SURFACE WATER AND HYDROLOGY BASELINE REPORT FOR PROPOSED WABUSH 3 MINE SITE LABRADOR CITY NEWFOUNDLAND AND LABRADOR

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EXECUTIVE SUMMARY

The Iron Ore Company of Canada (IOC) is currently in the planning and environmental assessment stages for the Wabush 3 Project, a proposed open pit iron mine and waste rock dump located near Labrador City, Labrador. A hydrology and surface water assessment was carried out to support environmental assessment and permitting requirements.

The proposed 271 hectare pit is situated almost equally within two drainage basins, one reporting to Leg Lake to the southwest, and the second reporting to Dumbell Lake (the back-up water supply for the Town of Labrador City) to the east. Ground elevations in the proposed pit location range from about 780 to 820 MASL.

The proposed 105 hectare rock dump to the north-west of the proposed pit is located predominantly in the White Lake subwatershed of Luce Lake, with a small portion located in the Leg Lake watershed. Ground elevations at the proposed rock dump location range from about 780 to 840 MASL.

Topography in the study area is a combination of coniferous forest, discontinuous bogs and wetland areas, and lakes. Current land uses include ski runs, walking trails, and roads.

Long-term regional and local climate and hydrology data were compiled from several provincial and federal sources to establish the meteorological and hydrologic regime in the project area. In addition several background reports were reviewed including the Kami Iron Ore Project EIS (Canadian Environmental Assessment Agency, 2012); the Carol Lake Mine Site Water Balance (Piteau Associates, 2011); and the Draft Wabush 3 and Wabush 6 Hydrogeological and Hydrological Technical Report (Golder Associates, 2011). This review and analysis provided estimates of site evapotranspiration and runoff. These estimates were found to be consistent with the findings derived from analysis of data from the nearest WSC streamflow gauge.

Site-specific hydrology data was collected during the summer months of 2012 at points within the project footprint as an augmentation of the 2011 field data collection program. Analysis and interpretation of the 2012 results indicate (similar to observations made in the 2011 surface water flow monitoring report) an apparent groundwater influence from the proposed Wabush 3 site that may contribute baseflow to the stream supplying Dumbell Lake. It appears that Leg Lake may also be to some extent supplied from groundwater from the proposed Wabush 3 site.

A site water balance was set up to represent current watershed conditions. Effects of the proposed pit and rock dump development were evaluated by modifying the site water balance to represent the proposed Wabush 3 development and its preliminary surface water management concept.

The preliminary surface water management concept is that during the initial stages of mining, pit water will drain by gravity north into a creek leading to a proposed settling pond, and eventually

into Dumbell Lake. Once the pit bottom becomes lower than the settling pond, runoff and groundwater seepage will be drained south towards Leg Lake. Initially, this would be into two existing small lakes, and later in pit development, runoff and groundwater seepage water would be pumped into a proposed settling pond which would drain into Leg Lake. Depending on water quality, an alternative would be to pump pit water to the current Luce Lake pit water discharge point. The water balance assessment was carried out for the fully developed pit condition assuming that all water accumulated in the pit would be dewatered to the Leg Lake watershed.

A preliminary estimate of groundwater flow into the pit (Golder 2011) is considered conservative and does not account for depressurization due to the expansion of other surrounding pits. Groundwater inflow to the pit is currently being evaluated in more detail by AMEC as part of the ongoing hydrogeological investigation and study, and for this reason the effects of dewatering groundwater inflows to the pit were not addressed in the current surface water and hydrology assessment.

The results of the water balance indicate that the Wabush 3 development is not expected to have a major effect on the surface hydrology of the local watersheds for average precipitation and runoff conditions. Assuming that surface water intercepted by the pit is diverted to Leg Lake, the estimated effect on average annual runoff volume to the three affected watersheds is in the order of a 17% reduction to Dumbell Lake, a 14% increase to Leg Lake, and a 2.5% increase to the White Lake subwatershed of Luce Lake.

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1.0 INTRODUCTION

The Iron Ore Company of Canada (IOC) is in the planning and environmental assessment stages for the development of an open pit iron mine located near Labrador City, Labrador. For the purpose of this report, this undertaking is referred to as the Wabush 3 Project. The Wabush 3 Project consists of a proposed open pit mine and a nearby waste rock dump.

This document presents the hydrology and surface water assessment to support environmental assessment and permitting requirements for the Wabush 3 Project. The assessment described here evaluates the Wabush 3 project in its maximum extent, i.e. following full pit excavation and rock dump development. Coordinates for the pit and rock dump areas were provided by the Iron Ore Company of Canada, and are assumed to represent the ultimate extent of these facilities.

1.1 Project Location and Site Description

The proposed open pit and rock dump sites are located north of the Trans Labrador Highway 500, south of Luce Lake, and are directly west of Dumbell Lake. Ore from the proposed Wabush 3 open pit mine would be processed at the existing IOC concentrator and pelletizing plant facility located approximately 6 km to the southeast.

1.2 Scope of Work

The scope of the current assessment is to:

- Describe baseline meteorology and hydrologic conditions as part of continuing hydrological and hydrogeological investigations;
- Describe the 2012 field flow monitoring program, summarize the results, and provide discussion and interpretation;
- Estimate the influence that the pit development and rock dump are expected to have on the surface hydrology of the local watersheds for average precipitation and runoff conditions;
- Present preliminary surface water management concepts;
- Provide recommendations for further field and technical studies to continue to support engineering design and satisfy environmental permitting requirements.

All figures are presented following the text portion of this report.

2.0 SITE TOPOGRAPHY AND DRAINAGE

The maximum areal extents of the proposed pit and rock dump of the Wabush 3 expansion project are approximately 271 ha and 105 ha, respectively (Table 1).

Table 1: Pit and Rock Dump Watershed Areas

Watershed	Area (ha)		
	Total	Wabush 3 Pit	Rock Dump
Dumbell Lake	829.29	139.78	--
Leg Lake	1615.91	131.2	11.97
White Lake subwatershed of Luce Lake	1037.67	--	92.75

2.1 Wabush 3 Open Pit

The proposed pit is located in two drainage basins (Figure 1). One basin is located southwest of the pit and flows into Leg Lake. The second basin is to the east and flows into Dumbell Lake, which serves as the back-up water supply for the Town of Labrador City.

The surficial geology at the proposed Wabush 3 site is mainly composed of discontinuous glaciofluvial and glaciolacustrine tills. Soils are granular till comprised of poorly sorted silt, sand and gravel (Golder Associates, 2011). The bedrock at this location consists of lower and middle iron formations mixed with Shabogamo Intrusive. Directly north of the proposed pit boundaries is an area of high elevation peaking at approximately 880 MASL. South of the proposed pit boundary is a shelf of land with slightly lower elevations (820-840 MASL).

The proposed Wabush 3 pit area is located about equally within the Dumbell Lake and Leg Lake watershed areas. The ground elevation of the proposed pit location ranges from approximately 780 to 820 MASL. and is located on a saddle with drainage to both the east and the west towards Leg Lake and Dumbell Lake, respectively. Discontinuous bogs and wetland areas are located within the proposed pit area, as well as two small waterbodies, one of which is connected to surface water drainage. The north-east half of the proposed pit (comprising 139.79 ha) includes a stream which drains a small wetland area and flows east into Dumbell Lake. The Dumbell Lake watershed area is about 800 ha in total, and is made up of coniferous forest, lakes, ski runs and walking trails.

The south-western half of the proposed pit (comprising 131.20 ha) is located in the Leg Lake watershed and contains two small ponds that drain southwest into Leg Lake. The Leg Lake watershed area is about 1600 ha in total, and is made up of coniferous forest, lakes, walking trails, roads and residential areas (Labrador City). Further detailed descriptions of the aquatic resources within the project footprint are provided in the 2012 Freshwater Fish and Fish Habitat Baseline Study (AMEC, 2012).

2.2 Wabush 3 Rock Dump

The proposed rock dump is located north-west of the proposed Wabush 3 pit (Figure 1). The majority of the rock dump drains north-east to the White Lake subwatershed of Luce Lake (henceforth referred to simply as the White Lake watershed), while a small portion drains south to Leg Lake. The White Lake watershed area is about 1000 ha in total, and in general consists of coniferous forest, walking trails, and lakes.

The surficial geology at the site of the proposed waste rock dump is composed of granular till and exposed bedrock outcropping. The bedrock at this location is mainly of the Wishart and Attikamagen formations. Most of the proposed rock dump (92.75 ha) is located within the White Lake watershed, with the southernmost portion of the dump area (11.97 ha) located within the Leg Lake watershed. The ground elevation of the proposed rock dump area ranges from 780 to 840 MASL The south west portion of the proposed rock dump area is the greatest elevation (840 MASL), and from that point surface water flows to the north towards White Lake and south towards Leg Lake.

3.0 REGIONAL AND LOCAL CLIMATIC AND HYDROLOGY DATA

While specific hydrology data was collected during the summer months of 2012 at sites within the project footprint as an augmentation of the 2011 field data collection program, the total duration of available site data is limited. For that reason additional, long-term regional and local climate and hydrology data has been compiled from several sources to assist in establishing the expected hydrology regime within the project area. Provided below are descriptions of the long-term datasets available as well as recent site-specific investigations.

3.1 Review of Background Reports

3.1.1 Kami Iron Ore Project EIS

The location of the proposed Kami Iron Ore mine is approximately 17 kilometres from the proposed Wabush 3 site. Information from the Kami Iron Ore Project Environmental Impact Statement was used as a reference and to provide data input to the current assessment.

3.1.2 Carol Lake Mine Site Water Balance

Carol Lake is the initial name of the full IOC project in western Labrador. The project includes several open pits with Luce Pit being the closest (2-3 km north of Wabush 3) and Spooks Pit the furthest (10 km north of Wabush 3). Information from the Carol Lake Water Balance (Piteau Associates, 2011) was used as a reference and to provide data input to the current assessment.

3.1.3 Draft Wabush 3 and Wabush 6 Hydrogeological and Hydrological Technical Report

The Draft Wabush 3 and Wabush 6 Hydrogeological and Hydrological Technical Report prepared by Golder Associates (Golder, 2011) was made available to AMEC. The report provided background information on the site and the results of the 2011 field monitoring program, and was used as a reference and comparison for watershed boundary delineation.

3.2 Precipitation and Temperature

Precipitation data was obtained from Environment Canada. Climate normal data (Table 2) was available from 1971 to 2010 from the Wabush Lake Airport climate station (Climate ID 8504175), located approximately 8.5 km southeast from the site at an elevation of approximately 546 MASL. The monthly precipitation ranges from 56 to 112 mm between May to September, and ranges from 42 to 73 mm from October to April. Monthly average snowfall ranges from 0 to 16.5 cm in the non-winter months, and ranges from 42 to 75 cm in the winter months. The average annual total precipitation is 852 mm. The elevation difference between Wabush Airport and the areas inclusive of Dumbell Lake, Leg Lake and White Lake watersheds (which range in elevation from 600 to 860 MASL), may result in somewhat different precipitation at the Wabush 3 site.

Monthly temperature data for the Wabush 3 mine area was obtained from the same source as is shown in Table 2. The average monthly temperature at Wabush Airport is -3.5°C. The average monthly temperatures from October to April are below zero, and range from -0.5 to -27°C, and the average monthly temperatures from May to September range from 3.6 to 13.7°C.

Table 2: Wabush Lake Airport Climate Normals (1971-2010)

Parameter	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall	mm	0.5	1.6	3.1	12	40	82	112	95	89	37	6.8	2.9	482.6
Snow	cm	66.4	48.7	64.8	53	17	2.6	0	0.1	6.8	42	75	70.2	445.9
Precipitation	mm	54	41.7	57.4	57	56	85	112	95	96	74	68	56.8	851.6
Average Temperature	°C	-23	-21	-14	-4.6	3.6	10	13.7	12	6.8	-0.4	-8.6	-19	-3.53
Average Vapour Pressure	kPA	0.1	0.1	0.2	0.3	0.6	0.9	1.1	1.1	0.8	0.5	0.3	0.2	0.52

Source: Environment Canada Weather Office http://climate.weatheroffice.gc.ca/climate_normals

3.3 Evaporation

The annual evaporation at the site was estimated based on a compilation and comparison of values reported from various locations within the general region.

3.3.1 Mean Annual Lake Evaporation (Hydrologic Atlas of Canada)

The Hydrologic Atlas of Canada shows that the site's mean annual lake evaporation is between 300-400 mm per year. A value of 330 mm was interpolated for the project site.

3.3.2 Mean Annual Pan Evaporation (Environment Canada)

The only pan evaporation data available in the province is from the Stephenville Airport from 1942 to 2007, which is located on the island of Newfoundland approximately 760 km south from Wabush at an elevation of 0-25 MASL. The average annual potential and actual evaporation values were reported as 522 and 515 mm (Table 3). This was not considered representative of the Central Labrador climate.

