APPENDIX 7A

HYDROLOGY BASELINE REPORT

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

BASELINE HYDROLOGY REPORT

PREPARED FOR

Baffinland Iron Mines Corporation
1016 – 120 Adelaide Street West
Toronto, Ont M5H 1T1

PREPARED BY

Knight Piésold Ltd.
Suite 1400 – 750 West Pender Street
Vancouver, BC V6C 2T8

Knight Piésold
CONSULTING

VA102-181/11-8
Revision 0
January 30, 2009

ISO 9001:2000
FS 64925

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

BASELINE HYDROLOGY REPORT
(REF. NO. NB102-181/11-8)

Rev	Description	Date	Approved
0	Issued in Final	January 30, 2009	KJB

Knight Piésold Ltd.

Suite 1400
750 West Pender Street
Vancouver, British Columbia
Canada V6C 2T8

Telephone: 604.685.0543
Facsimile: 604.685.0147
E-mail: kpl@knightpiesold.com

Knight Piésold
CONSULTING

Knight Piésold
CONSULTING

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

BASELINE HYDROLOGY REPORT
(REF. NO. NB102-181/11-8)

EXECUTIVE SUMMARY

This report presents a summary of the hydrologic data collected at 18 streamflow gauging stations as a part of baseline studies for Baffinland Iron Mines Corporation's Mary River Project. These data, in addition to regional data, provide the basis for hydrologic assessment for engineering design and environmental assessment of the project. During the summer of 2006, 13 streamflow gauging stations were installed, four by Water Survey of Canada (WSC) and nine by Knight Piésold Ltd. (KPL). Seven of the KPL stations were installed within drainages immediately surrounding the proposed mine site. The other two KPL streamflow stations installed in 2006 were located to the north and south of the proposed mine site and provide information on spatial variability. The streamflow gauging stations installed by WSC are located south of the Project on large river systems. The WSC stations were installed within lakes, giving them the ability to collect data year-round, which gauges installed within streams and rivers cannot do as they freeze solid during the winter. During June 2008, a further five streamflow gauging stations were installed by KPL. These stations were all installed at various points along the proposed southern railway alignment, which would connect the Mary River Mine Site to the planned Steensby Port Site to the south. The purpose of all 18 hydrologic stations is to collect baseline hydrologic information within the Mary River Project area, which can then be utilized in the design, construction, reclamation and ongoing monitoring of the Project. The key findings presented in this report are based on data collected between July 2006 and September 2008 at the original nine KPL stations (H1-H9), between June 2007 and October 2008 at the four WSC stations, and between June and September 2008 at the five new KPL stations.

The key findings within this report pertain to four main categories: hydrograph shape, runoff, variations within both the hydrograph and runoff, and long-term streamflow estimates. Hydrograph shapes for systems near Mary River were first estimated by analyzing hydrographs from regional hydrologic stations operated by WSC, and were then validated by actual onsite measurements and observations. The characteristics of hydrographs in the vicinity of Mary River are as follows:

- Streamflow starts in early to mid June as temperatures climb above 0 ^{o}C, and ends in late September to late October, depending upon watershed characteristics.
- The annual hydrograph is dominated by a nival freshet which occurs between late June and the end of July, followed by a period of low baseflows driven by permafrost melt and shallow subsurface flow and punctuated by precipitation events through July to early September.
- Intense precipitation events during July, August and September punctuate the baseflows. In catchments without significant lakes, these events produce large, intense runoff events. At several of the gauging stations, these events produced the largest instantaneous flows on record. Runoff increases very rapidly, as little of the precipitation is slowed down or lost to infiltration, evaporation or transpiration as it makes its way into the channels due to shallow permafrost, cool temperatures and

lack of vegetative cover. In catchments with significant lakes, these events were attenuated, producing lower peaks and longer duration flow events.

As with the hydrograph shape, streamflow values were first estimated from regional analysis and then validated by onsite measurements. Initial estimates suggested that mean annual unit runoff (MAUR) in the vicinity of Mary River should be less than 10 l/s/km^2. They also suggested that mean annual peak daily unit runoff values likely range from less than 100 l/s/km^2 for watersheds with significant lake volumes, to approximately 400 l/s/km^2 for smaller watersheds without lakes. The actual measured results validate these estimates and are as follows:

- Watersheds H1-H9 operated by KPL had an average MAUR of 9 l/s/km^2 for the years of 2007 and 2008. The lowest measured annual mean unit runoff was recorded at H9 in 2007 at 3.3 l/s/km^2. The highest annual mean unit runoff of 19.0 l/s/km^2 was recorded in 2008 within the Isortoq River watershed, which contains significant glacial cover. The highest annual mean unit runoff measured in a non-glaciated catchment was 18.0 l/s/km^2 in the BR11 watershed during 2008.
- The maximum annual peak daily unit runoff varied greatly among the sites, and resulted from snowmelt events, precipitation events, as well as combinations of both. The lowest was recorded at 65 l/s/km^2 within the extensively lake covered BR137 catchment during 2008. The highest annual peak daily unit runoff was also recorded in 2008 within the BR11 watershed, which registered a unit runoff of 306 l/s/km^2.

As noted above, significant variation was recorded within both the annual hydrograph shape and the volume and intensity of unit runoff. Numerous factors can be attributed to this variation, but the primary factors are listed below:

- The proportion of lakes within a watershed has profound effects on both the hydrograph shape and unit runoff. Lakes attenuate rapid runoff events as well diurnal fluctuations in runoff, resulting in much lower intensity and longer lasting storm event runoff and an overall smoother hydrograph. Lakes also act to evaporate larger volumes of water than does the surrounding land, therefore lowering the mean annual unit runoff in catchments with large lake components. Furthermore, because the lakes are still free of ice when precipitation begins to fall as snow and permafrost melt ends, rivers fed by lakes freeze up approximately a month later than systems that don't include lakes.
- The presence of uplands, and especially lowland to upland transitions, within a watershed may also act to increase the MAUR of the system. This is achieved through increases in precipitation which result from orographic uplift of moisture laden air caused by the rise in ground elevation.
- In smaller watersheds, windblown snow deposition may act to increase and/or decrease the mean annual unit runoff depending on whether a net gain or net loss of snow is occurring within the watershed.

Finally, an attempt was made to develop long-term synthetic streamflow series for the hydrologic stations at Mary River. This would allow for the assessment of long-term hydrologic variability within the Project Area and the calculation of return period flood flows, drought low flow values, long term means, etc. However, the analysis was inhibited by a paucity of long-term regional data, which resulted in the failure to produce long-term synthetic streamflow series for the Mary River hydrologic stations. The analysis did, eventually, make use of regional streamflow and precipitation data to estimate long-term mean annual unit runoffs and a coefficient of variation for the sites, allowing for return period MADs to be calculated. Results are summarized as follows:

- The long-term mean annual unit runoffs ranged from 5 l/s/km^2 at H9 to 12 l/s/km^2 at H3. The average mean annual unit runoff for all stations was 9 l/s/km^2.
- The 10-year wet return period annual unit runoff ranged from 7 l/s/km^2 to 16 l/s/km^2. The 10-year dry return period annual unit runoff ranged from 4 l/s/km^2 to 9 l/s/km^2. Twenty, fifty and one-hundred year return period flows were also calculated.

The hydrologic data collected at the 18 stations are of good quality, as are the rating curves developed for the stations installed in 2006. However, the rating curves developed for the five stations installed during 2008 are only of moderate quality, as they lack the number of points required to be more robust. Two-and-a-half years of data are also insufficient to properly assess long term hydrologic means, variability and trends. It is therefore suggested that the collection of water level data be continued at all sites in an effort to better quantify hydrologic variability in the area. Furthermore, discharge measurements should continue to be collected at the new stations in order to strengthen their rating curves.

Knight Piésold
CONSULTING

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

BASELINE HYDROLOGY REPORT
(REF. NO. NB102-181/11-8)

TABLE OF CONTENTS

PAGE

TABLES

FIGURES

APPENDICES

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

BASELINE HYDROLOGY REPORT
(REF. NO. NB102-181/11-8)

SECTION 1.0 - INTRODUCTION

This report presents a summary of the hydrologic data collected during 2006, 2007 and 2008 from 18 streamflow gauging stations established for the Mary River Project. These data, in addition to regional data, are used to provide estimates of long-term flow conditions and statistical streamflow analysis at the Project site. The Mary River Project is located on northern Baffin Island in the Canadian Arctic, approximately 1000 km north-northeast of Iqaluit, the largest community on the Island. The main deposit is located on the southern edge of an upland plateau, while the camp and much of the Project area south of the main deposit is at lower elevation and dotted with innumerable lakes. Since 2006, seven streamflow gauging stations surrounding the exploration site have been recording baseline information within watersheds that could potentially be impacted by the Project. Six further stations were installed in 2006, five on systems to the south of the main deposit and one to the north of the main deposit, each providing information on regional streamflow variability. In 2008, five more streamflow gauging stations were installed along the proposed southern railway alignment between Mary River and the Steensby Port Site, in an effort to provide further regional streamflow variability information, and information specific to the railway alignment design. The locations of the streamflow gauging stations along with their corresponding drainage areas are shown on Figures 1.1, 1.2 and 1.3, and listed on Table 1.1. Of the 18 gauging stations, 14 were installed and operated by Knight Piésold Ltd. (KPL), while the remaining four stations were installed and operated by Water Survey of Canada (WSC). All of the KPL gauges were operated during open water conditions only, resulting in a data collection season from mid-June to mid-September. While streamflow has been witnessed and measured outside of this period, it has largely been of a negligible volume, especially within the smaller catchments where the KPL gauges are located. The WSC streamflow stations, however, are operated year-round as the submersed portions of their gauges are located deep within lakes, allowing them to remain unfrozen throughout the winter.

The following sections discuss regional hydrology before summarizing the data collected at the various hydrologic stations within the project area. A peak flow analysis developed using the collected data is then presented, along with a long-term regional analysis, a discussion of regional and temporal trends amongst the data, as well as several validations of the collected data. Finally, discussions of groundwater hydrology and climate change at Mary River are presented before the final section provides the conclusions and recommendations of the report.

SECTION 2.0 - REGIONAL STREAMFLOW AND CLIMATE CHARACTERIZATION

Baffin Island is one of the northernmost and coldest parts of Canada and the Mary River Project is situated towards the northern end of the Island. Regional data indicate a mean annual temperature of approximately -15 °C. Mean daily temperatures are below -20 °C from November through April, and are only above freezing (0 °C) during June through August, with July mean daily maximum temperatures reaching only 6-10 °C. The long length of the sub-zero degree temperatures in this region results in a very short runoff period that typically occurs from June through September, but may extend to late October in systems where large lakes are present. The frigid temperatures also result in very low precipitation values for northern Baffin Island, from the combined effect of the low moisture carrying capacity of cold air and the scarcity of liquid water for much of the year. According to Natural Resources Canada, the mean annual total precipitation ranges from 200 to 400 mm in the Project area, classifying it as semi-arid. Mean annual precipitation at the closest regional climate stations is closer to the 200 mm end of this range. Figure 2.1 presents the locations of these regional climate stations, while Figures 2.2 and 2.3 present graphs of average monthly precipitation and temperature for each regional station, respectively. Processes that act to further limit water available for runoff are evaporation, transpiration and sublimation. The frigid climate and subsequent lack of significant vegetative cover combine to minimize the volume of water evaporated and transpired to very low levels. Sublimation, which is the process by which solid water changes phase directly to water vapour, occurs during the winter months and is increased by blowing snow transport which is very common in the Mary River region. Therefore, sublimation may result in a greater loss of potential runoff than either evaporation or transpiration, and has been found to result in losses of up to 50% of winter precipitation in Arctic environments (Liston and Sturm, 2004).

Streamflow regimes in the high Arctic are influenced by numerous factors, most significant of which is temperature. Throughout the winter months the temperatures are bitterly cold, as described above, resulting in hydrologic systems freezing solid and ceasing to flow. As temperatures rise above 0 °C, snow and ice melt and streamflow resumes until freeze-up occurs during the following winter. Significant differences in the timing and volume of runoff occur between systems depending on elevation, aspect, glacial cover and lake cover. A watershed’s elevation affects the timing of the onset of the summer melt, and can also affect the volume of precipitation it receives as a result of orographic influences. The aspect of a watershed can also play a role in the timing of the summer melt, and possibly in the depth, and therefore volume, of permafrost melt later in the summer. Glacial cover tends to greatly increase the volume of runoff in a watershed, especially in the late summer, relative to other catchments that receive runoff only from permafrost melt and precipitation. Finally, lake content within a watershed acts to attenuate the effects of storm and melt events, resulting in a smoothed hydrograph without the rapid changes in runoff observed in catchments without significant lake area. Lakes also provide a source of water to river systems later in the year when precipitation is falling as snow, permafrost melt has ceased, and other systems are no longer receiving input of water and are therefore drying up and/or freezing over. As a result, systems that include significant lake components tend to continue to flow later into the winter than their non-lake counterparts. The presence of permafrost within the watersheds of the region, coupled with the lack of vegetative cover, also has a profound effect on hydrologic systems. Permafrost typically does not allow water to infiltrate the ground to any great depth, while the lack of surface vegetation results in little to no impedance or loss of runoff as it flows to the river channels. Therefore, storm driven runoff events tend to produce flashy streamflow conditions.

Five regional hydrologic stations operated by WSC were reviewed in an attempt to characterize the hydrology in the region around the Mary River Project Area. Due to the sparse hydrologic network in the Canadian Arctic, these systems are a significant distance from the Project, have records with few complete years, and are not all currently active. These five stations, listed in Table 2.1 and presented on Figure 2.1, range in location from 640 km northwest of the Mary River camp, to 1000 km southeast of the camp, and have drainage areas ranging from 60 km^2 to 2980 km^2. These systems begin to flow in late May to mid June, with the southern watersheds melting earlier than the northern watersheds. The majority of annual runoff then typically occurs during the nival freshet in late June through July, with runoff decreasing through the late summer before freezing up again at the onset of winter. The freeze-up date is significantly different between the northern and southern sites, ranging from late September in the northern watersheds more similar in latitude to Mary River, to November and December for the sites located far to the south near Iqaluit. Mean annual unit runoff (MAUR) also differs between the northern and southern watersheds, though not by a great amount. The southern watersheds have an average MAUR of 10 $l/s/km^2$, while the northern watersheds average 6 $l/s/km^2$. The mean annual peak daily unit runoff varies more randomly amongst the sites, with a low of 105 $l/s/km^2$ at Marcil Creek and a high of 251 $l/s/km^2$ on the Mecham River. The hydrographs of average daily unit runoff at each station are presented on Figure 2.4.

