*
20	*0.512*	*0.377*	*0.305*	*0.482*	2.782	11.752	19.422	24.534	10.140	*2.206*	*0.381*	*0.387*
21	*0.505*	*0.374*	*0.302*	*0.494*	2.879	10.958	19.395	22.970	15.806	*2.565*	*0.450*	*0.400*
22	*0.498*	*0.372*	*0.300*	*0.506*	3.163	10.163	19.172	17.103	29.605	*2.796*	*0.275*	*0.234*
23	*0.491*	*0.369*	*0.298*	*0.518*	3.443	10.386	20.449	14.952	23.800	*3.337*	*0.344*	*0.213*
24	*0.484*	*0.366*	*0.295*	*0.531*	3.520	11.022	26.698	13.275	17.309	*2.489*	*0.570*	*0.255*
25	*0.478*	*0.363*	*0.293*	*0.544*	4.473	12.011	26.672	15.594	12.708	*2.313*	*0.556*	*0.265*
26	*0.471*	*0.360*	*0.291*	*0.557*	5.608	10.799	27.214	12.241	11.153	*1.842*	*0.549*	*0.256*
27	*0.465*	*0.358*	*0.289*	0.570	5.475	10.500	28.651	13.266	7.466	*1.604*	*0.581*	*0.236*
28	*0.458*	*0.355*	*0.287*	0.662	4.903	9.666	40.031	17.031	5.981	*1.529*	*0.586*	*0.243*
29	*0.452*		*0.284*	0.842	4.806	8.689	*49.151*	20.345	5.066	*1.225*	*0.556*	*0.235*
30	*0.446*		*0.291*	1.000	4.275	7.260	*52.197*	22.381	4.415	*1.194*	*0.532*	*0.225*
31	*0.440*		*0.298*		4.301		*49.337*	17.050		*1.453*		*0.266*
MEAN	0.545	0.394	0.316	0.466	3.004	12.592	23.986	19.997	14.761	*2.738*	0.724	0.277
MAX	0.665	0.436	0.352	1.000	5.608	20.848	52.197	40.031	29.605	*5.128*	1.393	0.506
MIN	0.440	0.355	0.284	0.306	1.277	5.402	6.417	12.241	4.415	*1.194*	0.275	0.002

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6e. Station SL-H1 Daily Discharge Table

2010 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.362	0.460	0.433	0.644	1.708	10.458	8.374	23.287	10.340	7.728	1.134	*0.588*
2	0.286	0.475	0.442	0.567	1.995	11.141	7.707	25.419	24.452	7.277	1.931	*0.578*
3	0.328	0.486	0.441	0.463	1.851	10.943	7.612	29.349	*53.998*	4.907	1.978	*0.569*
4	0.311	0.474	0.450	0.615	1.687	9.939	8.492	32.924	31.343	3.991	3.819	*0.560*
5	0.289	0.440	0.450	0.665	1.628	10.083	8.508	34.095	16.372	4.213	3.593	*0.551*
6	0.267	0.427	0.456	0.392	1.581	9.445	10.659	30.690	12.295	8.753	2.248	*0.542*
7	0.330	0.432	0.507	0.368	1.702	9.044	16.369	26.378	10.639	10.832	1.709	*0.533*
8	0.393	0.433	0.606	0.379	1.838	9.097	19.247	21.243	10.804	8.642	1.523	*0.525*
9	0.398	0.460	0.535	0.398	1.904	9.913	20.416	18.888	9.664	12.623	1.752	*0.516*
10	0.454	0.461	0.530	0.394	2.060	12.319	21.916	18.408	8.755	16.048	1.911	*0.508*
11	0.428	0.450	0.514	0.380	2.333	12.138	22.424	20.496	7.566	8.594	1.399	*0.500*
12	0.419	0.445	0.525	0.389	2.621	12.369	18.412	20.950	7.458	6.661	1.183	*0.492*
13	0.443	0.432	0.518	0.383	2.746	8.673	16.983	22.601	7.382	5.712	1.099	*0.484*
14	0.456	0.437	0.475	0.361	3.043	7.050	16.107	29.268	6.891	5.325	1.332	*0.476*
15	0.456	0.439	0.455	0.344	3.182	6.216	14.001	32.684	6.198	3.911	1.377	*0.469*
16	0.456	0.431	0.461	0.456	3.225	6.038	13.160	31.529	6.295	3.356	1.092	*0.461*
17	0.460	0.455	0.449	0.518	3.640	7.487	11.788	27.756	6.356	3.947	0.737	*0.454*
18	0.456	0.547	0.444	0.763	4.658	9.484	12.488	28.652	6.335	4.939	*0.725*	*0.446*
19	0.451	0.500	0.446	1.213	6.795	11.075	16.930	18.040	5.744	4.025	*0.713*	*0.439*
20	0.439	0.470	0.444	2.228	7.031	12.098	18.006	14.802	3.997	3.190	*0.702*	*0.432*
21	0.444	0.469	0.456	2.606	6.355	12.146	17.381	12.890	3.412	2.621	*0.691*	*0.425*
22	0.455	0.466	0.447	1.885	5.742	11.993	15.578	11.643	3.236	2.130	*0.680*	*0.418*
23	0.458	0.459	0.445	1.357	5.989	14.299	20.716	11.285	3.251	1.975	*0.669*	*0.412*
24	0.463	0.456	0.441	1.125	6.730	14.649	21.529	16.462	5.698	2.045	*0.658*	*0.405*
25	0.478	0.444	0.441	1.121	7.729	14.270	16.025	14.066	7.803	1.999	*0.647*	*0.399*
26	0.454	0.452	0.436	1.199	8.720	13.301	15.492	11.427	10.911	1.794	*0.637*	*0.392*
27	0.457	0.448	0.443	1.415	10.890	13.577	20.676	10.213	15.180	1.656	*0.627*	*0.386*
28	0.458	0.441	0.445	1.672	11.787	14.008	23.900	10.006	21.077	1.353	*0.617*	*0.380*
29	0.439		0.464	1.805	12.448	12.105	22.771	9.786	10.936	1.159	*0.607*	*0.374*
30	0.438		0.468	1.837	12.191	10.005	20.115	8.438	8.113	1.110	*0.597*	*0.368*
31	0.440		0.475		11.641		20.334	10.624		1.090		*0.362*
MEAN	*0.415*	*0.457*	*0.469*	*0.931*	*5.079*	10.846	16.262	20.461	11.417	*4.955*	*1.280*	0.466
MAX	*0.478*	*0.547*	*0.606*	*2.606*	*12.448*	14.649	23.900	34.095	53.998	*16.048*	*3.819*	0.588
MIN	*0.267*	*0.427*	*0.433*	*0.344*	*1.581*	6.038	7.612	8.438	3.236	*1.090*	*0.597*	0.362