Table 3: Mean Monthly Evaporation for Stephenville Airport (1942-2007)

Evapotranspiration	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year
Potential	mm	2	2	5	19	55	87	115	107	72	40	15	3	522
Actual	mm	2	2	5	19	55	87	114	102	71	40	15	3	515

Source: Hydrogeology of Western Newfoundland, Water Resources Management Division, Department of Environment and Conservation, Government of Newfoundland and Labrador (AMEC, 2008)

3.3.3 Mean Annual Potential Evapotranspiration (Water Resources Atlas of Newfoundland)

The Water Resources Atlas of Newfoundland (Government of Newfoundland and Labrador Department of Environment and Lands, 1992) has estimated mean annual potential evaporation of 375 to 400 mm for central Labrador. The value for Wabush Lake is slightly less than 400 mm.

3.3.4 Mean Annual Evapotranspiration (Kami EIS)

The Kami EIS reported the runoff coefficient for the project site for total streamflow (surface runoff, interflow and groundwater discharge baseflow) data as 63%. The annual evapotranspiration was estimated based on the Thornwaite water balance model (Dunne 1978) at 318.5 mm (Table 4). This method is based on average monthly temperature, precipitation, soil storage and vegetation cover type.

Table 4: Mean Monthly Precipitation and Evapotranspiration for Kami Iron Ore Project (1982-2011)

Parameters (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation	50	39	54.2	51.9	54.1	83.3	116.1	107.7	94.4	77.3	75.5	54.5	858
Evapotranspiration	2.3	3.2	3.7	8.5	20	74.7	89.7	67.5	35.1	8	3.1	2.8	318.6

Source: Canadian Environment Assessment Agency, Environmental Impact Statement Guidelines for the Kami Iron Ore Project (2012)

3.3.5 Mean Annual Evapotranspiration (Carol Lake Mine Water Balance)

Climate normals for the Carol Lake water balance (Piteau Associates, 2011) were determined based on average annual data collected between 1960 and 2001 at the Wabush Lake Airport. Potential evaporation was calculated by the Thornthwaite method at 410.6 mm and actual evaporation was assumed to be 75% of the potential evaporation (Table 5), which is 305.8 mm. The resulting average runoff potential is 64%. As the facilities evaluated as part of the Carol Lake Mine Site water balance are within 10 km from the Wabush 3 mine location, the climatic parameters reported in the Carol Lake Mine Site water balance were assumed to reasonably represent the Wabush 3 site.

Table 5: Climate Normals and Calculated Evapotranspiration for Carol Lake Mine

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain (mm)	0.8	1.2	2.5	9.9	39.8	83.6	110.8	100.7	87.8	40.4	13.9	2.6	494.0
Snow (cm)	68.2	53	63.7	48	18.3	2.1	0	0.2	6.2	42.8	73.4	73.3	449.2
Snow Equivalent (mm)	55.1	42.5	52.1	41.1	16.8	2.1	0.1	0.2	6	39.2	60.3	57.7	373.2
Mean PPT (mm)	55.9	43.8	54.6	51	56.7	85.7	110.8	100.9	93.8	79.6	74.2	60.3	867.3
Potential Evapotranspiration (mm)	0	0	0	0	43.1	97.6	117.3	98.4	54.2	0	0	0	410.6
Actual Evapotranspiration (mm) (75%)	0	0	0	0	30.2	73.2	88.0	73.8	40.7	0	0	0	305.8

Source: Site Water Balance Carol Lake Mine (Piteau Associates, 2011)

3.3.6 Values Used for Current Assessment

For the current assessment the actual evapotranspiration was assumed to be 80% of the potential evapotranspiration stated by the Water Resources Atlas of Newfoundland, giving a annual evapotranspiration of 320 mm at the Wabush 3 site. Due to the Kami site's reasonably close proximity to the Wabush 3 site, the Kami site's climatic parameters were assumed to be reasonably representative. For this reason the monthly distribution of evapotranspiration at the Kami Iron Ore Project was used to determine the monthly distribution of evapotranspiration at the Wabush 3 site. These values were applied to represent evaporation from both water and land surfaces due to elevated soil moisture content of the region. This value results in a mean annual runoff of 532 mm and a mean annual runoff coefficient of 62%.

3.4 Water Survey of Canada (WSC) Streamflow Gauging Data

Streamflow gauging data was obtained from Water Survey of Canada (WSC) for three streams surrounding the Wabush 3 area. Data for Luce Brook below Luce Lake (03OA011) and White River at Outlet of White Lake (03OA013) are shown in Table 6. However drainage areas are not available from WSC for these stations, and accordingly this data was not used as part of the current evaluation.

Table 6: Regional Streamflow Data for 03OA011 and 03OA013

Station ID	Description	Month	Discharge (m^3/s)	
			2002	2003
03OA011	Luce Brook Below Luce Lake	Jan	0.315	0.263
		Feb	0.286	0.238
		Mar	0.256	0.232
		Apr	0.242	0.361
		May	0.563	0.817
		Jun	1.180	0.457
		Jul	0.581	0.571
		Aug	0.574	0.446
		Sep	0.494	0.401
		Oct	0.481	0.551
		Nov	0.374	0.405
		Dec	0.309	0.330
03OA013	White River at Outlet of White Lake	Jan	0.036	0.010
		Feb	0.030	0.006
		Mar	0.024	0.004
		Apr	0.019	0.009
		May	0.032	0.077
		Jun	0.150	0.051
		Jul	0.054	0.060
		Aug	0.049	0.044
		Sep	0.041	0.044
		Oct	0.036	0.069
		Nov	0.031	0.069
		Dec	0.018	0.046

Source: Environment Canada, Water Survey of Canada

Streamflow data that could be used in determining hydrology within the project footprint was available from one location, Luce Lake below Tinto Pond (03OA012) located 4 km from the proposed Wabush 3 location, with a drainage area of 43.4 km^2.

Daily discharge data for 2002, 2003, and 2007 to 2009 was obtained for WSC station 03OA012. Analysis of this data in comparison with precipitation data recorded at Wabush Airport (shown in Figure 2) showed that during this period, the annual runoff ranged from 477 to 563 mm and the annual runoff coefficient ranged from 49% to 69%, averaging 60% (Table 7). This is consistent with the mean annual runoff coefficient of 62% derived from mean annual precipitation and the mean annual evapotranspiration selected for the site.

Table 7: Regional Streamflow Data for Luce Lake Below Tinto Pond (WSC Station 03OA012)

	Month	2002	2003	2007	2008	2009	Average Annual
Discharge (m3/s)	Jan	0.436	0.380	0.279	0.456	0.261	
	Feb	0.406	0.355	0.209	0.374	0.223	
	Mar	0.375	0.355	0.175	0.333	0.205	
	Apr	0.374	0.537	0.154	0.565	0.393	
	May	1.02	1.15	0.696	2.21	1.16	
	Jun	1.730	0.648	1.25	1.27	1.20	
	Jul	0.854	0.937	1.40	1.05	0.984	
	Aug	0.866	0.661	0.909	0.878	0.999	
	Sep	0.732	0.703	1.23	0.515	1.01	
	Oct	0.712	0.904	0.957	0.607	1.11	
	Nov	0.533	0.699	0.903	0.603	0.852	
	Dec	0.430	0.522	0.603	0.389	0.625	
Annual	million m^3	22.2	20.3	23.9	21.2	23.4	22.2
Runoff Depth (mm)	Jan	26.9	23.5	17.2	28.1	16.1	
	Feb	22.6	19.8	11.7	20.8	12.4	
	Mar	23.1	21.9	10.8	20.6	12.7	
	Apr	22.3	32.1	9.2	33.7	23.5	
	May	62.9	71.0	43.0	136.4	71.6	
	Jun	103	38.7	74.7	75.8	71.7	
	Jul	52.7	57.8	86.4	64.8	60.7	
	Aug	53.4	40.8	56.1	54.2	61.7	
	Sep	43.7	42.0	73.5	30.8	60.3	
	Oct	43.9	55.8	59.1	37.5	68.5	
	Nov	31.8	41.7	53.9	36.0	50.9	
	Dec	26.5	32.2	37.2	24.0	38.6	
Annual	mm	513.5	477.2	532.6	562.7	548.6	526.9
Preci-pitation (mm)	Jan	13.4	28.4	52.8	59.4	33.4	
	Feb	60.5	25.3	52.5	28.0	60.4	
	Mar	56.4	29.1	67.0	70.0	36.4	
	Apr	28.6	50.8	36.0	63.3	61.9	
	May	74.6	10.8	61.4	85.0	48.7	
	Jun	56.8	74.8	136.2	108.6	85.2	
	Jul	61.4	170.8	104.2	91.0	126.9	
	Aug	125.0	128.6	77.5	84.2	145.1	
	Sep	94.2	90.5	157.4	41.3	68.0	
	Oct	71.3	162.9	87.0	99.2	63.2	
	Nov	69.5	129.8	73.8	128.2	71.5	

	Month	2002	2003	2007	2008	2009	Average Annual
	Dec	36.0	68.3	39.7	77.4	47.5	
Annual	**mm**	747.7	970.1	945.5	935.6	848.2	889.4
Runoff Coefficient	**%**	69	49	56	60	65	60

Discharge Data: Environment Canada, Water Survey of Canada
Climate Data: Environment Canada, National Climate Data and Information Archive, Wabush Lake A, Newfoundland. Latitude: 52°55'38.000" N Longitude: 66°52'27.000" W Elevation: 551.40 m, Climate ID: 8504175

3.5 2011 Field Monitoring Program

A field monitoring program for the Dumbell Lake, Luce Lake and Leg Lake watershed areas was carried out in 2011 to give some indication of baseline streamflow conditions (Golder 2011). Data was collected at 11 locations to the east, west and south of the project site, and is summarized in Appendix A. It was noted in that report that the majority of water in the streams at the time of the measurements was baseflow derived from groundwater discharge, since there was minimal precipitation within the previous month.

Stream discharge measurements were made on September 16th and 17th. Measured flows and subcatchment areas are presented in Appendix A. Discussion in the 2011 report noted that monitoring point 2, located downstream (east) of the proposed Wabush 3 pit and upstream of Dumbell Lake, received significantly more groundwater discharge than monitoring point 1, at the eastern edge of the proposed Wabush 3 pit boundary. This suggests that Dumbell Lake is partially supplied from runoff and groundwater from the proposed Wabush 3 pit.

It was also noted that monitoring location 7, in the south-west portion of the proposed Wabush 3 pit boundary, received significantly more groundwater discharge than monitoring point 1. This suggests that Leg Lake is also partially supplied from runoff and groundwater from the proposed Wabush 3 pit.

The findings of the report were based on the assumption that the Wabush 3 pit was bermed in order to divert runoff around the pit, and that pit dewatering would be directed to the mine water discharge area at Luce Lake. The report stated that, assuming an 80% runoff coefficient in the pit, the annual average runoff collected in the Wabush 3 pit would be approximately 1.46 million m^3 per year (not including groundwater). The development of the Wabush 3 pit would reduce the drainage areas to Dumbell Lake and Leg Lake. In accordance with this, a reduction in the amount of runoff and infiltration to Dumbell Lake and Leg Lake was predicted.

3.6 2012 Field Monitoring Program

The 2012 field monitoring program was carried out from July 10th to Sept 16th using some of the same stations as the 2011 program. The names of the monitoring stations used in the 2012 field monitoring program are unchanged from the 2011 program. The program consisted of spot flow gauging taken at six locations located along streams discharging from local watersheds downstream of the proposed Wabush 3 pit. In addition, continuous measurements were taken at two of these locations.

3.6.1 Description of Activities

Spot flow gauging was carried out at stations 1, 2, 3, 7, 8 and 11. Spot flow gauging was carried out on July 14, Aug 15 and Sept 14 for monitoring locations 1, 3, 8 and 11, and on July 10, July 14, July 24, Aug 15, and Sept 14-16 at locations 2 and 7. Subwatersheds were delineated for each station (as shown in Figure 1). Total stream discharge was determined based on direct measurements of stream velocity and area.

Field monitoring photographs are located in Appendix B-1. Monitoring station 1 was located on a stream running easterly towards Dumbell Lake and is located in the north-east quadrant of the proposed pit limits. The ground surface is heavily vegetated with moss and small shrubs among large coniferous and deciduous vegetation. The monitoring station 2 stilling well was located downstream from station 1 towards the outlet to the western edge of Dumbell Lake. Monitoring station 3 was located on a stream flowing easterly from Dumbell Lake to a confluence that eventually leads into Wabush Lake, between two culverted railway stream crossings. The stream was wide (~ 12 m) relative to the other monitoring locations, the substrate was generally sandy and the area is surrounded by large deciduous vegetation. The stilling well at monitoring station 7 was located at the south-western perimeter of the proposed pit. The stream flows south-south west and connects two small wetland areas. Monitoring station 8 is located at the southern most outlet of Leg Lake at Fermont Highway. This station is located upstream of the highway culvert. Station 8 is surrounded by small brush and the river substrate consists of large boulders and cobbles. Monitoring station 11 is located at on a stream flowing northeast towards the southern tip of Dumbell Lake.