WSC also installed four hydrologic stations on large river systems within, and close to, the Project area, the characteristics and results of which will be described in further detail in Section 3. These records lend strength to the more regional trends presented above. The runoff periods of all four records begin in early to mid June and end in late October. The MAUR of the three unglaciated watersheds are all very similar, ranging from 8.8 $l/s/km^2$ to 9.3 $l/s/km^2$, which lie within the MAUR range of the regional watersheds above, while the glaciated watershed of the Isortoq River has a much higher MAUR of 17.2 $l/s/km^2$. The mean annual peak daily unit runoff values of the four stations are also similar to those of the regional stations, ranging from 86 $l/s/km^2$ on the Ravn River to 181 $l/s/km^2$ on the Isortoq River. Through analysis of the regional and the more local WSC streamflow stations, it is assumed that the smaller, non-lake containing watersheds in the immediate vicinity of the Mary River Mine Site should begin to flow in early to mid June and cease to flow in late September to early October, have MAUR values of less than 10 $l/s/km^2$, and have mean annual peak daily unit runoff values ranging from approximately 100 to 400 $l/s/km^2$.

SECTION 3.0 - MARY RIVER HYDROLOGY PROGRAM

3.1 MARY RIVER HYDROLOGY

A streamflow gauging program was initiated at the Mary River Project site in July 2006. To date, there are 14 streamflow monitoring stations in seasonal operation within the Project area. There were also four regional WSC hydrology stations installed in 2006 that are operational year-round, and are located near the Project area. The following sections provide a summary of the datasets collected at all stations, with presentation of the datasets in the form of site specific rating curves, hydrographs, and summary tables. These data, coupled with onsite observations, suggest that streamflow at the Project site typically begins in early June and ends in late September. The annual hydrographs are dominated by a nival (snowmelt) freshet in late June to mid July, and low flows punctuated by large, rapid runoff, rainfall events in late July through early September. The hydrographs also exhibit significant diurnal variability during the freshet and just prior to freeze-up, likely due to temperature driven snowmelt. Annual maximum instantaneous discharges either occur as a result of snowmelt during the freshet, rainfall during summer precipitation events, or a combination of both. Streamflow can also rise extremely rapidly during rainfall driven runoff events, as a result of limited interception by vegetation and low infiltration due to shallow permafrost.

As outlined above and in Section 2.0, streamflow was assumed to begin June 1 and end September 30 for most sites, with streamflow extending until October 31 at those stations with significant lake area within their watershed. For those stations with missing periods of data, which may be a result of late installation dates, logger damage or malfunction, or the lowering of the water surface below the level of the pressure transducer, data was synthesized using linear regression with nearby stations in order to calculate monthly values. Linear interpolation was used to extend the flow records from the low flows at the beginning and end of the measured record to the June 1 and September 30 dates of zero flow for most sites. This interpolation was deemed reasonable through the assessment of regional data, as well as the knowledge that the total volume of interpolated flow comprises a very small fraction of the measured streamflow volume at roughly 5%. In 2006, no data were recorded at any of the sites during the month of June as the stations were not yet established, and therefore streamflow series were truncated at July 1 and no annual statistics were calculated for this year.

Annual statistics were determined using data collected during 2007 and 2008 for all stations, but the values presented in Table 3.1 summarize only those stations with more than one year of record and operated by KPL (H1-H9). The values indicate that the annual mean unit runoff varies from gauge to gauge and from year to year, but was generally in the order of 9 $l/s/km^2$. The maximum annual mean unit runoff of 16.6 $l/s/km^2$ was measured at H3 (Tom River Tributary) in 2008. The minimum annual mean unit runoff of 3.3 $l/s/km^2$ was recorded at H9 (Southern Access Route) in 2007. For water resources decisions it is useful to consider average unit runoff for the non-freeze period only, which is when streamflow is available for use and susceptible to degradation. During June to September, the average unit runoff for the period of record is approximately 27 $l/s/km^2$, although values range from approximately 12.3 $l/s/km^2$ to 36.8 $l/s/km^2$.

A brief description of each gauging station is provided in the following section, along with a discussion of the streamflow record and rating curve quality, a description of the data collection techniques used, and a summary of the regression and/or interpolation analysis used to synthesize missing periods of streamflow. Rating curves, daily steamflow hydrographs and streamflow summary tables are also presented for each site.

3.2 STREAMFLOW GAUGING STATION PROCEDURES

At the gauging stations operated by KPL (H1 to H10, BR11, BR25, BR96-2 and BR137) several procedures are common to all stations.

3.2.1 Gauge Installation and Removal

The gauging stations are comprised of an Instrumentation Northwest Inc. (INW) PT2X pressure transducer with internal data logger, which is housed within a 2 m or 3 m length of aluminum pipe. The pipes are attached to a bedrock outcrop or large boulders, which provide a stable location to measure stage. The pressure transducer is surveyed to two benchmarks a minimum of twice per year, once during installation and once during removal, to ensure that the transducer had not moved during the season and so that the stage record from successive years can be corrected to a common datum. Additional surveys were completed during the gauging season as required. The gauging station locations are selected to provide good hydraulic conditions for streamflow gauging, which includes:

1) A stable hydraulic control,
2) Suitable installation conditions,
3) A site with minimal turbulence and water surface fluctuations, and
4) A site where the pressure transducer will remain submersed at low flows.

The stream gauges are installed annually as ice cover at the station begins to clear, prior to the freshet. The pressure transducer is programmed to record stage (depth) measurements at 15 minute intervals throughout the season.

3.2.2 Discharge Measurements

Three different methods were used to collect discharge measurements at the gauging station locations. When flow in the channels allowed for safe wading, the discharge measurements were recorded using a velocity meter and the velocity-area technique. When the discharge was too high to allow for safe wading of the river, the dilution technique was employed at most sites by use of rhodamine dye slug injection. At sites whose channel characteristics do not allow for thorough mixing of rhodamine dye, an Acoustic Doppler Current Profiler (ADCP) was used to measure discharge at unwadeable flows. This method also makes use of the velocity-area technique, but the ADCP, which is engineered to float on the water surface and is pulled across the channel on a tethered rope, uses Doppler technology to image the channel cross-section and measure the velocity.

Measurement error for the velocity-area measurements was quantified by assessing the precision between concurrent discharge measurements, the distribution of cross-sectional discharge within depth-velocity measurement cells (ideally each cell contains less than 5% of the total discharge) and a qualitative assessment of the measurement transect quality. Measurement error for the dilution measurements was quantified primarily by visual assessment of the mixing quality during the measurement, the quality of the dye injection and the sonde location and calibration, and by assessing the precision between concurrent discharge measurements. Measurement error for the ADCP was quantified by assessing the difference between successive measurements and the difference between the measured discharge and the total discharge, which includes estimates of the flow along the edges and bottom of the channel.

3.2.3 Rating Curve Development

The rating curves were derived by a visual fit to the discharge/stage calibration points collected at each station, with direct consideration of the estimated uncertainty associated with each point. The rating curves were then slightly refined in order to reduce the overall uncertainty of the rating curves. For each rating curve, the overall uncertainty was determined by measuring the deviation of each measured discharge value from the rating curve prediction for the same stage. This difference was then divided by the mean of the measured and predicted values to get a percentage error. The percentage error for each measurement was then averaged to quantify the overall rating curve uncertainty. The form of the rating curve equation is also based on general hydraulic theory pertaining to open channel flow, which predicts that stage and discharge will be related by a power function with values of the coefficient and exponent being dependent on the hydraulic characteristics of the control section at the gauge (Maidment, 1993). The empirical rating curve equation can be compared against the expected theoretical values of the exponent and coefficient, which serves as a useful check on its reliability.

3.3 H1 - NORTHERN CONTROL SITE

The H1 hydrology station was first installed on July 5, 2006 on a tributary of Phillips Creek approximately 40 km northwest of the Mary River camp. It is the most northerly of all the Project hydrology stations and was originally installed on a potential transportation route between Mary River and Milne Inlet. The catchment area above the gauge is approximately 250 km^2 and includes several small lakes. The location of the gauge site is presented on Figure 1.1, while photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 1-5).

Sixteen discharge measurements have been successfully collected at the H1 gauging station during the period of record, July 5, 2006 to September 8, 2008. The measurements were collected using a current meter at low flows and rhodamine dye at high flows. Of these 16 measurements, 15 were used in developing the H1 rating curve, which is used to translate the stage record into a discharge record, while one measurement was deemed erroneous as a result of poor measurement quality. The H1 rating curve is presented on Figure 3.1. The overall uncertainty associated with the H1 rating curve was assessed at +/- 9.3%.

Measured annual hydrographs for the period of record at H1 are presented on Figure 3.2. Most notable on this figure is that the annual hydrographs do not begin nor end at zero flow. In order for mean monthly and annual streamflow statistics to be calculated, the streamflow record should not include any significant gaps. Therefore, these gaps were filled using linear interpolation between the first and last streamflow values and the dates of zero flow, as discussed in Section 3.1. These interpolation periods correspond to 6% and 3% of the measured flow volumes for 2007 and 2008 respectively. In 2006 no data were collected during June, and therefore synthetic values were only created to fill the gap between the install date and July 1, and no data were estimated for June 2006. Partial data records and onsite observations record an extreme flow event that occurred just prior to the July 5, 2006 install preceded by early season low flows at the start of July. Therefore, the mean 2006 freshet flow value was used to infill the missing July data in an effort to model the assumed average of the low flow and peak flow events that occurred during these four days.

The results of the data collection and data infilling are presented in Table 3.2, which summarizes the data as monthly, seasonal and annual mean discharges and unit runoffs. The H1 rating curve is of high quality, with 16 measured discharges recorded over the majority of the measured streamflow range. The lowest manually measured discharge at H1 of 1.8 m^3/s is equalled or exceeded 91% of the time during the period of record, and the highest measured discharge of 25 m^3/s equalled or exceeded only 3.5% of the time during the period of record. The rating curve is therefore derived from flows that have occurred 87% of the time within the H1 streamflow record, resulting in high quality mean monthly, seasonal and annual values. However, there remains some uncertainty at the extreme high and low flows, outside the range of manually measured discharge. It is recommended that the streamflow gauging program at H1 should be continued in order to gain a greater understanding of interannual streamflow variability in the northern portions of the Project area, but the collection of discharge measurements to further refine the rating curve is no longer considered a priority. Occasional discharge measurements should continue to be collected to confirm rating curve stability.

3.4 H2 - TOM RIVER

The H2 hydrology station was first installed on July 7, 2006 on the Tom River approximately 2.5 km northwest of the Mary River camp. The catchment area above the gauge is approximately 210 km^2 and is comprised primarily of upland areas to the immediate north and northwest of the main Mary River deposit. The location of the gauge site is presented on Figure 1.1 while a more detailed presentation of the H2 watershed is presented on Figure 1.2. Photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 6-10).

Nineteen discharge measurements have been successfully collected at the H2 gauging station during the period of record, July 7, 2006 to September 14, 2008. The measurements were collected using a current meter at low flows and rhodamine dye at high flows. These measurements were used to develop the H2 rating curve which is presented on Figure 3.3. The overall uncertainty associated with the H2 rating curve was assessed at +/- 9.1%.

Measured annual hydrographs for the period of record at H2 are presented on Figure 3.4. Interpolation between the first and last streamflow values and the dates of zero flow, as discussed in Section 3.1, correspond to 3% and 1% of the measured flow volumes for 2007 and 2008 respectively. In 2006 no data was collected during June, and therefore synthetic values were created to fill the gap between the install date and July 1. Significant gaps also occurred within the streamflow record at the start and end of the 2008 freshet, as a result of station damage and the water level dropping below the transducer elevation. To synthesize these data, streamflow measured at hydrology station H3, which is located on a tributary of the Tom River upstream of H2, was compared to concurrent streamflow data at H2 by linear regression. The regression modelling approach demonstrated a strong match between the two data sets, with a coefficient of determination, R^2, of 0.96. The equation relating the two streamflow records was then applied to the H3 record to produce synthetic streamflow at the H2 gauging station for the periods of missing data.

The results of the data collection and data infilling are presented in Table 3.3, which summarizes the data as monthly, seasonal and annual mean discharges and unit runoffs. The H2 rating curve is of high quality, with 19 measured discharges recorded throughout the majority of the measured streamflow range. The lowest manually measured discharge at H2 of 0.7 m^3/s was equalled or exceeded 99.5% of the time during the period of record, and the highest measured discharge of 52 m^3/s was equalled or exceeded only 0.3% of the time during the period of record. The rating curve is therefore derived from flows that have occurred 99.2% of the time within the H2 streamflow record, resulting in high quality mean monthly, seasonal and annual values. However, there is some uncertainty at the extreme high and low flows outside of the range of manually measured discharge. It is advised that the streamflow gauging program at H2 should be continued in order to gain a greater understanding of interannual streamflow variability in the vicinity of the main deposit, but the collection of discharge measurements to further refine the rating curve is no longer considered a necessity. Occasional discharge measurements should continue to be collected to confirm rating curve stability.

3.5 H3 - TOM TRIBUTARY

The H3 hydrology station was first installed on July 7, 2006 on a tributary of the Tom River approximately 5 km north of the Mary River camp. The catchment area above the gauge is approximately 30.5 km^2 and is comprised primarily of upland areas to the immediate north of the main Mary River deposit, including the north slopes of the deposit. The H3 catchment is a sub-catchment of the H2 catchment. The location of the gauge site is presented on Figure 1.1 while a more detailed presentation of the H3 catchement is presented on Figure 1.2. Photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 11-15).

Sixteen discharge measurements have been successfully collected at the H3 gauging station during the period of record, July 7, 2006 to September 14, 2008. The measurements were collected using a current meter at all flows. These measurements were used to develop the H3 rating curve which is presented on Figure 3.5. The overall uncertainty associated with the H3 rating curve was assessed at +/- 10.7%.

Measured annual hydrographs for the period of record at H3 are presented on Figure 3.6. Interpolation between the first and last streamflow values and the dates of zero flow, as discussed in Section 3.1, correspond to 3% and 4% of the measured flow volumes for 2007 and 2008 respectively. In 2006 no data were collected during June, and therefore synthetic values were created to fill the gap between the install date and July 1. A significant gap also occurred within the streamflow record during much of the 2007 freshet, as a result of a late transducer installation date. To synthesize this data, streamflow measured at hydrology station H2, which is located on the Tom River downstream of H3, was compared to concurrent streamflow data at H3 by linear regression. The regression modelling approach demonstrated a strong match between the two data sets, with a coefficient of determination, R^2, of 0.99.

The equation relating the two streamflow records was then applied to the H2 record to produce streamflow at the H3 gauging station for the period of missing data.