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6e. Station SL-H1 Daily Discharge Table

2011 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*0.300*	*0.351*	*0.405*	*0.475*	*0.554*	*13.240*	18.373	20.803	*19.035*	11.645	2.965	0.402
2	*0.302*	*0.353*	*0.408*	*0.477*	*0.557*	*13.752*	18.305	20.376	*18.244*	10.431	2.670	0.343
3	*0.303*	*0.355*	*0.410*	*0.480*	*0.559*	*14.597*	18.081	19.620	*16.615*	8.935	2.401	0.350
4	*0.305*	*0.357*	*0.412*	*0.482*	*0.562*	*15.542*	17.842	19.179	*17.880*	7.507	1.976	0.358
5	*0.306*	*0.359*	*0.414*	*0.485*	*0.565*	*16.091*	17.303	19.033	*24.014*	6.372	1.337	0.367
6	*0.308*	*0.361*	*0.416*	*0.487*	*0.568*	*15.582*	16.949	18.904	*22.278*	5.969	1.233	0.382
7	*0.309*	*0.362*	*0.418*	*0.490*	*0.571*	*14.574*	16.805	17.893	*51.482*	5.457	1.228	0.525
8	*0.311*	*0.364*	*0.420*	*0.492*	0.574	*13.941*	16.709	17.204	*63.892*	4.978	1.214	0.580
9	*0.313*	*0.366*	*0.422*	*0.495*	0.658	*13.652*	16.476	16.993	*62.773*	4.514	1.139	0.569
10	*0.314*	*0.368*	*0.425*	*0.497*	0.795	*13.563*	16.130	16.706	*62.945*	4.211	1.026	0.501
11	*0.316*	*0.370*	*0.427*	*0.500*	0.808	*14.530*	15.603	16.530	*40.502*	4.040	0.957	0.411
12	*0.317*	*0.372*	*0.429*	*0.503*	0.704	*14.467*	15.226	16.426	*30.583*	3.617	0.908	0.400
13	*0.319*	*0.374*	*0.431*	*0.505*	0.675	*14.000*	15.441	16.679	*24.082*	3.350	0.868	0.338
14	*0.321*	*0.376*	*0.433*	*0.508*	0.628	*13.574*	16.190	16.058	*20.378*	3.408	0.833	0.338
15	*0.322*	*0.378*	*0.436*	*0.510*	0.735	*13.464*	17.660	15.243	*18.598*	3.487	0.798	0.312
16	*0.324*	*0.379*	*0.438*	*0.513*	1.190	*13.669*	18.565	15.266	*17.637*	3.252	0.746	0.273
17	*0.326*	*0.381*	*0.440*	*0.516*	1.937	*14.617*	18.952	15.288	*15.840*	2.930	0.697	0.231
18	*0.327*	*0.383*	*0.442*	*0.518*	2.070	*14.557*	19.437	15.258	*14.258*	2.773	0.660	0.216
19	*0.329*	*0.385*	*0.445*	*0.521*	*2.905*	*14.780*	20.188	15.184	*15.306*	3.808	0.618	0.229
20	*0.331*	*0.387*	*0.447*	*0.523*	*4.077*	*15.491*	20.605	*17.486*	*15.346*	4.942	0.523	0.193
21	*0.332*	*0.389*	*0.449*	*0.526*	*8.031*	13.420	20.740	*32.487*	*28.710*	5.304	0.471	0.200
22	*0.334*	*0.391*	*0.451*	*0.529*	*8.528*	14.710	20.636	*45.217*	*35.487*	5.063	0.421	0.213
23	*0.336*	*0.393*	*0.454*	*0.532*	*9.574*	15.343	20.797	*32.729*	*28.006*	4.371	0.391	0.188
24	*0.337*	*0.395*	*0.456*	*0.534*	*10.349*	15.942	20.861	*28.235*	*25.225*	4.000	0.386	0.176
25	*0.339*	*0.397*	*0.458*	*0.537*	*11.134*	16.710	21.071	*32.108*	36.267	3.627	0.389	0.166
26	*0.341*	*0.399*	*0.461*	*0.540*	*11.562*	16.893	21.600	*25.082*	30.195	3.203	0.404	0.159
27	*0.343*	*0.401*	*0.463*	*0.543*	*10.943*	16.981	21.867	*20.910*	25.029	2.768	0.394	0.147
28	*0.344*	*0.403*	*0.465*	*0.545*	*11.072*	17.117	21.897	*22.968*	18.990	2.470	0.406	0.144
29	*0.346*		*0.468*	*0.548*	*11.706*	17.748	21.853	*31.605*	15.166	3.321	0.397	0.132
30	*0.348*		*0.470*	*0.551*	*12.110*	18.304	21.449	*26.293*	12.357	3.118	0.399	0.129
31	*0.350*		*0.473*		*12.410*		21.156	*21.909*		3.203		0.127
MEAN	*0.324*	*0.377*	*0.438*	*0.512*	*4.487*	*15.028*	18.863	21.473	*27.571*	*4.712*	*0.962*	*0.293*
MAX	*0.350*	*0.403*	*0.473*	*0.551*	*12.410*	*18.304*	21.897	45.217	*63.892*	*11.645*	*2.965*	*0.580*
MIN	*0.300*	*0.351*	*0.405*	*0.475*	*0.554*	*13.240*	15.226	15.184	*12.357*	*2.470*	*0.386*	*0.127*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6f. Station SC-H1 Daily Discharge Table