Stilling wells were installed at two gauges: station 2 and station 7. The stilling well consisted of a perforated PVC pipe inserted into the stream bed. A non-vented pressure transducer was installed in each stilling well in order to take continual measurements of stream stage. The measurements were taken every 10 minutes and the water level above the transducer was barometrically corrected using measurements from an on-site barometer. Water levels at these gauges were monitored between July 10th and October 19th, 2012. Stream stage was verified using manual water level measurements. Figure 3 presents the stream stage measured by the transducers and the manual water level measurements at gauges 2 and 7.

Step changes in the base-flow water level height at gauge 2 occurred after two major rainfall events; the first change occurred after a rainfall event between the 3rd and 5th of August, 2012, and the second event occurred after a rainfall event between the 12th and 16th of September, 2012. These changes are interpreted to have been caused by a change in stream morphology. Field measurements of the top of the stilling well to the stream bed support this interpretation, as the difference between these point recorded as 0.93 m on visits prior to the storm between the 3rd and 5th of August, 2012 and 0.86 m after the storm.

Rating curves were produced using discharge measurements and stream stage according to the transducers in the stilling wells. A total of 9 discharge measurements were taken at each of these gauges, 5 measurements were taken between September 14th and 16th at each station during a storm event. The rating curves are presented in Appendix B-2. The rating curve for gauge 2 excludes measurement taken prior to the August 2nd, 2012 as the relationship between stream height and discharge is a function of the stream morphology, and this appears to have changed after the storm event between the 3rd and 5th of August, 2012.

3.6.2 Results and Interpretation of Surface Water Monitoring

Results of spot gauge stream discharge values measured at all 6 monitoring stations are shown in Figure 4.

Results of discharge produced using the transducer measurements and the rating curve function as well as the manual water level measurements at gauges 2 and 7 are presented in Figures 5 and 6. Note that discharge at gauge 2 is presented only for the period between the two storms events previously discussed, as there were enough manual discharge measurements to determine a reasonable stage-discharge relationship in that interval.

Unit flows and runoff coefficients calculated for continuous discharge measurements at gauges 2 and 7 are shown in Table 8. Unit flow rates were found to be consistent with the results from the spot flow measurements.

Table 8: 2012 Field Monitoring Program - Continuous Streamflow Results

Monitoring Location 2						
Drainage Area	267.9 ha	**July**	**August**	**September**	**October**	**Average**
Data Starts		-	8/2/2012 0:00	9/1/2012 0:00	-	
Data Stops		-	8/31/2012 23:50	9/18/2012 23:50	-	
Discharge	m^3	-	237,876	132,321	-	
Runoff Depth	mm	-	88.8	49.4	-	
Precipitation (1)	mm	-	154.3	77.4	-	
Unit Flow	$L/s/km^2$	-	34.3	31.8	-	33
Unit Flow (Spot Flows)	$L/s/km^2$	-	-	-	-	38
Runoff Coefficient		-	58	64	-	60

Monitoring Location 7						
Drainage Area	114.1 ha	**July**	**August**	**September**	**October**	**Average**
Data Starts		7/10/2012 13:50	8/1/2012 0:00	9/1/2012 0:00	10/1/2012 0:00	
Data Stops		7/31/2012 23:50	8/31/2012 23:50	9/30/2012 23:50	10/19/2012 13:20	
Discharge	m^3	17,650	93,515	52,272	25,357	
Runoff Depth	mm	15.5	82.0	45.8	22.2	
Precipitation (1)	mm	88.3	164.8	116.5	64.2	
Unit Flow	$L/s/km^2$	8.4	30.6	17.7	13.9	18
Unit Flow (Spot Flows)	$L/s/km^2$	-	-	-	-	19
Runoff Coefficient		18	50	39	35	38

Note 1: Precipitation reflects the depth during the field monitoring period.

Unit flows were calculated also for all the spot flow gauging stations. The results are shown in Table 9 and found to be on average within 10% of the results of the 2011 field program.

Table 9: 2012 Field Monitoring Program - Spot Flow Gauging Results

Site	Drainage Area	Date	Flow (m^3/s)	Unit Flow ($L/s/km^2$) 2012	2011 (1)	Comparison
Gauge 1	93.726	7/14/2012	0.0014	2		
		8/15/2012	0.0092	10		
		9/14/2012	0.0017	2		
Average			**0.0041**	**4**	**5**	**-13%**
Gauge 2	267.90	7/10/2012	0.0945	35		
		7/14/2012	0.0789	29		
		7/24/2012	0.1267	47		
		8/15/2012	0.0901	34		
		9/14/2012	0.0626	23		
		9/15/2012	0.1279	48		
		9/15/2012	0.0855	32		
		9/15/2012	0.1001	37		
		9/16/2012	0.1610	60		
Average			**0.1030**	**38**	**45**	**-15%**
Gauge 3	617.27	7/14/2012	0.1167	19		
		8/15/2012	0.2470	40		
		9/14/2012	0.1175	19		
Average			**0.1604**	**26**	**26**	**0%**
Gauge 7	114.103	7/10/2012	0.0106	9		
		7/14/2012	0.0032	3		

Site	Drainage Area	Date	Flow (m^3/s)	Unit Flow ($L/s/km^2$)		
				2012	**2011 (1)**	**Comparison**
Gauge 7	114.103	7/24/2012	0.0393	34		
		8/15/2012	0.0290	25		
		9/14/2012	0.0055	5		
		9/15/2012	0.0208	18		
		9/15/2012	0.0159	14		
		9/15/2012	0.0155	14		
		9/16/2012	0.0529	46		
Average			**0.0214**	**19**	**21**	**-11%**
Gauge 8	862.68	7/14/2012	0.2261	26		
		8/15/2012	0.3290	38	(2)	
		9/14/2012	0.2017	23	(2)	
Average			**0.2523**	**29**	**25**	**17%**
Gauge 11	212.02	7/14/2012	0.0439	21		
		8/15/2012	0.0599	28		
		9/14/2012	0.0246	12		
Average			**0.0428**	**20**	**30**	**-33%**
Average						**-9%**

Note 1: 2011 values: Draft Wabush 3 and Wabush 6 - Hydrogeological and Hydrological Technical Report (Golder Assoc. 2011)
Note 2: Averaged from 2 values

Streamflow measured at monitoring station 1, on the stream discharging from the eastern perimeter of the proposed Wabush 3 pit boundary, was low relative to the other locations, which reflects the smaller catchment area. Station 1 also showed a low unit runoff which suggests that portions of the sub-catchment may be recharge areas contributing to downstream groundwater discharges. Surface flows are expected to be highly influenced by Wabush 3 pit, as its catchment is within the pit boundary.

Station 2 is on a stream discharging into Dumbell Lake from the east, at the lake. Runoff per unit area is higher at station 2 than directly upstream at station 1, which suggests that there is an element of groundwater discharge in the streamflow at station 2.

Station 3 is on the stream discharging from Dumbell Lake. The measured streamflow at station 3 was also high relative to the other monitored locations, which reflects the larger catchment area.

Station 7 is on the stream discharging from the south-west perimeter of the proposed Wabush 3 pit boundary. Streamflow measured at monitoring station 7 was low relative to the other locations, which reflects the smaller catchment area. Station 7 showed a lower unit runoff than station 2, but about five times higher than station 1, which suggests that Leg Lake may be partially supplied from groundwater from the proposed Wabush 3 pit. Surface flows at this point are expected to be highly influenced by Wabush 3 pit, as its catchment is within the pit boundary.

Station 8 is on the stream discharging from Leg Lake. The measured streamflow at station 8 was high relative to the other monitored locations, which reflects the larger catchment area.

Station 11 is on a stream discharging into Dumbell Lake from the south-west, at the lake inflow. Streamflow measured at monitoring station 11 was low relative to the other locations, which reflects the smaller catchment area. Surface flows are not expected to be influenced by Wabush 3 pit, as its catchment is outside the pit boundary.

3.6.3 Discussion

The results of the 2012 field monitoring program in terms of unit flow support the findings of the 2011 field program (as seen in Table 8), and indicate an apparent groundwater influence that maintains baseflow on the stream feeding Dumbell Lake.

Due to the limited length of the data record from the 2011 and 2012 field monitoring programs, this data is not necessarily representative of long term average conditions, and accordingly was not used in the site water balance. The characterization of monthly runoff for the site water balance was based on a review of data from other projects and studies as discussed in Section 3.

4.0 WATER BALANCE METHODOLOGY

4.1 Introduction

A conceptual water balance was prepared, that quantifies surface flows generated within the Dumbell Lake, Leg Lake and White Lake watersheds. This water balance was developed to represent baseline conditions, and to predict expected surface flow changes as a result of the change to land use and drainage patterns due to the development of the open pit and rock dump that constitute the proposed Wabush 3 development.

The water balance assumes the final stage (i.e. full pit development). Earlier stages of mine development were not considered, as pit and rock dump layouts for earlier stages are not yet available.

4.2 Preliminary Surface Water Management Concept

During the initial stages of mining operation, gravity drainage would be used to drain water accumulated in the pit north into a creek leading to a proposed settling pond and eventually into Dumbell Lake. Once the bottom of the pit becomes lower than the settling pond, all runoff and groundwater seepage will be drained south towards Leg Lake. Initially, accumulated water would be pumped into the existing two small lakes that drain southwest into Leg Lake. Later in pit development accumulated water would be pumped into a proposed settling pond which would drain into Leg Lake. Depending on the water quality, an alternative would be to pump accumulated pit water to the currently used Luce Lake pit water discharge point. The current hydrologic assessment, which was carried out for the fully developed pit condition, assumed that all water accumulated in the pit would be dewatered to the Leg Lake watershed.

It is assumed that the area surrounding the pit boundary will be bermed or diverted to prevent additional runoff flow into the pit.

4.3 Water Balance Modelling Approach

The model was setup and run using a deterministic Excel-based spreadsheet. The model calculates runoff based on precipitation and evapotranspiration. On a watershed basis, annual changes to groundwater storage due to infiltration (increase in storage) and recharge to lakes and rivers (decrease in storage) were assumed to be negligible (i.e. input to groundwater is balanced by discharge from groundwater). Monthly values were predicted for a mean precipitation year for two conditions:

- Existing site conditions with all watersheds yielding runoff at the currently estimated rate;
- Site conditions for Wabush 3 development, with modified catchment areas and runoff coefficients.

The hydrology of each of the watersheds of Dumbell Lake, Leg Lake and White Lake was estimated based on regional precipitation and evaporation data estimates as described in Section 3. A schematic of the surface water balance is provided in Appendix C. The pit was assumed to be continuously dewatered throughout the mine operation.

4.4 Mean Annual Runoff Coefficient

The mean annual evapotranspiration at the Wabush 3 site, estimated at 320 mm, results in 62% mean average runoff coefficient for natural ground. This is consistent with regional runoff data as presented and summarized in Section 3:

- WSC gauge Luce Lake below Tinto Pond (03OA012): 60%
- Kami Iron Ore Project: 63%
- Carol Lake Site Water Balance: 64%

4.5 Monthly Runoff Distribution

The runoff was calculated assuming a negligible groundwater storage component, and was determined by precipitation minus evapotranspiration. The monthly variation in runoff attributed to snow accumulation during the winter months, and snow melt during the spring, was estimated based on trends from Luce Lake streamflow measurements and values reported in the Kami Iron Ore Mine Environmental Impact Statement (Figure 7).

As is typical of regional watersheds, predicted monthly runoff is relatively low (below 25 mm) during the winter months, due to below freezing average seasonal temperatures. Monthly runoff increases in the spring season, with peak runoff at about 75 to 80 mm in May and June. During the summer and fall seasons, monthly runoff ranges from about 50 to 70 mm.

4.6 Wabush 3 Pit Groundwater Inflows

The proposed ultimate pit depth indicates that the pit bottom will be at a lower elevation than the surrounding surface water bodies. A preliminary estimate of groundwater flow into the pit was presented by Golder Associates (Golder 2011). The estimated value of 688 L/s is considered conservative and does not account for depressurization due to the expansion of other surrounding pits. Groundwater inflow to the pit is currently being evaluated in more detail by AMEC as part of the ongoing hydrogeological investigation and study. As the value is currently being re-evaluated, the effects of dewatering groundwater inflows to the pit were not addressed in the current surface water and hydrology assessment. This will be updated when the results of AMEC hydrogeological investigation and study become available.

4.7 Changes to Surface Hydrology from Developed Areas

Runoff rates are dependent upon the surface cover. The runoff potential of the open pit and rock dump areas of the site is assumed to increase relative to natural ground due to higher imperviousness and the removal of vegetation. For the rock dump and open pit areas, runoff coefficients of 80% were used.