The results of the data collection and data infilling are presented in Table 3.4, which summarizes the data as monthly, seasonal and annual mean discharges and unit runoffs. The H3 rating curve is of high quality, with 16 measured discharges recorded throughout the majority of the measured streamflow range. The lowest manually measured discharge at H3 of 0.11 m^3/s was equalled or exceeded 99% of the time during the period of record, and the highest measured discharge of 7.3 m^3/s was equalled or exceeded only 4% of the time during the period of record. The rating curve is therefore derived from flows that have occurred 95% of the time within the H3 streamflow record, resulting in high quality mean monthly, seasonal and annual values. However, there is some uncertainty at the extreme high and low flows outside of the range of manually measured discharge. It is advised that the streamflow gauging program at H3 should be continued in order to gain a greater understanding of interannual streamflow variability in the vicinity of the main deposit, but the collection of discharge measurements to further refine the rating curve is no longer considered a necessity. Occasional discharge measurements should continue to be collected to confirm rating curve stability.

3.6 H4 – CAMP LAKE TRIBUTARY

The H4 hydrology station was first installed on July 3, 2006 on a small unnamed creek approximately 1 km northwest of the Mary River camp. The catchment area above the gauge is approximately 9.6 km^2 and the catchment includes a portion of the western slope of the main deposit. The location of the gauge site is presented on Figure 1.1 while a more detailed presentation of the H4 watershed is presented on Figure 1.2. Photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 16-20).

Sixteen discharge measurements have been successfully collected at the H4 gauging station during the period of record, July 7, 2006 to September 14, 2008. Discharge measurements at H4 were recorded using a current meter at all flows. Of these 16 measurements, 15 were used in developing the H4 rating curve, which is used to translate the stage record into a discharge record, while one measurement was deemed erroneous as a result of poor measurement quality. The H4 rating curve is presented on Figure 3.7. The overall uncertainty associated with the rating curve is assessed at +/- 8.2%.

Measured annual hydrographs for the period of record at H4 are presented on Figure 3.8. Interpolation between the first and last streamflow values and the dates of zero flow, as discussed in Section 3.1, correspond to 12% and 5% of the measured flow volumes for 2007 and 2008 respectively. In 2006 no data were collected during June, and therefore synthetic values were created to fill the gap between the install date and July 1. A significant gap also occurred within the streamflow record during the first half of the 2008 freshet, as a result of a late transducer installation date. To synthesize this data, streamflow measured at hydrology station H5, which is located on a similarly small system adjacent to the H4 catchment, was compared to concurrent streamflow data at H4 by linear regression. The regression modelling approach demonstrated a strong match between the two data sets, with a R^2 goodness of fit statistic of 0.87. The equation relating the two streamflow records was then applied to the H5 record to produce streamflow at the H4 gauging station for the period of missing data.

The results of the data collection and data infilling are presented in Table 3.5, which summarizes the data as monthly, seasonal and annual mean discharges and unit runoffs. The H4 rating curve is of high quality, with 16 measured discharges recorded throughout the majority of the measured streamflow range. The lowest manually measured discharge at H4 of 0.06 m^3/s was equalled or exceeded 96.5% of the time during the period of record, and the highest measured discharge of 2.3 m^3/s was equalled or exceeded only 0.7% of the time during the period of record. The rating curve is therefore derived from flows that have occurred over 95% of the time within the H4 streamflow record, resulting in high quality mean monthly, seasonal and annual values. However, there is some uncertainty at the extreme high and low flows outside of the range of manually measured discharge. It is advised that the streamflow gauging program at H4 should be continued in order to gain a greater understanding of interannual streamflow variability in the vicinity of the main deposit, but the collection of discharge measurements to further refine the rating curve is no longer considered a necessity. Occasional discharge measurements should continue to be collected to confirm rating curve stability.

3.7 H5 - NORTH OF CAMP

The H5 hydrology station was first installed on July 4, 2006 on a small unnamed creek approximately 1 km northeast of the Mary River camp. The catchment area above the gauge is approximately 5.3 km^2, which is the smallest of all the Project hydrology stations, and is includes of a portion of the western slope of the main deposit. The location of the gauge site is presented on Figure 1.1 while a more detailed presentation of the H5 watershed is presented on Figure 1.2. Photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 21-24).

Twenty-two discharge measurements have been successfully collected at the H5 gauging station during the period of record, July 4, 2006 to September 13, 2008. Discharge measurements at H5 were recorded using a current meter at all flows. Of these 22 measurements, 21 were used in developing the H5 rating curve, which is used to translate the stage record into a discharge record, while one measurement was deemed erroneous as a result of poor measurement quality. The H5 rating curve is presented on Figure 3.9. The overall uncertainty associated with the rating curve is assessed at +/- 16.1%. The moderately high overall uncertainty is largely a result of the numerous discharge measurements that have been recorded at extremely low discharges, where the current meter performs less well, and where a small absolute error, such as 0.01 m^3/s, may correspond to a high relative uncertainty, such as 30%.

Measured annual hydrographs for the period of record at H5 are presented on Figure 3.10. Most notable on this figure is that the annual hydrographs do not begin nor end at zero flow. In order for mean monthly and annual streamflow statistics to be calculated, the streamflow record should not include any significant gaps. Therefore, these gaps were filled using linear interpolation between the first and last streamflow values and the dates of zero flow, as discussed in Section 3.1. These interpolation periods correspond to 11% and 7% of the measured flow volumes for 2007 and 2008 respectively. In 2006 no data were collected during June, and therefore synthetic values were created to fill the gap between the install date and July 1. Partial data records and onsite observations record an extreme flow event that occurred on the July 4, 2006 install preceded by early season low flows at the start of July. Therefore, the mean 2006 freshet flow value was used to infill the missing July data in an effort to model the assumed average of the low flow and peak flow events that occurred during these three days.

The results of the data collection and data infilling are presented in Table 3.6, which summarizes the data as monthly, seasonal and annual mean discharges and unit runoffs. The H5 rating curve is of high quality, with 21 measured discharges recorded throughout the majority of the measured streamflow range. The lowest manually measured discharge at H5 of 0.03 m^3/s was equalled or exceeded more than 98% of the time during the period of record, and the highest measured discharge of 2.7 m^3/s was equalled or exceeded less than 0.1% of the time during the period of record. The rating curve is therefore derived from flows that have occurred approximately 98% of the time within the H5 streamflow record, resulting in high quality mean monthly, seasonal and annual values. However, there is some uncertainty at the extreme high and low flows outside of the range of manually measured discharge. It is advised that the streamflow gauging program at H5 should be continued in order to gain a greater understanding of interannual streamflow variability in the vicinity of the main deposit, but the collection of discharge measurements to further refine the rating curve is no longer considered a necessity. Occasional discharge measurements should continue to be collected to confirm rating curve stability.

3.8 H6 - MARY RIVER CANYON

The H6 hydrology station was first installed on July 7, 2006 on the Mary River within the canyon adjacent to the main deposit, approximately 6 km east of the Mary River camp. The catchment area above the gauge is approximately 243 km^2, and is comprised primarily of upland regions, along with most of the eastern slope of the main deposit. The catchment also includes a small glacier approximately 5 km^2 in size in its upper headwaters. The location of the gauge site is presented on Figure 1.1 while a more detailed presentation of the H6 watershed is presented on Figure 1.2. Photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 25-28).

Thirteen discharge measurements have been successfully collected at the H6 gauging station during the period of record, July 7, 2006 to September 13, 2008. The measurements were collected using a current meter at low flows and rhodamine dye slug injection at higher flows. Of these 13 measurements, 11 were used in developing the H6 rating curve, which is used to translate the stage record into a discharge record, while two measurements were conducted outside of the period of record when the transducer was not in the channel and therefore had no stage associated with them. However, these two measurements were used in delineating early and late season flows as outlined below. The H6 rating curve is presented on Figure 3.11. The overall uncertainty associated with the rating curve was assessed at +/- 9.8%.

Measured annual hydrographs for the period of record at H6 are presented on Figure 3.12. Interpolation between the first and last streamflow values and the dates of zero flow, as discussed in Section 3.1, correspond to 4% and 1% of the measured flow volumes for 2007 and 2008 respectively. In 2006 no data were collected during June, and therefore synthetic values were created to fill the gap between the install date and July 1. Partial data records and onsite observations record an extreme flow event that occurred on the July 4, 2006 install preceded by early season low flows at the start of July. Therefore, the mean 2006 freshet flow value was used to infill the missing July data in an effort to model the assumed average of the low flow and peak flow events that occurred during these six days. Significant gaps also occurred throughout the 2007 streamflow record, as the water level frequently dropped below the level of the transducer. To synthesize these data, streamflow measured at hydrology station H8, which is located on the Mary River upstream of H6, and data from station H2, located on the Tom River which shares a drainage divide with much of the Mary River, were compared to concurrent streamflow data at H6 by linear regression. The regression modelling approach demonstrated a strong match between the data sets, with a R^2 goodness of fit statistics of 0.98 between H6 and H8, and a R^2 of 0.95 between H6 and H2. The resulting equations were then applied to the H2 and H8 streamflow records to produce streamflow at the H6 gauging station for the periods of missing data.

The results of the data collection and data infilling are presented in Table 3.7, which summarizes the data as monthly, seasonal and annual mean discharges and unit runoffs. The H6 rating curve is of high quality, with 11 measured discharges recorded throughout the majority of the measured streamflow range. The lowest manually measured discharge used in the H6 rating curve of 3 m^3/s was equalled or exceeded more than 88% of the time during the period of record, and the highest measured discharge of 55 m^3/s was equalled or exceeded less than 2% of the time during the period of record. The rating curve is therefore derived from flows that have occurred approximately 86% of the time within the H6 streamflow record, resulting in high quality mean monthly, seasonal and annual values. However, there is some uncertainty at the extreme high and low flows outside of the range of manually measured discharge. It is advised that the streamflow gauging program at H6 should be continued in order to gain a greater understanding of interannual streamflow variability in the vicinity of the main deposit, but the collection of discharge measurements to further refine the rating curve is no longer considered a necessity. Occasional discharge measurements should continue to be collected to confirm rating curve stability.

3.9 H7 - MARY RIVER TRIBUTARY

The H7 hydrology station was first installed on July 6, 2006 on a tributary of the Mary River approximately 6.5 km east of the Mary River camp. The catchment area above the gauge is approximately 15 km^2, and drains most of the eastern slope of the main deposit. The location of the gauge site is presented on Figure 1.1 while a more detailed presentation of the watershed is presented on Figure 1.2. Photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 29-32).

Nineteen discharge measurements have been successfully collected at the H7 gauging station during the period of record, July 6, 2006 to September 13, 2008. The measurements were collected using a current meter at low flows and rhodamine dye slug injection at high flows. Of these 19 measurements, 17 were used in developing the H7 rating curve, which is used to translate the stage record into a discharge record, while two measurements were conducted while ice was present at the control section resulting in an altered stage-discharge relationship. The H7 rating curve is presented on Figure 3.13. The overall uncertainty associated with the rating curve was assessed at +/- 17.7%. The majority of the error can be attributed to two extremely low flow measurements recorded in 2007, at which flow the current meter performs less accurately and a small absolute error can result in a large percentage error. When the error from these two measurements is ignored, the overall uncertainty of the rating curve drops to +/- 10.8%, which is a more representative reflection of the rating curve quality.

Measured annual hydrographs for the period of record at H7 are presented on Figure 3.14. In order for mean monthly and annual streamflow statistics to be calculated, the streamflow record should not include any significant gaps. Therefore, these gaps were filled using linear interpolation between the first and last streamflow values and the dates of zero flow, as discussed in Section 3.1. These interpolation periods correspond to 5% and 4% of the measured flow volumes for 2007 and 2008 respectively. Significant gaps also occurred during the 2007 and 2008 freshets due to late installation resulting from instream snow and ice conditions that persist longer than at most other sites. To synthesize these data, streamflow measured at hydrology station H3, which shares some of its drainage divide with H7, along with data from H2, which includes H3 within its catchment, were compared to concurrent streamflow data at H7 by linear regression. The regression modelling approach demonstrated a strong match between the data sets, with a R^2 goodness of fit statistics of 0.89 between H7 and H2, and a R^2 of 0.93 between H7 and H3. The resulting equations were then applied to the H2 and H3 streamflow records to produce streamflow at the H7 gauging station for the periods of missing data.

The results of the data collection and data infilling are presented in Table 3.8, which summarizes the data as monthly, seasonal and annual mean discharges and unit runoffs. The H7 rating curve is of high quality, with 17 measured discharges recorded throughout the majority of the measured streamflow range. The lowest manually measured discharge of 0.03 m^3/s was equalled or exceeded more than 99.9% of the time during the period of record, and the highest measured discharge of 3.3 m^3/s was equalled or exceeded less than 2% of the time during the period of record. The rating curve is therefore derived from flows that have occurred approximately 98% of the time within the H7 streamflow record, resulting in high quality mean monthly, seasonal and annual values. However, there is some uncertainty at the extreme high and low flows outside of the range of manually measured discharge. It is advised that the streamflow gauging program at H7 be continued in order to gain a greater understanding of interannual streamflow variability in the vicinity of the main deposit, but the collection of discharge measurements to further refine the rating curve is no longer considered a necessity. Occasional discharge measurements should continue to be collected to confirm rating curve stability.

3.10 H8 – UPPER MARY RIVER

The H8 hydrology station was first installed on July 6, 2006 on the Mary River upstream of H6 approximately 11 km east of the Mary River camp. The catchment area above the gauge is approximately 210 km^2, and is comprised of the upland regions of the Mary River, which includes a glacier approximately 5 km^2 in size in the upper headwaters. The location of the gauge site is presented on Figure 1.1 while a more detailed presentation of the watershed is presented on Figure 1.2. Photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 33-35).

Sixteen discharge measurements have been successfully collected at the H8 gauging station during the period of record, July 6, 2006 to September 14, 2008. The measurements were recorded using a current meter at low flows and an ADCP at high flows. Of these 16 measurements, 13 were used in developing the H8 rating curve, which is used to translate the stage record into a discharge record, while two measurements were of very poor quality and a third was conducted prior to the installation of the gauging station. The H8 rating curve is presented on Figure 3.15. The overall uncertainty associated with the rating curve was assessed at +/- 12.9%.

Measured annual hydrographs for the period of record at H8 are presented on Figure 3.16. In order for mean monthly and annual streamflow statistics to be calculated, the streamflow record should not include any significant gaps. Therefore, these gaps were filled using linear interpolation between the first and last streamflow values and the dates of zero flow, as discussed in Section 3.1. These interpolation periods correspond to 4% and 1% of the measured flow volumes for 2007 and 2008 respectively. In 2006 no data were collected during June, and therefore synthetic values were created to fill the gap between the install date and July 1. Significant gaps also occurred during the 2007 and 2008 freshets due to late installation resulting from instream snow and ice conditions that persist longer than at most other sites. To synthesize this data, streamflow measured at hydrology station H6 which is also on the Mary River, downstream of H8, along with data from H2, which is located on the Tom River and shares part of its watershed boundary with the Mary River, were compared to concurrent streamflow data at H8 by linear regression. The regression modelling approach demonstrated a strong match between the data sets, with a R^2 goodness of fit statistics of 0.94 between H8 and H2, and a R^2 of 0.98 between H8 and H6. The resulting equations were then applied to the H2 and H6 streamflow records to produce streamflow at the H8 gauging station for the periods of missing data.