2008 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*4.318*	*4.318*	*4.318*	*4.318*	*4.683*	39.188	57.903	37.955	26.822	66.007	9.014	7.302
2	*4.318*	*4.318*	*4.318*	*4.318*	*5.078*	36.810	71.185	40.477	27.149	71.568	10.095	5.612
3	*4.318*	*4.318*	*4.318*	*4.318*	*5.506*	35.424	75.482	43.593	23.967	63.829	12.098	5.452
4	*4.318*	*4.318*	*4.318*	*4.318*	*5.970*	35.456	74.088	46.581	22.557	40.215	9.727	5.427
5	*4.318*	*4.318*	*4.318*	*4.318*	*6.474*	34.028	75.501	52.583	23.274	31.607	8.629	5.444
6	*4.318*	*4.318*	*4.318*	*4.318*	*7.020*	32.731	76.531	62.622	23.127	24.742	7.978	5.735
7	*4.318*	*4.318*	*4.318*	*4.318*	*7.612*	30.971	64.761	67.411	24.216	20.476	7.935	5.607
8	*4.318*	*4.318*	*4.318*	*4.318*	*8.254*	26.860	57.322	67.595	33.057	17.647	8.024	5.441
9	*4.318*	*4.318*	*4.318*	*4.318*	*8.950*	23.056	50.993	64.691	28.181	15.290	8.087	5.551
10	*4.318*	*4.318*	*4.318*	*4.318*	*9.705*	23.528	41.571	57.578	28.508	13.360	7.353	5.548
11	*4.318*	*4.318*	*4.318*	*4.318*	10.524	26.536	37.645	52.876	33.689	14.426	7.181	5.417
12	*4.318*	*4.318*	*4.318*	*4.318*	9.323	28.686	39.674	65.813	27.333	14.852	7.648	5.089
13	*4.318*	*4.318*	*4.318*	*4.318*	8.447	24.422	42.068	79.595	23.774	16.666	7.183	*5.043*
14	*4.318*	*4.318*	*4.318*	*4.318*	11.447	22.289	44.781	96.467	25.160	13.120	6.809	*4.997*
15	*4.318*	*4.318*	*4.318*	*4.318*	36.363	23.354	48.802	92.994	50.003	12.564	6.521	*4.952*
16	*4.318*	*4.318*	*4.318*	*4.318*	29.108	25.609	52.482	89.277	59.021	11.618	5.999	*4.907*
17	*4.318*	*4.318*	*4.318*	*4.318*	32.516	26.131	49.933	91.006	56.189	11.522	6.078	*4.862*
18	*4.318*	*4.318*	*4.318*	*4.318*	31.392	25.949	47.417	106.810	52.597	10.761	5.752	*4.818*
19	*4.318*	*4.318*	*4.318*	*4.318*	26.874	27.051	53.542	82.963	48.154	10.342	5.411	*4.774*
20	*4.318*	*4.318*	*4.318*	*4.318*	25.181	30.789	51.979	76.204	45.687	10.758	5.570	*4.731*
21	*4.318*	*4.318*	*4.318*	*4.318*	26.300	39.276	51.292	67.963	31.692	10.263	5.471	*4.688*
22	*4.318*	*4.318*	*4.318*	*4.318*	24.242	40.670	43.268	61.679	24.127	32.304	5.351	*4.645*
23	*4.318*	*4.318*	*4.318*	*4.318*	26.290	33.416	40.943	74.087	19.554	19.005	5.264	*4.603*
24	*4.318*	*4.318*	*4.318*	*4.318*	32.319	34.919	40.440	104.064	16.898	16.938	5.237	*4.561*
25	*4.318*	*4.318*	*4.318*	*4.318*	40.578	32.620	44.725	77.441	14.932	12.616	5.151	*4.520*
26	*4.318*	*4.318*	*4.318*	*4.318*	49.143	28.967	56.579	59.592	13.683	10.744	5.052	*4.479*
27	*4.318*	*4.318*	*4.318*	*4.318*	52.317	31.914	50.876	46.755	14.293	10.145	4.973	*4.438*
28	*4.318*	*4.318*	*4.318*	*4.318*	51.326	50.595	42.488	50.921	22.413	9.691	5.205	*4.398*
29	*4.318*	*4.318*	*4.318*	*4.318*	45.560	46.614	51.310	40.484	83.703	10.187	5.552	*4.358*
30	*4.318*		*4.318*	*4.318*	41.012	46.652	46.084	34.940	70.308	9.445	5.138	*4.318*
31	*4.318*		*4.318*		42.208		41.253	30.244		9.821		*4.279*
MEAN	*4.318*	*4.318*	*4.318*	*4.318*	*23.281*	*32.150*	52.352	*65.267*	*33.136*	*20.727*	*6.850*	*5.032*
MAX	*4.318*	*4.318*	*4.318*	*4.318*	*52.317*	*50.595*	76.531	*106.810*	*83.703*	*71.568*	*12.098*	*7.302*
MIN	*4.318*	*4.318*	*4.318*	*4.318*	*4.683*	*22.289*	37.645	*30.244*	*13.683*	*9.445*	*4.973*	*4.279*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6f. Station SC-H1 Daily Discharge Table

2009 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*6.566*	*5.015*	*3.186*	*2.379*	*11.975*	23.173	24.487	99.373	44.037	11.945	5.583	2.683
2	*6.513*	*4.934*	*3.135*	*2.510*	*12.638*	31.193	28.003	85.349	42.659	10.575	5.163	2.599
3	*6.459*	*4.855*	*3.084*	*2.649*	14.280	40.772	37.959	73.636	44.547	9.460	4.757	2.666
4	*6.407*	*4.777*	*3.035*	*2.796*	11.610	47.681	48.521	76.788	44.616	8.621	4.077	3.035
5	*6.355*	*4.700*	*2.986*	*2.951*	11.338	52.780	55.390	72.222	40.152	10.079	4.858	*2.997*
6	*6.303*	*4.625*	*2.938*	*3.114*	12.640	63.708	62.283	70.671	43.440	19.254	5.459	*2.960*
7	*6.252*	*4.550*	*2.891*	*3.286*	12.612	70.666	62.706	69.845	42.176	15.572	4.851	*2.924*
8	*6.201*	*4.477*	*2.844*	*3.468*	11.875	67.571	64.786	70.808	36.380	13.037	4.378	*2.887*
9	*6.150*	*4.405*	*2.798*	*3.660*	11.669	62.444	73.765	68.697	41.380	11.076	4.042	*2.852*
10	*6.100*	*4.334*	*2.753*	*3.863*	11.739	59.785	79.781	59.950	52.999	9.292	3.947	*2.816*
11	*6.050*	*4.265*	*2.709*	*4.077*	12.019	62.044	80.970	50.836	66.816	7.953	3.718	*2.781*
12	*6.001*	*4.196*	*2.666*	*4.302*	12.864	61.306	84.966	44.357	68.341	7.056	3.506	*2.747*
13	*5.952*	*4.129*	*2.623*	*4.541*	12.670	54.365	85.153	42.351	64.237	5.748	3.619	*2.713*
14	*5.904*	*4.062*	*2.581*	*4.792*	12.195	51.709	82.402	41.763	44.585	5.730	3.307	*2.679*
15	*5.856*	*3.997*	*2.539*	*5.057*	11.626	49.634	76.614	41.060	47.517	5.770	3.418	*2.646*
16	*5.808*	*3.933*	*2.498*	*5.337*	11.895	50.703	70.270	44.471	69.755	7.013	3.208	*2.613*
17	*5.761*	*3.870*	*2.458*	*5.633*	14.516	53.121	72.641	57.963	56.488	7.769	3.216	*2.581*
18	*5.714*	*3.807*	*2.419*	*5.944*	13.073	50.076	72.565	81.808	47.994	6.628	3.055	*2.549*
19	*5.667*	*3.746*	*2.380*	*6.273*	13.486	47.710	69.025	74.063	42.205	6.607	3.145	*2.518*
20	*5.621*	*3.686*	*2.341*	*6.621*	14.424	45.673	65.712	71.315	31.682	5.957	2.965	*2.486*
21	*5.575*	*3.627*	*2.304*	*6.987*	14.865	42.385	65.656	72.466	61.849	6.213	2.975	*2.456*
22	*5.530*	*3.568*	*2.267*	*7.374*	16.480	38.704	64.356	54.750	93.695	7.228	2.988	*2.425*
23	*5.485*	*3.511*	*2.230*	*7.782*	17.533	38.074	71.080	48.629	71.749	8.917	2.893	*2.395*
24	*5.440*	*3.455*	*2.195*	*8.213*	17.330	39.512	89.181	42.242	53.533	6.869	2.701	*2.365*
25	*5.396*	*3.399*	*2.159*	*8.668*	21.089	43.603	84.842	49.977	41.437	6.175	2.806	*2.336*
26	*5.352*	*3.344*	*2.125*	*9.147*	24.353	38.696	83.210	38.401	40.002	6.326	3.058	*2.307*
27	*5.308*	*3.291*	*2.090*	*9.654*	24.998	35.060	86.627	40.807	23.344	5.522	2.796	*2.040*
28	*5.265*	*3.238*	*2.057*	*10.188*	19.532	33.090	99.984	54.220	18.067	4.618	2.699	*1.837*
29	*5.265*		*2.024*	*10.752*	19.818	31.394	*121.242*	64.719	14.796	4.605	2.814	*1.855*
30	*5.180*		*2.136*	*11.347*	18.493	27.326	*128.169*	71.808	12.687	4.995	2.807	*1.872*
31	*5.097*		*2.254*		18.465		117.151	53.684		6.961		*4.022*
MEAN	5.824	4.064	2.539	5.779	14.971	47.132	74.500	60.936	46.772	*8.180*	3.627	2.601
MAX	6.566	5.015	3.186	11.347	24.998	70.666	128.169	99.373	93.695	*19.254*	5.583	4.022
MIN	5.097	3.238	2.024	2.379	11.338	23.173	24.487	38.401	12.687	*4.605*	2.699	1.837