5.0 WATER BALANCE RESULTS

5.1 Existing Conditions

The baseline water balance is reported in Table 10 (upper portion) and in Figures 8-10 (existing conditions). The average annual runoff coefficient as determined from regional precipitation and evaporation is 62%. The annual runoff for the Dumbell Lake watershed is approximately 4.3 million cubic metres. Leg Lake and White Lake watershed annual runoffs are approximately 8.4 and 5.4 million cubic metres, respectively.

5.2 Wabush 3 Development

Projected effects on watersheds due to Wabush 3 development are due to changes to land use and diversion of water due to the pit dewatering operations. The assumed pit dewatering drainage strategy for this assessment was that water from the pit was redirected and released within the Leg Lake watershed.

The water balance for the Wabush 3 development is reported in Table 10 (lower portion) and in Figures 8-10 (developed conditions). The annual runoff for Dumbell Lake is approximately 3.7 million cubic meters. The annual runoff for Leg Lake is approximately 9.8 million cubic meters and White Lake annual runoff is approximately 5.7 million cubic meters.

6.0 SURFACE WATER EFFECTS OF WABUSH 3 DEVELOPMENT

Table 11 presents a comparison of annual runoff volume for existing and developed conditions. This is also shown in Figure 11 as runoff depth. The expected changes are summarized as follows:

- **Dumbell Lake**: As 17% of the Dumbell Lake watershed will be displaced due to the development of the pit, the total runoff and streamflow are expected to decrease by an equivalent amount, about 17% relative to baseline conditions. This is due to the assumed dewatering of the pit into the Leg Lake watershed. The annual surface runoff within the Dumbell Lake watershed is predicted to decrease by about 740,000 m^3.

- **Leg Lake**: The Leg Lake watershed area will increase by 8.1% due to the pit development combined with a small portion of the rock dump that will constitute 0.7% of the Leg Lake watershed area. These changes in surface area cover, in addition to the assumed dewatering of the pit to Leg Lake, will result in an approximately 14% increase in runoff relative to baseline conditions within the Leg Lake watershed. The annual surface runoff in the Leg Lake watershed is predicted to increase by about 1,170,000 m^3.

- **White Lake**: The rock dump area is proposed to occupy 9% of the existing White Lake watershed area. The development of the rock dump is predicted to result in a relatively small (2.5%) increase in runoff relative to baseline conditions within the White Lake watershed. The annual surface runoff in the White Lake watershed is predicted to increase by about 140,000 m^3.

Table 10: Water Balance for Existing Watershed and Wabush 3 Development Conditions

Existing Watershed Conditions

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual (mm)	Annual Runoff Coefficient (%)
Precipitation		mm	54	41.7	57.4	56.7	55.8	84.8	111.5	95.4	95.8	73.5	68.2	56.8	851.6	
Evapotranspiration		mm	2.3	3.2	3.7	8.5	20.1	75.1	90.1	67.8	35.3	8.0	3.1	2.8	320.1	
	Area (ha)		**Runoff Volume**												**Annual (million m^3)**	
Dumbell Lake	829	m^3	128,596	95,745	97,940	119,815	629,472	682,634	631,874	570,762	502,007	434,297	313,052	201,468	4.4	
Leg Lake	1616	m^3	250,576	186,565	190,842	233,467	1,226,560	1,330,150	1,231,240	1,112,160	978,188	846,251	610,000	392,571	8.6	
White Lake	1038	m^3	160,910	119,805	122,551	149,923	787,649	854,171	790,655	714,186	628,155	543,430	391,718	252,094	5.5	
	Area (ha)		**Runoff Depth**												**Annual (mm)**	
Dumbell Lake	829	mm	15.5	11.5	11.8	14.4	75.9	82.3	76.2	68.8	60.5	52.4	37.7	24.3	531.5	**62**
Leg Lake	1616	mm	15.5	11.5	11.8	14.4	75.9	82.3	76.2	68.8	60.5	52.4	37.7	24.3	531.5	**62**
White Lake	1038	mm	15.5	11.5	11.8	14.4	75.9	82.3	76.2	68.8	60.5	52.4	37.7	24.3	531.5	**62**

Wabush 3 Development

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual (mm)	Annual Runoff Coefficient (%)
Precipitation		mm	54	41.7	57.4	56.7	55.8	84.8	111.5	95.4	95.8	73.5	68.2	56.8	851.6	
Evapotranspiration		mm	2.3	3.2	3.7	8.5	20.1	75.1	90.1	67.8	35.3	8.0	3.1	2.8	320.1	
	Area (ha)		**Runoff Volume**												**Annual (million m^3)**	
Dumbell Lake	690	m^3	106,919	79,606	81,431	96,298	526,596	573,399	529,768	477,867	417,387	361,090	246,820	167,508	3.7	
Leg Lake	1756	m^3	273,170	203,981	208,434	248,486	1,371,918	1,567,400	1,474,292	1,311,116	1,109,483	927,969	630,755	428,207	9.8	
White Lake	1038	m^3	161,211	120,223	122,906	146,001	802,682	898,132	838,366	750,088	643,455	546,220	372,200	252,643	5.7	
	Area (ha)		**Runoff Depth**												**Annual (mm)**	
Dumbell Lake	690	mm	15.5	11.5	11.8	14.0	76.4	83.2	76.8	69.3	60.5	52.4	35.8	24.3	531.5	**62**
Leg Lake	1756	mm	15.6	11.6	11.9	14.2	78.1	89.3	84.0	74.7	63.2	52.9	35.9	24.4	555.6	**65**
White Lake	1038	mm	15.5	11.6	11.8	14.1	77.3	86.5	80.8	72.3	62.0	52.6	35.9	24.3	544.7	**64**

Table 11: Runoff Comparison of Existing and Wabush 3 Development

Watershed	Annual Runoff			Runoff Coefficient		
	Existing	Developed	Difference	Existing	Developed	Difference
	Million m^3		%	%		
Dumbell Lake	4.4	3.7	-17%	62	62	0.0%
Leg Lake	8.6	9.8	14%	62	65	4.5%
White Lake	5.5	5.7	2.5%	62	64	2.5%

7.0 CONCLUSIONS

Local climate data and streamflow data were collected and analysed, and relevant environmental studies and water balance reports reviewed to gain an understanding of baseline conditions in the local watersheds within the Wabush 3 project footprint.

The findings of the 2011 field monitoring program were reviewed, and the stream flow measurements obtained from the 2012 field monitoring program were analysed and interpreted. These were found to provide a similar indication, that the stream flowing east from the Wabush 3 pit (towards Dumbell Lake), and (to a lesser extent) the stream flowing south-west from the Wabush 3 pit (towards Leg Lake), appear to have a significant groundwater flow contribution. The development of the Wabush 3 pit would be expected to decrease the groundwater component of streamflow reporting to these lakes, as the groundwater currently feeding these streams will be partially intercepted in the pit.

A water balance was carried out to estimate the expected hydrologic response of the local watersheds to the Wabush 3 project in terms of surface water flows. This did not include the effect of dewatering groundwater inflow to the pit, as the quantity of groundwater inflows to the pit is currently the subject of an ongoing AMEC hydrogeological investigation and study.

Assuming that dewatering of surface inflows to the pit is directed to the Leg Lake watershed, Dumbell Lake would be expected to experience lower flows; however, Leg Lake and its downstream outflow would experience higher flows. However, the water balance results indicate that the Wabush 3 project is not expected to have a major effect on the surface hydrology of the local watersheds. For average precipitation conditions, the estimated effect on average annual runoff volume to the three affected watersheds is in the order of a 17% reduction to the Dumbell Lake watershed, a 14% increase to the Leg Lake watershed, and a 2.5% increase to the White Lake subwatershed of Luce Lake.

8.0 REFERENCES

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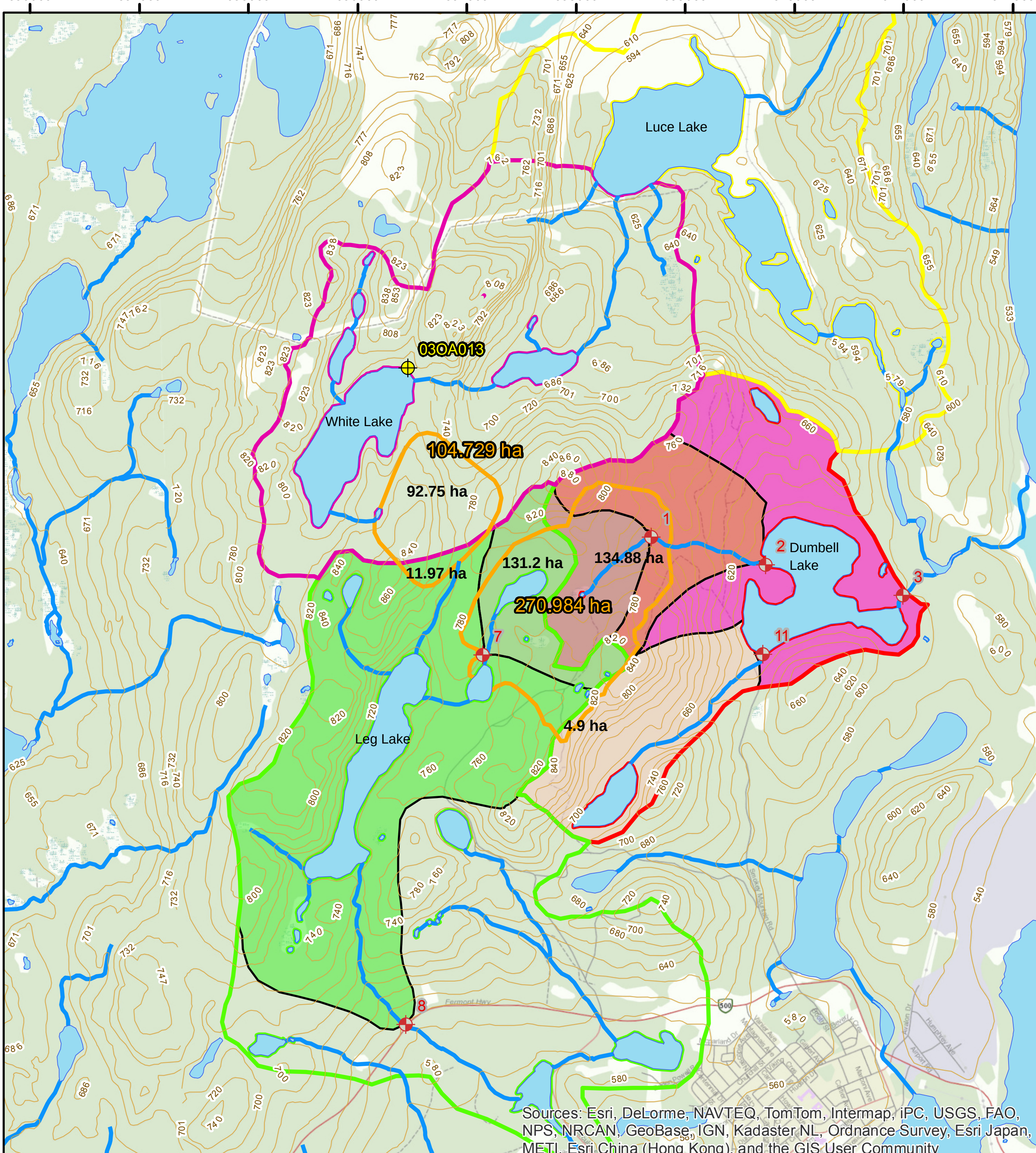
FIGURES



Legend

	Watershed	Subcatchment
Station	Dumbell Lake	Dumbell 1
Monitor	Leg Lake	Dumbell 11
Contour	Luce Lake	Dumbell 2
Watercourse	White Lake subwatershed of Luce Lake	Dumbell 3
Waterbody		Leg Lake 7
Pit		Leg Lake 8

0 500 1,000 2,000 Metres

NOTES:
- Watersheds approximated from Golder Draft Hydrogeo Report, 20 Dec 2011

Datum & Projection:
NAD 1983 UTM Zone 19N

N W E S

amec

Wabush Surface Water

Site Watersheds (Approximate)