The results of the data collection and data infilling are presented in Table 3.9, which summarizes the data as monthly, seasonal and annual mean discharges and unit runoffs. The H8 rating curve is of high quality, with 13 measured discharges recorded throughout the majority of the measured streamflow range. The lowest manually measured discharge used in developing the rating curve of 1.1 m^3/s was equalled or exceeded approximately 90% of the time during the period of record, and the highest measured discharge of 46 m^3/s was equalled or exceeded approximately 1% of the time during the period of record. The rating curve is therefore derived from flows that have occurred roughly 89% of the time within the H8 streamflow record, resulting in high quality mean monthly, seasonal and annual values. However, there is some uncertainty at the extreme high and low flows outside of the range of manually measured discharge. It is advised that the streamflow gauging program at H8 be continued in order to gain a greater understanding of interannual streamflow variability in the vicinity of the main deposit, but the collection of discharge measurements to further refine the rating curve is no longer considered a necessity. Occasional discharge measurements should continue to be collected to confirm rating curve stability.

3.11 H9 - SOUTHERN ACCESS ROUTE

The H9 hydrology station was first installed on July 5, 2006 at the outlet of a small lake approximately 70 km south of the Mary River camp. The catchment area above the gauge is approximately 157 km^2, and includes numerous small lakes. The location of the gauge site is presented on Figure 1.1 while a more detailed presentation of the watershed is presented on Figure 1.3. Photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 36-39).

Fifteen discharge measurements have been successfully collected at the H9 gauging station during the period of record, July 5, 2006 to September 15, 2008. The measurements were recorded using a current meter at low flows and both rhodamine dye slug injection and an ADCP at high flows. The H9 rating curve is presented on Figure 3.17. The overall uncertainty associated with the rating curve was assessed at +/- 7.6%, although there is greater uncertainty at higher flows resulting from lower measurement quality.

Measured annual hydrographs for the period of record at H9 are presented on Figure 3.18. Most notable on this figure is that the annual hydrographs do not begin nor end at zero flow. In fact, much of the annual freshets were not recorded due to snow-drifts impeding early installation of the gauge. In order for mean monthly and annual streamflow statistics to be calculated, the streamflow record should not include any significant gaps. As such large amounts of the flow were missing, simple linear interpolation between the first measured flows and the inferred date of zero flow was not possible as it was for the other sites. The remote location of the site and its unique watershed characteristics also resisted attempts to use linear regression analysis to synthesize the missing values. However, the shapes of the H9 annual hydrographs and the annual hydrographs for the Mary Lake gauging station (WSC 06SA001), which is also located at a lake outlet, were quite similar, albeit the timing of events was often different. Therefore, exponential decay curves that were fit to the shape of the Mary Lake hydrographs were used to synthesize flow from and to zero flow at H9. The date of zero flow at the end of the hydrograph was also extended until October 31, as suggested by the Mary Lake hydrographs, along with other regional stations that include significant lake components. These interpolation periods correspond to 13% and 16% of the measured flow volumes for 2007 and 2008 respectively. In 2006 the majority of the freshet was not measured, and therefore synthesizing the data would result in a very high synthesized to measured flow volume ratio which, given the method of flow synthesis, would result in large uncertainties in the flow record and statistics calculated from this record. Therefore, only the tail end of the hydrograph was synthesized and no June, July, or annual statistics were calculated for 2006.

The results of the data collection and data infilling are presented in Table 3.10, which summarizes the data as monthly, seasonal and annual mean discharges and unit runoffs. The H9 rating curve is of high quality, with 15 measured discharges recorded throughout the majority of the measured streamflow range. The lowest manually measured discharge used in developing the rating curve of 0.9 m^3/s was equalled or exceeded approximately 91% of the time during the period of record, and the highest measured discharge of 46 m^3/s was equalled or approximately 1.5% of the time during the period of record. The rating curve is therefore derived from flows that have occurred roughly 89% of the time within the H9 streamflow record. However, there is some uncertainty at the extreme high and low flows outside of the range of manually measured discharge. It is advised that the streamflow gauging program at H9 be continued in order to gain a greater understanding of interannual streamflow variability in the southern portion of the Project area, but the collection of discharge measurements to further refine the rating curve is no longer considered a necessity. Occasional discharge measurements should continue to be collected to confirm rating curve stability.

3.12 H10 – SHEARDOWN LAKE

The H10 hydrology station was first installed on May 30, 2008 at the outlet of Sheardown Lake, approximately 4 km southeast of the Mary River camp. The catchment area above the gauge is approximately 8.2 km^2, and is comprised primarily of Sheardown Lake and the southern slope of the main deposit. The location of the gauge site is presented on Figure 1.1 while a more detailed presentation of the watershed is presented on Figure 1.2. Photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 41-45).

Initially, it was intended that a streamflow monitoring station would be developed at this site, which would include a rating curve, annual hydrographs, etc. However, during a site visit in late June, 2008, it was recorded that water was no longer flowing out of Sheardown Lake, but was flowing into the lake from Mary River. Further investigation revealed that the lake is frequently backwatered by the Mary River, and therefore a rating curve could not be developed for the site. However, a stage record was collected and is presented on Figure 3.19, which records the fluctuations of the lake surface elevation.

3.13 BR11

The BR11 hydrology station was first installed on June 4, 2008 on a tributary of Angajurjualuk Lake approximately 15 km southeast of the Mary River camp. The gauge is located near the proposed rail crossing location and it is the northernmost gauge on the proposed railway alignment between Mary River and Steensby Inlet. The catchment area above the gauge is approximately 53 km^2. The location of the gauge site is presented on Figure 1.1 while a more detailed presentation of the watershed is presented on Figure 1.2. Photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 46-49).

Nine discharge measurements have been successfully collected at the BR11 gauging station during the period of record, June 4, 2008 to September 14, 2008. The measurements were collected using a velocity meter at low flows and rhodamine dye slug injection at high flows. Of these nine measurements, six were used in developing the BR11 rating curve, which is used to translate the stage record into a discharge record, while the other three were recorded prior to the control becoming ice free. The BR11 rating curve is presented on Figure 3.20. The overall uncertainty associated with the rating curve was assessed at +/- 10.3%.

Measured annual hydrographs for the period of record at BR11 are presented on Figure 3.21. Gaps were filled using linear interpolation between the first and last streamflow values and the dates of zero flow, as discussed in Section 3.1. These interpolation periods correspond to 0.25% of the measured flow volumes for 2008.

The results of the data collection and data infilling are presented in Table 3.11, which summarizes the data as monthly, seasonal and annual mean discharges and unit runoffs. The BR11 rating curve is of moderate quality, with six measured discharges recorded throughout the majority of the measured streamflow range. The lowest manually measured discharge at BR11 of 0.85 m^3/s was equalled or exceeded 70% of the time during the period of record, and the highest measured discharge of 22 m^3/s was equalled or exceeded only 1% of the time during the period of record. The rating curve is therefore derived from flows that have occurred 69% of the time within the BR11 streamflow record, resulting in moderate quality mean monthly, seasonal and annual values. However, there is significant uncertainty at the extreme high and low flows outside of the range of manually measured discharge. It is advised that the streamflow gauging program at BR11 should be continued in order to gain a greater understanding of interannual streamflow variability in the Project area. Additionally, the collection of discharge measurements to further refine the rating curve should be continued.

3.14 BR25

The BR25 hydrology station was first installed on June 6, 2008 on a tributary of Angajurjualuk Lake approximately 30 km southeast of the Mary River camp. It is installed on the northern end of a proposed railway alignment between Mary River and Steensby Inlet. The catchment area above the gauge is approximately 113 km^2. The location of the gauge site is presented on Figure 1.1 while a more detailed presentation of the watershed is presented on Figure 1.2. Photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 50-53).

Eleven discharge measurements have been successfully collected at the BR25 gauging station during the period of record, June 6, 2008 to September 15, 2008. The measurements were collected using a current meter at low flows and rhodamine dye at high flows. Of these 11 measurements, eight were used in developing the BR25 rating curve, which is used to translate the stage record into a discharge record. Two of the other measurements were recorded while the control was affected by ice, while the third was deemed erroneous. The BR25 rating curve is presented on Figure 3.22. The high flow rhodamine dye discharge measurements were assessed to likely over-estimate the flow, and were therefore treated conservatively. The overall uncertainty associated with the rating curve was assessed at +/- 12.9%.

Measured annual hydrographs for the period of record at BR25 are presented on Figure 3.23. Gaps were filled using linear interpolation between the first and last streamflow values and the dates of zero flow, as discussed in Section 3.1. These interpolation periods correspond to 1.2% of the measured flow volumes for 2008.

The results of the data collection and data infilling are presented in Table 3.12, which summarizes the data as monthly, seasonal and annual mean discharges and unit runoffs. The BR25 rating curve is of moderate quality, with eight measured discharges recorded throughout the majority of the measured streamflow range. The lowest manually measured discharge at BR25 of 0.45 m^3/s was equalled or exceeded 99.5% of the time during the period of record. The highest measured discharge of 38.9 m^3/s, which is estimated by the rating curve to equal 29 m^3/s, was equalled or exceeded only 2% of the time during the period of record. The rating curve is therefore derived from flows that have occurred approximately 98% of the time within the BR25 streamflow record, resulting in moderate quality mean monthly, seasonal and annual values. However, there is significant uncertainty at the extreme high and low flows both within and outside of the range of manually measured discharge. It is advised that the streamflow gauging program at BR25 should be continued in order to gain a greater understanding of interannual streamflow variability in the Project area. Additionally, the collection of discharge measurements to further refine the rating curve should be continued.

3.15 BR96-2

The BR96-2 hydrology station was first installed on June 7, 2008 on a tributary of Cockburn Lake approximately 90 km southeast of the Mary River camp. It is installed on the southern portion of a proposed railway alignment between Mary River and Steensby Inlet. The catchment area above the gauge is approximately 31 km^2. The location of the gauge site is presented on Figure 1.1 while a more detailed presentation of the watershed is presented on Figure 1.3. Photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 54-56).

Nine discharge measurements have been successfully collected at the BR96-2 gauging station during the period of record, June 7, 2008 to September 14, 2008. The measurements were collected using a current meter at low flows and rhodamine dye slug injection at high flows. Of these nine measurements, eight were used in developing the BR96-2 rating curve, which is used to translate the stage record into a discharge record. The BR96-2 rating curve is presented on Figure 3.24. The overall uncertainty associated with the rating curve was assessed at +/- 7.5%.

Measured annual hydrographs for the period of record at BR96-2 are presented on Figure 3.25. Most notable on this figure is that the annual hydrographs do not begin nor end at zero flow. In order for mean monthly and annual streamflow statistics to be calculated, the streamflow record should not include any significant gaps. Therefore, these gaps were filled using linear interpolation between the first and last streamflow values and the dates of zero flow, as discussed in Section 3.1. These interpolation periods correspond to 2.4% of the measured flow volumes for 2008.

The results of the data collection and data infilling are presented in Table 3.13, which summarizes the data as monthly, seasonal and annual mean discharges and unit runoffs. The BR96-2 rating curve is of good quality, with eight measured discharges recorded throughout the majority of the measured streamflow range. The lowest manually measured discharge at BR96-2 of 0.34 m^3/s was equalled or exceeded 96% of the time during the period of record, and the highest measured discharge of 4.98 m^3/s was equalled or exceeded only 1.5% of the time during the period of record. The rating curve is therefore derived from flows that have occurred 94.5% of the time within the BR96-2 streamflow record, resulting in good quality mean monthly, seasonal and annual values. However, there is some uncertainty at the extreme high and low flows outside of the range of manually measured discharge. It is advised that the streamflow gauging program at BR96-2 should be continued in order to gain a greater understanding of interannual streamflow variability in the southern portions of the Project area. Additionally, the collection of discharge measurements to further refine the rating curve should be considered continued.

3.16 BR 137

The BR137 hydrology station was first installed on June 14, 2008 on a lake that drains into Steensby Inlet approximately 110 km southeast of the Mary River camp. It is the southernmost gauge on a proposed railway alignment between Mary River and Steensby Inlet. The catchment area above the gauge is approximately 308 km^2 and has extensive lake coverage. The location of the gauge site is presented on Figure 1.1 while a more detailed presentation of the watershed is presented on Figure 1.3. Photos of the gauge site and surrounding terrain are provided in Appendix A (Photos 57-58).

Eight discharge measurements have been successfully collected at the BR137 gauging station during the period of record, June 14, 2008 to September 14, 2008. All the discharge measurements were recorded using a current meter and application of the velocity-area technique. Discharges higher than the maximum manually measured flow would not be wadeable, and other measurement methods would be required. Of these eight measurements, seven were used in developing the BR137 rating curve, which is used to translate the stage record into a discharge record, while one was deemed erroneous. The BR137 rating curve is presented on Figure 3.26. The overall uncertainty associated with the rating curve was assessed at +/- 3.5%.

Measured annual hydrographs for the period of record at BR137 are presented on Figure 3.27. Most notable on this figure is that the annual hydrographs do not begin nor end at zero flow. In order for mean monthly and annual streamflow statistics to be calculated, the streamflow record should not include any significant gaps. Therefore, these gaps were filled using exponential decay curves between the first and last streamflow values and the dates of zero flow, which for BR137 are June 1 and October 31. The later freeze-up date is a result of the stream gauges location at a lake outlet, and is supported by the streamflow record collected at the outlet of Mary Lake. These interpolation periods correspond to 15% of the measured flow volumes for 2008.

The results of the data collection and data infilling are presented in Table 3.14, which summarizes the data as monthly, seasonal and annual mean discharges and unit runoffs. The BR137 rating curve is of moderate quality, with seven measured discharges recorded throughout the majority of the measured streamflow range. The lowest manually measured discharge at BR137 of 7.6 m^3/s was equalled or exceeded 93% of the time during the period of record, and the highest measured discharge of 18.8 m^3/s was equalled or exceeded only 6.5% of the time during the period of record. The rating curve is therefore derived from flows that have occurred 86.5% of the time within the BR137 streamflow record, resulting in moderate quality mean monthly, seasonal and annual values. However, there is significant uncertainty at the flows outside of the range of manually measured discharge, which includes a large portion of the low flow period. It is advised that the streamflow gauging program at BR137 be continued in order to gain a greater understanding of interannual streamflow variability in the southern portions of the Project area. Additionally, the collection of discharge measurements to further refine the rating curve should be continued.