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6f. Station SC-H1 Daily Discharge Table

2010 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3.830	2.695	2.456	3.427	8.221	38.610	30.170	65.936	37.201	29.260	9.467	*9.360*
2	3.827	2.641	2.588	3.180	7.238	34.850	26.293	75.106	38.086	28.608	9.810	*9.086*
3	3.686	2.554	3.078	2.954	7.209	35.036	24.689	79.088	84.742	29.704	16.003	*8.819*
4	3.547	2.556	3.003	3.160	6.580	35.189	25.749	86.542	*132.122*	19.970	13.644	*8.560*
5	3.412	2.557	2.926	2.967	6.223	30.074	30.848	94.041	80.288	17.128	21.755	*8.309*
6	3.279	2.559	2.876	2.847	6.290	28.808	29.911	95.469	51.204	19.760	19.098	*8.065*
7	3.150	2.560	2.623	2.993	6.367	27.771	37.144	92.511	43.566	45.070	14.476	*7.828*
8	3.024	2.602	2.725	2.956	6.738	27.828	52.698	84.933	38.181	38.621	12.565	*7.599*
9	2.881	2.693	2.513	2.846	7.021	29.020	60.527	69.179	37.508	32.887	11.329	*7.376*
10	2.921	2.568	2.412	2.820	6.914	32.002	64.858	61.087	35.394	41.505	10.526	*7.159*
11	2.824	2.466	2.343	2.743	7.103	39.231	66.402	59.334	32.365	54.079	10.045	*6.949*
12	4.139	2.442	2.493	2.605	8.128	39.024	69.437	67.068	27.481	32.255	9.701	*6.745*
13	4.029	2.575	2.477	2.650	8.485	43.101	56.288	65.670	27.366	27.456	9.197	*6.547*
14	4.053	2.462	2.551	2.834	8.114	31.599	51.337	70.371	26.862	24.137	10.030	*6.355*
15	3.505	2.768	2.484	2.822	8.970	23.735	49.853	84.717	25.561	22.806	12.716	*6.169*
16	3.586	2.477	2.585	3.329	9.730	19.889	45.240	94.019	23.749	19.052	11.632	*5.987*
17	3.222	2.694	2.405	4.231	9.697	18.865	41.454	93.792	24.379	18.055	9.857	*5.812*
18	3.189	2.590	2.710	5.145	11.197	23.072	38.704	85.419	24.750	21.199	8.673	*5.641*
19	3.087	2.425	2.463	5.822	13.827	29.646	42.142	89.789	24.597	26.257	10.429	*5.476*
20	3.028	2.458	2.342	7.752	21.125	36.040	54.598	60.591	21.879	20.395	12.899	*5.315*
21	3.040	2.490	2.342	11.465	21.178	39.741	57.513	48.539	17.005	16.793	12.821	*5.159*
22	3.071	2.560	2.434	10.116	18.590	39.929	58.201	41.942	15.530	14.597	12.238	*5.008*
23	3.133	2.633	2.522	7.422	16.682	38.415	53.748	38.444	14.500	13.177	*11.879*	*4.861*
24	3.060	2.592	2.643	6.283	17.718	44.500	72.665	39.715	13.638	12.347	*11.530*	*4.718*
25	2.785	2.560	2.845	5.835	18.713	48.533	70.917	63.259	19.613	11.999	*11.192*	*4.579*
26	2.822	2.713	3.186	6.028	22.300	48.436	54.199	49.564	28.026	11.518	*10.864*	*4.445*
27	2.865	2.528	3.376	6.333	26.204	47.239	52.275	39.650	40.901	10.969	*10.545*	*4.315*
28	2.701	2.555	3.396	7.352	34.183	46.008	65.034	36.532	53.010	10.511	*10.235*	*4.188*
29	2.729		3.991	8.164	38.246	43.392	74.882	35.509	75.133	9.708	*9.935*	*4.065*
30	2.724		3.865	8.435	39.142	36.922	72.525	33.952	37.735	9.753	*9.643*	*3.946*
31	2.686		3.827		39.993		64.600	29.063		10.345		*3.830*
MEAN	*3.220*	*2.571*	*2.790*	*4.917*	*15.101*	35.217	51.448	65.511	38.412	*22.578*	*11.825*	*6.202*
MAX	*4.139*	*2.768*	*3.991*	*11.465*	*39.993*	48.533	74.882	95.469	132.122	*54.079*	*21.755*	*9.360*
MIN	*2.686*	*2.425*	*2.342*	*2.605*	*6.223*	18.865	24.689	29.063	13.638	*9.708*	*8.673*	*3.830*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6f. Station SC-H1 Daily Discharge Table