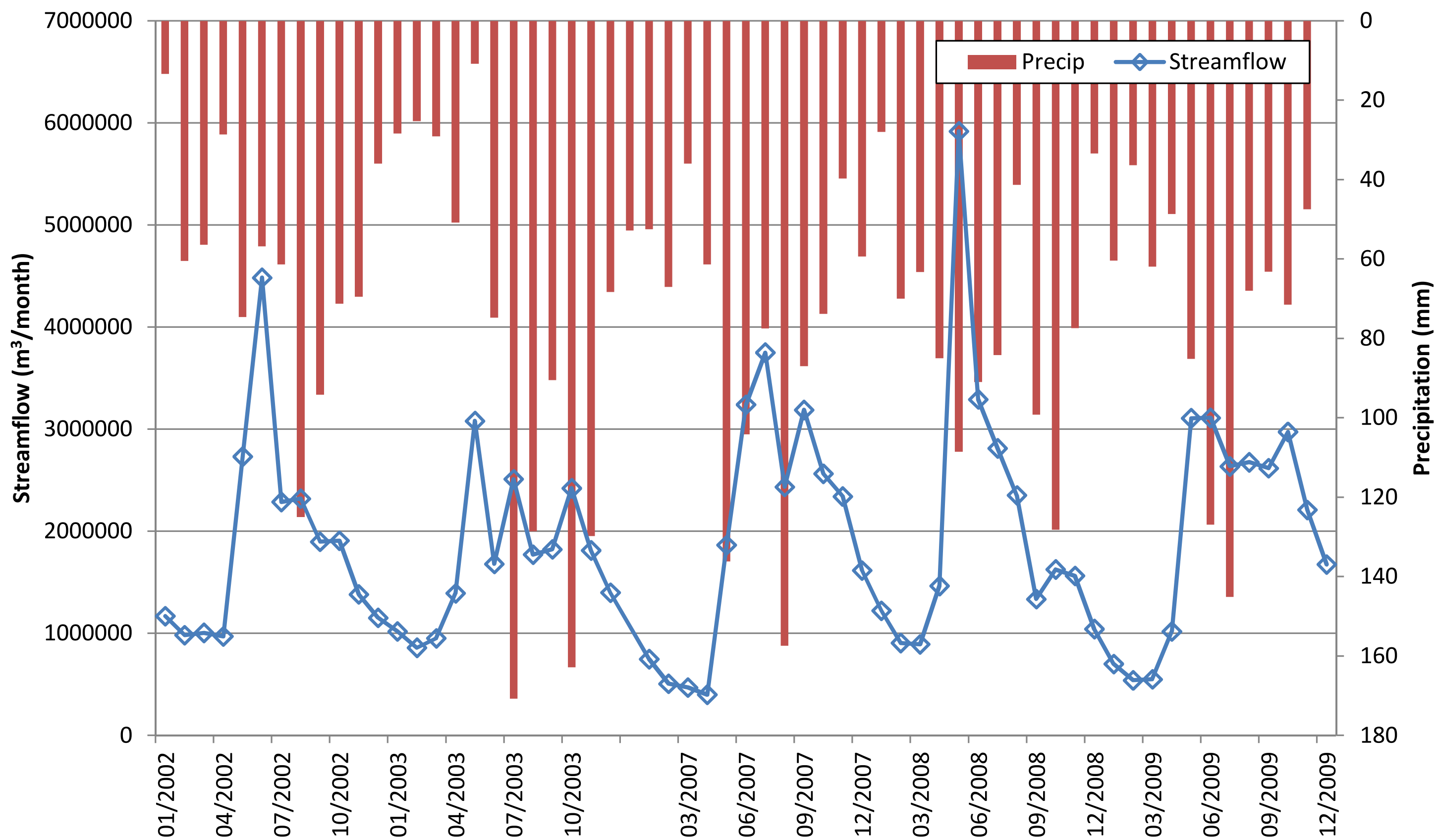
PROJECT N^{o}: TF1243033

SCALE: 1:50,000

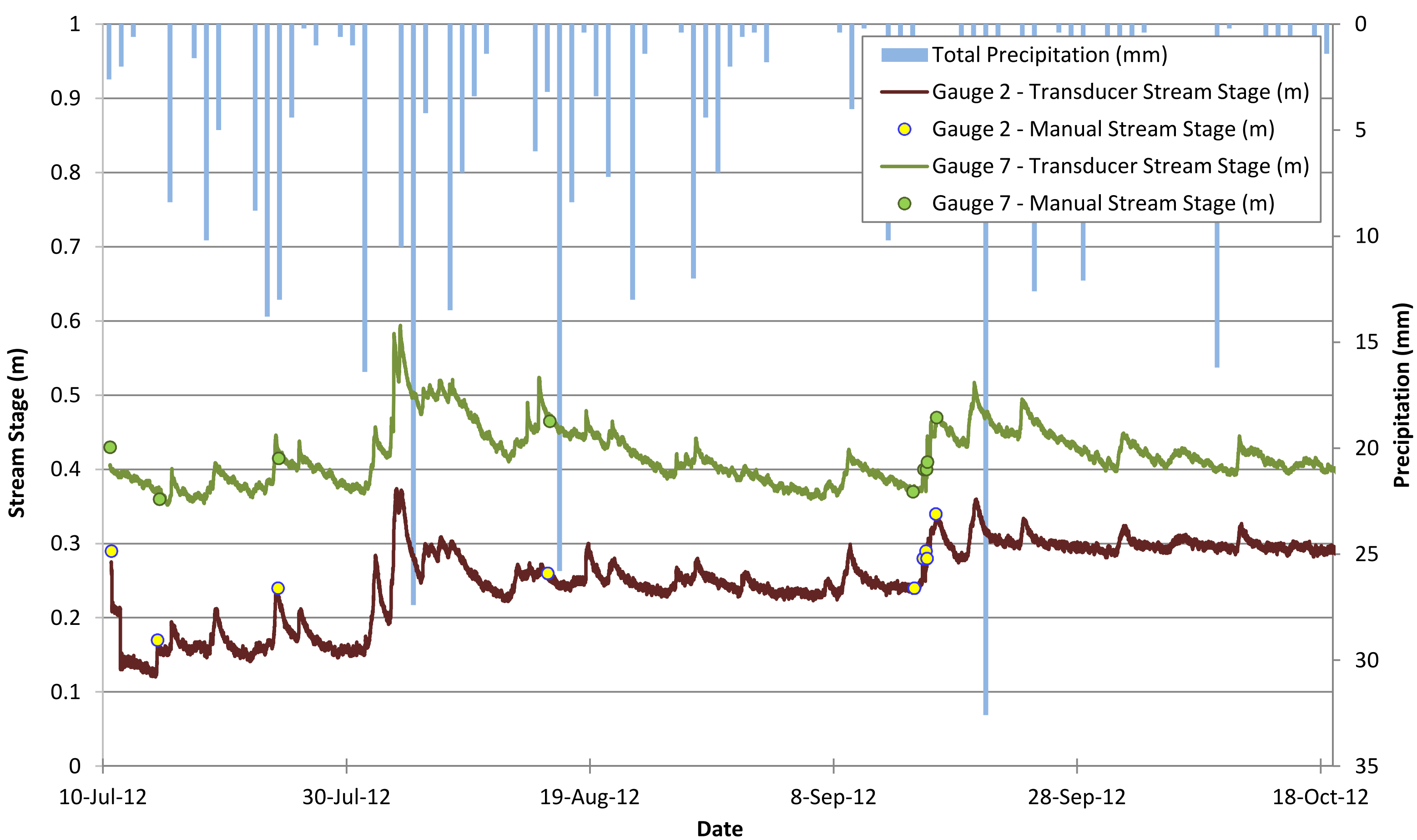
FIGURE: 1

October, 2012

Path: G:\TF1243033-Wabush 3 Surface Water\GIS\MXD\WatershedsContours3.mxd, Author: Michael Collins, modified by michael.collins, 15 October 2012



Luce Lake Stream Flow Data (WSC Station No. 03OA012) and Wabush Lake A Precipitation	
Wabush 3 Surface Water and Hydrology Baseline Report	
November 2012	FIGURE 2



Stream Stage Gauge 2 and 7 (Logger Data) and Total Precipitation	
Wabush 3 Surface Water and Hydrology Baseline Report	
November 2012	FIGURE 3

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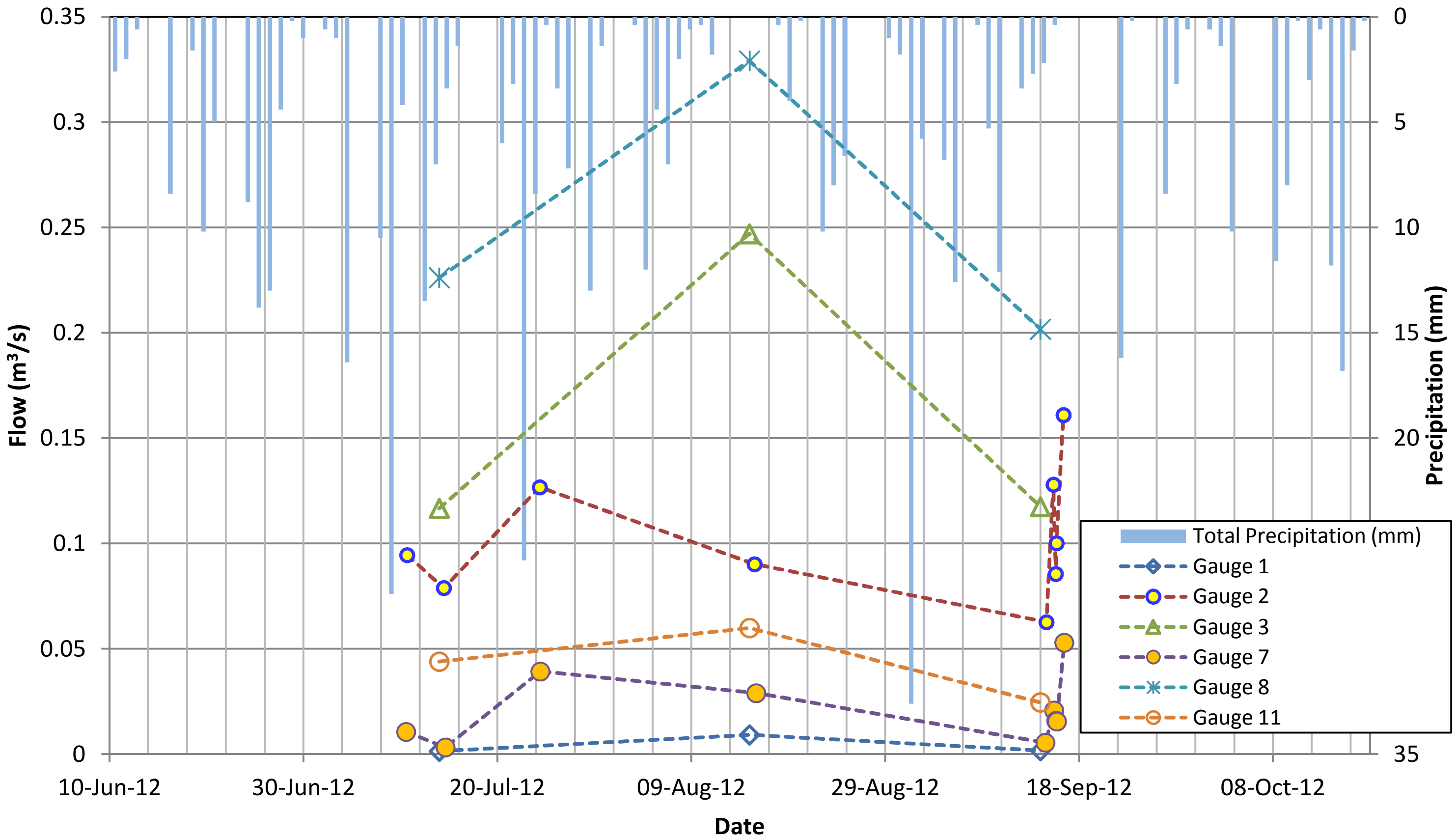
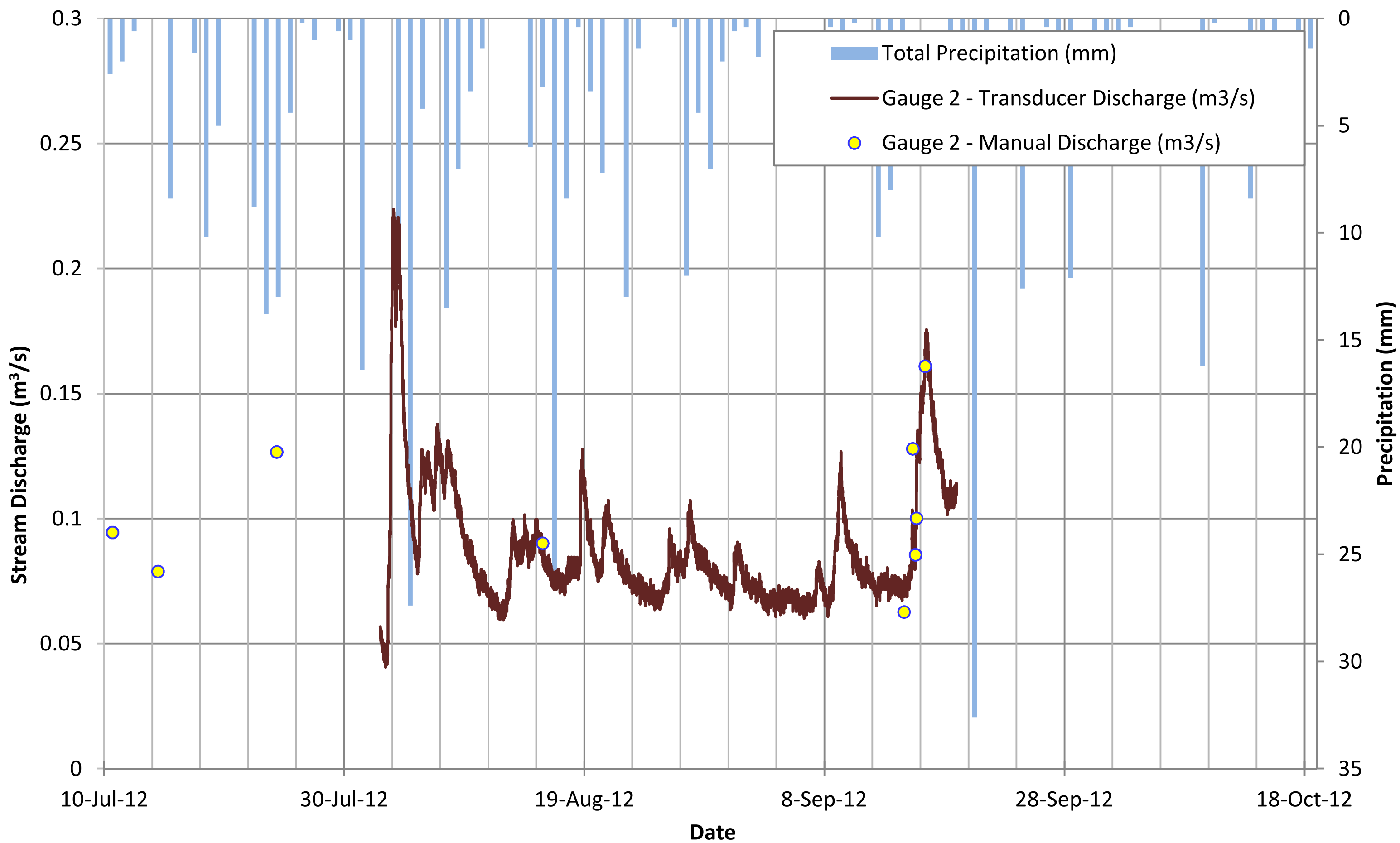