3.17 MARY RIVER AT THE OUTLET OF MARY LAKE (WSC 06SA001)

In August 2006, a streamflow gauging station was established on the Mary River by Water Survey of Canada at the request of and with funding from Baffinland Iron Mines Corporation. The location of the gauging station is shown on Figure 1.1. Daily flow data for 2006 through 2008 were provided by WSC and are presented on Figure 3.28. Average monthly discharge and unit runoff values are summarized in Table 3.15.

3.18 RAVN RIVER AT THE OUTLET OF ANGAJURJUALUK LAKE (WSC 06SA002)

In August 2006, a streamflow gauging station was established on the Ravn River by Water Survey of Canada (WSC) at the request of and with funding from Baffinland Iron Mines Corporation. The location of the gauging station is shown on Figure 1.1. Daily flow data for 2006 through 2008 were provided by WSC and are presented on Figure 3.29. Average monthly discharge and unit runoff values are summarized in Table 3.16.

3.19 ROWLEY RIVER ABOVE SEPARATION LAKE (WSC 06SB002)

In August 2006, a streamflow gauging station was established on the Rowley River by Water Survey of Canada (WSC) at the request of and with funding from Baffinland Iron Mines Corporation. The location of the gauging station is shown on Figure 1.1. Daily flow data for 2006 through 2008 were provided by WSC and are presented on Figure 3.30. Average monthly discharge and unit runoff values are summarized in Table 3.17.

3.20 ISORTOQ RIVER AT THE OUTLET OF ISORTOQ LAKE (WSC 06SB001)

In August 2006, a streamflow gauging station was established on the Isortoq River by Water Survey of Canada (WSC) at the request of and with funding from Baffinland Iron Mines Corporation. The location of the gauging station is shown on Figure 1.1. Daily flow data for 2006 through 2008 were provided by WSC and are presented on Figure 3.31. Average monthly discharge and unit runoff values are summarized in Table 3.18.

SECTION 4.0 - REGIONAL HYDROLOGIC ANALYSIS

A regional hydrologic analysis was carried out in 2008 using streamflow data collected in 2007. The analysis attempted to develop long-term synthetic streamflow series for the hydrologic stations at Mary River. The development of synthetic flow series would allow the long-term hydrologic variability within the Project Area to be assessed, and return period flood flows, drought low flow values, long term means, etc. to be calculated. However, the analysis was inhibited by a paucity of long-term regional data, and correlation relationships between the Mary River hydrologic stations (H1-H9) and regional stations could not be developed. Eventually, it was assumed that 2007 annual mean discharges at the streamflow gauging stations were 15% greater than long-term average conditions, based Nanisivik and Hall Beach precipitation records. A more thorough explanation of how the long-term flow estimates were generated and a discussion of the regional correlation attempts is provided in Appendix B.

The above analysis was reassessed in early 2009 after analyzing the 2008 hydrologic data and receiving 2008 precipitation data for Hall Beach from Environment Canada. The reassessment of the above procedure disproved the assumption that Hall Beach precipitation was correlated to streamflow at Mary River. This realization was provided by comparison of the 2007 and 2008 data. In 2008, the annual mean discharge at stations H1-H9 averaged 180% of the 2007 annual mean discharge, however at Hall Beach total 2008 precipitation was only 67% of the total precipitation that occurred in 2007.

In an attempt to derive a new estimate of long-term mean annual discharge (MAD) at H1-H9, the mean annual unit runoff (MAUR) values of the five regional stations discussed in Section 2 and detailed in Table 2.1 were compared. The three stations to the north of Mary River, (Allen River, Mecham River and Marcil Creek) had an average MAUR of 5.6 l/s/km^2, ranging from 4.0 to 7.3 l/s/km^2 for the years of 1971, 1977-1979 and 1981. The northern watersheds also contained little to no lakes, very similar to most of the gauged Mary River watersheds. The southern hydrologic stations (Apex River and Sylvia Grinell River) recorded an average MAUR of 10.4 l/s/km^2, ranging from 10.1 to 10.6 l/s/km^2 for the years of 1971-1973, 1982-1992, 1994-1995 and 2007. However, these watersheds contain significant lake fractions, and as measured data near Mary River suggest the larger water surface area can result in much higher evaporation volumes and consequently lower unit runoff rates than would occur if no lakes were present in the watershed. Therefore, higher MAUR rates would be expected in lakeless watersheds near the southern hydrologic stations. The average unit runoff of all stations is 8 l/s/km^2.

The regional value of 8 l/s/km^2 was then compared to the mean annual unit runoffs measured at Mary River. The 2007 average MAUR for sites H1-H9 was 6.4 l/s/km^2 while the 2008 average MAUR for these stations was 11.4 l/s/km^2. The average MAUR for these two years is 9 l/s/km^2. This average is very similar to the average regional MAUR of 8 l/s/km^2, especially given that the regional value is likely lower than it would be if the southern stations had watershed characteristics more similar to H1-H9. Therefore, it was assumed that the average of the 2007 and 2008 MAUR values, and by extension the average of the MAD values, for stations H1-H9 is reasonably representative of the long-term means. A summary of the long-term MAD and MAUR values for stations H1-H9 is provided in Table 4.1.

The values presented in Table 4.1 were derived from limited hydrologic data and analysis involving numerous assumptions. The values should therefore be considered estimates and used as such. The values may also be subject to revision as more data become available.

SECTION 5.0 - PEAK FLOW ESTIMATES

For the purpose of designing river and creek crossings and other mine infrastructure, it was necessary to develop a design flow model. The hydrologic data currently being collected in the project area are of a short period of record and are not generally appropriate for this application. Rather, long-term historical peak flow and extreme rainfall data collected by Environment Canada were used. These data were combined with an understanding of the hydrologic characteristics of the area to develop a series of peak flow scaling equations. Each equation corresponds to a different return period (flood severity) and requires an input of drainage area to generate a design flow estimate. The equations for return periods of 2 years, 5 years, 10 years, 25 years and 100 years are presented, as follows:

$$\mathbf{Q_2 = 1.1 \times A^{0.79}}$$

$$\mathbf{Q_5 = 1.7 \times A^{0.77}}$$

$$\mathbf{Q_{10} = 2.0 \times A^{0.76}}$$

$$\mathbf{Q_{25} = 2.6 \times A^{0.75}}$$

$$\mathbf{Q_{100} = 3.5 \times A^{0.73}}$$

Where, Q = peak instantaneous flow in m^3/s
A = drainage area in km^2

These equations were developed according to a regional scaling model using linear moment (L-moment) statistics computed from the historical peak daily flow records for five WSC stations, which are summarized in Table 2.1. Given the regional data available, the model was considered appropriate for catchments ranging in size from 0.5 km^2 to 1000 km^2. A complete discussion of the methodology, assumptions and statistics used to develop the return period discharge equations above is provided in Appendix C.

To assess the validity of the results of this peak flow analysis the equations above were applied to the Project hydrology stations. These results are presented in Table 5.1, while Figure 5.1 shows a comparison of the maximum recorded instantaneous flow at each project station and the estimated return period peak flows. All stations were plotted, even those with catchment areas greater than 1000 km^2. The maximum recorded instantaneous peak flow at most stations lie near the predicted 2-year return period flow and less than the 5-year return period flow. Given the period of record at the stations, this result suggests the peak flow model produces reasonable results. Three outliers are H9, BR137 and the Isortoq River. However, these stations are also hydrologically different to the stations used to produce the peak flow models. The watersheds of BR137 and H9 have very large proportions of lakes within their watersheds, which attenuate peak flow events. Consequently, the peak flows within these basins are significantly lower than were predicted using a model based on watersheds with less extensive lake coverage. The Isortoq River watershed recorded a significantly higher peak flow event, with a return period of approximately 10 years. The catchment area above the Isortoq River gauging station is

7121 km^2, so the station is well above the recommended 1000 km^2 maximum catchment size. But, rather than catchment size the high peak flow is likely a result of the approximately 950 km^2 of the Barnes Ice Cap that lies within the Isortoq watershed, which equates to 13% of the total drainage area. The peak flow events within this watershed result from a combination of snow and glacier melt, as opposed to only snowmelt or precipitation within the regional watersheds used to develop the peak flow model.

Given the paucity of regional data available for peak flow prediction, there is undoubtedly a significant level of uncertainty associated with such predictions. However, given the measured results, it is believed that the peak flow model has appropriate predictive capabilities. As highlighted by data from H9, BR137 and Isortoq River, site specific conditions must also be considered when applying the model.

SECTION 6.0 - WET AND DRY RETURN PERIOD ANALYSIS

Annual discharges for wet and dry year return periods were estimated for sites H1-H9. These values illustrate the range of annual discharges that likely occur at each site, and are commonly used in different design aspects of the mine, such as water management plans or impact assessment. The analysis made use of the long-term mean annual discharges (MAD) calculated in Section 4, a coefficient of variation (CV) of 0.25, and assumed an Extreme Value Type 1 (Gumbel) distribution. Annual mean discharges were calculated for return periods of 10 years, as shown on Table 4.1, and 20, 50 and 100 years as shown on Table 6.1.

The coefficient of variation (CV) representative of the Mary River watersheds was derived from the CVs of regional precipitation and streamflow stations, as plotted on Figure 6.1. This figure clearly exhibits the greater variability in annual precipitation when compared to annual streamflow, which is common. Due to the paucity of hydrologic data within the region and in an effort to be conservative, an envelope curve was placed above all of the regional streamflow CVs to represent the mine site streamflow CV. Therefore the CV applied to stations H1-H9 is 0.25.

The return period analysis also assumed that long-term MAD data would fit a Gumbel distribution. The Gumbel distribution was selected as it is a common distribution often fitted to different types of hydrologic data, and regional annual precipitation data was also found to best fit a Gumbel distribution. The statistical software package @RISK was used to model a Gumbel distribution unique to each sites MAD and CV, from which the return period values were derived. These values, shown in Tables 4.1 and 6.1, were developed from limited data, as were the long-term mean flows discussed in Section 4. These values should be applied with appropriate conservatism.

SECTION 7.0 - GROUNDWATER HYDROLOGY

The Mary River Project is located in a zone of continuous permafrost. The active layer in the Project area ranges from approximately 1 m to 2 m in depth, but may be greater in areas where there is loose, sandy soil at the edges of lakes or rivers.

The depth of permafrost in the region is in the order of a half kilometre, based on ground temperature measurements at the former Nanisivik Mine located 270 km northwest of Mary River, where permafrost has been measured at depths greater than 430 m (Gartner Lee, 2003). Boreholes located 450 km west and 450 km south of Pond Inlet indicate permafrost thicknesses of 500 m and 400 m, respectively (Geological Survey of Canada, 2006). A deep thermistor (approx. 400 m) installed near Mary River's No. 1 Deposit during 2007, indicates that the permafrost depth may approach 700 m below the deposit.

Based on this information, it can be assumed that groundwater infiltration and storage is minimal, which is reflected in the observed rapid runoff response of streams to rainfall events. Further, small diurnal fluctuations in the flow patterns are evident in the late July and August base flows, and these may be due to melting of the active permafrost layer as temperatures vary.

SECTION 8.0 - CLIMATE CHANGE

According to the Intergovernmental Panel on Climate Change (IPCC) mission statement, they have been "assess(ing) on a comprehensive, objective, open and transparent basis, the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation" (IPCC, 2004). A significant part of their work has been summarizing the numerous modelling efforts that attempt to predict future climate change under different scenarios. The scenario most often used as a baseline for modelling current and future climate change is the A1B scenario, which represents a future with ""Balanced" progress across all resources and technologies from energy supply to end use (Morita *et al.*, 1998)", in regards to efforts to minimize climate change and reduce greenhouse gas emissions. It is a 'middle-of-the-road' scenario, neither predicting extreme nor minor climate changes, and is used frequently by the IPCC to estimate mean effects of climate change for different areas. For the Arctic, and the Mary River Mine Site in particular, the ensemble mean of 21 different climate models for the A1B scenario predicts significant increases in both temperature and precipitation by 2080-2099 compared to 1980-1999 mean values, as presented on Figure 8.1 and Figure 8.2. Mean annual temperature is predicted by all 21 models to increase by approximately 4 - 7 ^{o}C by the end of the 21st century in the region of the Mary River Mine Site., with mean December, January and February (DJF) temperatures rising by over 7 ^{o}C and mean June, July and August (JJA) temperatures increasing by approximately 2.5 ^{o}C. An increase in mean annual precipitation was also predicted for northern Baffin Island by 2080-2099, the average of which predicts an increase of 15%-30% over 1980-1999 levels. The mean DJF precipitation is expected to increase approximately 30%, while the mean JJA precipitation is expected to increase by 10%-15%.

The effects of the predicted increases in temperature and precipitation on the hydrology of streams in the Mary River Project area are not easy to determine. For instance, increases in precipitation may not necessarily lead to increases in runoff as they may be offset by higher evaporation rates driven by warmer temperatures. Along similar lines, a shorter winter season resulting from warmer temperatures may not lead to smaller spring freshet flows, since higher winter precipitation may be enough to offset the shorter snow-accumulation period. The IPCC predicts that streamflow throughout the Arctic will increase by at least 20% by 2090-2099 over 1980-1999 levels. This is based upon 12 models using the A1B scenario, however they warn that the map in Figure 8.3 is for large scale use only, and should not be applied to more local scales. Also, annual precipitation within the Project area is quite low, so a large percentage increase in precipitation may not result in a large absolute increase in precipitation.

Data collected at the Hall Beach climate station, one of the longest running, most complete regionally representative Environment Canada climate stations in the vicinity of Mary River, lends support to some of the IPCC predictions. As presented on Figure 8.4, the annual average temperature has been rising at a mean rate of 0.4 ^{o}C per decade (statistically significant at the 0.01 significance level) for the last half century. This is similar to the IPCC prediction, as is the increasing summer (JJA) temperature which has been rising at 0.3 ^{o}C per decade (statistically significant at the 0.05 significance level). However the biggest temperature increases have occurred during March through May (MAM) and September through

November (SON), with average mean monthly temperature increases of 0.6 and 0.7 ^{o}C per decade respectively (both statistically significant at the 0.01 significance level), whereas the period of December through February (DJF), predicted by IPCC to record the greatest increase in temperature throughout the next century, did not register a statistically significant trend at any reasonable significance level between 1959 and 2003. The same analysis was conducted using precipitation data, and like winter temperature most trends were not statistically significant at any reasonable level, however a strong increasing trend was identified during the SON period of 2.5 mm/decade, significant at the 0.05 level, as shown on Figure 8.5.

A recent memo by Rowan Williams Davies and Irwin Inc. (RWDI), which outlines the effects of climate change at the Project site, agrees with the IPCC findings above. They also predict that climate change should alter the shape of the annual hydrograph, as increases in temperature result in an earlier freshet, less precipitation falling as snow which in turn would result in a smaller freshet, and increased intensity of storm events resulting in larger peak runoffs. Other effects of climate change in the Arctic include shrinking glacial and sea-ice cover, changes in permafrost, especially the active layer, and biotic impacts.