2011 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3.515	3.147	2.831	3.122	5.587	48.163	52.109	47.399	41.709	*42.159*	*13.178*	*4.401*
2	3.503	3.135	2.819	2.989	5.098	53.730	45.934	43.602	44.149	*40.607*	*12.693*	*4.362*
3	3.491	3.124	2.808	2.954	4.691	54.176	42.941	43.005	36.972	*39.112*	*12.225*	*4.323*
4	3.479	3.112	2.798	2.941	5.267	49.607	40.084	49.070	45.658	*37.672*	*11.775*	*4.285*
5	3.467	3.101	2.787	2.839	5.934	45.387	38.072	50.652	77.105	*36.285*	*11.342*	*4.247*
6	3.455	3.089	2.776	2.719	5.901	41.237	39.618	49.727	59.332	*34.949*	*10.924*	*4.210*
7	3.443	3.078	2.765	2.665	7.121	39.500	40.140	44.197	98.214	*33.662*	*10.522*	*4.173*
8	3.431	3.066	2.754	2.670	8.489	38.753	36.069	46.133	103.594	*32.423*	*10.135*	*4.136*
9	3.418	3.055	2.743	2.723	9.764	44.731	33.936	46.059	87.414	*31.229*	*9.761*	*4.099*
10	3.406	3.044	2.732	2.770	10.898	44.862	34.034	45.502	64.226	*30.079*	*9.402*	*4.063*
11	3.394	3.032	2.721	2.693	10.452	40.890	38.506	46.381	*67.718*	*28.972*	*9.056*	*4.027*
12	3.382	3.021	2.710	2.659	9.491	38.084	45.601	52.569	*70.623*	*27.905*	*8.722*	*3.992*
13	3.371	3.009	2.696	2.612	9.232	37.228	57.082	42.956	*69.770*	*26.878*	*8.401*	*3.956*
14	3.359	2.998	2.569	2.632	8.825	38.416	69.443	37.732	*71.144*	*25.888*	*8.092*	*3.921*
15	3.347	2.987	2.279	2.695	10.280	43.347	68.409	36.927	*67.579*	*24.935*	*7.794*	*3.887*
16	3.335	2.976	2.264	2.744	13.521	42.875	58.139	35.695	*62.835*	*24.017*	*7.507*	*3.852*
17	3.323	2.964	2.232	2.798	18.836	43.263	57.579	45.486	*59.598*	*23.133*	*7.231*	*3.818*
18	3.311	2.953	2.228	2.845	16.163	46.067	62.560	45.656	*58.988*	*22.281*	*6.964*	*3.785*
19	3.299	2.942	2.203	2.772	15.813	44.180	66.636	38.880	*57.838*	*21.461*	*6.708*	*3.751*
20	3.287	2.931	2.201	2.780	18.751	42.776	58.850	39.872	*56.154*	*20.670*	*6.461*	*3.718*
21	3.276	2.919	2.226	2.808	24.927	48.025	55.727	88.632	*54.361*	*19.909*	*6.223*	*3.685*
22	3.264	2.908	2.257	2.804	29.193	46.502	53.399	127.123	*52.151*	*19.176*	*5.994*	*3.653*
23	3.252	2.897	2.238	2.841	30.677	50.168	60.868	96.928	*50.118*	*18.470*	*5.773*	*3.620*
24	3.240	2.886	2.247	2.979	33.234	51.049	61.326	78.939	*48.443*	*17.790*	*5.561*	*3.588*
25	3.229	2.875	2.283	3.242	29.682	51.747	66.005	76.930	*46.974*	*17.135*	*5.356*	*3.557*
26	3.217	2.864	2.400	3.762	32.091	51.335	63.514	52.360	*45.392*	*16.504*	*5.159*	*3.525*
27	3.205	2.853	2.559	4.392	36.249	56.155	58.964	48.280	*43.753*	*15.897*	*4.969*	*3.494*
28	3.193	2.842	2.788	4.759	35.202	61.744	58.878	44.007	*42.119*	*15.311*	*4.786*	*3.463*
29	3.182		2.898	5.355	38.528	63.073	62.596	59.352	*40.507*	*14.748*	*4.610*	*3.433*
30	3.170		2.888	5.637	42.691	58.736	54.071	60.800	*43.771*	*14.205*	*4.440*	*3.402*
31	3.159		3.130		44.492		51.930	45.916		*13.682*		*3.372*
MEAN	*3.336*	*2.993*	*2.575*	*3.140*	*18.615*	*47.194*	52.678	53.767	*58.940*	*25.392*	*8.059*	*3.864*
MAX	*3.515*	*3.147*	*3.130*	*5.637*	*44.492*	*63.073*	69.443	127.123	*103.594*	*42.159*	*13.178*	*4.401*
MIN	*3.159*	*2.842*	*2.201*	*2.612*	*4.691*	*37.228*	33.936	35.695	*36.972*	*13.682*	*4.440*	*3.372*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6g. Station UR-H1 Daily Discharge Table