2012 Field Monitoring Streamflow Data Average Discharge Summary	
Wabush 3 Surface Water and Hydrology Baseline Report	
November 2012	FIGURE 4



Stream Gauge 2 Discharge (Logger Data) and Total Precipitation	
Wabush 3 Surface Water and Hydrology Baseline Report	
November 2012	FIGURE 5

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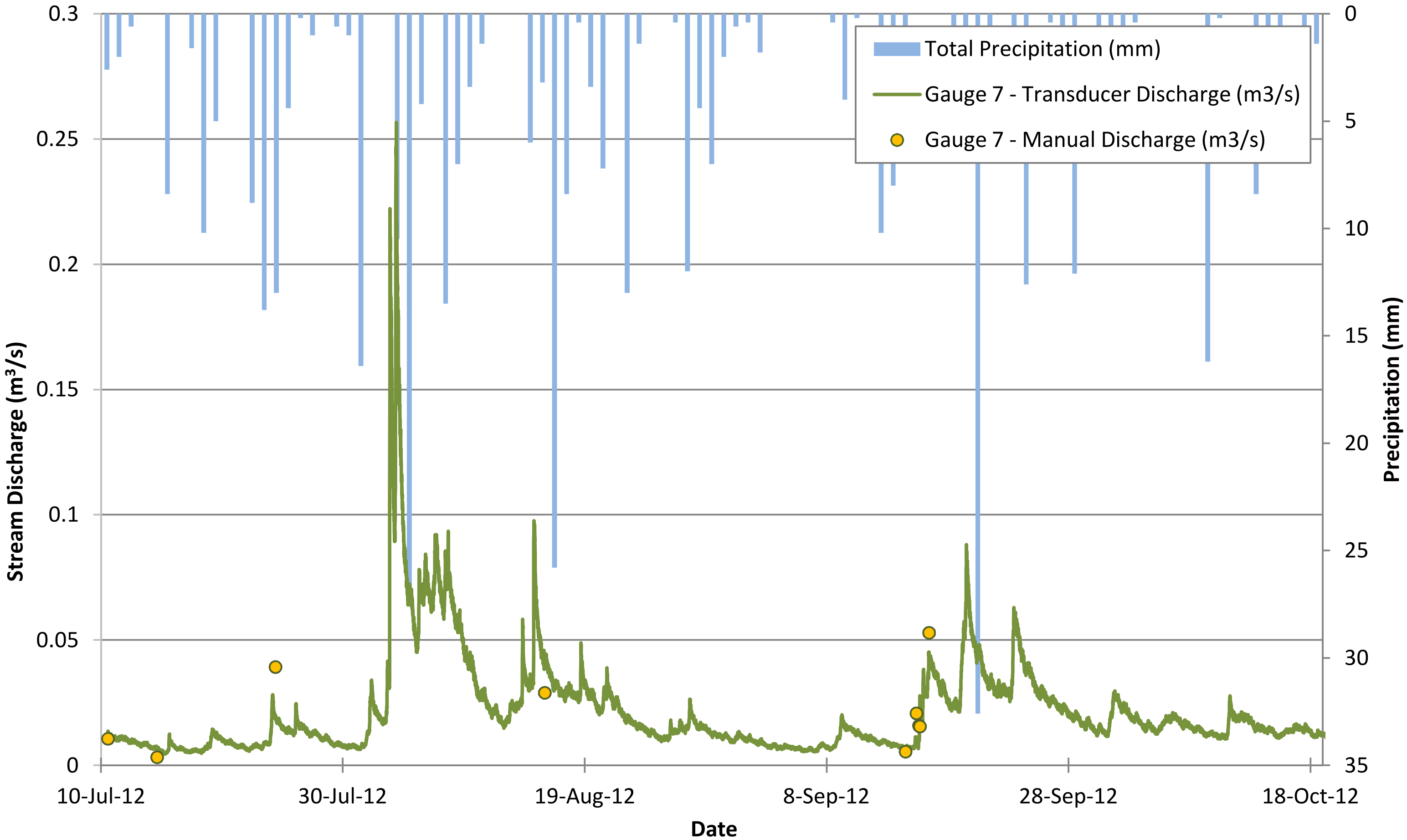
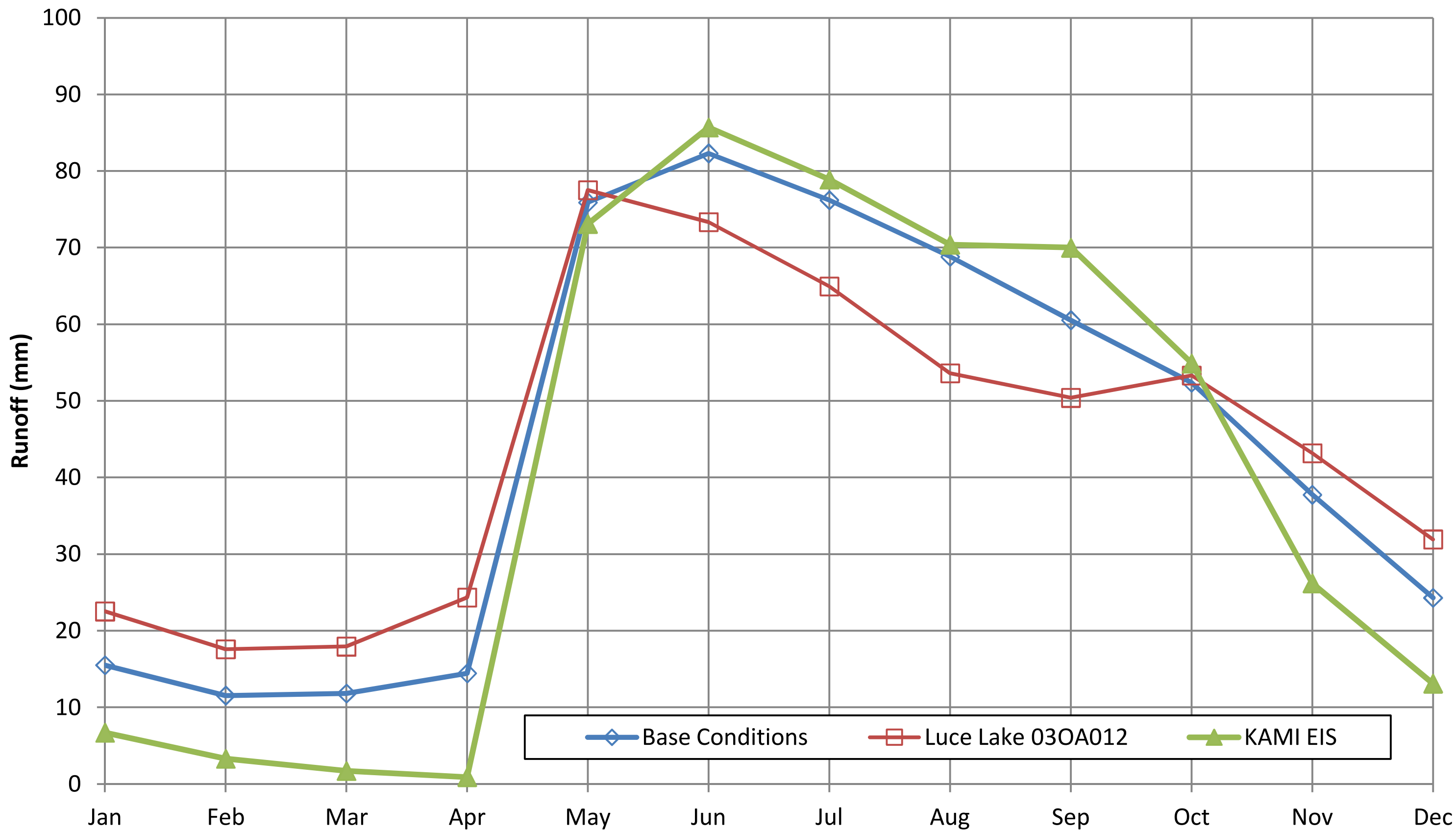


Stream Gauge 7 Discharge (Logger Data) and Total Precipitation	
Wabush 3 Surface Water and Hydrology Baseline Report	
November 2012	FIGURE 6

Job No. TF1243033.2003

amec



Assumed Site Baseline Runoff Compared to Regional Surface Runoff	
Wabush 3 Surface Water and Hydrology Baseline Report	
November 2012	FIGURE 7