Despite the difficulty in predicting what effects climate change will have on the various natural processes operating at the Mary River Mine Site, the current climate models indicate that temperature, precipitation and runoff will increase throughout the rest of the century. However, due to the interdependent nature of the physical processes operating at the Mine Site, it is extremely difficult to predict what net effects such potential changes will have. It is recommended that these predicted changes be considered, and appropriate conservatism be incorporated into hydrologic decisions.

SECTION 9.0 - CONCLUSIONS AND RECOMMENDATIONS

This report presented a summary of the hydrologic data collected at 18 streamflow gauging stations as a part of baseline studies for Baffinland Iron Mine Corporation's Mary River Project. These data, in addition to regional data, provide the basis for hydrologic analysis for engineering design and environmental assessment of the project. The key findings presented in this report are based on data collected between July 2006 and September 2008 at the original nine Knight Piésold Ltd (KPL) stations (H1-H9), between June 2007 and October 2008 at the four Water Survey of Canada (WSC) stations, and between June and September 2008 at the five new KPL stations.

The key findings within this report pertain to four main categories: hydrograph shape, runoff, variations within both the hydrograph and runoff, and long-term streamflow estimates. The characteristics of hydrographs in the vicinity of Mary River are as follows:

- Streamflow typically commences in early to mid June as temperatures climb above 0 ^{o}C, and ends in late September to late October, depending upon watershed characteristics.
- The annual hydrograph is dominated by a nival freshet which occurs between late June and the end of July, followed by a period of low baseflows driven by permafrost melt and shallow subsurface flow and punctuated by precipitation events through July to early September.
- Precipitation runoff events are usually quite large and flows increase rapidly as interception, infiltration, and evaporation or transpiration are minimal due to shallow permafrost, cool temperatures and lack of vegetative cover.

As with the hydrograph shape, streamflow values were first estimated from regional analysis and then validated by onsite measurements. Initial estimates suggested that mean annual unit runoff (MAUR) in the vicinity of Mary River should be less than 10 l/s/km^2. They also suggested that mean annual peak daily unit runoff values likely range from less than 100 l/s/km^2 for watersheds with significant lake volumes, to approximately 400 l/s/km^2 for smaller watersheds without lakes. The actual measured results validate these estimates and are as follows:

- Watersheds H1-H9 operated by KPL had an average MAUR of 9 l/s/km^2 for the years of 2007 and 2008. The lowest measured mean annual unit runoff was recorded at H9 in 2007 at 3.3 l/s/km^2. The highest mean annual unit runoff of 19.0 l/s/km^2 was recorded in 2008 within the Isortoq River watershed, which contains significant glacial cover. The highest mean annual unit runoff measured in a non-glaciated catchment was 18.0 l/s/km^2 in the BR11 watershed during 2008.
- The annual maximum peak daily unit runoff varied greatly among the sites, and resulted from snowmelt events, precipitation events, as well as combinations of both. The lowest peak daily unit runoff was 65 l/s/km^2 within the extensively lake covered BR137 catchment during 2008. The highest annual peak daily unit runoff was also recorded in 2008 within the BR11 watershed, which registered a unit runoff of 306 l/s/km^2.

As noted above, significant variation was recorded within both the annual hydrograph shape and the volume and intensity of unit runoff. Numerous factors can be attributed to this variation, but the primary factors are listed below:

- The proportion of lakes within a watershed has a significant effect on both the hydrograph shape and unit runoff. Because the lakes are still free of ice when precipitation begins to fall as snow and permafrost melt ends, rivers fed by lakes freeze up approximately a month later than systems that do not include lakes. Furthermore, lakes attenuate rapid runoff events as well diurnal fluctuations in runoff, resulting in much lower intensity and longer lasting storm event runoff peaks and an overall smoother hydrograph. Lakes also allow larger volumes of water to evaporate than does the surrounding land, therefore lowering the mean annual unit runoff in catchments with large lake components.
- In smaller watersheds, windblown snow deposition may act to increase and/or decrease the mean annual unit runoff depending on whether a net gain or net loss of snow is occurring within the watershed.

Finally, an attempt was made to develop long-term synthetic streamflow series for the hydrologic stations at Mary River, along with peak instantaneous flow return period discharges. Results are summarized as follows:

- The long-term mean annual unit runoff values ranged from 5 $l/s/km^2$ at H9 to 12 $l/s/km^2$ at H3. The average mean annual unit runoff for all stations was 9 $l/s/km^2$.
- The 10-year wet return period annual unit runoff ranged from 7 $l/s/km^2$ to 16 $l/s/km^2$. The 10-year dry return period annual unit runoff ranged from 4 $l/s/km^2$ to 9 $l/s/km^2$. Longer return period flows were also calculated.
- Peak measured discharges were generally scattered from just less than the 2-year return period flow up to the 5-year return period flow, as would be expected for records of this length, validating the peak discharge return period analysis. Outliers included the Isortoq River, whose high flows were a result of the large glacial component of its watershed, and H9 and BR137 whose low peak flows resulted from substantial lake attenuation.

Climate change was also discussed within this report as it pertains to the Mary River Mine Site. It was concluded that a conservative approach should be applied to hydrologic estimates to account for potential changes in annual, seasonal and extreme flow events due to climate change.

The hydrologic data collected at the 18 stations are of good quality for the stations installed in 2006 and 2007. However, the rating curves developed for the five stations installed during 2008 are only of moderate quality, as they lack the number of points required to be more robust. Two-and-a-half years of data are also insufficient to properly assess long term hydrologic conditions. Combined with a paucity of regional data, it is recommended that the collection of streamflow data be continued at all sites in an effort to better quantify hydrologic variability in the area. Furthermore, discharge measurements should continue to be collected at the new stations in order to strengthen their rating curves.

SECTION 10.0 - REFERENCES

Christensen, J.H., B. Hewitson, A. Busuioc, A. Chen, X. Gao, I. Held, R. Jones, R.K. Kolli, W.-T. Kwon, R. Laprise, V. Magaña Rueda, L. Mearns, C.G. Menéndez, J. Räisänen, A. Rinke, A. Sarr and P. Whetton, 2007: Regional Climate Projections. In: *Climate Change 2007:* The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Bernstein et. al, 2007: Synthesis Report. In: *Climate Change 2007* [Abdelkader A. et. al (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Gartner Lee Ltd., 2003. Phase II Environmental Site Assessment Nanisivik Mine, Nunavut. Gartner Lee, Jan. 2003.

Natural Resources Canada. Permafrost - Canadian Geothermal Data Collection. 6 Jan. 2006. 16 Nov. 2006. <http://gsc.nrcan.gc.ca/permafrost/geothermaldb/index_e.php>.

Liston and Sturm. The Role of Winter Sublimation in the Arctic Moisture Budget. Nordic Hydrology 2004;35(4-5):325-334.

Maidment, D.R., 1993. *Handbook of Hydrology*. McGraw-Hill, Inc., New York, New York.

Morita et al. A1 Marker Scenario. Accessed December 9, 2008 from the World Wide Web: http://sres.ciesin.org/OpenProcess/htmls/A1_marker_scenario.html

SECTION 11.0 - CERTIFICATION

This report was prepared, reviewed and approved by the undersigned.

Prepared: ______________________ ______________________

Kyle Terry, B.Sc.,
Staff GeoScientist

PROFESSIONAL PROVINCE OF T. J. PERKINS # 32079 BRITISH COLUMBIA ENGINEER

Feb. 2/09

Toby Perkins, M.A.Sc., P.Eng.
Project Engineer

Reviewed: ______________________

Jaime Cathcart, Ph.D., P.Eng.
Specialist Hydrotechnical Engineer

Approved: ______________________

pe. Jeremy Haile, P.Eng.
Principal

Knight Piésold CONSULTING

TABLE 1.1

BAFFINLAND IRON MINES
MARY RIVER PROJECT

SUMMARY OF HYDROLOGY MONITORING STATION CHARACTERISTICS AND LOCATION

Print Jan/30/09 16:32:20

Stations	Station Type	Period of Record	Drainage Area (km^2)	Coordinates (UTM)		
				Zone	Easting	Northing
H01	Streamflow	2006-2008	250	17W	532831	7946247
H02	Streamflow	2006-2008	210	17W	555712	7915514
H03	Streamflow	2006-2008	30.5	17W	557485	7919401
H04	Streamflow	2006-2008	9.6	17W	557639	7915579
H05	Streamflow	2006-2008	5.3	17W	558906	7915079
H06	Streamflow	2006-2008	243	17W	563922	7912984
H07	Streamflow	2006-2008	14.8	17W	564451	7913194
H08	Streamflow	2006-2008	211	17W	568732	7912881
H09	Streamflow	2006-2008	157	17W	576011	7847687
H10	Water Level	2008	8.2	17W	560905	7911838
BR11	Streamflow	2008	52.7	17W	573122	7904914
BR25	Streamflow	2008	113	17W	585420	7900082
BR96-2	Streamflow	2008	30.7	17W	609300	7839474
BR137	Streamflow	2008	308	17W	598663	7807981
Isortoq River	Streamflow	2007-2008	7170	18W	432810	7780920
Mary River	Streamflow	2007-2008	690	17W	556360	7903750
Ravn River	Streamflow	2007-2008	8220	17W	558020	7894160
Rowley River	Streamflow	2007-2008	3500	18W	411230	7818830

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\[Watershed Characteristics Table.xls]Table

NOTES:

1. STATIONS H1 THROUGH BR137 ARE OPERATED BY KNIGHT PIESOLD LTD. (KPL)
2. THE ISORTOQ, MARY, RAVN AND ROWLEY RIVER STATIONS ARE OPERATED BY WATER SURVEY OF CANADA (WSC)

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	16JAN'09	ISSUED WITH REPORT NB102-181/11-8	KT	TJP	JGC

Knight Piésold
CONSULTING

TABLE 2.1

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

REGIONAL STREAMFLOW MONITORING STATIONS

Print Feb/02/09 8:34:10

Section Name	ID	Period of Record	# of Years with a Complete Summer Record	Latitude	Longitude	Catchment Area (km2)	Mean Annual Discharge (m3/s)	Average Annual Unit Runoff (l/s/km2)	Average Unit Runoff (June - September) (l/s/km2)	Distance from Mary River (km2)
Apex River at Apex	10UH002	1973 - 2007	7	63^{O}44'03"	68^{O}27'15"	58.5	0.534	10.1	28.55	965
Allen River near mouth	10VC001	1970 - 1984	4	74^{O}50'48"	95^{O}03'31"	448	2.46	5.5	15.69	635
Mecham River near Resolute	10UJ001	1971 - 1979	3	74^{O}41'24"	94^{O}47'10"	86.8	0.63	7.3	17.17	620
Marcil Creek near Arctic Bay	10VC002	1978 - 1983	3	72^{O}59'37"	84^{O}59'16"	139	0.55	4.0	11.73	265
Sylvia Grinell River Near Iqaluit	10UB001	1971 - 2007	15	63^{O}45'59"	68^{O}34'50"	2980	29.81	10.6	31.45	960

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\Regional Analysis\[Table 2.1.xls]Table 2.1

NOTES:

1. SEE FIGURE 2.1 FOR STATION LOCATIONS

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	JM	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 3.1

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

MEASURED STREAMFLOW SUMMARY

Print Feb/02/09 10:11:04

Streamflow Station	Mean Monthly Unit Runoff ($L/s/km^2$)				Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	($L/s/km^2$)	($L/s/km^2$)
H1	30.3	41.9	21.1	9.2	22.5	7.5
H2	38.8	64.4	25.4	11.2	30.3	10.2
H3	52.6	91.2	25.6	13.0	36.8	12.3
H4	28.1	44.5	24.1	10.8	21.0	7.0
H5	37.9	40.9	25.2	10.7	23.6	7.9
H6	46.1	75.9	25.4	10.4	34.8	11.6
H7	43.5	65.2	19.1	8.7	29.2	9.7
H8	42.8	69.5	23.2	10.1	32.6	10.8
H9	19.6	15.4	15.4	9.7	12.3	5.1
Average	38	57	23	10	27	9

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\Summary\[Summary.xls]Table 1

NOTES:
1) THE ABOVE VALUES WERE CALCULATED USING BOTH MEASURED AND SYNTHETIC DATA FOR 2007 AND 2008 ONLY

0	13JAN'09	ISSUED WITH REPORT NB102-181/11-8	KT	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 3.2

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

H1 - NORTHERN ACCESS ROUTE
STREAMFLOW RECORD SUMMARY

Print Jan/19/09 12:43:57

YEAR	Mean Monthly Measured Discharge (m^3/s)				Mean Discharge (June - Sept)	MAD
	June	July	August	September	(m^3/s)	(m^3/s)
2006	-	15.0	5.5	3.9	-	-
2007	4.6	6.6	3.5	0.8	3.9	1.3
2008	10.6	9.8	6.9	2.2	7.4	2.5

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)				Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	($L/s/km^2$)	($L/s/km^2$)
2006	-	59.9	21.9	15.8	-	-
2007	18.2	26.5	13.9	3.2	15.5	5.2
2008	42.4	39.1	27.5	8.7	29.5	9.9

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\H1\[H1 Measured String File_KT_Sept22'08.xls]Table

NOTES:
1. DRAINAGE AREA OF H1 IS 250.2 km^2.
2. THE FLOWS PRESENTED ABOVE INCLUDE SYNTHETIC FLOWS FOR THE LOW FLOW PERIODS BETWEEN THE INFERRED ZERO FLOW IN THE CHANNEL AND THE INSTALL AND UNINSTALL OF THE PRESSURE TRANSDUCER.
3. THE FLOWS PRESENTED ABOVE ASSUME THAT ON AVERAGE, MEASUREABLE FLOW BEGINS JUNE 1 AND ENDS SEPT 30.
4. NO STREAMFLOW WAS MEASURED DURING JUNE 2006, AND THEREFORE ANNUAL VALUES COULD NOT BE CALCULATED.
5. WATER WAS OBSERVED IN THE CHANNEL IN MID TO LATE MAY 2008, PRIOR TO THE PRESSURE TRANSDUCER'S INSTALLATION, HOWEVER THROUGH VISUAL OBSERVATIONS AND POINT DISCHARGE MEASUREMENTS THE VOLUME OF FLOW WAS DEEMED NEGLIGIBLE.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	KT	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 3.3

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

H2 - TOM RIVER
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/19/09 12:50:47

YEAR	Mean Monthly Measured Discharge (m^3/s)				Mean Discharge (June - Sept)	MAD
	June	July	August	September	(m^3/s)	(m^3/s)
2006	-	20.3	5.3	3.4	-	-
2007	4.6	7.7	4.0	1.2	4.4	1.5
2008	11.7	12.5	6.7	2.5	8.3	2.8