2008 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*5.000*	*6.800*	*9.068*	*12.333*	*16.608*	66.285	68.208	36.757	19.450	42.725	13.445	11.220
2	*5.050*	*6.868*	*9.158*	*12.456*	*16.774*	65.124	76.124	38.480	20.233	41.675	16.774	8.472
3	*5.100*	*6.937*	*9.249*	*12.580*	*16.941*	58.702	78.985	40.979	17.657	43.481	20.523	7.651
4	*5.151*	*7.006*	*9.341*	*12.705*	*17.110*	60.415	79.738	42.484	17.065	32.275	17.588	7.729
5	*5.202*	*7.076*	*9.435*	*12.832*	*17.280*	55.575	83.675	44.484	16.115	28.892	15.054	7.436
6	*5.254*	*7.146*	*9.529*	*12.960*	*17.453*	52.054	83.482	47.456	15.084	24.594	13.748	7.583
7	*5.307*	*7.218*	*9.624*	*13.089*	*17.627*	54.068	69.096	50.185	15.044	21.215	13.727	7.354
8	*5.360*	*7.290*	*9.720*	*13.220*	*17.802*	48.590	60.844	51.041	25.177	18.952	13.557	6.964
9	*5.413*	*7.362*	*9.817*	*13.351*	*17.980*	41.180	59.275	48.702	19.029	17.000	14.170	7.193
10	*5.467*	*7.436*	*9.914*	*13.485*	*18.159*	42.010	51.593	47.583	20.316	14.759	12.200	8.521
11	*5.521*	*7.510*	*10.013*	*13.619*	*18.340*	46.344	48.692	43.972	25.509	16.272	11.785	8.185
12	*5.577*	*7.585*	*10.113*	*13.755*	18.523	50.628	49.667	47.688	20.692	17.888	13.278	7.390
13	*5.632*	*7.660*	*10.214*	*13.892*	13.656	46.454	51.612	54.460	16.909	21.696	12.864	*7.239*
14	*5.688*	*7.737*	*10.316*	*14.030*	18.636	47.069	54.427	68.148	16.610	17.618	11.628	*7.092*
15	*5.745*	*7.814*	*10.419*	*14.170*	61.004	49.085	55.265	63.911	35.970	17.247	11.473	*6.948*
16	*5.802*	*7.892*	*10.523*	*14.312*	49.127	49.071	57.248	59.672	34.914	16.059	10.369	*6.806*
17	*5.860*	*7.970*	*10.627*	*14.454*	51.673	47.412	55.771	57.809	34.650	17.211	9.945	*6.668*
18	*5.919*	*8.050*	*10.733*	*14.598*	54.023	50.066	53.730	79.129	34.027	16.000	9.455	*6.532*
19	*5.978*	*8.130*	*10.840*	*14.744*	47.462	50.014	57.423	58.418	32.176	16.031	8.499	*6.399*
20	*6.037*	*8.211*	*10.949*	*14.891*	42.721	49.835	60.318	49.796	30.590	19.400	8.370	*6.269*
21	*6.097*	*8.293*	*11.058*	*15.039*	49.273	59.188	59.618	45.818	21.113	17.227	8.110	*6.141*
22	*6.158*	*8.376*	*11.168*	*15.189*	45.830	60.710	52.135	40.349	14.736	40.027	7.995	*6.016*
23	*6.220*	*8.459*	*11.279*	*15.341*	50.390	51.670	45.999	46.005	11.905	34.887	7.787	*5.894*
24	*6.282*	*8.544*	*11.392*	*15.494*	59.542	51.228	44.220	70.094	9.916	31.704	7.913	*5.774*
25	*6.344*	*8.629*	*11.505*	*15.648*	70.057	51.303	45.254	53.404	8.417	24.378	7.876	*5.656*
26	*6.407*	*8.715*	*11.620*	*15.804*	80.416	46.886	53.121	42.951	7.543	19.292	7.640	*5.541*
27	*6.471*	*8.802*	*11.736*	*15.962*	82.076	48.254	50.693	35.257	7.496	18.563	7.376	*5.429*
28	*6.536*	*8.889*	*11.853*	*16.121*	79.421	77.214	41.919	48.370	17.693	17.712	8.082	*5.318*
29	*6.601*	*8.978*	*11.971*	*16.282*	73.683	66.362	43.994	36.718	95.708	19.008	11.122	*5.210*
30	*6.667*		*12.090*	*16.444*	72.062	58.769	44.010	30.329	56.723	15.601	10.614	*5.104*
31	*6.733*		*12.211*		70.116		39.757	23.849		13.828		*5.000*
MEAN	*5.825*	*7.841*	*10.564*	*14.293*	*41.347*	*53.386*	57.287	*48.526*	*23.949*	*23.007*	*11.432*	*6.798*
MAX	*6.733*	*8.978*	*12.211*	*16.444*	*82.076*	*77.214*	83.675	*79.129*	*95.708*	*43.481*	*20.523*	*11.220*
MIN	*5.000*	*6.800*	*9.068*	*12.333*	*13.656*	*41.180*	39.757	*23.849*	*7.496*	*13.828*	*7.376*	*5.000*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6g. Station UR-H1 Daily Discharge Table

2009 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*5.324*	*3.727*	*2.701*	*2.371*	16.195	64.173	45.360	73.798	29.529	22.185	17.082	5.602
2	*5.264*	*3.684*	*2.670*	*2.528*	24.044	90.552	50.228	62.662	28.591	20.056	15.487	*5.590*
3	*5.203*	*3.642*	*2.639*	*2.695*	35.165	114.413	62.479	53.218	29.538	17.255	14.503	*5.577*
4	*5.144*	*3.601*	*2.609*	*2.874*	27.523	*134.036*	70.906	51.608	28.994	15.273	13.253	*5.564*
5	*5.085*	*3.559*	*2.579*	*3.064*	24.822	*146.928*	74.979	48.778	25.561	15.709	13.897	*5.551*
6	*5.027*	*3.519*	*2.550*	*3.266*	29.183	*164.655*	82.759	45.462	28.018	36.493	15.178	*5.539*
7	*4.969*	*3.478*	*2.520*	*3.482*	32.632	*169.981*	75.862	46.927	30.860	22.534	13.779	*5.526*
8	*4.912*	*3.439*	*2.492*	*3.713*	30.415	*165.560*	72.054	47.643	28.157	18.715	12.647	*5.513*
9	*4.856*	*3.399*	*2.463*	*3.958*	29.374	*135.126*	78.625	45.759	29.050	16.090	11.479	*5.501*
10	*4.801*	*3.360*	*2.435*	*4.220*	28.459	*128.068*	89.013	40.403	38.121	14.095	10.749	*5.488*
11	*4.746*	*3.322*	*2.407*	*4.499*	28.545	*129.885*	81.881	36.070	50.418	12.651	10.357	*5.475*
12	*4.691*	*3.284*	*2.380*	*4.797*	30.467	*123.988*	80.285	31.641	45.260	11.209	10.085	*5.463*
13	*4.638*	*3.246*	*2.352*	*5.114*	29.985	102.804	77.240	30.533	47.344	9.242	9.548	*5.450*
14	*4.585*	*3.209*	*2.325*	*5.452*	29.982	89.190	73.680	30.463	33.833	8.763	9.265	*5.438*
15	*4.532*	*3.173*	*2.299*	*5.813*	28.554	80.394	68.374	32.341	32.743	8.974	9.799	*5.426*
16	*4.480*	*3.136*	*2.273*	*6.197*	28.779	78.944	62.614	36.220	42.740	9.693	8.461	*5.413*
17	*4.429*	*3.100*	*2.247*	*6.607*	35.523	88.148	61.525	43.560	38.809	11.795	7.916	*5.401*
18	*4.379*	*3.065*	*2.221*	*7.044*	33.669	86.013	61.081	49.578	35.102	9.942	7.385	*5.388*
19	*4.328*	*3.030*	*2.195*	*7.510*	31.647	76.858	60.480	44.143	39.743	11.056	6.997	*5.376*
20	*4.279*	*2.995*	*2.170*	*8.006*	34.200	68.122	57.949	41.305	30.220	10.694	6.671	*5.364*
21	*4.230*	*2.961*	*2.145*	*8.536*	37.705	66.878	55.703	42.018	80.748	10.494	6.551	*5.351*
22	*4.182*	*2.927*	*2.121*	*9.100*	39.450	62.298	53.068	34.024	*200.085*	14.071	6.274	*5.339*
23	*4.134*	*2.894*	*2.097*	*9.702*	46.727	61.854	55.228	31.281	95.107	21.146	6.079	*5.327*
24	*4.086*	*2.861*	*2.073*	*10.344*	45.031	65.396	68.857	27.858	84.339	17.396	6.025	*5.315*
25	*4.040*	*2.828*	*2.049*	*11.028*	57.544	68.995	62.990	34.118	69.650	17.392	6.245	*5.303*
26	*3.994*	*2.795*	*2.026*	*11.757*	72.116	64.563	58.453	30.333	86.678	17.506	6.582	*5.291*
27	*3.948*	*2.763*	*2.002*	*12.535*	66.607	56.144	59.126	26.895	49.800	14.569	6.282	*5.278*
28	*3.903*	*2.732*	*1.979*	*13.364*	54.157	52.523	65.229	35.018	34.820	12.706	6.056	*5.266*
29	*3.858*		*1.957*	*14.248*	53.858	52.030	73.944	39.855	26.648	12.557	6.081	*5.254*
30	*3.814*		*2.086*	*15.190*	52.162	48.452	79.471	45.257	21.909	17.030	5.873	*5.242*
31	*3.770*		*2.224*		49.960		77.957	35.641		23.442		*5.230*
MEAN	4.504	3.205	2.300	6.967	37.564	94.566	67.658	41.110	48.081	*15.507*	9.553	5.414
MAX	5.324	3.727	2.701	15.190	72.116	169.981	89.013	73.798	200.085	*36.493*	17.082	5.602
MIN	3.770	2.732	1.957	2.371	16.195	48.452	45.360	26.895	21.909	*8.763*	5.873	5.230