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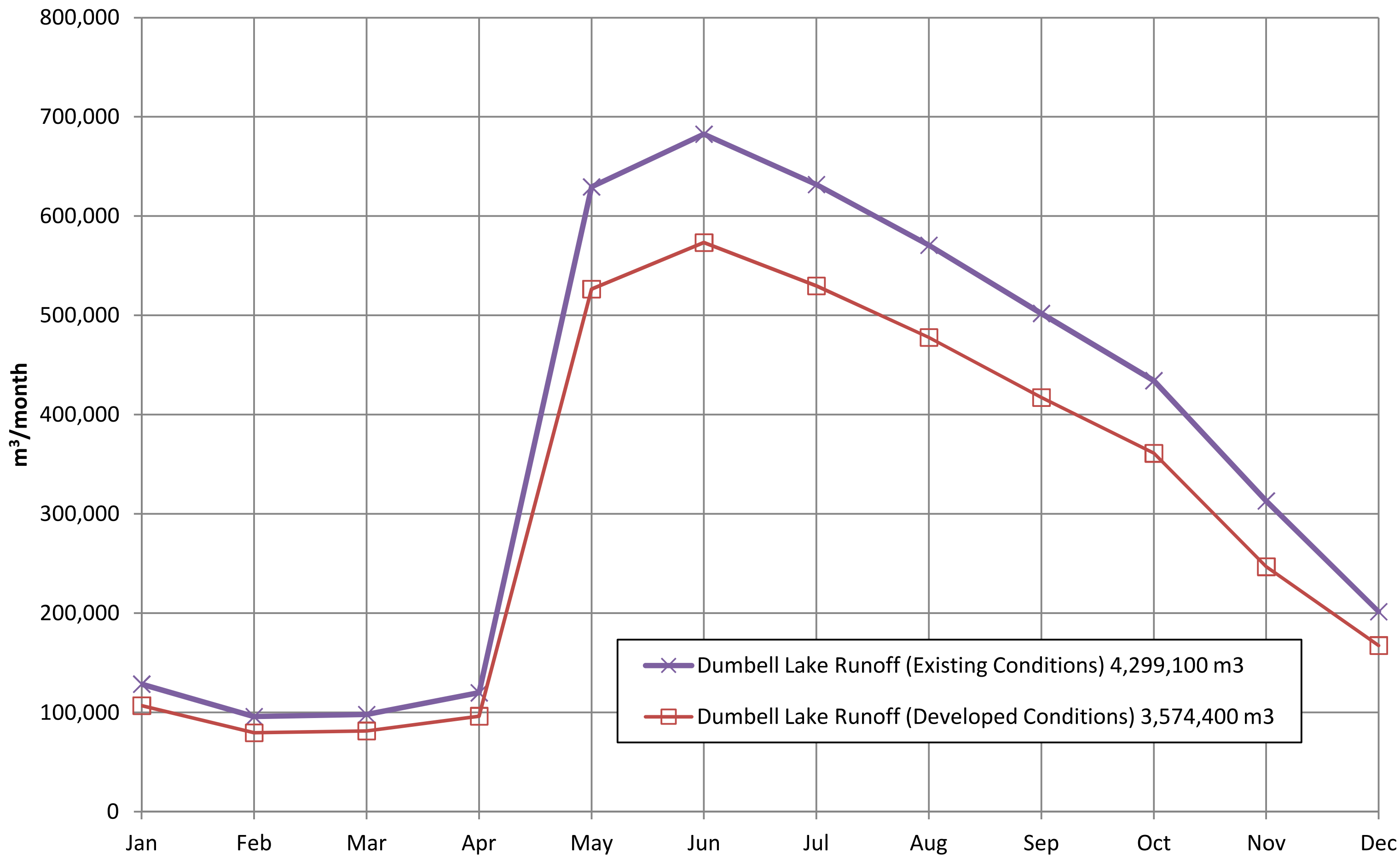
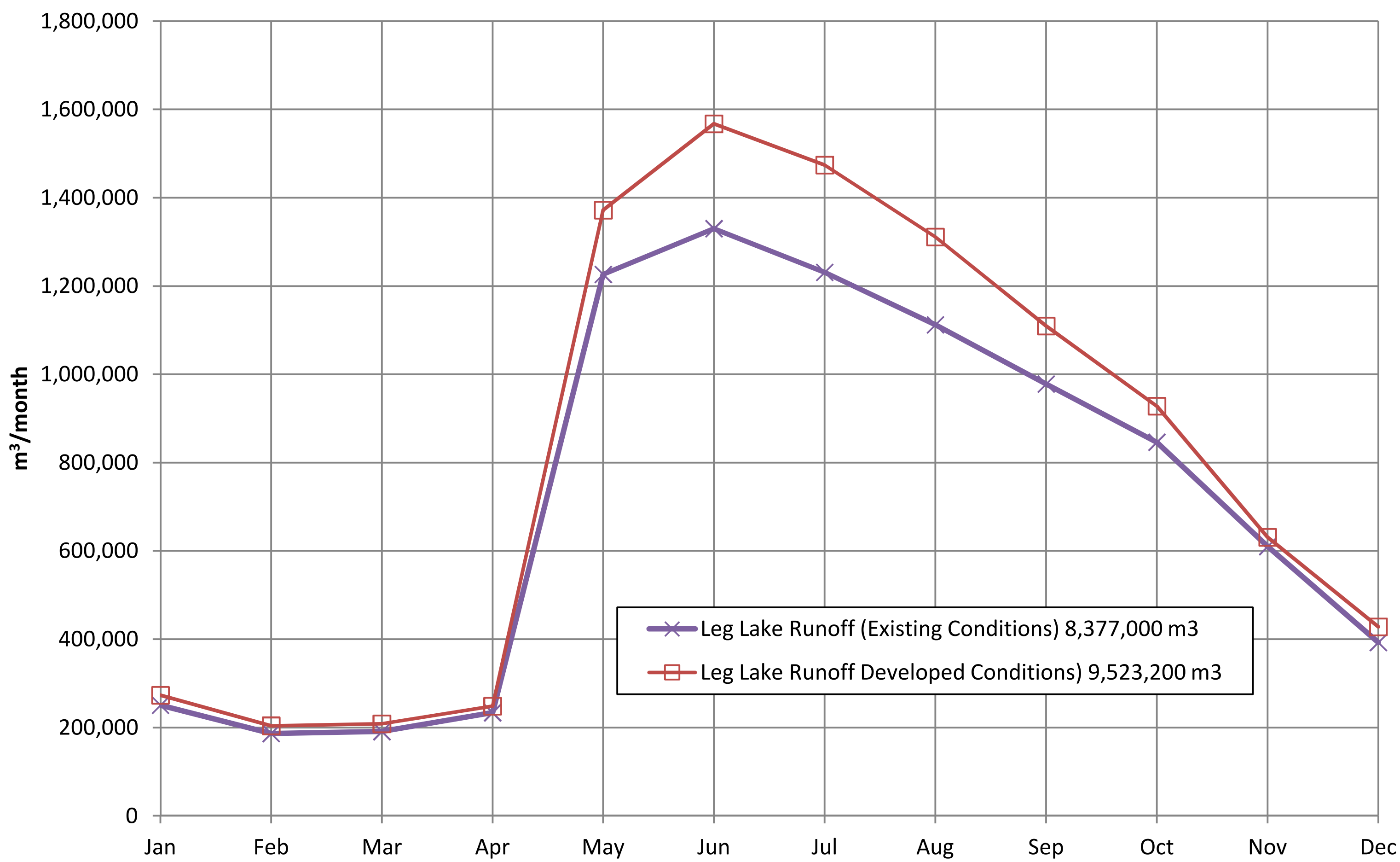
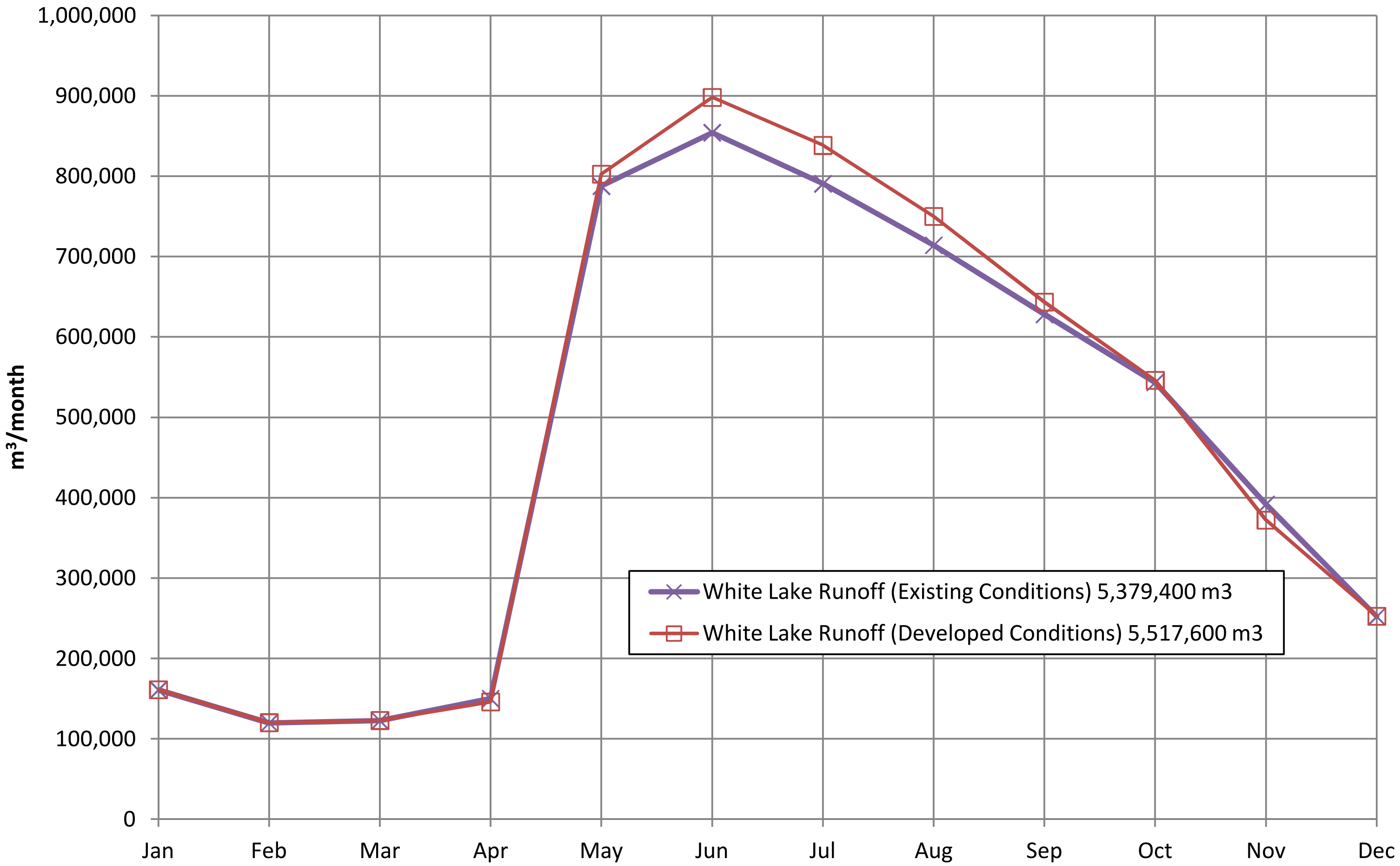


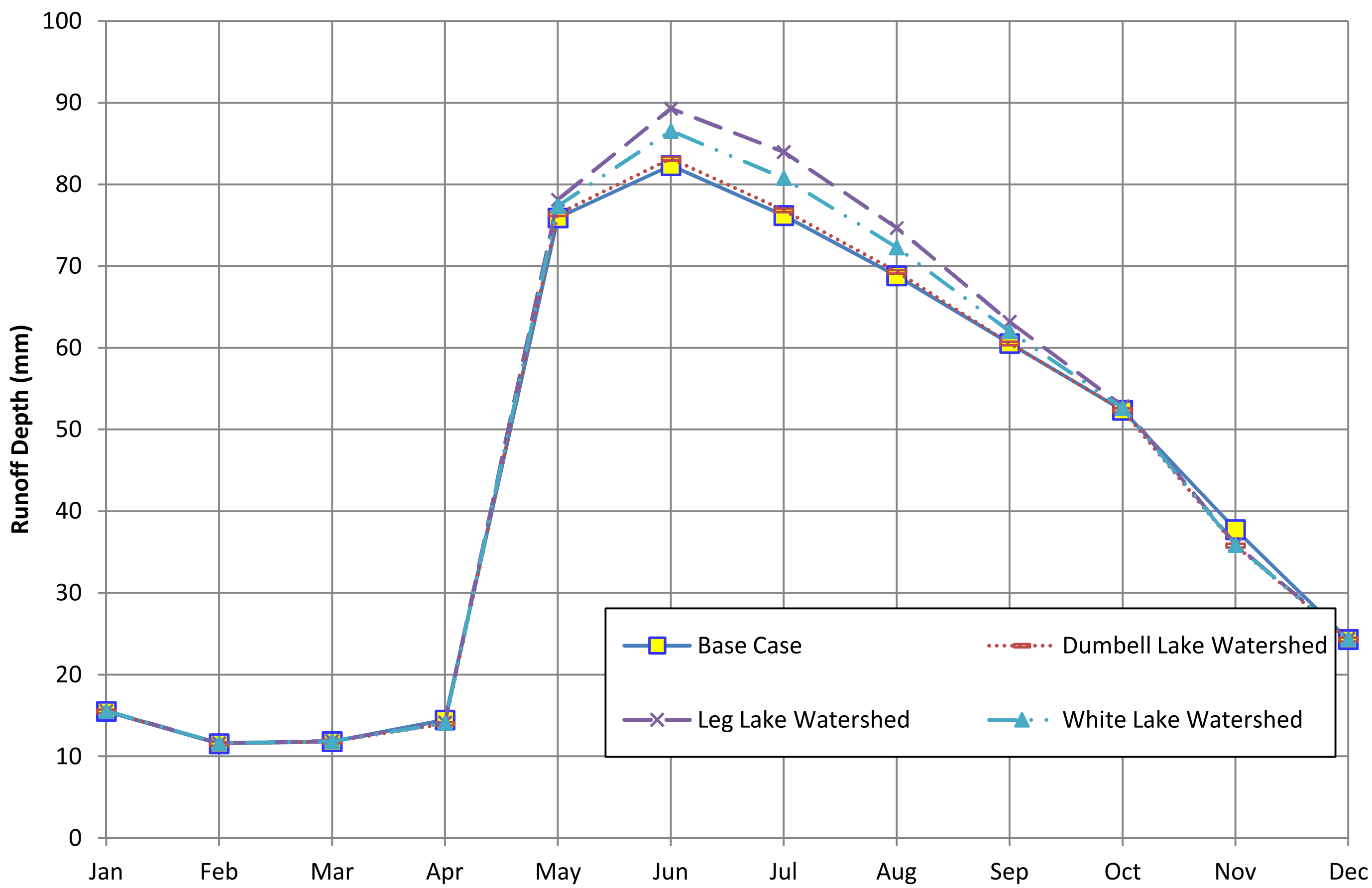
Dumbell Lake Annual Runoff Volume Existing versus Developed Conditions	
Wabush 3 Surface Water and Hydrology Baseline Report	
November 2012	FIGURE 8