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)				Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	($L/s/km^2$)	($L/s/km^2$)
2006	-	96.9	25.4	16.1	-	-
2007	22.0	36.7	18.9	5.6	20.8	7.0
2008	55.6	59.5	31.9	12.0	39.7	13.3

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\H2\[H2 Measured String File_KT_Sept23'08.xls]Table

NOTES:
1. DRAINAGE AREA OF H2 IS 209.5 km^2.
2. THE FLOWS PRESENTED ABOVE INCLUDE SYNTHETIC FLOWS FOR THE LOW FLOW PERIODS BETWEEN THE INFERRED ZERO FLOW IN THE CHANNEL AND THE INSTALL AND UNINSTALL OF THE PRESSURE TRANSDUCER.
3. THE FLOWS PRESENTED ABOVE ASSUME THAT ON AVERAGE, MEASUREABLE FLOW BEGINS JUNE 1 AND ENDS SEPT 30.
4. NO STREAMFLOW WAS MEASURED DURING JUNE 2006, AND THEREFORE ANNUAL VALUES COULD NOT BE CALCULATED.
5. WATER WAS OBSERVED IN THE CHANNEL IN MID TO LATE MAY 2008, PRIOR TO THE PRESSURE TRANSDUCER'S INSTALLATION, HOWEVER THROUGH VISUAL OBSERVATIONS AND POINT DISCHARGE MEASUREMENTS THE VOLUME OF FLOW WAS DEEMED NEGLIGIBLE.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	KT	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold
CONSULTING

TABLE 3.4

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

H3 - TOM RIVER TRIBUTARY
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/19/09 12:59:06

YEAR	Mean Monthly Measured Discharge (m^3/s)				Mean Discharge (June - Sept)	MAD
	June	July	August	September	(m^3/s)	(m^3/s)
2006	-	4.7	0.8	0.6	-	-
2007	0.9	1.4	0.5	0.1	0.7	0.2
2008	2.3	2.2	1.0	6.4	1.5	0.5

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)				Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	($L/s/km^2$)	($L/s/km^2$)
2006	-	155.7	26.9	19.5	-	-
2007	29.7	46.6	15.4	3.7	24.0	8.0
2008	75.5	71.4	34.4	210.5	49.5	16.6

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\H3\[H3 Measured String File_KT_Sept23'08.xls]Table

NOTES:
1. DRAINAGE AREA OF H3 IS 30.5 km^2.
2. THE FLOWS PRESENTED ABOVE INCLUDE SYNTHETIC FLOWS FOR THE LOW FLOW PERIODS BETWEEN THE INFERRED ZERO FLOW IN THE CHANNEL AND THE INSTALL AND UNINSTALL OF THE PRESSURE TRANSDUCER.
3. THE FLOWS PRESENTED ABOVE ASSUME THAT ON AVERAGE, MEASUREABLE FLOW BEGINS JUNE 1 AND ENDS SEPT 30.
4. NO STREAMFLOW WAS MEASURED DURING JUNE 2006, AND THEREFORE ANNUAL VALUES COULD NOT BE CALCULATED.
5. WATER WAS OBSERVED IN THE CHANNEL IN MID TO LATE MAY 2008, PRIOR TO THE PRESSURE TRANSDUCER'S INSTALLATION, HOWEVER THROUGH VISUAL OBSERVATIONS AND POINT DISCHARGE MEASUREMENTS THE VOLUME OF FLOW WAS DEEMED NEGLIGIBLE.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	KT	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 3.5

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

H4 - OPPOSITE CAMP
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/27/09 14:16:35

YEAR	Mean Monthly Measured Discharge (m^3/s)				Mean Discharge (June - Sept)	MAD
	June	July	August	September	(m^3/s)	(m^3/s)
2006	-	0.76	0.29	0.16	-	-
2007	0.14	0.20	0.14	0.06	0.14	0.05
2008	0.40	0.32	0.26	0.09	0.27	0.09

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)				Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	($L/s/km^2$)	($L/s/km^2$)
2006	-	79.0	30.4	16.9	-	-
2007	14.9	21.1	15.1	6.2	14.4	4.8
2008	41.4	33.2	26.7	9.3	27.7	9.3

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\H4\[H4 Measured String File_KT_Sept24'08.xls]Table

NOTES:
1. DRAINAGE AREA OF H4 IS 9.6 km^2.
2. THE FLOWS PRESENTED ABOVE INCLUDE SYNTHETIC FLOWS FOR THE LOW FLOW PERIODS BETWEEN THE INFERRED ZERO FLOW IN THE CHANNEL AND THE INSTALL AND UNINSTALL OF THE PRESSURE TRANSDUCER.
3. THE FLOWS PRESENTED ABOVE ASSUME THAT ON AVERAGE, MEASUREABLE FLOW BEGINS JUNE 1 AND ENDS SEPT 30.
4. NO STREAMFLOW WAS MEASURED DURING JUNE 2006, AND THEREFORE ANNUAL VALUES COULD NOT BE CALCULATED.
5. WATER WAS OBSERVED IN THE CHANNEL IN MID TO LATE MAY 2008, PRIOR TO THE PRESSURE TRANSDUCER'S INSTALLATION, HOWEVER THROUGH VISUAL OBSERVATIONS AND POINT DISCHARGE MEASUREMENTS THE VOLUME OF FLOW WAS DEEMED NEGLIGIBLE.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	KT	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold
CONSULTING

TABLE 3.6

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

H5 - NORTH OF CAMP
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/19/09 13:10:28

YEAR	Mean Monthly Measured Discharge (m^3/s)				Mean Discharge (June - Sept)	MAD
	June	July	August	September	(m^3/s)	(m^3/s)
2006	-	0.40	0.14	0.08	-	-
2007	0.12	0.10	0.10	0.03	0.09	0.03
2008	0.28	0.15	0.15	0.06	0.16	0.05

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)				Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	($L/s/km^2$)	($L/s/km^2$)
2006	-	75.0	27.3	15.7	-	-
2007	22.9	19.3	19.3	6.1	17.0	5.7
2008	53.0	28.4	29.0	10.4	30.2	10.1

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\H5\[H5 Measured String File_KT_Sept24'08.xls]Table

NOTES:

1. DRAINAGE AREA OF H5 IS 5.3 km^2.
2. THE FLOWS PRESENTED ABOVE INCLUDE SYNTHETIC FLOWS FOR THE LOW FLOW PERIODS BETWEEN THE INFERRED ZERO FLOW IN THE CHANNEL AND THE INSTALL AND UNINSTALL OF THE PRESSURE TRANSDUCER.
3. THE FLOWS PRESENTED ABOVE ASSUME THAT ON AVERAGE, MEASUREABLE FLOW BEGINS JUNE 1 AND ENDS SEPT 30.
4. NO STREAMFLOW WAS MEASURED DURING JUNE 2006, AND THEREFORE ANNUAL VALUES COULD NOT BE CALCULATED.
5. WATER WAS OBSERVED IN THE CHANNEL IN MID TO LATE MAY 2008, PRIOR TO THE PRESSURE TRANSDUCER'S INSTALLATION, HOWEVER THROUGH VISUAL OBSERVATIONS AND POINT DISCHARGE MEASUREMENTS THE VOLUME OF FLOW WAS DEEMED NEGLIGIBLE.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	KT	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 3.7

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

H6 - MARY RIVER
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/27/09 14:18:26

YEAR	Mean Monthly Measured Discharge (m^3/s)				Mean Discharge (June - Sept)	MAD
	June	July	August	September	(m^3/s)	(m^3/s)
2006	-	26.35	5.93	3.49	-	-
2007	6.65	11.57	4.92	0.98	6.03	2.03
2008	15.48	16.76	7.44	2.99	10.67	3.52

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)				Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	($L/s/km^2$)	($L/s/km^2$)
2006	-	109.8	24.7	14.6	-	-
2007	27.7	48.2	20.5	4.1	25.1	8.5
2008	64.5	69.8	31.0	12.4	44.4	14.7

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\H6\[H6 Measured String File_KT_Nov26'08.xls]Table

NOTES:
1. DRAINAGE AREA OF H6 IS 240 km^2.
2. THE FLOWS PRESENTED ABOVE INCLUDE SYNTHETIC FLOWS FOR THE LOW FLOW PERIODS BETWEEN THE INFERRED ZERO FLOW IN THE CHANNEL AND THE INSTALL AND UNINSTALL OF THE PRESSURE TRANSDUCER.
3. THE FLOWS PRESENTED ABOVE ASSUME THAT ON AVERAGE, MEASUREABLE FLOW BEGINS JUNE 1 AND ENDS SEPT 30.
4. NO STREAMFLOW WAS MEASURED DURING JUNE 2006, AND THEREFORE ANNUAL VALUES COULD NOT BE CALCULATED.
5. WATER WAS OBSERVED IN THE CHANNEL IN MID TO LATE MAY 2008, PRIOR TO THE PRESSURE TRANSDUCER'S INSTALLATION, HOWEVER THROUGH VISUAL OBSERVATIONS AND POINT DISCHARGE MEASUREMENTS THE VOLUME OF FLOW WAS DEEMED NEGLIGIBLE.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	KT	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 3.8

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

H7 - MARY RIVER TRIBUTARY
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/19/09 13:35:03

YEAR	Mean Monthly Measured Discharge (m^3/s)				Mean Discharge (June - Sept)	MAD
	June	July	August	September	(m^3/s)	(m^3/s)
2006	-	1.51	0.27	0.16	-	-
2007	0.37	0.57	0.24	0.07	0.32	0.11
2008	0.91	0.79	0.33	0.15	0.54	0.18

YEAR	Mean Monthly Measured Unit Runoff ($L/s/km^2$)				Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	($L/s/km^2$)	($L/s/km^2$)
2006	-	102.6	18.6	11.0	-	-
2007	25.4	39.0	16.5	4.7	21.5	7.2
2008	61.6	53.9	22.2	10.4	37.0	12.2

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\H7\[H7 Measured String File_KT_Nov26'08.xls]Table

NOTES:
1. DRAINAGE AREA OF H7 IS 14.7 km^2.
2. THE FLOWS PRESENTED ABOVE INCLUDE SYNTHETIC FLOWS FOR THE LOW FLOW PERIODS BETWEEN THE INFERRED ZERO FLOW IN THE CHANNEL AND THE INSTALL AND UNINSTALL OF THE PRESSURE TRANSDUCER.
3. THE FLOWS PRESENTED ABOVE ASSUME THAT ON AVERAGE, MEASUREABLE FLOW BEGINS JUNE 1 AND ENDS SEPT 30.
4. NO STREAMFLOW WAS MEASURED DURING JUNE 2006, AND THEREFORE ANNUAL VALUES COULD NOT BE CALCULATED.
5. WATER WAS OBSERVED IN THE CHANNEL IN MID TO LATE MAY 2008, PRIOR TO THE PRESSURE TRANSDUCER'S INSTALLATION, HOWEVER THROUGH VISUAL OBSERVATIONS AND POINT DISCHARGE MEASUREMENTS THE VOLUME OF FLOW WAS DEEMED NEGLIGIBLE.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	KT	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 3.9

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

H8 - UPPER MARY RIVER
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/19/09 13:42:54

YEAR	Mean Monthly Measured Discharge (m^3/s)				Mean Discharge (June - Sept)	MAD
	June	July	August	September	(m^3/s)	(m^3/s)
2006	-	20.03	4.68	3.05	-	-
2007	4.95	9.87	4.30	0.86	5.03	1.68
2008	12.87	13.54	5.53	2.40	8.56	2.83

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)				Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	($L/s/km^2$)	($L/s/km^2$)
2006	-	96.1	22.5	14.6	-	-
2007	23.8	47.4	20.7	4.1	24.1	8.1
2008	61.8	64.9	26.5	11.5	41.1	13.6

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\H8\[H8 Measured String File_KT_Nov26'08.xls]Table

NOTES:
1. DRAINAGE AREA OF H8 IS 208.4 km^2.
2. THE FLOWS PRESENTED ABOVE INCLUDE SYNTHETIC FLOWS FOR THE LOW FLOW PERIODS BETWEEN THE INFERRED ZERO FLOW IN THE CHANNEL AND THE INSTALL AND UNINSTALL OF THE PRESSURE TRANSDUCER.
3. THE FLOWS PRESENTED ABOVE ASSUME THAT ON AVERAGE, MEASUREABLE FLOW BEGINS JUNE 1 AND ENDS SEPT 30.
4. NO STREAMFLOW WAS MEASURED DURING JUNE 2006, AND THEREFORE ANNUAL VALUES COULD NOT BE CALCULATED.
5. WATER WAS OBSERVED IN THE CHANNEL IN MID TO LATE MAY 2008, PRIOR TO THE PRESSURE TRANSDUCER'S INSTALLATION, HOWEVER THROUGH VISUAL OBSERVATIONS AND POINT DISCHARGE MEASUREMENTS THE VOLUME OF FLOW WAS DEEMED NEGLIGIBLE.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	KT	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 3.10

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

H9 - SOUTHERN ACCESS ROUTE
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/19/09 13:51:05

YEAR	Mean Monthly Measured Discharge (m^3/s)					Mean Discharge (June - Oct)	MAD
	June	July	August	September	October	(m^3/s)	(m^3/s)
2006	-	-	1.7	2.1	0.1	-	-
2007	1.9	2.5	1.0	0.8	0.1	1.2	0.5
2008	4.3	2.3	4.6	1.8	0.2	2.6	1.1

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)					Mean Unit Runoff (June - Oct)	MAUR
	June	July	August	September	October	($L/s/km^2$)	($L/s/km^2$)
2006	-	-	11.1	13.0	0.8	-	-
2007	12.0	15.9	6.2	4.8	0.7	7.9	3.3
2008	27.2	14.9	29.1	11.1	1.0	16.6	7.0

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\H9\[H9 Measured String File_KT_Sept30'08.xls]Table

NOTES:
1. DRAINAGE AREA OF H9 IS 157.6 km^2.
2. THE FLOWS PRESENTED ABOVE INCLUDE SYNTHETIC FLOWS FOR THE LOW FLOW PERIODS BETWEEN THE INFERRED ZERO FLOW IN THE CHANNEL AND THE INSTALL AND UNINSTALL OF THE PRESSURE TRANSDUCER.
3. THE FLOWS PRESENTED ABOVE ASSUME THAT ON AVERAGE, MEASUREABLE FLOW BEGINS JUNE 1 AND ENDS OCT 30.
4. NO STREAMFLOW WAS MEASURED DURING JUNE 2006, AND THEREFORE ANNUAL VALUES COULD NOT BE CALCULATED.
5. WATER WAS OBSERVED IN THE CHANNEL IN MID TO LATE MAY 2008, PRIOR TO THE PRESSURE TRANSDUCER'S INSTALLATION, HOWEVER THROUGH VISUAL OBSERVATIONS AND POINT DISCHARGE MEASUREMENTS THE VOLUME OF FLOW WAS DEEMED NEGLIGIBLE.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	KT	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 3.11

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

BR11
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/19/09 11:02:34

YEAR	Mean Monthly Measured Discharge (m^3/s)				Mean Discharge (June - Sept)	MAD
	June	July	August	September	(m^3/s)	(m^3/s)
2008	4.4	4.4	1.8	0.7	2.8	0.9

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)				Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	($L/s/km^2$)	($L/s/km^2$)
2008	84.4	83.8	33.3	13.9	53.9	18.0

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\BR11\[BR11 Measured String File_JM_Dec 08.xls]Table

NOTES:

1. DRAINAGE AREA OF BR11 IS 52.7 km^2.
2. THE FLOWS PRESENTED ABOVE ASSUME THAT ON AVERAGE, MEASUREABLE FLOW BEGINS JUNE 1 AND ENDS SEPT 30.