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6g. Station UR-H1 Daily Discharge Table

2010 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*5.218*	*5.572*	*6.329*	*7.571*	8.230	64.478	25.480	54.101	19.601	41.071	4.588	*7.160*
2	*5.206*	*5.598*	*6.358*	*7.654*	7.982	59.952	23.385	54.817	115.898	41.171	16.651	*7.083*
3	*5.194*	*5.623*	*6.387*	*7.738*	5.132	59.544	24.281	55.242	*180.400*	28.775	11.640	*7.007*
4	*5.182*	*5.649*	*6.416*	*7.823*	3.125	47.850	35.045	56.106	74.955	25.321	28.062	*6.932*
5	*5.170*	*5.675*	*6.445*	*7.908*	3.439	42.903	35.203	59.913	55.643	28.847	33.828	*6.858*
6	*5.159*	*5.701*	*6.475*	*7.995*	4.642	43.831	40.186	62.485	42.926	105.980	*30.558*	*6.784*
7	*5.147*	*5.727*	*6.504*	*8.083*	5.871	43.860	53.772	59.763	38.125	59.105	*27.603*	*6.712*
8	*5.135*	*5.753*	*6.534*	*8.172*	7.098	49.248	55.193	50.327	35.444	57.203	*24.935*	*6.640*
9	*5.123*	*5.779*	*6.564*	*8.261*	7.280	54.825	59.765	41.106	35.042	60.731	*22.524*	*6.569*
10	*5.111*	*5.805*	*6.593*	*8.352*	7.743	60.192	58.927	35.378	32.736	94.009	*20.346*	*6.498*
11	*5.100*	*5.832*	*6.623*	*8.443*	10.141	60.435	65.624	43.574	27.595	60.046	*18.379*	*6.429*
12	*5.088*	*5.858*	*6.654*	*8.536*	12.310	73.205	51.533	40.681	26.274	45.149	*16.602*	*6.360*
13	*5.111*	*5.885*	*6.684*	*8.630*	10.850	52.848	42.958	40.153	25.277	35.759	*14.997*	*6.292*
14	*5.134*	*5.912*	*6.714*	*8.724*	13.025	40.557	44.660	48.449	23.663	32.790	*13.547*	*6.224*
15	*5.158*	*5.939*	*6.745*	*8.820*	16.960	34.571	40.950	54.574	21.992	25.356	*12.237*	*6.158*
16	*5.181*	*5.966*	*6.776*	*8.917*	18.330	29.989	34.714	60.336	21.475	21.375	*11.054*	*6.092*
17	*5.205*	*5.993*	*6.807*	*9.015*	23.163	32.415	29.275	55.547	20.946	28.864	*9.985*	*6.026*
18	*5.229*	*6.020*	*6.838*	*9.114*	32.960	41.566	28.106	61.845	20.678	51.330	*9.020*	*5.962*
19	*5.253*	*6.048*	*6.869*	*9.213*	57.081	47.682	37.743	37.595	19.269	30.590	*8.148*	*5.898*
20	*5.276*	*6.075*	*6.900*	*9.315*	50.444	51.330	41.133	23.346	15.265	18.825	*8.061*	*5.835*
21	*5.301*	*6.103*	*6.932*	*9.417*	40.373	53.651	46.972	17.787	13.175	14.360	*7.974*	*5.772*
22	*5.325*	*6.131*	*6.963*	*9.520*	29.016	51.802	44.361	16.383	12.461	10.738	*7.889*	*5.710*
23	*5.349*	*6.159*	*6.995*	*9.624*	40.242	50.482	66.993	19.149	11.586	8.742	*7.804*	*5.649*
24	*5.373*	*6.187*	*7.027*	*9.730*	40.435	54.866	67.404	44.715	16.660	7.460	*7.721*	*5.589*
25	*5.398*	*6.215*	*7.059*	*9.837*	47.163	60.808	44.330	31.198	22.074	6.391	*7.638*	*5.529*
26	*5.422*	*6.243*	*7.091*	*9.945*	53.407	51.732	37.986	21.247	55.027	5.561	*7.556*	*5.469*
27	*5.447*	*6.272*	*7.169*	10.054	73.552	47.321	42.969	18.403	91.934	5.297	*7.475*	*5.411*
28	*5.472*	*6.300*	*7.247*	10.164	72.881	44.504	51.222	16.505	102.712	4.215	*7.395*	*5.353*
29	*5.497*		*7.327*	13.551	68.671	37.740	52.238	14.450	58.300	4.413	*7.316*	*5.296*
30	*5.522*		*7.407*	13.726	68.425	30.480	46.435	11.640	49.953	6.038	*7.237*	*5.239*
31	*5.547*		*7.489*		69.498		42.851	17.794		4.505		*5.183*
MEAN	*5.259*	*5.929*	*6.804*	*9.128*	*29.338*	49.156	44.248	39.504	42.903	*31.291*	*13.959*	*6.120*
MAX	*5.547*	*6.300*	*7.489*	*13.726*	*73.552*	73.205	67.404	62.485	180.400	*105.980*	*33.828*	*7.160*
MIN	*5.088*	*5.572*	*6.329*	*7.571*	*3.125*	29.989	23.385	11.640	11.586	*4.215*	*4.588*	*5.183*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.