Leg Lake Annual Runoff Volume Existing versus Developed Conditions	
Wabush 3 Surface Water and Hydrology Baseline Report	
November 2012	FIGURE 9



White Lake Annual Runoff Volume Existing versus Developed Conditions	
Wabush 3 Surface Water and Hydrology Baseline Report	
November 2012	FIGURE 10



Surface Water Runoff Depth Comparison	
Wabush 3 Surface Water and Hydrology Baseline Report	
November 2012	FIGURE 11

Job No. TF1243033.2003

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APPENDIX A

SURFACE WATER FLOW DATA FROM 2011 FIELD MONITORING

Appendix A: Surface Water Flow Data from 2011 Field Monitoring

Date	Location	Measured Flow L/s	Catchment Area km^2	Unit Flow $L/s/km^2$	Notes
16-Sep-11	SW1	5	1.0	5.0	Located in Wabush 3
16-Sep-11	SW2	83	1.8	46.1	Downstream of Falls; upstream of Dumbell Lake
16-Sep-11	SW3	219	8.3	26.4	Downstream of Dumbell Lake
16-Sep-11	SW4	659	10.2	64.6	Downstream of Luce Lake; Located in Wabush 6
16-Sep-11	SW5	845	12.6	67.1	Downstream of lake between SW4 and SW5
16-Sep-11	SW6	977	22.0	44.4	Catchment SW6 includes SW3 and SW5 flow
16-Sep-11	SW7	22	1.1	20.0	Located in Wabush 3
16-Sep-11	SW8	180	7.2	25.0	Downstream of Leg Lake
16-Sep-11	SW9	21	3.3	6.4	Upstream of Tanya Lake
16-Sep-11	SW10	199	16.0	12.4	Downstream of SW8 and SW9; Upstream of Harrie Lake confluence
17-Sep-11	SW11	63	2.1	30	Upstream of Dumbell Lake

Source: Draft Wabush 3 and Wabush 6 Hydrogeological and Hydrological Technical Report, Table 6 (Golder Assoc., 2011)

APPENDIX B-1

2012 FIELD MONITORING PROGRAM PHOTOGRAPHS

Photo 1: Site 1 Transect

Photo 2: Site 1 Down

Photo 3: Site 1 Up

Photo 4: Site 2 Transect

Photo 5: Site 2 Down

Photo 6: Site 2 Up

Photo 7: Site 3 Transect

Photo 8: Site 3 Down

Photo 9: Site 3 Up

Photo 10: Site 7

Photo 11: Site 8 Transect

Photo 12: Site 8 Down

Photo 13: Site 8 Up

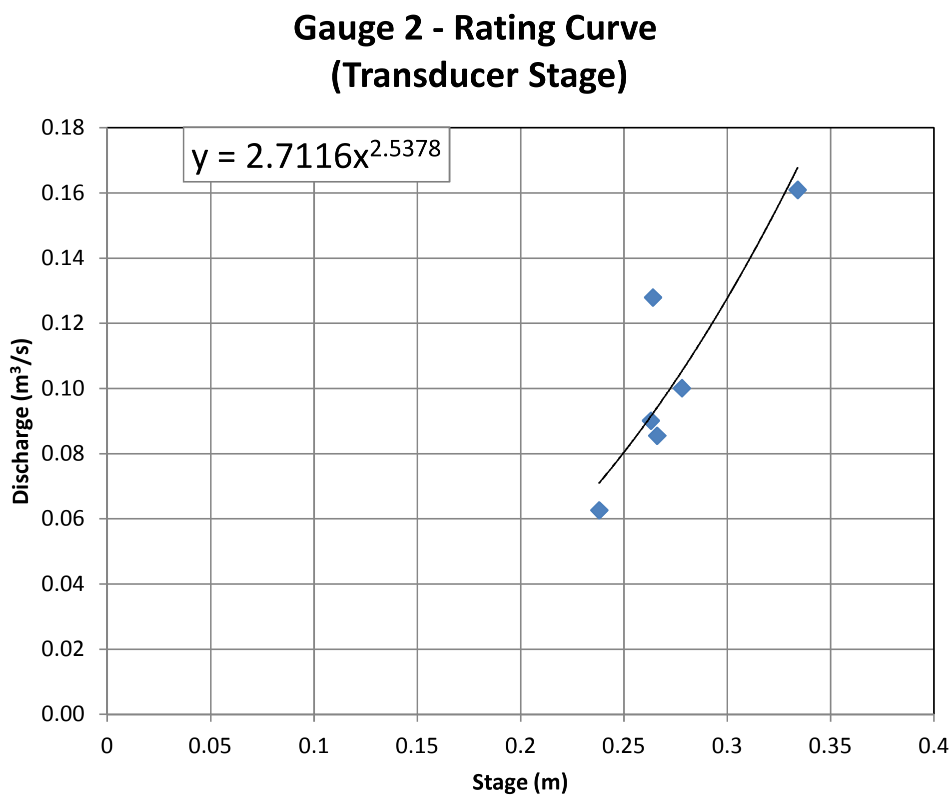
Photo 14: Site 11 Transect

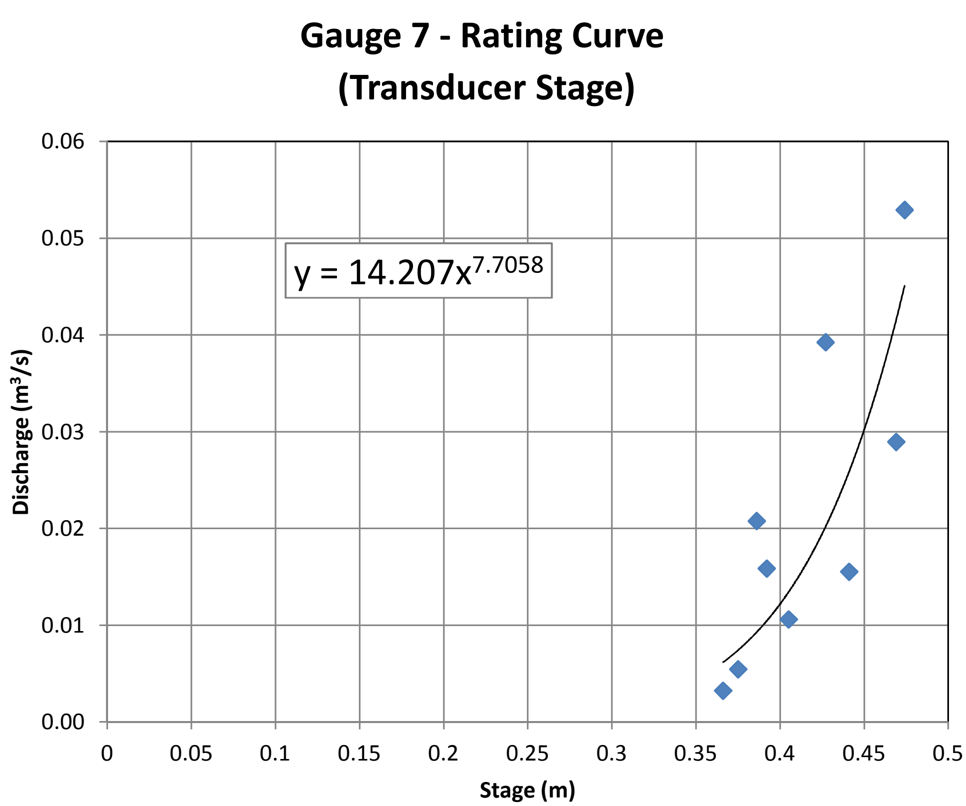
Photo 15: Site 11 Down

Photo 16: Site 11 Up

APPENDIX B-2

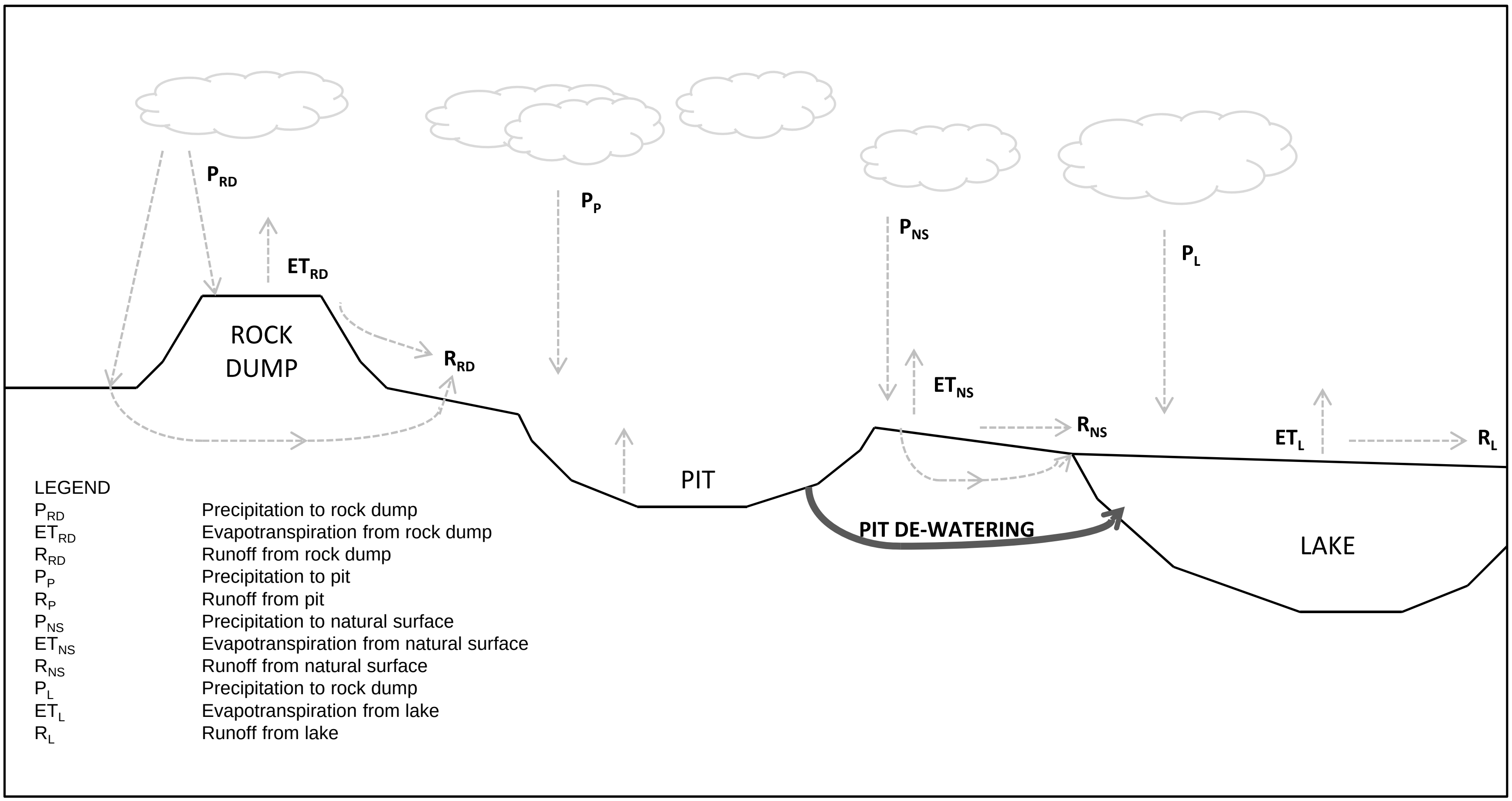
**2012 FIELD MONITORING PROGRAM
STREAM DISCHARGE RATING CURVES**


Gauge 2 - Rating Curve
(Transducer Stage)
y = 2.7116x^2.5378
Discharge (m³/s)
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
Stage (m)


Gauge 7 - Rating Curve
(Transducer Stage)
y = 14.207x^7.7058
Discharge (m³/s)
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Stage (m)

APPENDIX C

SITE WATER BALANCE SCHEMATIC


P RD
ET RD
ROCK DUMP
R RD
P P
PIT
P NS
ET NS
R NS
P L
ET L
R L
PIT DE-WATERING
LAKE
LEGEND
P RD Precipitation to rock dump
ET RD Evapotranspiration from rock dump
R RD Runoff from rock dump
P P Precipitation to pit
R P Runoff from pit
P NS Precipitation to natural surface
ET NS Evapotranspiration from natural surface
R NS Runoff from natural surface
P L Precipitation to rock dump
ET L Evapotranspiration from lake
R L Runoff from lake