0	15DEC'08	ISSUED WITH REPORT NB102-181/11-8	JM	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 3.12

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

BR25
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/19/09 11:18:44

YEAR	Mean Monthly Measured Discharge (m^3/s)				Mean Discharge (June - Sept)	MAD
	June	July	August	September	(m^3/s)	(m^3/s)
2008	8.4	8.0	3.7	1.3	5.4	1.8

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)				Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	($L/s/km^2$)	($L/s/km^2$)
2008	74.0	70.8	32.9	11.9	47.5	15.8

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\BR25\[BR25 Measured String File_JM_Dec 08.xls]Table

NOTES:

1. DRAINAGE AREA OF BR25 IS 113.1 km^2.
2. THE FLOWS PRESENTED ABOVE ASSUME THAT ON AVERAGE, MEASUREABLE FLOW BEGINS JUNE 1 AND ENDS SEPT 30.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	JM	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

TABLE 3.13

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

BR96-2
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/19/09 11:21:55

YEAR	Mean Monthly Measured Discharge (m^3/s)				Mean Discharge (June - Sept)	MAD
	June	July	August	September	(m^3/s)	(m^3/s)
2008	1.5	1.1	1.3	0.4	1.1	0.4

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)				Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	($L/s/km^2$)	($L/s/km^2$)
2008	50.0	34.4	42.2	13.4	35.1	11.7

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\BR96-2\[BR96-2 Measured String File_JM_Dec 08.xls]Table

NOTES:

1. DRAINAGE AREA OF BR96-2 IS 30.7 km^2.
2. THE FLOWS PRESENTED ABOVE ASSUME THAT ON AVERAGE, MEASUREABLE FLOW BEGINS JUNE 1 AND ENDS SEPT 30.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	JM	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold
CONSULTING

TABLE 3.14

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

BR137
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/19/09 11:44:30

YEAR	Mean Monthly Measured Discharge (m^3/s)					Mean Discharge (June - Sept)	MAD
	June	July	August	September	October	(m^3/s)	(m^3/s)
2008	8.5	10.4	12.8	11.8	0.8	8.3	2.8

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)					Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	October	($L/s/km^2$)	($L/s/km^2$)
2008	27.5	33.7	41.6	38.4	2.4	26.9	9.0

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\BR137\[BR137 Measured String File_JM_Dec 08.xls]Tabl

NOTES:
1. DRAINAGE AREA OF BR137 IS 308.1 km^2.
2. THE FLOWS PRESENTED ABOVE ASSUME THAT ON AVERAGE, MEASUREABLE FLOW BEGINS JUNE 1 AND ENDS OCT 30.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	JM	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold
CONSULTING

TABLE 3.15

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

MARY RIVER AT OUTLET OF MARY LAKE (06SA001)
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/27/09 12:25:01

YEAR	Mean Monthly Measured Discharge (m^3/s)					Mean Discharge (June - Sept)	MAD
	June	July	August	September	October	(m^3/s)	(m^3/s)
2006	-	-	19.3	14.2	1.0	-	-
2007	6.4	30.0	11.0	4.7	0.2	13.0	4.4
2008	18.6	40.9	22.3	11.7	0.6	23.4	7.9

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)					Mean Unit Runoff (June - Sept)	MAUR
	June	July	August	September	October	($L/s/km^2$)	($L/s/km^2$)
2006	-	-	27.9	20.6	1.4	-	-
2007	9.3	43.5	15.9	6.8	0.4	18.9	6.4
2008	26.9	59.2	32.3	17.0	0.8	33.9	11.4

M:\1\02\00181\11\A\Data\Hydrology\WSC\[Mary Lake Outlet Measured String File_JM_Dec 08.xls]Table

NOTES:
1. DRAINAGE AREA AT THE MARY RIVER WSC GAUGE IS 690 km^2.
2. ALL DATA COLLECTED AND PROVIDED BY WSC. DATA ARE PROVISIONAL AND SUBJECT TO REVIEW.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	JM	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 3.16

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

RAVN RIVER AT OUTLET OF ANGAJURJUALUK LAKE (06SA002)
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/27/09 12:29:24

YEAR	Mean Monthly Measured Discharge (m^3/s)					Mean Discharge (June - Oct)	MAD
	June	July	August	September	October	(m^3/s)	(m^3/s)
2007	20.1	368.4	177.2	90.4	19.1	135.0	57.0
2008	163.6	501.1	294.8	148.3	27.9	227.1	95.6

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)					Mean Unit Runoff (June - Oct)	MAUR
	June	July	August	September	October	($L/s/km^2$)	($L/s/km^2$)
2007	2.4	44.8	21.6	11.0	2.3	16.4	6.9
2008	19.9	61.0	35.9	18.0	3.4	27.6	11.6

M:\1\02\00181\11\A\Data\Hydrology\WSC\[Ravn River Measured String File_JM_Dec 08.xls]Table

NOTES:

1. DRAINAGE AREA AT THE RAVN RIVER WSC GAUGE IS 8219 km^2.
2. ALL DATA COLLECTED AND PROVIDED BY WSC. DATA ARE PROVISIONAL AND SUBJECT TO REVIEW.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	JM	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 3.17

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

ROWLEY RIVER ABOVE SEPARATION LAKE (06SB002)
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/27/09 12:33:31

YEAR	Mean Monthly Measured Discharge (m^3/s)					Mean Discharge (June - Oct)	MAD
	June	July	August	September	October	(m^3/s)	(m^3/s)
2006	-	-	-	11.8	3.5	-	-
2007	2.9	176.4	53.0	25.5	1.6	64.4	21.8
2008	115.2	208.4	100.5	44.6	3.0	117.2	39.4

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)					Mean Unit Runoff (June - Oct)	MAUR
	June	July	August	September	October	($L/s/km^2$)	($L/s/km^2$)
2006	-	-	-	3.4	1.0	-	-
2007	0.8	50.4	15.1	7.3	0.5	18.4	6.2
2008	32.9	59.6	28.7	12.8	0.9	33.5	11.3

M:\1\02\00181\11\A\Data\Hydrology\WSC\[Rowley River Measured String File_JM_Dec 08.xls]Table

NOTES:

1. DRAINAGE AREA AT THE ROWLEY RIVER WSC GAUGE IS 3499 km^2.
2. ALL DATA COLLECTED AND PROVIDED BY WSC. DATA ARE PROVISIONAL AND SUBJECT TO REVIEW.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	JM	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 3.18

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

ISORTOQ RIVER AT OUTLET OF ISORTOQ LAKE (06SB001)
MEASURED STREAMFLOW RECORD SUMMARY

Print Jan/27/09 12:18:00

YEAR	Mean Monthly Measured Discharge (m^3/s)					Mean Discharge (June - Oct)	MAD
	June	July	August	September	October	(m^3/s)	(m^3/s)
2006	-	-	371.8	22.5	8.4	-	-
2007	39.4	712.2	466.1	70.8	3.6	258.4	109.4
2008	371.9	727.5	434.3	76.3	5.0	323.0	135.9

YEAR	Mean Monthly Measured Unit Runoff (m^3/s)					Mean Unit Runoff (June - Oct)	MAUR
	June	July	August	September	October	($L/s/km^2$)	($L/s/km^2$)
2006	-	-	51.8	3.1	1.2	-	-
2007	5.5	99.3	65.0	9.9	0.5	36.0	15.3
2008	51.9	101.4	60.6	10.6	0.7	45.0	19.0

M:\1\02\00181\11\A\Data\Hydrology\WSC\[Isortoq Measured String File_JM_Dec 08.xls]Table

NOTES:
1. DRAINAGE AREA AT THE ISORTOQ RIVER WSC GAUGE IS 7172 km^2.
2. ALL DATA COLLECTED AND PROVIDED BY WSC. DATA ARE PROVISIONAL AND SUBJECT TO REVIEW.

0	19JAN'09	ISSUED WITH REPORT NB102-181/11-8	JM	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 4.1

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

REGIONAL HYDROLOGICAL ANALYSIS
SUMMARY OF SYNTHETIC MEAN ANNUAL DISCHARGE (MAD)

Print Jan/30/09 15:36:41

Site	Annual Mean Discharge		Estimate Long-Term Flow		Coefficient of Variation	10-Yr Return Period	
	2007	2008	MAD	MAUR		Dry MAD	Wet MAD
	m^3/s	m^3/s	m^3/s	$l/s/km^2$		m^3/s	m^3/s
H1	1.30	2.47	1.89	7.6	0.25	1.37	2.51
H2	1.46	2.79	2.13	9.8	0.25	1.55	2.82
H3	0.24	0.50	0.37	12.2	0.25	0.27	0.49
H4	0.05	0.09	0.07	7.4	0.25	0.05	0.09
H5	0.03	0.05	0.04	7.4	0.25	0.03	0.05
H6	2.03	3.52	2.78	11.6	0.25	2.01	3.68
H7	0.11	0.18	0.15	9.9	0.25	0.11	0.19
H8	1.68	2.83	2.26	10.8	0.25	1.63	2.99
H9	0.52	1.10	0.81	5.1	0.25	0.59	1.08

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\Regional Analysis\[RP Analysis_KT_Jan15'08.xls]MAD Summary

NOTES:

1) A COMPLETE YEAR OF 2007 AND 2008 STREAMFLOW DATA WAS NOT COLLECTED AT ALL SITE. DATA GAPS WERE FILLED IN BY CREATING SYNTHETIC STREAMFLOW RECORDS THROUGH REGRESSION ANALYSIS OR AREA PRORATION
2) THE LONG-TERM MAD WAS CALCULATED BY AVERAGING THE 2007 AND 2008 MADS
3) THE 10-YR RETURN PERIODS ASSUME AN ESTREME VALUE DISTRIBUTION
4) JUSTIFICATION FOR THE CALCULATION OF THE LONG-TERM AMD AND THE COEFFICIENT OF VARIATION IS BASED ON ANALYSIS OF REGIONAL PRECIPITATION AND STREAMFLOW DATA

1	19JAN'09	ISSUED WITH REPORT 102-181/11-8	KT	TJP	JGC
0	12AUG'08	ISSUED WITH LETTER VA08-01442	KT	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 5.1

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

ESTIMATED AND MEASURED PEAKFLOW SUMMARY

Print Jan/22/09 8:56:50

Site	Drainage Area (km^2)	Estimated Peak Instantaneous Flows (m^3/s)					Measured Peak Instantaneous Flows (m^3/s)	
		2 Year	5 Year	10 Year	25 Year	100 Year	# Years	Flow
BR11	52.7	25	36	41	51	63	1	29.9
BR137	308.1	102	140	156	191	231	1	20.2
BR25	113.7	46	65	73	91	111	1	60.6
BR96-2	30.7	16	24	27	34	43	1	8.9
H1	250.2	86	119	133	164	198	2.5	42.8
H2	209.5	75	104	116	143	174	2.5	73.5
H3	30.5	16	24	27	34	42	2.5	22.1
H4	9.6	7	10	11	14	18	2.5	4.1
H5	5.3	4	6	7	9	12	2.5	3.4
H6	240.0	84	116	129	159	192	2.5	96.4
H7	14.7	9	13	15	20	25	2.5	5.9
H8	208.4	75	104	116	143	173	2.5	85.4
H9	157.6	60	84	94	116	141	2.5	17.5
Mary River (06SA001)	690	192	261	287	350	416	2	156.3
Rowley River (06SB002)	3499	694	911	987	1183	1364	2	747.9
Isortoq River (06SB001)	7172	1223	1582	1703	2026	2307	2	1742.5
Ravn River (06SA002)	8219	1362	1757	1889	2244	2549	2	963.6

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\Peak Flows\[Peak Flow.xls] Site Summary Table

NOTES:
1. PEAK INSTANTANEOUS FLOW DATA FOR WSC STATIONS IS SCALED FROM PEAK DAILY DATA.
2. DAILY VALUES ARE SCALED USING A RATIO OF I/D = 2.8 x $A^{-0.10}$ WHERE "I/D" IS THE RATIO OF INSTANTANEOUS TO DAILY PEAK FLOWS AND "A" IS THE DRAINAGE AREA IN KM^2.

0	08JAN'09	ISSUED WITH REPORT NB102-181/11-8	JM	KT	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Knight Piésold CONSULTING

TABLE 6.1

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

DRY AND WET RETURN PERIOD ANNUAL MEAN DISCHARGE
RETURN PERIOD STREAMFLOW SUMMARY

Print: 01/27/09 14:12

Station	Dry (m^3/s)			Mean	Wet (m^3/s)		
	100 yr.	50 yr.	20 yr.		20 yr.	50 yr.	100 yr.
H1	1.12	1.18	1.28	**1.89**	2.77	3.11	3.37
H2	1.26	1.33	1.44	**2.13**	3.12	3.51	3.79
H3	0.22	0.23	0.25	**0.37**	0.55	0.61	0.66
H4	0.04	0.04	0.05	**0.07**	0.10	0.12	0.13
H5	0.02	0.02	0.03	**0.04**	0.06	0.07	0.07
H6	1.64	1.73	1.87	**2.78**	4.07	4.57	4.95
H7	0.09	0.09	0.10	**0.15**	0.21	0.24	0.26
H8	1.33	1.40	1.52	**2.26**	3.31	3.72	4.03
H9	0.48	0.50	0.55	**0.81**	1.19	1.34	1.45

M:\1\02\00181\11\A\Data\Hydrology\Hydrology analysis\Regional Analysis\[RP Analysis_KT_Jan15'08.xls]DryWetTable

NOTE:

1. VALUES SIMULATED BY @RISK SOFTWARE PACKAGE ASSUMING AN EXTREME VALUE DISTRIBUTION

0	19JAN'09	ISSUED WITH REPORT 102-181/11-8	KT	TJP	JGC
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D