Appendix 6g. Station UR-H1 Daily Discharge Table

2011 Q	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	*5.127*	*3.671*	*3.805*	*4.213*	8.170	51.474	65.807	55.000	42.639	*17.191*	*11.653*	*9.221*
2	*5.072*	*3.632*	*3.818*	*4.227*	7.441	49.546	62.944	63.086	33.961	*12.999*	*53.439*	*9.083*
3	*5.018*	*3.593*	*3.830*	*4.241*	6.837	55.763	59.906	55.907	31.365	*12.647*	*39.883*	*8.946*
4	*4.964*	*3.555*	*3.843*	*4.255*	7.639	80.580	57.763	51.680	*150.742*	*14.580*	*25.946*	*8.812*
5	*4.911*	*3.517*	*3.855*	*4.269*	9.701	98.013	64.759	42.311	*183.704*	*34.681*	*20.713*	*8.680*
6	*4.858*	*3.528*	*3.868*	*4.283*	9.851	97.763	59.561	51.027	*116.879*	*54.558*	*19.498*	*8.549*
7	*4.806*	*3.540*	*3.881*	*4.297*	11.749	108.700	59.448	49.109	*87.770*	*46.616*	*19.369*	*8.421*
8	*4.755*	*3.551*	*3.894*	*4.311*	14.608	94.501	58.010	53.147	*103.266*	*58.491*	*17.842*	*8.294*
9	*4.704*	*3.563*	*3.906*	*4.325*	18.482	100.553	72.694	52.840	*63.447*	*52.149*	*16.448*	*8.170*
10	*4.653*	*3.575*	*3.919*	*4.339*	23.744	112.474	71.948	47.552	*49.530*	*35.378*	*17.257*	*8.047*
11	*4.603*	*3.587*	*3.932*	*4.354*	5.538	103.227	74.771	47.206	*44.754*	*27.270*	*16.764*	*7.926*
12	*4.554*	*3.598*	*3.945*	*4.368*	6.409	108.538	79.798	55.170	*64.620*	*24.768*	*16.245*	*7.807*
13	*4.505*	*3.610*	*3.958*	*4.382*	6.794	118.687	88.928	49.610	*68.208*	*23.063*	*17.915*	*7.690*
14	*4.457*	*3.622*	*3.971*	*4.397*	7.553	117.770	81.972	43.126	*53.179*	*20.057*	*19.638*	*7.574*
15	*4.409*	*3.634*	*3.984*	*4.411*	8.170	*138.120*	62.908	37.429	*42.115*	*23.255*	*18.928*	*7.461*
16	*4.362*	*3.646*	*3.997*	*4.426*	7.441	*157.518*	50.383	33.720	*50.092*	*19.689*	*17.617*	*7.349*
17	*4.315*	*3.658*	*4.010*	*4.440*	6.837	*140.557*	46.366	31.071	*39.972*	*17.013*	*17.147*	*7.238*
18	*4.269*	*3.670*	*4.024*	*4.455*	7.639	111.024	46.070	34.526	*51.017*	*15.179*	*14.698*	*7.130*
19	*4.223*	*3.682*	*4.037*	*4.470*	9.701	91.066	42.197	38.725	*111.025*	*14.363*	*13.192*	*7.022*
20	*4.178*	*3.694*	*4.050*	*4.484*	9.851	82.501	43.677	42.404	*72.830*	*13.400*	*12.880*	*6.917*
21	*4.133*	*3.706*	*4.063*	*4.499*	11.749	77.174	44.731	32.598	*290.613*	*13.121*	*12.077*	*6.813*
22	*4.089*	*3.719*	*4.077*	*4.514*	14.608	71.874	38.541	28.463	*220.219*	*12.775*	*11.590*	*6.711*
23	*4.045*	*3.731*	*4.090*	*4.529*	18.482	87.603	36.942	28.306	*255.370*	*12.129*	*10.886*	*6.610*
24	*4.002*	*3.743*	*4.104*	*4.544*	23.744	85.006	37.603	27.957	*179.634*	*13.806*	*10.347*	*6.511*
25	*3.959*	*3.755*	*4.117*	*4.558*	24.361	71.187	37.558	28.787	*62.315*	*12.963*	*10.098*	*6.413*
26	*3.917*	*3.768*	*4.131*	4.573	19.280	62.665	41.875	35.666	*32.102*	*11.714*	*9.946*	*6.317*
27	*3.875*	*3.780*	*4.144*	5.538	18.328	59.395	55.512	27.184	*23.327*	*13.220*	*9.797*	*6.222*
28	*3.833*	*3.793*	*4.158*	6.409	16.241	55.040	67.871	20.555	*23.068*	*13.341*	*9.650*	*6.128*
29	*3.792*		*4.172*	6.794	19.650	67.263	74.342	21.293	*21.041*	*12.348*	*9.505*	*6.036*
30	*3.751*		*4.185*	7.553	31.455	70.132	61.281	22.599	*21.693*	*11.151*	*9.362*	*5.946*
31	*3.711*		*4.199*		51.406		54.762	39.962		*10.546*		*5.856*
MEAN	*4.382*	*3.647*	*3.999*	*4.682*	*14.305*	*90.857*	58.094	40.259	*86.350*	*21.757*	*17.011*	*7.416*
MAX	*5.127*	*3.793*	*4.199*	*7.553*	*51.406*	*157.518*	88.928	63.086	*290.613*	*58.491*	*53.439*	*9.221*
MIN	*3.711*	*3.517*	*3.805*	*4.213*	*5.538*	*49.546*	36.942	20.555	*21.041*	*10.546*	*9.362*	*5.856*

Note: Estimated and ice-affected values are italicized

Values in red denote high uncertainty based on extrapolation of the rating curve beyond 2 times the greatest measured discharge.